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June 24, 2015

Samuel Unger, Executive Officer
Los Angeles Regional Water Quality Control Board
320 West Fourth Street, Suite 200
Los Angeles, California 90013

Via Regional Board website

Attention: Mr. Ivar Ridgeway and Ms. Rebecca Christmann

Beach Cities Watershed Management Group: Enhanced Watershed Management Program (EWMP), Pursuant to the Los Angeles County Municipal Separate Storm Sewer System (MS4) Permit (NPDES No. CAS004001; Order No. R4-2012-0175)

Dear Mr. Unger:

On June 28, 2013 the Beach Cities Watershed Management Group (Beach Cities) submitted the Notice of Intent (NOI) for the development of an Enhanced Watershed Management Program (EWMP) Plan and Coordinated Integrated Monitoring Program (CIMP) Plan. All members of the Beach Cities have agreed to a collaborative approach in meeting the requirements of the MS4 Permit by Order No. R4-2012-0175. On March 27, 2014 the California Regional Water Quality Control Board, Los Angeles Region (Regional Water Board) approved the Beach Cities' NOI. The Beach Cities EWMP Work Plan was submitted on June 26, 2014. The Beach Cities CIMP was submitted on June 27, 2014.

As noted in the Regional Water Board's May 29, 2015 letter, the Beach Cities EWMP is due by June 29, 2015. To comply with this requirement, enclosed is the Beach Cities EWMP. All agencies have reviewed and approved the EWMP for its submission to your Board.

Should you have any questions regarding the EWMP Work Plan, please contact me at tim.shea@redondo.org or via telephone at (310) 318-0686, extension 4110, or Geraldine Trivedi at geraldine.trivedi@redondo.org or via telephone at (310) 318-0661, extension 2036.

Sincerely,

Wisam Altowaij

for Tim Shea
Interim Public Works Director
Attachment

cc:
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DRAFT
ENHANCED WATERSHED MANAGEMENT PROGRAM (EWMP)

for the Beach Cities Watershed Management Area (Santa Monica Bay and Dominguez Channel Watersheds)

Submitted to:
Los Angeles Regional Water Quality Control Board

Submitted by:
Beach Cities EWMP Group

June 2015

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LIST OF ACRONYMS

AED	Allowable Exceedance Days
ASBS	Area of Special Biological Significance
ASCE	American Society of Civil Engineers
BMP	Best Management Practice
Caltrans	California Department of Transportation
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CFCC	California Financing Coordinating Committee
cfs	Cubic feet per second
CIMP	Coordinated Integrated Monitoring Program
CML	Compliance Monitoring Location
CNT	Center for Neighborhood Technology
COMM	Commercial and Sport Fishing
CSMP	Coordinated Shoreline Monitoring Plan
CTR	California Toxic Rules
cu-ft	Cubic feet
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DC	Dominguez Channel
DCu	Dissolved Copper
DDT	Dichloro-diphenyl-trichloroethane
DP	Dissolved Phosphorus as P
DZn	Dissolved Zinc
EIFD	Enhanced Infrastructure Financing Districts
EMC	Event Mean Concentration
EWMP	Enhanced Watershed Management Program
FAA	Federal Aviation Administration
FC	Fecal coliform
FIB	Fecal Indicator Bacteria
ft	Foot
GIS	Geographic Information System
GM	Geometric Mean
GO	General Obligation
gpm	Gallons per minute
HFS	High Flow Suspension
HSPF	Hydrological Simulation Program - Fortran
IBD	International BMP Database
IC/ID	Illicit Connection/Illicit Discharge
IDDE	Illicit Discharge Detection and Elimination
IGP	Industrial General Permit
in	inch
IND	Industrial Service Supply
in/hr	Inches per hour
IPM	Integrated Pest Management

J5&6	Jurisdictional Groups 5 and 6
JPA	Joint Powers Authority
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power
LARWQCB	Los Angeles Regional Water Quality Control Board
lb	Pound
LID	Low Impact Development
LSPC	Loading Simulation Program C++
MAR	Marine Habitat
MB	Manhattan Beach
MCM	Minimum Control Measure
MEP	Maximum Extent Practical
MIGR	Migration of Aquatic Organisms
min	Minute
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
MUN	Municipal and Domestic Supply
NAV	Navigation
NH3	Ammonia as N
NO3	Nitrate as N
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
OM&R	Operations, Maintenance, and Replacement
PCB	Polychlorinated Biphenyl
PIPP	Public Information and Participation Program
RAA	Reasonable Assurance Analysis
RARE	Rare, Threatened, or Endangered Species
RB	Redondo Beach
REC-1	Water Contact Recreation
REC-2	Non-Contact Water Recreation
RWL	Receiving Water Limitation
SBPAT	Structural BMP Prioritization and Analysis Tool
SCCWRP	Southern California Coastal Watershed Research Project
SCPWA	Southern California Public Water Authority
SFPUC	San Francisco Public Utilities Commission
SHELL	Shellfish Harvesting
SMB	Santa Monica Bay
SMBBB	Santa Monica Bay Beaches Bacteria
SPWN	Spawning, Reproduction, and/or Early Development
SUSMP	Standard Urban Stormwater Management Program
SWMM	Storm Water Management Model, originally developed by USEPA
SWQDv	Storm Water Quality Design Volume
SWQPA	State Water Quality Protection Area
SWRCB	State Water Resources Control Board

TAC	Technical Advisory Committee
TCu	Total Copper
TKN	Total Kjeldahl Nitrogen as N
TP	Total Phosphorus
TPb	Total Lead
TIE	Toxicity Identification Evaluation
TLR	Total Load Reduction
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
TZn	Total Zinc
USEPA	United States Environmental Protection Agency
WARM	Warm Freshwater Habitat
WBPC	Water Body-Pollutant Combination
WDR	Waste Discharge Requirement
WER	Water Effects Ratio
WERF	Water Environment Research Foundation
WET	Wetland Habitat
WHAT	Web-Based Hydrograph Analysis Tool
WILD	Wildlife Habitat
WLA	Waste Load Allocation
WMA	Watershed Management Area
WMG	Watershed Management Group
WMMS	Watershed Management Modeling System
WMP	Watershed Management Program
WQBEL	Water Quality-Based Effluent Limitation

EXECUTIVE SUMMARY

PURPOSE AND OBJECTIVES

Following adoption of the 2012 Los Angeles Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit[1] (Permit), the Cities of Hermosa Beach, Manhattan Beach, Redondo Beach and Torrance, together with the Los Angeles County Flood Control District (LACFCD), collectively referred to as the Beach Cities Watershed Management Group (Beach Cities WMG) agreed to collaborate on the development of an Enhanced Watershed Management Program (EWMP) for the Santa Monica Bay (SMB) and Dominguez Channel Watershed areas within their jurisdictions (referred to herein as the Beach Cities EWMP Area). The Machado Lake Watershed is being addressed separately by the City of Torrance, and is not addressed in this EWMP[2].

This EWMP is intended to facilitate effective, watershed-specific Permit implementation strategies in accordance with Permit Part VI.C. Watershed Management Program. This EWMP:

- Summarizes watershed-specific water quality priorities identified by the Beach Cities WMG;
- Outlines the program plan, including specific strategies, control measures and best management practices (BMPs)[3], necessary to achieve water quality targets (Water Quality-Based Effluent Limitations [WQBELs] and Receiving Water Limitations [RWLs]); and
- Describes the quantitative analyses completed to support target achievement and Permit compliance.

In compliance with Section VI.C.4.b of the Permit, the Beach Cities WMG submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) a Notice of Intent (NOI) (**Appendix A**) to develop an EWMP on June 28, 2013, with a revised NOI submitted December 17, 2013 in response to comments received from LARWQCB staff. On March 27, 2014, the Beach Cities WMG received a letter from the Executive Officer of the LARWQCB approving the revised NOI submittal.

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[1] Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4.

[2] The City of Torrance developed a Special Study Work Plan for the Machado Lake Nutrient TMDL (City of Torrance, 2011) (**Appendix C**), which was approved by the LARWQCB. On January 28, 2015, the City of Torrance submitted to the LARWQCB the BMP Implementation Plan for the Machado Lake Nutrient and Toxics TMDL (City of Torrance, 2014). For reference, the Implementation Plan is attached to this EWMP as **Appendix D**, but it should be reviewed separately from this EWMP. A separate discussion of the Walteria Basin is also attached as **Appendix E**. Previous work also includes the City of Torrance's Stormwater Quality Master Plan, which is included as **Appendix F.** LACFCD infrastructure in the Machado Lake Watershed is covered under this EWMP as explained in **Attachment G**.

[3] For simplification, the term "BMP" will be used to collectively refer to strategies, control measures, and/or best management practices. The Permit also refers to these measures as Watershed Control Measures.

In compliance with Section VI.C.4.c.iv of the Permit, the Beach Cities WMG then submitted a draft EWMP Work Plan to the LARWQCB on June 26, 2014. LARWQCB comments were not received on the EWMP Work Plan; therefore work proceeded on EWMP development consistent with the approach outlined in the EWMP Work Plan. The Beach Cities WMG was required by Section VI.C.4.c.iv of the Permit to submit a draft EWMP no later than June 30, 2015. This document has been developed to serve as the Beach Cities Draft EWMP and is consistent with the Work Plan previously submitted to the LARWQCB.

Watershed Management Programs (WMPs) are a voluntary opportunity afforded by Section VI.C.1 of the Permit for Permittees to collaboratively or individually develop comprehensive watershed-specific control plans and are intended to facilitate Permit compliance and water quality target achievement. Enhanced WMPs (EWMPS) are WMPs which comprehensively evaluate opportunities for collaboration on multi-benefit regional projects that retain all non-stormwater runoff and runoff from the 85th percentile, 24 hour storm event while also achieving benefits associated with issues such as flood control and water supply. Where it is not feasible for regional projects to retain the 85th percentile 24 hour storm, the EWMP must demonstrate through a Reasonable Assurance Analysis, that applicable water quality targets should be achieved. Permittees within the Beach Cities Watershed Management Area (WMA) have elected to prepare an EWMP. The EWMP allows Permittees to collaboratively or individually develop comprehensive watershed-specific control plans which a) prioritize water quality issues, b) identify and implement focused strategies, control measures and BMPs, c) execute an integrated monitoring and assessment program, and d) allow for modification over time. In general, WMPs and EWMPs are intended to facilitate Permit compliance and water quality target achievement and goals that: 1) discharges from covered MS4s achieve applicable WQBELs and RWLs and do not include prohibited non-stormwater discharges; and 2) control measures are implemented to reduce the discharge of pollutants to the maximum extent practicable (MEP). Per Permit Section VI.C.1.e, WMPs and EWMPs are to be developed based on the LARWQCB's WMAs or subwatersheds thereof.

Consistent with Permit requirements, this EWMP is written to:

1. Be consistent with Permit provisions for EWMPs in Part VI.C.1.a.-f and Part VI.C.5-C.8;
2. Incorporate applicable State agency input on priority setting and other key implementation issues;
3. Provide for meeting water quality standards and other Clean Water Act obligations;
4. Include multi-benefit regional projects which retain stormwater from the 85th percentile 24 hour storm where feasible;
5. Include watershed control measures which achieve compliance with all interim and final WQBELs in drainage areas where retention of the 85th percentile 24 hour storm is infeasible with reasonable assurance;
6. Maximize the effectiveness of funding;
7. Incorporate effective innovative technologies;

8. Ensure existing requirements to comply with technology based effluent limitations and core requirements are not delayed; and
9. Ensure a financial strategy is in place.

This EWMP is applicable to the Beach Cities WMG EWMP Area, which consists of all of the incorporated MS4 areas of the cities of Redondo Beach, Manhattan Beach, Hermosa Beach and Torrance (excluding the Machado Lake Watershed) and includes the infrastructure of the LACFCD within those jurisdictions (**Figure ES-1**). This area includes portions of two distinct HUC-12 watersheds[4], Santa Monica Bay Watershed and Dominguez Channel Watershed, as summarized in **Table ES-1**. The Wylie Sump, Bishop Montgomery Basin, and Ocean Basin are all retention basins with no outlet. Therefore, their drainage areas have been excluded from the EWMP, with no analyses required.

- The western portion of the Beach Cities EWMP Area consists of approximately 7,840 acres of land that drains to Santa Monica Bay (SMB). This accounts for 52% of the total Beach Cities WMG area, and includes portions of the cities of Manhattan Beach, Redondo Beach, and Torrance, and the entirety of the City of Hermosa Beach. This portion of the study area is hereinafter referred to as the "SMB Watershed".
- The northeastern portion of the Beach Cities EWMP Area is tributary to Dominguez Channel (including Torrance Carson Channel) and is comprised of approximately 7,380 acres of land. This watershed accounts for 48% of the total Beach Cities EWMP Area, and includes portions of the cities of Manhattan Beach, Redondo Beach, and Torrance. Storm drains from the Cities of Manhattan Beach and Redondo Beach drain through the City of Lawndale before discharging to Dominguez Channel. The City of Torrance's MS4 discharges directly to Dominguez Channel and Torrance Carson Channel (Torrance Lateral). Collectively, this portion of the study area is hereinafter referred to as the "Dominguez Channel Watershed".

[4] A HUC-12 watershed is defined by a 12-digit hydrologic unit code (HUC) delineation, which identifies the watershed area based on six levels of classification: regional, sub-region, hydrologic basin, hydrologic sub-basin, watershed, and subwatershed.

Table ES-1. Beach Cities WMG Area Distribution by Participating Agency

Participating Agency	Area (acres)		
	Santa Monica Bay Watershed	Dominguez Channel Watershed	Total EWMP Area (% of total)
City of Redondo Beach	2,614	1,217	3,831 (25%)
City of Manhattan Beach	2,078	350	2,428 (16%)
City of Hermosa Beach	832	-	832 (5%)
City of Torrance	2,314	5,812	8,126 (53%)
Total	**7,837**	**7,379**	**15,217 (100%)**

The EWMP approach, including model selection, data inputs, critical condition selection, calibration performance criteria, and output types is consistent with the LARWQCB Reasonable Assurance Analysis Guidance Document (LARWQCB, 2014) and also leverages previous efforts where relevant models have already been developed. The individual water quality targets, BMPs, Reasonable Assurance Analyses, schedules, and costs for each of the watersheds are summarized in watershed-specific sections that follow.

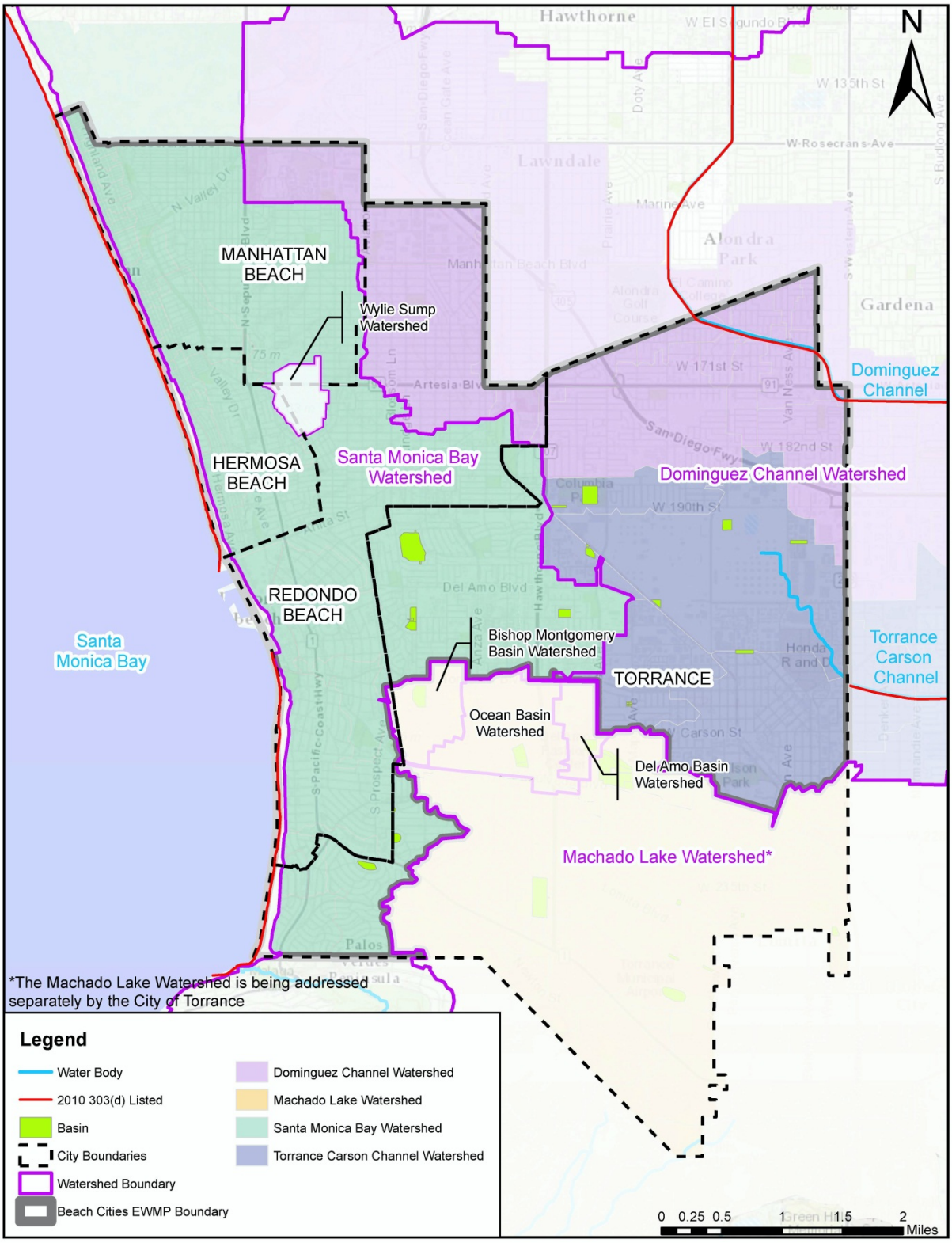


Figure ES-1. Beach Cities EWMP Area

SANTA MONICA BAY WATERSHED

Receiving waters for stormwater runoff from the Beach Cities EWMP Area were screened for water quality priorities by reviewing Total Maximum Daily Loads (TMDLs), the State's 303(d) list, and additional water quality data. Each identified water quality priority for a given receiving water body was categorized as a water body-pollutant combination. Water body-pollutant combinations were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit. **Table ES-2** presents the prioritized water body-pollutant combinations within the SMB Watershed portion of the Beach Cities EWMP Area. Water body-pollutant combinations categorized below are subject to change based on future data collected as part of the Coordinated Integrated Monitoring Program (CIMP) or other monitoring program.

Table ES-2. Water Body-Pollutant Combination Prioritization for the Santa Monica Bay Watershed

Category	Water Body	Pollutant	Reason/Justification
1: Highest Priority	Santa Monica Bay Beaches	Dry Weather Bacteria	SMB Beaches Dry Weather Bacteria TMDL
		Wet Weather Bacteria	SMB Beaches Wet Weather Bacteria TMDL
	Santa Monica Bay	Trash/Debris	SMB Debris TMDL
		DDTs	SMB PCBs and DDT TMDL
		PCBs	SMB PCBs and DDT TMDL
2: High Priority	N/A	None	No other 303(d) listings exist for the Beach Cities portion of SMB
3: Medium Priority	N/A	None	Outfall and receiving water monitoring data are not available for the Beach Cities portion of SMB

The Reasonable Assurance Analysis was performed on bacteria in each of the defined analysis regions (**Figure ES-2**), as it was the controlling pollutant within the SMB Watershed. Bacteria targets are summarized in **Table ES-3**.

The MS4 compliance targets for dichloro-diphenyl-trichloroethanes (DDTs) and polychlorinated biphenyls (PCBs) established in the Santa Monica Bay DDT & PCB TMDL were based on the assumption that the existing stormwater pollutant loads for DDT and PCBs were lower than what was needed to protect the Santa Monica Bay from these legacy pollutants (i.e., based on data used in the TMDL, no MS4 pollutant load reduction is expected to be required). Therefore, no reductions in DDT and PCB loading from the Beach Cities WMG MS4s are required to meet the TMDL and therefore, no Reasonable Assurance Analysis is required.

Trash was not modeled as part of the Reasonable Assurance Analysis, instead the Reasonable Assurance Analysis describes how the Beach Cities WMG Agencies will comply with the TMDL through their Trash Monitoring and Reporting Programs which are aimed at meeting the zero trash discharge definition in the TMDL.

Table ES-3. Water Quality Targets for the Santa Monica Bay Watershed

Water Body	Pollutant	RWL/WQBEL from the Permit	Note on Modeling Assumptions
Santa Monica Bay Beaches	Fecal Coliform (modeled as surrogate for all three fecal indicator bacteria in the Santa Monica Bay Beaches Bacteria [SMBBB] TMDL)	Allowable Exceedance Days per season per year (varies by beach Compliance Monitoring Location)	Used 90th percentile rain year (based on wet days) as the critical condition. Accounted for site-specific exceedance rates and the number of discharge days modeled for each Compliance Monitoring Location.

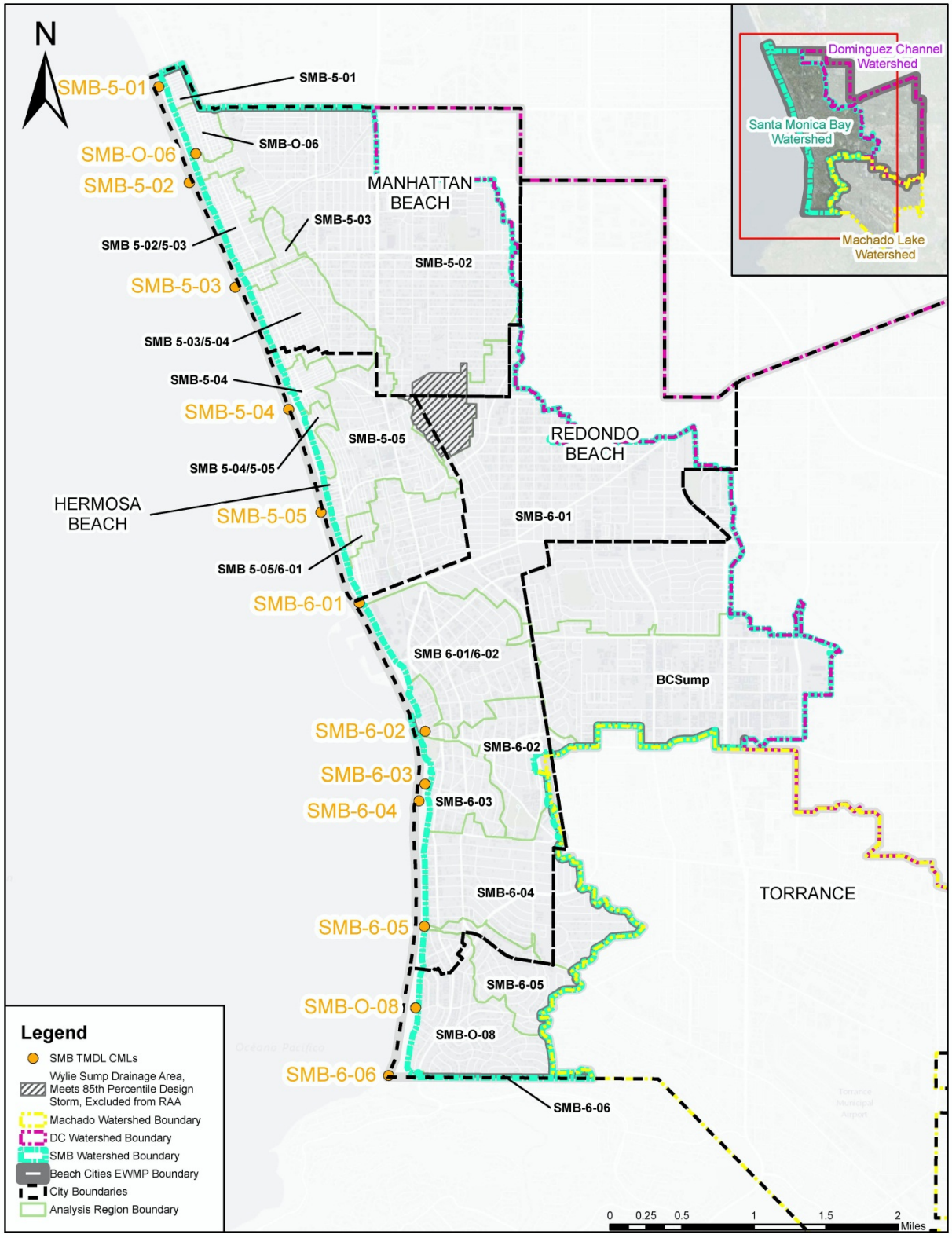


Figure ES-2. Analysis Regions and Compliance Monitoring Locations within the SMB Watershed portion of the Beach Cities EWMP Area

Targets – Santa Monica Bay

Target load reductions (TLRs) represent a numerical expression of the Permit compliance metrics that can be modeled and can serve as a basis for confirming, with reasonable assurance, that implementation of the proposed BMPs will result in attainment of the applicable TMDL-based WQBELs and RWLs in the Permit for Category 1 pollutants, or the Water Quality Objectives for Category 2 and Category 3 pollutants. For bacteria the target load reductions are expressed as Allowable Exceedance Days (AEDs) per year. TLRs for both interim and final compliance deadlines are presented for all analysis regions including both open beach and point zero compliance monitoring locations (CMLs) (**Table ES-4**).

Table ES-4. TLRs for Fecal Coliform in the Santa Monica Bay Watershed

Analysis Region	Baseline Annual Load (10^{12} Most Probable Number [MPN])	Interim Target Load Reduction		Final Target Load Reduction	
		Absolute (10^{12} MPN)	% of baseline annual load	Absolute (10^{12} MPN)	% of baseline annual load
SMB-5-01[1]	7.4	Interim target load reduction assessed on a watershed-wide basis		0	0%
SMB-O-06	23.0			0	0%
SMB-5-02	534.8			247.6	46.3%
SMB-5-02/SMB-5-03[2]	34.9			0	0%
SMB-5-03[1]	29.0			0	0%
SMB-5-03/SMB-5-04[2]	89.3			0	0%
SMB-5-04[1]	17.1			0	0%
SMB-5-04/SMB-5-05[2]	8.2			0	0%
SMB-5-05[1]	182.8			0	0%
SMB-5-05/SMB-6-01[2]	6.7			0	0%
SMB-6-01[3]	706.6			312.1	44.2%
BCSump[3]	379.4			178.0	46.9%
SMB-6-01/ SMB-6-02[2]	162.5			0	0%
SMB-6-02[1]	99.6			0	0%
SMB-6-03	62.2			0	0%
SMB-6-04	209.9			0	0%
SMB-6-05[1]	90.9			0	0%
SMB-O-08	138.9			0	0%
SMB-6-06[1]	6.7			0	0%
SMB Watershed-Wide	**3875.9**	**368.9**	**13%**	**737.7**	**26%**

[1] Anti-degradation site

[2] For the unmonitored tributary areas located in-between the CML tributary areas, TLRs were assigned from the geographically smaller of the two adjacent CML analysis regions.

[3] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

Nine CMLs were assigned zero TLRs to reflect their historic good water quality (consistent with anti-degradation-based wet weather allowable exceedance days). Although the SMBBB TMDL requires only the maintaining of beach water quality at anti-degradation compliance locations, the Beach Cities EWMP will seek to implement nonstructural and Low Impact Development (LID)-based BMPs within the SMB portion of their EWMP area; this will further protect and potentially improve water quality at these beaches and is consistent with the Jurisdictional Group 5 and 6 (J5&6) Implementation Plan (Geosyntec Consultants, 2011).

BMPs – Santa Monica Bay

EWMPs offer Permittees the opportunity to identify and implement focused strategies, control measures and BMPs to achieve applicable water quality targets (WQBELs and RWLs) and to reduce the discharge of pollutants to the maximum extent practicable. In order to demonstrate reasonable assurance, BMPs were identified and prioritized. Prioritization was based on cost (low cost BMPs were prioritized); BMP effectiveness for the pollutants of concern (BMPs that had greater treatment efficiency for the specific pollutants of concern were prioritized); and implementation feasibility as determined by the Beach Cities agencies. In general, nonstructural (e.g., programmatic) BMPs were prioritized over structural BMPs due to their lower relative cost.

The following is an overview of the types of BMPs contemplated in this EWMP within the Santa Monica Bay Watershed.

Programmatic BMPs: These source controls include a combination of BMPs such as new or enhanced pet waste controls (ordinance, signage, education/outreach, mutt mitts, etc.), Clean Bay Restaurant Program, human waste source tracking and remediation (e.g., leaking sewer investigations including implementation of each agency's Sanitary Sewer Management Plan consistent with Statewide Waste Discharge Requirements [WDRs], etc.), enhanced street sweeping (e.g., 100% vacuum sweepers, increased frequency, posting of 'No Parking' signs for street sweeping, etc.), increased catch basin and storm drain cleaning, and other new or enhanced nonstructural BMPs that target the pollutants addressed in this EWMP.

Public Retrofit Incentives: These BMPs include programs directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnection programs that redirect roof runoff to vegetated or otherwise pervious areas.

Redevelopment: Beginning in 2001, redevelopment projects were required by the Permit (via the Standard Urban Stormwater Management Program [SUSMP]) to incorporate stormwater treatment BMPs into their projects if their project size exceeded specified thresholds. The 2001 MS4 Permit SUSMP redevelopment requirements were applied between 2003 (the point at which the Bacteria TMDL was implemented) and 2015 for the SMB EWMP area. Additionally, the 2012 MS4 Permit established new criteria for redevelopment projects, requiring certain sized projects to capture, retain, or infiltrate the 85th percentile design storm or the 0.75-inch design storm, whichever is greater, via the implementation of LID BMPs. These were taken into account as well.

Non-MS4 Permitted Parcels or Areas: In general, this BMP assumes that regulated parcels/areas would be in compliance with the NPDES Statewide Storm Water Permit Waste Discharge

Requirements (WDRs) from State of California Department of Transportation (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and the California NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit [IGP], Order 2014-0057-DWQ).

Structural BMPs: Both existing and proposed regional and distributed structural BMPs are included in this EWMP to address water quality targets in the SMB Watershed. Because bacteria were identified as the controlling pollutant of concern, infiltration BMPs were prioritized as they are most effective for addressing bacteria. General design criteria for proposed structural BMPs are summarized in **Table ES-5**.

Table ES-5. Proposed Structural BMPs in the Santa Monica Bay Watershed

Analysis Region	Project Name	Description	Storage Volume (cu-ft)	Tributary Area (acres)
SMB-5-02	Manhattan Beach Infiltration Trench[2]	Located along the coast of Manhattan Beach, the sub-surface trench has a potential surface area of 2 ac, an average depth of 2 ft with a diversion rate of 160 cfs and an infiltration rate under the trench of 13 in/hr.	198,000	1,475[1]
SMB-5-02	Distributed Green Streets	The distributed green streets, proposed to address runoff from 5% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	205,500	66
SMB-6-01	Hermosa Beach Infiltration Trench	Located along the coast of Hermosa Beach, the sub-surface trench has a potential surface area of 0.2 ac, an average depth of 1.7 ft, a diversion flowrate of 25 cfs, and an infiltration rate of 12.5 in/hr.	13,300	2,000[1]
SMB-6-01	Hermosa Beach Greenbelt Infiltration[2]	Located in Hermosa Beach, between Valley Dr. and Ardmore Ave., the sub-surface trench has a potential surface area of 1.5 ac, an average depth of 5 ft, a diversion flowrate of 48 cfs, and an assumed infiltration rate of 12 in/hr.	319,000	1,800[1]
SMB-6-01	Park #3	Located northwest of Blossom Lane and 190th street, the sub-surface infiltration basin has a potential surface area of 0.5 ac, an average depth of 5ft , a diversion flowrate of 13 cfs, and an infiltration rate of 1 in/hr.	87,000	1,430[1]

Analysis Region	Project Name	Description	Storage Volume (cu-ft)	Tributary Area (acres)
SMB-6-01	Distributed Green Streets	The distributed green streets, proposed to address runoff from 25% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	605,200	190

[1] This includes upstream BMPs and associated tributary drainage areas
[2] Alternative project locations have also been identified

Distributed green streets BMPs are proposed and were modeled as part of the Reasonable Assurance Analysis within select analysis regions, at analysis region-specific implementation levels (e.g., runoff from 14% of single family residential, multi-family residential, and commercial land uses would be treated by green streets BMPs). It should be noted that if at any time in the future, specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, alternative BMPs or operational changes will be planned within the same subwatershed and within the same timeline, to meet an equivalent subwatershed load reduction. In addition, if monitoring data indicate that more easily implementable, alternative BMPs can provide equivalent (or superior) load reductions, these alternative BMPs may be implemented at the discretion of the WMG Agencies.

Demonstration of Compliance – Santa Monica Bay

To demonstrate wet weather compliance, a Reasonable Assurance Analysis was conducted in which the following steps were taken:

1. For each analysis region, develop TLRs for 90th percentile year based on Permit requirements and LARWQCB guidance;
2. Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future:
    a. Assume a load reduction for non-modeled non-structural (or programmatic) BMPs (five percent of baseline pollutant load);
    b. Calculate load reductions for public incentives for retrofits on private property (e.g., downspout disconnects) and redevelopment (e.g., low impact development requirements);
    c. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 Permittees (e.g., Industrial General Permit holders and California Department of Transportation [Caltrans]); and
    d. Calculate load reductions for proposed regional BMPs that were identified in existing plans;
3. Compare total estimated load reduction for each analysis region with the TLRs; and

4. Meet the TLRs by backfilling the remaining load reduction with new regional or distributed green streets BMPs, and with green streets that address a certain percentage of specific developed land uses.

Results of the Reasonable Assurance Analysis for each analysis region in the SMB watershed are presented in **Table ES-6** below. The values provided correspond to the load reductions attributable to the BMP types following the applicable final and interim compliance deadlines. As shown, the final TLR is met in all SMB watershed analysis regions with varying applications of non-structural and regional BMPs. The interim 50% TLR is met through a combination of nonstructural and existing regional BMPs.

For dry weather bacteria compliance, a qualitative analysis was conducted to show compliance at each of the CMLs. Many CMLs have an effective diversion such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the surf zone during year-round dry weather days. For the remaining smaller outfalls a systematic screening conducted in 2002 demonstrated that there was no discharge to the wave wash during summer dry weather from these storm drains. Rescreening of outfalls will be conducted as part of the Non-Stormwater Screening and Monitoring in the Coordinated Integrated Monitoring Program and will include both summer dry weather and winter dry weather screening. For the CMLs in the SMB Watershed that have anti-degradation based allowed exceedance days for both winter-dry and summer-dry weather, reasonable assurance is assumed to be demonstrated through the basis that the TMDL established their allowed exceedance days based on historic conditions (i.e., no water quality improvements were necessary).

Table ES-6. Santa Monica Bay Watershed – Fecal Coliform Reasonable Assurance Analysis Results – Interim and Final Compliance

Analysis Region	Implementation Benefits (average load reduction as % of baseline load for critical year)							TLR	Compliance (TLR Met)?
	Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level	Estimated Load Reduction		
SMB-5-01	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-O-06	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-5-02	5%	4%	2%	36%	3%	5% MFR/COM/SFR	**50%**	**46%**	Yes
SMB-5-02/5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03/5-04	5%	4%	0%	5%	0%	N/A	**15%**	**0%**	Yes
SMB-5-04	5%	5%	0%	1%	1%[2]	N/A	**12%**	**0%**	Yes
SMB-5-04/5-05	5%	4%	0%	2%	0%	N/A	**11%**	**0%**	Yes
SMB-5-05	5%	4%	5%	3%	0%	N/A	**18%**	**0%**	Yes
SMB-5-05/6-01	5%	3%	0%	2%	0%	N/A	**10%**	**0%**	Yes
SMB-6-01+ BCSump[1]	5%	3%	3%	33%	2%	25% MFR/COM/SFR	**46%**	**45%**	Yes
SMB-6-01/6-02	5%	2%	4%	0%	0%	N/A	**11%**	**0%**	Yes
SMB-6-02	5%	3%	1%	4%	0%	N/A	**13%**	**0%**	Yes
SMB-6-03	5%	3%	5%	10%	0%	N/A	**23%**	**0%**	Yes
SMB-6-04	5%	4%	3%	0%	0%	N/A	**12%**	**0%**	Yes
SMB-6-05	5%	3%	6%	0%	0%	N/A	**15%**	**0%**	Yes
SMB-O-08	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-6-06	5%	5%	0%	0%	0%	N/A	**10%**	**0%**	Yes
Final Compliance Deadline (2021)	**5%**	**3%**	**3%**	**21%**	**1%**	**N/A**	**33%**	**26%**	**Yes**
Interim Compliance Deadline (2018)	**2.5%**	**0.8%**	**1.5%**	**9.6%**	**0%**	**N/A**	**14.4%**	**13%**	**Yes**

[1] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

[2] Distributed green street BMP load reduction in SMB-5-04 is a result of the existing filter/infiltration boxes retrofitted on the east side of Hermosa Avenue in the City of Hermosa Beach.

Schedule – Santa Monica Bay

In order to meet the compliance deadlines for the water body-pollutant combinations discussed above based on load reduction projections in the Reasonable Assurance Analysis, the proposed structural BMPs within the SMB Watershed would be implemented as described in **Figure ES-3**.

Figure ES-3. Proposed Project Sequencing in the Santa Monica Bay Watershed

Project Name	Timeline						
	2015	2016	2017	2018	2019	2020	2021
Catch basin retrofits							
Manhattan Beach Infiltration Trench*							
Green streets application in SMB-5-02							
Hermosa Beach Greenbelt Infiltration*							
Hermosa Beach Infiltration Trench							
Park #3							
Green streets application in SMB-6-01							

* Alternative project locations have also been identified

Dominguez Channel Watershed

Within the Dominguez Channel Watershed, water body-pollutant combinations were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit. **Table ES-7** presents the prioritized water body-pollutant combinations within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area. Water body-pollutant combinations categorized below are subject to change based on future data collected as part of the CIMP or other monitoring program.

Table ES-7. Water Body-Pollutant Prioritization for the Dominguez Channel Watershed

Category	Water Body	Pollutant	Reason for Categorization
1: Highest Priority	Dominguez Channel (including Torrance Lateral)	Toxicity	Dominguez Channel Toxics TMDL
		Total Copper	Dominguez Channel Toxics TMDL
		Total Lead	Dominguez Channel Toxics TMDL
		Total Zinc	Dominguez Channel Toxics TMDL
2: High Priority	Dominguez Channel (including Torrance Lateral)	Indicator Bacteria	303(d) List
3: Medium Priority	Dominguez Channel (including Torrance Lateral)	Cyanide	Historic exceedances of the California Toxics Rule (CTR) continuous concentration water quality objective (5.2 ug/L)
		pH	Historic exceedance of the Basin Plan Objective (6.5 – 8.5)

Category	Water Body	Pollutant	Reason for Categorization
		Selenium	Historic exceedances of the CTR continuous concentration water quality objective (5.0 ug/L)
		Mercury	Historic exceedances of the CTR human health criterion for organisms only (0.051 ug/L)
		Cadmium	Historic exceedances of the CTR continuous concentration water quality objective (2.2 ug/L)

For the purposes of the wet weather Reasonable Assurance Analysis, the EWMP area draining to Dominguez Channel was combined into a single analysis region to establish TLRs and into two analysis regions, one including the portion of the Cities of Redondo Beach and Manhattan Beach (Dominguez Channel – Redondo Beach/Manhattan Beach [DC–RB/MB]) and one including the portion of the City of Torrance (DC – Torrance), to evaluate the performance of BMPs. For the purposes of the dry weather Reasonable Assurance Analysis for which bacteria are the only water body-pollutant combination, the EWMP area draining to Dominguez Channel was combined into the same single analysis region. The Dominguez Channel watershed analysis regions are shown in **Figure ES-4.**

The wet weather Reasonable Assurance Analysis was performed on copper, lead, zinc, and bacteria (fecal coliform) within the Dominguez Channel Watershed. Water quality targets were identified for Dominguez Channel watershed in the same manner as in SMB Watershed. The water quality targets for prioritized water body-pollutant combinations are summarized in **Table ES-8** below.

Table ES-8. Water Quality Targets for the Dominguez Channel Watershed

Water Body	Pollutant	RWL/WQBEL from the Permit or Assumed Based on Other Similar Los Angeles Region TMDLs	Approach for Applying the Critical Period
Dominguez Channel	Fecal Coliform	19% allowed exceedance of the REC-1 water quality objective, (400 MPN/100mL) on non-high flow suspension days	90th percentile year (based on wet days) was used as the critical condition. Allowable number of wet weather exceedance days for the critical year was set to 19% of non-high flow suspension wet days, rounding down.
	Total Copper	WQBEL=9.7 ug/L Waste load allocation (WLA)= Concentration*Daily Volume	90th percentile daily load during wet weather was used as the critical condition. This calendar day was identified for each metal by ranking daily loads for metal wet days between 2003 and 2012.
	Total Lead	WQBEL=42.7 ug/L WLA= Concentration*Daily Volume	
	Total Zinc	WQBEL=69.7 ug/L WLA= Concentration*Daily Volume	

Although toxicity was identified as a Category 1 water body-pollutant combination, it was not modeled for Dominguez Channel and the Torrance Lateral since it is not a wet weather parameter that can be modeled using currently available Reasonable Assurance Analysis tools for the Los Angeles Region. Instead, the Reasonable Assurance Analysis qualitatively describes how the Beach Cities WMG Agencies will comply with the TMDL WQBELs. Toxicity will continue to be monitored

under the Beach Cities' CIMP. Although ammonia was identified as a Category 2 water body-pollutant combination, monitoring data since 2003 show that all water quality samples at monitoring locations S28 and TS19 meet the freshwater Basin Plan Objective for ammonia, and as a result, ammonia was not modeled as part of the Beach Cities' Reasonable Assurance Analysis. Similarly, the Category 3 water body-pollutant combinations cyanide, pH, selenium, mercury, and cadmium, all within the Torrance Lateral, were not modeled either due to a lack of demonstrated MS4 linkage or due to data limitations. These parameters will be monitored under the Beach Cities' CIMP and if future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to cadmium exceedances in the receiving water, the EWMP will be revised to address these pollutants.

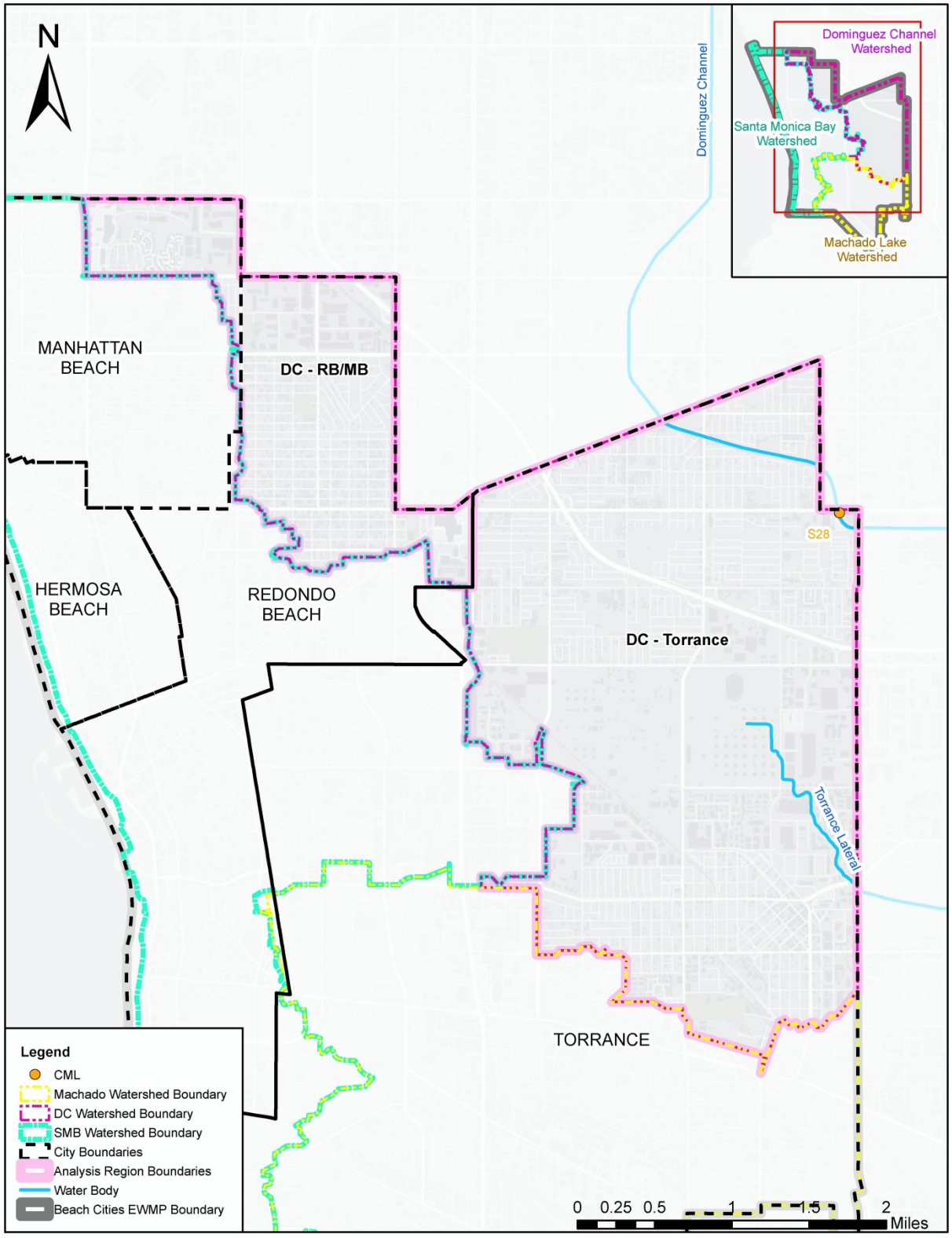


Figure ES-4. Analysis Regions within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area

Targets – Dominguez Channel

As discussed previously, TLRs represent a numerical expression of the Permit compliance metrics (e.g., allowed mass per day for metals for wet weather and allowable exceedance days per year for bacteria) that can be modeled and can serve as a basis for confirming, with reasonable assurance, that implementation of the proposed BMPs will result in attainment of the applicable TMDL-based WQBELs and RWLs in the Permit for Category 1 pollutants, or the Water Quality Objectives for Category 2 and Category 3 pollutants. TLRs were developed for the single combined analysis region (**Table ES-9**).

Table ES-9. TLRs for the Dominguez Channel Watershed

Pollutant	Compliance Deadline	Units	Baseline Annual Load	Interim Target Load Reductions		Final Target Load Reductions	
				Absolute	% of baseline annual load	Absolute	% of baseline annual load
Copper	2032	lb	21	N/A		13	62%
Lead	2032	lb	8.7			0	0%
Zinc	2032	lb	230			175	76%
Fecal coliform	2022	10^{12} MPN	1,498	124	8.3%	-	-
	2027	10^{12} MPN	1,498	255	17%	-	-
	2032	10^{12} MPN	1,498	-	-	493	33%

BMPs – Dominguez Channel

Both existing and proposed regional and distributed BMPs are included in this EWMP to address water quality targets in the Dominguez Channel Watershed. Distributed green streets BMPs are proposed and were modeled as part of the Reasonable Assurance Analysis within the DC-RB/MB analysis region, at an implementation level of 14% (i.e., runoff from 14% of single family residential, multi-family residential, commercial, and industrial land uses would be treated by green streets BMPs). General design criteria for proposed structural BMPs are summarized in **Table ES-10**.

Table ES-10. Proposed Structural BMPs in the Dominguez Channel Watershed

Analysis Region	Project Name	Description	Storage Volume (cu-ft)	Tributary Area (acres)
DC – MB/RB	Powerline Easement Infiltration*	Located along powerline easements and/or adjacent to Marine Avenue and Manhattan Beach Boulevard, the sub-surface biofilter has a potential surface area of 7.2 ac, an average depth of 5 ft, a diversion flowrate of 132 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	1,500
DC – MB/RB	Artesia Blvd. and Hawthorne Blvd. Filtration	Located near the intersection of Artesia Blvd. and Hawthorne Blvd., the sub-surface biofilter has a potential surface area of 1 ac, an average depth of 5 ft, a diversion flowrate of 13.6 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	130
DC-MB/RB	Distributed Green Streets BMPs	The distributed green streets (to address runoff from 14% of single family residential, multi-family residential, commercial, and industrial land uses) are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	636,300	200
DC-Torrance	Catch Basin Inlet Filters	The City of Torrance plans to retrofit catch basins with inlet filters.	N/A	5,760

*Alternative project location has also been identified

It should be noted that if at any time specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, or new innovative BMPs are developed, alternative BMPs or operational changes will be planned within the same analysis region and within the same timeline, to meet an equivalent analysis region load reduction. The performance of the proposed catch basin inlet filters within the City of Torrance will also be evaluated as potential alternatives to the proposed structural BMPs within the Cities of Redondo Beach and Manhattan Beach.

Demonstration of Compliance – Dominguez Channel

To demonstrate wet weather compliance, the Reasonable Assurance Analysis was performed according to the following steps:

1. For each analysis region, develop TLRs for the critical condition (90th percentile year for bacteria and 90th percentile load day for metals) based on Permit requirements and LARWQCB guidance;
2. Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future:
    a. Assume a load reduction for non-modeled non-structural (or programmatic) BMPs (five percent of baseline pollutant load);
    b. Calculate load reductions for public incentives for private retrofit (e.g., downspout disconnects) and redevelopment;
    c. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 entities (e.g., Industrial General Permit holders and Caltrans); and
    d. Calculate load reductions for proposed regional BMPs that were identified in existing plans;
3. Compare total estimated load reduction for each analysis region with the TLRs; and
4. Meet the TLRs by backfilling the remaining load reduction with new regional or distributed green streets BMPs, with green streets modeled by assuming treatment of runoff from a percentage of specific developed land uses. Within the DC-Torrance analysis region, an estimated load reduction attributable to distributed catch basin inlet filters was derived from a review of literature/studies on their performance (**Appendix B**). If the estimated performance is supported by future monitoring data, these filters may be used as alternative BMPs in other portions of the Dominguez Channel Watershed.

Results of the wet weather Reasonable Assurance Analysis for each analysis region are presented in **Table ES-11** below. The values provided correspond to the load reductions attributable to the BMP types following the applicable compliance deadline. As shown, the TLRs are predicted to be met in the DC-RB/MB analysis region for metals and fecal coliforms with varying applications of non-structural and regional BMPs as described previously. Within the DC-Torrance analysis region, the TLRs will be met through implementation of catch basin inlet filters as needed. Monitoring and subsequent adaptive management will be employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed until compliance is achieved for every applicable WQBEL or RWL.

For dry weather, bacteria is the only applicable pollutant in the Dominguez Channel watershed, and it is a Category 2 water body-pollutant combination (i.e., 303(d)-listed but not currently subject to a TMDL).

The City of Torrance's dry weather load reduction strategy will focus on non-structural source control and pollution prevention measures that are designed to reduce the amount of pollutants and understand the effect of pollutants entering runoff though education, enforcement and behavioral modification programs.

Within the Cities of Redondo Beach and Manhattan Beach, the implementation of the two regional BMPs at both outlets from the DC-RB/MB analysis region to address wet weather pollutants will control dry weather flows by capturing the small flows in the pre-treatment volume and either retaining them or treating them in the media filter.

In addition, each of the EWMP WMG cities has water conservation regulations which will reduce dry weather runoff at its source. Collectively, by controlling dry weather MS4 flows prior to entering Dominguez Channel using the proposed suite of BMPs, bacteria will be addressed. If necessary, the EWMP Group agencies retain the option of installing low flow diversions sized to effectively eliminate discharges to the receiving water year-round dry weather days. Therefore, reasonable assurance of meeting the applicable RWLs was demonstrated in this EWMP through a qualitative assessment of the proposed BMPs and their overall approach of eliminating or substantially reducing MS4 discharges during dry weather.

Table ES-11. Dominguez Channel Watershed – Reasonable Assurance Analysis Results – Interim and Final Compliance

Pollutant	Date	Implementation Benefits (average load reduction as % of baseline for the critical condition[1])						Estimated Load Reduction	TLR	Compliance (TLR Met)?
		Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level			
Analysis Region DC-RB/MB										
Zinc	2032 (Final)	5%	9%	6%	39%	20%	14% SFR, MFR, COM, IND	**79%**	**76%**	Yes
Copper	2032 (Final)	24%[2]	0%	5%	30%	26%		**85%**	**62%**	Yes
Fecal coliform	2022 (Interim)	2.1%	1.5%	0.7%	0%	4.1%	3% SFR, MFR, COM, IND	**8.4%**	**8.3%**	Yes
	2027 (Interim)	3.5%	2.4%	1.3%	0%	10%	7% SFR, MFR, COM, IND	**17%**	**17%**	Yes
	2032 (Final)	5%	3.2%	1.8%	45%	20%	14% SFR, MFR, COM, IND	**74%**	**33%**	Yes
Analysis Region DC-Torrance										
Zinc	2032 (Final)	5%	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	76%	See note 3
Copper	2032 (Final)	14%[2]	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	62%	See note 3
Fecal coliform	2022 (Interim)	2.1%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	8.3%	See note 3
	2027 (Interim)	3.5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	17%	See note 3
	2032 (Final)	5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	33%	See note 3

[1] The critical condition is TMDL year 1995 for fecal coliform, 11/30/2007 for copper, 2/5/2010 for lead, and 2/26/2006 for zinc.

[2] Load reduction attributable to copper brake pad phase-out, after accounting for other BMPs, up to 55%.

[3] Load reduction sum cannot be estimated at this time. The individual load reduction for each inlet filter's drainage area is shown under the "Distributed BMPs" column. Initially, 200 of 643 catch basins are planned to be retrofitted in high priority catchments. Therefore, the total load reduction from inlet filters will be evaluated in the future through monitoring, and the BMPs will be modified through the adaptive management process, with additional filters installed as necessary to meet the TLRs by the compliance deadlines.

Schedule – Dominguez Channel

In order to meet the compliance deadlines for the water body-pollutant combinations based on load reduction projections in the Reasonable Assurance Analysis, the proposed structural BMPs within the Dominguez Channel Watershed would be implemented per the timeline provided in **Figure ES-5** .

Figure ES-5 Project Sequencing in the Dominguez Channel Watershed

Project Name	Timeline																
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Catch basin inlet filters in DC-Torrance																		
Green streets application in DC-RB/MB																		
Powerline Easement Filtration*																		
Artesia Boulevard and Hawthorne Boulevard Filtration																		

*Alternative project location has also been identified

Compliance Schedule

Table ES-12 summarizes the existing and proposed implementation actions and dates within the Santa Monica Bay and Dominguez Channel watersheds, for each identified water body-pollutant combination. The compliance schedule for Category 1 water body-pollutant combinations is consistent with the associated TMDLs. The compliance schedule for the Category 2 water body-pollutant combinations has been selected to achieve the proposed wet and dry weather bacteria milestones, with implementation actions not exceeding one year, in accordance with the Permit (Section ii(5)9B). As described in **Table ES-12,** the compliance schedule for the Category 3 water body-pollutant combinations will be dependent on the results of the CIMP.

Table ES-12. Compliance Schedule for the Santa Monica Bay and Dominguez Channel Watersheds

Category	Watershed	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
1: Highest Priority	Dominguez Channel	Toxicity Total Copper Total Lead Total Zinc	Wet	Current	Interim: Comply with the interim water quality-based effluent limitations as listed in the TMDL
				March 2032	Final: Comply with the final water quality-based effluent limitations as listed in the TMDL
	Santa Monica Bay	Bacteria	Dry	N/A	Final compliance in effect and attained through diversions and non-structural BMPs.
			Wet	July 2018	Interim: 50% single sample ED reduction
				July 2021	Final: Geometric Mean [GM] targets met Final: Single sample AED targets met
		Trash/Debris	N/A	March 2016	Interim: 20% load reduction met through implementation of trash excluders
				March 2017	Interim: 40% load reduction met through implementation of trash excluders
				March 2018	Interim: 60% load reduction met through implementation of trash excluders
				March 2019	Interim: 80% load reduction met through implementation of trash excluders
				March 2020	Final: 100% load reduction met through implementation of trash excluders
		DDTs	N/A	N/A	Since the TMDL effectively implements an anti-degradation approach (i.e., historic low MS4 concentrations or loads must be kept the same or lower), and the Beach Cities EWMP Agencies are currently presumed to be achieving the WLAs (thus negating the need for Reasonable Assurance Analysis), no compliance schedule is proposed.
		PCBs	N/A	N/A	
2: High Priority	Dominguez Channel	Bacteria	Dry	December 2023	Interim: 50% load reduction
				December 2025	Final: 100% compliance may be demonstrated by the Permittee in one of three ways: 1. Meeting the allowed exceedance days (5 days during the dry weather period); or 2. Meet the allowed exceedance percentage (1.6% during a dry weather period) within the total drainage area served by the MS4. 3. Diversions are in place such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the receiving water year-round dry weather days.
			Wet	December 2016	Provide documentation supporting minimum control measure (MCM) enhancements implemented over the past year
				December 2017	Provide documentation supporting MCM enhancements implemented over

Category	Watershed	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
					the past year
				December 2018	Identify planned green streets locations to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2019	City Council approval of Plans & Specifications for green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Begin installation of catch basin inlet filters in the DC-Torrance analysis region.
				December 2020	Develop concept reports for regional BMPs in the cities of Redondo Beach and Manhattan Beach. Begin construction on green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2021	Submit grant application for any one of the proposed regional projects in the cities of Redondo Beach and Manhattan Beach.
				December 2022	Interim Milestone: 25% of target load reduction
				December 2023	Identify planned green streets locations to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2024	Begin construction on planned green streets to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Continue installation of catch basin inlet filters in the DC-Torrance analysis region.
				December 2025	Release Request for Proposals for regional BMP designs in Redondo Beach and/or Manhattan Beach
				December 2026	Complete construction on planned green streets to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2027	Interim Milestone: 50% of target load reduction
				December 2028	Produce regional BMP design reports; identify locations for green streets implementation to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities of Redondo Beach and Manhattan Beach.
				December 2029	Begin regional BMP permitting process for project in Redondo Beach or Manhattan Beach.
				December 2030	Begin construction on planned green streets to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities

Category	Watershed	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
					of Redondo Beach and Manhattan Beach.
				December 2031	Begin regional BMP construction of project in Redondo Beach or Manhattan Beach.
				December 2032[1]	Final Milestone: 100% compliance may be demonstrated by the Permittee in one of three ways: 1. Meeting the allowed exceedance days (10 days during a wet weather period, plus high flow suspension days) 2. Meeting the target load reduction (33%); or 3. Meeting the allowed exceedance percentage (19% during a wet weather period) within the total drainage area served by the MS4.
3: Medium Priority	Dominguez Channel	Cyanide pH Selenium Mercury Cadmium	N/A	N/A	As required by the Permit, monitoring for these pollutants will occur under the CIMP. If monitoring data suggest that the Beach Cities Agencies' MS4s may cause or contribute to exceedances of these pollutants in the receiving water,[2] these contributions will be addressed through modifications to the EWMP as a part of the adaptive management process, as described in Permit section VI.C.2.a.iii.

[1] The final compliance date for wet weather bacteria was selected to be consistent with the Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters Toxic Pollutants TMDL (RWQCB, 2011).

[2] This will be assumed to be the case if monitoring data show that outfall concentrations and receiving water concentrations are in excess of the applicable water quality criteria for the same monitoring event.

Planning Level Cost Opinion

Planning-level cost opinions associated with implementation of the proposed structural best management practices within the Beach Cities WMG area are provided based on results from the Reasonable Assurance Analysis for the Beach Cities EWMP. Cost opinions are presented as an aid for decision makers, and contain considerable uncertainties. Given the iterative and adaptive nature of the EWMP and the many variables associated with the projects, the budget forecasts are order-of magnitude opinions, and are subject to change based on site-specific BMP feasibility assessment findings, preliminary and final BMP designs and landscaping, BMP effectiveness assessments, results of outfall and receiving water monitoring, and special studies such as those that might result in site specific objectives which could modify water quality objectives or TMDL Waste Load Allocations for a specific water body-pollutant combination.

EWMP planning-level cost opinions were developed for the proposed structural BMPs in addition to programmatic costs. Costs approximated for structural BMPs include "hard" costs for tangible assets and "soft" costs, which include considerations such as design and permitting. **Table ES-13** summarizes the total 20-year life-cycle costs for each proposed structural BMP, which are composed of the cost to construct or implement each structural BMP plus the associated annual O&M costs over 20 years. In order to account for possible variations in BMP design, BMP configurations, and site-specific constraints, as well as for uncertainties in available BMP unit costs from literature or estimated BMP unit costs, a range of costs is presented. These cost opinions are provided for information only, and it is recognized that should monitoring information demonstrate that alternative, less-expensive BMPs are equally (or superior) to those described herein, that these alternative BMPs may be implemented at the discretion of the WMG agencies. Not included in these costs are the annual monitoring costs for implementing the CIMP or the costs associated with implementing baseline and enhanced MCMs.

Table ES-13. Cost Opinion for Proposed Structural BMPs in Santa Monica Bay and Dominguez Channel Watersheds

Watershed/ Analysis Region		Location of BMP	Project Name	Construction Cost Range		Annual O&M Range		Total 20-Year Life-Cycle[1] Range	
				Low	High	Low	High	Low	High
Santa Monica Bay Watershed	SMB-5-02, Alternative 1	Manhattan Beach	Manhattan Beach Infiltration Trench[2]	$3.7M	$6.8M	$140K	$190K	$6.5M	$11M
		Manhattan Beach	Distributed Green Streets	$2.4M	$6.5M	$110K	$220K	$4.6M	$11M
		SMB-5-02 Alternative 1 Combined Costs		**$6.1M**	**$13M**	**$250K**	**$410K**	**$11M**	**$22M**
	SMB-6-01	Hermosa Beach	Hermosa Beach Infiltration Trench	$500K	$1.1M	$18K	$32K	$860K	$1.7M
		Hermosa Beach	Hermosa Beach Greenbelt Infiltration[2]	$5.5M	$8.0M	$81K	$90K	$7.1M	$9.8M
		Redondo Beach	Park #3	$1.9M	$3.0M	$28K	$33K	$2.5M	$3.7M
		Hermosa Beach	Distributed Green Streets	$7.0M	$19M	$310K	$640K	$13M	$32M
		SMB-6-01 Combined Costs		**$15M**	**$31M**	**$440K**	**$800K**	**$23M**	**$47M**
	All Analysis Regions	Hermosa Beach	Trash exclusion devices	$160K	$430K	$50K	$64K	$1.1M	$1.7M
		Redondo Beach	Trash exclusion devices	$1.1M	$3.1M	$360K	$460K	$8.3M	$12M
		Manhattan Beach	Trash exclusion devices	$590K	$1.7M	$210K	$270K	$4.8M	$7.1M
	Combined Costs in Santa Monica Bay Watershed			**$23M**	**$50M**	**$1.3M**	**$2.0M**	**$49M**	**$90M**
Dominguez Channel Watershed	DC-RB/MB	Redondo Beach	Powerline Easement Infiltration[2]	$11M	$16M	$160K	$180K	$14M	$20M
		Redondo Beach	Artesia Blvd Infiltration	$2.0M	$3.1M	$30K	$35K	$2.6M	$3.8M
		Redondo Beach + Manhattan Beach	Distributed Green Streets	$7.4M	$20M	$330K	$670K	$14M	$33M
		DC-RB/MB Combined Costs		**$20M**	**$39M**	**$520K**	**$890K**	**$31M**	**$57M**
	DC-Torrance	Torrance	Catch basin inlet filters	$240K	$360k	$130K	$170k	$2.8M	$3.7M
		DC-Torrance Combined Costs		**$240K**	**$360k**	**$130K**	**$170k**	**$2.8M**	**$3.7M**
	Combined Costs in Dominguez Channel Watershed			**$20M**	**$39M**	**$650K**	**$1.1M**	**$33M**	**$61M**
Combined Costs of All Proposed Structural BMPs				**$43M**	**$89M**	**$2.0M**	**$3.1M**	**$82M**	**$150M**

M = Million dollars, K = Thousand dollars

[1] Life-cycle costs include construction costs and 20 years of annual O&M (in 2015 dollars) and are not discounted.

[2] Alternative project locations have also been identified, but are not included in combined cost opinion

FINANCING DISCUSSION

The availability of funds will be critical for the implementation of the EWMP. Section 7 of this EWMP provides an overview of potentially available funding sources to pay for programs proposed in the EWMP. Examples show that a multi-pronged funding strategy using multiple sources rather than rely on a single storm drain fee may be the most prudent approach. A list of potential fees and charges has been developed, which will be further considered and explored by the Beach Cities WMG in the future:

- Vehicle license and vehicle rental fees
- Solid waste management surcharge
- Water service surcharge (under AB850)
- Property assessment
- Fines (not a stable source, it is an exemption under Proposition 26)
- Financial subsidy to encourage private sector participation to develop local and district projects
- One time capital recovery fee
- Dedicated storm drain fee
- Taxes (e.g. fuel taxes)
- A TMDL fee / tax could be developed based on the pollutant contribution from polluters / activities

In addition, Public Private Partnerships and alternative delivery and financing methods may facilitate and streamline implementation, and could result in program cost reductions.

From the analysis of potential costs in this section as summarized in **Table ES-13**, it is clear that projected costs of implementing the EWMP are substantial and orders of magnitude higher than have previously been expended by the agencies under the previous MS4 Permit. Thus availability of funds will be critical for the implementation of the EWMP. Currently, the Beach Cities do not have sufficient funds or dedicated funding streams to construct and maintain the projects proposed in this EWMP.

The Beach Cities agencies are working with the Los Angeles County Division of the League of California Cities and the California Contract Cities Association to partner with other affected agencies to collectively influence State policies, pursue changes in legislation and lobby high level officials for additional stormwater funding. Working together with the other cities will increase effectiveness, communication, collaboration, and reduce redundant efforts. The LACFCD will also work with the Beach Cities in their efforts to address source controls; assess, develop, and pursue funding for structural BMPs, and promote the use of water reuse and infiltration. As regional project scopes are further refined, the LACFCD will determine on a case-by-case basis their contribution to the projects.

In addition to working with other affected cities on a regional level, the Beach Cities WMG individually and collaboratively are committed to pursue funding sources at a local level including but not limited to:

- *Grants* - Collaboration and coordination between the Beach Cities will be important to increase accessible grant funding opportunities for stormwater projects, however alternative funding sources will also be needed to provide stable O&M revenues since grants typically do not provide for O&M.
- *Interagency Partnerships* – Interagency partnerships, like the Beach Cities WMG, can allow agencies to leverage local funding resources to make cost intensive projects possible.
- *Local Bond Issuance* - Two types of local bonds can be utilized. General Obligation (GO) bonds are issued by local governments and repaid through a property tax surcharge. Revenue bonds are tax-exempt securitized bonds repaid through utility rate increases charged directly to customers.
- *Local Stormwater Assessments* - Stormwater charges are potentially the most critical local funding source to finance stormwater programs. These charges include stormwater fees and taxes.
- *Direct Subsidies* - Direct financial subsidies to local projects do not contribute to cash revenue generation. However, subsidies can create a financial incentive to encourage local participation without providing the full cost for project implementation. Such an approach can increase financial efficiency by leveraging financial input from communities.

These potential sources of funding are discussed in greater detail in Section 7.

1 INTRODUCTION

Following adoption of the 2012 Los Angeles Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit[5] (Permit), the Cities of Hermosa Beach, Manhattan Beach, Redondo Beach and Torrance, together with the Los Angeles County Flood Control District (LACFCD), collectively referred to as the Beach Cities Watershed Management Group (Beach Cities WMG) agreed to collaborate on the development of an Enhanced Watershed Management Program (EWMP) for the Santa Monica Bay (SMB), Dominguez Channel, and Machado Lake Watershed areas within their jurisdictions (referred to herein as the Beach Cities EWMP Area). This EWMP is intended to facilitate effective, watershed-specific Permit implementation strategies in accordance with Permit Part VI.C. and summarizes the SMB and Dominguez Channel-specific water quality priorities identified jointly by the Beach Cities WMG, outlines the program plan, including specific strategies, control measures and best management practices (BMPs)[6], necessary to achieve water quality targets (Water Quality-Based Effluent Limitations [WQBELs] and Receiving Water Limitations [RWLs]), and describes the quantitative analyses completed to support target achievement and Permit compliance.

In compliance with Section VI.C.4.b of the Permit, the Beach Cities WMG submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) a Notice of Intent (NOI) to develop an EWMP on June 28, 2013 with a revised NOI submitted December 17, 2013. On March 27, 2014, the Beach Cities WMG received a letter from the Executive Officer of the LARWQCB approving the revised NOI submittal. In compliance with Section VI.C.4.c.iv of the Permit, the Beach Cities WMG then submitted a draft EWMP Work Plan to the LARWQCB on June 26, 2014. Comments were not received. As the next step in EWMP development, the Beach Cities WMG was required by Section VI.C.4.c.iv of the Permit to submit a draft EWMP no later than June 30, 2015. This document has been developed to serve as the Beach Cities Draft EWMP and is consistent with the Work Plan previously submitted to the LARWQCB.

1.1 PURPOSE AND REGULATORY FRAMEWORK

Watershed Management Programs (WMPs) are a voluntary opportunity afforded by Section VI.C.1 of the Permit for Permittees to collaboratively or individually develop comprehensive watershed-specific control plans and are intended to facilitate Permit compliance and water quality target achievement. Enhanced WMPs (EWMPS) are WMPs which comprehensively evaluate opportunities for collaboration on multi-benefit regional projects that retain all non-stormwater runoff and runoff from the 85th percentile, 24 hour storm event while also achieving benefits associated with issues such as flood control and water supply. Additional details on the regulatory

[5] Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4.

[6] For simplification, the term "BMP" will be used to collectively refer to strategies, control measures, and/or best management practices. The Permit also refers to these measures as Watershed Control Measures.

background for NPDES Permit and Water Quality Standards and the Permit specifics of WMPs and EWMPs are provided below.

1.1.1 NPDES Permit

The 1972 Clean Water Act (CWA) established the NPDES Program to regulate the discharge of pollutants from point sources to waters of the United States. In 1990, the United States Environmental Protection Agency (USEPA) developed Phase I of the NPDES Stormwater Permitting Program, which established a framework for regulating municipal and industrial discharges of stormwater and non-stormwater that had the greatest potential to negatively impact water quality within waters of the United States. In particular, under Phase I, USEPA required NPDES Permit coverage for discharges from medium and large MS4 servicing populations greater than 100,000 persons. Operators of MS4s regulated under the Phase I NPDES Stormwater Program were required to obtain permit coverage for municipal discharges of stormwater and non-stormwater to waters of the United States.

The LARWQCB designated the MS4s owned and/or operated by the incorporated cities and Los Angeles County unincorporated areas within the Coastal Watersheds of Los Angeles County as a large MS4 due to the total population of Los Angeles County. All MS4s within the Coastal Watersheds of Los Angeles County except for the City of Long Beach MS4 are subject to the waste discharge requirements set forth in Order No. R4-2012-0175 Permit No. CAS004001. General permit requirements, which are relevant to and must be ensured by WMPs, include (i) a requirement to effectively prohibit non-stormwater discharges through the MS4, (ii) requirements to implement controls to reduce the discharge of pollutants to the maximum extent practicable, and (iii) other provisions the LARWQCB has determined appropriate for the control of such pollutants.

1.1.2 Water Quality Standards and Total Maximum Daily Loads (TMDLs)

The CWA also required that the RWQCB establish water quality standards for each water body in its region. Water quality standards include beneficial uses, water quality objectives and criteria that are established at levels sufficient to protect those beneficial uses, and an anti-degradation policy to prevent degrading waters. The LARWQCB adopted a Water Quality Control Plan - Los Angeles Region (hereinafter Basin Plan) on June 13, 1994 addressing this portion of the CWA which designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters in the Los Angeles Region. Pursuant to California Water Code section 13263(a), the requirements of the Permit implement the Basin Plan.

The State Water Resources Control Board (State Water Board) adopted the Water Quality Control Plan for Ocean Waters in California, California Ocean Plan (hereinafter Ocean Plan) in 1972 and adopted the most recent amended Ocean Plan on September 15, 2009. The Ocean Plan also establishes water quality objectives and a program of implementation to protect beneficial uses at all MS4 discharge points within Los Angeles County coastal watersheds with the exception of Long Beach.

CWA Section 303(d)(1) requires each state to identify the waters within its boundaries that do not meet water quality standards. Water bodies that do not meet water quality standards are considered impaired and are placed on the state's "CWA Section 303(d) List". For each listed water body, the state is required to establish a TMDL for each pollutant impairing the water quality standards in that water body. TMDLs establish the allowable pollutant loadings for a water body and provide the basis upon which to establish water quality-based controls (required by NPDES Permits). The 2010 CWA Integrated Report and updated 303(d) list were approved by the State Water Resources Control Board (SWRCB) on August 4, 2010 and by the USEPA on October 11, 2011. Provisions regarding TMDLs are included in NPDES Permits once they have been developed and adopted. Specific TMDLs applicable to the Beach Cities EWMP Area are discussed in more detail in Sections 2 and 3.

1.1.3 WMPs and Enhanced WMPs

The voluntary WMPs and EWMPs allow Permittees to collaboratively or individually develop comprehensive watershed-specific control plans which a) prioritize water quality issues, b) identify and implement focused strategies, control measures and BMPs, c) execute an integrated monitoring and assessment program, and d) allow for modification over time. In general, WMPs and EWMPs are intended to facilitate Permit compliance and water quality target achievement with the goals that: 1) discharges from covered MS4s achieve applicable WQBELs and RWLs and do not include prohibited non-stormwater discharges; and 2) control measures are implemented to reduce the discharge of pollutants to the maximum extent practicable (MEP). Per Permit Section VI.C.1.e, WMPs and EWMPs are to be developed based on the LARWQCB's Watershed Management Areas (WMAs) or subwatersheds thereof.

Permittees within a WMA may elect to prepare an EWMP, which is defined in the Permit as a WMP that comprehensively evaluates opportunities for collaboration amongst Permittees and other partners on multi-benefit regional projects that, wherever feasible, retain, 1) all non-stormwater runoff, and 2) all stormwater runoff from the 85th percentile 24 hour storm event while also achieving benefits associated with issues such as flood control and water supply. Where regional projects cannot achieve these standards, the EWMP must demonstrate through a Reasonable Assurance Analysis (RAA), that applicable water quality targets are achieved.

The Permit specifies that an EWMP shall:

1. Be consistent with Permit provisions in Part VI.C.1.a.-f and Part VI.C.5-C.8,
2. Incorporate applicable State agency input on priorities and key implementation factors,
3. Provide for meeting water quality standards and other CWA obligations,
4. Include multi-benefit[7] regional projects which retain stormwater from the 85th percentile 24 hour storm

[7] Potential multiple benefits include neighborhood greening, water conservation and/or supply, groundwater recharge, public education and/or awareness, etc.

5. Include watershed control measures which achieve compliance with all interim and final WQBLs in drainage areas where retention of the 85th percentile 24 hour storm is infeasible with reasonable assurance,
6. Maximize the effectiveness of funding,
7. Incorporate effective innovative technologies,
8. Ensure existing requirements to comply with technology based effluent limitations and core requirements are not delayed, and
9. Ensure a financial strategy is in place.

1.2 Applicability of EWMP

The agencies of the Beach Cities WMG have been working together since 2004 to implement the previously developed Jurisdictional Groups 5 and 6 Implementation Plan for the Santa Monica Bay Beaches Bacteria (SMBBB) TMDLs, including a BMP Siting Study (Geosyntec, 2011a) and Dry Weather Source Characterization and Control Study (Geosyntec, 2011b) for two high priority subwatersheds, along with joint implementation of programmatic solutions. Since 2004, the Beach Cities have also been jointly funding receiving water monitoring consistent with the Coordinated Shoreline Monitoring Plan for the SMBBB TMDLs along the shoreline of the Beach Cities WMG EWMP Area. These ongoing efforts by the Beach Cities WMG to comply with the SMBBB TMDLs have been an effective facilitator for the development of the EWMP.

This EWMP is applicable to the Beach Cities EWMP Area, which consists of all of the incorporated MS4 areas of the cities of Redondo Beach, Manhattan Beach, Hermosa Beach and Torrance and includes the infrastructure of the LACFCD within those jurisdictions (**Figure 1-1**), with the exception of the Machado Lake Watershed which is being addressed separately by the City of Torrance, and is not addressed in this EWMP[8]. The beach areas within the geographic area of the Beach Cities WMG do not have any storm drain infrastructure that collect and discharges beach runoff directly to the receiving water and are therefore considered non-point sources and not subject to the MS4 Permit or EWMP requirements. Similarly, the Hermosa Beach and Manhattan Beach piers are not part of the MS4; they are non-point sources excluded from the MS4 Permit scope and therefore the EWMP. The Redondo Beach Pier including the King Harbor Marina are included in the geographic scope of the Beach Cities WMG EWMP as these areas are equipped with MS4 infrastructure. The Wylie Sump, Bishop Montgomery Basin, and Ocean Basin are all retention basins with no outlet. Therefore, their drainage areas have been excluded from the EWMP, with no analyses required.

[8] The City of Torrance developed a Special Study Work Plan for the Machado Lake Nutrient TMDL (City of Torrance, 2011) (**Appendix C**), which was approved by the LARWQCB. On January 28, 2015, the City of Torrance submitted to the LARWQCB the BMP Implementation Plan for the Machado Lake Nutrient and Toxics TMDL (City of Torrance, 2014). For reference, the Implementation Plan is attached to this EWMP as **Appendix D**, but it should be reviewed separately from this EWMP. A separate discussion of the Walteria Basin is also attached as **Appendix E**. Previous work also includes the City of Torrance's Stormwater Quality Master Plan, which is included as **Appendix F.** LACFCD infrastructure in the Machado Lake Watershed is covered under this EWMP as explained in **Attachment G**.

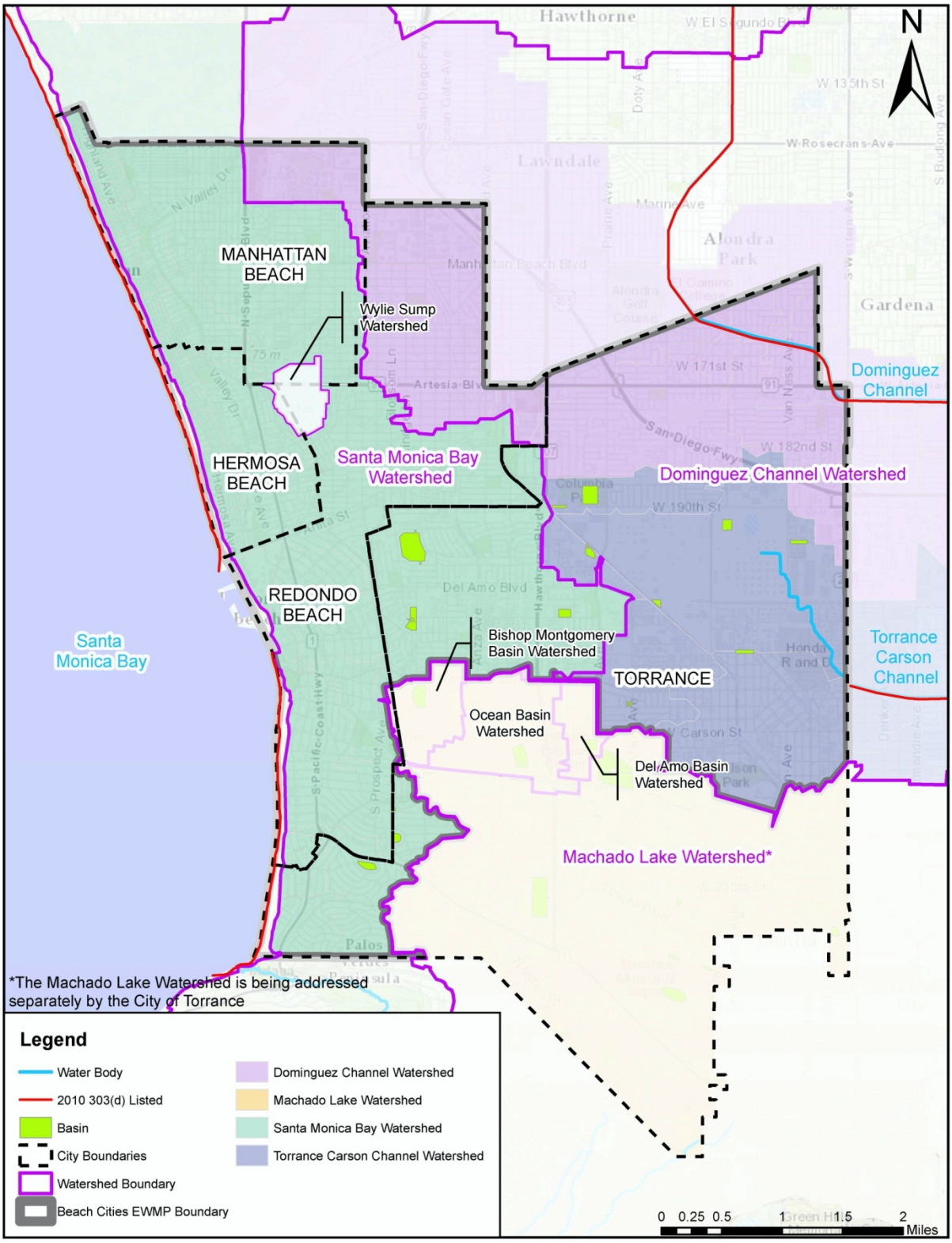


Figure 1-1. Beach Cities EWMP Area

1.3 EWMP Development Process

Section VI.C.1.f.v of the Permit requires a stakeholder process for collaboration on EWMP development. The development process must:

- Provide appropriate opportunity for stakeholder input;
- Include participation in the Permit-wide Technical Advisory Committee (TAC); and
- Incorporate applicable State agency input on priority setting and other key implementation issues.

The Beach Cities WMG has conducted public outreach to engage the public, LARWQCB staff, and other interested parties to support EWMP development. Input has been incorporated as appropriate. These efforts are described in more detail below.

Public Workshops. Public workshops were held on May 21, 2014 at the Joslyn Center in Manhattan Beach and on May 27, 2015 at the Redondo Beach Public Library. An informational presentation was provided followed by a question and answer period to encourage stakeholder input. Concerns were noted and considered during EWMP development by the Beach Cities WMG.

Technical Advisory Committee (TAC). The Beach Cities WMG has, and will continue to, actively participate in the Los Angeles region TAC and applicable subcommittees throughout the EWMP process.

LARWQCB Presentations. The Beach Cities WMG presented the proposed RAA approach to LARWQCB staff on April 9 and June 6, 2014. LARWQCB staff provided feedback during these meetings and in general they were supportive of the proposed approach. One additional meeting was held on July 31, 2014 to discuss Torrance-specific matters.

1.4 Report Organization

This Beach Cities EWMP addresses the required EWMP elements from Section VI.C. of the Permit for both the SMB and Dominguez Channel Watersheds. Because the SMB and Dominguez Channel watersheds have their own unique water quality conditions, their technical evaluations were performed independently and are documented in separate sections in this EWMP. This includes the water quality prioritization, RAA, and BMP identification. Section 2 summarizes the technical aspects of the EWMP for Santa Monica Bay watershed while Section 3 covers the same technical elements for Dominguez Channel Watershed. Section 4 presents individual EMWP implementation schedules for both watersheds. In Section 5, the adaptive management process proposed by the Beach Cities WMG is described, and in Section 6, the cost opinions associated with EWMP implementation are summarized. Section 7 describes potential funding sources and financial strategies. Sections 8 and 9 include the legal authority and references, respectively.

Discussion of the Machado Lake watershed in the context of Permit compliance and water quality target achievement is excluded from the main body of this EWMP document. Instead, it is addressed within the following Appendices: The Machado Lake Special Study Work Plan is

included as **Appendix C,** the Machado Lake Implementation Plan is included as **Appendix D**, and a supplementary write-up describing the Walteria Basin is included as **Appendix E**.

1.5 Terms of Reference

This work was conducted by Geosyntec Consultants for the Beach Cities WMG with the purpose of developing a comprehensive control plan to facilitate Permit compliance and achievement of water quality standards and serves as the deliverable for Task 4.5 of the Beach Cities WMP contract. This work was managed by Ken Susilo, P.E., D.WRE., CPSWQ, with support from Megan Otto, P.E., Stacy Luell, P.E, Stacey Schal, Curtis Fang, and Scott Mansell, Ph.D. Peer review was provided by Megan Otto, P.E., and Lucas Nguyen. Senior review was provided by Brandon Steets, P.E., Kathleen McGowan, P.E. and Ken Susilo, P.E., in accordance with Geosyntec's quality assurance policies.

2 SANTA MONICA BAY WATERSHED

2.1 BACKGROUND

2.1.1 GEOGRAPHICAL CONTEXT

The western portion of the Beach Cities EWMP Area consists of approximately 7,840 acres of land that drains to SMB. This accounts for 52% of the total Beach Cities WMG area, and includes portions of the cities of Manhattan Beach, Redondo Beach, and Torrance, and the entirety of the City of Hermosa Beach (**Figure 2-1**). This portion of the study area is hereinafter referred to as the SMB Watershed. The majority of the SMB Watershed consists of residential land uses (**Figure 2-2**).

The LACFCD is not responsible for land within the Beach Cities EWMP Area, but does own and maintain infrastructure within all three watersheds. Background information on the LACFCD is provided in **Appendix G**. **Table 2-1** provides a breakdown of the Beach Cities EWMP Area by agency and watershed. This section of the EWMP focuses on the SMB Watershed only.

Table 2-1. Beach Cities WMG EWMP Area Distribution by Participating Agency

Participating Agency	Area (acres)		
	Santa Monica Bay Watershed	**Dominguez Channel Watershed**	**Total EWMP Area (% of total)**
City of Redondo Beach	**2,614**	1,217	3,831 (25%)
City of Manhattan Beach	**2,078**	350	2,428 (16%)
City of Hermosa Beach	**832**	-	832 (5%)
City of Torrance	**2,314**	5,812	8,126 (53%)
Total	**7,837**	7,379	15,217 (100%)

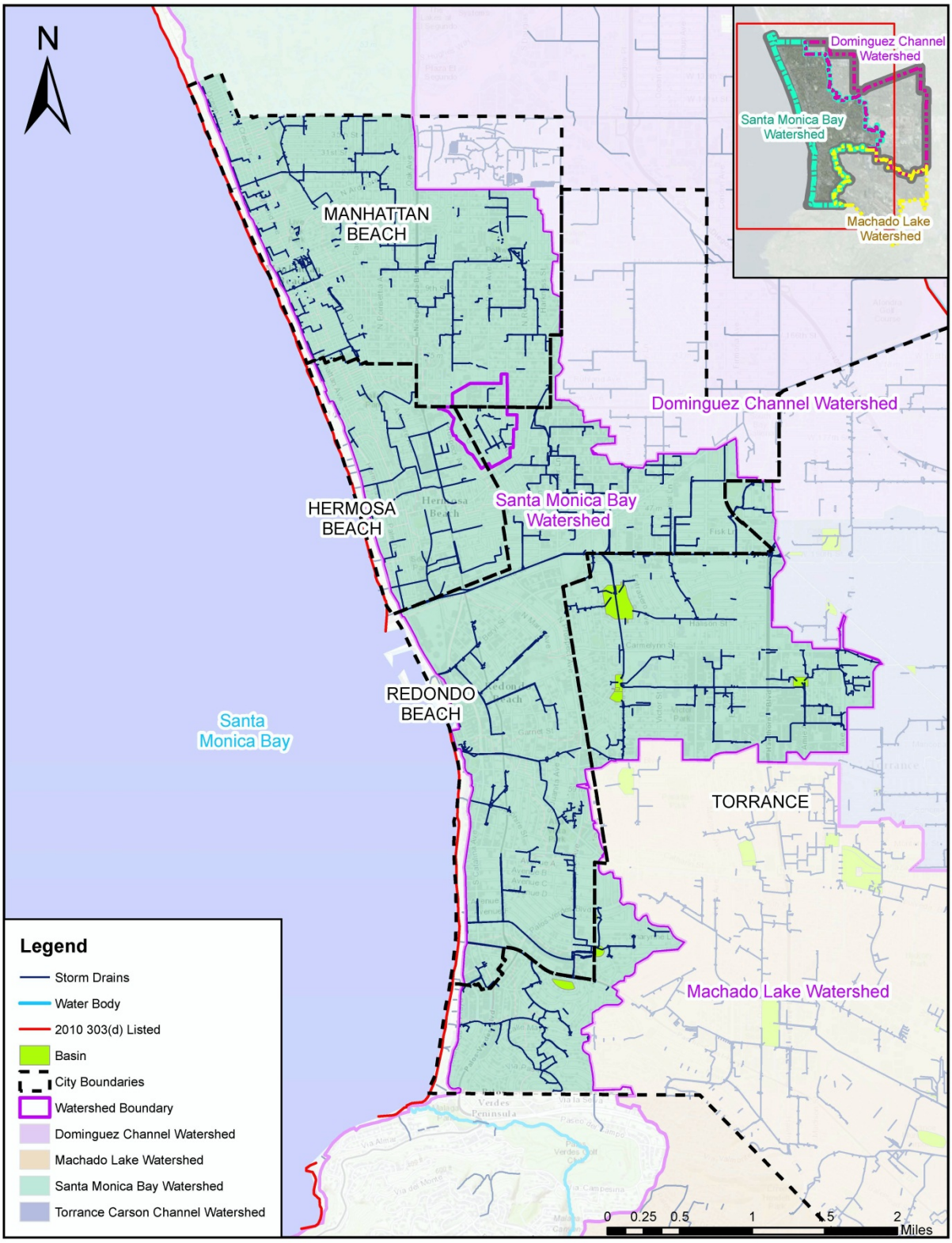


Figure 2-1. Beach Cities WMG MS4 Infrastructure within the Santa Monica Bay Watershed

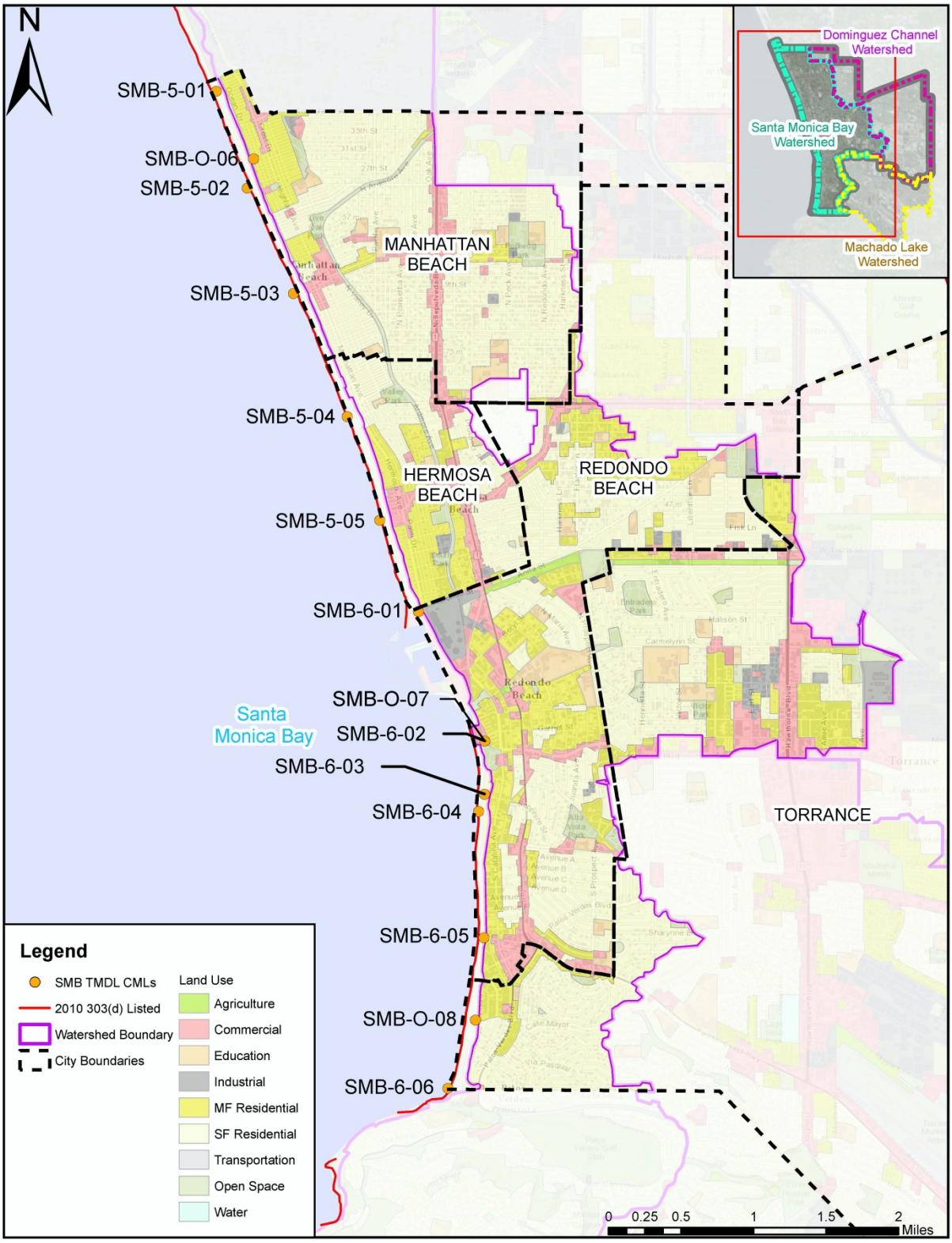


Figure 2-2. Beach Cities WMG Land Uses within the Santa Monica Bay Watershed

2.2 Identification of Water Quality Priorities

As part of the EWMP, the Permit requires the Beach Cities WMG to identify water quality priorities within their WMA. To accomplish this per Permit Section VI.C.5.a, the Beach Cities WMG conducted the following for the Santa Monica Bay watershed portion of the Beach Cities EWMP Area:

1. Characterize the water quality of stormwater and non-stormwater discharges from the MS4 as well as receiving water bodies;
2. Prioritize water body-pollutant combinations (WBPCs); and
3. Assess sources for high priority water body.

A summary of results is provided below.

2.2.1 Water Quality Characterization

The Basin Plan (LARWQCB, 1995, updated 2011) identifies receiving waters within the Los Angeles region and sets regulatory objectives for these receiving waters. Within the SMB Watershed, identified receiving water bodies include SMB itself as well as coastal beaches within the Beach Cities WMG Area. Regulations set forth in the California Ocean Plan (SWRCB, 2012) are therefore also applicable to the SMB Watershed.

Both the Basin Plan and Ocean Plan regulate waste discharges to protect the quality of surface waters for use and enjoyment by the general public. Regulations set forth in the Basin Plan are based on assigned beneficial uses for each receiving water body. Beneficial use designations for receiving waters within the Beach Cities WMG Area include:

- **Municipal and Domestic Supply (MUN)**: Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
- **Industrial Service Supply (IND)**: Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
- **Navigation (NAV)**: Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
- **Water Contact Recreation (REC-1)**: Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, what water activities, fishing, or use of natural hot springs.
- **Non-Contact Water Recreation (REC-2)**: Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

- **High Flow Suspension (HFS)**: Applies to water contact recreational activities associated with the swimmable goal regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities.
- **Commercial and Sport Fishing (COMM)**: Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
- **Warm Freshwater Habitat (WARM)**: Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- **Marine Habitat (MAR)**: Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).
- **Wildlife Habitat (WILD)**: Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
- **Rare, Threatened, or Endangered Species (RARE)**: Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.
- **Migration of Aquatic Organisms (MIGR)**: Uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.
- **Spawning, Reproduction, and/or Early Development (SPWN)**: Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
- **Shellfish Harvesting (SHELL)**: Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.
- **Wetland Habitat (WET)**: Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

According to the Ocean Plan (SWRCB, 2012), "The beneficial uses of the ocean waters of the State that shall be protected include industrial water supply (IND); water contact recreation (REC-1) and non-contact recreation (REC-2), including aesthetic enjoyment; navigation (NAV); commercial and sport fishing (COMM); mariculture; preservation and enhancement of designated Areas of Special Biological Significance (ASBS); rare and endangered species (RARE); marine habitat (MAR); fish migration (MIGR); fish spawning (SPWN) and shellfish* harvesting (SHELL)." Additional beneficial uses are defined as follows:

- **Mariculture**: The culture of plants and animals in marine waters independent of any pollution source.
- **ASBS**: Those areas designated by the State Water Board as ocean areas requiring protection of species or biological communities to the extent that maintenance of natural water quality is assured. ASBS are also referred to as State Water Quality Protection Areas – Areas of Special Biological Significance (SWQPA-ASBS).

Table 2-2 summarizes the existing beneficial uses for the Santa Monica Bay water bodies in the Beach Cities WMG Area, as designated in the Basin Plan.

Table 2-2. Beach Cities EWMP Area - Santa Monica Bay Watershed Water Bodies and Beneficial Uses

Water Body	MUN	IND	NAV	REC1	REC2	HFS	COMM	WARM	MAR	WILD	RARE	MIGR	SPWN	SHELL	WET[2]
Santa Monica Bay Nearshore + Offshore[1]		E	E	E	E		E		E	E	E	E	E	E	
Manhattan Beach			E	E	E		E		E	E			P	E	
Hermosa Beach			E	E	E		E		E	E			E[3]	E	
King Harbor		E	E	E	E		E		E	E	E				
Redondo Beach		E	E	E	E		E		E	E	E	E	E[3]	E	
Torrance Beach			E	E	E		E		E	E		E	E[3]	E	

E = Existing beneficial use

[1] The Preservation of Biological Habitats (BIOL) beneficial use is not included since no Areas of Special Biological Significance are present within the Beach Cities WMG Area.

[2] Water bodies designated as WET may have wetlands habitat associated with only a portion of the water body. Any regulatory action would require a detailed analysis of the area.

[3] Most frequently used grunion spawning beaches. Other beaches may be used as well.

2.2.2 WATER BODY-POLLUTANT CLASSIFICATION

Receiving waters for stormwater runoff from the Santa Monica Bay Watershed portion of the Beach Cities EWMP Area were screened for water quality priorities by reviewing TMDLs, the State's 303(d) list, and additional water quality data. Each identified water quality priority for a given receiving water body was categorized as a WBPC. WBPCs were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit. No 303(d) listings exist beyond the TMDL WBPCs, and no other recent monitoring data are available beyond the SMBBB TMDL Coordinated Shoreline Monitoring Plan (CSMP) data; therefore, no Category 2 or 3 WBPCs have been identified for the Beach Cities portion of SMB at this time.

Category 1 – Highest Priority

WBPCs under Category 1 (highest priority) are defined in the Permit as "water body-pollutant combinations for which WQBELs and/or RWLs are established in Part VI.E and Attachments L through R of [the Permit]." These WBPCs include:

- SMB beaches for bacteria (wet and dry weather): These are considered Category 1 due to the SMBBB TMDL.
- SMB offshore/nearshore for dichloro-diphenyl-trichloroethanes (DDTs) and polychlorinated biphenyls (PCBs)[9]: These are considered Category 1 due to the USEPA TMDL for DDT and PCBs for SMB Offshore/Nearshore. However, the load-based WQBELs for DDT and PCBs established by the TMDL were set to be the existing stormwater loads (i.e., based on data used in the TMDL, no MS4 load reduction is expected to be required). Therefore, no reductions in DDT and PCB loading from the Beach Cities WMG MS4s are required to meet the TMDL WQBELs and therefore, no RAA is required.
- SMB offshore/nearshore for debris: This is considered Category 1 due to the TMDL for Debris for SMB Offshore/Nearshore. Section VI.E.5.b(i) of the Permit states, "Pursuant to California Water Code section 13360(a), Permittees may comply with the trash [debris] effluent limitations using any lawful means. Such compliance options are broadly classified as full capture, partial capture, institutional controls, or minimum frequency of assessment and collection… and any combination of these may be employed to achieve compliance." While trash will not be modeled as part of the RAA, the RAA will qualitatively describe how the Beach Cities WMG Agencies will comply with the TMDL WQBELs by providing details on the planned implementation of the methods listed above, primarily through their Trash Monitoring and Reporting Programs.

"Highest Priority" WBPCs have been assigned based strictly on the Permit definition. Not all of these pollutants (e.g., DDT and PCBs) have been definitively linked to MS4 sources. As a result, this categorization and prioritization will be reevaluated based on results from the future water

[9] SMB Offshore/Nearshore is 303(d)-listed for fish consumption advisory due to DDT and PCBs. Therefore, the fish consumption advisory will be assumed to be addressed by the DDT and PCB categorization.

quality monitoring efforts conducted under the Coordinated Integrated Monitoring Program (CIMP).

Category 2 – High Priority

WBPCs under Category 2 (high priority) are defined in the Permit as, "Pollutants for which data indicate water quality impairment in the receiving water according to the State's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) (SWRCB, 2004) and for which MS4 discharges may be causing or contributing to the impairment." There are no Category 2 WBPCs in the SMB Watershed portion of the Beach Cities EWMP area.

Category 3 – Medium Priority

WBPCs under Category 3 (medium priority) are defined in the Permit as, "Pollutants for which there are insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable RWLs contained in this Order and for which MS4 discharges may be causing or contributing to the exceedance." There are no Category 3 WBPCs in the SMB Watershed portion of the Beach Cities EWMP area.

The Beach Cities WMG agencies understand that data collected as part of their approved CIMP may result in future Category 3 designations in instances when RWLs are exceeded and MS4 discharges are identified as contributing to such exceedances. Under these conditions, the Beach Cities WMG agencies will adhere to Section VI.C.2.a.iii of the Permit and the EWMP will be updated.

Figure 2-3 provides a brief conceptual overview of the process used to identify and categorize the WBPCs within the Beach Cities EWMP Area.

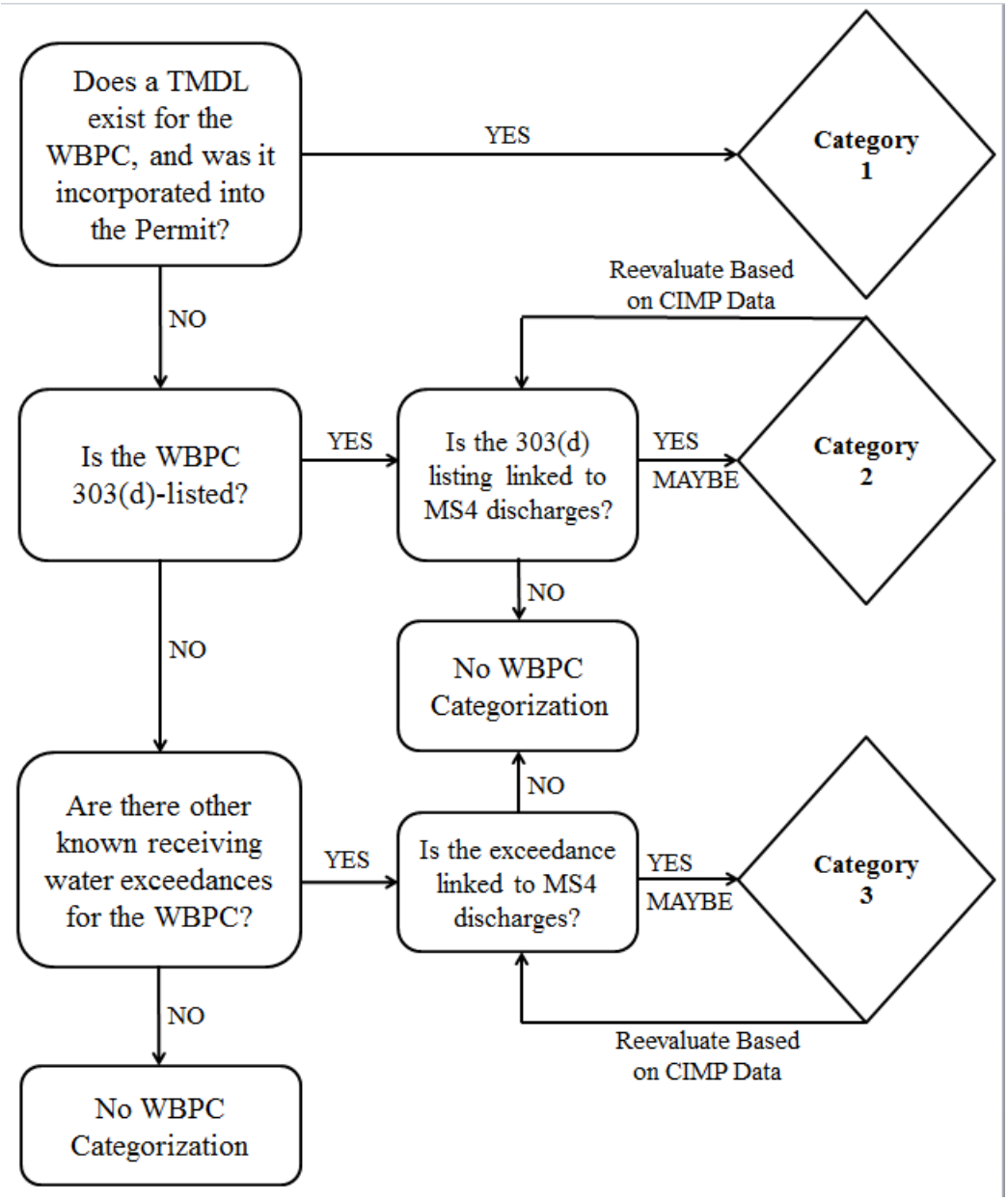


Figure 2-3. Process for Categorizing Water Body-Pollutant Combinations

Table 2-3 presents the prioritized WBPCs within the SMB Watershed portion of the Beach Cities EWMP Area. WBPCs categorized below are subject to change based on future data collected as part of the CIMP or other monitoring program.

Table 2-3. Water Body-Pollutant Prioritization for the Santa Monica Bay Watershed portion of the Beach Cities EWMP Area

Category	Water Body	Pollutant	Reason/Justification
1: Highest Priority	SMB Beaches	Dry Weather Bacteria	SMB Beaches Dry Weather Bacteria TMDL
		Wet Weather Bacteria	SMB Beaches Wet Weather Bacteria TMDL
	SMB	Trash/Debris	SMB Debris TMDL
		DDTs	SMB PCBs and DDT TMDL
		PCBs	SMB PCBs and DDT TMDL
2: High Priority	N/A	None	No other 303(d) listings exist for the Beach Cities portion of SMB
3: Medium Priority	N/A	None	Outfall and receiving water monitoring data are not available for the Beach Cities portion of SMB

Sections VI.C.2 and VI.C.3 of the Permit describes how compliance with RWLs/WQBELs is attained for the prioritized WBPCs identified. **Appendix H** sets forth the EWMP framework for evaluating and addressing receiving water exceedances and a brief summary is included below.

Different actions are required to demonstrate compliance for different types of WBPCs. Specifically; the following classifications are addressed by the Permit:

- WBPCs addressed by a TMDL.
- 303(d)-listed WBPCs: Pollutants in the same class as those identified in a TMDL and for which the water body is 303(d)-listed (Section VI.C.2.a.i), and pollutants not in the same class as those identified in a TMDL, but for which the water body is 303(d)-listed (Section VI.C.2.a.ii).
- Non 303(d)-listed WBPCs: Pollutants for which there are exceedances of RWLs, but for which the water body is not 303(d)-listed (Section VI.C.2.a.iii).

For Category 1 WBPCs, adherence to all implementation actions and compliance dates identified in the approved EWMP will constitute compliance with applicable TMDL-based interim water quality based effluent limits and interim receiving water limits. For any Category 2 and 3 WBPCs that are identified in the future through the adaptive management process, adherence to all implementation actions, milestones, and compliance schedules identified in the updated EWMP will constitute compliance with applicable receiving water limits. This approach is outlined in **Appendix H**.

2.2.3 Source Assessment

The following data sources were reviewed as part of the source assessment for the WBPCs listed previously:

- Findings from the Permittees' Illicit Connections and Illicit Discharge Elimination Programs (IC/ID);
- Findings from the Permittees' Industrial/Commercial Facilities Programs;
- Findings from the Permittees' Development Construction Programs;
- Findings from the Permittees' Public Agency Activities Programs;
- TMDL source investigations;
- Watershed model results;
- Findings from the Permittees' monitoring programs, including but not limited to TMDL compliance monitoring and receiving water monitoring; and
- Any other pertinent data, information, or studies related to pollutant sources and conditions that contribute to the highest water quality priorities.

The following source assessment is broken down by pollutants applicable to the SMB Watershed.

Indicator Bacteria

The SMBBB TMDLs for dry and wet weather were the first bacteria TMDLs adopted by the LARWQCB. The SMBBB TMDLs were recently opened for reconsideration, although the source assessment was not part of this update. As a result, the general findings from the original source assessment remain unchanged. These findings are summarized in the 2012 Basin Plan Amendment for the reopened SMBBB TMDL (Attachment A to Resolution No. R12-007):

> "With the exception of isolated sewage spills, dry weather urban runoff and stormwater runoff conveyed by storm drains and creeks is the primary source of elevated bacterial indicator densities to SMB beaches. Limited natural runoff and groundwater may also potentially contribute to elevated bacterial indicator densities during winter dry weather" (LARWQCB, 2012b).

The SMBBB TMDL source assessment (LARWQCB, 2002) maintained that dry weather urban runoff and stormwater runoff were the primary sources of elevated bacteria concentrations at SMB beaches at the time of the TMDL. Although definitive information regarding the specific sources of bacteria within the watershed was not presented, speculation provided in the dry weather staff report provided some insight into possible sources at the time:

> "Urban runoff from the storm drain system may have elevated levels of bacterial indicators due to sanitary sewer leaks and spills, illicit connections of sanitary lines to the storm drain system, runoff from homeless encampments, illegal discharges from recreational vehicle holding tanks, and malfunctioning septic tanks among other things. Swimmers can also be a direct source of bacteria to recreational waters. The bacteria indicators used to assess water quality are not specific to human sewage; therefore, fecal matter from animals and birds can

> also be a source of elevated levels of bacteria, and vegetation and food waste can be a source of elevated levels of total coliform bacteria, specifically" (LARWQCB, 2002).

Information on non-MS4 sources of surfzone bacteria along specific SMB beaches was provided by the City of Malibu in its comment letter on the SMBBB TMDL reconsideration, based on a comprehensive review of local and Southern California source identification studies (City of Malibu, 2012):

> "A number of recent Santa Monica Bay studies have further identified and confirmed natural (non-anthropogenic) sources of fecal indicator bacteria including plants, algae, decaying organic matter, beach wrack and bird feces – implicating these as potentially significant contributors to exceedances (Imamura *et al* 2011, Izbicki 2012b). Beach sands, sediments and beach wrack have been shown to be capable of serving as reservoirs of bacteria, possibly by providing shelter from UV inactivation and predation by allowing for regrowth (Imamura *et al* 2011, Izbicki *et al* 2012b, Lee *et al* 2006, Ferguson *et al* 2005, Grant *et al* 2001, Griffith 2012, Litton *et al* 2010, Phillips *et al* 2011, Jiang *et al* 2004, Sabino *et al* 2011, and Weston Solutions 2010). In fact, enterococci include non-fecal or "natural" strains that live and grow in water, soil, plants and insects (Griffith, 2012). Thus, elevated levels of enterococci in water could be related to input from natural sources. The phenomenon of regrowth of bacteria from either anthropogenic or natural sources has been suggested by several studies as a possible source of beach bacteria exceedances (Griffith 2012, Litton *et al* 2010, Weston Solutions 2010, Izbicki *et al* 2012b, Weisberg *et al* 2009)."

In 2009, a dry weather bacterial source identification study was undertaken at the Redondo Beach Pier (Los Angeles County Sanitation District [LACSD], 2009). This study implemented a multi-tiered toolbox approach to investigate sources of dry weather fecal indicator bacteria (FIB) exceedances near Redondo Beach Pier (CSMP monitoring location SMB 6-02).). Utilizing microbial source tracking, the sampling focused on the shoreline near the pier, a storm drain under the pier, and ponded water near the storm drain. Investigators found a lack of human fecal markers within the surfzone:

> "Lack of detectable human viruses and the de minimus quantities detection of human-associated *Bacteridales* in the ocean water strongly implied that a human source was not present. Other sources of FIB may include bacterial persistence in the sand and sea wrack, as well as endogenous sea life and birds. Tide, wave action, wind, and other natural fluctuations may be affecting FIB levels at the shoreline monitoring locations next to the pier."

However, the study also indicated that,

> "…the storm drain under the pier and the pond that forms at the storm drain outlet are probably impacted by human fecal pollution but are not contributing to microbial contamination of the ocean water during the dry season. This conclusion is most strongly supported by the differences between the FIB concentrations and *Bacteroidales* populations at the shoreline sites compared to the pond and storm drain samples, particularly with respect to human-associated *Bacteroidales*."

Another dry weather MS4 microbial source tracking study was conducted in 2010, focusing on two high priority analysis regions (SMB-5-02 and 6-01) within the Beach Cities EWMP Area (Geosyntec Consultants, 2010). Although both of these shoreline monitoring locations are served by low flow diversions, the purpose of the study was to investigate FIB sources to inform identification of new source control measures. Observational results indicated that non-human sources include pet waste, irrigation runoff, and in-drain sources (i.e., re-growth, sediment, etc.). Similar to the Redondo Beach pier study, human *Bacteroidales* marker (HBM) was also identified in some MS4 dry weather samples, suggesting that human fecal sources may also be present. Although specific sources of human waste were not definitively identified in the study, "sources were surmised to include direct contamination (i.e., illicit connections, RV discharges, homeless deposits), and indirect contamination (i.e., sewer exfiltration)."[10]

To address the identification of dry weather bacteria sources within or to the MS4s, the Beach Cities WMG agencies have implemented measures to divert dry weather flows from all storm drains discharging at point zero shoreline monitoring locations. A total of seven low flow diversions are operational within the Beach Cities EWMP area. No wet weather bacteria source identification studies have been conducted in the Beach Cities EWMP area to date. Wet weather bacteria sources are believed to be derived from the entire watershed, and potentially include a mixture of human sources, non-human anthropogenic sources (e.g., pet waste), and non-anthropogenic sources (e.g., birds and other urban wildlife, storm drain biofilms/regrowth, beach sands and wrack). A wet weather stormwater monitoring study by the Southern California Coastal Water Research Project (SCCWRP) investigated bacteria concentrations in stormwater runoff from various land uses in the Los Angeles region (Stein *et al*, 2007). Results showed that wet weather runoff event mean concentrations (EMCs) for fecal coliform bacteria were highest for agricultural land uses, followed by commercial and educational, single family residential, multi-family residential, open space, industrial, and transportation. In this study, results showed that bacteria concentrations in stormwater are highly variable, with concentrations often varying by one to two orders of magnitude during a single storm, and by up to five orders of magnitude on seasonal and inter-annual scales.

Additional local monitoring data will be needed to quantify the contribution of MS4 discharges – particularly relative to the many other identified sources that have been documented along SMB beaches – to the elevated bacteria concentrations measured at Beach Cities WMG compliance monitoring locations during dry and wet weather. Additional data are also needed to identify the sources of bacteria within MS4 discharges as well as their potential to contribute to recreational illness risks; such source tracking data have the potential to affect the TMDL waste load

[10] The LACSD and Geosyntec microbial source tracking studies predate the 2013 California Source Identification Pilot Project, which identifies and recommends new, more definitive microbial source tracking markers for multiple source types, including human waste. Therefore new analytical methods may need to be applied to these previously studied areas to verify or update prior findings.

allocations (WLAs) through a future reopener[11]. And the combination of MS4 outfall monitoring (through the CIMP) and source identification (through special studies) could support future BMP planning and EWMP updates.

DDT and PCBs

As stated previously, limited data are available characterizing DDT and PCBs within Santa Monica Bay, particularly since direct discharges of these pollutants from publically owned treatment works (POTWs) have ceased. The largest concentration of DDT and PCBs within SMB is contained within the Palos Verdes shelf, which is being addressed by the USEPA as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. Loadings from the shelf to the bay are large and have been well characterized (USEPA, 2012).

With respect to stormwater, the TMDL does not specifically characterize MS4 loadings, though it does recognize that "DDT and PCBs are no longer detected in routine stormwater sampling from Ballona Creek or Malibu Creek." However, the TMDL also states that current detection limits used to analyze DDT and PCB concentrations are too high to appropriately assess the water quality. Despite a lack of supporting data, however, EPA assumed that stormwater inputs of DDT and PCBs come from urban areas (USEPA, 2012).

No other data or source information are available at this time. Once three years of water quality data are collected under the CIMP and evaluated consistent with the recommendations by USEPA in the TMDL to utilize a three-year averaging period, then further source assessment will be considered and the categorization and prioritization of PCB and DDTs as MS4-related pollutants of concern will be reevaluated.

Trash

Source information for trash within SMB is provided by the SMB Nearshore Debris TMDL. A detailed source breakdown is not provided, but other debris TMDLs attribute trash to general areas such as "litter from adjacent land areas, roadways, and direct dumping and deposition" (LARWQCB, 2008) while also attributing trash inputs to point sources such as storm drains.

The plastic pellet portion of the SMB Debris TMDL is not assumed to be applicable to the Beach Cities WMG, as the respective Agencies have applied to be exempt from this portion of the TMDL.

2.2.4 PRIORITIZATION

Based on the water quality characterization above, the WBPCs have been classified into one of three categories, in accordance with Section IV.C.5(a)ii of the Permit: highest priority, high priority, and medium priority (**Table 2-3**). This categorization is intended to prioritize WBPCs in order to guide the implementation of structural and institutional BMPs. An RAA was performed on the WBPCs in Categories 1, as there are no Category 2 or 3 pollutants in the SMB Watershed

[11] For example, if human fecal sources are found to be undetected in MS4 discharges to SMB beaches using a rigorous sampling design, the latest analytical markers, and a credible laboratory, then TMDL revisions may be proposed.

within the Beach Cities WMG. WBPCs will be further prioritized based on the applicable compliance schedules, as discussed in Section 4.

2.3 Selection of Appropriate Best Management Practices

2.3.1 Objectives

The Permit requires the Beach Cities WMG to identify strategies, control measures, and BMPs to implement within their EWMP AREA. Specifically, the Permit specifies that BMPs are expected to be implemented so that MS4 discharges meet effluent limits as established in the Permit and to reduce impacts to receiving waters from stormwater and non-stormwater runoff. This expectation assumes the implementation of both types of BMPs – non-structural and structural – by the Beach Cities WMG.

The objectives of selecting and incorporating BMPs into the Beach Cities EWMP include:

1. Preventing and/or eliminating non-stormwater discharges to the MS4 that are a source of pollutants from the MS4 to receiving waters;
2. Achieving all applicable interim and final WQBELs and/or RWLs pursuant to corresponding compliance schedules; and
3. Ensuring that discharges form the MS4 do not cause or contribute to exceedances of RWLs.

2.3.2 Definition of Best Management Practices

The Permit defines BMPs as "practices or physical devices or systems designed to prevent or reduce pollutant loading from stormwater or non-stormwater discharges to receiving waters, or designed to reduce the volume of stormwater or non-stormwater discharged to the receiving water." These BMPs may include:

1. Structural and/or non-structural BMPs and operation and maintenance procedures that are designed to achieve applicable WQBELs and/or RWLs;
2. Retrofitting areas of existing development known or suspected to contribute to the highest water quality priorities with regional or sub-regional BMPs;
3. Stream and/or habitat rehabilitation or restoration projects where stream and/or habitat rehabilitation or restoration are necessary for, or will contribute to demonstrable improvements in the physical, chemical, or biological receiving water conditions and restoration and/or protection of water quality standards in receiving waters.

Structural BMPs involve the construction of a physical control measure to alter the hydrology or water quality of incoming stormwater or non-stormwater. There are two categories of structural

BMPs, defined by the runoff area treated by the BMP: regional BMPs[12] and distributed BMPs. Regional BMPs are designed to treat runoff from a large drainage area expected to include multiple parcels and various land uses. These may include infiltration basins, treatment plants, and subsurface flow wetlands, among others. Distributed BMPs are designed to treat runoff from smaller drainage areas and are normally installed to collect runoff close to the source from a limited number of parcels. Distributed BMPs typically include swales, bioretention facilities, biofiltration facilities, and cisterns, among others. Relevant regional and distributed structural BMPs are described below.

Non-structural BMPs prevent or reduce the release of pollutants or transport of pollutants within the MS4 area but do not involve construction of physical facilities. Non-structural BMPs are often implemented as programs or strategies which seek to reduce runoff and/or pollution close to the source. Examples include but are not limited to: street sweeping, downspout disconnect programs, pet waste cleanup stations, irrigation ordinances, or illicit discharge elimination. Minimum control measures (MCMs) as set forth in the Permit are a subset of non-structural BMPs even though some MCMs include measures that require the implementation of structural BMPs by private parties.

2.3.3 Incorporated Provisions

Permit Section VI.C.5.b.iv sets forth the provisions regarding the types of BMPs that must be considered in development of the EWMP. These provisions are described in more detail below.

Minimum Control Measures

The Beach Cities WMG has assessed the MCMs defined in the Permit to identify opportunities for focusing resources on the high priority issues in each watershed. The Permit requires the permittees to implement prescribed MCMs in each of six categories/programs: Public Information & Participation Program (PIPP), Industrial/Commercial Facilities, Planning & Land Development, Development Construction, Public Agency Activities, and Illicit Connection & Illicit Discharges Elimination. These measures include procedures such as outreach programs, inspections, and reporting requirements designed to reduce runoff-related pollution within each permittees' MS4 area. MCMs in each of these categories are already being implemented by the Beach Cities WMG as prescribed under the previous MS4 Permit (Order 01-182), and in some cases MCM program enhancements have been implemented to address watershed priorities for TMDL implementation. Details on the selected MCMs, including proposed modifications to any programs, are provided in Section 2.6.2 (Santa Monica Bay Watershed) and Section 3.6.2 (Dominguez Channel Watershed).

Non-Stormwater Discharge Measures

The Permit requires Permittees to identify non-stormwater discharges that cause or contribute to exceedances of RWLs, and to then identify and implement BMPs to effectively eliminate the source

[12] The term "regional BMP" does not necessarily indicate that the project can capture and retain the 85th percentile storm, as described in the Permit. The term "regional EWMP project" is therefore used for those regional BMPs that are expected to be able to capture and retain the 85th percentile storm.

of pollutants. These BMPs may include measures to prohibit non-stormwater discharge to the MS4, additional structural BMPs to reduce pollutants in the non-stormwater discharge, diversion to a sanitary sewer for treatment, or strategies to require the non-stormwater discharge to be separately regulated under a general NPDES permit. As previously stated, the Beach Cities WMG agencies currently operate seven low flow diversions to eliminate non-stormwater discharges.

The non-stormwater screening process consists of the steps shown in **Figure 2-4**. Further details on the Beach Cities WMGs approach to meet this requirement are provided in the CIMP for the Beach Cities Watershed Management Group (Beach Cities Watershed Management Group, 2014).

TMDL-Specific Control Measures

The Beach Cities WMG has evaluated BMPs that have been previously identified in TMDLs and corresponding implementation plans. Those BMPs that have been constructed are discussed in Section 2.6.4 (Santa Monica Bay Watershed) and Section 3.6.4 (Dominguez Channel Watershed). Other measures identified in TMDLs and TMDL implementation plans were evaluated as part of the RAA process in order to determine what combination of measures would achieve compliance with Permit-specified WQBELs and/or RWLs.

Additional BMPs

In addition to the MCMs, non-stormwater discharge measures, and TMDL control measures, the Beach Cities WMG has identified additional BMPs to achieve compliance with Permit-specified WQBELs and/or RWLs. These BMPs are discussed in more detail in Section 2.6 (Monica Bay Watershed) and Section 3.6 (Dominguez Channel Watershed) below.

Demonstration of BMP Performance – Introduction to the Reasonable Assurance Analysis

The EWMP is a planning document intended to lay out a framework of activities that will comply with water quality requirements. Therefore, it is necessary to demonstrate that selected BMPs are reasonably expected to meet defined goals and objectives. This demonstration of performance is described through a technically robust and rigorous RAA. Through this analysis the Beach Cities WMG identified and evaluated BMP implementation scenarios within the Beach Cities EWMP Area for each WBPC identified in Section 2.2. The RAA process demonstrates that implementation of EWMP-defined activities should result in the attainment of applicable Permit-specified WQBELs, and will also prevent discharges from causing or contributing to exceedances of applicable RWLs. Since the modeling conducted as part of the RAA serves as the basis not only for BMP evaluation but also BMP identification, Section 2.4 is devoted to providing details on the RAA process. Results from the RAA are presented in Section 2.7.

Legal Authority

The Permit-required legal authority that the Beach Cities WMG has to implement the BMPs identified in the EWMP is discussed in Section 8.

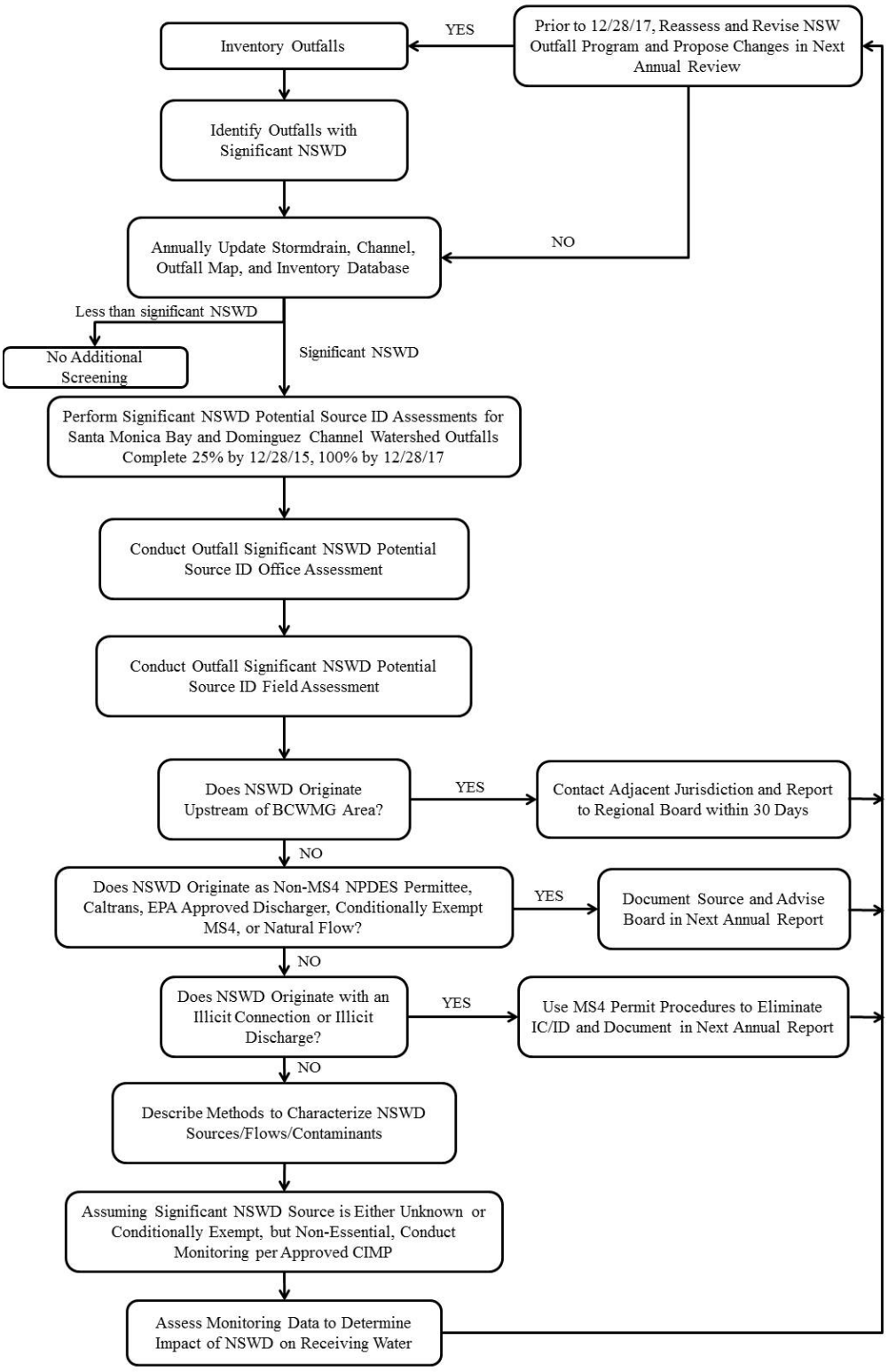


Figure 2-4. Non-Stormwater Outfall Screening Program

2.4 Reasonable Assurance Analysis Approach

The following subsections provide a summary of the modeling tools and approach, modeling data, calibration, and validation.

2.4.1 Description of Modeling Tools and Approach

The approaches for performing the RAA in both dry and wet weather are described below.

Dry Weather

Demonstrating "reasonable assurance" of compliance with dry weather limits for the SMBBB TMDL requires a methodology that accounts for many factors which cannot be accurately modeled based on urban runoff processes alone (Thoe et al, 2014), despite the extensive summer-dry and winter-dry weather beach-specific monitoring datasets that are available. Therefore, to perform the RAA for dry weather for the Beach Cities WMG area, a semi-quantitative methodology has been developed to follow a permit compliance structure, as independent lines of evidence for demonstrating that MS4 discharges could not be causing or contributing to receiving water exceedances at the beaches. Because FIB are considered the "controlling" pollutants of concern during dry weather in the Beach Cities WMG area (i.e., if MS4 discharges are compliant for bacteria during dry weather, they will be compliant for all TMDL and 303(d) pollutants during dry weather), the methodology was developed to focus on bacteria (Beach Cities WMG, 2014).

The following criteria form the proposed dry weather RAA methodology. This methodology was presented to LARWQCB staff on April 9, 2014, and verbal feedback received at the time was supportive. If one criterion is met for CSMP compliance monitoring location (CML), then "reasonable assurance" is considered to be demonstrated.

1. A dry weather low flow diversion, disinfection system, or infiltration system is located at the CML. To meet this criterion, any such system should have records to show that it is consistently operational, well maintained, and sized to effectively eliminate freshwater surface discharges to the surf zone during year-round dry weather days.
2. There are no MS4 outfalls owned by the Beach Cities WMG Agencies within the CML's drainage area, and therefore MS4 discharges could not be contributing to pollutant concentrations at the CML.
3. Non-stormwater MS4 outfall discharges do not reach the wave wash and thus are effectively eliminated within the CML's drainage area. For this criterion to be met, supporting records from the non-stormwater outfall screening program should be supplied.

Wet Weather

The wet-weather RAA process consists generally of the following steps:

- Identify WBPCs for which the RAA will be performed;

- Identify the MS4 service area (exclude lands of agencies not party to this EWMP such as separately-permitted lands, Federal land, State land, etc.);
- For each analysis region (**Figure 2-5**), develop target load reductions (TLRs) for 90th percentile year for bacteria in SMB watershed based on LARWQCB RAA Guidelines, limit expressions in the Permit, and critical periods identified in the TMDLs;
- Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future;
- Evaluate the performance of these BMPs in terms of annual pollutant load reductions;
- Compare these estimates with the TLRs; and
- Revise the BMP implementation scenario until TLRs are met.

TLRs, as discussed previously, represent a numerical expression of the Permit compliance metrics (e.g., bacteria allowable exceedance days [AEDs] per year for wet weather) that can be modeled and can serve as a basis for confirming, with reasonable assurance, that implementation of the proposed BMPs will result in attainment of the applicable TMDL-based WQBELs and RWLs in the Permit for Category 1 pollutants, or the Water Quality Objectives for Category 2 and Category 3 pollutants.

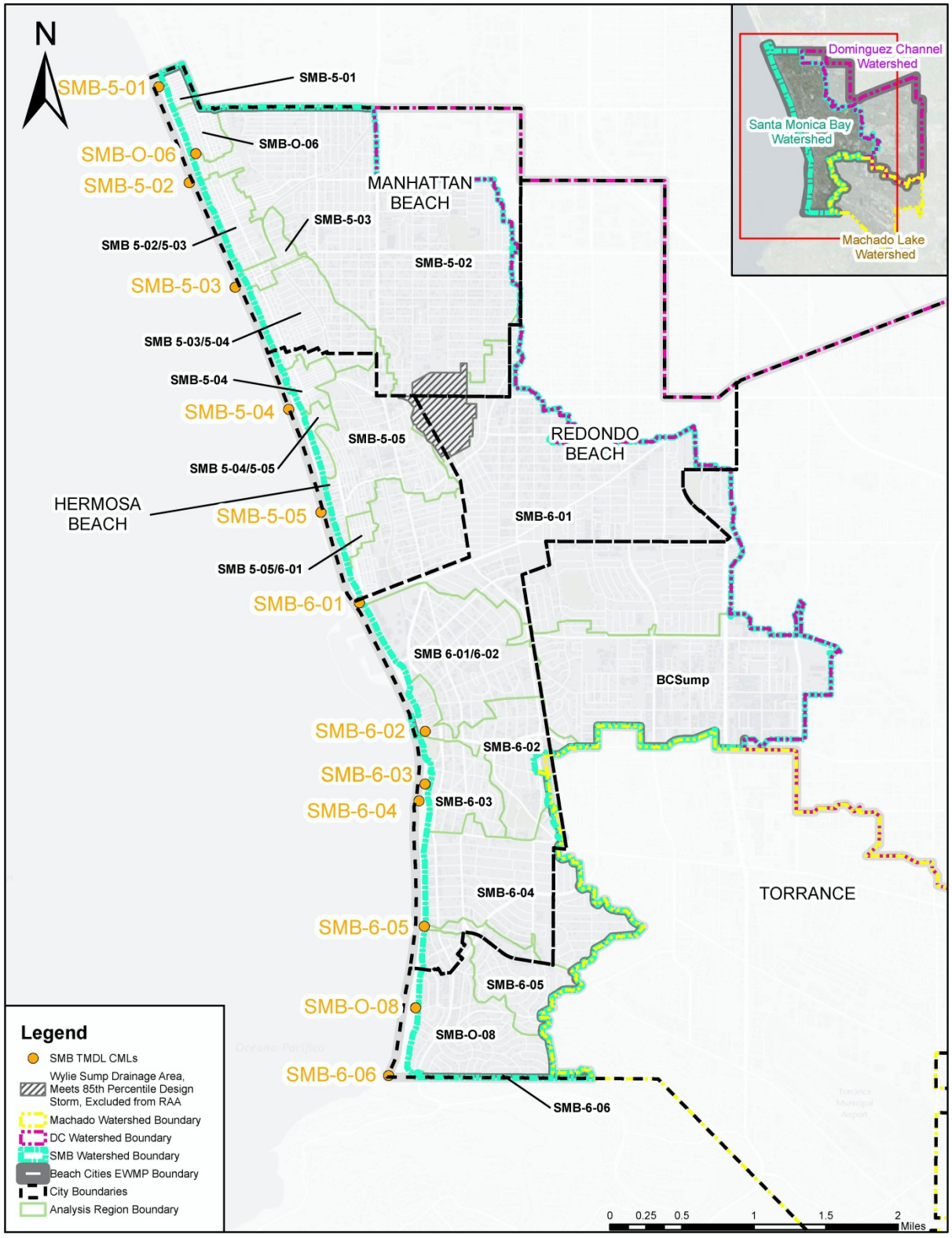


Figure 2-5. Analysis Regions and Monitoring Locations within the SMB Watershed portion of the Beach Cities EWMP Area

Structural BMP Prioritization and Analysis Tool (SBPAT) Model

The recommended RAA approach leverages the strengths of the publicly available, Permit-approved, Geographical Information System (GIS)-based model that has already been developed for the region and previously utilized in Jurisdictional Group 5 and 6 (J5&6): the Structural BMP Prioritization and Analysis Tool (SBPAT)[13].

SBPAT is a public domain, "open source," GIS-based water quality analysis tool intended to: 1) facilitate the prioritization and selection of BMP project opportunities and technologies in urbanized watersheds; and 2) quantify benefits, costs, variability, and potential compliance risk associated with stormwater quality projects. The decision to use SBPAT for the SMB EWMP RAA in the manner described below is based on the model capabilities and the unique characteristics of the SMB, specifically:

1. **Modeling of SMB hydrologic and watershed processes** – SBPAT utilizes EPA's Stormwater Management Model (SWMM) as the hydrologic engine, and SBPAT has been calibrated to local rainfall and Santa Monica Bay (SMB) stream flow gauges, consistent with requirements of the RAA Guidelines;
2. **SMB pollutants of concern and their compliance metric expression** – SBPAT has been utilized for planning applications related to Bacteria TMDL compliance (and specifically exceedance-day predictions, based on SMB criteria), including a demonstrated linkage of modeled bacteria loads to measured exceedance days;
3. **Availability of new open space water quality loading data** – Recently developed EMC data are consistent with SBPAT and were also updated to reflect new data developed in SMB as part of this RAA-development effort;
4. **Capability to conduct opportunity and constraints screening** – SBPAT was designed to support structural BMP placement, prioritization, and cost-benefit quantification, and was previously successfully used for such purposes in the SMB EWMP Group area and other nearby SMB subwatersheds;
5. **Characterization of water quality variability** – SBPAT is capable of quantifying model output variability and confidence levels, which is a requirement of the LARWQCB's RAA Guidance; and
6. **Supports quantification of both structural and non-structural BMPs, and demonstrating compliance at both interim and final compliance dates** – SBPAT's modeling framework is easily compatible with methods for addressing non-structural BMPs and provides quantitative results for multiple BMP phasing milestones, as required by the Permit.

[13] SBPAT is specifically referenced in the MS4 Permit Part VI.C.5.b.iv and was presented at the first two Permit Group TAC RAA Subcommittee meetings. Furthermore, SBPAT has been used for reasonable assurance analysis purposes in the Los Angeles region for four TMDL Implementation Plans, two WMPs, four EWMPs, and, in the San Diego region, for two Combined Load Reduction Plans and two Water Quality Improvement Plans.

The quantification analysis component of SBPAT includes a number of features. The model:

- Calculates and tracks inflows to BMPs, treated discharge, bypassed flows, evaporation, and infiltration at each 10 minute time step;
- Distinguishes between individual runoff events by defining six-hour minimum inter-event time in the rainfall record (in order to track rain events), while also tracking inter-event antecedent conditions;
- Tracks volume captured by and bypassing BMPs, and summarizes and records these volumes by storm event; and
- Produces a table of each BMP's hydrologic performance, including concentrations and loads by storm event, and consolidates these outputs on an annual basis.

2.4.2 Modeling Data

Data used for the quantification/analysis module include both fixed and stochastic parameters. The model utilizes Los Angeles region land use EMCs, USEPA SWMM, USEPA/American Society of Civil Engineers/Water Environment Research Foundation (USEPA/ASCE/WERF) International BMP Database (IBD) BMP effluent concentrations, watershed/GIS data, and a Monte Carlo approach (relying on repeated random sampling) to quantify water quality benefits and uncertainties. Model data flow is provided below in **Figure 2-6**.

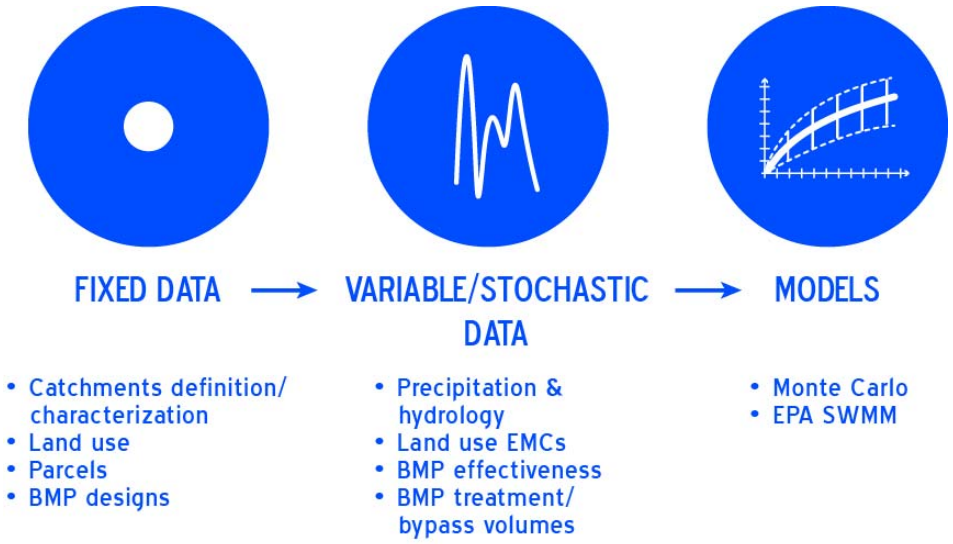


Figure 2-6. SBPAT Model Data Flow

Each model simulation integrates Monte Carlo methods that rely on repeated random sampling to obtain numerical results. Model simulations are run 20,000 to 50,000 times to calculate a distribution of outcomes that can support the definition of confidence levels and quantify variability. Consistent with the SBPAT usage, Monte Carlo methods are used in physical and mathematical problems when it is difficult to obtain a closed-form expression or when a deterministic algorithm is not desired. A schematic of SBPAT's Monte Carlo process is provided in **Figure 2-7**.

Model documentation, as well as links to related technical articles and presentations, is provided at www.sbpat.net.

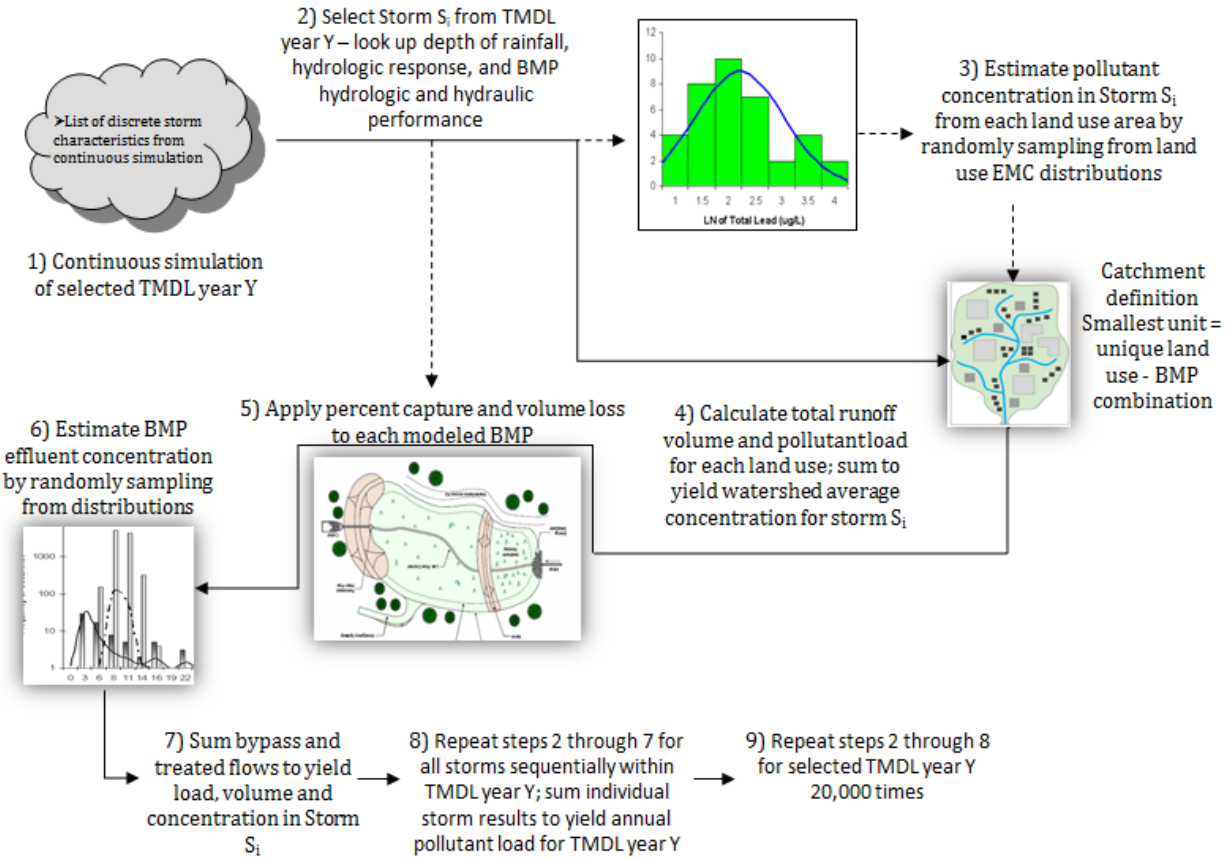


Figure 2-7. SBPAT Monte Carlo Method Components

The spatial domain of the RAA includes the land within the Beach Cities EWMP area tributary to SMB and Dominguez Channel. Adjustments were made to account for contributions from agencies not party to this EWMP (e.g., State/Federal, California Department of Transportation [Caltrans], Industrial General Permit holders, etc.) and are described in more detail later in this document.

GIS layers used in SBPAT included, but were not limited to, the following:

- Storm drains;
- Soils;
- Rain gauge polygons;
- Parcels;
- Land use; and
- Catchments.

SBPAT utilizes a customized version of SWMM for continuously simulating study area hydrology and BMP hydraulics. Long-term, hourly rainfall data and average monthly evapotranspiration

values are used along with land use-linked catchment imperviousness and soil properties to estimate runoff volumes. Revised and recalibrated SBPAT database values and EWMP-defined BMP information are used to estimate the volume of runoff generated from watershed areas and captured by BMPs. Storm events are individually tracked for the entire simulation so that the volumes of runoff infiltrated, evapotranspired, captured, and released (if applicable) by BMPs are estimated for every storm event. Hourly rainfall data from LAX (NCDC ID45114) were used in the portion of the Beach Cities EWMP area draining to Santa Monica Bay. Hourly rainfall data from a Los Angeles County rainfall gauge at Manhattan Beach (Station ID 1070) was used for the portion of the Beach Cities EWMP area draining to Dominguez Channel. Rain gauges are shown in **Figure 2-8.**

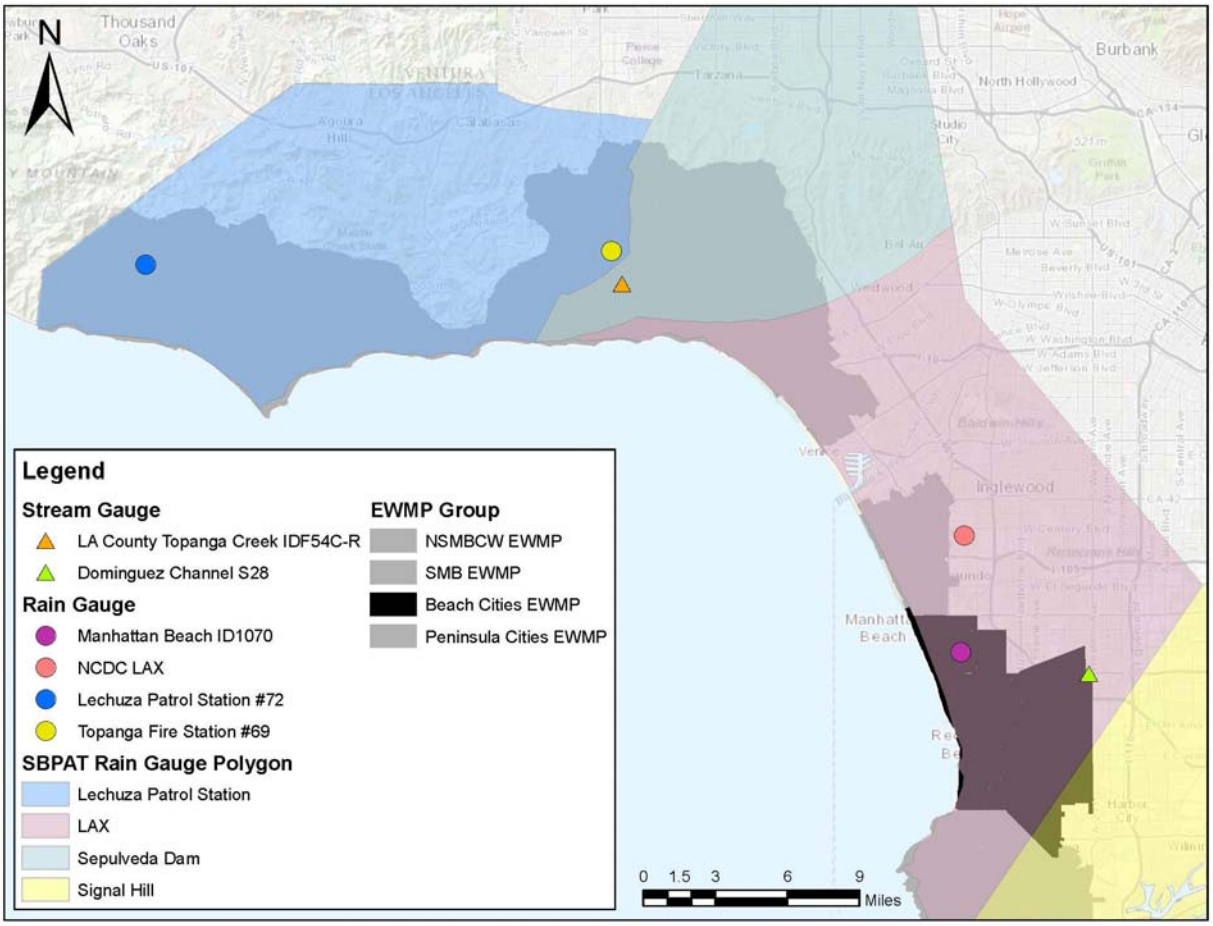


Figure 2-8. SBPAT Rain and Stream Gauges

Critical Condition Definition

Consistent with the SMBBB TMDL and the LARWQCB RAA Guidance Document, the RAA was performed on the 90th percentile critical year. This year was determined by evaluation of local rainfall records for all four EWMP Groups located along Santa Monica Bay over the 1989 to 2011 period of record, evaluating "TMDL years" as defined by the SMBBB TMDL (i.e., November 1 – October 31). Of the local rain gauges evaluated, the Manhattan Beach gauge (Station ID 1070)

(**Figure 2-8**), was determined to be the most representative of the Beach Cities WMG area. The rainfall record was analyzed to determine the 90th percentile year based on both the number of wet days (days with >=0.10-inch for rainfall and the three days following, per the SMBBB TMDL) as well as total annual rainfall. **Table 2-4** below presents these results. The 90th percentile year was determined to be either 1995 or 2005 based on wet days (73 total). TMDL year 1995 was selected to be the most conservative of these two years because while it is the 90th percentile year based on number of wet days, 1995 also had slightly more total rainfall than 2005. Therefore, the RAA was performed on TMDL year 1995. Although detailed results are only provided for the Beach Cities WMG, the 90th percentile year was determined to be 1995 across all four SMB EWMP Groups (Santa Monica Bay, North Santa Monica Bay Coastal Watersheds, Beach Cities, and Peninsula). A summary of annual rainfall data for the gauge above is provided in **Appendix Q**.

Table 2-4. Rainfall Summary at Manhattan Beach Precipitation Gauge (Station ID 1070)

90th Percentile TMDL Year (Type)	TMDL Year	Wet Days*	Total Rainfall (in)
Number of Wet Days	1995	73	22.0
Total Annual Rainfall	2005	73	21.9

*Compliance with the wet weather SMBBB TMDL is based on the number of allowable exceedance days.

The priority WBPCs for the Beach Cities EWMP area, combined with data availability, establishes the specific WBPCs addressed by the RAA. As previously described, SBPAT links the long-term hydrologic output from SWMM to a stochastic Monte Carlo water quality model to develop statistical descriptions of stormwater quantity and quality. Through this approach, the predicted runoff volumes for each storm are randomly sampled from the long-term storm event runoff volume record produced by SWMM. Land use-based wet weather pollutant EMC values (see **Appendix I)** and BMP effluent concentrations (see **Appendix J**) for each storm are then randomly sampled from their lognormal statistical distributions. The runoff volumes (including volumes treated and bypassed by BMPs), land use EMCs, and BMP effluent concentrations are combined to determine the total pollutant loads and load reductions (i.e., difference between existing and post-BMP load estimates) for each sampled storm event. This procedure is then repeated thousands of times, each time recording the volume, pollutant concentrations, loads, and load reductions for each selected storm event. The statistics of these recorded results are then used to characterize the average daily values as well as the average (mean) values for the annual volume, pollutant loads, and pollutant concentrations in stormwater runoff from the modeled area, with and without BMPs implemented.

The IBD is a comprehensive source of BMP performance information (www.bmpdatabase.org), comprised of data from a peer-reviewed collection of studies that have monitored the effectiveness of a variety of BMPs in treating water quality pollutants for a variety of land use types. Water quality performance data from the IBD were used to develop effluent concentrations (averages and standard deviations) for the BMPs and constituents in **Table 2-5**. As with land use EMCs, the effluent quality of BMPs is highly variable. To account for this variability in SBPAT, effluent quality data were analyzed and descriptive statistics were generated for use in the Monte Carlo statistical sampling technique. **Appendix J** contains detailed information on the BMP effluent statistics.

Table 2-5. BMPS and Constituents Modeled in SBPAT[1]

BMPs	Constituents
Constructed Wetland / Retention Pond (with Extended Detention)	Fecal Coliform (FC)
Constructed Wetland / Retention Pond (without Extended Detention)	Total lead (TPb)
Dry Extended Detention Basin	Total suspended solids (TSS)
Hydrodynamic Separator	Total phosphorus (TP)
Media Filter	Dissolved phosphorus as P (DP)[3]
Subsurface Flow Wetland	Ammonia as N (NH3)
Treatment Plant	Nitrate as N (NO3)
Bioswale	Total Kjeldahl nitrogen as N (TKN)
Bioretention with underdrain	Dissolved copper (DCu)
Bioretention (volume reduction only)[2]	Total copper (TCu)
Cistern (volume reduction only)[2]	Dissolved zinc (DZn)
Green Roof (volume reduction only)[2]	Total zinc (TZn)
Porous Pavement (volume reduction only)[2]	
Low Flow Diversion (volume reduction only)[2]	

[1] Constituents are addressed for BMPs that provide treatment (i.e., excluding those identified as "volume reduction only").

[2] For these BMPs, it is assumed that 100% of pollutant loads associated with the volume of water infiltrated is treated by the BMP. Water that bypasses or otherwise discharges from the BMP is assumed to receive no treatment.

[3] Dissolved phosphorus and orthophosphate datasets were combined to provide a larger dataset and because the majority of orthophosphate is typically dissolved and many datasets either report dissolved phosphorus or orthophosphate, but not both.

2.4.3 CALIBRATION

Hydrology

The hydrology component of SBPAT was calibrated for the only location in the entire greater SMB watershed where all data requirements (daily flow, hourly precipitation, and daily beach bacteria concentrations) were met - the Topanga Creek subwatershed. No other SMB areas have sufficient data available. The Topanga Creek subwatershed is located north of the Beach Cities WMG area.

Since primary output for SBPAT's prediction of the SMB watershed are annual volumes and pollutant loads, the calibration focused on accurate prediction of annual discharge volumes from the Topanga Creek subwatershed outlet, with estimated baseflow removed. Hourly rainfall data were used for the nearby Lechuza Patrol Station #72 gauge (gauge reference ID 352b, see **Figure 2-8**, in Malibu, with these data adjusted upward based on an annual rain depth ratio between the higher elevation Topanga Fire Station #69 gauge (gauge reference ID 6) and the coastal Lechuza gauge. Los Angeles County's Topanga Creek streamflow gauge (gauge reference ID F54C-R) was used to estimate measured annual discharge volumes for comparison with modeled volumes. The effective impervious percentage for the open space land use category and the saturated hydraulic conductivity of all mapped soil types served as calibration parameters.

Previous hydrologic calibration reported in the Beach Cities EWMP Work Plan (Beach Cities WMG, 2014) was refined to include additional precipitation and streamflow data. The refined calibration used a vacant undifferentiated land use effective imperviousness value of 1 percent. The refined calibration required the evaluation of various saturated hydraulic conductivity multipliers that would result in increased model runoff (i.e., each soil type's original hydraulic saturated conductivity was multiplied by the same value). The calibration was performed iteratively with multipliers ranging from 0.1 to 2.0 until the average annual modeled volume produced an acceptable error value when compared to the average annual observed volumes. A multiplier of 0.20 was selected as most appropriate. **Figure 2-9** is a depiction of the refined hydrologic calibration results, including the 0.20 saturated hydraulic conductivity multiplier. The emphasis of the calibration effort focused on accurate, unbiased prediction of "non-extreme" annual conditions (annual volumes exceeding a 25-year frequency, 4 percent probability, were excluded from the calibration effort). Based on available data, the period of calibration was 12 years, between 2001 and 2012, with water years 2005 and 2008 excluded due to outlying streamflow measurement results[14]. These calibrated input parameter values were used throughout the SMB watersheds in the wet weather RAAs.

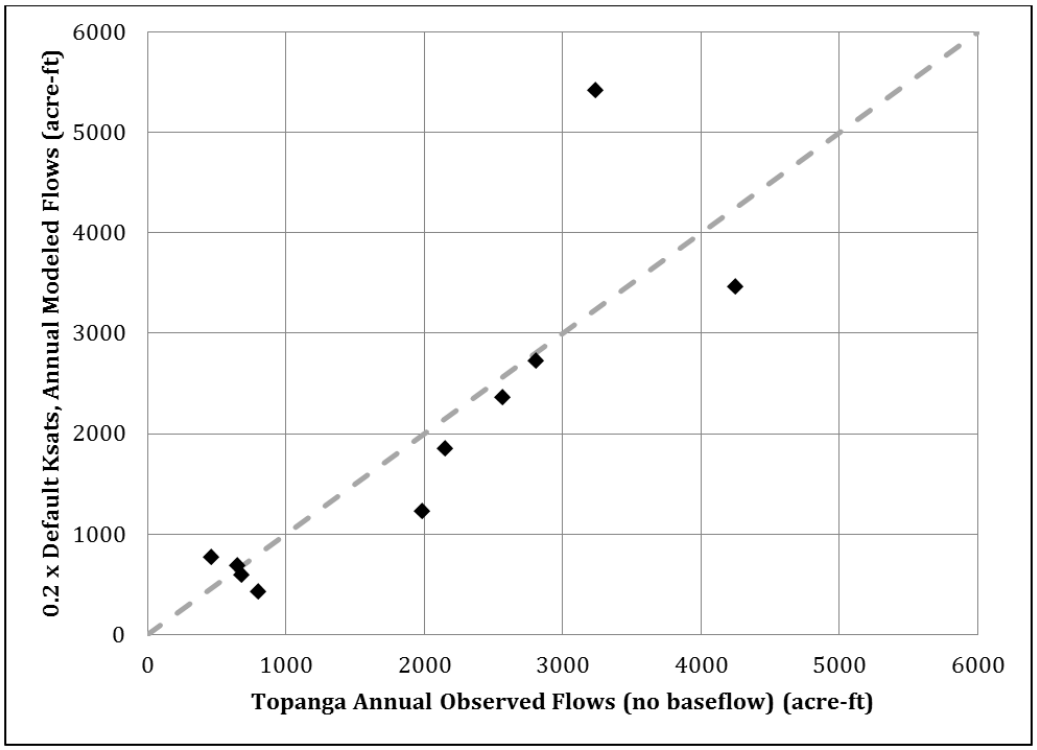


Figure 2-9. Annual Runoff Volumes for Topanga Creek Subwatershed: Modeled vs. Observed, 2001-2012

[14] The stream gauge annual volume measurement in 2008 was unexplainably high (corresponding to a runoff coefficient greater than one), and the 2005 year included a 15-day period of near-record rainfall levels that were anomalously high (where the mean annual rainfall depth fell between December 27 and January 10, and major landslides were reported in nearby coastal Ventura County).

Following calibration, average relative prediction error (or the percent differences between the average annual observed and modeled annual runoff volume) was calculated to be -0.24%. According to the LARWQCB's RAA Guidance Document, which is based on Donigian, 2000, SBPAT model performance with respect to hydrology as a result of this calibration is in the "very good" category.

Water Quality

The RAA Guidelines require water quality calibration based on available monitoring data from each analysis region over the most recent 10 years. However, in the SMB EWMP analysis regions, freshwater (i.e., mass emission type) monitoring stations with fecal coliform data[15] are not available from a recent 10 year period. Therefore, calibration that meets the guidelines is not possible at this time. After several years of CIMP monitoring data have been collected, this may be reevaluated as part of the EWMP adaptive management process. Also, since a conventional water quality calibration was not possible at this time, a validation of baseline exceedance day output was performed for the Leo Carrillo reference watershed using recent beach bacteria monitoring results, as described below. The reference watershed was used for this validation because it is the basis of the TMDL Waste Load Allocations, which the RAA TLRs are intended to represent.

2.4.4 VALIDATION

A validation step was performed to demonstrate that modeled annual fecal coliform loads are indeed predictive of the compliance metric, or annual exceedance days for fecal indicator bacteria. For bacteria modeling, verifying the linkage between modeled *fecal coliform loads* (i.e., discharged from the watershed outlets) and total observed wet weather *exceedance days* (in the receiving water, based on REC1 daily maximum water quality objectives) was critical to establish reasonable assurance that CMLs would be in compliance with the Permit limits. To establish this linkage, an analysis was conducted using shoreline monitoring data at Topanga Canyon[16] (SMB-1-18) between 2005 and 2013. **Figure 2-10** illustrates that decreasing fecal coliform loads should result in measurable reductions in exceedance days, and that there is a reasonable correlation between total annual modeled fecal coliform loads and total annual observed wet weather exceedance days. Each point shown represents one TMDL year.

[15] Fecal coliform data and objectives were used to represent all fecal indicator bacteria because fecal coliform has the most robust land use and BMP effluent EMC datasets.

[16] This subwatershed is 88 percent open space and was selected for water quality validation due to it being the hydrologic calibration subwatershed as well as because it had *daily* shoreline monitoring data, which was necessary in order to have a sufficiently robust dataset of annual wet weather exceedance days.

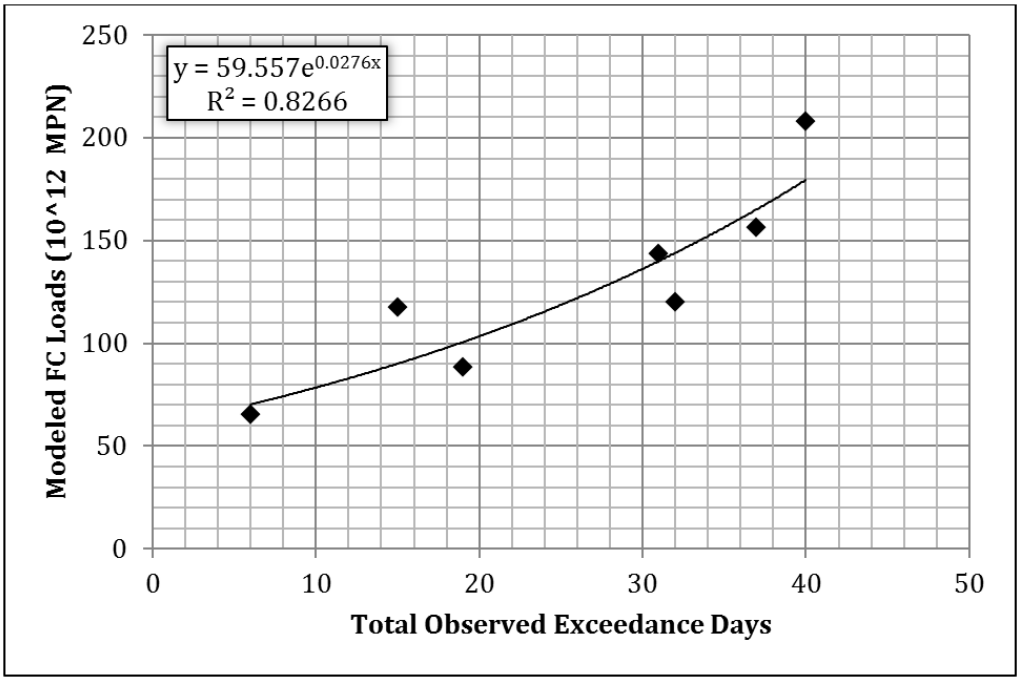


Figure 2-10. Correlation between Modeled Fecal Coliform Loads and Observed Exceedance Days (each point represents one TMDL year, 2005-2013)

2.5 Baseline Loads and Target Load Reductions

The process for establishing TLRs for the modeled WBPC (bacteria in Santa Monica Bay) is described in the following section. For analysis regions with SMBBB TMDL CMLs that have anti-degradation-based allowable exceedance days for wet weather, a target load reduction of zero was assumed consistent with the TMDL's approach which acknowledges that historic bacteria exceedance rates for each of these analysis regions are lower than that of the reference beach, on average. This assumption of zero target load reduction applies for seven of the 11 total SMBBB TMDL CMLs in this Beach Cities watershed – i.e., SMB-5-1, SMB-5-3, SMB-5-4, SMB-5-5, SMB-6-2, SMB-6-5, and SMB-6-6. Historic wet weather monitoring data (2005 – 2013) at these sampling locations confirm this understanding, as the long-term exceedance rate at all seven sites varies between 6.4 and 22%, below the long-term wet weather exceedance rate at the reference beach (26%). Bacteria reductions were still modeled using SBPAT in these analysis regions, but BMP modeling results were not compared with a target load reduction; i.e., quantification only serves to express the additional water quality benefits of existing and proposed BMPs in these analysis regions.

2.5.1 Bacteria

In order to establish a TLR for each modeled Santa Monica Bay analysis region, a modeling methodology was developed and tested to relate the annual number of modeled calendar days with rainfall-generated runoff (or "discharge days") to the expected annual bacteria exceedance

days, which is the Permit's WQBEL expression for the SMBBB TMDL. To be consistent with the SMBBB TMDL for wet weather, which established the allowed exceedance day Waste Load Allocations based on monitoring results from the Leo Carrillo reference beach, this modeling methodology was first tested on Leo Carrillo and its Arroyo Sequit subwatershed for the same critical year as the TMDL (TMDL year 1993). The goal of this analysis was to validate the modeling methodology by comparing its predicted exceedance days for Leo Carrillo with the 17 exceedance days from the TMDL, for TMDL year 1993. This analysis occurred in three steps:

1. The calibrated SBPAT model, using the nearby Lechuza Patrol Station gauge for TMDL year 1993 (consistent with the TMDL), resulted in 59 discharge days for Arroyo Sequit.
2. Based on 2003 to 2013 Leo Carrillo monitoring data, 27% of wet weather samples exceeded the single sample recreational Water Quality Objectives on days with rainfall greater than 0.10-in. In other words, 27% of wet weather days when runoff discharges might be expected (i.e., days with rainfall), FIB concentrations at the beach exceeded the objectives.
3. Multiplying 59 discharge days by the 27% exceedance percentage results in 16 predicted wet weather exceedance days for Leo Carrillo for TMDL Year 1993. This result is within 6% of the 17 exceedance days that were determined through the original analysis in the SMBBB wet weather TMDL, thereby validating the proposed exceedance day calculation methodology.

After validation of the modeling methodology using the reference watershed, it was applied to all SMB analysis regions to predict baseline exceedance days for the 90th percentile year, or TMDL year 1995. Once baseline exceedance days were estimated for every analysis region, the exceedance day count was compared with allowed exceedance days from the TMDL (i.e., 17 for all non-anti-degradation compliance monitoring beaches). To determine the TLR necessary for each analysis region to meet the allowed exceedance days, a virtual retention BMP was modeled at the outlet of each analysis region. This approach was presented to LARWQCB staff on June 6, 2014 and verbal feedback received during the meeting was supportive.

Each virtual retention BMP included a diversion with a virtual hydraulic capacity that results in in a model-derived bypass frequency (or number of discharge days), during TMDL year 1995 that meets the allowable exceedance day criteria. Each diversion is modeled as a full capture system. The net load reduction resulting from this BMP scenario (i.e., baseline analysis region load minus analysis region load with the diversion system and retention BMP in place) for the 90th percentile year (1995) becomes the TLR for each analysis region. For the RAA, reasonable assurance of compliance is established when load reductions associated with proposed BMPs equal the TLR for each analysis region.

In summary, the following approach was implemented to calculate a TLR for each modeled analysis region (see **Appendix K** for example calculation):

1. Each analysis region was modeled in SBPAT for the 90th percentile year (TMDL 1995).

2. The existing, baseline condition (i.e., without any outlet retention BMP) was modeled for each analysis region, resulting in a mean baseline fecal coliform (FC) load for the 90th percentile year (baseline load).
3. The exceedance percentage of samples collected during days with precipitation greater than 0.1 inches was determined for each analysis region.
4. The allowable number of discharge days for each analysis region was calculated by dividing 17 TMDL allowable exceedance days by the exceedance percentage calculated in Step 3.
5. An instream diversion to a large virtual retention BMP at the outlet of each analysis region was iteratively sized so that it only bypasses during the number of allowable discharge days determined in Step 4.
6. Each diversion and virtual retention BMP was then modeled in SBPAT to produce a mean FC load for the 90th percentile year (allowed load).
7. For each analysis region , the difference between the baseline load (step 2) and the allowed load (step 6) resulted in a TLR for the 90th percentile year, which was the target load reduction required to meet the 17 allowable TMDL exceedance days for wet weather.

By implementing the steps described above, TLRs were developed for all analysis regions within the MS4, including both open beach and point zero CMLs. These TLRs are presented in **Table 2-6** for both the interim and final compliance deadlines. TLRs for the interim compliance deadlines are assumed to be 50% of the final TLR. TLRs for analysis regions located between two point zero CMLs, but not representing an open beach site, were assigned the TLR of the geographically smaller of the two adjacent CML analysis regions.

It should be noted that a zero percent TLR was calculated in the analysis region draining to CML SMB-6-03. This analysis region and CML had a lower average wet weather exceedance rate than the reference watershed based on a recent nine year period (2005-2013), produced relatively few modeled stormwater discharge days, and had few years with measured wet weather exceedance days greater than allowable exceedance days (i.e., only three of the recent nine years exceeded the allowed days, and each year by just one exceedance day).

Similarly, a zero percent TLR was also calculated in the analysis region draining to CML SMB-6-04. The frequency of exceedance at SMB-6-04 (27.6%) was lower than that of the surrounding anti-degradation sites SMB-6-02 (33.3%) and SMB-6-05 (31.0%) and also lower than the exceedance rate of SMB-6-03 (37.9%), which was calculated to have a TLR of zero. Further, SMB-6-04 is an open beach CML with no major MS4 outfall at the sampling location.

As stated earlier, nine CMLs with anti-degradation-based wet weather allowable exceedance days were assigned zero TLRs to reflect their historic good water quality. Although the SMBBB TMDL requires only that beach water quality at anti-degradation compliance locations be maintained, the Beach Cities EWMP will seek to implement nonstructural and Low Impact Development (LID)-based BMPs within the SMB portion of their EWMP area which will protect and potentially improve water quality at these beaches and is consistent with the J5&6 Implementation Plan (Geosyntec Consultants, 2011) for the SMBBB TMDL. These measures, though not required for RAA demonstration, are quantified in Section 2.6.3 below.

Table 2-6. TLRs for Fecal Coliform for each Modeled Analysis Region in Santa Monica Bay Watershed - TMDL Year 1995

Analysis Region	2003-2013 Historical Exceedance Frequency (Daily Rainfall >0.10-in)	Allowable Discharge Days (Daily Rainfall > 0.10-in)	Diversion Flowrate (cfs)	Baseline Load (10^{12} Most Probable Number [MPN])	Interim (2018) Target Load Reduction		Final (2021) Target Load Reduction	
					Absolute (10^{12} MPN)	% of baseline annual load	Absolute (10^{12} MPN)	% of baseline annual load
SMB-5-01[1]	10.3%	4	0	7.4	Interim target load reduction assessed on a watershed-wide basis		0	0%
SMB-O-06	N/A	4	0	23.0			0	0%
SMB-5-02	67.9%	17	53	534.8			247.6	46.3%
SMB-5-02/SMB-5-03[2]	N/A	12	0	34.9			0	0%
SMB-5-03[1]	17.2%	6	0	29.0			0	0%
SMB-5-03/SMB-5-04[2]	N/A	9	0	89.3			0	0%
SMB-5-04[1]	31.0%	12	0	17.1			0	0%
SMB-5-04/SMB-5-05[2]	N/A	10	0	8.2			0	0%
SMB-5-05[1]	31.0%	8	0	182.8			0	0%
SMB-5-05/SMB-6-01[2]	N/A	13	0	6.7			0	0%
SMB-6-01[3]	63.9%	17	70	706.6			312.1	44.2%
BCSump[3]	63.9%	17	40	379.4			178.0	46.9%
SMB-6-01/ SMB-6-02[2]	N/A	16	0	162.5			0	0%
SMB-6-02[1]	33.3%	14	0	99.6			0	0%
SMB-6-03	37.9%	17	0	62.2			0	0%
SMB-6-04	27.6%	17	0	209.9			0	0%
SMB-6-05[1]	31.0%	11	0	90.9			0	0%
SMB-O-08	N/A	7	0	86.0			0	0%
SMB-6-06[1]	10.3%	3	0	6.7			0	0%
SMB Watershed-Wide	N/A	N/A	N/A	**3875.9**	**368.9**	**13%**	**737.7**	**26%**

[1] Anti-degradation site
[2] For the unmonitored tributary areas located in-between the CML tributary areas, TLRs were assigned from the geographically smaller of the two adjacent CML analysis regions.
[3] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

2.6 Best Management Practices

2.6.1 Methods to Select and Prioritize BMPs

In order to demonstrate reasonable assurance, BMPs were identified in a prioritized manner. Prioritization was based on cost (low cost BMPs were prioritized first); BMP effectiveness for the pollutants of concern (BMPs that had greater treatment efficiency for the pollutant of concern in a particular analysis region were prioritized over other BMPs); and implementation feasibility as determined by the Beach Cities WMG. In general, nonstructural BMPs were prioritized over structural BMPs due to their lower relative cost, and then structural BMPs were identified that would likely result in the greatest load reduction per dollar.

The RAA was performed according to the following steps:

1. Calculate load reductions associated with existing structural BMPs;
2. Assume a load reduction for non-modeled non-structural BMPs(five percent of baseline pollutant load);
3. Calculate load reductions for public retrofit incentives (e.g., downspout disconnects) and redevelopment;
4. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 entities (e.g., Industrial General Permit holders and Caltrans);
5. Calculate load reductions for proposed regional BMPs that were identified in existing plans; and
6. Meet the TLR by backfilling the remaining load reduction with new regional or distributed green streets BMPs, with green streets modeled by assuming treatment of runoff from a percentage of specific developed land uses.

The following schedule assumptions were made:

- Only BMPs implemented after the TMDL effective date (2003) were included;
- Redevelopment BMPs were assumed to use different sizing criteria before and after 2015 (EWMP submittal date), consistent with the Permit's post-construction requirements; and
- Modeled load reduction output are reported for both the interim (2018) and final (2021) TMDL compliance dates.

2.6.2 Recommended MCMs and Nonstructural BMPs

The Permit allows permittees developing an EWMP the opportunity to customize the MCMs specified in the Permit to focus resources on high priority issues within their watersheds. Modifications to the MCMs must be appropriately justified and still be consistent with 40 CFR § 122.26(d)(2)(iv)(A)-(D). A control measure may only be eliminated based on the justification that it is not applicable to a particular permittee (per Section IV.C.5.b.iv.1(c). Customized measures, once approved as part of the EWMP, will replace in part or in whole the prescribed MCMs in the

Permit. The Planning & Land Development Program is not eligible for customization in that it may be no less stringent than the baseline requirements in the Permit. However, it can be enhanced over the baseline permit requirements if desired. The Permit-specified MCMs (baseline MCMs) build upon the MCMs in the previous MS4 Permit (Order 01-182). Although similar in many ways to the previously required MCMs, in most cases the baseline MCMs contain more prescriptive record-keeping and/or implementation requirements.

Summary assessments of each MCM contained in the Permit are provided in **Table 2-7**, as well as a determination as to whether the Beach Cities WMG will implement the MCM provisions as defined in the Permit, or whether modifications will be made. Additional modifications may also be made through the Adaptive Management Process, outlined in Section 5.

General Framework for MCM Customization

An approach for evaluating existing institutional MCMs was developed as part of the Beach Cities EWMP Work Plan and was used to evaluate existing MCMs and develop the customized MCMs. The following steps provide a general framework for MCM customization:

1. Identify MCMs for potential customization. This may include identifying:
    a. MCM requirements prescribed by the Permit which are not already being implemented by the permittee;
    b. Currently implemented MCMs which have been enhanced over the previous Permit as part of TMDL implementation, e.g., Clean Bay Restaurant Program;
    c. Programmatic solutions/non-structural controls identified in TMDL implementation plans which may not yet have been implemented; and
    d. MCMs which are currently being implemented but which may be excessive in scope. For example, commercial inspections being conducted of retail gasoline facilities which are already heavily regulated through other environmental programs in areas that have no receiving water impairments for the pollutants of concern may be carried out less frequently, or discontinued indefinitely.
2. Identify MCMs which are not applicable. A control measure may be eliminated based on the justification that it is not applicable to a particular permittee. For example if it is the policy of a permittee not to use pesticides in public agency activities, then there is no need for tracking of pesticide use and this MCM may be proposed for elimination.
3. Assess the effectiveness of the incremental baseline MCM requirements with respect to water quality priorities. The data necessary to quantify this will vary greatly by MCM, but may include information such as: receiving water quality, inspection and reporting records, number of qualifying projects (e.g., number of construction projects greater than 1 acre), number of pet station bags used, amount of material picked up by street sweeping activities, number of employees trained, and maintenance records. Additionally, the California Stormwater Quality Association (CASQA) provides a tool to estimate the effectiveness of stormwater management programs (CASQA, 2015). The tool recommends possible assessment metrics that can be used for various stormwater programs.

4. Quantify the additional resources required to implement the incremental baseline MCMs. This may include estimating additional staff resources in terms of full-time employees, consulting resources, and contracted services.
5. Assess the effectiveness and resources required to implement the customized MCM. The process to quantify these will be the same as the process used to quantify the baseline effectiveness of the existing MCM.
6. Compare the assessed effectiveness and resources required to implement the incremental baseline MCMs and the customized MCMs. Customization can be justified in several ways:
    a. If the customized MCM effectiveness is equal to or greater than the baseline MCM, customization can be justified.
    b. If an MCM requirement is not applicable, then elimination is justified.
    c. If the incremental MCM requires additional resources that are disproportionate to the increased effectiveness achieved, then retention of the existing MCM may be justified.
7. Document the customized MCM justification.

MCMs were evaluated based on their effectiveness in addressing the WBPCs specific to the Beach Cities EWMP Area and based on the Beach Cities WMGs knowledge and experience with existing MCMs. In many ways, the Group's practical experience with MCM implementation over time provides the best insight as to what MCM modifications/ enhancements will be most helpful to target the WBPCs of concern in the Beach Cities EWMP Area.

Table 2-7 summarizes the proposed MCM modifications common to the Beach Cities EWMP WMG, which include promotion of Ocean Friendly Landscaping Workshops as part of the residential outreach permit requirement, distribution of a Clean Bay Restaurant Program brochure to promote public education, establishment of a stormwater website for J5&6, implementation of the Clean Bay Restaurant Program as an assistance program for small businesses, and annual restaurant inspection as commercial pollutant sources. The LACFCD will implement the MCMs identified in VI.D.44 of the MS4 Permit with no additional modifications.

In addition to the MCM modifications being implemented by the WMG as a group, the Beach Cities WMG has identified additional individual city-specific MCM enhancements, which include organization of educational and cleanup-oriented events, installation of pet waste collection stations as a part of the residential outreach requirement, a ban on plastic bags in Manhattan Beach and polystyrene food containers in Hermosa Beach, and development of environmentally oriented city websites. City-specific MCMs enhanced beyond the 2012 Permit requirements are specified in **Table 2-7.** Details and descriptions of these enhancements are provided in **Appendix L**. The MCM enhancements shown in **Table 2-7** and **Appendix L** are examples and are not comprehensive. The Beach Cities WMG agencies' LID Ordinances and Green Street Policies are included as **Appendix M** and **Appendix N**, respectively.

Table 2-7. MCM Modifications and Agency-Specific Enhancements for Beach Cities EWMP Area

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
D.2 Progressive Enforcement (Applies D.6, D.7, D.8, and D.10)						
Develop and maintain a Progressive Enforcement Policy	X					X
Conduct follow-up inspection within 4 weeks of date of initial inspection	X					
Take progressive enforcement	X					X
Retain records	X					
Refer violations to LARWQCB	X					
Investigate complaints from LARWQCB	X					
Assist LARWQCB with Enforcement Actions	X					
D.5 Public Information and Participation Program (PIPP)						
Participate in a Countywide PIPP, WMP PIPP, or individual PIPP that measurably increases knowledge and changes behavior, and involves a diversity of socio economic and ethnic communities	X					X
Maintain reporting hotline	X					X
Publish hotline info on web, telephone book	X					
ID staff/department that serve as the contact (publish this info)	X					
Organize events (e.g., clean ups)	X	X	X	X	X	X
Residential Outreach (Individually or with group):	X	X	X	X	X	X
Public Service Announcements	X	X	X	X	X	
(Develop) Public education materials on: vehicle fluids; household waste; construction waste; pesticides, fertilizers, and integrated pest management (IPM); green wastes; and animal wastes	X		X		X	X
Distribute public education materials at points of purchase	X	X		X	X	X
Maintain stormwater website	X	X	X		X	X

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Provide schools with materials to educate children (K-12); can use state produced materials	X		X		X	X
D.6 Industrial/ Commercial						
Track Critical Sources - maintain inventory (watershed based or lat/long recorded)	X					
Educate - notify critical sources of BMP requirements	X					
Implement a Business Assistance Program for select sectors or small businesses - technical assistance, and distribute materials to specific sectors	X	X	X			X
Inspect Commercial Sources	X	X				X
Inspect Industrial Sources - Initial mandatory inspection	X		N/A		N/A	X
Secondary mandatory inspection	X		N/A		N/A	
No Exposure - evaluate and conduct 2nd inspection at 25% of facilities	X		N/A		N/A	
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)	X					
D.7 Planning and Land Development						
Update ordinance/design standards to conform with new requirements (LID)	X				X	X
Optional: Establish alternative compliance for technical infeasibility, e.g., allow onsite biofiltration or offsite infiltration or groundwater replenishment or retrofit	X					
Optional if allowing offsite mitigation: Develop a prioritized list of offsite mitigation projects	X					
Optional if allowing offsite mitigation: Develop a schedule for completion of offsite projects (must be with 4 yr of the Certificate of Occupancy of the first project that contributed funds)	X					

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Optional if allowing offsite mitigation: Notice offsite projects to RB website	X					
Optional if allowing offsite mitigation: List of mitigation projects descriptions and estimated pollutant and flow reductions	X					
Optional if allowing offsite mitigation: Provide aggregated comparison of alternative compliance to results that would have been expected with on-site retention of the SWQDv	X					
Optional: Submit documentation that a previously adopted LID ordinance provides equivalent pollutant loading and flow reduction	X					
Plan Review process - check LID and BMP sizing, etc.,	X			X	X	X
Establish internal agreements with structure for communication and authority for departments overseeing plan approval and project construction	X					
Require O&M plan for LID, treatment and hydromod BMPs	X					
Implement tracking and enforcement program for LID, treatment and hydromod BMPs	X					
Inspect all development sites upon completion and prior to occupancy certificates	X					
Verify O&M of BMPs operated by Permittee through inspection	X					
Develop maintenance inspection checklist	X					
Require private parties that operate BMPs to submit verification of O&M; enforce as needed	X					
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)	X					
D.8 Development Construction Program						
Update erosion and sediment control ordinance/procedures to conform with new requirements	X				X	X
Sites < 1 acre; inspect based upon water quality threat	X				X	

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Establish priority inspection process	X					X
Site < 1 acre; Require sites with soil disturbing activities to implement minimum BMPs	X					
Require construction sites to prepare erosion sediment control plan(ESCP); review and approve (≥ 1 acre)	X					
Verify construction sites coverage under the CGP and 401 cert	X					
Develop/implement ESCP review checklist	X					
Require construction sites to adhere to standards and make standards readily available	X					
Conduct inspections at public and private sites (at least 1x/2 weeks for high threat sites (more frequently when rain is predicted or occurs; at least monthly for lower threat; also must inspect during all phases of construction - at least 3 times)	X					
Develop/implement SOPs/inspection checklist	X					
Track number of inspections for inventoried sites and verify minimum inspections are completed	X					
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)	X					
Train plan review staff and inspectors	X				X	X
Staff must be knowledgeable in QSD/P key objectives, local BMPs standards	X					
D.9 Public Agency Activities						
Require public construction sites to implement Planning and Land Development requirements, implement Erosion and Sediment Control BMPs, and obtain Construction General Permit coverage	X					X
Maintain inventory of Permittee owned facilities (including parks and recreation facilities,)	X					
Update inventory	X					

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Develop retrofit opportunity inventory; evaluate and rank	X		X			X
Cooperate with private land owners to encourage site specific retrofitting; includes pilot projects and outreach	X					
Obtain IGP coverage for public facilities where appropriate	X					
Develop procedures to assess impact of flood mgmt. projects on water quality of receiving waters; evaluate to determine if retrofitting is feasible	X					
Evaluate existing structural flood control facilities to determine if retrofitting facility to provide additional pollutant removal is feasible	X					
Implement source control BMPs at Permittee owned facilities/activities	X					
Require city-hired contractors to implement source control BMPs	X					
Prevent vehicle/equipment washing discharges to the MS4, including firefighting and emergency response vehicles	X					X
Ensure new/redeveloped/replaced wash facilities are plumbed to the sanitary sewer or self-contained.	X					
Implement IPM program	X				X	
Ordinances, policies, and procedures reflect IPM techniques and include commitments and schedules to reduce the use of pesticides that cause impairments	X					X
Annually update in inventory of pesticides used by agency; quantify pesticides used by staff and contractors; demonstrate IPM alternatives to reduce pesticide use	X					X
Use SOPs for pesticide application	X					X
Ensure no application of pesticides or fertilizers when two or more days with a 50% chance of rain is predicted by NOAA; within 48 hr of 1/2 inch of rain; or when water is flowing off the site	X					
Ensure staff applying pesticides are certified or working under supervision of a certified applicator in the appropriate category	X					

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Update catch basin map add GPS locations and update priority	X					
Inspect/Clean catch basin in areas not subject to Trash TMDL- Priority A: 3x during wet season, 1x during dry 1x; PriorityB:1x during wet 1x and 1x during dry; Priority C: 1x per yr. Maintain records.	X					
Required trash management at public events	X				X	X
Place and maintain trash receptacles/capture devices at newly identified high trash generating areas	X		X	X	X	X
Label storm drains	X					X
Inspect labels prior to each wet season	X					
Record and relabel illegible labels within 180 days of inspection	X					
Post signs at access points to water bodies (open channels, creeks; lakes)	X					
In areas not subject to the Trash TMDL, install trash excluders on catch basins or outfalls in areas defined as Priority A, or implement substantially equivalent BMPs	X		X	X	X	X
Inspect and Remove trash and debris from open channels and other drainage structures 1x/yr before rainy season.	X					
Eliminate discharge of contaminants during MS4 maintenance	X					
Implement controls to limit infiltration of seepage from sanitary sewers to the storm drains	X					
Implement routine preventative maintenance for both systems, survey sanitary sewer and MS4. May use SSO General Waste Discharge Requirement [WDR] to fulfill this requirement.	X					
Implement inspection and maintenance program for Permittee owned BMPs	X					
Manage residual water in treatment control BMPs removed during maintenance	X					

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Street sweeping - Priority A: 2x/mo; B: 1x/mo; C: as needed, not less than 1x/yr	X		X	X	X	X
Implement road construction maintenance BMPs (e.g., restrict paving activity to exclude periods of rain)	X					
Inspect and/or clean Permittee owned parking lots 2x/mo	X					X
Train employees and contractors on stormwater requirements	X					X
Train employees and contractors on pesticide use	X					
D.10 Illicit Connections and Illicit Discharges Elimination						
Continue IC/ID program	X		X	X	X	X
Written procedures for conducting investigations and eliminations	X					X
Initiate investigation within 72 hours from becoming aware of the discharge	X					X
Implement solutions to eliminate discharge; conduct follow-up investigation to verify elimination; follow Progressive Enforcement Plan (see Part VI.D.2)	X		X	X	X	X
When discharge originates upstream of jurisdiction, notify the upstream jurisdiction and LARWQCB within 30 days	X					
Initiate investigation within 21 days for illicit connection	X					
Permit or document illicit connection that only discharge stormwater or allowed non-stormwater	X					
Eliminate illicit connection within 180 days of investigation	X					
Facilitate public reporting via hotline	X					X
Signage adjacent to open channels provide info re: public reporting	X					
Document calls and actions associated with hotline	X					X
Implement procedures on responding to complaints; evaluate and update procedures	X					X
Implement a spill response plan	X					X

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement			
			City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Train staff and contractors on ID/IC	X					X
Create a list of positions and contractors that require ID/IC training	X					

2.6.3 Quantified Non-Structural BMPs

Non-structural BMPs have been categorized as follows for purposes of RAA. Specific model inputs are summarized in tabular format below.

Non-Modeled Programmatic BMPs

These source controls include a combination of BMPs such as new or enhanced pet waste controls (ordinance, signage, education/outreach, mutt mitts, etc.), Clean Bay Restaurant Program, human waste source tracking and remediation (e.g., leaking sewer investigations including implementation of each agency's Sanitary Sewer Management Plan consistent with Statewide WDRs, etc.), enhanced street sweeping (e.g., 100% vacuum sweepers, increased frequency, posting of 'No Parking' signs for street sweeping, etc.), increased catch basin and storm drain cleaning, and other new or enhanced nonstructural BMPs that target the pollutants addressed in this EWMP. A combined credit of 2.5 – 7.5% load reduction (average of 5%) was applied for all pollutants to represent the cumulative benefit from these BMPs.

Modeled Redevelopment

Beginning in 2001, redevelopment projects were required by the Permit (via the Standard Urban Stormwater Management Program [SUSMP]) to incorporate stormwater treatment BMPs into their projects if their project size exceeded specified thresholds. The 2001 MS4 Permit SUSMP redevelopment requirements were applied between 2003 (the point at which the Bacteria TMDL was implemented) and 2015 for the SMB EWMP area. Redevelopment in this period was modeled as flow-through media filters at a 0.2 in/hr design event.

The 2012 MS4 Permit established new criteria for redevelopment projects, requiring certain sized projects to capture, retain, or infiltrate the 85th percentile design storm or the 0.75-inch design storm, whichever is greater, via the implementation of LID BMPs. To account for these redevelopment requirements, BMPs were modeled in SBPAT assuming land use-specific annual redevelopment rates for projects that triggered former SUSMP requirements or will trigger the Permit's LID BMP requirements (**Table 2-8**).

Table 2-8. Estimated Annual Redevelopment Rates

Land Use	Annual Redevelopment Rate (% of total land use area)		
	Cities of Redondo Beach and Torrance[1]	City of Hermosa Beach	City of Manhattan Beach
Residential	0.18	0.31	0.10
Commercial	0.15	0.79	0.38
Industrial	0.34	0.79	0.38
Education	0.16	0.16	0.16
Transportation	2.7	2.7	2.7

[1] Regionally developed redevelopment rates were applied to the City of Torrance and Redondo Beach (City of Los Angeles Bureau of Sanitation, 2012).

Redondo Beach and Torrance areas used regionally developed redevelopment rates. For Hermosa Beach, the recent 4-year rate for redevelopment of residential areas was used based on city-specific LID implementation tracking data. The rate of redevelopment in all commercial land use categories tracked by SUSMP was combined to give an overall rate for both commercial and industrial (as that City has very few light industrial parcels), for historical as well as future redevelopment.

For Manhattan Beach, a City-specific redevelopment rate of 3.8 percent for commercial redevelopment was provided based on historical SUSMP data over the past ten years. This value was also assumed for historical industrial redevelopment as well as future commercial and limited industrial redevelopment. For the residential land use, because there are insufficient data to project LID rates, a nominal 0.10 percent was assumed.

BMPs were assumed to be implemented and to continue to be implemented in the future, at these rates across two distinct time periods:

- **2003 (SMBBB TMDL Effective Date) - 2015:** The SUSMP requirements, based on the 2001 MS4 Permit, were assumed to be implemented over this period as flow-through media filters at a 0.2 in/hr design intensity (Los Angeles County Department of Public Works, 2002).
- **2015 – 2021 (SMBBB TMDL Final Compliance Deadline):** The 2012 MS4 Permit post-construction requirements were assumed to be implemented over this period as 50% biofiltration and 50% bioretention. Biofiltration (bioretention with underdrains) were modeled using bioswale BMP types with effluent EMCs set to bioretention and sized to retain 150 percent of the 1-year, 1-hour design storm (approximately 0.3 in/hr)[17] because they do not retain all the design storm volume on site (they are flow-through systems), while bioretention units were sized to retain 100 percent of the 85th percentile, 24-hour design storm depth, calculated as the mean for each analysis region.

2015 is used as a transition date since the LID post-construction requirements from the 2012 MS4 Permit are required to be in full effect via local LID ordinances by this time.

In order to estimate load reductions associated with these redevelopment BMPs, the land use percentages shown in **Table 2-1** were multiplied by the respective land use areas in each analysis region, resulting in an assumed area treated by LID BMPs each year. This area was multiplied by the applicable number of years, since new BMPs are assumed to be implemented each year. The total land use area assumed to be redeveloped for each analysis region was then modeled as being treated by the BMPs described below (**Table 2-9**) and the total load reduction was quantified. The default design parameter assumptions for the biofiltration redevelopment projects were that the longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 inches.

[17] 150% of the 1-year, 1-hour design storm was used per Section VI.D.7.c.iii of the Permit.

Modeled Public Retrofit Incentives

These BMPs include programs directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnects. Public incentives for retrofitting existing development were modeled in SBPAT between 2015, when the EWMP will begin to be implemented, and the respective TMDL final compliance date. Public retrofit incentives were assumed to be a downspout disconnection program, modeled as bioswales sized to a design storm intensity of 0.2 in/hr (**Table 2-9**). The default design parameter assumptions for the biofiltration redevelopment projects were that longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 in.

It was assumed that 10 percent of single family residential areas would be converted to disconnected downspout systems over 2015 to 2021, and that, based on GIS analysis, 38 percent of the single family residential area consists of rooftops that can be effectively disconnected. Therefore, 3.8 percent of single family residential neighborhoods were modeled as treated by bioswales in order to account for public retrofit incentives.

Table 2-9. Redevelopment and Public Retrofit Incentives Model Assumptions

Implementation Level	BMP Type	Design Storm	Longitudinal Slope (ft/ft)	Manning n	Hydraulic Residence Time (min)	Water Quality Flow Depth (in)	Effective Retention Depth (in)	Infiltration Rate (in/hr)
Redevelopment (2003-2015)	Media Filter	0.2 in/hr	-	-	-	-	-	-
Redevelopment (2015-2021)	Biofilters[1]	0.3 in/hr	0.03	0.25	10	4	2	Based on analysis region-specific soil type
	Bioretention	0.75 in	-	-	-	-	12	0.15
Public Retrofit Incentives (2015-2021)	Bioswales representing downspout disconnects	0.2 in/hr	0.03	0.25	10	4	2	Based on analysis region-specific soil type

[1] Modeled as bioswales using bioretention effluent EMCs

Modeled Non-MS4 Permitted Parcels or Areas

SBPAT was used to quantify the load reduction assuming that regulated parcels/areas would be in compliance with the NPDES Statewide Storm Water Permit Waste Discharge Requirements (WDRs) from State of California Department of Transportation (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and the California NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit [IGP], Order 2014-0057-DWQ) (**Figure 2-11**).

A load reduction was obtained from these areas by simulating treatment plants sized to treat the IGP's design storm requirement, the 85th percentile, 24-hour storm event (0.2 in/hr), with an effluent concentration set equal to the water quality standard (**Table 2-10**). For fecal coliform, 400 MPN/100mL was used.

Table 2-10. Non-MS4 Parcels – Modeled as Treated by Treatment Plants (i.e., BMPs that will treat stormwater to the Water Quality Objectives)

Implementation Level	BMP Type	Treatment Flowrate (cfs)	Design Storm (in/hr)	Average Basin Depth (ft)	Equalization Volume (cu-ft)	Diversion Flowrate (cfs)	Infiltration Rate (in/hr)
Non-MS4 Parcels	Treatment Plant	10,000	0.20	100.00	1,000	10,000	0.00001

2.6.4 Structural BMPs

Existing (constructed between 2003 and 2014) and proposed structural BMPs (regional and distributed) were modeled in SBPAT based on best available design information. The following sections outline the structural BMPs that were modeled as well as their drainage areas, design details in SBPAT, and any relevant assumptions. Modeled regional BMPs are depicted in **Figure 2-12**. Modeled distributed BMPs are depicted in **Figure 2-13**.

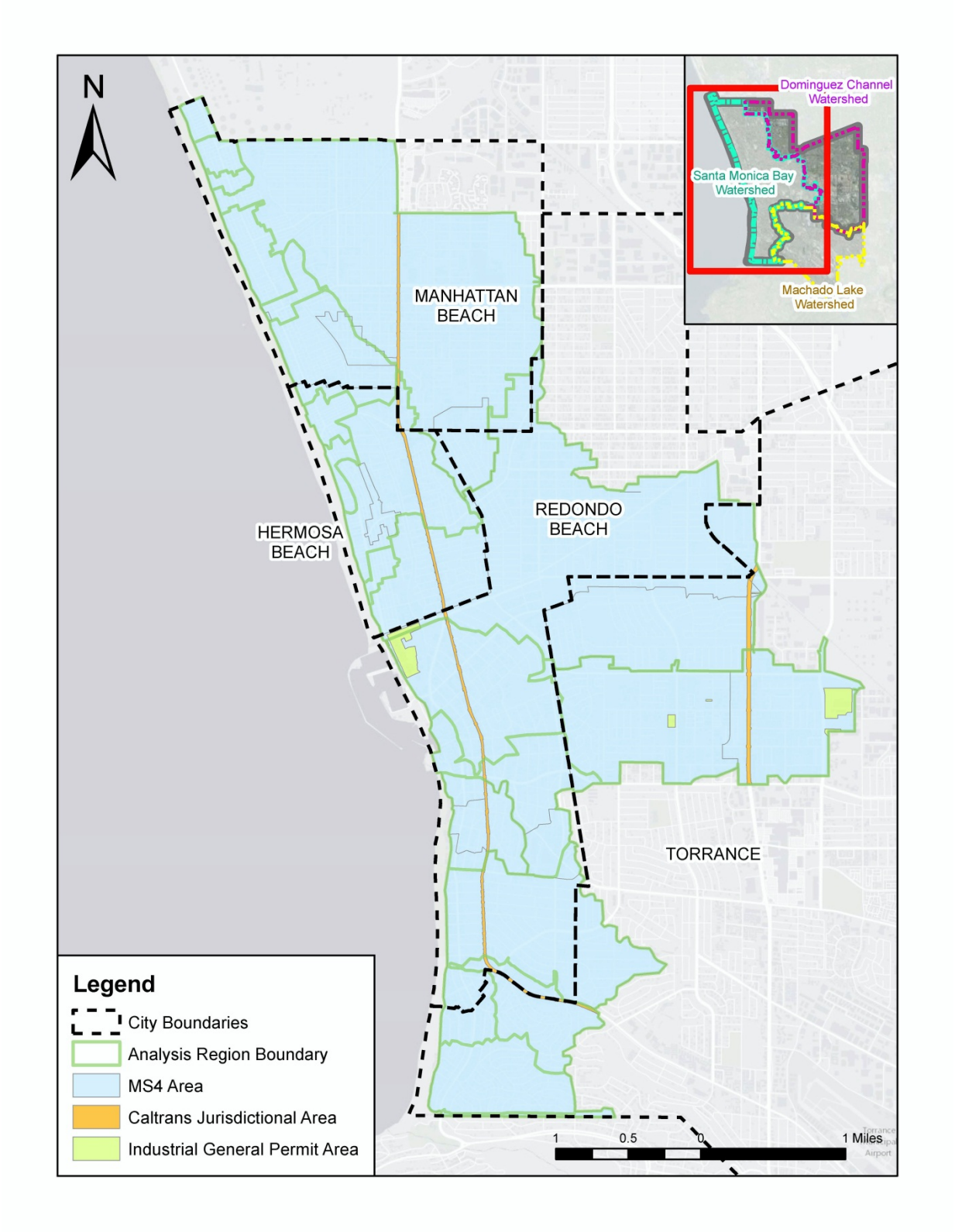


Figure 2-11. IGP and Caltrans Area within the Santa Monica Bay portion of the Beach Cities EWMP Area

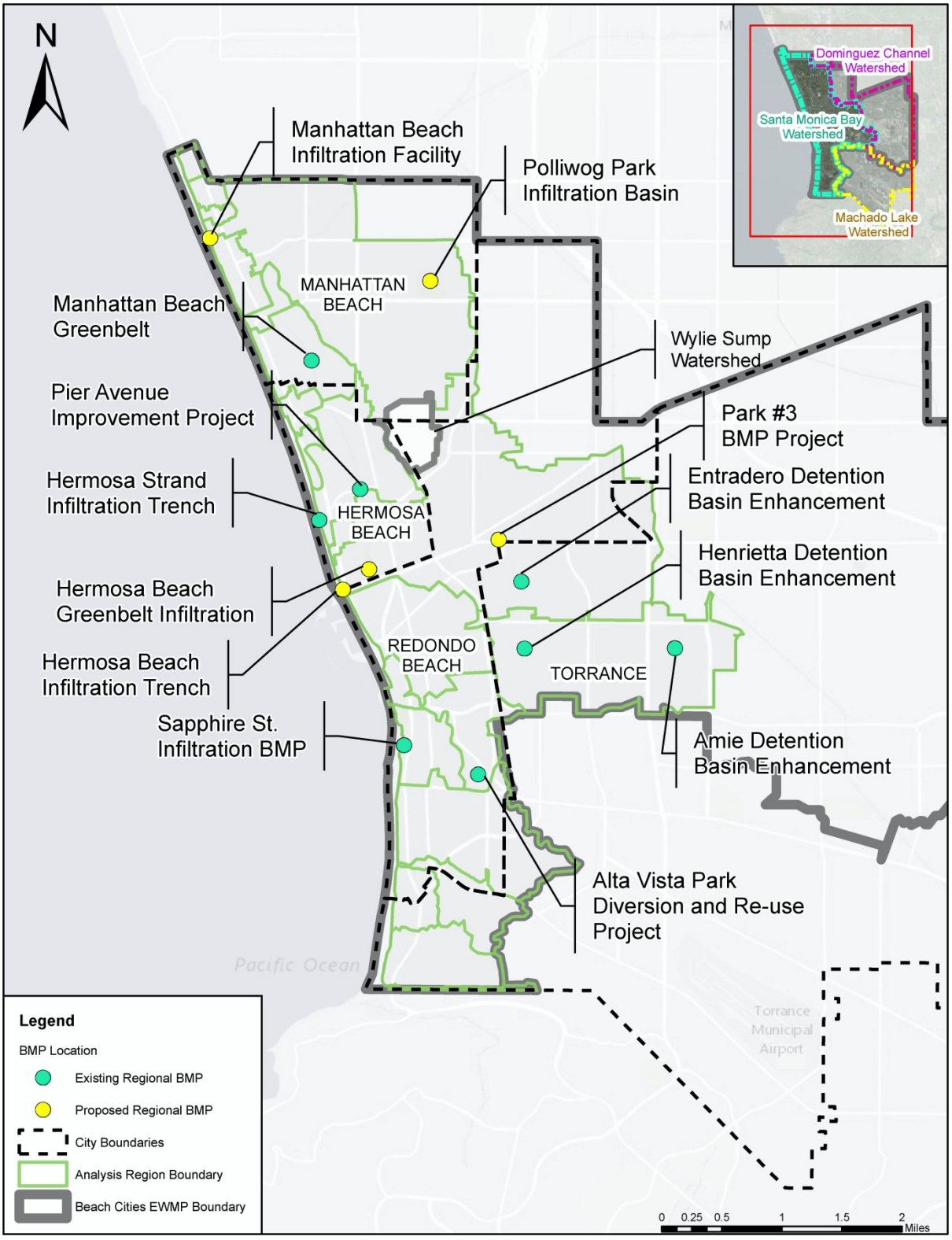


Figure 2-12. Existing and Proposed Regional BMPs within EWMP Area

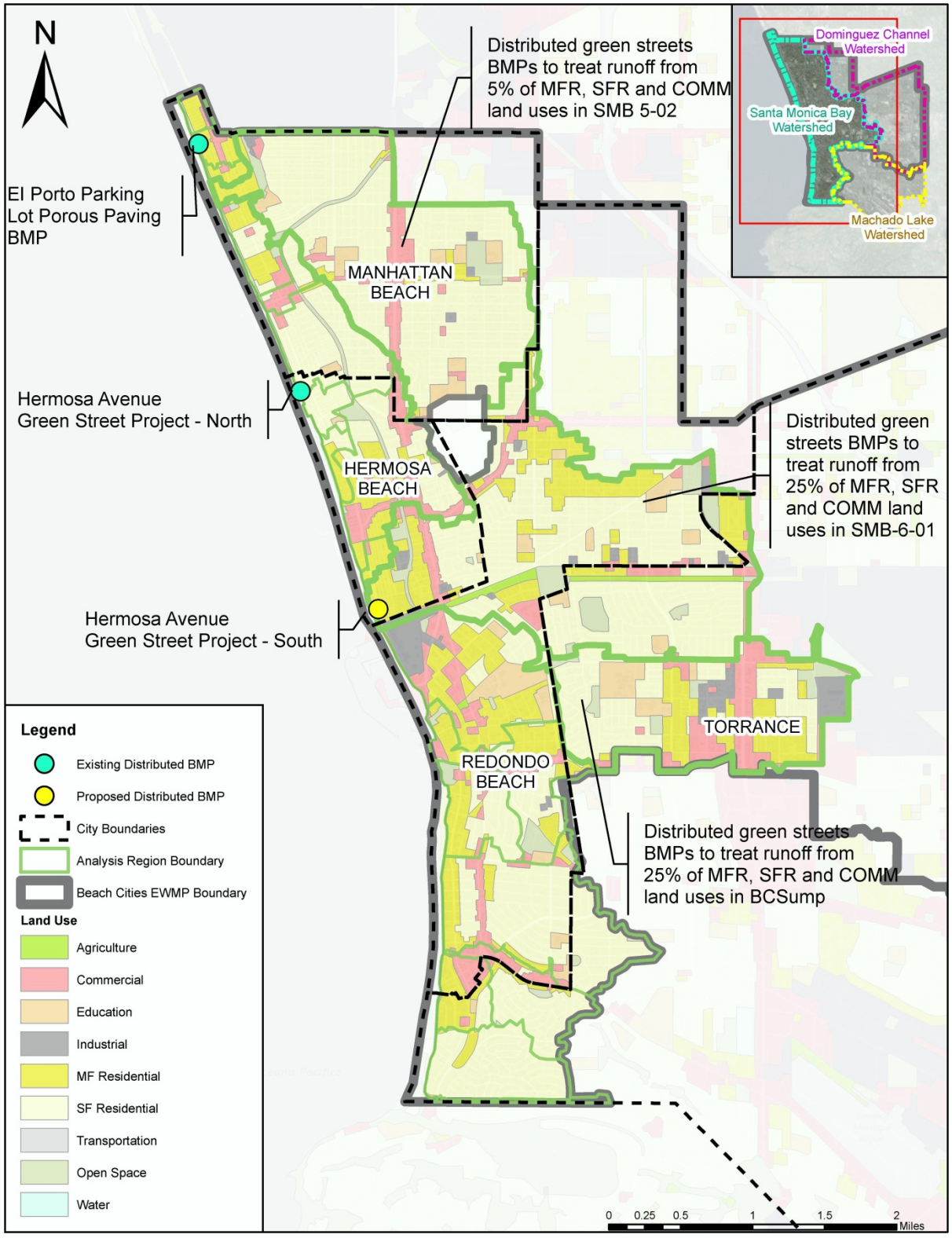
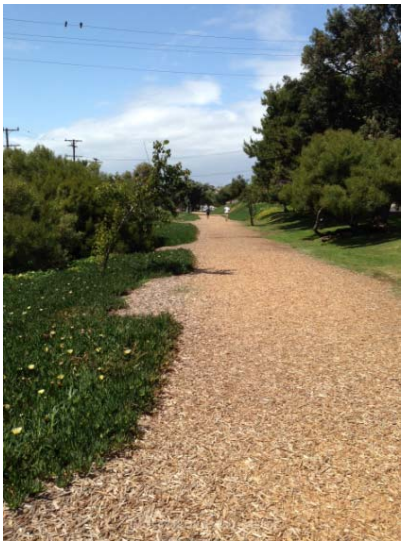


Figure 2-13. Existing and Proposed Distributed BMP Locations within the EWMP Area.

Existing Regional BMPs

Analysis Regions SMB-5-02 and SMB-5-03/SMB-5-04



The Manhattan Beach Green Belt Infiltration Project tributary area spans analysis regions SMB-5-02 and SMB-5-03/SMB-5-04. The Project, completed in February 2013, utilizes the linear greenbelt parkland that runs through the City to intercept and infiltrate dry weather and wet weather low flows from existing storm drains that intersect the parkway. The Project was designed to reduce the downstream peak flow and runoff volume from the 55.2 acres of contributing developed residential land use while also increasing groundwater recharge and subsequently increasing the effective permeability of the developed area. The 55.2 acre drainage area is part of the 161 acre tributary area that drains to the 1st Street outfall and Santa Monica Bay , which is part of the approximately 205 acres of drainage influencing the SMB-5-04 open beach monitoring site under the CSMP (2004).

Analysis Region SMB-5-05

The Pier Avenue Improvement Project captures and treats stormwater/urban runoff from residential areas on surrounding streets and commercial development in the downtown corridor along Pier Avenue (36-acre drainage area). The Project includes drainage improvements for treatment and infiltration of dry and wet-weather flows up to the design storm to reduce pollutant loading at the beach and to reduce flooding.

The Hermosa Strand Infiltration Trench project receives runoff from a 76.2-acre, intensely developed mixed commercial and residential coastal subdrainage area conveyed via the Pier Avenue storm drain. The Pier Avenue storm drain was retrofit with a diversion structure and tide gate to direct dry-weather flows and wet weather low flows from the storm drain into a pump well, through a baffle-box pretreatment unit, then into the subsurface infiltration trench 1,000 feet long constructed on the beach adjacent to the Strand. The diversion pump was designed to divert up to 250 gallons per minute (GPM), which is significantly greater than would be required solely to divert dry weather runoff from the drainage area, thereby allowing for diversion of some wet weather flows.

Analysis Region SMB-6-01

Three existing regional BMPs were modeled within analysis region SMB-6-01. These include Amie Basin, Entradero Basin, and Henrietta Basin in their post-enhancement state. Since the basins were in existence prior to the 2003 TMDL effective date, pollutant removal credit was not assigned to the basins for their pre-2003 function, rather only the basin improvement design parameters that 1) improved water quality and 2) were implemented post-2003 were

modeled. Infiltration rate, depth, volume, and discharge rate of the basins and their extended storage were extracted from analysis of the stage-discharge curves provided in the Stormwater Basin Enhancement Project Design Memorandum (CWE Corp., 2012).

Amie Basin, post-enhancements. Amie Detention Basin is an existing BMP that captures runoff from 409 acres of upstream land in analysis region BCSump, which drains to SMB-6-01. Based on boring test results, the average on-site infiltration rate is reported as 0.0082 in/hr. Due to its limited infiltration capacity, Amie Detention Basin is not designed for the purpose of on-site infiltration. Instead, its primary purpose is to discharge runoff slowly to the downstream Henrietta Detention Basin. The basin enhancements, completed in 2014, increased the extended retention volume by reducing the permanent pool volume by 25% by creating additional flow paths within the basin. Due to the nature of the basin enhancements, Amie Detention Basin was modeled as a wet pond with extended detention capacity.

Entradero Basin, post-enhancements. Entradero Detention Basin is an existing BMP that treats runoff from 436 acres of upstream land in analysis region SMB-6-01 and is sized to capture the 0.75 inch storm. Based on boring test results, the average on-site infiltration rate is 1.28 in/hr. To increase the infiltration capacity, the post-enhancement design significantly increased the infiltration surface area from 0.03 acres to 1.44 acres. Entradero Detention Basin was modeled as an infiltration basin. The basin includes a small permanent pool (1500 cubic feet), the volume of which was excluded from the calculation of total storage capacity.

Henrietta Basin, post-enhancements. Henrietta Detention Basin is an existing BMP that treats runoff from Amie Detention Basin as well as an additional 153 acres of upstream land in analysis region BCSump for up to 0.75 inches storm. Based on boring test results, the average on-site infiltration rate is 2.1 in/hr. To further increase the infiltration capacity, recent design enhancements increased the maximum basin depth from 23 feet to 30 feet, and created additional flow path within the basin. In SBPAT, the Henrietta basin is modeled as an infiltration basin. The basin included a small permanent pool (6900 cubic feet), the volume of which was excluded from the total storage capacity.

Analysis Region SMB-6-02

The Alta Vista Park Diversion and Re-Use Project is located in Redondo Beach and is designed to divert wet weather flows up to a rainfall event of 0.3 inches in 24 hours, collected from its 101-acre watershed. HDPE pipes comprise the approximately 100,000 gallons of underground storage. Excess overflows from the tank go into a 4,200 square feet infiltration bed located under the tank. The Project diversion facilities include structures that divert up to 4.5 cfs of the storm flow through a gross pollutant removal device.

Analysis Region SMB-6-03

The Sapphire Street Infiltration BMP consists of a low flow diversion and infiltration bed. The low flow diversion is intended to divert all dry weather flow and wet weather runoff from a storm up to 0.1 inches in 24 hours. The diversion facilities include a structure that will divert up to 11 cfs of the storm flow through a CDS unit. A smaller amount, up to 160 gpm, are diverted to a pump station that pumps the water to two stormwater bioretention filtration units, where it is then conveyed to the infiltration bed.

Summary of Existing Regional BMPs

The existing regional BMPs, including their location, analysis region, model inputs, and expected performance, are summarized in **Table 2-11** and **Table 2-12** below. Wylie Sump and its tributary area were excluded from the RAA analysis because it is an 85th percentile capture project and also does not produce outflow and would therefore have no impact on the TLR or contribute any loads. The Wylie Sump receives runoff from 38 acres of the City of Manhattan Beach, 20 acres of Hermosa Beach, and 73 acres of Redondo Beach. There are no other 85th percentile capture projects in the Santa Monica Bay Watershed portion of the Beach Cities EWMP Area.

Table 2-11. Parameters and Performance for Existing Regional BMPs Modeled as Infiltration Basins

Location of BMP	Analysis Region	Project Name	Model Inputs					Expected Performance (load reduction as a % of analysis region baseline load)
			Treatment Volume (cu-ft)	Design Storm (in)	Average Depth (ft)	Diversion Rate (cfs)	Infiltration Rate (in/hr)	
Manhattan Beach	SMB-5-03/ SMB-5-04	Manhattan Beach Green Belt Infiltration	-	0.45	2.6	6.7	2.1	4.7%
	SMB5-02							1.1%
Hermosa Beach	SMB-5-05	Pier Avenue Improvement Project infiltration systems	-	0.21	2.6	11	0.77	2.3%
Hermosa Beach	SMB-5-03/ SMB-5-04	Hermosa Strand Infiltration Trench	1,400	-	-	2.9	0.56	0.5%
	SMB-5-04/ SMB-5-05							1.9%
	SMB-5-05/ SMB-6-01							2.0%
	SMB5-04							1.4%
	SMB5-05							0.9%
	SMB6-01							0.2%
Torrance	SMB-6-01	Entradero Detention Basin Enhancement	88,860	-	2.0	16	1.3	2.6%
		Henrietta Detention Basin Enhancement	383,000	-	12.0	54	2.1	4.6%
Redondo Beach	SMB-6-02	Alta Vista Park Diversion and Re-Use Project	-	0.30	3.0	4.5	0.18	3.8%
Redondo Beach	SMB-6-03	Sapphire St Infiltration BMP	-	0.10	1.5	11	0.74	9.5%

Table 2-12. Parameters and Performance for Existing Regional BMPs Modeled as Wet Ponds with Extended Detention

Location of BMP	Analysis Region	Project Name	Model Assumptions						Expected Performance (load reduction as a % of analysis region baseline load)
			Volume (cu-ft)	Surcharge Depth (ft)	Surcharge Drawdown Time (hr)	Permanent Pool Volume (cu-ft)	Permanent Pool Depth (ft)	Diversion Flowrate (cfs)	
Torrance	SMB-6-01	Amie Detention Basin Post Enhancement	5,600,000	45	160	99,750	5	46	8.8%

Proposed Regional BMPs

Analysis Region SMB-5-02 Regional BMP Parameters and Criteria

One regional BMP (Alternative 1) is being proposed and was modeled within analysis region SMB-5-02 (**Figure 2-14**) — Manhattan Beach Infiltration Trench Project (see **Table 2-13**). The Manhattan Beach Infiltration Trench site is proposed along a public beach adjacent to a walking/bike path and consists of recreational open space. The project has an approximate infiltration footprint of 2.2 acres and drainage area of 1,600 acres. The storage volume of the project was estimated as 4.6 acre-feet, with an estimated drawdown time of 72 hours.

An alternative design (Alternative 2) is for a beach infiltration trench at 80% of Alternative 1 in combination with an infiltration-based BMP at Polliwog Park, which would achieve approximately 10% of the target load reduction needed for analysis region SMB-5-02 and could potentially offset 20% of the required storage capacity of the Manhattan Beach Infiltration Project (**Figure 2-14**). In other words, the load reduction of Polliwog Park infiltration is equivalent to that of Manhattan Beach Infiltration Trench at 20% of its full Alternative 1 treatment volume.

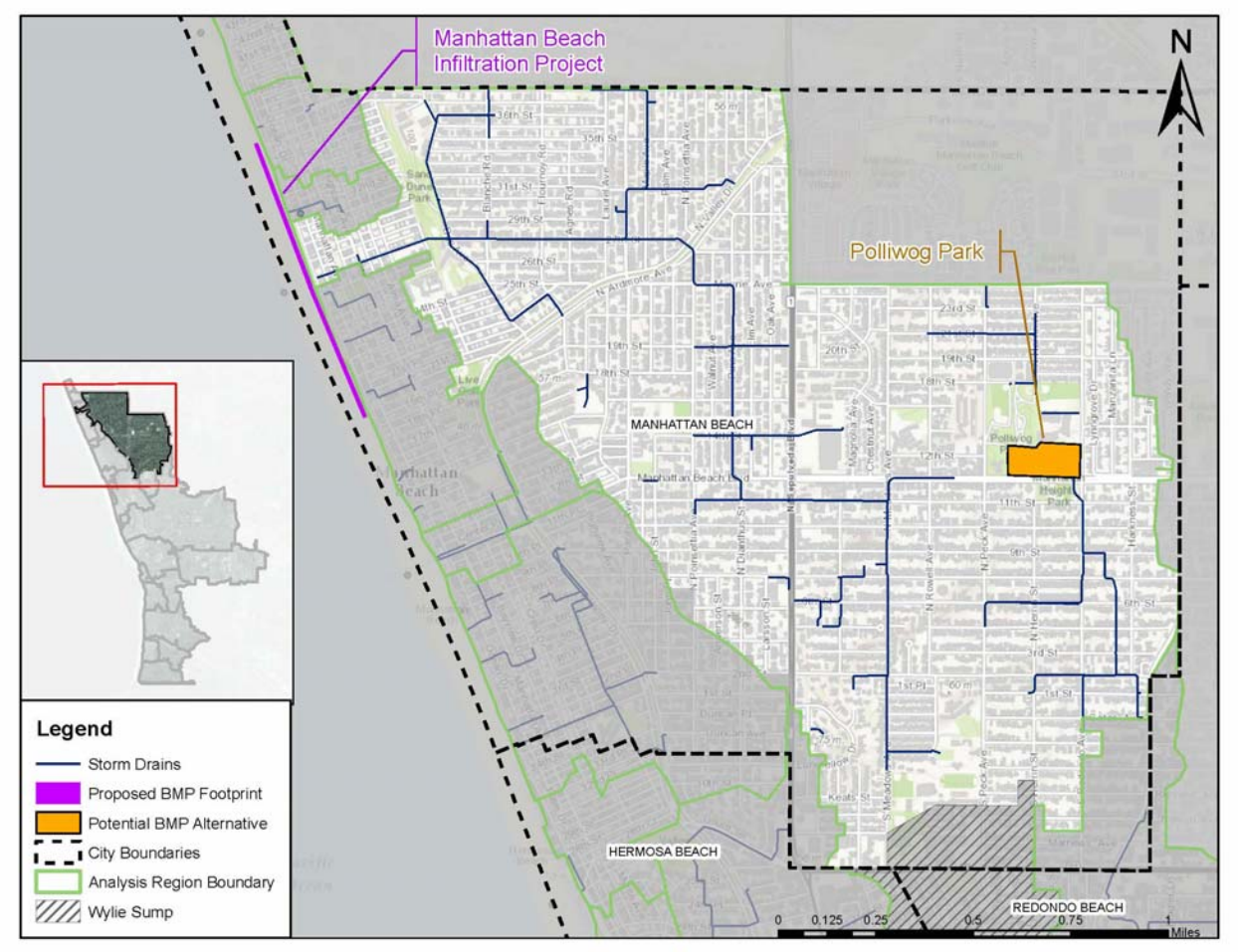


Figure 2-14. Proposed Regional Projects, Analysis Region SMB-5-02

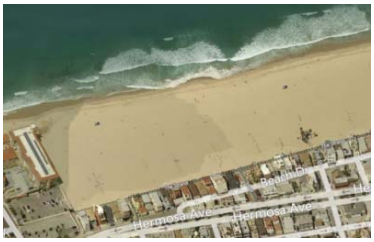
Analysis Region SMB-6-01 Regional BMP Parameters and Criteria

Three regional BMPs (and one potential alternative) are proposed within Analysis Region SMB-6-01, as described below, and depicted in **Figure 2-15**.

Park #3. The Park #3 Project was identified as a potentially suitable site for several different BMP types, including infiltration, wetlands, or a detention basin. Park #3 is located northwest of Blossom Ln. and 190th St, and has an approximately footprint of 0.4 acres and drainage area of 1,430 acres. The storage volume of the project was estimated as 87,000 cubic feet. Diversion flowrate was assumed to be 0.015% of the volume for preliminary planning purposes.

Hermosa Beach Greenbelt Project. The Greenbelt site in Hermosa Beach was identified as a potentially suitable site for several different BMP types, including infiltration, wetlands, or a detention basin. The Greenbelt is situated between Valley Dr. and Ardmore Ave. and has a potential footprint of 1.5 ac and an approximate tributary area of 1,800 acres. The project storage volume is a function of its footprint. The diversion flowrate was assumed to be 0.015% of the volume for preliminary planning purposes.

Powerline Easement. A potential alternative location to the Hermosa Beach Greenbelt Project facility is located south of Herondo Street between N. Francisca Ave. and N. Catalina Ave., within a powerline easement.[18]



Hermosa Beach Infiltration Trench. The Hermosa Beach Infiltration Trench project has a tributary area of 2000 acres. The project may be designed to reduce downstream water volumes and facilitate compliance with the dry-and wet-weather WLAs allotted in the SMBBB TMDL at the SMB-6-01 CML. If upstream projects (e.g., LID projects) and other City activities are implemented, TMDL compliance may be able to be achieved under reduced design requirements.

[18] If this proposed design is to be developed within the powerline easements, certain considerations should be made. To alleviate concerns of saturating soils around powerline footings, and to allow for powerline maintenance activities to occur, stormwater facilities should be installed at least 100 feet from any tower and 10 feet from any pole. Special consideration and increased distances may be necessary when working around "dead-end" towers, or towers where transmission lines change direction. Access road clearance should also be maintained and basin depth must be considered for safety and illegal dumping purposes.

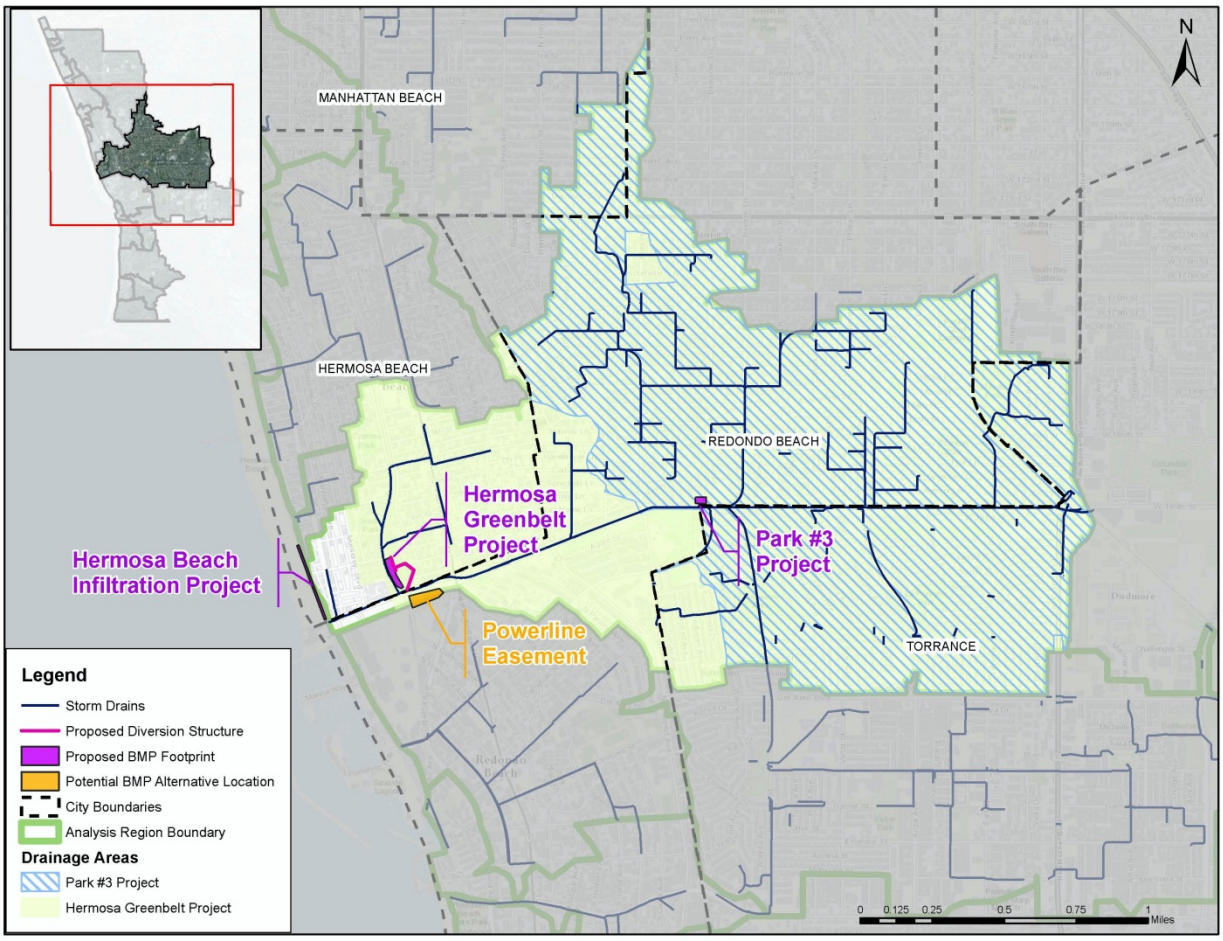


Figure 2-15. Proposed Regional Projects, Analysis Region SMB-6-01

Summary of Proposed Regional BMPs

Four regional BMPs are proposed in the Santa Monica Bay Watershed portion of the Beach Cities EWMP Area. None of these projects could be feasibly sized to meet the 85th percentile design criteria. Proposed regional BMPs, including their location, analysis region, project name, model inputs, and expected performance, are summarized in **Table 2-13.**

Table 2-13. Parameters and Performance for Proposed Regional BMPs Modeled as Infiltration Basins

Analysis Region	Location of BMP	Project Name	Model Assumptions					Expected Performance (load reduction as a % of analysis region baseline load)
			Treatment Volume (cu-ft)	Design Storm (in)	Average Depth (ft)	Diversion Rate (cfs)	Infiltration Rate (in/hr)	
SMB-5-02	Manhattan Beach	Manhattan Beach Infiltration Trench, Alt 1	198,000	-	2.1	160	13	36.5%
		Manhattan Beach Infiltration Trench, Alt 2	158,400*	-	2.1	160	13	32.1%[1]
		Polliwog Park Infiltration, Alt 2	148,000	-	4.0	11	0.7	4.4%
SMB-6-01	Hermosa Beach	Hermosa Beach Greenbelt Infiltration	319,000	-	5.0	48	12	15.1%
		Hermosa Beach Infiltration Trench	13,300	-	1.70	25	13	0.4%
	Redondo Beach	Park #3 BMP Project	87,100	-	5.00	410	1.0	1.3%

[1] The treatment volume of Manhattan Beach Infiltration Trench in Alternative 2 is set at 80% of the Alternative 1 volume so that load reductions achieved by BMP configurations in Alternative 1 and Alternative 2 are identical.

Existing Distributed BMPs

In 2008-09, the City of Hermosa Beach retrofitted the east side of Hermosa Avenue between 27th and 35th Streets with a series of seven filter/infiltration boxes to intercept, filter, and infiltrate low flows conveyed down side streets from the areas east of Hermosa Avenue prior to entry into catch basin inlets on Hermosa Avenue. The infiltration boxes were modeled in the RAA analysis as two bioretention systems due to their infiltration capabilities and combined into two systems (System A and System B) — one system per analysis region SMB-5-04 and SMB-5-03/SMB-5-04, respectively. The City of Manhattan Beach also replaced several downtown asphalt parking lots with pervious concrete. See **Table 2-14** and **Figure 2-13** for design assumptions and BMP locations.

Proposed Distributed BMPs

Proposed distributed BMPs, including green streets, were modeled by assuming that stormwater runoff from high priority land use areas can be treated in the right-of-way, and 50%-50% use of biofilters and bioretention. Biofilters (also known as bioretention with underdrains) were sized to 150% of the 85th percentile, 24-hour design storm (0.3 in/hr) because they do not retain on site (they are flow-through systems), while bioretention units were sized to 100% of the 85th percentile, 24-hour design storm depth, calculated as the mean for each analysis region. Biofilters were modeled using bioswale volume reduction and bioretention effluent EMCs. Default modeling assumptions included longitudinal slopes of 0.03 ft/ft, Manning's n of 0.25, hydraulic residence time of 10 min, and water quality flow depth of 4 in.

Distributed green streets were implemented at similar rates (as a percentage of land use area) in residential and commercial land uses. Distributed BMPs were applied at levels unique to each analysis region, iteratively determined based on compliance with TLRs, after accounting for load reductions attributable to nonstructural and regional BMPs. They were applied by assuming treatment of stormwater from analysis region-specified percentages of single family, multi-family, and commercial land use areas, until TLRs are met. These land use and BMP type combinations were chosen based on their ability to result in maximum bacteria load reduction.

In order to minimize redundancy of BMP coverage and avoid double-counting BMP benefits, distributed BMPs were not applied in the drainage area footprints of existing regional BMPs. However, they were modeled in the drainage area of proposed BMPs, as long as both were included in the same model run to avoid double counting. Performance of existing and proposed distributed BMPs are shown in **Table 2-15**.

Table 2-14. Existing and Proposed Distributed BMPs

Implementation Level	Analysis Region(s)	BMP Type	Design Storm	Longitudinal Slope (ft/ft)	Manning n	Hydraulic Residence Time (min)	Water Quality Flow Depth (in)	Effective Retention Depth (in)	Infiltration Rate (in/hr)
Existing Manhattan Beach Porous Paving Project – El Porto Lot	SMB-5-01	Porous Pavement	Removal of existing asphalt and replacement with 10 inches of porous concrete						
Existing Distributed Green Streets BMPs (2003-2015)[1]	SMB-5-04 (System A)	Bioretention	0.038	-	-	-	-	35	10
	SMB-5-03/SMB-5-04 (System B)	Bioretention	0.026	-	-	-	-	35	10
Proposed Distributed Green Street BMPs (2015-2021)	MFR and COM/SFR land uses in BCSump, SMB-5-02, and SMB-6-01	Biofilters[2]	0.3 in/hr	0.03	0.25	10	4	2	Based on analysis region-specific soil type
		Bioretention	Varies by analysis region (0.77 to 0.82 in)	-	-	-	-	12	0.15

[1] In 2008-09 the City of Hermosa Beach retrofit the east side of Hermosa Avenue with a series of seven (7) filter/infiltration boxes to intercept, filter, and infiltrate low flows conveyed down side streets from the areas east of Hermosa Avenue prior to entry into catch basin inlets on Hermosa Avenue. The infiltration boxes were modeled as two bioretention systems due to their infiltration capabilities and combined into two systems (System A and System B) — one system per defined subcatchment.

[2]Modeled as a bioswale using bioretention EMCs.

Table 2-15. Existing and Proposed Distributed BMP Performance

Analysis Region	Implementation Level	Status	Estimated load reduction (as % of analysis region baseline load)
SMB-5-04	N/A - Existing	Existing	1%
SMB-5-03/ SMB-5-04	N/A - Existing	Existing	0.1%
SMB-5-02	5% on MFR/COM/SFR land uses	Proposed	3%
SMB-6-01+BCSump[1]	25% on MFR/COM/SFR land uses	Proposed	2%

[1] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

2.7 Reasonable Assurance Analysis Results

2.7.1 Wet Weather

Quantitative analyses were conducted for each analysis region separately and are summarized below. Average BMP load reduction results for each analysis region are presented in **Table 2-16** below. The values provided correspond to the fecal coliform load reductions attributable to the BMP types at both the interim (2018) and final (2021) TMDL compliance deadlines. As shown, the TLRs were met in all analysis regions as a result of varying levels of implementation of non-structural and regional BMPs as described previously. The interim 50% TLR is met through a combination of nonstructural and existing regional BMPs. It should be noted that if at any time specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, alternative BMPs or operational changes will be planned within the same subwatershed and within the same timeline, to meet an equivalent subwatershed load reduction, unless the TLRs or compliance schedules are modified.

Table 2-16. Santa Monica Bay Watershed – Fecal Coliform RAA Results – Interim and Final Compliance

Analysis Region	Implementation Benefits (average load reduction as % of baseline load for critical year)							TLR	Compliance (TLR Met)?
	Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level	Estimated Load Reduction		
SMB-5-01	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-O-06	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-5-02	5%	4%	2%	36%	3%	5% MFR/COM/SFR	**50%**	**46%**	Yes
SMB-5-02/5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03/5-04	5%	4%	0%	5%	0%	N/A	**15%**	**0%**	Yes
SMB-5-04	5%	5%	0%	1%	1%[2]	N/A	**12%**	**0%**	Yes
SMB-5-04/5-05	5%	4%	0%	2%	0%	N/A	**11%**	**0%**	Yes
SMB-5-05	5%	4%	5%	3%	0%	N/A	**18%**	**0%**	Yes
SMB-5-05/6-01	5%	3%	0%	2%	0%	N/A	**10%**	**0%**	Yes
SMB-6-01+ BCSump[1]	5%	3%	3%	33%	2%	25% MFR/COM/SFR	**46%**	**45%**	Yes
SMB-6-01/6-02	5%	2%	4%	0%	0%	N/A	**11%**	**0%**	Yes
SMB-6-02	5%	3%	1%	4%	0%	N/A	**13%**	**0%**	Yes
SMB-6-03	5%	3%	5%	10%	0%	N/A	**23%**	**0%**	Yes
SMB-6-04	5%	4%	3%	0%	0%	N/A	**12%**	**0%**	Yes
SMB-6-05	5%	3%	6%	0%	0%	N/A	**15%**	**0%**	Yes
SMB-O-08	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-6-06	5%	5%	0%	0%	0%	N/A	**10%**	**0%**	Yes
Final Compliance Deadline (2021)	**5%**	**3%**	**3%**	**21%**	**1%**	**N/A**	**33%**	**26%**	**Yes**
Interim Compliance Deadline (2018)[3]	**2.5%**	**0.8%**	**1.5%**	**9.6%**	**0%**	**N/A**	**14.4%**	**13%**	**Yes**

[1] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

[2] Distributed green street BMP load reduction in SMB-5-04 is a result of the existing filter/infiltration boxes retrofitted on the east side of Hermosa Avenue in the City of Hermosa Beach.

[3] The total interim load reduction is the sum of the load reductions calculated for each analysis region by 2018. The TLR is met through a combination of nonstructural and existing regional BMPs.

Time Series Output

Electronic input and output SWMM files and Excel summary spreadsheets will be provided to the LARWQCB upon submittal of this Draft EWMP

Consistency with LARWQCB Guidance

The approaches described above, including model selection, data inputs, critical condition selection (90th percentile year), calibration performance criteria, and output types were selected for consistency with the LARWQCB RAA Guidance Document (LARWQCB, 2014).

2.7.2 Dry Weather

For dry weather bacteria compliance, a qualitative analysis was conducted to show compliance at each of the CMLs. **Table 2-17** outlines the results of this analysis. Many CMLs have an effective diversion[19] such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the surf zone during year-round dry weather days. For the remaining smaller outfalls a systematic screening conducted in 2002 demonstrated that there was no discharge to the wave wash during summer dry weather from these storm drains. Rescreening of outfalls will be conducted as part of the Non-Stormwater Screening and Monitoring in the Coordinated Integrated Monitoring Program and will include both summer dry weather and winter dry weather screening. For the CMLs in the SMB Watershed that have anti-degradation based allowed exceedance days for both winter-dry and summer-dry weather, reasonable assurance is assumed to be demonstrated through the basis that the TMDL established their allowed exceedance days based on historic conditions (i.e., no water quality improvements were necessary).

If following dry weather outfall re-screening, dry weather reasonable assurance has not been demonstrated by the evaluation criteria shown in **Table 2-17**, the Beach Cities EWMP Group's compliance approach is consistent with the Permit requirement to eliminate 100 percent of non-exempt dry weather MS4 discharges. The Group's implementation approach for achieving this is to use a suite of non-structural source controls (e.g., water conservation incentives, enhanced illicit discharge detection and elimination [IDDE] efforts, and enhanced education/outreach and inspection/enforcement to prevent non-exempt sources of stormwater flow) and source investigations. By eliminating flows, this is equivalent to 100 percent load reduction for all pollutants, thereby demonstrating reasonable assurance of meeting all applicable TMDL limits and water quality objectives in the Permit during dry weather. Elimination of discharges is a pathway for compliance with RWLs and WQBELs in the MS4 Permit (per Section VI.E.2.e.i.(3)); without discharges there can be no "cause or contribute" to receiving water issues.

Since the dry weather compliance deadlines for the SMBBB TMDL have passed, this analysis is provided for informational purposes only, and is not intended to support or justify a new

[19] The seven existing low flow diversions include Polliwog Park, SMB 5-2 (28th Street), SMB 5-3 (Manhattan Beach Boulevard), SMB 5-5 (south of Pier Avenue), SMB 6-1 (Herondo Street), SMB 6-3 (Sapphire Street), and SMB 6-5 (Avenue I).

compliance schedule, additional non-structural or structural BMPs, or an evaluation of whether any newly proposed BMPs will provide a dry weather benefit.

Table 2-17. Dry Weather RAA Evaluation of Santa Monica Bay Watershed CMLs

CML	Effective Diversion/Disinfection at Analysis Region Outlet?	WMG MS4 Outfall Absent?	NSW MS4 Discharges Absent?	Reasonable Assurance Demonstrated?
SMB-5-01	No	Yes	To be determined pending results of non-stormwater screening	**Yes**
SMB-5-02	Yes	No		**Yes**
SMB-5-03	Yes	Yes		**Yes**
SMB-5-04	No	No		**TBD**
SMB-5-05	Yes	No		**Yes**
SMB-6-01	Yes	No		**Yes**
BCSump	Yes	No		**Yes**
SMB-6-02	Yes	No		**Yes**
SMB-6-03	Yes	No		**Yes**
SMB-6-04	No	No		**TBD**
SMB-6-05	Yes	No		**Yes**
SMB-6-06	No	No		**TBD**

2.8 Multiple Benefits

Not only is reasonable assurance demonstrated for the water quality objectives, but some of the proposed projects also provide multiple benefits beyond pollutant load reduction. Such benefits are described below.

2.8.1 Neighborhood Greening

Increased green space can positively impact the aesthetics, and even the property value, of highly urbanized areas. Property value tends to increase when an urban neighborhood has green space or trees in sight (Center for Neighborhood Technology [CNT], 2010).

Green infrastructure and green space can also alleviate urban heat-island effects by reducing temperatures by about 5°F through shade and evaporation (CNT, 2010). Urban heat-island effects describe the process by which urbanized regions become warmer than their rural surroundings due to an increase in black top and hardscape surfaces, an increase in vehicular and industrial emissions, and a reduction in shade and green space. Reduced temperatures will in turn reduce both energy consumption needs and the heat and pollution-related risks to human health (CNT, 2010).

2.8.2 Water Conservation/Supply

Stormwater retained in the regional structural BMPs can be reused for irrigation and other on-site, non-potable uses, thus promoting water conservation and offsetting reliance on the potable water supply.

2.8.3 Groundwater Recharge

Stormwater capture may increase groundwater supplies in cases where BMPs are designed for water supply augmentation and captured stormwater is recharged to groundwater basins that are used as drinking water sources. Green infrastructure allows captured runoff to infiltrate to useable groundwater basin storage, thereby reducing contaminated stormwater runoff, lower peak flood elevations, and lessening the erosive potential of surface water flow, and in coastal areas may protect subsurface infrastructure from saline intrusion associated with sea level rise.

2.8.4 Public Education/Awareness

Public education and outreach engages the public's interest in preventing stormwater pollution and is achieved most effectively through an understanding of the varying levels of public background knowledge about stormwater management and pollution prevention (USEPA, 2014).

Public outreach is a major facet of the public retrofit incentives element of the RAA approach, which is directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnects. Outreach for this incentive may occur in the form of direct conversations, a variety of media, and/or short training courses, for example. Structural BMPs proposed in the EWMP will also serve as public education opportunities in the form of on-site educational materials, such as signage posted at construction and completed sites.

2.9 Parallel Compliance Efforts

During the remaining compliance period, the Beach Cities WMG may also elect to perform special studies to evaluate the SMBBB dry and wet weather WLAs. Various pathways are available to reopen the TMDL and modify the WLAs, including use of microbial source tracking to support a natural source exclusion, and quantitative microbial risk assessment to develop site specific objectives as allowed by the recent USEPA recreational criteria update. Furthermore, TMDL WLA changes are anticipated if the pending statewide bacteria objectives are adopted. The proposed changes for marine water include removal of the total coliform, fecal coliform, and fecal-to-total coliform ratio objectives, changing the enterococcus single sample maximum of 104 MPN/100ML to a statistical threshold value (10% allowed exceedances in a 30 day period) of 110 MPN/100mL, and other clarification and implementation guidance. Through the adaptive management process, the RAA may be reevaluated after any changes to the statewide objectives, TMDL WLAs, and/or Permit limits.

3 DOMINGUEZ CHANNEL WATERSHED

3.1 BACKGROUND

3.1.1 GEOGRAPHICAL CONTEXT

The northeastern portion of the Beach Cities EWMP Area is tributary to Dominguez Channel[20] (including Torrance Carson Channel) and is comprised of approximately 7,380 acres of land (**Figure 3-1**), the majority of which is comprised of residential land uses (**Figure 3-2**). This watershed accounts for 48% of the total Beach Cities EWMP Area, and includes portions of the Cities of Manhattan Beach, Redondo Beach, and Torrance. Storm drains from the Cities of Manhattan Beach and Redondo Beach drain through the City of Lawndale before discharging to Dominguez Channel. The City of Torrance's MS4 discharges directly to Dominguez Channel and Torrance Carson Channel (Torrance Lateral). Collectively, this portion of the study area is hereinafter referred to as the Dominguez Channel Watershed.

LACFCD is not responsible for land within the Beach Cities EWMP Area, but does own and maintain infrastructure within all three watersheds. Background information on the LACFCD is provided in **Appendix G. Table 3-1** provides a breakdown of the Beach Cities EWMP Area by city and tributary watershed. This section of the EWMP focuses on the Dominguez Channel Watershed only.

Table 3-1. Beach Cities WMG Area Distribution by Participating Agency

Participating Agency	Area (acres)		
	Santa Monica Bay Watershed	Dominguez Channel Watershed	Total EWMP Area (% of total)
City of Redondo Beach	2,614	**1,217**	3,831 (25%)
City of Manhattan Beach	2,078	**350**	2,428 (16%)
City of Hermosa Beach	832	**-**	832 (5%)
City of Torrance	2,314	**5,812**	8,126 (53%)
Total	**7,837**	**7,379**	**15,217 (100%)**

[20] Other portions of the Dominguez Channel Watershed, including Los Angeles County Unincorporated areas, are addressed by separate EWMP groups.

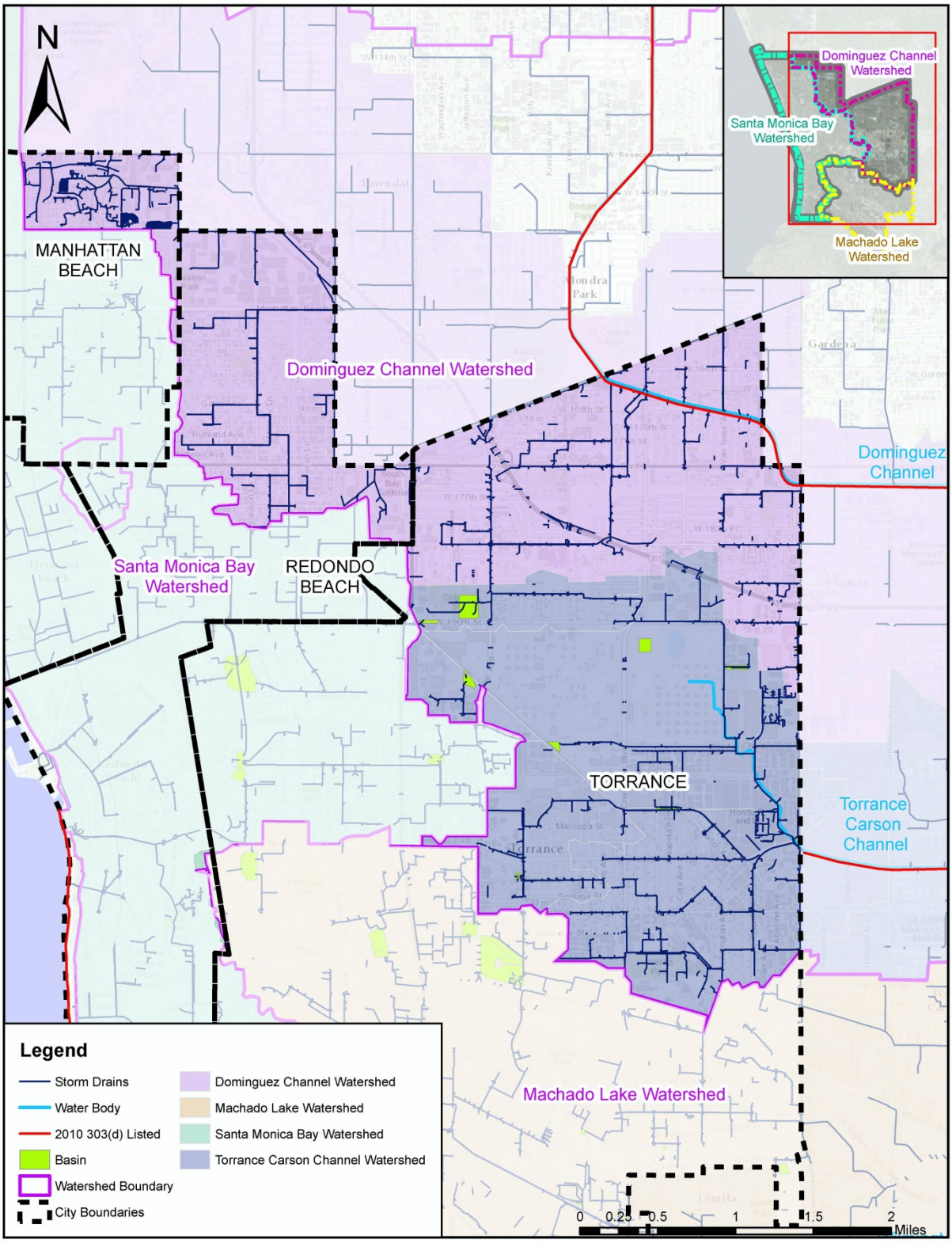


Figure 3-1. Beach Cities WMG MS4 Infrastructure within the Dominguez Channel Watershed

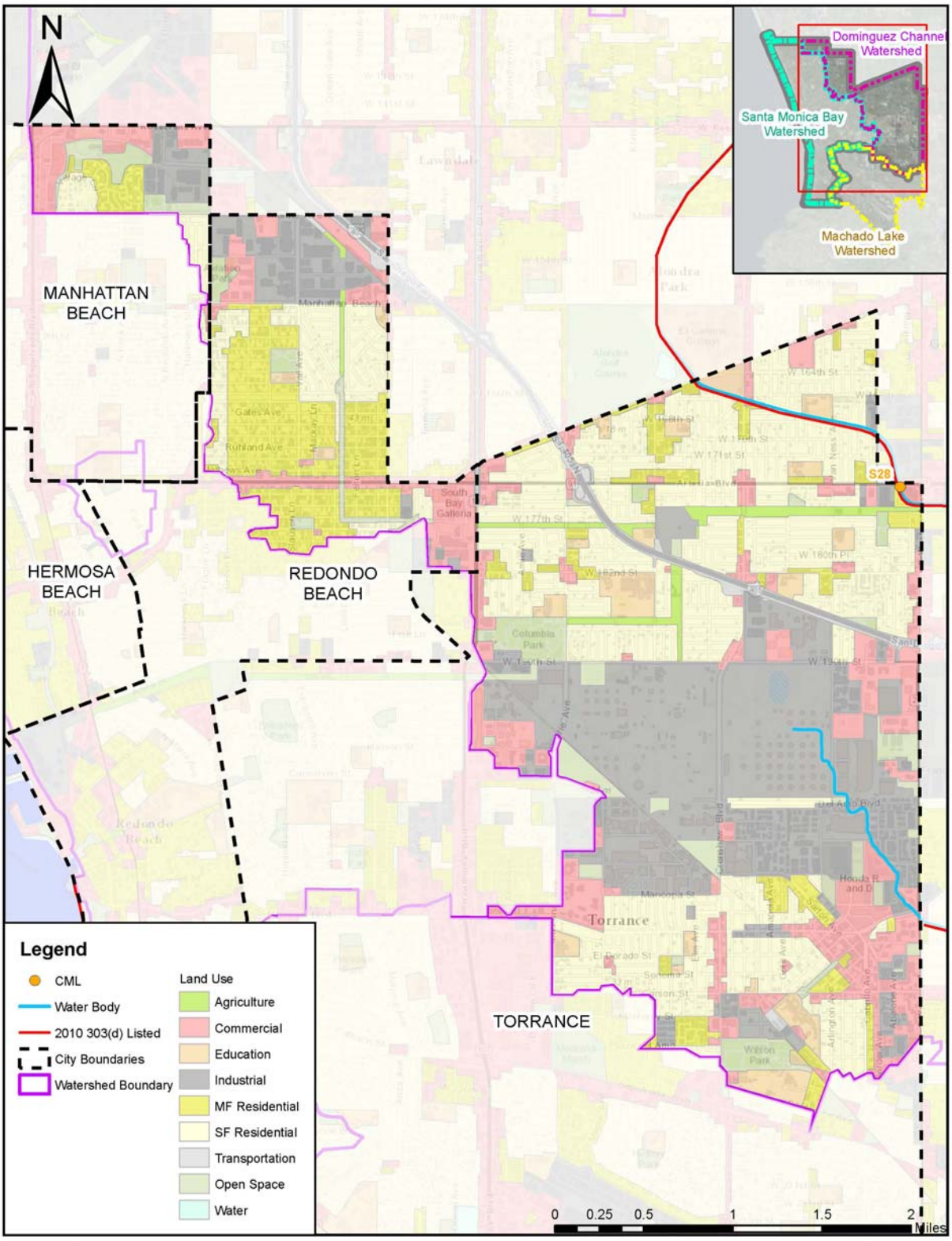


Figure 3-2. Beach Cities WMG Land Uses within the Dominguez Channel Watershed

3.2 IDENTIFICATION OF WATER QUALITY PRIORITIES

As part of the EWMP, the Permit requires the Beach Cities WMG to identify water quality priorities within their EWMP AREA. To accomplish this per Permit Section VI.C.5.a, the Beach Cities WMG conducted the following for the Dominguez Channel watershed portion of the Beach Cities EWMP Area:

1. Characterize the water quality of stormwater and non-stormwater discharges from the MS4 as well as receiving water bodies;
2. Prioritize WBPCs; and
3. Assess sources for high priority water body.

A summary of results is provided below.

3.2.1 WATER QUALITY CHARACTERIZATION

As discussed in Section 2.2.1, the Basin Plan (LARWQCB, 1995, updated 2011) identifies receiving waters within the Los Angeles region and sets regulatory objectives for these receiving waters. The Basin Plan regulates waste discharges to protect the quality of surface waters for use and enjoyment by the general public. Regulations set forth in the Basin Plan are based on assigned beneficial uses for each receiving water body. Beneficial use designations for receiving waters within the Beach Cities WMG Area are defined in Section 2.2.1 and summarized in **Table 3-2** below.

Table 3-2. Beach Cities EWMP Area – Dominguez Channel Watershed Water Bodies and Beneficial Uses

Water Body	MUN	IND	NAV	REC1	REC2	HFS	COMM	WARM	MAR	WILD	RARE	MIGR	SPWN	SHELL	WET[3]
Dominguez Channel	P[1]			P	E	E		P		P	E				
Torrance Lateral[2]	P[1]			P	E	E		P		P	E				

E = Existing beneficial use
P = Potential beneficial use

[1] Designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date.

[2] Listed in Basin Plan Table 1 as a "major surface water," tributary to Dominguez Channel Estuary.

[3] Water bodies designated as WET may have wetlands habitat associated with only a portion of the water body. Any regulatory action would require a detailed analysis of the area.

The high flow suspension beneficial use, which was approved by the USEPA as a Basin Plan Amendment in 2004, applies to Dominguez Channel and its tributaries. During days on which this beneficial use suspension is in effect, bacteriological objectives applicable to Dominguez Channel and its tributaries are suspended. The high flow suspension applies on days with rainfall greater than or equal to ½ inch and the 24 hours following the end of such an event.

3.2.2 WATER BODY-POLLUTANT CLASSIFICATION

Receiving waters for stormwater runoff from the Dominguez Channel Watershed portion of the Beach Cities EWMP area were screened for water quality priorities by reviewing TMDLs, the State's 303(d) list, and recent available water quality data. Each identified water quality priority for a given receiving water body was categorized as a WBPC. WBPCs were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit, and further detailed in Section 2.2.2 herein.

Figure 2-3 in Section 2.2.2 provides a conceptual overview of the process used to identify and categorize the WBPCs within the Beach Cities EWMP Area. In order to categorize and prioritize the WBPCs within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area, relevant TMDLs, 303(d) listings, recent available monitoring data, and water quality objectives from the Basin Plan were considered.

Category 1 – Highest Priority

WBPCs under Category 1 (highest priority) are defined in the Permit as "water body-pollutant combinations for which WQBELs and/or RWLs are established in Part VI.E and Attachments L through R of [the Permit]." These WBPCs include:

- Dominguez Channel for copper, lead, and zinc in wet weather: These WBPCs are considered Category 1 due to the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxics and Metals TMDL (LARWQCB, 2011).
- Dominguez Channel for toxicity: This is considered Category 1 due to the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxics and Metals TMDL. Toxicity will not be modeled for Dominguez Channel and Torrance Lateral as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of toxicity. Toxicity will continue to be monitored under the Beach Cities' CIMP.

Category 2 – High Priority

Category 2 (high priority) WBPCs are defined as "pollutants for which data indicate water quality impairment in the receiving water according to the State's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) (SWRCB, 2004) and for which MS4 discharges may be causing or contributing to the impairment." Aside from those WBPCs already identified as Category 1, the remaining WBPC list can be condensed by excluding pollutants which are not stormwater related (i.e., MS4 discharges are unlikely to cause or contribute to the impairment) as well as pollutants which are already being addressed (directly or indirectly) by one of the TMDLs. Therefore, the Category 2 WBPCs are limited to the following:

- Dominguez Channel (including Torrance Lateral) for indicator bacteria. This qualifies as a Category 2 WBPC based on the 303(d) listing for indicator bacteria.
- Dominguez Channel (including Torrance Lateral) for ammonia. In conformance with Permit requirements, this qualifies as a Category 2 WBPC based on the 303(d)

listing for ammonia. However, monitoring data since 2003 show that all water quality samples at S28 and TS19 meet the freshwater Basin Plan Objective for ammonia. As a result, ammonia will not be modeled as part of the Beach Cities' RAA. Monitoring for ammonia will occur under the CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to ammonia exceedances in the receiving water, the EWMP will be revised accordingly.

Category 3 – Medium Priority

Category 3 (Medium Priority) designations are applied to WBPCs which are not 303(d)-listed but which exceed applicable RWLs contained in the Permit and for which MS4 discharges may be causing or contributing to the exceedance.

The annual monitoring reports published by LACDPW list exceedances of each sampled constituent relative to various water quality criteria, including Basin Plan Objectives (BPOs) and California Toxics Rule (CTR) criteria.[21] Raw data from S28 and TS19 have been reevaluated. Aside from the constituents described previously, measured exceedances at S28 and TS19 are summarized in **Table 3-3.** A single exceedance of the Department of Fish and Game's chronic criterion for chlorpyrifos (0.05 mg/L) occurred in October 2005 at S28. This exceedance occurred prior to EPA's December 31, 2005 chlorpyrifos ban. Since this time, 85 total samples from S28 and TS19 have been analyzed for chlorpyrifos and no exceedances have been recorded.

Table 3-3. LACDPW Monitoring Results Summary

Pollutant	Dominguez Channel Mass Emission Station (S28)			Torrance Lateral Tributary Station (TS19)			Water Quality Criteria (Source)
	No. of Samples	No. of Exceedances	% Exceed	No. of Samples	No. of Exceedances	% Exceed	
Cyanide	61	24	39%	25	8	32%	5.2 ug/L (CTR continuous concentration)
pH	66	13	20%	26	11	42%	6.5 – 8.5 (BPO)
Selenium	66	3	5%	26	2	8%	5.0 ug/L (CTR continuous concentration)

[21] Because of some additional water quality criteria used to evaluate exceedances in the County's annual monitoring reports (e.g., applying Ocean Plan Objectives to freshwater bodies; applying MUN-specific BPOs to potential-MUN-designated water bodies), exceedances were over-reported. As a result, pollutants evaluated as part of this appendix were limited to those pollutants which had at least one reported exceedance since 2003. For pollutants with a reported exceedance since 2003, all historic water quality data from that time forward was evaluated against appropriate water quality criteria. For pollutants with no reported exceedances, it was assumed that LACDPW's exceedance analyses were accurate.

Pollutant	Dominguez Channel Mass Emission Station (S28)			Torrance Lateral Tributary Station (TS19)			Water Quality Criteria (Source)
	No. of Samples	No. of Exceedances	% Exceed	No. of Samples	No. of Exceedances	% Exceed	
Mercury	66	5	8%	26	3	12%	0.051 ug/L (CTR human health criterion, organisms only)
Dissolved Oxygen	60	1	2%	25	0	0%	5.0 mg/L (BPO)
Cadmium	66	3	5%	26	1	4%	2.2 ug/L (CTR continuous concentration)

Although data are not currently available to evaluate a linkage between Beach Cities WMG MS4 discharges and these receiving water exceedances, the following WBPCs are considered Category 3 based on the receiving water exceedances described above:

- Dominguez Channel (including Torrance Lateral) for cyanide, due to exceedances of the CTR continuous concentration criterion for cyanide summarized in **Table 3-3**. Cyanide will not be modeled for Dominguez Channel and Torrance Lateral due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of cyanide. Cyanide will continue to be monitored under the Beach Cities' CIMP.
- Dominguez Channel (including Torrance Lateral) for pH, due to exceedances of the Basin Plan Objective for pH summarized in **Table 3-3**. However, due to the fact that there is currently no evidence supporting a linkage between MS4 discharges and exceedances of the pH criteria, pH will not be modeled as part of the Beach Cities' RAA. Monitoring for pH will occur under the CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to pH exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel (including Torrance Lateral) for selenium, due to exceedances of the CTR continuous concentration criterion for selenium summarized in **Table 3-3**. However, due to the fact that there is currently no evidence supporting a linkage between MS4 discharges and exceedances of selenium[22], selenium will not be addressed in the Beach Cities' RAA. Monitoring for selenium will occur under the CIMP. If future monitoring data

[22] Water quality results from urban runoff throughout Southern California show average selenium concentrations to be well below the referenced CTR criterion of 5 ug/L. A 2003 study by SCCWRP examined selenium concentrations in runoff from five different developed land uses types. Findings showed that even 90th percentile concentrations for each land use were all below the 5 ug/L threshold, with the largest 90th percentile concentration being 2.9 ug/L from agricultural land (Ackerman and Schiff, 2003).

suggest that the Beach Cities' MS4s may cause or contribute to selenium exceedances in the receiving water, the EWMP will be revised accordingly.

- Dominguez Channel (including Torrance Lateral) for mercury, due to exceedances of the CTR human health criterion for mercury summarized in **Table 3-3**. Mercury will not be modeled for Dominguez Channel and Torrance Lateral as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of mercury. Mercury will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to mercury exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel (including Torrance Lateral) for cadmium, due to exceedances of the CTR continuous concentration criterion for cadmium summarized in **Table 3-3**. Cadmium will not be modeled for Dominguez Channel and Torrance Lateral as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of cadmium. Cadmium will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to cadmium exceedances in the receiving water, the EWMP will be revised accordingly.

Table 3-4 summarizes the prioritized WBPCs within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area.

Table 3-4. Water Body-Pollutant Prioritization for the Dominguez Channel Watershed portion of the Beach Cities EWMP Area

Category	Water Body	Pollutant	Reason/Justification
1: Highest Priority	Dominguez Channel (including Torrance Lateral)[1]	Toxicity	Dominguez Channel Toxics TMDL
		Total Copper	Dominguez Channel Toxics TMDL
		Total Lead	Dominguez Channel Toxics TMDL
		Total Zinc	Dominguez Channel Toxics TMDL
2: High Priority	Dominguez Channel (including Torrance Lateral)	Indicator Bacteria	303(d) List
3: Medium Priority	Dominguez Channel (including Torrance Lateral)	Cyanide	Historic exceedances of the CTR continuous concentration water quality objective (5.2 ug/L)
		pH	Historic exceedance of the water quality objective (6.5 – 8.5)
		Selenium	Historic exceedances of the CTR continuous concentration water quality objective (5.0 ug/L)
		Mercury	Historic exceedances of the CTR human health criterion for organisms only (0.051 ug/L)
		Cadmium	Historic exceedances of the CTR continuous concentration water quality objective (2.2 ug/L)

[1] Wet weather only, based on the Dominguez Channel Toxics TMDL

The Beach Cities WMG agencies understand that data collected as part of their approved CIMP may result in future Category 3 designations in instances when RWLs are exceeded and MS4 discharges are identified as contributing to such exceedances. Under these conditions, the Beach Cities WMG agencies will adhere to Section VI.C.2.a.iii of the Permit.

Sections VI.C.2 and VI.C.3 of the Permit describe how compliance with RWLs and WQBELs is attained for the prioritized WBPCs identified. **Appendix H** sets forth the EWMP framework for evaluating and addressing receiving water exceedances and a brief summary is included below.

Different actions are required to demonstrate compliance for different types of WBPCs. Specifically; the following classifications are addressed by the Permit:

- WBPCs Addressed by a TMDL;
- 303(d)-listed WBPCs: Pollutants in the same class as those identified in a TMDL and for which the water body is 303(d)-listed (Section VI.C.2.a.i), and pollutants not in the same class as those identified in a TMDL, but for which the water body is 303(d)-listed (Section VI.C.2.a.ii); and
- Non 303(d)-listed WBPCs: Pollutants for which there are exceedances of RWLs, but for which the water body is not 303(d)-listed (Section VI.C.2.a.iii).

For WBPCs already addressed by a TMDL, adherence to all requirements and compliance dates as set forth in the approved EWMP will constitute compliance with applicable interim TMDL-based water quality based effluent limits and interim receiving water limits. 303(d)-listed WBPCs are equivalent to the identified Category 2 combinations. For any Category 2 and 3 WBPCs that are identified in the future through the adaptive management process, adherence to all implementation actions, milestones, and compliance schedules identified in the updated EWMP will constitute compliance with applicable receiving water limits. This approach is outlined in **Appendix H**.

3.2.3 Source Assessment

The following data sources have been reviewed as part of the source assessment for the WBPCs listed previously:

- Findings from the Permittees' IC/ID Programs;
- Findings from the Permittees' Industrial/Commercial Facilities Programs;
- Findings from the Permittees' Development Construction Programs;
- Findings from the Permittees' Public Agency Activities Programs;
- TMDL source investigations;
- Watershed model results;
- Findings from the Permittees' monitoring programs, including but not limited to TMDL compliance monitoring and receiving water monitoring; and
- Any other pertinent data, information, or studies related to pollutant sources and conditions that contribute to the highest water quality priorities.

Since sources of pollutants for the various water bodies within the Beach Cities WMG Area are essentially identical based on similarity of land uses (e.g., sources of trash within SMB Watershed and Dominguez Channel Watershed are believed to be the same), the following source assessment is broken down by pollutants applicable to the Dominguez Channel Watershed.

Copper, Lead, and Zinc

The Dominguez Channel Toxics TMDL (which applies to wet weather only) provides general information on sources of metals within the Dominguez Channel Watershed, but does not provide a detailed source assessment. The TMDL states that "the major pollutant sources of metals into Dominguez Channel and Torrance Lateral freshwaters are stormwater and urban runoff discharges. Nonpoint sources include atmospheric deposition" (LARWQCB and USEPA, 2011).

SCCWRP conducted a detailed study of various wet weather pollutants throughout the Los Angeles region, including Dominguez Channel (Stein et al., 2007). They found that industrial land use sites contributed a substantially higher flux of copper and zinc compared to other land uses evaluated, followed by agriculture, recreational, transportation (for copper), and high density residential (for zinc). Wet weather EMCs for copper and zinc, based on the Los Angeles County land use EMC dataset (Geosyntec Consultants, 2012),), were similar to SCCWRP's findings, showing that the highest runoff concentrations are expected from industrial, transportation, and commercial land uses, excluding agriculture. With respect to copper, research has shown that brake pads are a significant source of copper in urban stormwater (TDC Environmental, 2013). Copper and other pollutants are deposited on roads and other impervious surfaces and then transported to aquatic habitats via stormwater runoff.

Pollutant loads of copper from urban land uses is expected to decrease due to Senate Bill (SB) 346 which was signed into law on September 25, 2010. This legislation phases out copper in vehicle brake pads over a period of years; milestones include the following dates:

- January 1, 2021: Limits the use of copper in motor vehicle brake pads to no more than five percent by weight; and
- January 1, 2025: Limits the use of copper in motor vehicle brake pads to no more than 0.5 percent by weight.

A separate study focusing on zinc showed that the major sources of zinc in urban runoff are outdoor zinc surfaces (including galvanized surfaces) and tire wear debris (TDC Environmental, 2013).

For lead, SCCWRP found that the greatest land use contributors were agricultural (minimal in Dominguez Channel Watershed), high density residential, and recreational (horse) land uses (Stein et al., 2007). Based on the Los Angeles County land use EMC dataset (Geosyntec Consultants, 2012), the highest lead contributing land uses are agriculture, industrial, commercial, and single family residential. Lead was also formerly used as an additive in gasoline and is still used in general aviation gasoline (Avgas) for small piston-engine aircraft. According to Federal Aviation Administration (FAA), Avgas emissions are the largest contribution to relatively low levels of lead emission in the U.S. (FAA, 2015). This has contributed to the contamination of some

soils near highways and streets and in drainage ways in urban areas. Exhaust particulates, fluid losses, drips, spills, and mechanical wear products continue to contribute lead to street dust.

For both copper and lead, the SCCWRP and Los Angeles County datasets indicate that average EMCs exceed applicable CTR continuous concentration criteria for each land use sampled. For zinc, some land uses (single family residential, education, and vacant) have average EMCs below the CTR continuous concentration criterion, while others (commercial, industrial, transportation, multi-family residential, and agriculture) exceed this criterion.

These land use EMC datasets were used to support BMP placement as part of the RAA.

Toxicity

As is the case with metals, the Dominguez Channel Toxics TMDL does not provide a detailed source assessment for toxicity within the Dominguez Channel Watershed, nor is a linkage provided to other specific surrogate pollutants, such as total suspended solids or dissolved metals. The source assessment simply states that "the major sources of organo-chlorine pesticides [and] PCBs…into Dominguez Channel are stormwater and urban runoff discharges. Nonpoint sources include atmospheric deposition and fluxes from contaminated sediments into the overlying water" (LARWQCB and USEPA, 2011).

Pesticides are used in urban settings for structural pest control, landscape maintenance (parks, golf courses, cemeteries, right-of-ways), vector control, and public health pest control. Two specific pesticides, diazinon and chlorpyrifos, were banned by the USEPA on December 31, 2005. As a result, mass emission monitoring at S28 has resulted in no measured exceedance of the 1 toxicity unit criteria for chlorpyrifos or diazinon in Dominguez Channel since 2006. Similarly, both DDT and PCBs were banned from general production and use in the 1970s, resulting in the elimination of direct discharges of these chemicals to Dominguez Channel, SMB, and other local surface water bodies, except from legacy sources.

Additional sources of toxicity within the Dominguez Channel Watershed are unknown at this time. Therefore, toxicity monitoring will be conducted under the Beach Cities CIMP to help assess if MS4 discharges are causing or contributing toxicity exceedances in Dominguez Channel. In addition, a toxicity identification evaluation (TIE) will be performed as necessary to identify the compound(s) responsible for any observed toxicity.

Indicator Bacteria

Although the Dominguez Channel is 303(d) listed for indicator bacteria, a bacteria TMDL has not yet been developed for the watershed. The source assessment for indicator bacteria within the Santa Monica Bay watershed portion of the Beach Cities EWMP area is provided in Section 2.2.3, and many of these urban anthropogenic and non-anthropogenic sources apply to the Dominguez Channel portion of the Beach Cities EWMP Area as well.

Additional local monitoring data will be needed to quantify the contribution of MS4 discharges – particularly relative to the many other identified non-anthropogenic sources that have been documented. Additional data are also needed to identify the sources of bacteria within MS4

discharges as well as their potential to contribute to recreational illness risks; such source tracking data have the potential to affect the TMDL WLAs through a future reopener. For example, if human fecal sources are found to be undetected in MS4 discharges to Dominguez Channel using a rigorous sampling design, the latest analytical markers, and a credible laboratory, then TMDL revisions may be proposed. And the combination of MS4 outfall monitoring (through the CIMP) and source identification (through special studies) will be essential to support future BMP planning and EWMP updates.

3.2.4 Prioritization

Based on the water quality characterization above, the WBPCs have been classified into one of three categories, in accordance with Section IV.C.5(a)ii of the Permit: highest priority, high priority, and medium priority (**Table 3-4**). This categorization is intended to prioritize WBPCs in order to guide the implementation of structural and institutional BMPs. An RAA was performed on the WBPCs in Categories 1 and 2. WBPCs will be further prioritized based on the applicable compliance schedules, as discussed in Section 4.

3.3 Selection of Appropriate Best Management Practices

3.3.1 Objectives

The Permit requires the Beach Cities WMG to identify strategies, control measures, and BMPs to implement within their EWMP area. Specifically, the Permit specifies that BMPs are expected to be implemented so that MS4 discharges meet effluent limits as established in the Permit and to reduce impacts to receiving waters from stormwater and non-stormwater runoff. This expectation assumes the implementation of both types of BMPs – non-structural and structural – by the Beach Cities WMG.

The objectives of selecting and incorporating BMPs into the Beach Cities EWMP include:

1. Preventing and/or eliminating non-stormwater discharges to the MS4 that are a source of pollutants from the MS4 to receiving waters;
2. Achieving all applicable interim and final WQBELs and/or RWLs pursuant to corresponding compliance schedules; and
3. Ensuring that discharges form the MS4 do not cause or contribute to exceedances of RWLs.

3.3.2 Definition of Best Management Practices

See Section 2.3.2.

3.3.3 Incorporated Provisions

Minimum Control Measures

See Section 2.3.3.

Non-Stormwater Discharge Measures

See Section 2.3.3.

TMDL-Specific Control Measures

See Section 2.3.3.

Additional BMPs

See Section 2.3.3.

Demonstration of BMP Performance – Introduction to the Reasonable Assurance Analysis

See Section 2.3.3.

Legal Authority

The Permit-required legal authority that the Beach Cities WMG has to implement the BMPs identified in the EWMP is discussed in Section 8.

3.4 Reasonable Assurance Analysis Approach

The general approach used for Dominguez Channel is described below with references to relevant portions of Section 2 where the approaches or data used in the Santa Monica Bay Watershed are similar (e.g., for calculating bacteria TLRs).

3.4.1 Description of Modeling Tools and Approach

The approaches for performing the RAA in both dry and wet weather are described below.

Dry Weather

For the purposes of the dry weather RAA, the EWMP area draining to Dominguez Channel was combined into a single analysis region, for which bacteria are the only WBPC.

The Beach Cities WMG dry weather compliance approach for Dominguez Channel is to eliminate non-exempt dry weather MS4 discharges using a suite of non-structural source controls (e.g., water conservation incentives, enhanced IDDE efforts, and enhanced education/outreach and inspection/enforcement to prevent sources of non-stormwater flow), source investigations following dry weather outfall screening, and structural BMPs that are primarily designed to support wet weather reasonable assurance demonstration. If monitoring shows that this combination of nonstructural and structural BMPs does not eliminate non-exempt dry weather flows, additional measures such as low flow diversion to sanitary sewers will be constructed as necessary so that dry weather flows are eliminated. By eliminating dry weather flows, this is equivalent to 100% load reduction for all pollutants, thereby demonstrating reasonable assurance of meeting all applicable Permit limitations during dry weather. Elimination of discharges is a pathway for compliance with RWLs and WQBELs in the MS4 permit (per section VI.E.2.e.i.(3)); without discharges there can be no "cause or contribute" to receiving water issues.

Wet Weather

The modeled wet-weather RAA applied in the Dominguez Channel watershed consists generally of the following steps:

- Identify WBPCs for which the RAA will be performed;
- Identify the MS4 service area (exclude lands of agencies not party to this EWMP such as Federal land, State land, etc.);
- For each analysis region, develop TLRs for the critical condition;
- Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future;
- Evaluate the performance of these BMPs in terms of annual pollutant load reductions;
- Compare these estimates with the TLRs; and
- Revise the BMP implementation scenario until TLRs are met.

For the purposes of the wet weather RAA, the EWMP area draining to Dominguez Channel was combined into a single analysis region to establish TLRs and into two analysis regions, one including the portion of the Cities of Redondo Beach and Manhattan Beach (Dominguez Channel – Redondo Beach/Manhattan Beach [DC-RB/MB]) and one including the portion of the City of Torrance (DC – Torrance), to evaluate the performance of BMPs. The Dominguez Channel watershed analysis regions are shown in **Figure 3-3.**

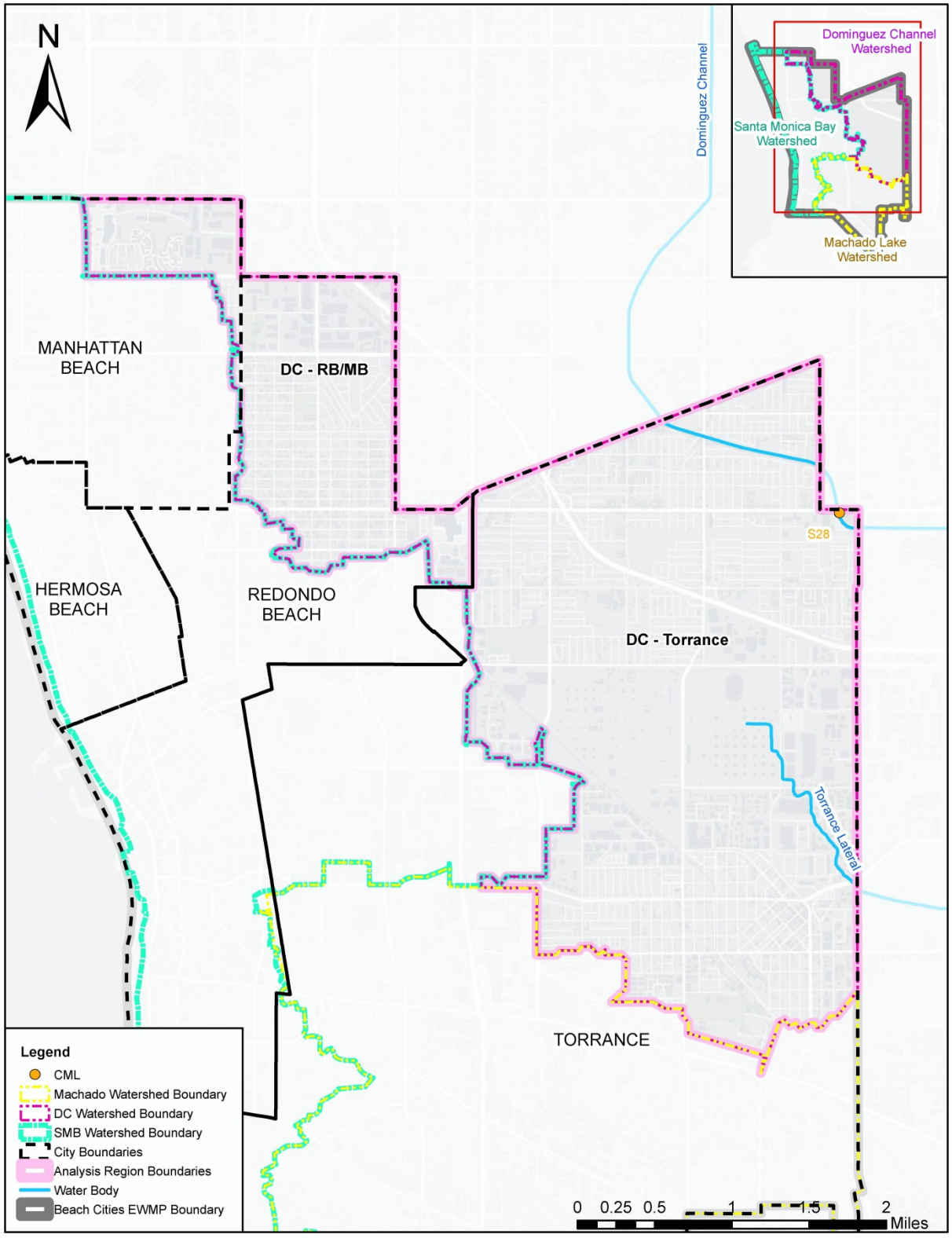


Figure 3-3. Analysis Regions within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area

In general, the approach, including model selection, data inputs, critical condition selection (90th percentile year for bacteria and 90th percentile load day for metals), calibration performance criteria, and output types have been selected for consistency with the LARWQCB RAA Guidance Document (LARWQCB, 2014) and to leverage previous efforts where relevant models have already been developed. Previous efforts include the development of a Loading Simulation Program C++ (LSPC) model for the LACFCD in connection with Watershed Management Modeling System (WMMS). LSPC is a publically available watershed model that was developed for the LACFCD in connection with WMMS. This model uses Hydrologic Simulation Program Fortran (HSPF) algorithms to simulate hydrology, sediment transport, water quality on land, and fate and transport within streams. GIS is used for the spatial component of the analysis in addition to visualization. The LSPC model used for the RAA was recently calibrated by CWE to stream gauge S28 which receives runoff from almost all of the Dominguez Channel Watershed.

To leverage these previous calibration efforts, the portion of the LSPC model within the Dominguez Channel watershed EWMP Area was used to calibrate SBPAT's hydrology. SBPAT was used to establish all TLRs in the Dominguez Channel Watershed. SBPAT was also used to perform the RAA for the portion of the Cities of Redondo Beach and Manhattan Beach within the Dominguez Channel watershed. The RAA for the portion of the City of Torrance within the Dominguez Channel watershed was performed using SWMM to determine baseline loading and static spreadsheet-based calculations based on a literature review to estimate load reductions from the proposed BMPs. The SWMM model used for baseline loading was calibrated using the recently calibrated LSPC model. **Table 3-5** below summarizes the TLR and RAA models used across the Dominguez Channel watershed for this EWMP. These models are discussed in more detail below.

Table 3-5. RAA Models Used in the Dominguez Channel Watershed

City	Model Selection		
	Set Target Load Reduction	**Perform RAA**	**Calibration Data Source**
Manhattan Beach	SBPAT	SBPAT	Recently calibrated LSPC model
Redondo Beach	SBPAT	SBPAT	Recently calibrated LSPC model
Torrance	SBPAT	SWMM for baseline/static spreadsheet-based calculations for load reductions	Recently calibrated LSPC model

As in the Santa Monica Bay watershed, the Beach Cities RAA was conducted within the Dominguez Channel watershed to demonstrate reasonable assurance of compliance with Permit specified TMDL RWLs and WQBELs, as well as other RWLs and water quality objectives for non-TMDL WBPCs. In instances where critical conditions were not explicitly defined in the Permit (e.g., a critical condition of "wet weather" without an associated rainfall or flow-based criterion), steps were taken to establish a link between the expressed Permit limit and the modeled pollutant concentrations and loads (i.e., rainfall, runoff, and pollutant concentrations in the runoff). **Table 3-6** summarizes these steps for the modeled WBPC in the Dominguez Channel watershed with a

Permit-established limit. Because no evidence currently exists to support a linkage between ongoing MS4 discharges and exceedances of toxicity, mercury, cadmium, cyanide, selenium, or pH in Dominguez Channel, these pollutants were not modeled as part of this analysis.

Table 3-6. Wet Weather Permit Limits (Final Compliance Limits for Modeled Pollutants)

Pollutant	RWL/WQBEL from the Permit or Assumed Based on Other Similar Los Angeles Region TMDLs	Approach for Applying the Critical Period
Fecal Coliform	19% allowed exceedance of the REC-1 water quality objective, (400 MPN/100mL) on non-high flow suspension days[2].	90th percentile year (based on wet days[1]) was used as the critical condition. Allowable number of wet weather exceedance days for the critical year was set to % of non-high flow suspension wet days, rounding down.
Total Copper	WQBEL= 9.7 ug/L *Daily Volume[3]	90th percentile daily load during wet weather was used as the critical condition. This calendar day was identified for each metal by ranking daily metal loads for wet days[1] between 2003 and 2012.
Total Lead	WQBEL= 42.7 ug/L *Daily Volume[3]	
Total Zinc	WQBEL= 69.7 ug/L *Daily Volume[3]	

[1] For bacteria, wet days were defined as days with 0.1" or greater of rainfall plus the next three days. For metals, the TMDL defines wet weather as days in which the maximum daily flow at the S-28 gauge on Dominguez Channel is 63 cfs or greater; for the purpose of this RAA, this was assumed to equate to days in which the SBPAT model (which responds to rainfall events greater than 0.1", had a non-zero flow).

[2] High Flow Suspension days are defined based on the criteria used in bacteria TMDLs in the region in which days in which 0.5" or greater of rainfall occurs, and the day following such an event, are both high flow suspension days.

[3] The MS4 permit provides both the concentration-based effluent limitations above as well as load based limitations on page N-6 which come from the Dominguez Channel Toxics TMDL. The load-based limitations are based on multiplying the metal concentration-based limitations by the runoff volume on the 90th percentile day. However, the TMDL does not provide quantitative load-based effluent limitations, but instead states that the WLAs are the water quality effluent target multiplied by the daily flow volume. The MS4 permit states that the load-based limitations can be recalculated based on the flow volume at the time of sampling. Therefore, the load-based effluent limitations will change based on the daily flow volume, so the WQBEL is written to account for flow variability.

Cities of Redondo Beach and Manhattan Beach (DC-RB/MB Analysis Region). SBPAT was used for the portion of the Dominguez Channel watershed within the Cities of Redondo Beach and Manhattan Beach to evaluate BMP scenarios and demonstrate reasonable assurance of achieving applicable Permit limits. SBPAT was used in the same capacity for the Santa Monica Bay watershed and is described in detail in Section 2.4.1 above.

City of Torrance (DC-Torrance Analysis Region). In general, the RAA approach used within the City of Torrance portion of the Dominguez Channel watershed was conducted using static spreadsheet calculations coupled with a literature review on the performance of catch basin inlet filters to determine reasonable removal percentages for metals and bacteria.

3.4.2 Modeling Data

The critical condition definition and a summary of data associated with the models used in the RAA are described below.

Critical Condition Definition

Bacteria. Consistent with all existing Los Angeles region bacteria TMDLs for freshwater bodies, as well as the LARWQCB RAA Guidance (LARWQCB, 2014), the RAA for bacteria was performed on the 90th percentile critical wet year in the Dominguez Channel Watershed. This was determined in the same manner as the Santa Monica Bay portion of the EWMP area as described in Section 2.4.2 using the same rain gauge and the same period of record. The 90th percentile TMDL year (Nov 1-Oct 31), based on the number of wet days based on gage D1070 was determined to be 1995 (see **Appendix Q**).

Metals. The critical condition for metals is based on the 90th percentile metal load day on wet days (see **Appendix Q**). Wet days in the Dominguez Channel Toxics TMDL are defined as days where the maximum daily flow at the S-28 stream gauge in lower Dominguez Channel is 62.7 cfs or greater. Consistent with RAA Guidelines, the most recent 10 year period with available rainfall data was selected; this period was 2003 to 2012 (Nov 1, 2002-Oct 31, 2012). The stream gauge data at this S-28 prior to October 2011 are segmented and do not cover the entire period. This could result in actual wet days that do not get classified as wet days if stream gage data are missing from that day, and could bias the TLR calculations and RAA analysis. Therefore, wet days for this analysis were based on days where the calibrated SBPAT model (which models only wet weather, i.e., no dry weather runoff or baseflows are modeled) predicted non-zero flow. This was compared to the bacteria wet day definition in which days with 0.1" or greater rainfall plus the next three days were counted as wet days. Storms that were greater than 0.1" produced runoff in SBPAT throughout the modeled period, thereby confirming that predicted flow in SBPAT was a reasonable representation of wet days. The calibrated SBPAT model (discussed below) was used to determine the daily metal load on wet days. These days were ranked by their daily metals load for each metal to determine the 90th percentile load day for TLR calculation. The 90th percentile load days were found to be Nov 30, 2007, February 5, 2010, and February 26, 2006 for copper, lead, and zinc, respectively. Other data related to the SBPAT model are discussed in detail in Section 2.4.2.

3.4.3 CALIBRATION

Hydrology

No stream gauge exists that measures flow from only the Dominguez Channel portion of the EWMP area. However, a stream gauge does exist on lower Dominguez Channel above the Torrance Lateral. This gauge captures flow from 24,275 acres. Approximately 3,687 acres of the EWMP area drain to this gauge. The rest of the EWMP area drains to the Torrance Lateral and is therefore downstream of this gauge. The EWMP area upstream of this gauge constitutes only 15% of the total area draining to the gauge. Therefore, in lieu of local measured stream flow data from within the EWMP area, a Los Angeles County LSPC model of the Dominguez Channel Watershed which had previously been calibrated to the S28 stream gauge on Dominguez Channel was used as

a stream flow calibration comparison dataset for SBPAT. As future monitoring data become available, this calibration may be reassessed as part of the EWMP adaptive management process.

The Los Angeles County LSPC model was previously calibrated by CWE to gauge S28 for the Dominguez Channel watershed using the calibration parameters in Table 3.0 of the RAA Guidelines. A ten-year calibration period was used (2003-2012). The percent difference for both daily and monthly runoff volumes between the LSPC model and the stream gauge was less than 10%, which is in the 'very good' category in the RAA guidelines (CWE, 2015). The mean annual runoff volume in the LSPC model (7,210 acre-ft) was within 12% of the stream gauge volume (8,210 acre-ft) which is in the 'good' range in the RAA Guidelines.

For modeling the portion of the Beach Cities EWMP area which drains to Dominguez Channel, the calibrated LSPC model was clipped to the Dominguez Channel analysis region (including Torrance, see Figure 1), while keeping all other model parameters unchanged. Because SBPAT only includes storm generated runoff and LSPC includes dry weather flows (irrigation was turned off for the purposes of this analysis), any dry weather flows were first removed from the LSPC annual volumes using the Web-based Hydrograph Analysis Tool (WHAT) for porous aquifers with ephemeral streams; this tool was developed by Purdue University to separate base flows and runoff. Because dry weather flows are minimal in Dominguez Channel Watershed in the LSPC model, this resulted in a decrease in volume of only 6%.

The SBPAT calibration of the Dominguez Channel analysis region focused on accurate prediction of annual discharge volumes predicted by the LSPC model for TMDL years 1989-2011. The dominant rain gauge used by LSPC (Manhattan Beach Station ID 1070) was also used by SBPAT. This gage had less than 2% difference in total rainfall volume than the aggregate of the surrounding rain gauges making it a good representative gauge for the EWMP area. The calibration parameters were the soil saturated hydraulic conductivities and the land use imperviousness, which were changed by a uniform multiplier for all soil and land use types in all subcatchments to match the LSPC predictions. **Table 3-7** shows the mean annual volume predicted by the calibrated SBPAT model versus the mean annual volume predicted by the calibrated LSPC model for the Dominguez Channel portion of the Beach Cities EWMP area. **Figure 3-4** compares the annual volumes predicted by SBPAT to the annual volumes predicted by LSPC for all years between 1989 and 2011. The difference in mean annual volume between LSPC and the calibrated SBPAT model was 2%, and the difference for the 90th percentile year was 1%, both of which are in the "very good" category for calibration in the RAA Guidelines.

Table 3-7. Mean Annual Volume Predicted by SBPAT and LSPC and Measured at the S28 Stream Gauge

Model/Source	Average Annual Volume (acre-ft)
SBPAT	2,943
LSPC	2,890
Stream Gauge	-
Difference (%)	2%

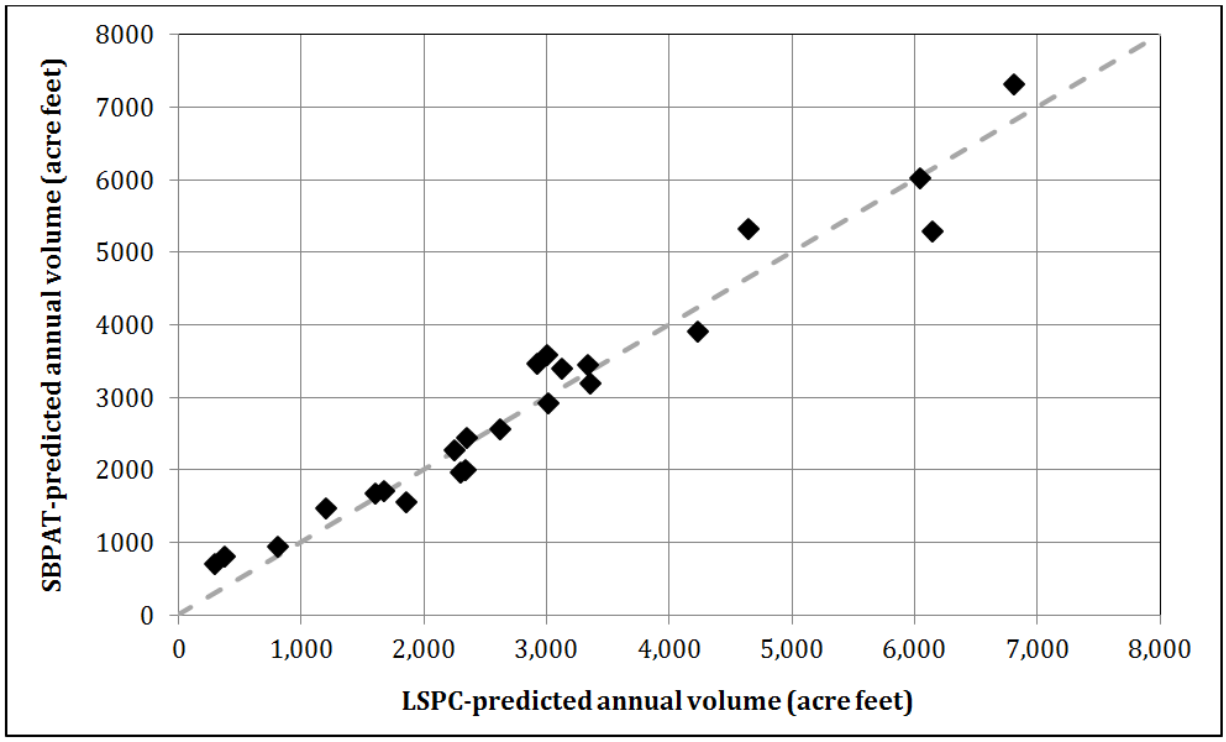


Figure 3-4. Annual Runoff Volumes Predicted by LSPC and SBPAT

Water Quality

The RAA Guidelines require water quality calibration based on available monitoring data from the most recent 10 years. However, in the portion of the Beach Cities EWMP draining to Dominguez Channel, recent water quality monitoring data are not available for the applicable pollutants for a nearby receiving water monitoring station (the Dominguez Channel mass emission station S28 [**Figure 3-2**] is located downstream of a portion of the Beach Cities EWMP area, but upstream of the rest and includes large areas outside the EWMP area), so a conventional water quality calibration was not feasible. In the future as new local monitoring data become available, SBPAT's water quality input parameters may be calibrated as part of the EWMP adaptive management process. In the meantime, to meet current model verification needs for the RAA, SBPAT's log-normal land use EMC statistics were compared with the original land use monitoring datasets upon which were based. This land use based comparison is consistent with the calibration method applied for the original county-wide LSPC model (Los Angeles County Department of Public Works, 2010).

The land use EMCs used in SBPAT were calculated from data collected by Los Angeles County between 1996 to 2000 (County of Los Angeles, 2000) for metals, and land use-specific data collected by SCCWRP (SCCWRP, 2007) between 2000 to 2005 for fecal coliform. An example of the fecal coliform distribution for high density residential land use from the SCCWRP results and the distributions used in SBPAT for multi-family land use are shown in **Figure 3-5** for fecal coliform

bacteria. An additional example of the zinc distribution for high density residential land use from Los Angeles County results and the distributions used in SBPAT is shown in **Figure 3-6**. As shown by the percentiles, the pollutant EMC distribution is well representative of measured data. The example is provided for high density residential land use since this is the dominant developed land use in the Dominguez portion of the Beach Cities WMG area. Modeled EMC values are consistent with the recommended values for land use-specific loading in Table 3.3 of the RAA Guidelines.

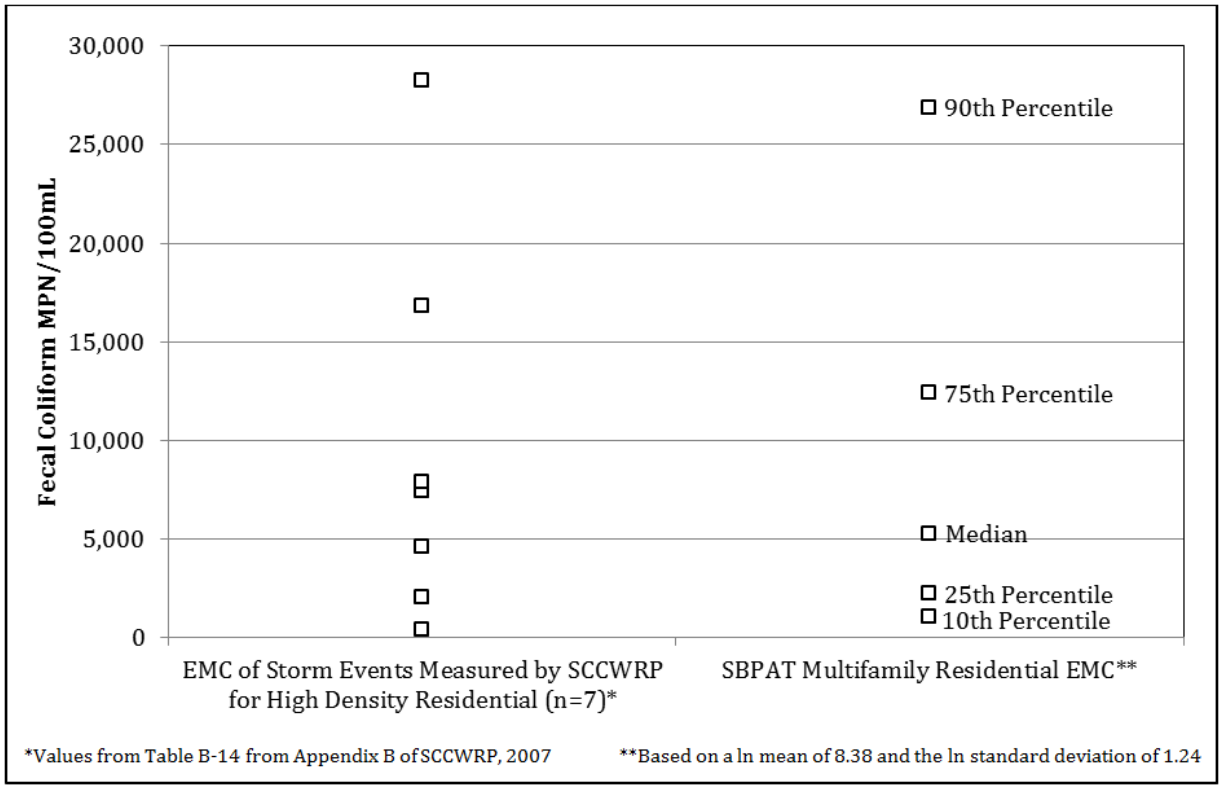


Figure 3-5. Comparison of Fecal Coliform High Density Residential EMC Values between SCCWRP Measurements (n=7) and Multi-Family Residential EMC distribution in SBPAT[23]

[23] A full log distribution is used by the model, but non-parametric summary statistics are shown for comparison.

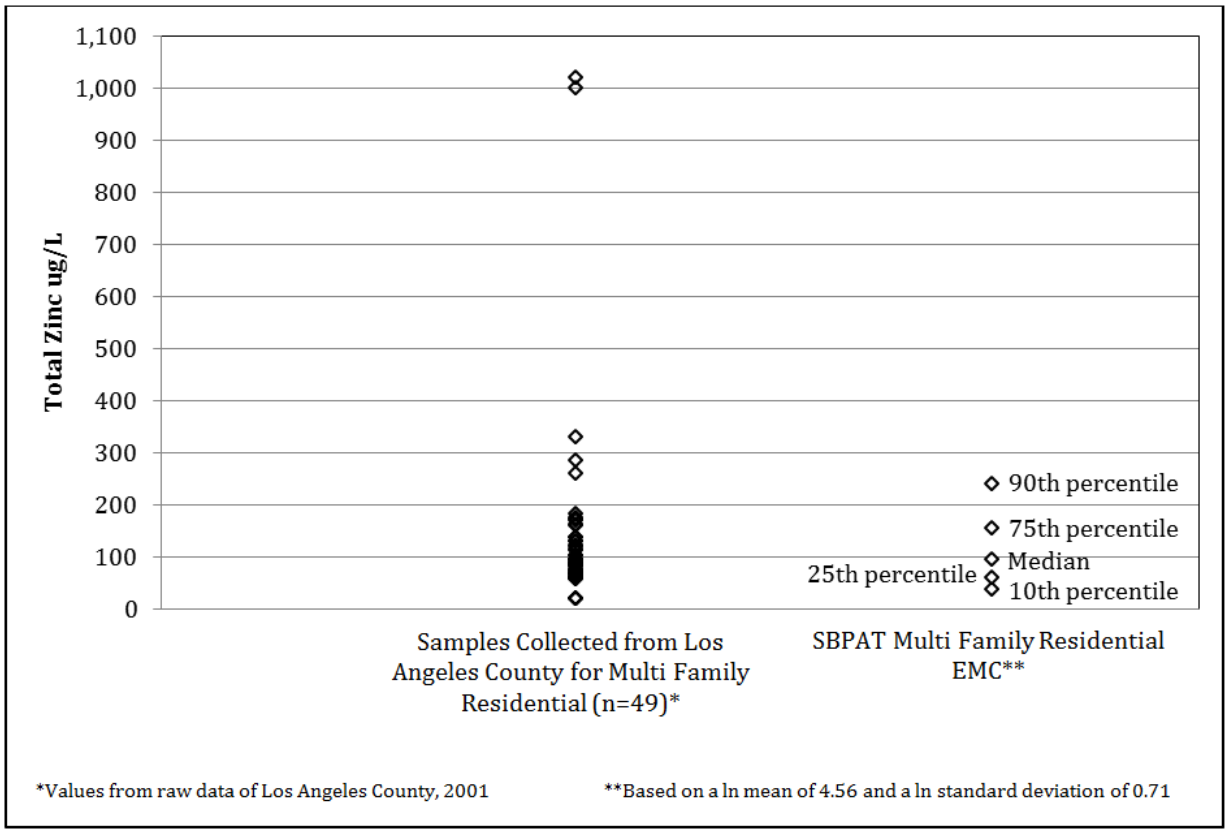


Figure 3-6. Comparison of Total Zinc Multi Family Residential EMC Values between Los Angeles County Measurements (n=4) and Multi-Family Residential EMC distribution in SBPAT[24]

3.4.4 VALIDATION

A validation step was performed to demonstrate that modeled annual fecal coliform loads are indeed predictive of the compliance metric, or annual exceedance days for fecal indicator bacteria. For bacteria modeling, verifying the linkage between modeled *fecal coliform loads* (i.e., discharged from the watershed outlets) and total observed wet weather *exceedance days* (in the receiving water, based on REC1 daily maximum water quality objectives) was critical to establish reasonable assurance that CMLs would be in compliance with the Permit limits. To establish this linkage, an analysis was conducted using shoreline monitoring data at Topanga Canyon[25] (SMB-1-18) between 2005 and 2013. As presented in Section 2.4.4, **Figure 2-10** in Section 2.4.4 illustrates that decreasing fecal coliform loads should result in measurable reductions in exceedance days, and that there is a reasonable correlation between total annual modeled fecal coliform loads and

[24] A full log distribution is used by the model, but non-parametric summary statistics are shown for comparison.

[25] Fecal coliform data and objectives were used to represent all fecal indicator bacteria because fecal coliform has the most robust land use and BMP effluent EMC datasets.

total annual observed wet weather exceedance days. Each point shown represents one TMDL year.

3.5 Baseline Loads and Target Load Reductions

Baseline loads for the critical period for bacteria and metals from the entire EWMP area draining to Dominguez Channel were computed using SBPAT. For bacteria, the critical period was the 90th percentile wet TMDL year, which was computed to be 1995 as discussed in Section 3.4.2. For metals, the critical condition is the 90th percentile metal load day between 2003 and 2012. These dates were found to be November 30, 2007, February 5, 2010, and February 26, 2006 for copper, lead, and zinc, respectively, as discussed in Section 3.4.2. The computed baseline loads for the critical condition are shown in **Table 3-8** below.

Table 3-8. Baseline Loads for Pollutants in the Dominguez Channel Watershed for the Critical Condition

Pollutant	90th Percentile Critical Condition	Baseline Load
Copper (lb/day)	11/30/2007	21
Lead (lb/day)	2/5/2010	8.7
Zinc (lb/day)	2/26/2006	230
Bacteria (MPN*10^12/yr)	11/1/1994-10/31/1995	1,498

The process for establishing TLRs for the modeled WBPCs (copper, lead, zinc, and bacteria in Dominguez Channel) is described in the following section. TLRs were set for the entire Dominguez Channel analysis region, including the cities of Manhattan Beach, Redondo Beach, and Torrance. Because no evidence currently exists to support a linkage between MS4 discharges and exceedances of toxicity, mercury, cadmium, cyanide, selenium, or pH in Dominguez Channel, these pollutants were not modeled as part of this analysis. This potential linkage will be re-evaluated based on results of future monitoring efforts.

3.5.1 Metals

For the Dominguez Channel and Greater LA Harbor Toxics and Metals TMDL, the final WQBELs in the Permit are expressed as allowed daily loading of total copper, total lead, and total zinc during wet weather. The WQBEL loads were calculated as the CTR freshwater chronic criteria-based numeric target concentrations (9.7, 42.7, 62.7 ug/L for total copper, total lead, and total zinc, respectively) multiplied by the daily flow volume at the time of sampling.

The following approach was implemented to calculate a wet weather TLR for each metal in the Dominguez Channel portion of the Beach Cities EWMP area:

1. The analysis region was modeled in SBPAT for TMDL years 2003 to 2012.
2. Including only wet[26] days, the day with the 90th percentile metal load (the critical daily load) was determined (see **Appendix Q**).
3. The target load was calculated by multiplying the allowed concentration by the runoff volume on that day which is the WQBEL expressed in the permit.
4. The difference between the baseline load (step 2) and the target load (step 3) resulted in a TLR for the 90th percentile load day, which was the load reduction required to meet the allowable TMDL concentration.

Appendix K provides an example calculation for this TLR process.

Zinc was found to require the greatest TLR and was also found to be the controlling pollutant for BMP implementation, meaning that meeting the zinc requirement required the most stringent BMP implementation, which will likely produce load reductions for the other pollutants greater than the TLR. The TLR for lead was found to be zero because the baseline concentration on the 90th percentile critical day was found to be less than the allowed concentration. TLRs for each of the metals are shown in **Table 3-9**.

3.5.2 Fecal Coliform Bacteria

Since no TMDL exists for this WBPC, an approach was developed to compute a wet weather bacteria TLR consistent with freshwater bacteria TMDLs in the region, which use allowable exceedance days (per year) and the 90th percentile critical year as the basis for their WLAs. The TLR calculation for bacteria for Dominguez Channel EWMP area was similar to the method used in the SMB portion. The method relates the annual number of modeled calendar days with rainfall-generated runoff (or "discharge days") to the expected annual bacteria exceedance days. The validation of this methodology on the Arroyo Sequit reference watershed is described in Section 2.5.1.

The TLR-development methodology was applied to the EWMP area to predict the number of baseline exceedance days for the 90th percentile year, or TMDL year 1995. Once the number of baseline discharge days were estimated, the number of allowed discharge days was established. Consistent with other Los Angeles region freshwater bacteria TMDLs, it was assumed that 19% of non-high flow suspension days were allowed to exceed the REC1 single sample limit, or 400 MPN/100mL for fecal coliforms[27].The D1070 rain gauge, which was used to determine the 90th percentile year and used to model both the Dominguez Channel and Santa Monica Bay portions of the EWMP area, was used to determine the number of wet days and high flow suspension days in

[26] Wet days defined as days in which gauge S28 has flows equal than or greater than 62.7 cfs. Due to insufficient continuous flow data at this gauge, wet days were estimated as days in which flows in SBPAT were non-zero excluding days with less than 0.1 inch of rainfall. This is discussed in more detail in Section 3.4.2.

[27] Fecal coliform, and its previous freshwater Basin Plan objective value (400 mpn/100mL), is used as the modeled surrogate for *E. coli* due to its more robust available modeling datasets.

TMDL year 1995. Wet day definition and high flow suspension day definition were based on other bacteria TMDLs in the region, where wet days are days in which 0.1" or greater of rainfall occur, plus the following 3 days, and high flow suspension days are days in which 0.5" or greater of rainfall occur plus the following day. In TMDL year, 1995, a total of 73 wet days (19 of which were high flow suspension days) occurred using this methodology. Because the REC1 single sample limits are suspended on high flow suspension days, the total number of applicable wet days is 54. Using the 19% allowable exceedance rate, the number of allowable exceedance days was set to 10 (19% x 54 wet days). Thus, 10 wet days (that are not high flow suspension days) were allowed to exceed 400 MPN/100mL. Any remaining exceedance days must be removed using BMPs.

To determine the TLR necessary to meet the allowed discharge days, a virtual retention BMP was modeled in SBPAT at the outlet of the EWMP area. This approach was presented to LARWQCB staff on June 6, 2014 and verbal feedback received during the meeting was supportive.

For the outlet virtual retention BMP included a diversion with a virtual hydraulic capacity that results in a model-derived bypass frequency (or number of discharge days), during TMDL year 1995 that meets the allowable exceedance day criteria. The diversion is modeled as a full capture system. High flow suspension days were not included in the number of exceedance days, and the concentration on each discharge day was confirmed to be greater than 400 MPN/100mL to ensure it was actually an exceedance day. The diversion is modeled as a full capture system. The load reduction resulting from this BMP scenario (i.e., baseline analysis region load minus analysis region load with the diversion system and retention BMP in place) became the TLR. "Reasonable assurance" of compliance with the allowed discharge days was then considered to have been met when actual and proposed BMPs combined to achieve the TLR for each analysis region. The calculated TLR for bacteria is shown in **Table 3-9**.

In summary, the following approach was implemented to calculate a wet weather bacteria TLR in the Dominguez Channel analysis region:

1. The analysis region is modeled in SBPAT for the 90th percentile year (TMDL year 1995) (see **Appendix Q**).
2. The existing, baseline condition (i.e., without any outlet retention BMP) is modeled for the analysis region, resulting in a mean baseline fecal coliform (FC) load for the 90th percentile year (baseline load).
3. The allowable number of non-high flow suspension discharge days is calculated to be 10 (19% of 54 non-high flow suspension wet weather days in TMDL year 1995).
4. An in-stream diversion to a large, virtual retention BMP at the outlet of the analysis region is iteratively sized so that the number of non-high flow suspension discharges meets the criteria established in Step 3.
5. The diversion and retention BMP is then modeled in SBPAT to produce a mean FC load for the 90th percentile year (allowed load).

6. The difference between the baseline load (step 2) and the allowed load (step 5) results in a TLR for the 90th percentile year, which is the load reduction required to meet the 10 allowable exceedance days for wet weather.
7. In order to meet the allowable exceedance days of 10, the TLR (as a percentage of the baseline 90th percentile year load) is 33%.

Table 3-9. Target Load Reductions for Pollutants in the Dominguez Channel Watershed for the Critical Condition

Pollutant	Baseline Load	Allowable Load	Target Load Reduction	
			Absolute	% of baseline load
Copper (lb/day)	21	8.0	13	62%
Lead (lb/day)	8.7	32	0	0%
Zinc (lb/day)	230	55	175	76%
Bacteria (MPN*10^12/yr)	1,498	1,005	493	33%

3.6 Best Management Practices

3.6.1 Methods to Select and Prioritize BMPs

In order to demonstrate reasonable assurance, BMPs were identified in a prioritized manner. Prioritization was based on cost (low cost BMPs were prioritized); BMP effectiveness for the pollutants of concern (BMPs that had greater treatment efficiency for the pollutant of concern in a particular analysis region were prioritized over other BMPs); and implementation feasibility as determined by the Beach Cities agencies. In general, nonstructural BMPs were prioritized over structural BMPs due to their lower relative cost, and then structural BMPs were identified that would likely result in the greatest load reduction per dollar.

The RAA was performed according to the following steps:

1. Calculate load reductions associated with existing structural BMPs;
2. Assume a load reduction for non-modeled non-structural BMPs(five percent of baseline pollutant load);
3. Calculate load reductions for public retrofit incentives (e.g., downspout disconnects) and redevelopment;
4. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 entities (e.g., Industrial General Permit holders and Caltrans);
5. Calculate load reductions for proposed regional BMPs that were identified in existing plans; and

6. Meet the TLR by backfilling the remaining load reduction with new regional or distributed green streets BMPs, with green streets modeled by assuming treatment of runoff from a percentage of specific developed land uses.

The following schedule assumptions were made:

- Only BMPs implemented after the TMDL effective date (2012) were included;
- Redevelopment BMPs were assumed to use different sizing criteria before and after 2015 (EWMP submittal date), consistent with the Permit's post-construction requirements; and
- Modeled load reduction outputs are reported for the proposed interim bacteria (2018, 2023, and 2027) and final proposed bacteria/toxics TMDL (2032) compliance dates.

3.6.2 Recommended MCMs and Nonstructural BMPs

See Section 2.6.2. All information provided in **Table 2-7**, excluding the City of Hermosa Beach (which is not in the Dominguez Channel Watershed), also pertains to the Dominguez Channel Watershed.

3.6.3 Quantified Non-Structural BMPs

Non-structural BMPs have been categorized as follows. Specific model inputs are summarized below. No modeling of non-structural BMPs was conducted in the City of Torrance, as all load reductions were quantified based on literature references.

Non-Modeled Programmatic BMPs

These source controls include a combination of BMPs such as new or enhanced pet waste controls (ordinance, signage, education/outreach, mutt mitts, etc.), Clean Bay Restaurant Program, human waste source tracking and remediation (e.g., leaking sewer investigations, etc.), enhanced street sweeping (e.g., 100% vacuum sweepers, increased frequency, posting of 'No Parking' signs for street sweeping, etc.), increased catch basin and storm drain cleaning, and other new or enhanced nonstructural BMPs that target the pollutants addressed in this EWMP. The City of Torrance, for instance, has committed to such BMPs as smart gardening program enhancements, TMDL-specific stormwater training, enhancement of commercial and industrial facility inspections, enhancement escalation procedures, improved street sweeping technology, and reduction of irrigation return flow. A combined credit of 5% load reduction was applied for all pollutants to represent the cumulative benefit from non-modeled programmatic BMPs.

In addition, a separate load reduction is assumed for copper due to the elimination of copper in brake pads. In 2010, California Senate Bill 346 (SB 346) was enacted to eliminate nearly all use of copper in brake pad manufacturing. In 2013, TDC Environmental prepared a draft detailed study for the California Stormwater Quality Association (CASQA) describing the expected percent reduction for copper as a result of the passage of SB 346 (TDC Environmental, 2013). The TDC study identifies three possible implementation scenarios, the least aggressive of which estimates that a 55% load reduction in copper will be achieved by 2032 due to the brake pad phase out. Therefore, a 55% load reduction was assumed for copper in the Greater LA Harbor analysis

region; however, to avoid double counting load reductions, this reduction was applied to the copper load *after* accounting for all future nonstructural and structural BMP load reductions.

Modeled Redevelopment

Beginning in 2001, redevelopment projects were required by the Permit (via the SUSMP) to incorporate stormwater treatment BMPs into their projects if their project size exceeded specified thresholds. The 2001 MS4 Permit SUSMP redevelopment requirements were applied between 2012 (the point at which the Metals TMDL was implemented) and 2015 for the Dominguez Channel EWMP area. Redevelopment in this period was modeled as flow-through media filters at a 0.2 in/hr design event**.**

The 2012 MS4 Permit established new criteria for redevelopment projects, requiring certain sized projects to capture, retain, or infiltrate the 85th percentile design storm or the 0.75-inch design storm, whichever is greater, via the implementation of LID BMPs. To account for these redevelopment requirements in the Cities of Redondo Beach and Manhattan Beach, BMPs were modeled in SBPAT assuming land use-specific annual redevelopment rates for projects that triggered former SUSMP requirements or will trigger the Permit's LID BMP requirements (**Table 3-10).** No load reduction from this non-structural BMP was quantified for the City of Torrance.

Table 3-10. Estimated Annual Redevelopment Rates

Land Use	Annual Redevelopment Rate (% of total land use area)	
	Cities of Redondo Beach and Torrance[1]	City of Manhattan Beach
Residential	0.18	0.10
Commercial	0.15	0.38
Industrial	0.34	0.38
Education	0.16	0.16
Transportation	2.7	2.7

[1]Regionally developed redevelopment rates were applied to the City of Torrance and Redondo Beach (City of Los Angeles Bureau of Sanitation, 2012).

A City-specific redevelopment rate of 3.8 percent for commercial redevelopment in Manhattan Beach was provided based on historical SUSMP data over the past ten years. This value was also assumed for historical industrial redevelopment and both commercial and industrial redevelopment moving forward. For residential land use, because there are insufficient data to project LID rates, a nominal 0.10 percent was assumed and is subject to change based on the model outcomes and discussions with City staff as the LID ordinance is finalized.

BMPs were assumed to be implemented and to continue be implemented in the future, at these rates across five distinct time periods in the Dominguez Channel watershed:

- **2012 (Dominguez Channel Toxics TMDL Effective Date) – 2015:** The SUSMP requirements, based on the 2001 MS4 Permit, were assumed to be implemented over this

period as flow-through media filters at a 0.2 in/hr design intensity (Los Angeles County Department of Public Works, 2002).

- **2015 - 2032 (Final Dominguez Channel Toxics TMDL Compliance Deadline and Proposed Final Bacteria Compliance Deadline):** The 2012 MS4 Permit post-construction requirements were assumed to be implemented over this period as 50% biofiltration and 50% bioretention. Biofiltration (bioretention with underdrains) were modeled using bioswale BMP types with effluent EMCs set to bioretention and sized to retain 150 percent of the 1-year, 1-hour design storm (approximately 0.3 in/hr) because they do not retain all the design storm volume on site (they are flow-through systems), while bioretention units were sized to retain 100 percent of the 85th percentile, 24-hour design storm depth, calculated as the mean for each analysis region.

2015 is used as a transition date since the LID post-construction requirements from the 2012 MS4 Permit are required to be in full effect via local LID ordinances by this time.

In order to estimate load reductions associated with these redevelopment BMPs, the land use percentages shown in **Table 3-10** were multiplied by the respective land use areas in each analysis region, resulting in an assumed area treated by LID BMPs each year. This area was multiplied by the applicable number of years, since new BMPs are assumed to be implemented each year. The total land use area assumed to be redeveloped for each analysis region was then modeled as being treated and the total load reduction was quantified. The default design parameter assumptions for the biofiltration redevelopment projects were that the longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 in.

Modeled Public Retrofit Incentives

These BMPs include programs directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnects. Public incentives for retrofitting existing development were modeled in SBPAT between 2015, when the EWMP will begin to be implemented, and the respective TMDL final compliance date. No quantification of these load reductions was done for the City of Torrance, although they may be taken into account in future iterations. Public retrofit incentives were assumed to be a downspout disconnection program, modeled as bioswales sized to a design storm intensity of 0.2 in/hr (see **Table 2-9**). The default design parameter assumptions for the biofiltration redevelopment projects were that longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 in.

Assumptions included that 10 percent of single family residential areas would be converted to disconnected downspout systems over 2015 to 2021, and that, based on GIS analysis, 38 percent of the single family residential area consists of rooftops that can be effectively disconnected. Therefore, 3.8 percent of single family residential neighborhoods were modeled as treated by bioswales in order to account for public retrofit incentives.

Modeled Non-MS4 Permitted Parcels or Areas

SBPAT was used to quantify the load reduction assuming that regulated parcels/areas would be in compliance with the NPDES Statewide Storm Water Permit Waste Discharge Requirements (WDRs) from State of California Department of Transportation (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and the California NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit [IGP], Order 2014-0057-DWQ) (**Figure 3-7**). The load reduction from these areas was quantified in analysis region DC-RB/MB. This load reduction was obtained from these areas by simulating treatment plants sized to treat the IGP's design storm requirement, the 85th percentile, 24-hour storm event, with an effluent concentration set equal to the water quality standard (see Section 2.6.3). For fecal coliform, 400 MPN/100mL was used. In the Dominguez portion of the Beach Cities EWMP, these constituted only a small fraction of the total area.

3.6.4 Structural BMPs

Structural BMPs have been categorized as follows. Proposed distributed BMPs in the Dominguez Channel Watershed area of the Beach Cities EWMP are shown in **Figure 3-8**, and existing and proposed regional BMPs are shown in **Figure 3-9**.

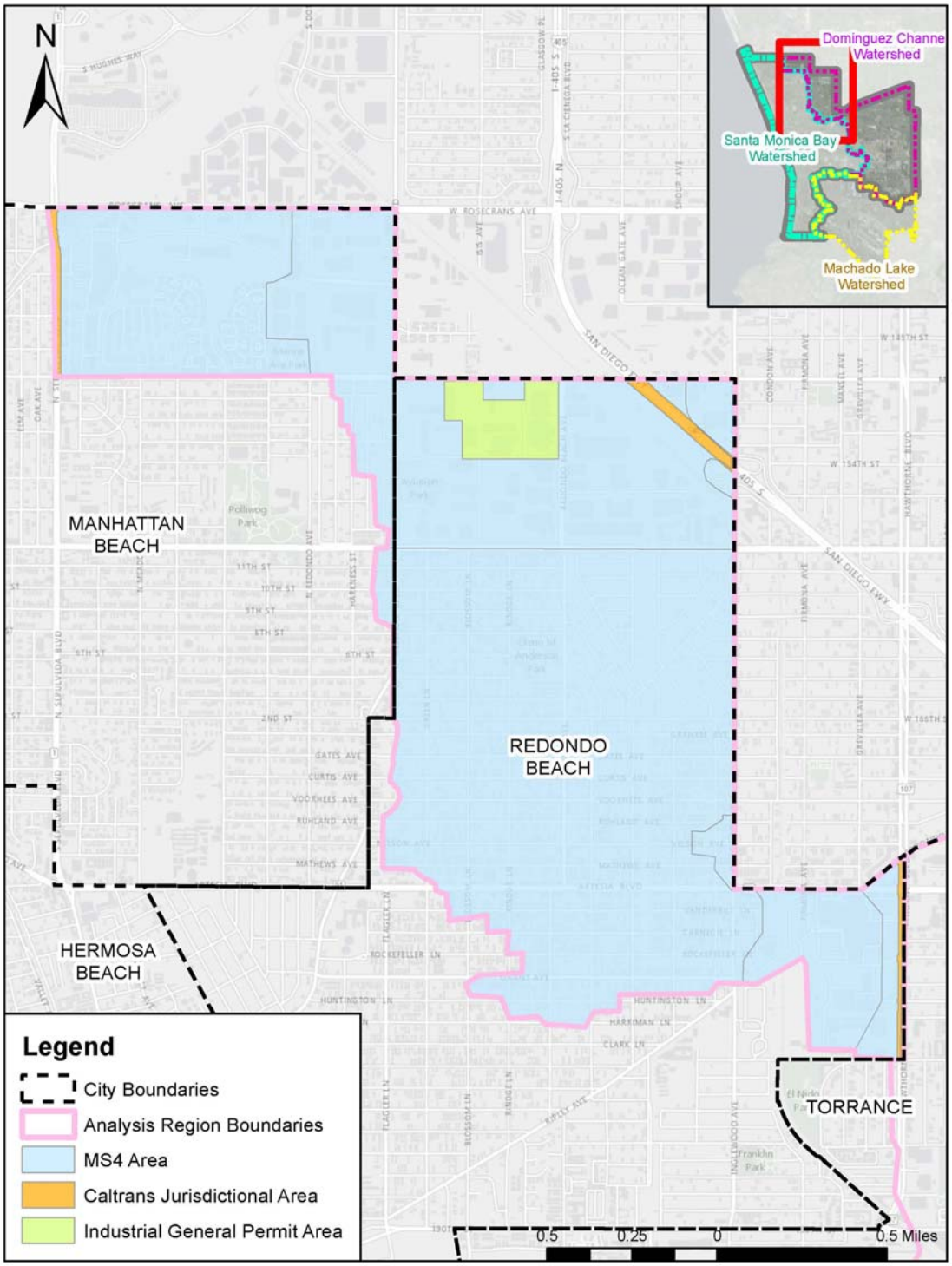


Figure 3-7. IGP and Caltrans Area within the Dominguez Channel portion of the Beach Cities EWMP Area

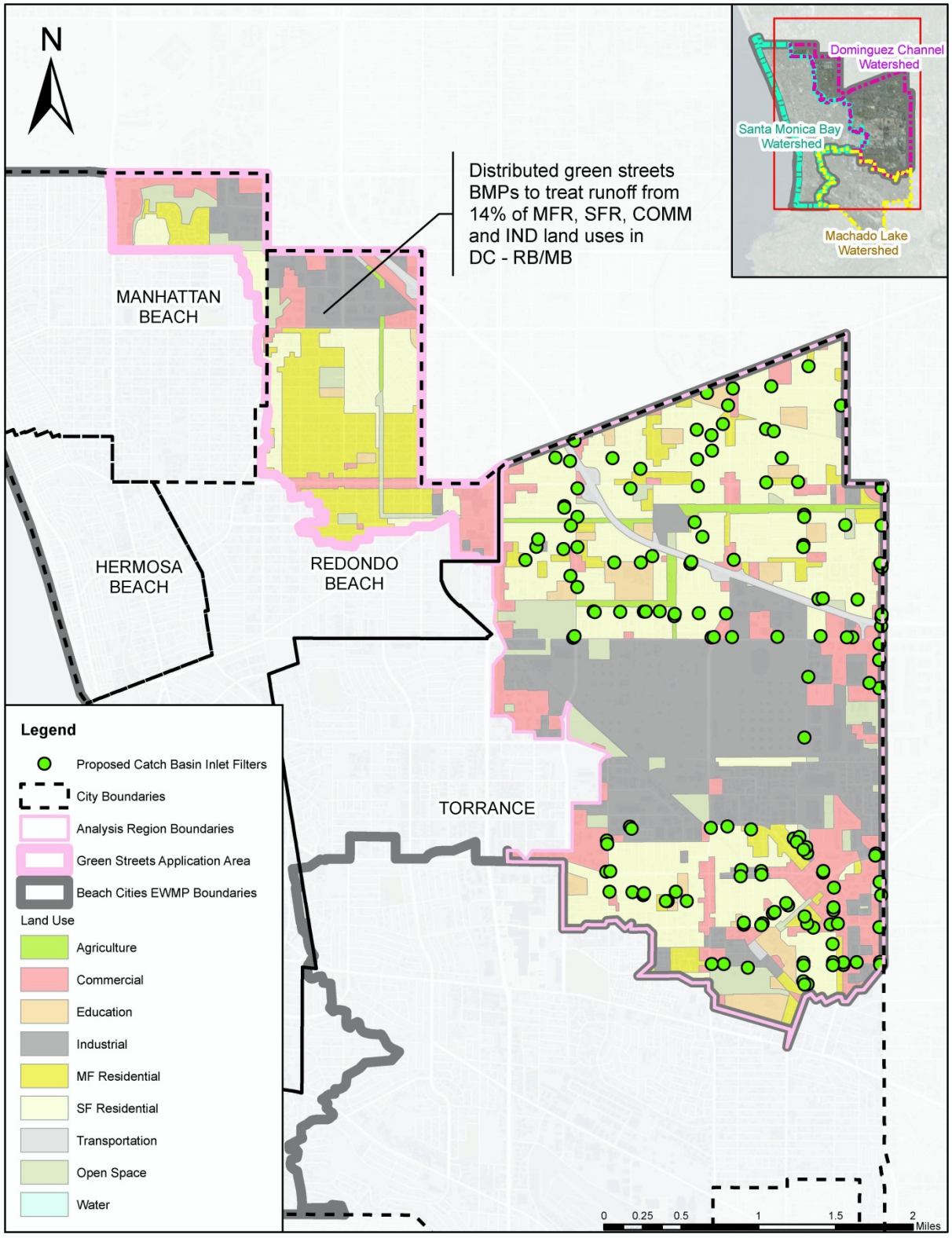


Figure 3-8. Proposed Distributed BMPs within the Dominguez Channel Watershed

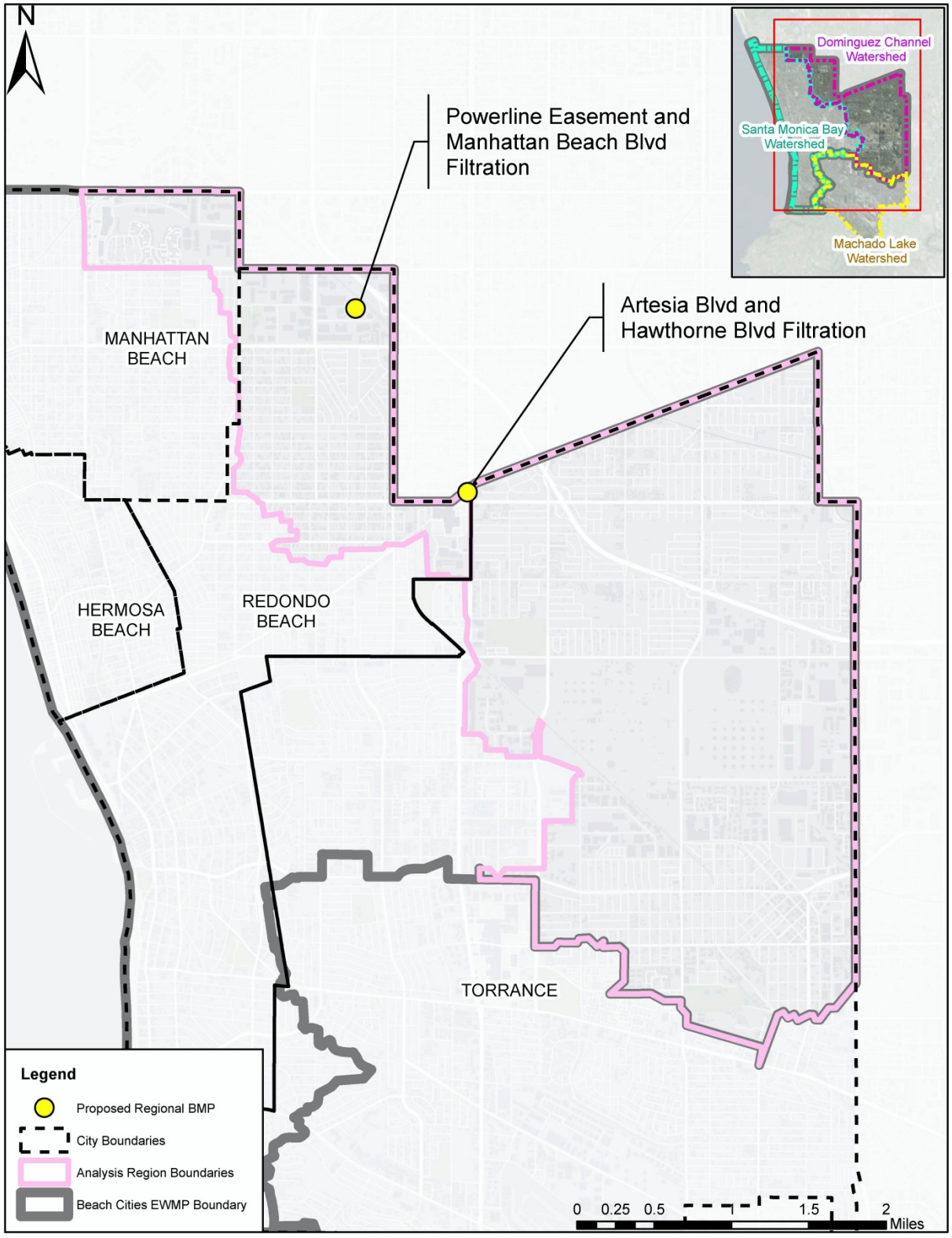


Figure 3-9. Proposed Regional BMPs within the Dominguez Channel Watershed

Existing Regional BMPs

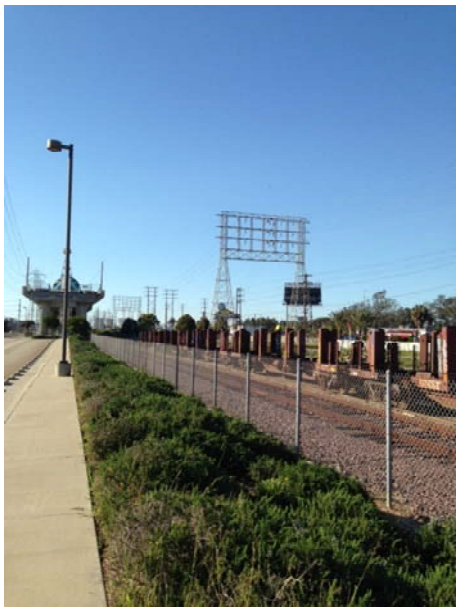
There are no existing regional BMPs in either Dominguez Channel analysis region; as such, none were modeled in SBPAT.

Proposed Regional BMPs

Two regional BMPs are being proposed in the Dominguez Channel watershed, both within the City of Redondo Beach in Analysis Region DC-RB/MB.

Analysis Region DC – RB/MB

Two proposed regional BMPs in the DC-RB/MB analysis region were modeled in SBPAT based on conceptual design information and discussions with the Beach Cities WMG (**Figure 3-10**). While the BMPs are conceptual at this point, they will include media filtration such as proprietary media filters or bioretention. Infiltration is not feasible due to the low saturated flow rates in the areas where regional BMPs could be constructed (0.3-0.4 in/hr).



Powerline Easement Filtration. This regional BMP would include a filtration system (i.e., media filter, biofilter, or bioretention with underdrains) or systems along the powerline easement. This BMP could be constructed to capture runoff from the EWMP areas draining towards the intersection of Manhattan Beach Blvd and Inglewood Ave. In order to determine a conservative estimate of the footprint available for this BMP, an analysis was conducted along the powerline easement and along Manhattan Beach Blvd that included the following criteria:

- 100 ft away from large utility poles; and
- 25 ft away from roads, railroads, and buildings.

These criteria aim to address some of the concerns with BMP construction within a powerline easement, as was previously described. The resulting approximate footprint shown in **Figure 3-10** should be considered approximate and large enough to allow for construction in the roadway right-of-way or easement or both. It is noted that this is meant to be a conservative estimate given the above criteria and would be sited to capture runoff from the drainage area shown in Error! Reference source not found.. The total footprint area calculated for this BMP was 313,500 square feet. It was assumed that approximately 15% of this area would be used for pretreatment (10%) and side slopes (5%) so only 85% of the area was used as the footprint available for filtration. The BMP was modeled as a flow through BMP, with the only storage available being the pretreatment. A media filter was chosen to represent this BMP. The treatment rate was set to 10 inches per hour multiplied by the available footprint. This constitutes a design flow of approximately 48% of the 0.2 in/hr 85th percentile design intensity in the Permit. The BMP was assumed to be 5 feet deep, and the diversion flow rate was estimated based on the flow rate from 0.2 in/hr on the drainage area using the rational method. Modeling criteria are shown in **Table 3-11**.

A potential alternative location to the Powerline Easement Filtration facility is the green space adjacent to Manhattan Beach Blvd and Marine Avenue. Due to limited spatial availability, high-capacity filter media would be required for the alternative location in order to achieve the same reduction objective as the Powerline Easement Filtration facility.

Artesia Blvd and Hawthorne Blvd Filtration. This regional BMP would include a filtration system or systems near the intersection of Artesia Blvd and Hawthorne Blvd. It was assumed that this BMP could be constructed to capture runoff from the EWMP areas draining towards this intersection. A conceptual footprint was developed based on the space available in medians, park strips, and areas that could be converted for subsurface filtration systems. The approximate footprint is shown in **Figure 3-10**.

The total footprint area calculated for this BMP was 43,700 square feet. It was assumed based on other similar BMPs in the Los Angeles region that approximately 15% of this area would be used for pretreatment (10%) and side slopes (5%), so only 85% of the area was used as the footprint available for filtration. The BMP was modeled as a flow-through BMP, with the only storage available being the pretreatment. A treatment plant type BMP was chosen for the modeling, and the EMCs from distributed media filters were assigned to the treatment plant to simulate a regional media filter. The treatment rate was set to 10 inches per hour multiplied by the available footprint. This constitutes a design flow of approximately 63% of the 0.2 in/hr intensity in the Permit. The BMP was assumed to be 5 feet deep, and the diversion flow rate was estimated based on the flow rate from 0.2 in/hr on the drainage area using the rational method. Modeling criteria are shown in **Table 3-11**.

Analysis Region Dominguez Channel – Torrance (DC-Torrance)

No regional BMPs are proposed in the DC-Torrance analysis region.

Summary of Proposed Regional BMPs

Two regional BMPs are proposed in the Dominguez Channel portion of the Beach Cities EWMP Area. None of these projects could be feasibly sized to meet the 85th percentile design criteria. Proposed regional BMPs, including their location, analysis region, project name, model inputs, and expected performance, are summarized in **Table 3-11.**

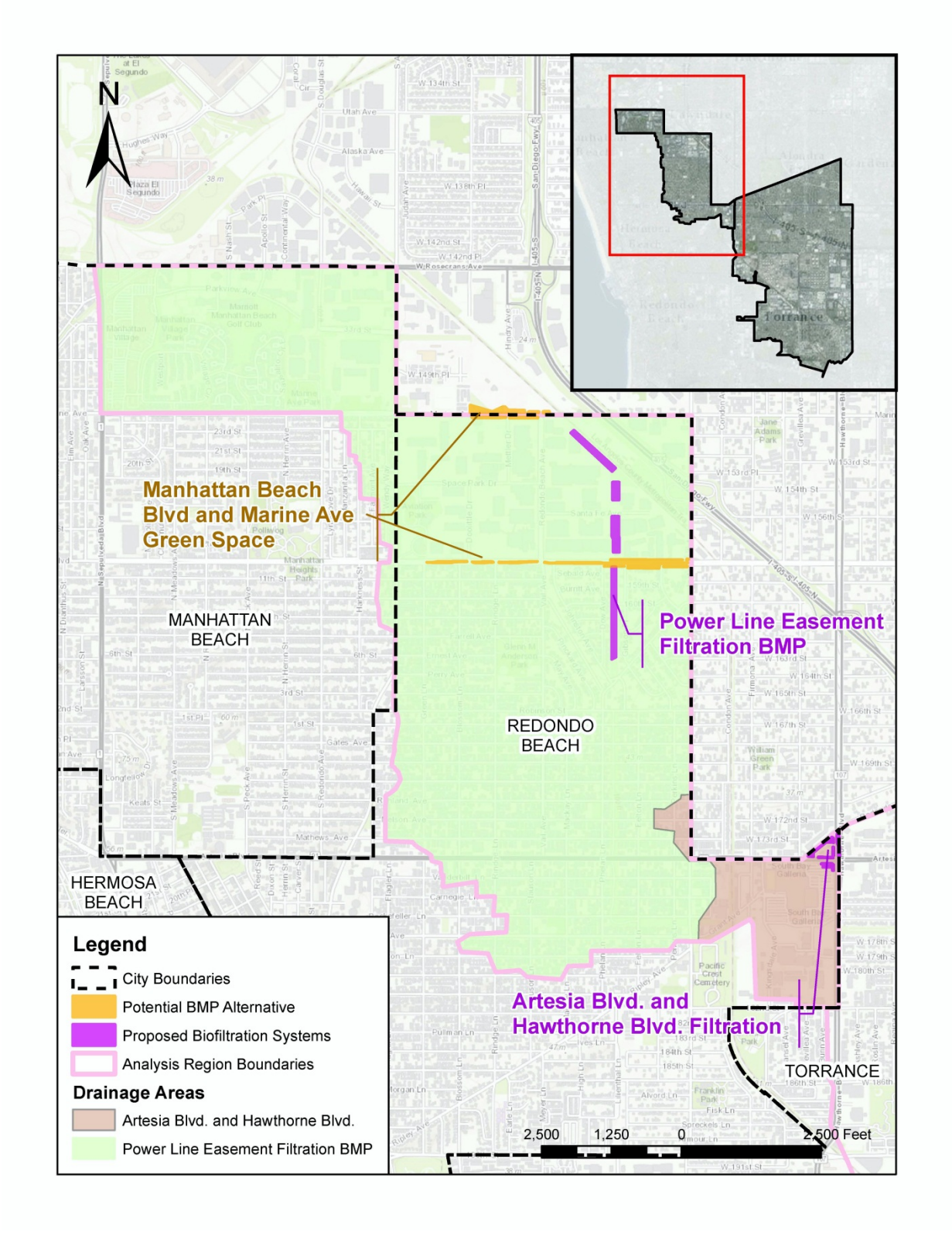


Figure 3-10. Proposed Regional BMPs, DC-RB/MB Analysis Region

Table 3-11. Parameters and Performance for Proposed Regional BMPs Modeled as Media Filters

Location of BMP	Analysis Region	Project Name	Model Assumptions						Expected Performance (load reduction as a % of analysis region baseline load)
			Design Storm (in/hr)	Treatment Flow Rate (cfs)	Average Basin Depth (ft)	Equalization Volume (cu-ft)	Diversion Flow Rate (cfs)	Infiltration Rate (in/hr)[1]	
Redondo Beach	DC-RB/MB	Powerline Easement Filtration	0.09	62	5	141,086	132	0.00001	Fecal coliform: 36% Zinc: 34% Copper: 26%
Redondo Beach	DC-RB/MB	Artesia Blvd and Hawthorne Blvd. Filtration	0.13	8.6	5	19,682	13.6	0.00001	Fecal coliform: 9% Zinc: 5% Copper: 4%

[1] Model requires some infiltration, but infiltration minimized to essentially 0.

Existing Distributed BMPs

No existing distributed BMPs were accounted for or modeled in the Dominguez Channel portion of the Beach Cities EWMP area.

Proposed Distributed BMPs

Proposed distributed BMPs are depicted in **Figure 3-8**. Distributed green streets BMPs are proposed and were modeled as part of the RAA within the DC-RB/MB analysis region, at an implementation level of 14% (i.e., runoff from 14% of single family residential, multi-family residential, commercial, and industrial land uses would be treated by green streets BMPs designed as described in Section 2.6.4).

Approximately 200 catch basin inlet filters (media filtration devices with a variety of media types and configurations such as cartridge filters, vertical bed filters, etc.) are proposed within the DC-Torrance analysis region. Infiltration of runoff is not feasible in the DC-Torrance analysis region due to the prevalence of Montezuma Clay Adobe soils. Roads represent a potentially significant source of pollutant loads, and therefore treating road runoff is considered a key strategy for multi-pollutant TMDL implementation. Implementing catch basin inlet filters throughout the DC-Torrance Watershed is highly applicable because of the high density of catch basins. The predicted load reduction attributable to catch basin inlet filters was estimated on a percent load removal basis, extracted from a review of relevant literature.

Fact sheets and literature available on commercially available catch basin inlet filters suggest that catch basin inlet filters are effective at capturing and removing pollutants from stormwater runoff including sediments, heavy metals, and bacteria. A study titled, Optimization of Stormwater Filtration at the Urban/Watershed Interface by the University of California, Irvine, Department of Environmental Health (2005), estimated a 99% removal efficiency of lead concentrations by a grate inlet skimmer box/round curb inlet basket. Another study conducted by the City of El Monte at Longo Toyota in 2002 concluded that the grate inlet skimmer box/round curb inlet baskets were effective in removing 95% of zinc and copper concentrations and 87% of lead concentrations.

A more recent independent test conducted in 2013-2014 by the City of Lake Forest showed that the tested catch basin inlet filters achieve 75% removal of heavy metals. The product tested was the Ultra Filter Sock Heavy Metal Drain Filter.

For bacteria, the 2005 UC Irvine study found a fecal coliform removal efficiency of 33% by the grate inlet skimmer box/round curb inlet basket.

In addition, the City of Torrance is in the process of developing the Green Street Program and the ordinances to implement green street design features as part of street redevelopment. While implementing redevelopment of arterial streets, the City of Torrance would assess opportunities for Green Street design features to facilitate treatment through filtration or infiltration. Green street elements may include infiltration trench that provides water quality treatment, reduction in peak flow discharges, and potential groundwater recharge. Other green street elements that may

be considered include bioretention/biofiltration practices to achieve water quality treatment through filtration by vegetation and soils to remove pollutants with perforated underdrain to convey the treated runoff. The City of Torrance is committed to developing the Green Street Policy by July 2015, as required by the MS4 Permit.

3.7 Reasonable Assurance Analysis Results

3.7.1 Discussion of Limiting Pollutants

Zinc was determined to be the controlling pollutant, therefore the cumulative BMP load reductions for copper, lead and bacteria are each greater than their respective TLRs.

3.7.2 Wet Weather

For all pollutants in the DC-RB/MB analysis region, cumulative load reductions are predicted to meet the interim and final TLRs. The non-structural BMPs achieve a relatively minor load reduction for zinc compared to the regional BMPs and the distributed green streets. After accounting for the load reductions attributed to non-modeled programmatic, public incentives and redevelopment, non-MS4 compliance, and regional BMPs, the implementation of distributed green street BMPs to treat stormwater from 14% of residential, commercial, and industrial land uses within Redondo Beach and Manhattan Beach was required to meet the zinc TLR (the limiting pollutant). **Table 3-12** below summarizes the estimated load reductions achieved by the proposed BMPs for both the interim and final compliance deadlines.

Within the DC-Torrance analysis region, cumulative load reductions are dependent on the level of implementation of the planned catch basin inlet filters. At this time, inlet filters are planned for 200 of 643 catch basins in the analysis region, targeting high priority areas. Since the estimated load reduction is applicable per filter, and not to the entire analysis region, monitoring and subsequent adaptive management will be employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed until compliance is achieved for every applicable WQBEL or RWL. At this time, the City of Torrance is not committing to any regional or distributed BMPs, aside from catch basin inlet filters and a review of green streets opportunities.

It should be noted that if at any time specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, alternative BMPs or operational changes will be planned within the same analysis region and within the same timeline, to meet an equivalent load reduction. The performance of the proposed catch basin inlet filters within the City of Torrance will also be evaluated as potential alternatives to the proposed structural BMPs within the Cities of Redondo Beach and Manhattan Beach.

Zinc

The zinc load reductions were quantified on the 90th percentile wet load day which was determined during TLR calculations (**Table 3-12**). Load reductions vary by day due to storm timing and size and due to some variability in the randomly generated pollutant concentrations in the model. To ensure that the load reductions estimated on the 90th percentile load day are not

significantly greater than typical daily load reductions, and to get an idea of the variability, the average of the daily load reductions during the 10 year modeling period were also calculated. The predicted zinc load reduction achieved on the 90th percentile load day in the DC-RB/MB analysis region is estimated to be 79%, which is greater than the TLR of 76%. Most of the zinc reduction comes from the proposed regional infiltration BMPs. For comparison, the average daily load reduction was 98%. Because the 90th percentile day has more flow than an average day, the capture rate of the BMPs would be expected to be lower on this day than for smaller storms, thereby justifying the decreased load removal on the 90th percentile day.

The estimated zinc load reduction in analysis region DC-Torrance is 85%, including both non-structural and distributed (catch basin inlet filters) BMPs, which is greater than the TLR of 76%. As noted above, the estimated load reduction cannot be applied to the entire analysis region. Therefore, adaptive management will be strongly employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed.

Copper

The copper load reductions were quantified on the 90th percentile wet load day which was determined during TLR calculations (**Table 3-12**). Similar to zinc, the average of the daily load reductions during the 10 year modeling period are also shown to account for variability. The load reduction achieved on the 90th percentile load day in the DC-RB/MB analysis region is predicted to be 85%, which is greater than the TLR of 62%.

The estimated copper load reduction in the DC-Torrance analysis region is predicted to be 89%, which also exceeds the copper TLR of 62%. As noted above, the estimated load reduction cannot be applied to the entire analysis region. Therefore, adaptive management will be strongly employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed.

Fecal Coliform

The average bacteria load reduction for TMDL year 1995 was quantified and compared to the TLR calculated for the 90th percentile critical year (1995) (**Table 3-12**). The predicted load reduction of 74% within the DC-RB/MB analysis region is greater than the TLR of 33%. Most of the reduction comes from the regional BMP filtration systems.

In the City of Torrance, the estimated bacteria load reduction is 38%, which is greater than the TLR of 33%. As noted above, the estimated load reduction cannot be applied to the entire analysis region. Therefore, adaptive management will be strongly employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed.

Lead

Although the load reductions for lead were not quantified because no load reductions were required to meet the TMDL WQBEL, the implementation of the proposed BMPs will result in similarly substantive load reductions for lead as for other metals. FAA and USEPA efforts to phase out lead from Avgas will further reduce lead in stormwater runoff in the future.

Time Series Output

Electronic input and output SWMM files and Excel summary spreadsheets will be provided to the LARWQCB upon submittal of this Draft EWMP.

Table 3-12. Dominguez Channel Watershed – RAA Results – Interim and Final Compliance

Pollutant	Date	Implementation Benefits (average load reduction as % of baseline for the critical condition[1])							TLR	Compliance (TLR Met)?
		Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level	Estimated Load Reduction		
Analysis Region DC-RB/MB										
Zinc	2032 (Final)	5%	9%	6%	39%	20%	14% SFR, MFR, COM, IND	**79%**	**76%**	Yes
Copper	2032 (Final)	24%[2]	0%	5%	30%	26%		**85%**	**62%**	Yes
Fecal coliform	2022 (Interim)	2.1%	1.5%	0.7%	0%	4.1%	3% SFR, MFR, COM, IND	**8.4%**	**8.3%**	Yes
	2027 (Interim)	3.5%	2.4%	1.3%	0%	10%	7% SFR, MFR, COM, IND	**17%**	**17%**	Yes
	2032 (Final)	5%	3.2%	1.8%	45%	20%	14% SFR, MFR, COM, IND	**74%**	**33%**	Yes
Analysis Region DC-Torrance										
Zinc	2032 (Final)	5%	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	**76%**	See note 3
Copper	2032 (Final)	14%[2]	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	**62%**	See note 3
Fecal coliform	2022 (Interim)	2.1%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**8.3%**	See note 3
	2027 (Interim)	3.5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**17%**	See note 3
	2032 (Final)	5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**33%**	See note 3

[1] The critical condition is TMDL year 1995 for fecal coliform, 11/30/2007 for copper, 2/5/2010 for lead, and 2/26/2006 for zinc.

[2] Load reduction attributable to copper brake pad phase-out, after accounting for other BMPs, up to 55%.

[3] Load reduction sum cannot be estimated at this time. The individual load reduction for each inlet filter's drainage area is shown under the "Distributed BMPs" column. Initially, 200 of 643 catch basins are planned to be retrofitted in high priority catchments. Therefore, the total load reduction from inlet filters will be evaluated in the future through monitoring, and the BMPs will be modified through the adaptive management process, with additional filters installed as necessary to meet the TLRs by the compliance deadlines.

3.7.3 Dry Weather

For dry weather, bacteria is the only applicable pollutant in the Dominguez Channel watershed, and it is a Category 2 water body-pollutant combination (i.e., 303(d)-listed but not currently subject to a TMDL).

The City of Torrance's dry weather load reduction strategy will focus on non-structural source control and pollution prevention measures that are designed to reduce the amount of pollutants and understand the effect of pollutants entering runoff though education, enforcement and behavioral modification programs.

Within the Cities of Redondo Beach and Manhattan Beach, the implementation of the two regional BMPs at both outlets from the DC-RB/MB analysis region to address wet weather pollutants will control dry weather flows by capturing the small flows in the pre-treatment volume and either retaining them or treating them in the media filter.

In addition, each of the EWMP Group cities has water conservation regulations which will reduce dry weather runoff at its source. Collectively, by controlling dry weather MS4 flows prior to entering Dominguez Channel using the proposed suite of BMPs, bacteria will be addressed. If necessary, the EWMP Group agencies retain the option of installing low flow diversions sized to effectively eliminate discharges to the receiving water year-round dry weather days. Therefore, reasonable assurance of meeting the applicable RWLs was demonstrated in this EWMP through a qualitative assessment of the proposed BMPs and their overall approach of eliminating or substantially reducing MS4 discharges during dry weather.

3.8 Multiple Benefits

The proposed projects in the Dominguez Channel watershed not only demonstrate reasonable assurance for the water quality objectives, but also provide multiple benefits beyond pollutant load reduction. Multiple benefits provided by the projects proposed in the Santa Monica Bay watershed are also applicable to those proposed in the Dominguez Channel watershed, including neighborhood greening, water conservation/supply, and public education and awareness (see Section 2.8 for more detail). However, infiltration in Dominguez Channel watershed is infeasible due to low saturated flowrates of the soil at the potential structural BMP locations; therefore, groundwater recharge is not considered an added benefit to the proposed structural BMPs in the Dominguez Channel watershed.

3.9 Parallel Compliance Efforts

During the remaining compliance period, the Beach Cities WMG may also elect to perform special studies to evaluate the Dominguez Channel Toxics TMDL WLAs and/or REC-1 indicator bacteria RWLs. For example, a reevaluation of the site-specific Water Effects Ratio (WER) used to calculate the targets for copper and zinc may result in modifications to the target load and TLR. Another example might include the application of a non-structural pollutant load reduction credit in the case that state legislation restricting zinc in manufactured rubber tires is passed. Through the adaptive management process, the RAA may be reevaluated after any changes to bacteria statewide objectives, TMDL WLAs, and/or Permit limits.

4 IMPLEMENTATION SCHEDULE

4.1 COMPLIANCE SCHEDULE

The following sections present the proposed compliance schedules and project sequencing necessary to meet the interim and final compliance deadlines for the Beach Cities EWMP WPBCs.

4.1.1 SANTA MONICA BAY WATERSHED

Bacteria, debris, and PCBs and DDTs have been identified as Category 1 WBPCs in the Santa Monica Bay Watershed. No Category 2 or 3 WBPCs are specified in this watershed. The interim and final compliance deadlines in the Santa Monica Bay watershed are summarized in **Table 4-1**.

Table 4-1. Compliance Deadlines associated with Santa Monica Bay Watershed WBPCs

Category	Pollutant(s)	Date	Action
1: Highest Priority	Dry Weather Bacteria	N/A	Final compliance in effect and attained through diversions and non-structural BMPs.
	Wet Weather Bacteria	7/15/2018	Interim: 50% single sample ED reduction
		7/15/2021	Final: Geometric Mean [GM] targets met Final: Single sample AED targets met
	Trash/Debris	3/20/2016	Interim: 20% load reduction
		3/20/2017	Interim: 40% load reduction
		3/20/2018	Interim: 60% load reduction
		3/20/2019	Interim: 80% load reduction
		3/20/2020[28]	Final: 100% load reduction
	DDTs	N/A	Since the TMDL effectively implements an anti-degradation approach (i.e., historic low MS4 concentrations or loads must be kept the same or lower), and the Beach Cities EWMP Agencies are currently presumed to be achieving the WLAs (thus negating the need for RAA), no compliance schedule is proposed.
	PCBs	N/A	
2: High Priority	N/A	N/A	N/A
3: Medium Priority	N/A	N/A	N/A

The final wet weather compliance deadline for the SMBBB TMDL is proposed to be met through a combination of non-structural, distributed green streets BMPs, and existing, planned, and proposed regional BMPs. The interim compliance deadline for the SMBBB TMDL requires a 50 percent reduction in exceedance days by July 2018; this will be met by achieving 50 percent of the

[28] Manhattan Beach will receive three additional years to meet the final deadline for having enacted all three bans specified in the TMDL prior to the stated deadline, these include bans on plastic bags, restaurant take out polystyrene, and smoking in public places.

final bacteria TLR (13.2%) on a watershed-wide basis, through a combination of non-structural BMPs including redevelopment, public retrofit incentives, non-MS4 parcels/areas NPDES Permit compliance, and programmatic BMPs, as well as and existing regional BMPs. Neither the load reductions from distributed green streets BMPs, nor planned/proposed regional BMPs, are necessary to meet the interim TLR. **Table 2-16** previously summarized the breakdown of estimated load reductions at the interim and final compliance deadlines. At the time of the interim compliance deadline, 2018, a 14.4% load reduction is estimated based on a combination of existing regional BMPs and existing and proposed non-structural BMPs, which is greater than the interim TLR of 13.2%.

Compliance with the Debris TMDL will be met through a phased retrofit of all catch basins throughout the Beach Cities EWMP Area to meet each interim and final compliance deadline.

4.1.2 Dominguez Channel Watershed

Toxicity, copper, lead, and zinc have been identified as Category 1 WBPCs in the Dominguez Channel Watershed. Additionally, indicator bacteria have been identified as a Category 2 WPBC, and cyanide, pH, selenium, mercury, and cadmium have been identified as Category 3 WBPCs. The compliance schedules associated with each WBPC are summarized in **Table 4-2**. The compliance schedule for Category 1 WBPCs is consistent with the associated TMDL. The compliance schedule for the Category 2 WBPC has been selected to achieve the proposed wet and dry weather bacteria milestones, with implementation actions not exceeding one year, in accordance with the Permit (Section ii(5)9B). As described in **Table 4-2**, the compliance schedule for the Category 3 WBPCs will be dependent on the results of the CIMP.

Table 4-2. Implementation Actions and Dates associated with Dominguez Channel Watershed WBPCs

Category	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
1: Highest Priority	Toxicity Total Copper Total Lead Total Zinc	Wet	Current	Interim: Comply with the interim water quality-based effluent limitations as listed in the TMDL
			March 2032	Final: Comply with the final water quality-based effluent limitations as listed in the TMDL
2: High Priority	Indicator Bacteria	Dry	December 2023	Interim: 50% load reduction
			December 2025[1]	Final: 100% compliance may be demonstrated by the Permittee in one of three ways: 4. Meeting the allowed exceedance days (5 days during the dry weather period); or 5. Meet the allowed exceedance percentage (1.6% during a dry weather period) within the total drainage area served by the MS4. 6. Diversions are in place such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the receiving water year-round dry weather days.
		Wet	December 2016	Provide documentation supporting MCM enhancements implemented over the past year
			December 2017	Provide documentation supporting MCM enhancements implemented over the past year
			December 2018	Identify planned green streets locations to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
			December 2019	City Council approval of Plans & Specifications for green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Begin installation of catch basin inlet filters in the DC-Torrance analysis region.
			December 2020	Develop concept reports for regional BMPs in the cities of Redondo Beach and Manhattan Beach. Begin construction on green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
			December 2021	Submit grant application for any one of the proposed regional projects in the cities of Redondo Beach and Manhattan Beach.
			December 2022	Interim Milestone: 25% of target load reduction
			December 2023	Identify planned green streets locations to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
			December 2024	Begin construction on planned green streets to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Continue installation of catch basin inlet filters in the DC-Torrance analysis region.
			December 2025	Release Request for Proposals for regional BMP designs in Redondo Beach and/or Manhattan Beach
			December 2026	Complete construction on planned green streets to treat runoff from an additional 4%

Category	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
				(7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
			December 2027	Interim Milestone: 50% of target load reduction
			December 2028	Produce regional BMP design reports; identify locations for green streets implementation to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities of Redondo Beach and Manhattan Beach.
			December 2029	Begin regional BMP permitting process for project in Redondo Beach or Manhattan Beach.
			December 2030	Begin construction on planned green streets to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities of Redondo Beach and Manhattan Beach.
			December 2031	Begin regional BMP construction of project in Redondo Beach or Manhattan Beach.
			December 2032	Final Milestone: 100% compliance may be demonstrated by the Permittee in one of three ways: 4. Meeting the allowed exceedance days (10 days during a wet weather period, plus high flow suspension days) 5. Meeting the target load reduction (33%); or 6. Meeting the allowed exceedance percentage (19% during a wet weather period) within the total drainage area served by the MS4.
3: Medium Priority	Cyanide pH Selenium Mercury Cadmium	N/A	N/A	As required by the Permit, monitoring for these pollutants will occur under the CIMP. If monitoring data suggest that the Beach Cities Agencies' MS4s may cause or contribute to exceedances of these pollutants in the receiving water, these contributions will be addressed through modifications to the EWMP as a part of the adaptive management process, as described in Permit section VI.C.2.a.iii.

[1] The final compliance date for dry weather bacteria was selected to be consistent with the draft TMDL for indicator bacteria in the San Gabriel River, Estuary and Tributaries, adopted by the LARWQCB in 2015, which requires that compliance is achieved with applicable MS4 WLAs 10 years after the effective date of the TMDL (Water Quality Control Plan, Attachment A to Resolution No. R15-0xx, adopted by the RWQCB in 2015).

[2] The final compliance date for wet weather bacteria was selected to be consistent with the Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters Toxic Pollutants TMDL (RWQCB, 2011).

[3] This will be assumed to be the case if monitoring data show that outfall concentrations and receiving water concentrations are in excess of the applicable water quality criteria for the same monitoring event.

Table 3-12 previously summarized the load reductions achieved for the quantified WBPCs for the interim and final compliance deadlines.

Zinc has been identified as the controlling pollutant for BMP implementation, as it would likely produce load reductions for the other pollutants greater than their individual TLRs. Therefore, it is assumed that the nonstructural and structural BMPs proposed to meet the zinc final TLR by 2032 would also achieve compliance with the other metals TLRs. Therefore, distributed green streets BMPs at a final implementation level of 14%[29] and all regional BMPs are planned to be implemented no later than 2032 (with the exception of the Powerline Easement Project, as discussed below). At the time of the proposed final compliance deadline (2032), the proposed projects result in a 79% (DC-RB/MB analysis region) to 80% (DC-Torrance analysis region) load reduction, both of which are greater than the TLR of 76%. Copper TLRs are also proposed to be met in both analysis regions, in combination with the adaptive management approach discussed previously.

For bacteria, within the DC-RB/MB analysis region, the proposed final wet weather compliance deadline of December 2032 is proposed to be met through the suite of non-structural and structural BMPs, including distributed green streets BMPs at a 14% implementation level[30]. At the time of the proposed final compliance deadline (2032), this implementation plan results in a load reduction of 74% in analysis region DC-RB/MB, which is greater than the TLR of 33%. A 38% bacteria load reduction is estimated in the DC-Torrance analysis region. As shown in **Table 3-12**, the interim deadlines for bacteria are also proposed to be met through a combination of non-structural and distributed green streets BMPs, phased in over the compliance period.

It should be noted that although the inlet filters proposed in the DC-Torrance analysis region are not planned for 100% of catch basins (200 of 643 are currently planned in high priority drainage areas), the achieved load reduction will be evaluated through adaptive management, with additional filters to be installed as necessary to meet the TLRs by the specified compliance deadlines.

4.2 Project Sequencing

In order to meet the compliance deadlines for the WBPCs discussed above based on load reduction projections in the RAA, the proposed structural BMPs within the Santa Monica Bay and Dominguez Channel Watersheds would be implemented per the timeline provided in **Figure 4-1**.

[29] An "implementation level" of 14% is defined here to mean that runoff from 14% of land use areas (commercial, single family residential, multi-family residential, and industrial land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

[30] An "implementation level" of 7% is defined here to mean that runoff from 7% of land use areas (commercial, single family residential, multi-family residential, and industrial land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

Figure 4-1. Proposed Project Sequencing

	BMP Location/Name	Timeline																	
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Santa Monica Bay Watershed	Catch basin retrofits																		
	Manhattan Beach Infiltration Trench*																		
	Green streets application in SMB-5-02																		
	Hermosa Beach Greenbelt Infiltration*																		
	Hermosa Beach Infiltration Trench																		
	Park #3																		
	Green streets application in SMB-6-01																		
Dominguez Channel Watershed	Catch basin inlet filters in DC-Torrance																		
	Green streets application in DC-RB/MB																		
	Powerline Easement Filtration*																		
	Artesia Boulevard and Hawthorne Boulevard Filtration																		

*Alternative project locations have also been identified

5 ASSESSMENT AND ADAPTIVE MANAGEMENT FRAMEWORK

Adaptive management is a critical component of the EWMP implementation process, and EWMP updates are required at two-year cycles by the Permit. The CIMP will gather additional data on receiving water conditions and stormwater/non-stormwater quality. These data will support adaptive management at multiple levels, including: (1) tracking improvements in water quality over the course of EWMP implementation and (2) generating data not previously available to support model updates. Furthermore, over time, the experience gained through intensive BMP implementation will provide lessons learned to support modifications to the control measures identified in the EWMP.

The adaptive management process also includes a schedule for developing and reporting on the EWMP updates, the approach to conducting the updates, and the process for implementing any modifications to the RAA and EWMP to reflect the updates.

The adaptive management approach for the Beach Cities EWMP area is designed to address the EWMP planning process and the relationship between monitoring, scheduling, and BMP planning. The adaptive management process outlines how the EWMP will be modified in response to monitoring results, updated modeling results, and lessons learned from BMP implementation. It is designed to accomplish three goals:

1. Clarify the short-term and long-term commitments of the Beach Cities WMG within the EWMP.
2. Provide a structured decision-making process for modifications to the EWMP based on the results of monitoring data.
3. Propose a structure for evaluating compliance with water-quality based permit requirements within an adaptive structure.

As outlined in Section 4, the schedule and milestones for the EWMP have been designed around meeting the interim and final TMDL requirements for bacteria and metals. While the EWMP identifies actions that will lead to compliance with the final TMDL limitations, the specific actions taken will be informed by monitoring data collected under the CIMP, special studies that may be conducted during implementation, and any applicable regulatory changes that could influence the remaining interim and final milestones and schedule. For example, the Statewide Bacteria Amendments have the potential to modify water quality objectives in the Ocean Plan and Basin Plan, as well as the TMDL WLAs and their WQBEL and/or RWL expressions in the Permit. These changes could affect the required load reductions for bacteria as well as the watershed control measures identified herein.

Monitoring data will be utilized to measure progress towards achieving RWLs and WQBELs. An evaluation of monitoring data will be carried out on a biennial basis in accordance with **Figure 5-1** to determine if modifications to the EWMP are necessary. Modifications that are warranted because final milestones are achieved *more quickly* than anticipated can be made at any time (i.e. no more actions are needed if fewer control measures result in meeting RWLs and/or WQBELs).

Modifications that are warranted because insufficient progress is being made will be noted every two years in the annual report and a schedule for implementation will be provided. A full update to the EWMP and the RAA is not anticipated as the schedule for bacteria compliance is only six years long. Updating the EWMP and RAA is a significant and costly undertaking that is not necessary unless conditions change significantly and additional modeling is needed to inform implementation decisions. However, at any point, the Beach Cities Agencies could choose to update the EWMP and the associated RAA, particularly if deemed appropriate based on monitoring data.

If at any point during the implementation period any of the permit conditions are modified in response to a regulatory action, TMDL modification, or local studies, the receiving water and outfall monitoring data will be compared to the new RWLs and WQBELs. The same procedure will be followed for evaluating the data and adapting the EWMP, but the new RWLs and WQBELs will be used for the analysis.

The process outlined in **Figure 5-1** applies during the implementation period for the EWMP. At the end of the implementation period for the TMDLs, if the final RWL and/or WQBELs are not being met, either the TMDL must be modified to adjust the schedule or the permittees will need to apply for a Time Schedule Order or other mechanism to get an extension of the compliance deadlines.

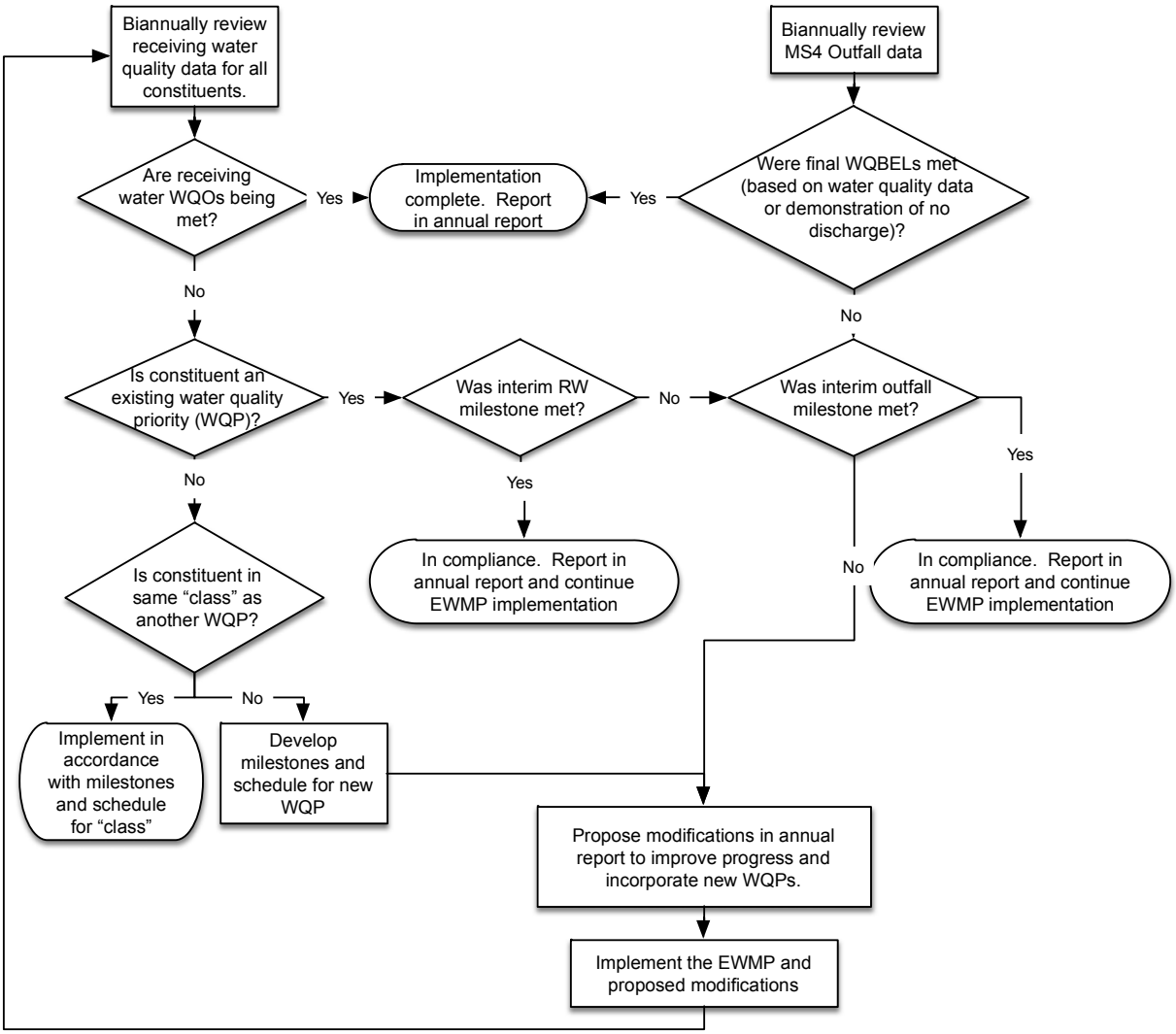


Figure 5-1. Adaptive Management Approach

6 FINANCIAL ANALYSIS

In June of 2014, the Beach Cities WMG submitted the Beach Cities EWMP Work Plan to the LARWQCB (Beach Cities WMG, 2014). The EWMP Work Plan described the approach to cost estimation and scheduling for the EWMP, which is addressed in this section. This section provides an order-of-magnitude estimate of the financial resources that may be required to attain compliance with the 2012 MS4 Permit's RWLs and WQBELs, as well as a recommended project scheduling in order to meet TMDL compliance deadlines and interim deadlines. Planning-level cost opinions associated with implementation of the proposed structural BMPs within the Beach Cities WMG area are provided based on RAA results.

Cost opinions are presented as an aid for decision makers, and contain considerable uncertainties. Given the iterative and adaptive nature of the EWMP and the many variables associated with the projects, the budget forecasts are order-of magnitude opinions, and are subject to change based on site-specific BMP feasibility assessment findings, preliminary and final BMP designs and landscaping, BMP effectiveness assessments, results of outfall and receiving water monitoring, and special studies such as those that might result in site specific objectives which could modify water quality objectives or TMDL Waste Load Allocations for a specific WBPC.

A financial strategy and details regarding potential funding sources and programs to support the financial resources required for the structural BMPs being proposed in the EWMP are also provided herein. These funding sources and programs may be utilized depending on applicability and feasibility.

6.1 BMP COST METHODOLOGY AND ASSUMPTIONS

6.1.1 HARD COST ASSUMPTIONS

Costs estimated for structural BMPs include "hard" costs for tangible assets and are determined using a line item unit cost approach, which separately accounts for each material cost element required for the installation of a given BMP. Quantities for each line item were calculated based on BMP storage/treatment volumes and typical design configurations. A safety factor was applied to the BMP footprints for calculation of design parameters, for both the low and high cost estimates. Unit costs were taken from RS Means[31], past projects based in Southern California, recent construction cost/bid information, and vendors. Line item unit costs of the proposed structural BMPs are included in **Appendix O**. Since the majority of proposed BMPs were located on publicly owned land to reduce land acquisition costs to the extent possible, land acquisition costs were not considered as part of this analysis.

6.1.2 SOFT COST ASSUMPTIONS

[31] RS Means is a unit cost database that is updated annually (http://www.rsmeansonline.com/). When costs from literature are not available project's design criteria and unit costs from the database were used to estimate the project's cost.

Structural BMP cost opinions also include "soft" costs, which include considerations such as design and permitting. Soft costs are project costs that cannot be calculated on a unit cost basis. For conceptual cost estimating, these costs are generally calculated as a percentage of total capital costs. The soft costs considered for each BMP were:

- **Utility Realignment**— Costs associated with the relocation of utilities that are located within the proposed BMP footprint or inhibit construction activities.
- **Mobilization and Demobilization** – The costs associated with activation/deactivation of equipment and manpower resources for transfer to/from a construction site until completion of the contract.
- **Planning, Permitting, Bond, and Insurance Costs** – Cost, including planning and permit fees and personnel hours, of obtaining required permits for BMP installation. Examples of permits needed may include erosion and sediment control, stormwater, construction, and public space permits. Potential bond and insurance costs are also included.
- **Engineering and Planning** – Costs associated with BMP and site design, as well as access for maintenance, environmental mitigation, buried objects, safety/security, traffic control, limited space, and site restoration.
- **Construction Management** – The costs associated with management and oversight of the construction of the BMP, from project initiation until completion of the contract.

Estimated soft costs as percent of total project capital costs are presented in **Table 6-1**. These percentages were based on literature, best professional judgment, and data from past projects (Brown and Schueler, 1997; International Cost Engineering Council, 2014).

Table 6-1. Range of Soft Costs for Proposed Structural BMP Projects as a Percent of Capital

Cost Item	Cost Range	
	Low	High
Utility Realignment	0%	3%
Mobilization/Demobilization[1]	3%	10%
Planning, permitting, bond, and insurance costs	5%	10%
Engineering and Planning	20%	40%
Construction Management	8%	15%

[1] $2,000 minimum fee

6.1.3 Operations and Maintenance

Annual Operations and Maintenance (O&M) costs were assumed to be two percent of the capital cost for subsurface infiltration basins, two percent of the capital cost for sub-surface biofilters, five percent of the capital cost for subsurface infiltration trenches, and six percent of the capital cost for green streets (USEPA, 2005; Weiss et al., 2007). O&M opinions for underground infiltration basins include cleaning and removal of debris after major storm events, mowing and maintenance of surface vegetated areas, and sediment cleanout. O&M necessary for maintaining

sub-surface biofilters includes landscape maintenance, media and gravel replacement once clogged when surface scarification is no longer effective, pest control, sediment and pre-treatment cleanout. O&M for underground infiltration trenches includes cleaning and removal of debris, repairs to inlet/control structures, and pre-treatment cleanup. O&M for green streets includes repairs to eroded areas, incremental landscape maintenance, media and gravel replacement once clogged and surface scarification is no longer effective, removal of trash and debris, and removal of aged mulch with installation of a new layer. O&M costs have been summarized as 20-year lifecycle costs, with no discounting applied, also including post-construction monitoring.

Additional maintenance will be necessary after the 20-year lifecycle. Extended maintenance for subsurface infiltration includes excavation and washing of all drain rock on a 25-year cycle and is estimated to be approximately 60 percent of capital costs. All drainage elements should be replaced on a 50-year cycle, at approximately 125 percent of capital costs. Cisterns should be replaced after a useful life of approximately 50 years, at 125 percent of the capital cost. Green streets should be excavated, disposing of existing soil media, and backfilled with new soil media every 25 to 50 years at approximately 90 percent of capital costs.

Typical maintenance for trash exclusion devices includes removal of trash and sediment, and catch basins should be cleaned at a minimum of once or twice per year. Trash exclusion devices can be plugged if they are overloaded with sediment or debris, greatly reducing their efficiency. Inspection and cleanout is recommended after major storm events, or storms with a rainfall intensity of greater than one inch in 12 hours.

6.1.4 *Additional Design Assumptions*

Additional design details were assumed for the purpose of the cost estimation presented herein, including, but not limited to:

- The percentage of excavated material requiring hauling;
- The type and length of BMP inflow and outflow conveyance structures;
- The type and quantity of vegetation required for the post-BMP condition;
- The percentage of the parcel area requiring hydroseeding for the post-BMP condition;
- The type of pre-treatment used for each BMP.

6.2 Proposed Structural BMPs

As previously described, regional and distributed structural BMP options are proposed to achieve compliance with the RWLs and WQBELs. **Table 6-2** summarizes the basic, concept-level design assumptions for each of the proposed structural BMPs which formed the basis for the conceptual cost opinions.

Table 6-2. Proposed BMP Design Assumptions for Conceptual Cost Opinions

Analysis Region	BMP Name	BMP Description	Storage Volume (cu-ft)	Tributary Area (acres)
SMB-5-02	Manhattan Beach Infiltration Trench – Alternative 1	Located along the coast of Manhattan Beach, the sub-surface trench has a potential surface area of 2 ac, an average depth of 2 ft with a diversion rate of 160 cfs and an infiltration rate under the trench of 13 in/hr.	198,000	1,475[1]
SMB-5-02	Manhattan Beach Infiltration Trench – Alternative 2	Located along the coast of Manhattan Beach, the sub-surface trench has a potential surface area of 1.6 ac, an average depth of 2 ft with a diversion rate of 128 cfs and an infiltration rate under the trench of 13 in/hr.	158,400	1,475[1]
SMB-5-02	Polliwog Park Infiltration Gallery – Alternative 2	Located adjacent to Manhattan Beach Boulevard in Manhattan Beach, the sub-surface infiltration gallery has a potential surface area of 1 ac, an average depth of 4 ft, a diversion flowrate of 11 cfs, and an infiltration rate of 0.74 in/hr.	148,100	470
SMB-5-02	Distributed Green Streets – Alternative 1	The distributed green streets, proposed to address runoff from 5% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	205,500	66
SMB-5-02	Distributed Green Streets – Alternative 2	The distributed green streets, proposed to address runoff from 5% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	142,100	45
SMB-6-01	Hermosa Beach Infiltration Trench	Located along the coast of Hermosa Beach, the sub-surface trench has a potential surface area of 0.2 ac, an average depth of 1.7 ft, a diversion flowrate of 25 cfs, and an infiltration rate of 12.5 in/hr.	13,300	2,000[1]
SMB-6-01	Hermosa Beach Greenbelt Infiltration[2]	Located between Valley Dr. and Ardmore Ave., the sub-surface trench has a potential surface area of 1.5 ac, an average depth of 5 ft, a diversion flowrate of 48 cfs, and an assumed infiltration rate of 12 in/hr.	319,000	1,800[1]

Analysis Region	BMP Name	BMP Description	Storage Volume (cu-ft)	Tributary Area (acres)
SMB-6-01	Park #3	Located northwest of Blossom Lane and 190th street, the sub-surface infiltration basin has a potential surface area of 0.5 ac, an average depth of 5ft , a diversion flowrate of 13 cfs, and an infiltration rate of 1 in/hr.	87,000	1,430[1]
SMB-6-01	Distributed Green Streets	The distributed green streets, proposed to address runoff from 25% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	605,200	190
SMB 5-02, SMB 6-01, DC – MB/RB	Trash exclusion devices	The City of Redondo Beach plans to retrofit 1,085 catch basins (634 of which are County-owned), the City of Hermosa Beach will retrofit 151 (79 of which are County-owned), and the City of Manhattan Beach plans to retrofit 640 (200 of which are County-owned) catch basins. All cities will retrofit catch basins with automatic retractable screens (ARS) and connector pipe screen full capture trash systems (CPS).	N/A	-
DC – MB/RB	Powerline Easement and Manhattan Beach Blvd Infiltration	Located along powerline easements and/or adjacent to Marine Avenue and Manhattan Beach Boulevard, the sub-surface biofilter has a potential surface area of 7.2 ac, an average depth of 5 ft, a diversion flowrate of 132 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	1,500
DC – MB/RB	Artesia Blvd. and Hawthorne Blvd. Filtration	Located near the intersection of Artesia Blvd. and Hawthorne Blvd., the sub-surface biofilter has a potential surface area of 1 ac, an average depth of 5 ft, a diversion flowrate of 13.6 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	130
DC-MB/RB	Distributed Green Streets	The distributed green streets are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	636,300	200
DC-Torrance	Catch basin inlet filters	The City of Torrance plans to retrofit 200 of 643 catch basins with inlet filters.	N/A	5,760

[1] This includes upstream BMPs and associated tributary drainage areas
[2] Alternative project locations have also been identified

6.2.1 Cost Opinion - SMB Watershed - Analysis Region SMB-5-02

For the SMB subwatershed tributary to compliance monitoring location SMB-5-02, two implementation alternatives were identified in the RAA. Alternative 1 includes the Manhattan Beach Infiltration Trench and distributed green streets at a 5% application rate[32]. Alternative 2 includes a reduced volume of the Manhattan Beach Infiltration Trench (i.e., reducing the volume by approximately 20%), the Polliwog Park Infiltration Gallery project, and distributed green street BMPs at a 5% application rate.

Table 6-3 outlines the costs associated with Alternative 1 and **Table 6-4** outlines the costs associated with Alternative 2. Based on projected cost alone, Alternative 1 (larger beach infiltration trench, without Polliwog Park project) is the preferred option, however a preliminary engineering study is needed to verify the feasibility of Alternative 1 so Alternative 2 is included to demonstrate an alternate approach to reasonable assurance. Trash exclusion devices will also be implemented in the SMB 5-02 analysis region. These costs were determined for each city (Redondo Beach, Manhattan Beach, and Hermosa Beach) and are presented in Section 6.2.5.

Further cost opinion details are provided in **Appendix O**.

[32] An "application rate" of 5% is defined here to mean that 5% of RAA-specified land use areas (commercial, single family residential, and multi-family residential land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

Table 6-3. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region SMB-5-02, Alternative 1

Project Name	Manhattan Beach Infiltration Trench		Distributed Green Streets	
Location of BMP	**Manhattan Beach**		**Manhattan Beach**	
Cost Range	**Low**	**High**	**Low**	**High**
Capital Subtotal	$2,700,000	$3,800,000	$1,800,000	$3,600,000
Utility Realignment	$0	$110,000	$0	$110,000
Mobilization/Demobilization	$81,000	$380,000	$53,000	$360,000
Planning, permitting, bond, and insurance costs	$140,000	$380,000	$89,000	$360,000
Engineering and Planning	$540,000	$1,500,000	$350,000	$1,500,000
Construction Management	$220,000	$570,000	$140,000	$550,000
Total Estimated Project Construction Cost	**$3,700,000**	**$6,800,000**	**$2,400,000**	**$6,500,000**
Annual O&M	$140,000	$190,000	$110,000	$220,000
Total 20-year Lifecycle Cost	**$6,100,000 (low) to $13,000,000 (high)**			

Table 6-4. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region SMB-5-02, Alternative 2

Project Name	Manhattan Beach Infiltration Trench		Polliwog Park Infiltration Gallery		Distributed Green Streets	
Location of BMP	**Manhattan Beach**		**Manhattan Beach**		**Manhattan Beach**	
Cost Range	**Low**	**High**	**Low**	**High**	**Low**	**High**
Capital Subtotal	$2,200,000	$3,300,000	$2,100,000	$2,500,000	$1,200,000	$2,500,000
Utility Realignment	$0	$98,000	$0	$74,000	$0	$75,000
Mobilization/Demobilization	$67,000	$330,000	$64,000	$250,000	$37,000	$250,000
Planning, permitting, bond, and insurance costs	$110,000	$330,000	$110,000	$250,000	$61,000	$250,000
Engineering and Planning	$450,000	$1,300,000	$430,000	$990,000	$240,000	$1,000,000
Construction Management	$180,000	$490,000	$170,000	$370,000	$98,000	$380,000
Total Estimated Project Construction Cost	**$3,000,000**	**$5,800,000**	**$2,900,000**	**$4,400,000**	**$1,700,000**	**$4,500,000**
Annual O&M	$110,000	$160,000	$43,000	$50,000	$73,000	$150,000
Total 20-year Lifecycle Cost	**$7,600,000 (low) to $15,000,000 (high)**					

6.2.2 Cost Opinion - SMB Watershed – Analysis Region SMB-6-01

The RAA within analysis region SMB-6-01 predicts that the TLR will be met with reasonable assurance through implementation of the proposed Hermosa Beach Infiltration Trench, Hermosa Beach Greenbelt Infiltration, Park #3, and a combination of green street BMPs at an application rate of 25%[33]. **Table 6-5** outlines the costs associated with this structural BMP combination which, when implemented with the existing structural regional BMPs and non-structural control measures[34] detailed in the RAA modeling efforts, will achieve TLR compliance at CML SMB-6-01.

Trash exclusion devices will also be implemented in the SMB 6-01 analysis region. These costs were determined for each city (Redondo Beach, Manhattan Beach, and Hermosa Beach) and are presented in Section 6.2.5. Further cost estimate details are provided in **Appendix O.**

[33] An "application rate" of 25% is defined here to mean that runoff from 25% of RAA-specified land use areas (commercial, single family residential, and multi-family residential land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

[34] Non-structural control measures include redevelopment, public retrofit incentives, non-MS4 parcels/areas, and programmatic BMPs.

Table 6-5. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region SMB-6-01

Project Name	Hermosa Beach Infiltration Trench		Hermosa Beach Greenbelt Infiltration		Park #3		Distributed Green Streets	
Location of BMP	**Hermosa Beach**		**Hermosa Beach or Redondo Beach**		**Redondo Beach**		**Hermosa Beach, Manhattan Beach, Redondo Beach, Torrance**	
Cost Range	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Capital Subtotal	$370,000	$640,000	$4,100,000	$4,500,000	$1,400,000	$1,700,000	$5,200,000	$11,000,000
Utility Realignment	$0	$19,000	$0	$130,000	$0	$50,000	$0	$320,000
Mobilization/Demobilization	$11,000	$64,000	$120,000	$450,000	$42,000	$170,000	$160,000	$1,100,000
Planning, permitting, bond, and insurance costs	$18,000	$64,000	$200,000	$450,000	$70,000	$170,000	$260,000	$1,100,000
Engineering and Planning	$74,000	$260,000	$810,000	$1,800,000	$280,000	$660,000	$1,000,000	$4,200,000
Construction Management	$29,000	$96,000	$320,000	$670,000	$110,000	$250,000	$410,000	$1,600,000
Total Estimated Project Construction Cost	**$500,000**	**$1,100,000**	**$5,500,000**	**$8,000,000**	**$1,900,000**	**$3,000,000**	**$7,000,000**	**$19,000,000**
Annual O&M	$18,000	$32,000	$81,000	$90,000	$28,000	$33,000	$310,000	$640,000
Total 20-year Lifecycle Cost	**$15,000,000 (low) to $31,000,000 (high)**							

6.2.3 Cost Opinion - Dominguez Channel Watershed – Analysis Region DC-RB/MB

According to the Beach Cities RAA model analysis of the Redondo Beach and Manhattan Beach areas within the Dominguez Channel watershed, it is predicted that the TLR will be met with reasonable assurance through implementation of the proposed Powerline Easement Infiltration Project, Artesia Boulevard Infiltration Project, and a combination of green street BMPs at an application rate of 14%[35]. **Table 6-6** outlines the costs associated with these proposed projects which, when implemented with non-structural control measures[36] detailed in the RAA modeling efforts, are predicted to achieve TLR compliance within the Manhattan Beach and Redondo Beach areas within the Dominguez Channel watershed.

Trash exclusion devices will also be implemented in the DC-RB/MB analysis region. These costs were approximated for each city (Redondo Beach, Manhattan Beach, and Hermosa Beach) and are presented in Section 6.2.5. Further cost estimate details are provided in **Appendix O.**

[35] An "application rate" of 14% is defined here to mean that runoff from 14% of RAA-specified land use areas (commercial, single family residential, and multi-family residential land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

[36] Non-structural control measures include redevelopment, public retrofit incentives, non-MS4 parcels/areas, and programmatic BMPs.

Table 6-6. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region DC-RB/MB[1]

Project Name	Powerline Easement Infiltration		Artesia Blvd Infiltration		Distributed Green Streets	
Location of BMP	**Redondo Beach**		**Redondo Beach**		**Redondo Beach/Manhattan Beach**	
Cost Range	**Low**	**High**	**Low**	**High**	**Low**	**High**
Capital Subtotal	$8,200,000	$9,200,000	$1,500,000	$1,800,000	$5,500,000	$11,000,000
Utility Realignment	$0	$270,000	$0	$53,000	$0	$340,000
Mobilization/Demobilization	$250,000	$920,000	$45,000	$180,000	$160,000	$1,100,000
Planning, permitting, bond, and insurance costs	$410,000	$920,000	$75,000	$180,000	$270,000	$1,100,000
Engineering and Planning	$1,600,000	$3,700,000	$300,000	$710,000	$1,100,000	$4,500,000
Construction Management	$660,000	$1,400,000	$120,000	$260,000	$440,000	$1,700,000
Total Estimated Project Construction Cost	**$11,000,000**	**$16,000,000**	**$2,000,000**	**$3,100,000**	**$7,400,000**	**$20,000,000**
Annual O&M	$160,000	$180,000	$30,000	$35,000	$330,000	$670,000
Total 20-year Lifecycle Cost	**$20,000,000 (low) to $39,000,000 (high)**					

[1] Costs for the Powerline Easement Infiltration project and Artesia Boulevard Infiltration project were estimated based on cost information for lined biofilters with engineered media; the design elements of which cover a range of infiltration options.

6.2.4 Cost Opinion - Dominguez Channel Watershed – Analysis Region DC-Torrance

An analysis of the proposed catch basin inlet filters predicts an estimated load reduction attributable to each inlet filter installed. **Table 6-7** outlines the approximate high and low capital and O&M costs associated with 200 retrofits. Further cost estimate details are provided in **Appendix O**.

Table 6-7. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region DC-Torrance

Project Name	Catch Basin Inlet Filters	
Location of BMP	**Torrance**	
Cost Range	**Low**	**High**
Capital Subtotal	$240,000	$360,000
Total Estimated Project Construction Cost	**$240,000**	**$360,000**
Annual O&M	$130,000	$170,000
Total 20-year Lifecycle Cost	**$2,840,000 (low) to $3,760,000 (high)**	

6.2.5 Cost Opinion – Trash Exclusion Devices – All Analysis Regions

The Cities of Manhattan Beach, Redondo Beach, and Hermosa Beach plan to retrofit catch basins with trash exclusion devices (either automatic retractable screens [ARSs] and/or connector pipe screen [CPS] full capture trash systems in the Santa Monica Bay watershed). The City of Redondo Beach plans to retrofit 1,085 catch basins (634 of which are County-owned), the City of Hermosa Beach will retrofit 151 catch basins (79 of which are County-owned), and the City of Manhattan Beach plans to retrofit 640 catch basins (200 of which are County-owned) catch basins. These catch basin retrofits will be located in SMB-5-02, SMB-6-01, as well as in the other analysis regions in SMB; these catch basin retrofits will work in combination with other regionally sited BMPs. The City of Torrance has substantially completed retrofit of its Santa Monica Bay watershed area through several recent grant funded projects so costs for City of Torrance trash exclusion devices are not included. Not included in these costs are the retrofits of catch basins in high priority areas of Dominguez Channel to meet the MCMs in the MS4 Permit for areas without trash TMDLs.

Table 6-8 outlines the costs associated with these retrofits, as approximated by each city. Annual O&M costs for trash exclusion devices reflect additional costs for cleaning the inserts/screens only. An estimate of current costs spent to clean non-retrofitted catch basins was subtracted from the annual O&M estimate, resulting in annual O&M required for the addition of the inserts/screens only. Further cost estimate details are provided in **Appendix O**.

Table 6-8. Estimated Construction and O&M Costs for Catch Basin Retrofits

Location of BMP	Hermosa Beach		Redondo Beach		Manhattan Beach	
Cost Range	**Low**	**High**	**Low**	**High**	**Low**	**High**
Capital Subtotal[1]	$110,000	$370,000	$790,000	$2,600,000	$470,000	$1,600,000
Mobilization[2]	$5,500	$18,000	$40,000	$130,000	$23,000	$78,000
Permitting[3]	$40,000	$40,000	$320,000	$320,000	$100,000	$100,000
Total Estimated Project Construction Cost	**$160,000**	**$430,000**	**$1,100,000**	**$3,100,000**	**$590,000**	**$1,700,000**
Annual O&M	$50,000	$64,000	$360,000	$460,000	$210,000	$270,000
Total 20-year Lifecycle Cost	**$1,900,000 (low) to $5,200,000 (high)**					

[1] Includes cost of both ARS and CPS

[2] 5% of capital subtotal cost

[3] $500 for each County-owned catch basin only

6.2.6 Summary of Cost Opinions

Table 6-9 summarizes the total 20-year life-cycle cost opinions for each proposed structural BMP, which are composed of the cost to construct or implement each structural BMP plus the associated annual O&M costs over 20 years. In order to account for possible variations in BMP design, BMP configurations, and site-specific constraints, as well as for uncertainties in available BMP unit costs from literature or estimated BMP unit costs, a range of costs is presented. **Table 6-9** includes combined costs for proposed structural BMPs by analysis region and by watershed. Not included in these costs are the annual monitoring costs for implementing the CIMP or the costs associated with implementing baseline and enhanced MCMs.

From the analysis of potential costs in this section as summarized in **Table 6-9**, it is clear that projected costs of implementing the EWMP are substantial and orders of magnitude higher than have previously been expended by the agencies under the previous MS4 Permit. Thus availability of funds will be critical for the implementation of the EWMP. Currently, the Beach Cities do not have sufficient funds or dedicated funding streams to construct and maintain the projects proposed in this EWMP.

The Beach Cities agencies are working with the Los Angeles County Division of the League of California Cities and the California Contract Cities Association to partner with other affected agencies to collectively influence State policies, pursue changes in legislation and lobby high level officials for additional stormwater funding. Working together with the other cities will increase effectiveness, communication, collaboration, and reduce redundant efforts. The LACFCD will also work with the Beach Cities WMG in their efforts to address source controls; assess, develop, and pursue funding for structural BMPs, and promote the use of water reuse and infiltration. As regional project scopes are further refined, the LACFCD will determine on a case-by-case basis their contribution to the projects.

In addition to working with other affected cities on a regional level, the Beach Cities WMG individually and collaboratively are committed to pursue funding sources at a local level including but not limited to:

- *Grants* - Collaboration and coordination between the Beach Cities will be important to increase accessible grant funding opportunities for stormwater projects, however alternative funding sources will also be needed to provide stable O&M revenues since grants typically do not provide for O&M.
- *Interagency Partnerships* – Interagency partnerships, like the Beach Cities WMG, can allow agencies to leverage local funding resources to make cost intensive projects possible.
- *Local Bond Issuance* - Two types of local bonds can be utilized. General Obligation (GO) bonds are issued by local governments and repaid through a property tax surcharge. Revenue bonds are tax-exempt securitized bonds repaid through utility rate increases charged directly to customers.
- *Local Stormwater Assessments* - Stormwater charges are potentially the most critical local funding source to finance stormwater programs. These charges include stormwater fees and taxes.

- *Direct Subsidies* - Direct financial subsidies to local projects do not contribute to cash revenue generation. However, subsidies can create a financial incentive to encourage local participation without providing the full cost for project implementation. Such an approach can increase financial efficiency by leveraging financial input from communities.

These potential sources of funding are discussed in greater detail in Section 7.

6.2.7 *Closing Discussion*

In concluding its review of the LA MS4 Permit in response to petitions on the order, the SWRCB acknowledges that:

> "Addressing the water quality impacts of municipal storm water is a complex and difficult undertaking, requiring innovative approaches and significant investment of resources. We recognize and appreciate the commendable effort of the Los Angeles Water Board to come up with a workable and collaborative solution to the difficult technical, policy, and legal issues, as well as the demonstrated commitment of many of the area's MS4 dischargers and of the environmental community to work with the Los Angeles Water Board in the development and implementation of the proposed solution. We also recognize the extensive work that interested persons from across the state, including CASQA, have invested in assisting us in understanding how the watershed-based alternative compliance approach developed by the Los Angeles Water Board may inform statewide approaches to addressing achievement of water quality requirements. While storm water poses an immediate water quality problem, we believe that a rigorous and transparent watershed-based approach that emphasizes low impact development, green infrastructure, multi-benefit projects, and capture, infiltration, and reuse of storm water is a promising long-term approach to addressing the complex issues involved. We must balance requirements for and enforcement of immediate, but often incomplete, solutions with allowing enough time and leeway for dischargers to invest in infrastructure that will provide for a more reliable trajectory away from storm water-caused pollution and degradation. We believe that the Los Angeles MS4 Order, with the revisions we have made, strikes that balance at this stage in our storm water programs, but expect that we will continue to revisit the question of the appropriate balance as the water boards' experience in implementing watershed-based solutions to storm water grows." [Revised draft Order, April 24, 2015, p.86-87 conclusion][37]

[37] Revised Draft April 24, 2015. State of California State Water Resources Control Board Order WQ 2015-XX In the Matter of Review of Order No. R4-2012-0175, NPDES Permit No. CAS004001 Waste Discharge Requirements for the Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4. Issued by the California Regional Water Quality Control Board, Los Angeles Region. SWRCB/OCC Files A-2236(a)-(kk).

The SWRCB also states that:

> "The WMP/EWMP provisions constitute an effort to set ambitious, yet achievable, targets for Permittees; receiving water limitations, on the other hand, while the ultimate goal of MS4 permitting, may not in all cases be achievable within the five-year permit cycle. Generally, permits are best structured so that enforcement actions are employed when a discharger shows some shortcoming in achieving a realistic, even if ambitious, permit condition and not under circumstances where even the most diligent and good faith effort will fail to achieve the required condition." [Revised draft Order, April 24, 2015, p.35][38]

Additionally, SWRCB in discussing compliance with receiving water limitations provisions stated:

> "Yet, we are sympathetic to the assertions made by MS4 dischargers that the receiving water limitations provisions mandated by our Order WQ 99-05 may result in many years of permit noncompliance, because it may take years of technical efforts to achieve compliance with the receiving water limitations, especially for wet weather discharges. Accordingly, we believe that the MS4 permits should incorporate a well-defined, transparent, and finite alternative path to permit compliance that allows MS4 dischargers that are willing to pursue significant undertakings beyond the iterative process to be deemed in compliance with the receiving water limitations." [Revised draft Order, April 24, 2015, p. 17][39]

The Beach Cities WMG agencies appreciate the SWRCB acknowledgement of the challenges that lie ahead, the understanding of the need for adaptive management in this complex and difficult undertaking, and the significant commitment of resources that must be secured to carry out this ambitious plan to address the water quality impacts of municipal stormwater.

[38] Revised Draft April 24, 2015. State of California State Water Resource's Control Board Order WQ 2015-XX In the Matter of Review of Order No. R4-2012-0175.

[39] Revised Draft April 24, 2015. State of California State Water Resource's Control Board Order WQ 2015-XX In the Matter of Review of Order No. R4-2012-0175.

Table 6-9. Capital, O&M, and 20-year Life-Cycle Cost Opinion for Proposed Structural BMPs by Analysis Region

Watershed/ Analysis Region		Location of BMP	Project Name	Construction Cost Range		Annual O&M Range		Total 20-Year Life-Cycle[1] Range	
				Low	High	Low	High	Low	High
Santa Monica Bay Watershed	SMB-5-02, Alternative 1	Manhattan Beach	Manhattan Beach Infiltration Trench[2]	$3.7M	$6.8M	$140K	$190K	$6.5M	$11M
		Manhattan Beach	Distributed Green Streets	$2.4M	$6.5M	$110K	$220K	$4.6M	$11M
		SMB-5-02 Alternative 1 Combined Costs		**$6.1M**	**$13M**	**$250K**	**$410K**	**$11M**	**$22M**
	SMB-6-01	Hermosa Beach	Hermosa Beach Infiltration Trench	$500K	$1.1M	$18K	$32K	$860K	$1.7M
		Hermosa Beach	Hermosa Beach Greenbelt Infiltration[2]	$5.5M	$8.0M	$81K	$90K	$7.1M	$9.8M
		Redondo Beach	Park #3	$1.9M	$3.0M	$28K	$33K	$2.5M	$3.7M
		Hermosa Beach	Distributed Green Streets	$7.0M	$19M	$310K	$640K	$13M	$32M
		SMB-6-01 Combined Costs		**$15M**	**$31M**	**$440K**	**$800K**	**$23M**	**$47M**
	All Analysis Regions	Hermosa Beach	Trash exclusion devices	$160K	$430K	$50K	$64K	$1.1M	$1.7M
		Redondo Beach	Trash exclusion devices	$1.1M	$3.1M	$360K	$460K	$8.3M	$12M
		Manhattan Beach	Trash exclusion devices	$590K	$1.7M	$210K	$270K	$4.8M	$7.1M
	Combined Costs in Santa Monica Bay Watershed			**$23M**	**$50M**	**$1.3M**	**$2.0M**	**$49M**	**$90M**
Dominguez Channel Watershed	DC-RB/MB	Redondo Beach	Powerline Easement Infiltration[2]	$11M	$16M	$160K	$180K	$14M	$20M
		Redondo Beach	Artesia Blvd Infiltration	$2.0M	$3.1M	$30K	$35K	$2.6M	$3.8M
		Redondo Beach + Manhattan Beach	Distributed Green Streets	$7.4M	$20M	$330K	$670K	$14M	$33M
		DC-RB/MB Combined Costs		**$20M**	**$39M**	**$520K**	**$890K**	**$31M**	**$57M**
	DC-Torrance	Torrance	Catch basin inlet filters	$240K	$360k	$130K	$170k	$2.8M	$3.7M
		DC-Torrance Combined Costs		**$240K**	**$360k**	**$130K**	**$170k**	**$2.8M**	**$3.7M**
	Combined Costs in Dominguez Channel Watershed			**$20M**	**$39M**	**$650K**	**$1.1M**	**$33M**	**$61M**
Combined Costs of All Proposed Structural BMPs				**$43M**	**$89M**	**$2.0M**	**$3.1M**	**$82M**	**$150M**

M = Million dollars, K = Thousand dollars

[1] Life-cycle costs include construction costs and 20 years of annual O&M (in 2015 dollars) and are not discounted.

[2] Alternative project locations have also been identified, but are not included in combined cost opinion

7 POTENTIAL FUNDING SOURCES AND FINANCIAL STRATEGY

The availability of funds will be critical for the implementation of the EWMP. This section provides an overview of potentially available funding sources for programs proposed in the EWMP. The funding sources included in this section for consideration are grants, interagency partnerships, bonds, State Revolving Funds, local funding opportunities, and public private partnerships.

7.1 GRANT OPPORTUNITIES

Grants have historically been a backbone for financing stormwater projects. The majority of the water-related grants are designated for flood control, drinking water, and watershed protection; very few grants are made available for the sole purpose of stormwater permit compliance. For example, the State of California has planned to spend $7.5 billion under the Water Quality, Supply and Infrastructure Improvement Act (2014), but only $200 million have been designated for stormwater capture projects statewide to enhance regional water reliability. In order to increase the likelihood of getting grant funding, a stormwater project might need to be added to a larger project or program that serves different proposes and has different objectives rather than just for stormwater management. Thus, collaboration and coordination between stormwater agencies and other public agencies would be important to increase accessible grant funding opportunities for stormwater projects.

It is noted that many grant funds do not cover 100% of the project costs, but instead, cost sharing from local governments (as much as 50%) is required under grant provisions. Furthermore, grants typically cover only project capital costs, but do not provide funding to cover ongoing operations and maintenance, and replacement costs of the infrastructure. Thus, alternative funding sources would be needed to provide stable O&M revenues as well as costs for replacement for any funded projects. **Table 7-1** presents the potential grant opportunities available that the Beach Cities can apply to fund the EWMP projects.

Since SB-985-Stormwater Resource Planning became effective in 2014, local governments have been required to have a stormwater resource plan and be in compliance with provisions of SB-985 in order to receive grants for stormwater and dry-weather runoff capture projects from a bond act approved by the voters after January 1, 2014. The EWMP could potentially be utilized as a functionally equivalent plan but further clarification will need to be provided in the guidance document which is anticipated to be established by the State Water Resource Control Board by July 1, 2016. Agencies and the LARWQCB staff should review and comment on the guidance document to ensure that these plans can be utilized.

Table 7-1. Relevant Grant Opportunities listed in the 2015 Funding Fairs Handbook (California Financing Coordinating Committee [CFCC], 2015)

Program	Department	Purpose	Ineligible Uses	Funding Limits
WaterSMART: Water and Energy Efficiency Grants	US Bureau of Reclamation	Projects should seek to conserve and use water more efficiently, increase the use of renewable energy, protect endangered and threatened species, facilitate water markets, or carry out other activities to address climate related impacts on water or prevent any water-related crisis or conflict.	Normal operations, maintenance, and replacement (OM&R). OM&R is described as system improvements that replace or repair existing infrastructure or function without providing increased efficiency or effectiveness of water distribution over the expected life of the improvement. Construction of a building.	Funding will be awarded at one of two levels: Funding Group I: Up to $300,000 per agreement for a project up to 2 years. Funding Group II: Up to $1,500,000 for an agreement for up to 3 years for a small number of projects.
WaterSMART: Cooperative Water Management Program (CWMP) Grants	US Bureau of Reclamation	The purpose is to improve water quality and ecological resilience and to reduce conflicts over water through collaborative conservation efforts in the management of local watersheds. The primary goal is to address two major concerns synonymous with watershed groups – 1) the need for funding to pay the salary of a full-time coordinator and 2) the limited funding available for project management.	Please visit the following website for evaluation criteria: http://www.usbr.gov/WaterSMART/cwmp/docs/CWMPEvaluationCriteria.pdf	Phase I funds shall be used to establish or enlarge a watershed group, to develop a mission statement for the watershed group, to develop project concepts, and to develop a restoration plan. Phase II funds shall be used to plan and carry out watershed management projects. Phase III funds shall be used to plan and carry out at least one watershed management project.
IRWM Implementation Program Proposition 84 (Chapter 2, §75026)	Department of Water Resources	Award funds for implementation of projects consistent with IRWM Plans to assist local public agencies in meeting long-term water management needs of the state, including the delivery of safe drinking water, flood risk reduction, and protection of water quality and	Operation and maintenance activities	Bond funding allocation for entire program is $1 billion. Prop 84 allots grant funding to 11 funding areas.

Program	Department	Purpose	Ineligible Uses	Funding Limits
		the environment.		
Flood Corridor Program Propositions 1E, 84 and 13	Department of Water Resources	Flood risk reduction through non-structural projects that include wildlife habitat enhancement and/or agricultural land preservation components	Flood protection projects that do not include wildlife habitat enhancement or agricultural land preservation benefits	$5 million per eligible project. 10% non-state, non-federal cost share required; may be reduced to 5% or no-cost share if serving disadvantaged or severely disadvantaged community
Flood Control Subventions Program Propositions 1E and 84	Department of Water Resources	Implementation of federally authorized flood control projects (minor or major) and Watershed Protection Flood Prevention Projects	Flood control projects without federal authorization	Variable state cost-share percentage based on multipurpose objectives for projects, ranging from a minimum of 50% to a maximum of 70%
Statewide Flood Emergency Response Program Proposition 84	Department of Water Resources	Preparing or updating local emergency plan; Coordinating flood emergency planning and preparedness (including training & exercise); Developing communication & coordination response process; Collecting & exchange of flood information; Purchase & installing equipment for interoperable emergency communication.	Projects not included in guidelines. Projects in the Legal Delta.	$10 million for Statewide (outside the legal Delta) for Prop 84.

7.2 PROJECT-SPECIFIC INTERAGENCY PARTNERSHIPS

Stormwater management projects often overlap with the jurisdiction of other public agencies, including water agencies, as well as parks and schools. Interagency partnerships would not only allow agencies involved to leverage one other's available funding resources to make cost intensive projects possible, but would also improve local government funding efficiency. These types of interagency partnership projects could also optimize the potential social, environmental, and economic benefits provided to the community. An interagency partnership also provides an alternative avenue for stormwater agencies to access to grant funding that would otherwise not be available to them. In addition to the above benefits, a partnership with public utility agencies, such as water and refuse collection services, might also provide a mechanism for cost transfer from stormwater agencies to these agencies. For example, the use of stormwater for non-potable water may conserve drinking water. The cost for providing the infrastructure and the ongoing O&M could be partly funded through fees charged by water agencies as part of their cost for water conservation. **Table 7-2** provides a list of potentially viable partnerships and the benefits derived from management of stormwater runoff.

Table 7-2. Added Benefits of Interagency Partnership for Stormwater Management

Potential Partners	Benefits Derived from Stormwater Management
Flood control district	• Flood protection • Climate change mitigation
Water agencies	• Potable water conservation through stormwater use for non-potable water purposes • Surface water pollution prevention • Increase non-potable water storage through installation of underground cisterns
Parks, Coastal Commission	• Terrestrial and marine habitat protection by reducing trash from entering the ocean and other terrestrial habitats • Water pollution prevention • Erosion reduction

7.3 LOCAL BOND ISSUANCE

Bonds have been utilized by local governments to provide funding for stormwater projects. There are two types of bonds that can be utilized. One of them is GO bonds. GO bonds are issued by local governments, which are repaid through a tax surcharge (e.g. property). The City of Los Angeles, for example, has used GO bonds to fund their stormwater projects. The City sold $440 million GO bonds under Proposition O Clean Water Bonds. The bond proceeds were used for implementation of 39 projects but could not be used for ongoing maintenance, operations and replacement of these facilities (Farfsing and Watson, 2014). The challenge of utilizing GO bonds is that GO bond issuance and the amount to be issued must be approved by two-third of the voters. The main drawback of election approval requirement is that the cost of holding an election can be high and the chance of success is often unpredictable.

Another type of bonds that can be used at the local level is revenue bonds. Revenue bonds are tax-exempt securitized bonds that are issued by utility agencies, such as water agencies. These bonds are repaid through utility rate increases charged directly to customers. Recent enactment of AB-850-Public Capital Facilities: Water Quality allows local publically owned water agencies to finance water quality and water conservation related projects by issuance of revenue bonds through a Joint Powers Authority (JPA). Under the provisions of AB-850, water agencies are allowed to use the bond proceeds to pay for construction, repair, maintenance, and operations of eligible projects. Both stormwater capture and water quality compliance projects are considered as eligible projects that can be financed through bond issuance under the AB-850 mechanism. Additionally, AB-850 authorizes water agencies to repay these bonds through water utility rate increases – the same way as other revenue bonds not issued under the SB-850 mechanism by water agencies. Such rate increases are also subject to Proposition 218 approval under the exempt category (i.e. only a public hearing is required).

Since the enactment of AB-850, a JPA, called Southern California Public Water Authority (SCPWA), has been established by the Los Angeles Department of Water and Power and the Burbank Water and Power (LADWP, 2015). The first two members of the SCPWA are the City of Los Angeles and the City of Burbank. The Beach Cities can consider becoming members of the SCPWA. However, details on how bond proceeds can be directed to pay for eligible stormwater projects identified in the EWMP will need to be further evaluated. It is expected that high level of collaboration and coordination between stormwater and water agencies would be required.

SB-628–Enhanced Infrastructure Financing Districts (EIFD) will allow issuance of general obligation bonds within the EIFD inside a city or a county. The Bill authorizes a legislative body to establish an enhanced infrastructure financing district, adopt an infrastructure financing plan, and issue bonds upon approval by 55% of the voters to finance public capital facilities such as collection and treatment of water for urban uses and flood control projects. Under the provisions of SB-628, a City or a County can establish an EIFD of any size. If a defined EIFD has fewer than 12 registered voters, only a protest hearing is required to be conducted for landowners. The number of votes that each landowner gets will depend on the size of the land they own. The ballot will specify a vote per acre or a portion of an acre. The bonds issued under this bill will be repaid through property tax increase (i.e. tax increment financing). The district will cease to exist in no more than 45 years from the date on which bond issuance is approved.

7.4 State Revolving Funds

Clean Water State Revolving Fund (CWSRF) Program, which is managed by the State Water Resource Control Board and funded by the US Environmental Protection Agency, is an alternative funding source for development of new infrastructure projects that will benefit water quality. The CWSRF finances water quality projects similar to those proposed in the EWMP, including nonpoint source, watershed protection or restoration, estuary management projects (USEPA, 2014). The main advantage of CWSRF is that their interest rates are typically much lower than market rates (e.g. 3% for a 20-year loan instead of 6%). The loans are project-specific and can serve as a good financial resource for funding project design and construction. The cost-saving achieved from utilizing the CWSRF can vary between 17% and 25% of the total project costs

compared to conventional loans (USEPA, 2014; SWRCB, 2014). The maximum repayment term is 20 years. The CWSRF also has an Expanded Use program that provides funding for stormwater treatment and diversion, sediment and erosion control as well as stream restoration projects (CFCC, 2015). This special program offers interest rate at one-half of the general obligation bond rate with a repayment period of up to 30 years. There is no limit in terms of the amount an agency can borrow under this program. The main limitation of the CWSRF is that it cannot be used for project operation and maintenance (O&M) purposes (USEPA, 2013).

The Infrastructure State Revolving Fund Program managed by the California Infrastructure and Economic Development Bank provides financing for public infrastructure projects for environmental mitigation purposes (CFCC, 2015). The loan can be used for construction or modification of public infrastructure, including educational, cultural, and social facilities, purchase and installation of pollution control equipment, and parks and recreation facilities. The loan size can range between $50,000 and $25 million with a maximum repayment period of 30 years. The interest rate is based on market rate but may be adjusted based on the social and economic status of the area where the project will be implemented.

Access to the State Revolving Funds is limited by the agencies' ability to borrow due to repayment of other debt obligations (e.g. lease burden). It has been reported that a typical median net lease burden for a California county is 1.7% of general fund revenues while the total burden of lease and General Fund obligations is 1.9% (Moody, 2012). Loan repayment will require alternative funding sources if reliance on general fund resources is not an option.

7.5 Local Public Funding Opportunities and Approval Procedures

Stormwater charges are potentially the most critical local funding source to finance stormwater programs in California. These charges include stormwater fees and taxes, as well as other funds generated through general obligation and revenue bond issuance. **Table 7-3** provides an overview of potential local funding sources that may be utilized to provide funds to finance stormwater programs. An important factor to consider when utilizing these funding mechanisms is the respective approval mechanisms as discussed below.

Table 7-3. Local Funding Opportunities

Fees	Taxes	Bonds
• Fixed and volumetric service fees • Property assessments or fees • Developer fees or connection fees (a one-time fee) • Permitting fees	**General taxes** • Property, sales, and other activities **Special taxes** • Parcel taxes to pay for flood protection, stormwater management, watershed protection • Sales tax add-ons • Transient Occupancy Tax to pay for creeks restoration and water quality improvement projects	**General bonds** • Repaid through a property tax surcharge **Revenue bonds** • Issued by local utilities (e.g. water) • Repaid by service fees, developer fees, plus occasional special taxes

Local funding opportunities presented in **Table 7-3** are subject to approval mechanisms that can vary from holding a simple written protest hearing to an election, depending on the type of funding sought after (**Table 7-4**). The types of charges that are deemed to be most suitable for stormwater-related services are property-related fees. For a property-based flood control-related stormwater management fees, an election is required to be conducted under the provisions of Proposition 218. However, there are two categories under Proposition 218 that are exempt from the election approval requirements. They are water-related and refuse collection services. The recent approval of AB2403 has extended the definition of water in Proposition 218 to include stormwater capture projects for infiltration and direct non-potable uses, which means that these projects are also exempt from the election requirement under Proposition 218.

Even with the extended definition of water in the California Constitution, the existing form of Proposition 218 still requires voter approval for stormwater fees which has limited stormwater agencies' ability to generate sufficient revenue to support stormwater projects related to permit compliance. An amendment to Proposition 218 that will allow stormwater fees to be treated like water, sewer, and refuse fees, is being discussed and considered (CSQA, 2015). A new AB-1362, which is designed to include the definition of "stormwater" into the California Constitution's Article XIII C and Article XIII D, was introduced to the State Assembly on February 27, 2015. The introduction of this Bill marks the first step toward such an amendment of Proposition 218.

Given the existing unique regulatory framework and limitation of Proposition 218, some local governments have broken down the stormwater revenue requirements by functions instead of a single property-related fee. Some of them have utilized the exempt category under Proposition 218 to fund stormwater projects with success. The Cities of Signal Hill, Poway, and Solana Beach, for example, have utilized a surcharge on trash collection fees to cover the some of the cost for stormwater-related trash collection and management. A surcharge on water utility fees has also been used by the Cities of Del Mar, Oceanside, and Solana Beach to provide funding to fund stormwater operation as part of the drinking water pollution prevention effort (Farfsing and Watson, 2014).

Pollution prevention is an important component in stormwater management. Given that majority of the pollutants in stormwater runoff originate from vehicles, some local governments have used other non-property-related surcharges to provide funding for stormwater programs. For example, the Orange County Transportation Authority has used the County's sales tax to provide some funding for a water quality improvement and environmental cleanup program. The San Mateo County has also added a surcharge on the vehicle license fee to provide funding for their stormwater pollution management program. It is also foreseeable that pollutant specific, such as a TMDL-related fee could be established to provide funding for TMDL compliance related programs in the future.

In addition to fees that provide steady revenue, another possible revenue source would be to charge fines to property owners that violate discharge limits (volumetric- or TMDL-based). Fines are not considered as a stable financial income, however it discourages behavior or practices that will lead to non-compliance. Furthermore, fines are exempt from election requirements under Proposition 26 and have been commonly used by water agencies to discourage excessive water consumption behavior. The use of fines under Proposition 26 as a financial instrument to management stormwater discharge in urban areas is still uncommon but might worth exploring.

Table 7-4. Local Funding Approval Mechanisms

	Proposition 13 (1978)	**Proposition 218 (1996)**	**Proposition 26 (2010)**
General taxes	Flexible	Simple majority for cities and counties, not available to special districts	*(rules from the earlier proposition remain in place)*
General obligation bonds	Two-thirds of local voters	Two-thirds of local voters	Two-thirds of local voters
Special taxes	Two-thirds of local voters	*(rules from the earlier proposition remain in place)*	*(rules from the earlier proposition remain in place)*
Property taxes	1% of purchase price + 2% annual increases	*(rules from the earlier proposition remain in place)*	*(rules from the earlier proposition remain in place)*
Property-related fees and assessments	Flexible	1. All water-related and refuse collection services: strict cost-of-service requirements 2. All water-related and refuse collection services: property-owner protest hearing 3. Floods and stormwater: 50% of property owners or two-third popular vote	*(rules from the earlier proposition remain in place)*
Non-property-related fees	Flexible	Flexible	Stricter requirements (more likely to be a tax)
Wholesale fees	Flexible	Flexible	Stricter cost-of-service requirements

Source: Public Policy Institute of California (PICC), 2014.

7.6 PUBLIC PRIVATE PARTNERSHIPS

Public private partnerships (P3) can be achieved through two approaches. The conventional approach will involve having the private partner to undertake design and construction, and sometimes even operation and maintenance of the facilities. The private partner will recover the cost plus their return-on-investment through a guaranteed revenue stream (e.g. a user fee) over a long period (e.g. 30- 40 years). The main advantage of such an approach is that the upfront financing costs are provided through the private partner while the project performance is guaranteed by the private partner. Also, P3 can be utilized when agencies have restrictions on the amount of debt that they can carry (e.g. agencies want to maintain low lease burden or have high lease burden). Potential cost saving can be achieved through higher financial efficiency during project implementation phase. P3 can also expedite project implementation by simplifying administrative procedures for financing as well as eliminating the need for tendering. The main challenge for implementation of P3 is to get voters to approve a longer revenue stream to repay the private partner. The amendment of Proposition 218 is expected to lower such hurdle for providing such a revenue stream.

The second P3 approach is through direct financial subsidies to local projects that do not contribute to cash revenue generation. However, subsidies can create a financial incentive to encourage local participation without providing the full cost for project implementation. Such an approach can increase financial efficiency by leveraging financial input from communities. A list of cities that utilize financial subsidies to maximize their local stormwater capture capacity is provided in **Table 7-5**. Based on these examples presented in **Table 7-5**, subsidies can be given out in forms of 1) rebates per project with caps for stormwater runoff reduction projects, 2) rebate per rain barrel or cistern, 3) rebate per parcel, 4) stormwater fee reduction, and 5) cost sharing.

Among all the runoff capture subsidy programs listed in **Table 7-5**, the approach adopted by the City and County of San Francisco is considered as the most progressive. The City and County adopted the onsite Water Reuse for Commercial, Multi-family, and Mixed Use Development Ordinance which amended the San Francisco Health Code to allow for the collection, treatment, and use of alternative water sources (including stormwater runoff) for non-potable applications. The City and County has since developed a Non-potable Water Program that allows commercial, mixed use, and multifamily residential property owners to collect, treat and reuse water from various sources onsite, including stormwater runoff. The Program also allows the property owners to act as local non-potable water suppliers to provide non-potable water to buildings in the vicinity. Property owners or developers are required to comply with stringent monitoring and reporting requirements for 10 years in order to maintain such privilege. The San Francisco Public Utilities Commission (SFPUC) has created a grant assistant program that provides up to $250,000 for single building projects and up to $500,000 for district-scale projects meeting specific eligibility criteria to encourage participation.

Table 7-5. Selected Cities that provide Financial Subsidies to encourage the Development of Stormwater Infrastructure in Private Properties

Reference	Runoff Reduction	Runoff Capture and Use
San Francisco, CA (SFPUC, 2015)	**Grants** • Up to $30,000 with 35% match requirement • Up to $100,000 with 25% match requirement	**Grants (treatment is required)** • Up to $250,000 for single building projects • Up to $500,000 for district-scale projects
Palo Alto, CA (City of Palo Alto, 2015)	**Rebates** • Permeable pavement, ≤ $1,000 at $1.5/sq. ft., • Green roofs, ≤ $1,000 at $1.5/sq. ft.	**Rebates (roof runoff)** • Rain barrel $50 each • Cisterns ≤ $1,000 at $1.50/sq. ft.
Seattle, WA (Seattle Public Utilities [SPU], 2015)	• Rebates for onsite facility installation, e.g. rain garden • Stormwater drainage fee reduction	• Rebates for onsite facility installation, e.g. cistern (Roof runoff) • Stormwater drainage fee reduction
Montgomery County, MD (County of Montgomery, 2015)	**Rebates** • Residential, ≤ $2,500 per parcel • Commercial, ≤ $10,000 per parcel	**Rebates (roof runoff)** • Residential, ≤ $2,500 per parcel • Commercial, ≤ $10,000 per parcel
Washington, D.C. (Washington D.C., 2015)	Residential rebates Trees, ≤ $50 or $100 per tree Pervious surface, ≤ $2,500 at $1.25/sq. ft. All customers: Provide ≤55% stormwater fee discount	Residential rebates (roof runoff) Cisterns, ≤ $500 at $1/gallons All customers: Provide ≤55% stormwater fee discount

7.7 FINANCIAL STRATEGY

The above examples describe how the stormwater management program can potentially be funded using multiple approaches rather than a single fee arrangement. Such a strategy could potentially reduce the risk of insufficient support by voters or property owners. Based on the above discussions, a summary of potential financial approaches is provided in **Table 7-6**.

Table 7-6. Funding Approach Summary

Approach	Funding Type	Limitations	Potential Significance (with Respect to Overall Funding)
Grants	New Revenue	• Competitive • No guarantee of funding accessibility • Infrastructure projects only • Application preparation/submission requires significant staff time • Can only be used to pay for infrastructure-related projects • O&M costs are typically excluded	Medium
Project-Specific Interagency Partnerships	New Revenue	• Requires coordination between agencies • Varying project implementation schedules between agencies limit the viability of such an option	High
Local Bond Issuance	Financing	• GO bonds require approval by voters. • Revenue bond requires to be backed by a revenue stream • There is a financing cost • Infrastructure projects only • O&M costs are typically excluded	High
State Revolving Funds	Financing	• Revenue stream is needed to obtain loans • There is a financing cost • Infrastructure projects only • O&M costs are typically excluded	High
Local Public Funding Opportunities	New Revenue	• Requires voter approval • Infrastructure projects only (except for stormwater fee) • O&M costs are typically excluded (except for stormwater fee)	High
Public Private Partnership	Financing	• Revenue stream is needed to allow the private partner to recover their cost as well as provide return on investment	High
	Direct Subsidies / Cost-Sharing	• Funding source is needed to fund a subsidy program • Some projects may underperform due to poor project implementation, O&M, and monitoring	Low

8 LEGAL AUTHORITY

The Beach Cities WMG Permittees have the necessary legal authority to implement the BMPs identified in the EWMP, as provided in **Appendix P**.

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Appendix A

Notice of Intent

NOTICE OF INTENT

Enhanced Watershed Management Program & Coordinated Integrated Monitoring Program

~~June 28, 2013~~
December 17, 2013

Beach Cities Watershed Management Group

City of Redondo Beach
City of Manhattan Beach
City of Hermosa Beach
City of Torrance
Los Angeles County Flood Control District

1. Introduction

The Cities of Redondo Beach, Manhattan Beach, Hermosa Beach, and Torrance and the Los Angeles County Flood Control District (LACFCD), collectively the Beach Cities Watershed Management Group (Beach Cities WMG), respectfully submit this Notification of Intent (NOI) to develop an Enhanced Watershed Management Program (EWMP) per Part VI.C.4.b. of Order No. R4-2012-0175 (MS4 Permit). Additionally, this NOI includes a statement of the Beach Cities WMG agencies' intent to follow a Coordinated Integrated Monitoring Program (CIMP) approach.

The Beach Cities WMG has determined to jointly develop an EWMP and CIMP to address both the Santa Monica Bay and Dominguez Channel Watershed areas within their jurisdictions. The development of the Work Plan, CIMP, and EWMP will be a collaborative process between the Beach Cities WMG agencies, coordinated with the Technical Advisory Committee as well as with Beach Cities watershed stakeholders.

The information provided in the following sections satisfies the EWMP requirements for NOI submittal as provided by Section VI.C.4.b of the MS4 Permit and the CIMP notification requirement as provided by Attachment E Section IV.C.1. Each of the following section headings includes the permit reference to the NOI requirement being addressed by that particular section.

2. Notification of Intent (Section VI.C.4.b.i and Attachment E Section IV.C.1.)

The Beach Cities WMG hereby notifies the Los Angeles Regional Water Quality Control Board (LARWQCB) of its intention to collaboratively develop an EWMP for the Santa Monica Bay and Dominguez Channel Watershed areas within their jurisdictions, and request submittal of the final Work Plan no later than 18 months after the effective date of the MS4 Permit (June 28, 2014) and submittal of the draft EWMP Plan no later than 30 months after the effective date of the MS4 Permit (June 28, 2015).

Additionally, the Beach Cities WMG agencies hereby notify the LARWQCB by this NOI of their intention to collaboratively develop a CIMP to address all of the monitoring elements required by the MS4 Permit for its jurisdictions and request submittal of the Draft CIMP 18 months after the effective date of the MS4 Permit (no later than June 28, 2014).

3. Interim and final TDML compliance deadlines (Section VI.C.4.b.ii)

Table 1 lists the TMDLs that are applicable within the Beach Cities WMG EWMP.

Table 1. TMDLs applicable within Beach Cities WMG.

TMDL	LARWQCB Resolution Number	Effective Date
Santa Monica Bay Beaches Bacteria TMDL	2002-004 and 2002-022 amended by R12-007	07/15/2003 R12-007 not yet effective
Machado Lake Trash TMDL [1]	2007-006	03/06/2008
Machado Lake Nutrient TMDL [2]	2008-006	03/11/2009
Machado Lake Toxics TMDL [3]	R10-008	03/20/2012
Los Angeles and Long Beach Harbors Toxics & Metals TMDL [4]	R11-008	03/23/2012
Santa Monica Bay Nearshore Debris TMDL [5]	R10-010	03/20/2012
Santa Monica Bay DDT and PCB TMDLs [6]	USEPA Region IX	03/26/2012

[1] Responsible agencies: Redondo Beach, Torrance, LACFCD
[2] Responsible agencies: Redondo Beach, Torrance, LACFCD
[3] Responsible agencies: Redondo Beach, Torrance, LACFCD
[4] Responsible agencies: Redondo Beach, Torrance, LACFCD, Manhattan Beach
[5] Responsible agencies: Redondo Beach, Torrance, LACFCD, Manhattan Beach, Hermosa Beach
[6] Responsible agencies: Redondo Beach, Torrance, LACFCD, Manhattan Beach, Hermosa Beach

Interim and final trash TMDL deadlines and final TMDL deadlines occurring prior to the anticipated approval date of the EWMP (April 28, 2016) are included in Table 2.

Table 2. Interim (trash) and final TMDL compliance deadlines prior to EWMP approval

TMDL	Milestone	Interim/Final	Deadline
Santa Monica Bay Beaches Bacteria Summer Dry Weather TMDLs	WLAs	Final	07/15/2006
Santa Monica Bay Beaches Bacteria Winter Dry Weather TMDLs	WLAs	Final	07/15/2009
Santa Monica Bay Nearshore Debris TMDL	20% of baseline load	Interim	3/20/2016
Machado Lake Trash TMDL	20% reduction of baseline load	Interim	03/06/2012
	40% reduction of baseline load	Interim	03/06/2013
	60% reduction of baseline load	Interim	03/06/2014
	80% reduction of baseline load	Interim	03/06/2015
	100% reduction of baseline load	Final	03/06/2016

The Beach Cities WMG will continue the implementation of watershed control measures concurrently with the EWMP development to meet these interim and/or final milestones. These control measures being implemented to meet the requirements of the interim and final trash water quality based effluent limits (WQBELs) and all other final WQBELs include but are not limited to the following:

Santa Monica Bay Beaches Bacteria TMDL – Dry Weather

All storm drains discharging at point zero shoreline monitoring locations within the Beach Cities EWMP subwatersheds have been diverted through cooperation with LACFCD and the Sanitation Districts of Los Angeles. A total of seven low flow diversions are operational within the subwatersheds as follows:

- Two low flow diversions operated by the LACFCD within the 28th Street storm drain system which outfalls at the zero point of SMB 5-2—one of the diversions is at the outfall, and the other is on a major catchment within the City of Manhattan Beach.
- A low flow diversion is operated at the outfall of the Manhattan Beach Pier drain by the City of Manhattan Beach and serves SMB 5-3.
- Hermosa Strand Infiltration Trench, a joint project of the City of Hermosa Beach and LACFCD started up in April 2010 and has been diverting both dry weather and wet weather flows from the Pier Avenue storm drain in Hermosa Beach and serves SMB 5-5.
- Herondo low flow diversion installed by the LACFCD diverts runoff from the Herondo storm drain which outfalls at the zero point of SMB 6-1.

- A low flow diversion installed by the City of Redondo Beach on the outlet to SMB-6-3 diverts dry weather flow to a biofiltration system before being infiltrated into the ground.
- A low flow diversion installed by the LACFCD on the outlet to SMB-6-5 diverts dry weather flows to the sanitary sewer system.

Santa Monica Bay Nearshore and Offshore Debris TMDL

Each of the Beach Cities WMG incorporated cities has individually submitted a Trash Monitoring and Reporting Plan to the LARWQCB describing an approach and schedule for meeting the interim and final deadlines for reductions in trash waste load allocation from baseline for point source discharges from the MS4. The Beach Cities WMG agencies are individually responsible for meeting those deadlines for point source discharges from the MS4.

Machado Lake Trash TMDL TMRPs

Only the cities of Redondo Beach and Torrance within the Beach Cities WMG are tributary to the Machado Lake subwatershed within the Dominguez Channel Watershed. The City of Redondo Beach accounts for only 0.02% of the Machado Lake Watershed and there are no catch basins within the City of Redondo Beach tributary to Machado Lake—the first catch basin which receives runoff for that area of Redondo Beach is in the City of Torrance. Therefore, the City of Torrance's plans to address the Machado Lake TMDLs are inclusive of the City of Redondo Beach. The City of Torrance submitted a Trash Monitoring and Reporting Plan to describe the approach and schedule for meeting the interim and final deadlines for reductions in trash waste load allocations from baseline for point source discharges from the MS4.

4. Geographic Scope (Section VI.C.4.b.iii.(1))

The geographic scope of the Beach Cities WMG EWMP encompasses all of the incorporated MS4 areas of the cities of Redondo Beach, Manhattan Beach, Hermosa Beach and Torrance and includes the infrastructure of the LACFCD within those jurisdictions.

The County of Los Angeles does own and operate 172 acres of beach area within the jurisdiction~~-~~s of the Beach Cities. These beach areas do not have any storm drain infrastructure that collects and discharges beach runoff directly to the receiving water and should therefore be considered non-point sources and would not be subject to the MS4 permit or EWMP requirements. The storm drains that outlet at the beaches are collecting and discharging drainage from upstream land areas. The City of Hermosa Beach owns the beach above the mean high tide line along its coastline and, like the County-owned beaches, the beaches of Hermosa Beach are non-point sources, not equipped with storm drain infrastructure, and as such are not subject to the MS4 Permit or EWMP requirements.

The Hermosa Beach Pier is not equipped with an MS4 infrastructure, rather the surface of the pier is slightly sloped so that stormwater sheet-flows off the pier laterally. Similarly, the Manhattan Beach Pier is not equipped with an MS4 infrastructure or stormwater conveyance system--rainfall sheet flows off the pier through multiple openings along its length which, depending on location along the pier, either falls onto the beach or into the ocean. Accordingly, the Hermosa Beach and Manhattan Beach piers are

not part of the MS4; they are non-point sources excluded from the MS4 Permit scope and therefore the EWMP.

The Redondo Beach Pier including the King Harbor Marina are included in the geographic scope of the Beach Cities WMG EWMP as these areas are equipped with MS4 infrastructures.

Attachment 1 provides a map of the watershed boundaries and the delineations of the land areas of the incorporated cities within the watershed. The breakdown of the Beach Cities WMG EWMP area by watershed and incorporated city is provided in Table 3.

Table 3. Beach Cities WMG EWMP watershed land area distribution and EWMP participation

Participation Agency	Santa Monica Bay Watershed Management area (acres)	Dominguez Channel Watershed Management area (acres)	Total EWMP Area (acres)	Total EWMP Percentage
City of Redondo Beach	2,613.50	1,217.61	3,831.11	19%
City of Manhattan Beach	2,078.37	350.07	2,428.44	12%
City of Hermosa Beach	831.51	0	831.51	4%
City of Torrance	2,313.76	11,056.79	13,370.55	65%
LACFCD	N/A	N/A		N/A
Area of Beach Cites WMG EWMP:	**7,837.14**	**12,624.47**	**20,461.61**	**100%**

5. Plan Concept (Section VI.C.4.b.iii.(1))

Based on studies and work done to date, the Beach Cities WMG has previously identified opportunities for regional projects within two high priority subwatersheds and anticipates that significant opportunities exist within the collective jurisdictional areas for collaboration on additional multi-benefit projects that will meet the intent of the EWMP approach. The Beach Cities WMG strong preference is to address both watersheds to which they are tributary within one EWMP.

Santa Monica Bay Watershed

The agencies of the Beach Cities have been working together since 2004 to implement the previously developed Jurisdictional Groups 5 and 6 Implementation Plan for the Santa Monica Bay Beaches Bacteria Total Maximum Daily Load (TMDL), including a Structural Best Management Practice (BMP) Siting Study and Dry Weather Source Characterization and Control Study for two high priority subwatersheds, along with joint implementation of programmatic solutions. Since 2004 the Beach Cities have also been jointly funding receiving water monitoring consistent with the Coordinated Shoreline Monitoring Plan for the Santa Monica Bay Beaches Bacteria (SMBBB) TMDL along the shoreline of the Beach Cities WMG. These ongoing efforts by the Beach Cities WMG to comply with the SMBBB TMDL will provide an effective springboard for the development of an EWMP.

Additionally, the agencies have submitted individual Trash Monitoring and Reporting Plans (TMRPs) for the Santa Monica Bay Debris TMDL.

Dominguez Channel Watershed

The cities of Redondo Beach, Manhattan Beach, Torrance and the LACFCD facilities within these cities are also tributary to the Dominguez Channel watershed. With the exception of the development of the City of Torrance Stormwater Quality Master Plan, there has not been extensive work to address the pollutants of the Dominguez Channel primarily because the TMDLs for Dominguez Channel were only recently approved by the State Water Resources Control Board. The EWMP for the Beach Cities WMG will leverage elements of the City of Torrance Stormwater Quality Master Plan to address the Dominguez Channel Watershed aspects of the Beach Cities EWMP. Due to the strong working relationship established among these agencies to implement the Santa Monica Bay Beaches Bacteria TMDLs, collaboration among these agencies to develop an EWMP that also addresses the Dominguez Channel Watershed is likely to yield a successful partnership.

The cities of Redondo Beach, Torrance and the LACFCD facilities within the Beach Cities Watershed Management Group are also tributary to the Machado Lake watershed within the Dominguez Channel Watershed. The City of Redondo Beach accounts for only 0.02% of the Machado Lake Watershed and storm drains within the City of Torrance receive runoff from this small area of Redondo Beach. Therefore, the City of Torrance's plans to address the Machado Lake TMDLs are inclusive of the City of Redondo Beach. To date, the City of Torrance has submitted a Special Study #3 Report for Machado Lake Nutrient TMDL monitoring. The City of Torrance is also preparing a BMP Implementation Plan to address Machado Lake Nutrient and Toxics TMDLs. The LACFCD has also submitted the "Machado Lake Nutrient & Toxics TMDL Monitoring & Reporting Plan. The Beach Cities WMG EWMP will incorporate the Machado Lake BMP Implementation Plans prepared by the City of Torrance and LACFCD as an appendix to the EWMP.

6. Cost estimate for plan development (Section VI.C.4.b.iii.(2))

The Beach Cities WMG agencies collaboratively prepared a scope of work and requested proposals for development of the EWMP Work Plan, the CIMP and the draft and final EWMP. Based on the response to the request for proposals, the Beach Cities WMG is developing a cost sharing agreement for the memorandum of agreement based on an estimate of $760,000 which includes $90,000 for the Work Plan, $155,000 for the CIMP, and $439,000 for the EWMP with an additional allocation of $76,000 for project administration by the lead agency. This estimate is based on a number of assumptions including that the CIMP and EWMP will leverage the existing Santa Monica Bay Beaches Bacteria TMDL Implementation Plan and Coordinated Shoreline Monitoring Plan work to-date. An additional key assumption for this cost estimate is that the City of Torrance Machado Lake TMDL Monitoring and Implementation Plans will be incorporated as stand-alone appendices to the EWMP and CIMP so that effort for the Machado Lake subwatershed of the Dominguez Channel is excluded from the cost estimate since it is being borne individually by the City of Torrance. In addition, the Beach Cities WMG agencies will contribute several hundred thousand of dollars in staff time and in-kind services.

7. Memorandum of Understanding (Section VI.C.4.b.iii.(3))

Attachment 2 includes the final drafts of the Memoranda of Understanding between the City of Redondo Beach, as the lead agency, and the other Beach Cities WMG agencies. All agencies have

committed to the execution of the agreement as indicated by the signed letters of intent (Attachment 3). The agreement will be executed no later than December 28, 2013.

8. Interim milestones and deadlines for plan development (section VI.C.4.b.iii.(4))

Table 4 summarizes the interim milestone and deadlines for Work Plan, CIMP, and EWMP Plan development which are based on the scope of work for developing the Work Plan, CIMP, and EWMP prepared by the Beach Cities WMG. Technical memoranda supporting the development of the plans are utilized as milestones. It is expected that the draft technical memos will not be finalized; rather, the information presented in the memos will be revised based on comments and presented in the Work Plan, CIMP, and EWMP Plan.

Table 4. Proposed interim milestones and deadlines for plan development

	• Milestones Deadlines
Work Plan	
Draft Workplan Elements/Approach • **Identification of Water Quality Priorities** • **Existing and Potential Control Measures** • **Reasonable Assurance Analysis Approach**	• March 2014
Draft Work Plan	• April 2014
Final Work Plan submitted to the LARWQCB	**June 2014**
Coordinated Integrated Monitoring Plan	
Draft Technical memos • **Outfall and receiving water monitoring approach** • **Monitoring sites selection** • **New development and redevelopment effectiveness tracking**	• March 2014
Draft CIMP	• April 2014
Final Draft CIMP submitted to the LARWQCB	**June 2014**
Enhanced Watershed Management Program	
Draft Technical memos • **Approach to US EPA TMDLs, 303(d) listings, other exceedances of RWLs** • **Initial list and screening of regional projects** • **Identify Selected Watershed Control Measures and Conduct Reasonable Assurance Analysis** • **Project schedules and cost estimates**	• March 2015
Draft EWMP	• May 2015
Final Draft EWMP submitted to the LARWQCB	**June 2015**
Final EWMP submitted to the LARWQCB	**January 2016**
Approval of final EWMP by LARWQCB	**April 2016**

9. Structural BMP Implementation (Section VI.C.4.b.iii.(5))

The Beach Cities WMG commits to implement the following structural BMPs or suite of BMPs to provide meaningful water quality improvement within each watershed within 30 months of the effective date of the MS4 Permit, that is, between the MS4 Permit effective date of December 28, 2012~~3~~ and the

deadline for EWMP submittal on June 28, 2015. The Beach Cities WMG plans to implement the following structural BMPs or suite of BMPs:

Manhattan Beach Greenbelt Infiltration System

The Manhattan Beach Greenbelt Infiltration project was designed to utilize the linear greenbelt parkland which runs through the City of Manhattan Beach to intercept and infiltrate dry weather and wet weather low flows from existing storm drains that cross or abut the parkway. Low flows from a 50-acre drainage area are screened to remove trash and gross solids before flowing by gravity to a subsurface infiltration system which also provides limited storage of storm flows for subsequent percolation into the sandy soils below the greenbelt. The Greenbelt Low Flow Infiltration system was designed to effectively divert dry-weather and wet-weather low flows from the storm drain system year round. The project construction was recently completed on February 19, 2013, within the 30 month period required as discussed in Section VI.C.4.b.iii of the MS4 Permit. Monitoring of project effectiveness is currently underway and a final report on this project will be available in advance of the EWMP submittal deadline.

Torrance Stormwater Basin Recharge and Enhancement Project

The Torrance Stormwater Basin Recharge and Enhancement Project will retrofit three existing detention basins serving 1,453 acres of drainage area in total within the City of Torrance. The project will utilize a number of BMPs in order to conserve water, recharge the aquifer, create critical habitat, and improve stormwater quality that discharges into the Santa Monica Bay, and eliminate non-stormwater discharges to the Dominguez Channel. Historically, the basins have provided temporary detention for stormwater and urban runoff—during the winter period discharge from this system has been pumped to the Herondo Storm Drain which discharges to the Santa Monica Bay, while the summer period flows from the system have been pumped to a storm drain discharging to the Dominguez Channel. This Stormwater Basin Recharge and Enhancement project proposes significant advances over the current system by providing wetland treatment of stormwater and non-stormwater runoff at the detention basins, recharging vitally needed groundwater supplies, and sustaining wetland habitat during the dry season in the basins.

The Project will eliminate dry weather run off and associated load for multiple pollutants for 1,453 acres of the Santa Monica Bay watershed. The Project will treat all stormwater from 1,453 acres for multiple pollutants, including priority pollutants such as trash and sediments by a combination of wetland treatment and infiltration. The project will capture and recharge an estimated 20 acre feet per year of runoff that would have otherwise been discharged to the Santa Monica Bay.

The project will enable the elimination of all discharges from the drainage area to Dominguez Channel, will eliminate dry weather discharges to Santa Monica Bay and will reduce the ~~winter~~ wet weather discharge to the Santa Monica Bay from this system. The project budget is $4.4 million and construction is scheduled for Spring 2014~~3~~.

The scope of the project includes:

Amie Basin [463 acre tributary area]:

1. Construction of a 2-acre wetland for storm water treatment. Clearing and grubbing of non-native plants and re-planting with native and wetland-suitable plants and trees.

2. Installation of a one-horsepower, energy-efficient submersible sump pump and 500 linear feet of irrigation pipelines to circulate and oxidize the storm water, provide UV exposure to eliminate bacteria, and promote wetland growth.

3. Installation of trash screens on all catch basins in the watershed to trap and remove solid waste from flowing into the basins from the stormwater inlets.

4. Replacement of pumps and controls for the Amie Basin Pump Station.

Henrietta Basin [594 acre tributary area]:

1. The construction of a 1.5-acre wetland for storm water treatment. Clearing and grubbing of non-native plants and re-planting with native and wetland-suitable plants and trees.

2. Construction of a 1.5 acre infiltration area which will be located at the south end of the basin.

3. Installation of an energy-efficient, one-horsepower submersible sump pump and 500 linear feet of irrigation pipelines to circulate and oxidize the water, provide UV exposure to eliminate bacteria, and promote wetland growth.

4. Installation of trash screens on all catch basins in the watershed to trap and remove solid waste from flowing into the basin from the stormwater inlets.

Entradero Basin [463 acre tributary area]:

1. The construction of a 15,031-square-foot infiltration area.

2. Installation of trash screens on all catch basins in the watershed to trap and remove solid waste from flowing into the basin from the stormwater inlets.

3. Installation of the new biofiltration swale next to the dog training area to capture and treat runoff from this specific area of the public park site and pet waste stations at trail heads.

4. Installation of 1,800 linear feet of irrigation pipeline and fittings to provide recycled water irrigation to the ball fields and native landscaped areas.

Accelerated Implementation of Machado Lake Trash TMDL

The City of Torrance is conducting accelerated implementation of the Machado Lake Trash TMDL by installing 631 Automatic Retractable Screens and 2,000 'no parking' signs as well as a program of

outreach and education. The screens will prevent trash from being carried into Machado Lake from urban runoff and storm drain flows, and the 'no parking' signs are to improve the effectiveness of street sweeping operations and the effectiveness of the Automatic Retractable Screens. The project will have multiple benefits because eliminating trash and plant debris from the storm drains will reduce the growth of bacteria and enhanced street sweeping will reduce sediment and nutrients bound in plant debris from being transported through the storm drains. The project is scheduled for construction in Fall of 2013 which is 2.5 years in advance of the March 2016 deadline for achieving zero trash discharge to Machado Lake.

10. LID ordinance (Sections VI.C.4.b.iii.(6) and VI.C.4.c.iv. (1))

Table 5 summarizes the status of Low Impact Development (LID) ordinances by the various Beach Cities WMG agencies. As presented in Table 5, greater than 50% of the land area within the geographic scope of the EMWP is addressed by LID ordinances that are in draft.

Table 5. Summary of percent EWMP area addressed by LID ordinances

EWMP agency	% EWMP area	Status LID ordinance
City of Redondo Beach	19	Draft LID Ordinance
City of Manhattan Beach	12	Draft LID Ordinance
City of Hermosa Beach	4	Draft LID Ordinance
City of Torrance	65	Draft LID Ordinance
LACFCD	N/A	N/A
Total	100	

Status Descriptions:

- Draft Ordinance – Permittee has completed or will complete by June 28, 2013 the development of a draft LID Ordinance that is in compliance with the MS4 Permit for its portion in the watershed.

11. Green street polices (Sections VI.C.4.b.iii.(6) and VI.C.4.c.iv. (2))

Table 6 summarizes the status of green street policies by the various Beach Cities WMG agencies. As presented in Table 6, greater than 50% of the land area within the geographic scope of the EMWP is addressed by green streets policies that are in place or in draft.

Table 6. Summary of percent EWMP area addressed by Green Street policies

EWMP agency	% EWMP area	Status Green Street Policies
City of Redondo Beach	19	Draft policy
City of Manhattan Beach	12	Draft policy
City of Hermosa Beach	4	In Place
City of Torrance	65	Draft policy
LACFCD	N/A	N/A
Total	100	

Status Descriptions:

- In Place – Permittee has an existing policy for its portion of the watershed.

- Draft Policy – Permittee has completed or will complete by June 28, 2013 the development of a draft Green Street Policy that is in compliance with the MS4 Permit for its portion in the watershed.

Attachment 1. Beach Cities WMG EWMP Boundary and Watershed Delineation

Attachment 2. Draft Memorandum of Understanding

Attachment 3. Letters of Intent

Appendix B

Reasonable Assurance Analysis for Dominguez Channel Watershed within the City of Torrance

CITY OF TORRANCE

BEACH CITIES EWMP

TECHNICAL MEMORANDUM NO. 2

REASONABLE ASSURANCE ANALYSIS FOR DOMINGUEZ CHANNEL WATERSHED WITHIN THE CITY OF TORRANCE

DRAFT
May 2015

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CITY OF TORRANCE

BEACH CITIES EWMP

TECHNICAL MEMORANDUM
NO. 2

REASONABLE ASSURANCE ANALYSIS FOR DOMINGUEZ CHANNEL

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1.0 EXECUTIVE SUMMARY

In order to satisfy the Los Angeles Municipal Separate Storm Sewer System (MS4) Permit (Permit) requirements, the Cities of Redondo Beach, Manhattan Beach, Hermosa Beach, and Torrance, along with the Los Angeles County Flood Control District (LACFCD) agreed to collaborate on the development of an Enhanced Watershed Management Program (EWMP) for both the Santa Monica Bay Watershed and Dominguez Channel Watershed areas within their jurisdictions. This group is hereafter referred to as the Beach Cities Watershed Management Group (Beach Cities WMG).

A required element of the EWMP is the Reasonable Assurance Analysis (RAA). The Permit requires compliance with appropriate water quality standards as developed through applicable total maximum daily loads (TMDLs) and other Permit limitations including water quality based effluent limitations (WQBELs), receiving water limitations (RWLs), and water quality objectives (WQOs).

This RAA includes a qualitative analysis based on literature review to demonstrate that proposed catch basin filters would be effective in meeting the TMDL requirements. The ultimate goal is to identify cost-effective water quality improvement projects through an integrated, watershed-based approach.

On March 25, 2014, the Los Angeles Regional Water Quality Control Board (Regional Board) issued “RAA Guidelines” (LARWQCB 2014) to provide information and guidance to assist permittees in development of the RAA. The Storm Water Management Model (SWMM) was utilized to perform the RAA for the portion of the Dominguez Channel within the City of Torrance. The portion of the Dominguez Channel watershed within the City of Torrance is referred to as DC-Torrance Watershed in this report. The pollutant combinations assessed by this RAA fall into two categories; Category 1 and Category 2. The Category 1 pollutants are copper, lead, and zinc and Category 2 pollutant is fecal coliform. The baseline load for the metals were determined using the 90th percentile wet weather (days with rainfall > 0.1”) daily load from the 10 year period from November 1, 2002 to October 31, 2012. The baseline load for fecal coliform was based on 90th percentile wet year load from November 1, 1994 to October 31, 1995. However, the target load reductions (TLRs) were established for both metals and bacteria by the South Bay Beach Cities Watershed Management Group and were used in this RAA memo to maintain consistency. The difference between the baseline load and the target load resulted in a TLR for the 90th percentile load day, which was the load reduction required to meet the allowable TMDL concentration.

Based on literature review documenting high removal efficiencies demonstrated by the catch basin filters, the City of Torrance has proposed to implement catch basin filters to meet the target load reductions (TLRs) set forth by the Dominguez Channel Toxics TMDL. All references reviewed as part of the literature review are included in Appendix B.

In addition, the City of Torrance is in the process of developing the Green Street Program and the ordinances to implement Green Street design features as part of street redevelopment. While implementing redevelopment of arterial streets, the City of Torrance would assess opportunities for Green Street design features to facilitate treatment through filtration or infiltration. Green Street elements may include infiltration trench that provides water quality treatment, reduction in peak flow discharges, and potential groundwater recharge. Other Green Street elements that may be considered include bioretention/biofiltration practices to achieve water quality treatment through filtration by vegetation and soils to remove pollutants with perforated underdrain to convey the treated runoff. The City of Torrance is committed to developing the Green Street Ordinance established and in effect by July 2015 as required by the MS4 Permit.

For bacteria, a combination of non-structural BMPs including Public Education and Outreach, reduction of irrigation return flows, and future development and implementation of Green Street design features would assist with meeting the TLRs for bacteria. In addition, the study on Optimization of Stormwater Filtration at the Urban/Watershed Interface conducted by the University of Irvine, California, Department of Environmental Health in 2005 indicated Fecal Coliform (bacteria) removal efficiency of 33% by the Grate Inlet Skimmer Box/Round Curb Inlet Basket.

These recommendations serve as goals for the Beach Cities WMG to seek opportunities for implementation over time, but strategies may change as opportunities for more cost-effective BMPs are identified throughout the schedule.

The publically available County's LSPC model, calibrated by California Watershed Engineering (CWE) in January 2015 for the Dominquez Channel Enhanced Watershed Management Program was used to calibrate the DC-Torrance SWMM model.

As part of the RAA, the metals TLRs reflect daily load reductions on the 90th percentile wet weather load days and bacteria TLRs is based on daily exceedance days.

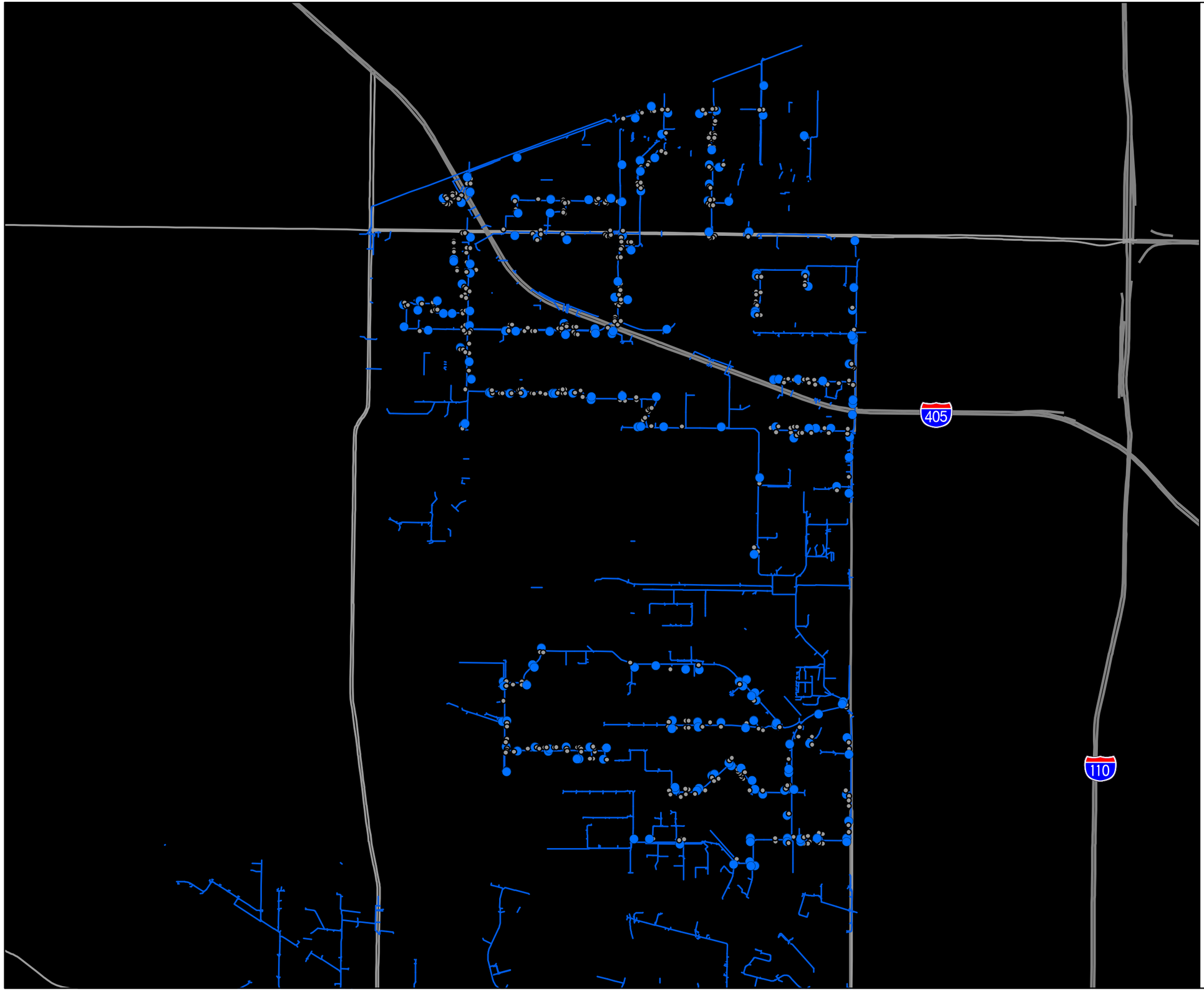
To meet the phased WQO, RWL and TMDL implementation schedules, a combination of distributed structural (catch basin filters) and nonstructural BMPs were identified to be considered by the City of Torrance for implementation. Table ES.1 lists the new nonstructural BMPs, enhancements to existing nonstructural BMPs, and their anticipated effectiveness with the treatment of concerned pollutants.

Table ES.1 Summary of Nonstructural BMPs to Support Pollutant Removal Beach Cities EWMP City of Torrance				
	Condition		Pollutants Addressed	
Nonstructural BMP	Wet Weather	Dry Weather	Bacteria	Metals
Enhancements to Existing BMPs				
Smart gardening program enhancements	√	√	◗	◗
TMDL-specific stormwater training	√	√	◗	◗
Enhancement of commercial and industrial facility inspection	√	√	◗	◗
Enhancement escalation procedures	√	√	◗	●
Improved street sweeping technology	√		◗	◗
New BMP				
Reduction of irrigation return flow	√	√	●	●
√ - applicable; ◗ - partially effective; ● - effective				

For identification of structural BMPs, distributed structural BMPs (Catch Basin filters) were considered. Distributed BMPs refer to those practices that provide the control or treatment (or both) of stormwater runoff at the site level. Table ES.2 summarizes the distributed structural BMPs (catch basin filters) identified through the RAA to address the TMDL implementation. The location of the identified distributed structural BMPs (catch basin filters) are shown on Figure ES.1.

Table ES.2 Summary of Distributed Structural BMPs to Support TMDL Implementation Beach Cities EWMP City of Torrance				
	Condition		Pollutants Addressed	
Structural BMP	Wet Weather	Dry Weather	Bacteria	Metals
Distributed BMPs				
Catch basin filters	√	√	●	●
Green Street Elements	√	√	●	●
√ - applicable; ○ - not effective; ● - effective				

For most nonstructural BMPs, quantification of benefits in terms of pollutant load reductions are challenging and often require extensive survey and monitoring information to assess performance. For the purposes of this RAA, a qualitative approach was used to evaluate the effectiveness and feasibility of the nonstructural BMPs.



Legend

- Catch Basins - 643
- Catch Basin Inserts - 200/643
- Storm Drains
- Freeway
- Major Roads
- Dominguez Channel
- City Boundary
- Parcels

N

0 1 Miles

ES-1
Location of Distributed Strucure BMPs
[Catch Basin Locations
Selected for Drain Inserts]
Enhanced Watershed Management Plan
City of Torrance

Fact sheets and literature available on commercially available catch basin filters suggested that the proposed catch basin filters were effective at capturing and removing pollutants from stormwater runoff including sediments, heavy metals, and oil and grease. One of the literatures summarized the pollutant removal efficiencies provided by Grate Inlet Skimmer Box/Round Curb Inlet Basket (Schematic included in Appendix B). It included numeric pollutant reductions from various studies or independent tests between 1998 and 2007. The study on Optimization of Stormwater Filtration at the Urban/Watershed Interface conducted by the University of Irvine, California, Department of Environmental Health in 2005 was an independent test conducted to assess the pollutant removal efficiency of the Grate Inlet Skimmer Box/Round Curb Inlet Basket. This study in 2005 concluded a 99% reduction in Lead. Other studies include the field test conducted by the City of El Monte in 2002 that concluded that the Grate Inlet Skimmer Box/Round Curb Inlet Basket were effective in removing 95% of Zinc and Copper each and 87% of Lead concentrations. In addition, we also referred to the independent performance assessment conducted by the City of Los Angeles in 2005 to evaluate the performance of storm drain inlet filter devices at removing oil and grease and associated pollutants from stormwater. The study aimed at evaluating the performance (at various stages of their useable lives) of four (4) different catch basin filters currently used by the City of Los Angeles in removing and retaining used motor oil and associated pollutants from urban runoff. This study tested the performance of five (5) different types of catch basin filters at removing sediments, trash, oil and grease, and metals for a flow rate ranging between 10 and 25 gallons per minute. It involved four (4) sampling events and five study sites. The key summary points indicated that qualitatively, the results of the study found that all of the units were moderately effective at removing oil and grease, suspended solids, and heavy metals. Furthermore, the study indicated that for most insert types, inspection and maintenance should occur before and after each rain event during wet weather and monthly during dry weather to maintain their performance integrity and to minimize leaching of previously captured pollutants.

A more recent independent test conducted in 2013-2014 by the City of Lake Forest suggested that the catch basin filters were effective in a heavy metal removal of 75%. The product tested was the Ultra Filter Sock Heavy Metal Drain Filter.

Based on literature review documenting the removal efficiencies demonstrated by the catch basin filters, the proposed catch basin inserts would meet the TLRs set forth by the Dominguez Channel Toxics TMDL with 75% as the estimated target load reduction for a flow rate ranging between 10 to 25 gallons per minute.

Pollutant reductions by catch basin filters resulted from various studies/literature review are summarized in Table ES.3 and shows that the TLRs would be met for each metal. The TMDL year was determined to represent typical rainfall frequencies and magnitudes observed over the recent 25-year rainfall record. The conclusions from literature review and fact sheets show that the catch basin filters would be effective in meeting the target reduction loads set up by the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL (the Dominguez Channel Toxics TMDL).

For bacteria, a combination of non-structural BMPs including Public Education and Outreach, reduction of irrigation return flows, and future development and implementation of Green Street design features would assist with meeting the TLRs for bacteria. In addition, the study on Optimization of Stormwater Filtration at the Urban/Watershed Interface conducted by the University of Irvine, California, Department of Environmental Health in 2005 indicated Fecal Coliform (bacteria) removal efficiency of 33% by the Grate Inlet Skimmer Box/Round Curb Inlet Basket.

Table ES.3 Pollutant Reduction After Implementing Catch Basin BMPs
Beach Cities EWMP
City of Torrance

Pollutants	Existing Load	Target Load Reduction (%)	Nonstructural BMP	Distributed Structural BMPs (Catch Basin Filters)	Structural + Nonstructural BMPs
Zinc 90th Percentile Load Day - 11/08/2002					
Copper (lb/d)	36.99	62%	5%	75%	80%
Zinc (lb/d)	133.39	76%	5%	75%	80%
Critical Wet Year - 1995					
Fecal Coliform (MPN/yr) x10^14	627	53%	5%	33%	38% plus filtration/infiltration opportunities through potential Green Street Implementation in future.

No TMDL developed for fecal coliform. Target Load Reduction calculated based on REC-1 standard and high-flow suspension days.

Note:

The City of Torrance is following the adaptive management approach that would allow them to monitor the performances of proposed distributed structural (catch basin filters) and non-structural best management practices with respect to meeting the established TLR requirements.

In addition, the City of Torrance is in the process of developing the Green Street Program and the ordinances to implement Green Street design features as part of street redevelopment. While implementing redevelopment of arterial streets, the City of Torrance would assess opportunities for Green Street design features to facilitate treatment through filtration or infiltration. Green Street elements may include infiltration trench that provides water quality treatment, reduction in peak flow discharges, and potential groundwater recharge. Other Green Street elements that may be considered include bioretention/biofiltration practices to achieve water quality treatment through filtration by vegetation and soils to remove pollutants with perforated underdrain to convey the treated runoff. The City of Torrance is committed to implementing the Green Street Ordinance established and in effect by July 2015 as required by the MS4 Permit.

Based on the monitoring results, the City of Torrance would consider additional control measures if the required TLRs were not met or other improvements to existing best management practices were found necessary. This would allow changes in the number and type of best management practices selected for implementation. Through adaptive management and based on the future monitoring results, the implementation schedules may be modified to reflect the increased knowledge of the watershed. Actual schedule for Implementation of BMPs will occur as funding becomes available.

2.0 INTRODUCTION

As required by the Permit, the Beach Cities WMG has to perform a Reasonable Assurance Analysis (RAA) as part of the EWMP. The report is prepared in compliance with Part VI,C.5.b.iv.(5) of Waste Discharge Requirements for MS4 Discharges within the Coastal Watersheds of Los Angeles County, Order Number R4-2012-0175 (NPDES Permit Number CAS004001).

The SWMM model used for this RAA was calibrated to the County's LSPC model calibrated by CWE for the Dominguez Channel Enhanced Watershed Management Program. However, the target load reductions (TLRs) were established for both metals and bacteria by the South Bay Beach Cities Watershed Management Group and were used in this RAA memo to maintain consistency. The difference between the baseline load and the target load resulted in a TLR for the 90th percentile load day, which was the load reduction required to meet the allowable TMDL concentration.

The baseline critical wet conditions for fecal coliform were simulated using SWMM for the time period ranging from November 1, 1994 through October 31, 1995. The wet conditions baseline load for the metals for metals were based on simulation results from 90th percentile load day for each metal.

2.1 Physiographic Setting – DC-Torrance Watershed

The City of Torrance (City) is located about 15 miles south of Downtown Los Angeles (LA), in southern LA County, just north of the Palos Verdes Hills. The City comprises 20.5 square miles in area. The City is bounded by Redondo Beach on the west and north, Lawndale and Gardena on the north, LA on the east, Lomita to the southeast, and Rolling Hills Estates and Palos Verdes Estates on the south. The City's stormwater conveyance systems are interconnected with neighboring city systems. The neighboring cities located at generally higher elevation such as Rolling Hills Estate and Palos Verde Estate discharge stormwater into the City's and/or Los Angeles County Flood Control District's (LACFCD's) stormwater conveyance systems located within the City's boundaries. The location of the City is shown on Figure 2.1.

The DC-Torrance Watershed area is approximately 9 square miles. The drainage within the watershed is largely to the east, via storm drains and stormwater from the east side of the City is routed via the Torrance Lateral to Machado Lake. This channel replaced the Dominguez Creek and its tributaries, once a system of braided streams, marshes, and small ponds that eventually reached San Pedro Bay. The portion of the Palos Verdes Hills that borders the City is drained by several north-trending canyons, including, from east to west, Bent Spring, Sepulveda, Agua Magna, Agua Negra, and Malaga canyons, as well as numerous smaller, unnamed canyons. Carrying significant amounts of water only during the winter, these streams now flow into storm drain structures.

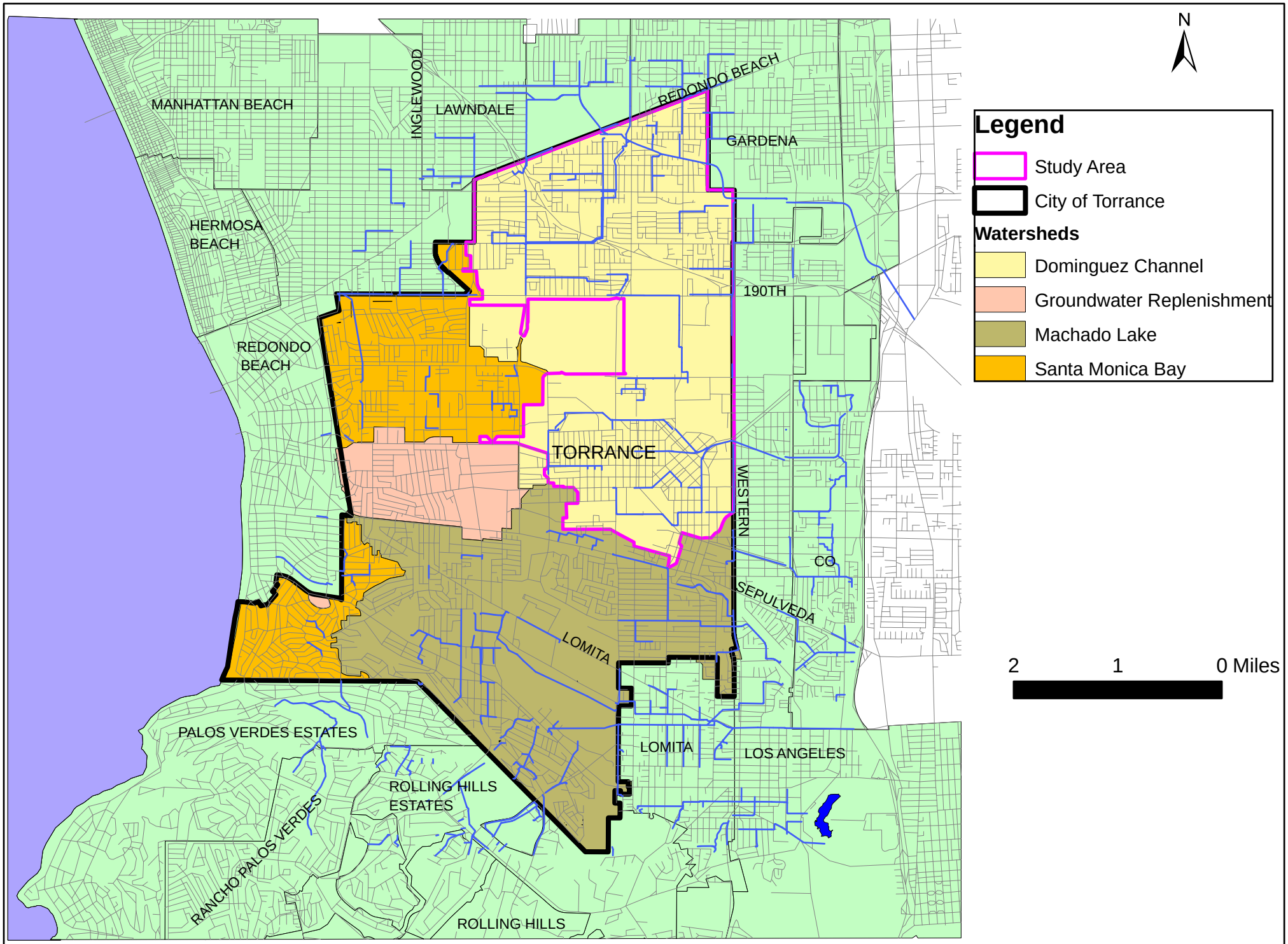


Figure 2.1 Subregional Location of City of Torrance

2.2 Climate

Like most of Southern California, Torrance has a Mediterranean climate characterized by hot, dry summers, and cool, somewhat rainy winters. Average summer temperatures range from highs in the high 80s to lows in the mid 60s (degrees Fahrenheit). Average winter temperatures range from highs in the low 70s to lows in the high 40s.

The average yearly precipitation in the Torrance area is about 13 inches whereas nearly 15 inches of precipitation fall annually in Los Angeles. Not only does rainfall vary from one location to the next, often within short distances, it is also extremely variable from year to year, ranging from one-third the normal amount to more than double the normal amount.

There are three types of storms that produce precipitation in southern California: winter storms, local thunderstorms, and summer tropical storms. Winter storms are characterized by heavy and sometimes prolonged precipitation over a large area. These storms usually occur between November and April, and are responsible for most of the precipitation recorded in southern California. Local thunderstorms can occur at any location, and usually affect relatively small areas. These storms are usually more prevalent in the higher mountains during the summer. Tropical rains are infrequent, and typically occur in the summer or early fall. These storms originate in the warm, southern waters off Baja California, in the Pacific Ocean, and move northward into southern California.

2.3 Watersheds and Storm Drains

The City is divided into four main watersheds as shown on Figure 2.1. These four main watersheds are;

1. Dominguez Channel.
2. Santa Monica Bay.
3. Groundwater Replenishment.
4. Machado Lake.

The RAA study area, DC-Torrance, includes only the portion of Dominguez Channel within the City excluding the groundwater replenishment basin. The groundwater replenishment basin does not discharge into the Santa Monica Bay or the Dominguez Channel. The ground water retention basins facilitate infiltration of stormwater and hence there are no flows exiting the basins.

The groundwater replenishment basin includes three active retention basins that are used to percolate stormwater into the groundwater basin. There are no discharges from these basins. Table 2.1 lists the three active retention basins along with volume and location. The City worked with the RWQCB to recognize the tributary areas to these basins as sub-regional BMPs for permit and TMDL compliance. Since these basins do not discharge to Section 303(d) listed impaired bodies of water, TMDLs, RWLs, and WQOs are not applicable to stormwater

discharge from the tributary areas to these basins. It should be noted that the Del Amo Center retention basin, though listed in Table 2.1, is privately owned. The relevant documentation about the groundwater replenishment basin is provided as an Appendix to the Model Calibration TM (TM01).

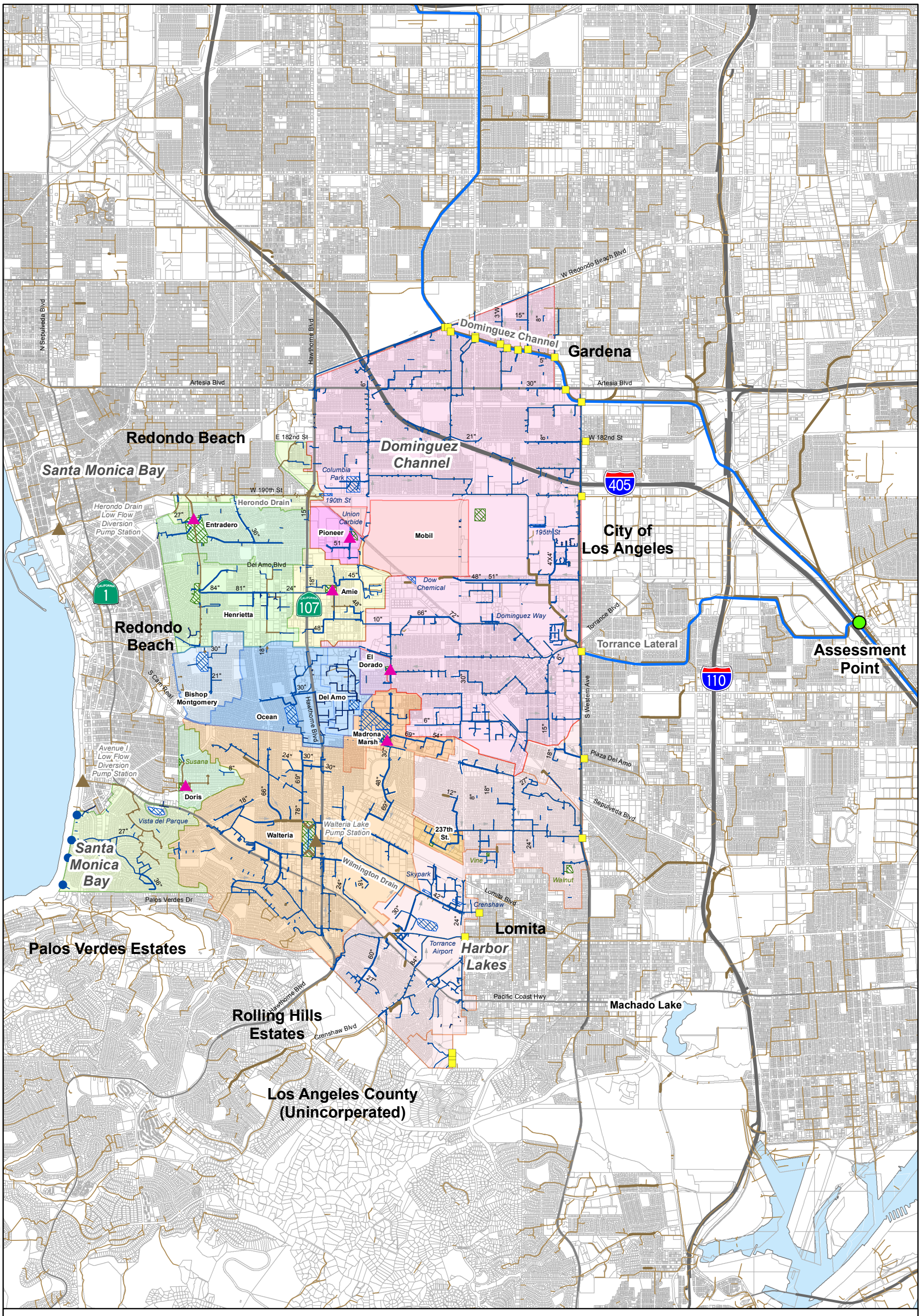
The DC-Torrance study area is shown on Figure 2.1. The DC-Torrance Watershed represents about 6.7 percent of the Dominguez Channel Watershed and about 44 percent of the City's total surface area. The DC-Torrance Watershed is highly urbanized and as a result, runoff is largely controlled by streets, retention basins, storm drains, and flood control channels. The main channels in the study area are the Dominguez Channel and the Torrance Lateral. The Dominguez Channel, which is maintained by the Los Angeles County Flood Control District, collects storm runoff from sections of the Cities of Hawthorne, Gardena, Lawndale, and Redondo Beach. The channel flows southerly, emptying into the Los Angeles Harbor area.

Table 2.1 Summary of Active Retention Basins
Beach Cities EWMP
City of Torrance

Basin Name	Volume (af)	Design Surface Elevation (ft-MSL)	Location
Bishop Montgomery	122	84	Palos Verdes Boulevard and Torrance Boulevard
Ocean Avenue	229	79	Ocean Avenue and Sepulveda Boulevard
Del Amo Center	86	75	Madrona Avenue and Plaza Del Amo
Total	**437**		

2.3.1 Discharge Locations

The City's stormwater system discharges into LACFCD storm drains at several locations, which are indicated on Figure 2.2. As shown on this figure, these points of discharge are primarily located along the east boundary of the City's service area. In addition, there are several discharge locations along the Dominguez Channel in the northeast portion of the City.



LEGEND

Watersheds

Groundwater Replenishment
- Bishop Montgomery
- Del Amo
- Ocean
- Vista Del Parque

Dominguez Channel
- Surface Drainage
- Eldorado
- Mobil
- Pioneer

Santa Monica Bay
- Surface Drainage
- Amie
- Doris
- Entradero
- Henrietta

Harbor Lakes
- Surface Drainage
- 237th St.
- Madrona Marsh
- Walteria

Facilities
- Storm Drains (Thickness Related to Size)
- Open Channels
- LACDPW Stormwater System
- Flow Direction
- Detention Basin
- Retention Basin

Pump Stations by Owner
- LACDPW
- City

- Continuous Deflective Separator
- Discharge to Storm Drain

Others
- channels
- Bodies of Water
- Parcels
- Assessment Point - Dominguez Channel and Torrance Lateral Meeting Point

Figure 2.2
Existing Stormwater System

0 0.25 0.5 1 Miles

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The stormwater collection system shown on Figure 2.2 also shows how stormwater is routed throughout the City. In general, the routing is as follows:

- Stormwater from the east side of the City is routed via the Torrance Lateral to Machado Lake.
- Stormwater from the west side of the City, stormwater discharge is routed to Santa Monica Bay.
- Stormwater from the northwest areas of the City's service area that are within the Santa Monica Bay watershed, is routed through LACFCD's Herondo Drain, which discharges stormwater into the Santa Monica Bay at the Redondo Beach King Harbor Marina and Pier. The Herondo Drain is also equipped with a low flow diversion pump station, which diverts dry weather flows into the sewer system.
- Stormwater from the southwest areas of the City's service area that are within the Santa Monica Bay watershed, is either directly discharged into Santa Monica Bay at Torrance Beach, passing through one of several Continuous Deflective Separation (CDS) units or is routed into LACFCD's storm drain network within Redondo Beach, which passes through the Avenue I Low Flow Diversion Pump Station, diverting dry weather flows to sanitary sewer.

3.0 APPLICABLE INTERIM AND FINAL REQUIREMENTS

The EWMP for Beach Cities follows the process in the Permit and identify the Water Quality Priorities (WQ Priorities) including the highest (Category 1) Water Quality Priorities, which are subject to TMDLs and WQBELs. Practically all of these TMDLs include associated compliance schedules that are considered in this RAA. Also included in this RAA is Category 2 pollutant (bacteria). There is no TMDL for bacteria; however, it is listed in the 303d list. The TMDL and EWMP milestones/compliance dates were considered while assessing the BMP options and the schedule for potential implementation. Traditionally, the approach of TMDL implementation plans has been focused on final TMDL compliance, whereas the Permit compliance paths offered to EWMPs increase emphasis on milestones. In line with the RAA Guidelines, for all final TMDL and TMDL/EWMP milestones that occur in 2032, the catch basin filters expected to result in attainment of the corresponding Permit limits are identified.

The waste load allocations (WLAs) in the Dominguez Channel Toxics TMDL are shown in Table 2.2. The Permits require the EWMP to provide reasonable assurance for the TMDL milestones that occur in the current Permit term. If applicable TMDLs do not prescribe a milestone in the current Permits, a milestone must be established. For bacteria, allowed exceedance days were set consistent with the Ballona Creek bacteria TMDL by taking 10 percent of wet days (at least 0.1 inch of rain plus following three days) that are not High Flow Suspension (HFS) days (at least 0.5 inches of rain plus the following day). An "exceedance" is defined as a sample that is above the WQO value of>4,000 MPN/100 mL fecal coliform.

Table 2.2 Summary of Schedule for Interim and Final Milestones Beach Cities EWMP City of Torrance			
	Schedule		
Pollutant	Interim (03/23/12)	Final (03/23/32)	Source
Copper	207.51 ug/L	9.7 ug/L	Automobile operation, industry, legacy pollutant
Lead	122.88 ug/L	42.7 ug/L	Vehicle brake pads, atmospheric deposition, soil erosion
Zinc	898.87 ug/L	69.7 ug/L	Vehicle tires, galvanized metal, atmospheric deposition
	REC-2 WQO		
Fecal Coliform	4000 #/100 mL[1]		Wastewater treatment plants, on-site septic systems, domestic and wild animal manure

Note:

(1) Obtained from Los Angeles Regional Water Quality Control Board (LARWQCB) Basin Plan Chapter 3 titled Water Quality Objectives, dated May 2, 2013 Section on In Waters Designated for Non-contact Water Recreation (REC-2)

4.0 WATERBODY POLLUTANT COMBINATIONS

A RAA involves providing an initial assessment of current baseline pollutant loading for water body pollutants using relevant subwatershed data and the best available representative land use and pollutant loading data collected within the last 10 years. Baseline loading estimates include modeling critical conditions that are used in the Dominguez Channel Toxics TMDL. There is only one TMDL (the Dominguez Channel Toxics TMDL) being evaluated here. As stated earlier, there is no TMDL for bacteria (Category 2) but it is being evaluated as it is listed on the 303(d) list.

Pollutant combinations assessed by a RAA fall into one of three categories:

- Category 1 (Highest Priority): Water body-pollutant combinations for which water quality based effluent limitations and/or receiving water limitations are established in Part VI.E, TMDL Provisions, and Attachments L through R of the Municipal Separate Stormwater Sewer System (MS4) Permit.
- Category 2 (High Priority): Pollutants for which data indicate water quality impairment in the receiving water according to the State Water Resources Control Board's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State's Listing Policy) and for which MS4 discharges may be causing or contributing to the impairment.

- Category 3 (Medium Priority): Pollutants for which there is insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable water limitations contained in Order R4-2012-0175 and for which MS4 discharges may be causing or contributing to the exceedance.

The water body pollutant classifications (WBPCs) were classified into one of the three MS4 Permit categories (Category 1-3). Those WBPCs with a TMDL were classified as Category 1, those WBPCs listed on the State's 303(d) list as impairing a particular water body segment were classified as Category 2, and those remaining WBPCs without an associated TMDL or on the State's 303(d) list, but showing exceedances of water quality criteria were classified as Category 3. A summary of these categorizations is presented in Table 2.3.

As part of the EWMP plan, a RAA for the Dominguez Channel is conducted for Category 1 (Highest Priority) pollutants and Category 2 (Fecal coliform). The RAA consists of an assessment, through catch basin filter literature review, to demonstrate that the activities and control measures (i.e., catch basin filters) identified are performed to demonstrate that applicable water quality based effluent limitations and/or receiving water limitations with compliance deadlines during the permit term will be achieved.

Table 2.3 Categorized Water Body-Pollutant Combinations
Beach Cities EWMP
City of Torrance

Water Body	Category 1 (TMDL)	Category 2 (303(d) List)	Category 3 (Other)
Dominguez Channel (lined portion above Vermont Ave)	Total copper, Total Lead, Total Zinc, Toxicity	Indicator Bacteria, Ammonia, Diazinon	Cadmium(diss.), Chromium (diss.), Mercury (diss.), Thallium (diss.), Bis(2Ethylhexl) phthalate, pH, Dissolved Oxygen
Torrance Lateral	Total Copper, Total Lead, Total Zinc	Coliform Bacteria	Cadmium (diss.), Cyanide, pH, Ammonia, PCBs (sed.), DDT (sed.)

5.0 POTENTIAL SOURCES OF POLLUTANTS OF CONCERN

5.1 Copper

Dominguez Channel is designated as impaired for copper and included on the Clean Water Act Section 303(d) list of impaired waterbodies for this pollutant and prioritized under the Dominguez Channel Toxics TMDL. The source of the copper in this watershed is not well known. Possible urban sources of metal loading include runoff from light industrial, transportation, and retail/commercial land uses with critical sources from auto repair, motor

freight transportation, and auto dealerships. Other potential urban sources of metals to the watershed include wet and dry atmospheric deposition and natural background loading.

Urban sources of copper include industrial sources and vehicle brake pads. Motor vehicles are a major source of copper, a metal that originates from brake pad wear. Copper and other pollutants are deposited on roads and other impervious surfaces and then transported to aquatic habitats via stormwater runoff.

Pollutant loads of copper from urban land uses is expected to decrease due to Senate Bill (SB) 346 which was signed into law on September 25, 2010. This legislation phases out copper in vehicle brake pads over a period of years; milestones include the following dates:

- January 1, 2021: Limits the use of copper in motor vehicle brake pads to no more than five percent by weight.
- January 1, 2025: Limits the use of copper in motor vehicle brake pads to no more than 0.5 percent by weight.

Full implementation of the legislation is expected to remove approximately 61 percent of the copper from urban runoff in metropolitan Los Angeles area watershed. Although vehicle brake pad wear is not expected to contribute as much copper in DC-Torrance Watershed as in the more urbanized metropolitan Los Angeles area, a decrease in copper loading is expected from vehicles due to the law's implementation.

5.2 Lead

Dominguez Channel is designated as impaired for lead and prioritized under the Dominguez Channel Toxics TMDL. The source of lead is associated with wet weather discharges from major municipal point sources (SWRCB 2011). Sources of lead in the urban environment also include automobile operation and industries with practices that may expose metals to stormwater. Lead was formerly used as an additive in gasoline. This has caused widespread contamination of soils near highways and streets and in drainage ways in urban areas. Exhaust particulates, fluid losses, drips, spills, and mechanical wear products continue to contribute lead to street dust.

5.3 Zinc

Dominguez Channel is designated as impaired for zinc and prioritized under the Dominguez Channel Toxics TMDL. Zinc loading can occur during wet weather storm events. Road dust, contaminated by tire wear, and erosion of zinc-plated material (i.e., galvanized chain link fences) are major contributors of zinc to urban runoff.

5.4 Fecal Coliform

Fecal coliform is listed in the 303d list for Dominguez channel. Fecal Coliforms are used as indicator of possible sewage contamination because they are commonly found in human and animal feces. Although they are generally not harmful themselves, they indicate the possible presence of pathogenic (disease-causing) bacteria, viruses, and protozoans that also live in human and animal digestive systems. Therefore, their presence in streams suggests that pathogenic microorganisms might also be present and that swimming and eating shellfish might be a health risk. Since it is difficult, time-consuming, and expensive to test directly for the presence of a large variety of pathogens, water is usually tested for coliforms and fecal streptococci instead. Antroponic sources of fecal contamination to surface waters include wastewater treatment plants, on-site septic systems, domestic and wild animal manure, and storm runoff. Non-antropogenic sources of fecal coliform include soils, (sediments), vegetation, decaying organic material, biofilms/regrowth, and atmospheric deposition.

6.0 APPROACH USED FOR THE RAA

This RAA involved a pollutant load reduction plan based on a cost-effective BMP implementation strategy that begins with enhancements to existing nonstructural BMP programs and development of new programs in some cases. This step is usually followed by implementation of distributed structural BMP (Catch basin filters) to meet TMDL reduction objectives.

Based on literature review documenting the removal efficiencies demonstrated by the catch basin filters, the proposed catch basin inserts would meet the TLRs set forth by the Dominguez Channel Toxics TMDL and bacteria target load reductions.

6.1 Uncertainty Analysis

There is often great uncertainty in water quality modeling for urban drainage systems because water quality variation in systems is complex and affected by many factors. The uncertainty analysis was done to assess uncertainty in the build-up and wash-off modeling of pollutants based on a calibrated water quantity SWMM model. A total of four SWMM 5 runoff parameters were considered for uncertainty analysis. The parameters were assumed to follow uniform distribution as done in Muleta and Nicklow (2005), and lower and upper bounds (+-10%) were assigned for each parameter. Values of the parameters vary from subbasin to subbasin depending on soil, land use, imperviousness, topography and/or other characteristics of the subbasin. The four parameters considered were imperviousness, infiltration parameters, subbasin width, and slope. During the uncertainty analysis, these baseline values were altered from the calibrated parameters by multiplying the parameter by the values in lower and upper bounds. This way, the baseline values would be scaled up or down while preserving the spatial variability determined from the watershed characteristics.

Comparison of uncertainties in the pollutant build-up and wash-off in SWMM indicated that those uncertainties varied slightly. This may be a consequence of the specific characteristics of rainfall events. The uncertainty analysis of water quality parameters in SWMM is conducive to effectively evaluating model reliability.

6.2 Estimated Required Pollutant Load Reduction

Using the 90th percentile load days for metals and critical wet year for bacteria (1995), the required pollutant reductions were calculated for attainment of final limitations. Per the RAA Guidelines, the percent reduction used to determine the control measures necessary to attain the final limits are based on the 90th percentile year. Even though the average year is included in the analysis, it should be noted that the interim limits, which were effective as of March 2012, for the Dominguez Channel Toxics TMDL are based on the 95th percentile of historic monitoring data (i.e., antidegradation-based), therefore MS4 agencies are assumed to be in compliance with these limits as of the effective date.

Required load reductions were evaluated at this RAA Assessment Point located just downstream of where Torrance Lateral and Dominguez Channel meet. The RAA Assessment Point represents location where the collective discharge from all subbasins in DC-Torrance Watershed can be assessed to contribute to pollutant loads to the Dominguez Channel. Pollutant loads outside of the DC-Torrance Watershed are not considered in this loading analysis at the RAA Assessment Point.

6.3 Baseline Loading - Average and 90th Percentile Wet Years

This RAA is based on continuous simulation, and a “representative” year-long time period was selected to represent the average year and a separate wet year was selected for bacteria as depicted in Table 2.4. The year-long simulation allows the modeling to capture the variability of rainfall and storm sizes and conditions. The metals baseline loading was based 90th percentile wet weather daily load from 10 year period from November 1, 2002 to October 31, 2012.

Table 2.4 Average and 90th Percentile Years by Pollutant
Beach Cities EWMP
City of Torrance

Pollutant	Average Year	90th Percentile Daily Load
Metals	2006 - 2007	Copper – 02/05/2009 Zinc – 11/08/2002
Pollutant	**Average Year**	**90th Percentile Year**
Fecal Coliforms	2006 - 2007	1994 - 1995

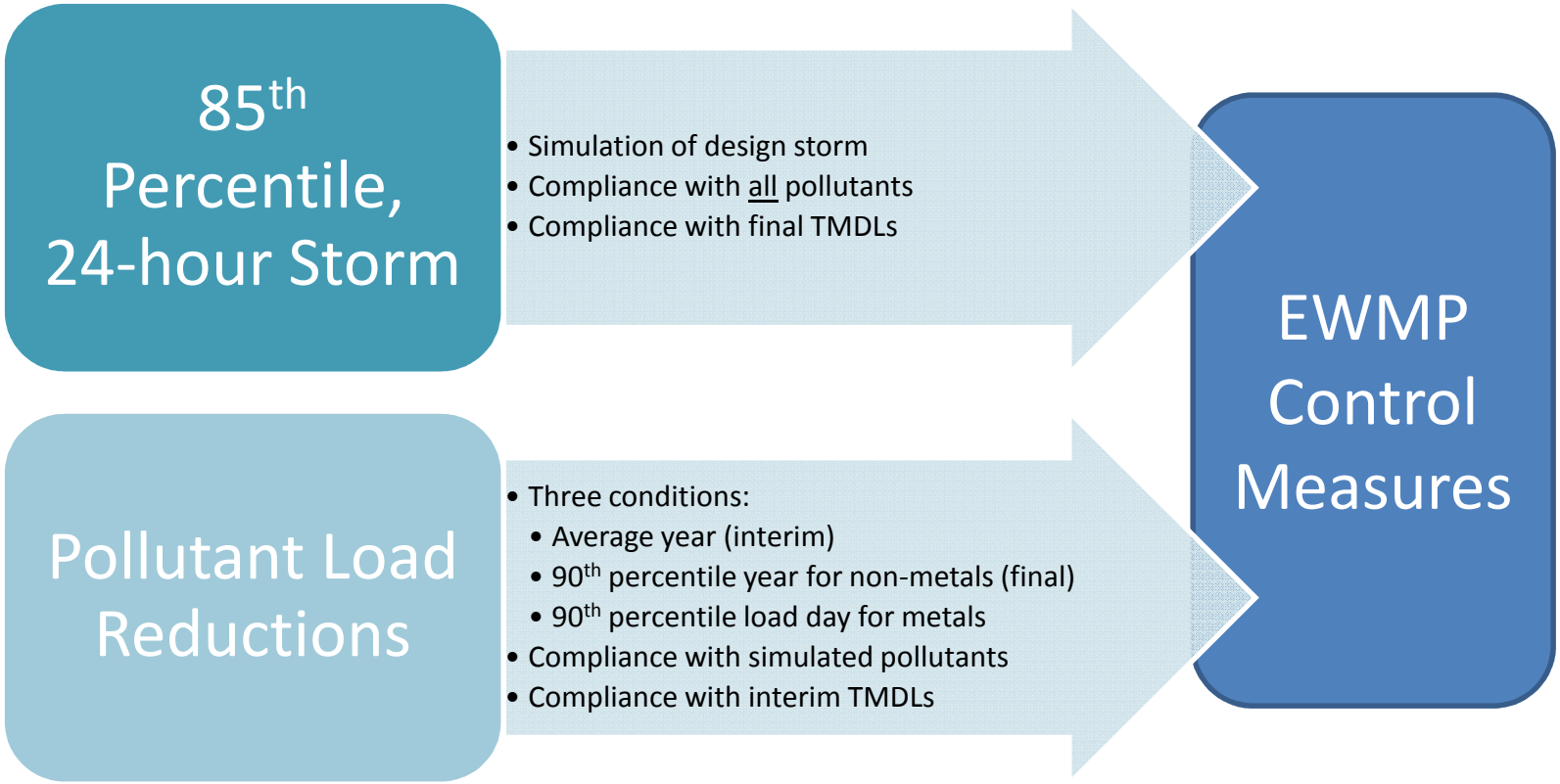
The average year and typical wet year (2002 -2003) loading results were used to prioritize the subbasins for BMP implementation. The flow conditions and loading results from the RAA for the average year and 90th percentile wet year are summarized in Tables 2.5 and 2.6. The

loading for subbasin and hydrologic subunit (HSU) on a typical wet year (2003) are summarized on Figures 2.3 and 2.4 for zinc. Similar figures have been developed for copper and fecal coliform, and are shown in Appendix A.

The typical wet year load was normalized by area for each HSU and subbasin, and then categorized into high, medium, and low groups. The rankings are shown for zinc on Figures 2.5 and 2.6. For each subbasin/HSU, classifications were based on the modeled annual pollutant loads normalized by area, which were then ranked in order from high to low and grouped into quintiles. A score of 5 indicates that the subbasin pollutant loading was in the top 20th percentile (high pollutant loading); whereas a score of 1 represents a subbasin loading in the bottom 20th percentile (low pollutant loading). Basins with ranking score between 4 and 5 were ground into high pollutant category. Medium pollutant loading category includes basin with ranking score between 3 and 4 and basins with ranking score less than 3 were characterized as low pollutant loading. Zinc was selected as the focus because of the priority in addressing metal loads. The figures show that the subbasins between 190th Street and Dominguez Street are associated with higher pollutant loading rates per unit area when compared to other subbasins.

Table 2.5 Modeled Annual Average Load (2007)
Beach Cities EWMP
City of Torrance

Subbasin	Volume (ac-ft)	Copper (lb)	Lead (lb)	Zinc (lb)	Fecal Coliform (MPN)
2019	45.96	26	5	131	3.96E+14
2020	7.83	4	1	19	6.91E+13
2021	81.39	56	14	238	1.40E+15
2022	32.55	17	4	78	6.53E+14
2037	6.46	4	1	19	2.92E+13
2038	11.62	11	3	46	1.53E+14
2049	11.81	8	2	37	4.51E+13
2051	1.57	1	0	6	9.12E+12
2047	0.83	1	0	3	1.16E+13
2042	2.20	2	1	8	2.00E+13
2050	3.07	3	1	11	2.05E+13
2044	7.81	7	2	28	8.66E+13
2046	3.05	2	1	10	1.84E+13
2043	4.09	3	1	13	1.88E+13
2045	5.25	4	1	15	1.46E+13
2048	52.15	34	9	147	9.21E+13
DC-Torrance (Assessment Point)	**277.6**	182.78	45.65	808.80	3.04E+15



TWO TYPES OF NUMERIC GOALS AND EWMP COMPLIANCE PATHS

FIGURE 2.3

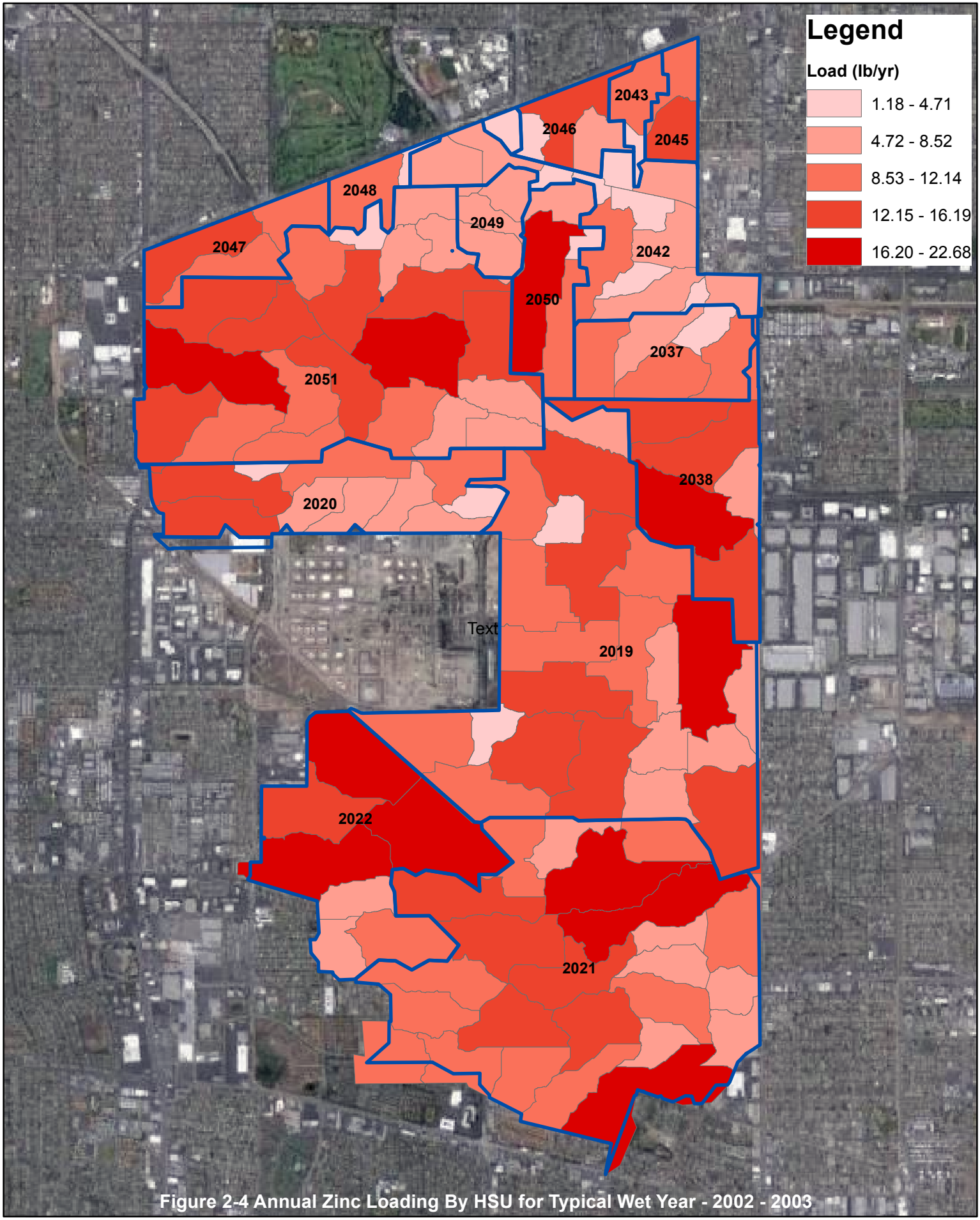


Figure 2-4 Annual Zinc Loading By HSU for Typical Wet Year - 2002 - 2003

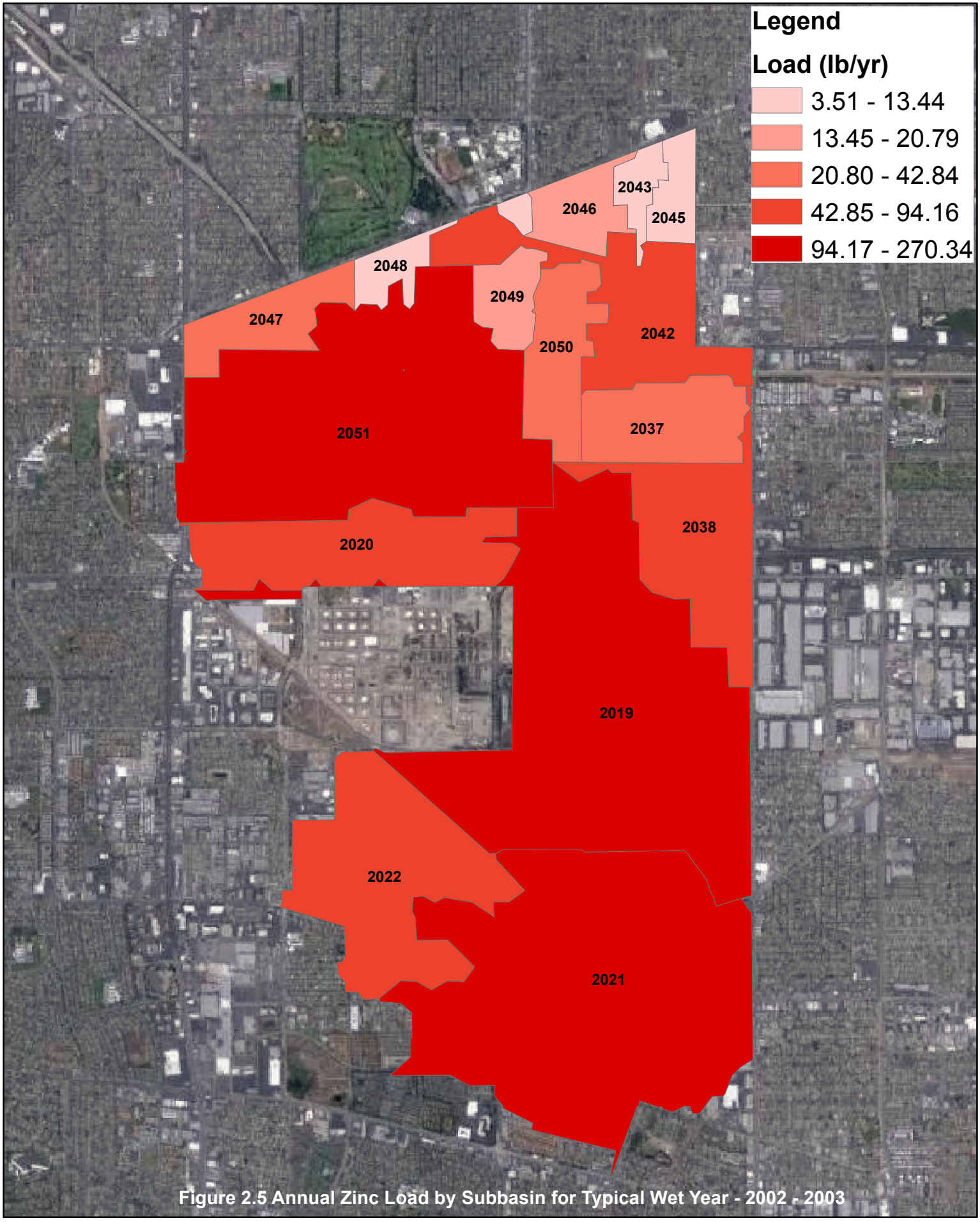


Figure 2.5 Annual Zinc Load by Subbasin for Typical Wet Year - 2002 - 2003

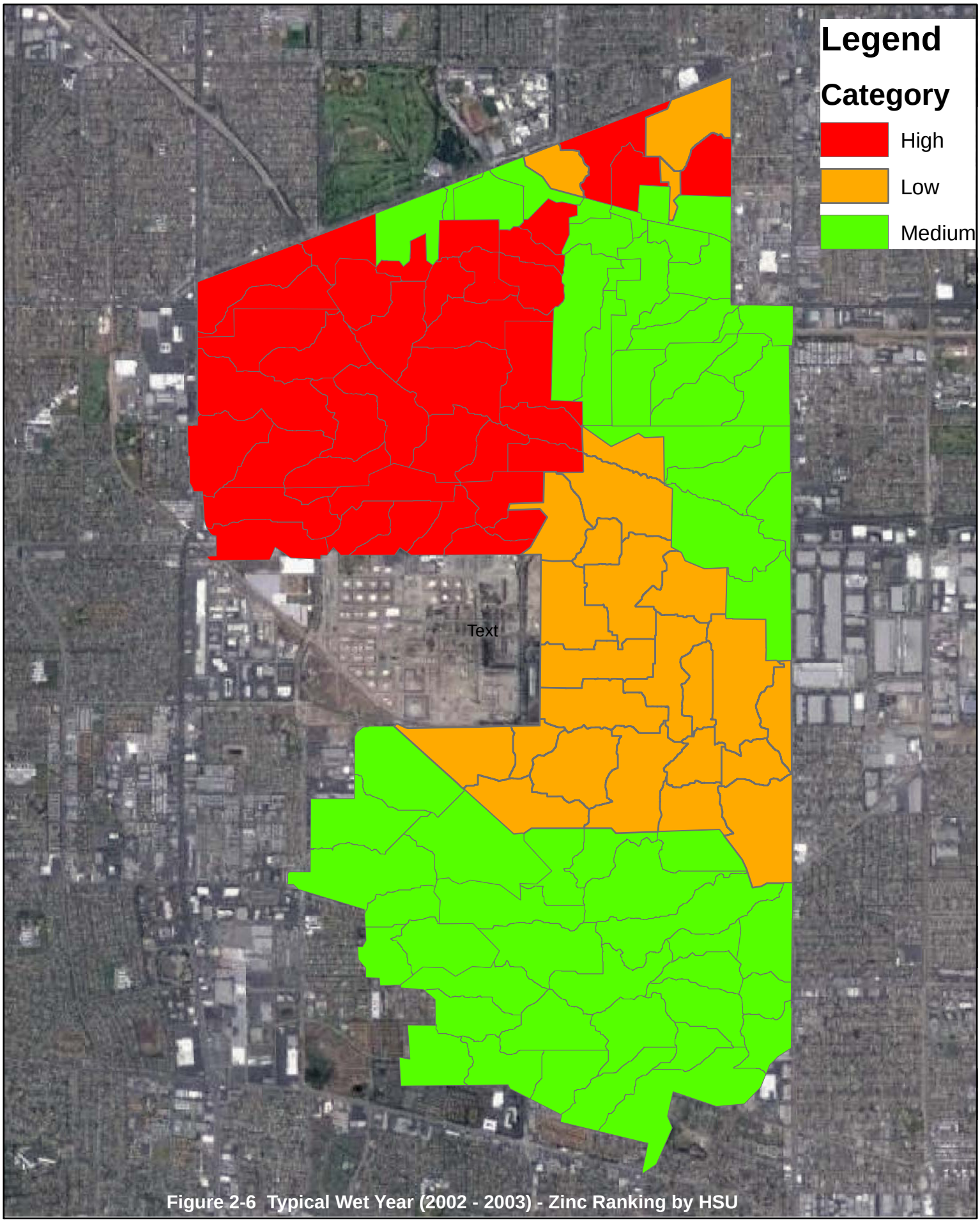


Figure 2-6 Typical Wet Year (2002 - 2003) - Zinc Ranking by HSU

Table 2.6 Summary Results of Critical Wet-weather (90th Percentile) Load Beach Cities EWMP City of Torrance						
Basin	90th Percentile –Day				90th Percentile Wet Year - 1995	
	Copper – 02/05/2009		Zinc – 11/08/2002			
	Volume (ac-ft)	Daily Load (lb)	Volume (ac-ft)	Daily Load (lb)	Volume (ac-ft)	Fecal Coliforms (MPN)
DC-Torrance (Assessment Point)	65.96	36.99	93.85	133.39	5333.24	6.27E+16

6.3.1 Fecal Coliform Baseline Loading –Exceedance Days

The 90th percentile wet day and dry day loading for fecal coliform was determined for the study area. The results were then compared against the applicable WQBELs, RWLs, and WQOs discussed earlier in this TM. During wet weather, the allowable load is a function of the volume of water in the channel and the fecal coliform target concentration.

The daily output concentrations from the model for the identified critical event days (1995) were compared against the applicable WQO value of 4,000 MPN/100 mL. The number of modeled exceedances for bacteria in DC-Torrance watershed is shown in Table 2.7.

Table 2.7 Modeled Bacteria Exeedance – Critical Wet-weather Conditions (1995) Beach Cities EWMP City of Torrance			
Subbasin	Total # of Critical Event Days	# of Fecal Coliform Exceedances	Fecal Coliform Exceeded (%)
DC-Torrance	210	81	38.6%

6.4 Determination of TMDL Reduction Objective

Numeric goals were calculated for each parameter based on the difference between the modeled load and calculated TMDL load for average and critical wet years. Modeled loads above the TMDL load were considered as a required reduction and subtracted from the model baseline load to develop an instream load reduction target.

6.4.1 Wet-Weather Required Reductions

The wet weather pollutant reduction targets for average and critical conditions are summarized in Table 2.8. For metals, the reductions are based on daily load and for bacteria, it is based on annual load. The determination of limiting pollutant considered implementation actions to control

the pollutant – for example, Senate Bill 346 will result in significant reductions of copper loading from brake pads.

Target load reductions (TLRs) are the reduction of baseline loads needed to achieve allowable loads for the 90th percentile day. To determine whether pollutant reductions are necessary and the extent of those reductions, the baseline loads for critical wet conditions determined from the SWMM model were compared against the allowed loading. Comparisons of baseline loading versus allowed loading are shown Table 2.9.

Interim limits, which were effective as of March 2012, for the Dominguez Channel Toxics TMDL are based on the 95th percentile of historic monitoring data, therefore MS4 agencies are assumed to be in compliance with these limits as of the effective date. Based on this, reasonable assurance of compliance with these interim limits has been demonstrated.

Table 2.8 Wet-weather Pollutant Reduction Targets[(1)]
Beach Cities EWMP
City of Torrance

Study Area	Metals – 90th Percentile Load Day		
	Copper	Lead	Zinc
DC-Torrance	62%*	0%*	76%*
	Fecal Coliform – 90th Percentile Wet Year		
	53%		

Notes:

(1) The critical year reduction targets were provided by Geosyntec.

* Metals TLRs reflect daily LRs on the 90th percentile wet weather load days and bacteria (fecal coliform) TLRs reflect annual LRs on the 90th percentile wet weather year.

Table 2.9 Wet-weather Load Reduction
Beach Cities EWMP
City of Torrance

Study Area	Metals			
	90th Percentile Load Day	Copper (lb)	Lead (lb)	Zinc (lb)
DC-Torrance	Copper – 02/05/2009 Zinc – 11/08/2008	22.93	0	101.38
	Fecal Coliform (MPNx10^14)			
	1995	332.3		

* Metals TLRs reflect daily LRs on the 90th percentile wet weather load days and bacteria (fecal coliform) TLRs reflect annual LRs on the 90th percentile wet weather year.

6.5 Dry-Weather Pollutant Reduction Targets

For dry weather, bacteria are the limiting pollutant (not zinc). That is bacteria are the only Category 1 or 2 WBPC. Reductions of bacteria during EWMP implementation will drive reductions of other the pollutants. This is based on qualitative analysis.

7.0 QUALITATIVE EVALUATION OF NONSTRUCTURAL AND DISTRIBUTED STRUCTURAL BMPS (CATCH BASIN FILTERS)

As shown in the previous sections, a number of nonstructural and distributed structural BMP (catch basin filters) options are needed to meet TMDL and the permit requirements. The evaluation uses identified implementation of catch basin filters and nonstructural projects to determine the set of actions that will most likely be implemented in an effort to achieve the TMDL and Permit requirements. As the implementation is an adaptive management process, the precise suite of actions and the timing may be changed to use resources more cost effectively. The adaptive management approach will allow changes in the number and type of catch basin filters and nonstructural BMPs to ensure cost effective measures are being implemented. Flexibility in the schedule and makeup of the Implementation Plan are key to adaptive management.

The qualitative analysis is based on the reductions from both nonstructural and catch basin filters that work together to reduce the concentration and load of pollutants. Generally nonstructural BMPs consist of pollution prevention activities and source control activities that reduce the amount of the constituent entering the MS4 system, ultimately reducing the concentration in stormwater. Nonstructural activities also encourage the effective use of water, aiming to reduce dry-weather flows. In this way, nonstructural activities reduce the constituent load entering catch basin filters located downstream of the sources.

7.1 Nonstructural BMPs

Non-structural BMPs committed by the Beach Cities' WMG will result in 5 percent reduction in metals and fecal coliform load. The nonstructural BMPs committed by the City are summarized in Table 2.10. The table lists the new nonstructural BMPs, enhancements to existing nonstructural BMPs, and the TMDL pollutants and flow conditions addressed. The City has committed to implement nonstructural BMPs in the DC-Torrance Watershed.

Table 2.10 Summary of Nonstructural BMPs to Support TMDL Implementation Beach Cities EWMP City of Torrance				
	Condition		Pollutants Addressed	
Nonstructural BMP	Wet Weather	Dry Weather	Bacteria	Metals
Enhancements to Existing BMPs				
Smart gardening program enhancements	√	√	◗	◗
TMDL-specific stormwater training	√	√	◗	◗
Enhancement of commercial and industrial facility inspection	√	√	◗	◗
Enhancement escalation procedures	√	√	◗	●
Improved street sweeping technology	√		◗	◗
New BMP				
Reduction of irrigation return flow	√	√	●	●
√ - applicable; ◗ - partially effective; ● - effective				

7.2 Distributed Structural BMPs - Catch Basin Filters

Roads represent a major source of TMDL pollutant loads, and therefore treating road runoff is considered a key strategy for multi-pollutant TMDL implementation. Because of the number and spatial distribution of catch basins in the DC-Torrance Watershed, they represent an excellent opportunity for treating pollutants in addition to trash. Implementing catch basin inserts throughout the DC-Torrance Watershed is highly applicable because of the high density of catch basins. The City will install about 200 catch basin filters in the DC-Torrance watershed. Catch basin filters were not evaluated quantitatively. Effectiveness of catch basin inserts to meet the study objectives was based on literature review documenting significant removal of heavy metals and experiences from nearby Cities.

Fact sheets and literature available on commercially available catch basin filters suggested that the proposed catch basin filters were effective at capturing and removing pollutants from stormwater runoff including sediments, heavy metals, and oil and grease. One of the literatures summarized the pollutant removal efficiencies provided by Grate Inlet Skimmer Box/Round Curb Inlet Basket (Schematic included in Appendix B). It included numeric pollutant reductions from various studies or independent tests between 1998 and 2007. The study on Optimization of Stormwater Filtration at the Urban/Watershed Interface conducted by the University of Irvine, California, Department of Environmental Health in 2005 was an independent test conducted to assess the pollutant removal efficiency of the Grate Inlet Skimmer Box/Round Curb Inlet Basket. This study in 2005 concluded a 99% reduction in Lead. Other studies include the field test conducted by the City of El Monte in 2002 that concluded that the Grate Inlet Skimmer Box/Round Curb Inlet Basket were effective in removing 95% of Zinc and Copper each and 87% of Lead concentrations. In addition, we also referred to the independent performance

assessment conducted by the City of Los Angeles in 2005 to evaluate the performance of storm drain inlet filter devices at removing oil and grease and associated pollutants from stormwater. The study aimed at evaluating the performance (at various stages of their useable lives) of four (4) different catch basin filters currently used by the City of Los Angeles in removing and retaining used motor oil and associated pollutants from urban runoff. This study tested the performance of five (5) different types of catch basin filters at removing sediments, trash, oil and grease, and metals for a flow rate ranging between 10 and 25 gallons per minute. It involved four (4) sampling events and five study sites. The key summary points indicated that qualitatively, the results of the study found that all of the units were moderately effective at removing oil and grease, suspended solids, and heavy metals. Furthermore, the study indicated that for most insert types, inspection and maintenance should occur before and after each rain event during wet weather and monthly during dry weather to maintain their performance integrity and to minimize leaching of previously captured pollutants.

A more recent independent test conducted in 2013-2014 by the City of Lake Forest suggested that the catch basin filters were effective in a heavy metal removal of 75%. The product tested was the Ultra Filter Sock Heavy Metal Drain Filter.

Based on literature review documenting the removal efficiencies demonstrated by the catch basin filters, the proposed catch basin inserts would meet the TLRs set forth by the Dominguez Channel Toxics TMDL with 75% as the estimated target load reduction for a flow rate ranging between 10 to 25 gallons per minute.

In addition, the City of Torrance is in the process of developing the Green Street Program and the ordinances to implement Green Street design features as part of street redevelopment. While implementing redevelopment of arterial streets, the City of Torrance would assess opportunities for Green Street design features to facilitate treatment through filtration or infiltration. Green Street elements may include infiltration trench that provides water quality treatment, reduction in peak flow discharges, and potential groundwater recharge. Other Green Street elements that may be considered include bioretention/biofiltration practices to achieve water quality treatment through filtration by vegetation and soils to remove pollutants with perforated underdrain to convey the treated runoff. The City of Torrance is committed to developing the Green Street Ordinance established and in effect by July 2015 as required by the MS4 Permit.

For bacteria, a combination of non-structural BMPs including Public Education and Outreach, reduction of irrigation return flows, and future development and implementation of Green Street design features would assist with meeting the TLRs for bacteria. In addition, the study on Optimization of Stormwater Filtration at the Urban/Watershed Interface conducted by the University of Irvine, California, Department of Environmental Health in 2005 indicated Fecal Coliform (bacteria) removal efficiency of 33% by the Grate Inlet Skimmer Box/Round Curb Inlet Basket.

7.3 Wet Weather

The interim and final targets are presented in total acre-feet per year that requires treatment through structural BMPs. Based on literature review documenting the removal efficiencies demonstrated by the catch basin inserts, it can be justified that the City's proposal to implement catch basin inserts to meet the TLRs set forth by the Dominguez Channel Toxics TMDL would be realistic and achievable.

Table 2.11 summarizes the catch basin filters identified through the RAA to address the TMDL implementation.

Table 2.11 Summary of Structural BMPs to Support TMDL Implementation
Beach Cities EWMP
City of Torrance

Structural BMP	Condition		TMDL Pollutant Addressed	
	Wet Weather	Dry Weather	Bacteria	Metals
Catch Basin Filters Distributed BMPs				
Catch basin Filters	√	√	●	●
Green Street Elements	√	√	●	●
√ - applicable; ○ - not effective; ● - effective				

7.4 Dry Weather

Although clearly defined definitions exist for wet periods, definitions for dry periods are less clearly defined. Wet weather periods are either defined in terms of rainfall or instream flow. For bacteria, a wet day is one with a rainfall total greater than 0.1 inches plus the three subsequent days, while metals criteria define wet days as those with instream flow above the 90th percentile. One seemingly intuitive way of defining a dry period is simply to use the "non-wet" days represented as the inverse of wet days. However, summary of model results indicate some residual influence of wet weather among the "non-wet" days. This presents some challenges for estimating loads and evaluating dry weather compliance because BMP planning would be better served by choosing design conditions that are more influenced by natural background baseflow and/or anthropogenic activities such as point source discharges or dry weather runoff from irrigation (instead of post-rain event interflow).

Dry weather reductions are attained through a combination of non-structural practices including flow reduction source controls as discussed in the EWMP.

The dry weather load reduction will focus on non-structural source control and pollution prevention measures that are designed to reduce the amount of pollutants and understand the effect of pollutants entering runoff though education, enforcement and behavioral modification programs. The City plans to continue and extend the dry weather flow diversion program to the

Dominguez Channel. This program will reduce runoff and pollutant loads by diverting non-storm water discharges to the sanitary sewer system and/or vegetated areas for infiltration.

8.0 POLLUTANT REDUCTION PLAN

Fact sheets and literature available on commercially available catch basin filters were reviewed and the results were discussed in earlier sections.

The Pollutant Reduction Plan is considered an "initial" scenario because over time, through adaptive management, the responsible agencies will likely "shift" among different types of BMPs (e.g., increase implementation of green streets and reduce implementation of regional BMPs) or substitute alterative BMPs altogether (e.g., implement dry wells instead of green streets). These shifts will be supported by analyses to show the substituted BMPs provide an equivalent target load reduction as the replaced BMPs.

Table 2.12 shows the qualitative analyses were performed to evaluate the ability of BMPs to meet load reduction targets associated with WLAs.

Table 2.12 Pollutant Reduction After Implementing catch Basin BMPs
Beach Cities EWMP
City of Torrance

Pollutants	Existing Load	Target Load Reduction (%)	Nonstructural BMP	Distributed Structural BMPs (Catch Basin Inserts)	Structural + Nonstructural BMPs
Zinc 90th Percentile Load Day - 11/08/2002					
Copper (lb/d)	36.99	62%	5%	75%	80%
Zinc (lb/d)	133.39	76%	5%	75%	80%
Critical Wet Year - 1995					
Fecal Coliform (MPN/yr) x10^14	627	53%	5%	33%	38% plus filtration/infiltration opportunities through potential Green Street Implementation in future.

No TMDL developed for fecal coliform. Target Load Reduction calculated based on REC-1 standard and high-flow suspension days.

Note:

The City of Torrance is following the adaptive management approach that would allow them to monitor the performances of proposed distributed structural BMPs (catch basin filters) and non-structural best management practices with respect to meeting the established TLR requirements.

Table 2.12 Pollutant Reduction After Implementing catch Basin BMPs Beach Cities EWMP City of Torrance					
Pollutants	Existing Load	Target Load Reduction (%)	Nonstructural BMP	Distributed Structural BMPs (Catch Basin Inserts)	Structural + Nonstructural BMPs

In addition, the City of Torrance is kick-starting building the Green Street Program and the ordinances to consider implementation of Green Street design features as part of street redevelopment within the City of Torrance. While implementing redevelopment of arterial streets, the City would assess opportunities for Green Street design with measures for treatment through filtration or infiltration. Green Street elements may include infiltration trench that provides water quality treatment, reduction in peak flow discharges, and potential groundwater recharge. Other Green Street elements that may be considered include bioretention/biofiltration practices to achieve water quality treatment through filtration by vegetation and soils to remove pollutants with perforated underdrain to convey the treated runoff. The City of Torrance is committed to developing the Green Street Ordinance established and in effect by July 2015 as required by the MS4 Permit.

Based on the monitoring results, the City of Torrance would consider additional control measures if the required TLRs were not met or other improvements to existing best management practices were found necessary. This would allow changes in the number and type of best management practices selected for implementation. Through adaptive management and based on the future monitoring results, the implementation schedules may be modified to reflect the increased knowledge of the watershed. Actual schedule for Implementation of BMPs will occur as funding becomes available.

8.1 Implementation Schedules

The estimated implementation schedules for the nonstructural and catch basin filters that are being considered by the City of Torrance to comply with WLAs and the Permit requirements are discussed below. The schedules presented herein are sufficient for long-term planning. Through adaptive management and based on the future monitoring results, the implementation schedules may be modified to reflect the increased knowledge of the watershed. Actual schedule for Implementation of BMPs will occur as funding becomes available.

8.1.1 TMDL Schedule

The TMDL implementation schedule consists of a phased approach, with interim WLAs to be met by March 23, 2012, and full compliance by March 23, 2032. Interim milestones for metals have been assumed to be met. Interim limits, which were effective as of March 2012, for the Dominguez Channel Toxics TMDL are based on the 95th percentile of historic monitoring data, therefore MS4 agencies are assumed to be in compliance with these limits as of the effective date.

For bacteria, no TMDL has been developed for fecal coliform. Reduction was estimated based on the Ballona Creek Bacteria TMDL. For bacteria, a combination of non-structural BMPs including Public Education and Outreach, reduction of irrigation return flows, and future development and implementation of Green Street design features would assist with meeting the TLRs for bacteria. In addition, the study on Optimization of Stormwater Filtration at the Urban/Watershed Interface

conducted by the University of Irvine, California, Department of Environmental Health in 2005 indicated Fecal Coliform (bacteria) removal efficiency of 33% by the Grate Inlet Skimmer Box/Round Curb Inlet Basket.

8.1.2 Nonstructural BMP Schedules

An estimated schedule for the nonstructural BMPs is summarized in Table 2.13. The schedule accounts for the planning and design of the nonstructural BMP programs and the long-term implementation of the programs.

8.1.3 Distributed Structural BMPs (Catch Basin Filters) Schedules

Catch basin inserts were identified as part of the RAA analysis that the City of Torrance would consider implementing as part of the EWMP process. The City of Torrance is committed to implementing catch basin filters to meet the TLR and an estimated schedule for implementation has been presented in Table 2.14.

9.0 CONCLUSIONS

The City has completed a Reasonable Assurance Analysis (RAA) for TMDL pollutants and those pollutants that may reasonably be expected to exceed ambient water quality standards in receiving waters during wet weather conditions. Facilitating the RAA is the model recommended by Los Angeles County: *Loading Simulation Program in* C++ *(LSPC).* Based on qualitative analysis of proposed BMPs, the City is expected to meet the Dominguez Channel Toxics TMDL and the bacteria target load reductions.

10.0 REFERENCES

1. *Storm Water Management Model, Version 4: User's Manual*. U.S. EPA, 1988.
2. *Storm Water Management Model, Version 5: User's Manual*, U.S. EPA, 2008.
3. Guidance for Performing Reasonable Assurance Analysis in a watershed management program, including an enhanced Watershed Management Program, Los Angeles Regional Water Quality Control Board, March 2014
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5. Stormwater Quality Master Plan, City of Torrance, CA, 2011
6. System for Urban Stormwater Treatment and Analysis IntegratioN (SUSTAIN) User's Manual Version 1.2, U.S. EPA, 2012
7. P8 Urban Catchment User's Manual, IEP, Inc.
8. Phosphorus Removal by Urban Runoff Detention Basins, Athayde et. al, 1983
9. Beach Cities EWMP Update dated February 2015, prepared by Geosyntec Consultants.

10. Los Angeles Regional Water Quality Control Board (LARWQCB) Basin Plan Chapter 3 titled Water Quality Objectives, dated May 2, 2013 Section on In Waters Designated for Non-contact Water Recreation (REC-2)
11. Removal Efficiencies of Grate Inlet Skimmer Box/Round Curb Inlet Basket as per Longo Toyota – Independent Field Test conducted in 2002 by the City of El Monte.
12. Optimization of Stormwater Filtration at the Urban/Watershed Interface, Department of Environmental Health, Independent Test conducted by the University of California, Irvine, in 2005.
13. The California Integrated Waste Management Board Catch Basin Insert Study Final Report, May 2005.
14. The City of lake Forest, Ultra Filter Sock Heavy Metal Drain Filter, Independent test, conducted by Environmental Chemistry lab, 2013-2014.

Table 2.13 Proposed Implementation Schedule for Nonstructural BMPs Beach Cities EWMP City of Torrance						
Structural Project	Duration (months)	Timeline				
		2014	2015	2016	2017	2018
Catch Basin Cleanouts						
Purchase Advanced cleaning Technology (steam cleaning), as needed						
Focus on Problem Areas	3 – 6					
Increase Frequency of Cleanouts	Ongoing					
Catch Basin Inserts						
Install Catch Basin Inserts in Implementation Area	Ongoing					
Downspout Disconnection Program						
Planning & Assessment	8 – 12					
Implementation	24					
Fats, Oils and Grease Outreach						
Focus on Residents in TMDL Implementation Area	8 – 12					
Continuation of Existing FOG Outreach	Ongoing					
Green Waste Outreach						
Planning & Assessment	8 – 12					
Implementation	24					
Illicit Connection Removal						
Survey System in TMDL Implementation Area	24					
Implementation	24 – 36					

Table 2.13 Proposed Implementation Schedule for Nonstructural BMPs Beach Cities EWMP City of Torrance						
Structural Project	Duration (months)	Timeline				
		2014	2015	2016	2017	2018
Impervious Cover Reduction						
Assess Feasibility of Reducing Existing Impervious cover	8 – 12					
Implementation, if appropriate	24					
Industrial/Commercial Facilities Control Program						
Nutrients and Toxics Specific Training	3 – 6					
Outreach to Facilities to Improve Onsite Source Control Activities	8 – 12					
Continuation of Existing I/C Facilities Program	Ongoing					
Pet Waste Outreach						
Planning & Assessment	8 – 12					
Implementation of Pet Waste Bag Dispenser Stations in TMDL Implementation Area	8 – 12					
Focus on TMDL Implementation Area Resident Outreach	24					
Continuation of Existing Pet waste Outreach	Ongoing					
Post Construction Requirements						
Specialized Nutrient, Toxics and Runoff Reduction Training for Staff	3 – 6					
Require Implementation of BMPs that Effectively Remove Nutrients and Toxics for Redevelopment Projects in County Islands	Ongoing					

Table 2.13 Proposed Implementation Schedule for Nonstructural BMPs Beach Cities EWMP City of Torrance						
Structural Project	Duration (months)	Timeline				
		2014	2015	2016	2017	2018
Sewer System Maintenance						
Specialized Training for Staff	3 – 6					
Focus maintenance in County Islands	8 – 12					
Smart Gardening Program						
Planning & Assessment	8 – 12					
Implementation	Ongoing					
Street and Parking Lot Sweeping						
Planning & Assessment	8 – 12					
Upgrade/Purchase More Effective Street Sweepers, as needed	3 – 6					
Conduct Residential Outreach	8 – 12					
Increase Frequency of Sweeping	Ongoing					

Table 2.14 Implementation Schedule for Distributed Structural BMPs (Catch Basin Inserts)
Beach Cities EWMP
City of Torrance

Structural Project	Timeline								
	2015	2017	2019	2021	2023	2025	2027	2029	2031
Catch Basin Inserts									
Green Street Elements									

Note:

Catch Basin Inserts are the distributed structural BMPs identified to be considered by the City of Torrance for implementation. The City has committed to the implementation of catch basin inserts to meet TLR requirements.

Based on literature review documenting the removal efficiencies demonstrated by the catch basin inserts, we justify that our proposal to implement catch basin inserts to meet the TLRs set forth by the Dominguez Channel Toxics TMDL would be realistic and achievable.

In addition, the City of Torrance is kick-starting developing the Green Street Program and the ordinances to consider implementation of Green Street design features as part of street redevelopment within the City of Torrance. While implementing redevelopment of arterial streets, the City would assess opportunities for Green Street with measures for treatment through filtration or infiltration. Green Street elements may include infiltration trench that provides water quality treatment, reduction in peak flow discharges, and potential groundwater recharge. Other Green Street elements that may be considered include bioretention/biofiltration practices to achieve water quality treatment through filtration by vegetation and soils to remove pollutants with perforated underdrain to convey the treated runoff. The City of Torrance is committed to developing the Green Street Ordinance established and in effect by July 2015 as required by the MS4 Permit.

For bacteria, a combination of non-structural BMPs including Public Education and Outreach, reduction of irrigation return flows, and future development and implementation of Green Street design features would assist with meeting the TLRs for bacteria. In addition, the study on Optimization of Stormwater Filtration at the Urban/Watershed Interface conducted by the University of Irvine, California, Department of Environmental Health in 2005 indicated Fecal Coliform (bacteria) removal efficiency of 33% by the Grate Inlet Skimmer Box/Round Curb Inlet Basket.

APPENDIX A – SUMMARY OF LOAD ESTIMATION

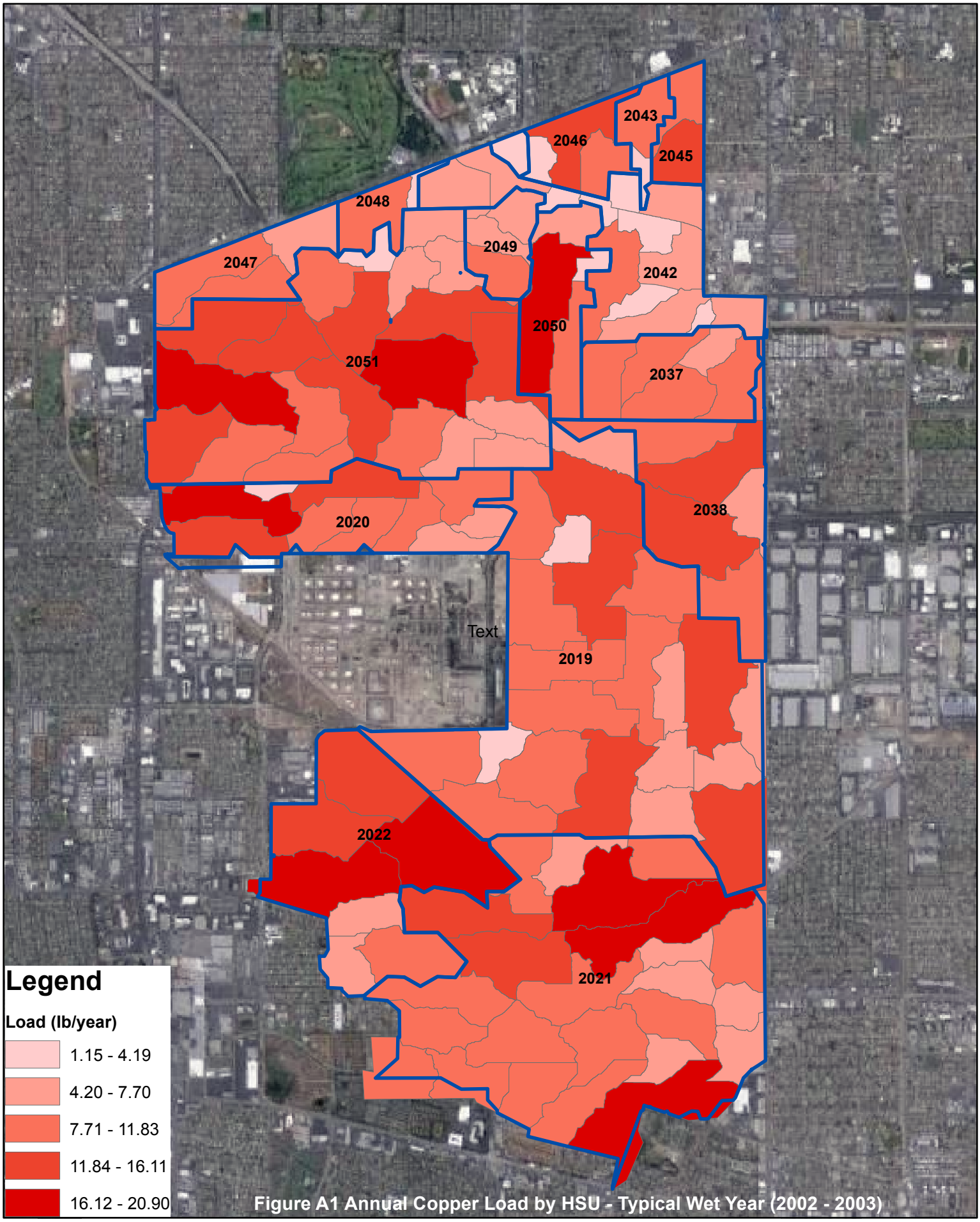

Figure A1 Annual Copper Load by HSU - Typical Wet Year (2002 - 2003)

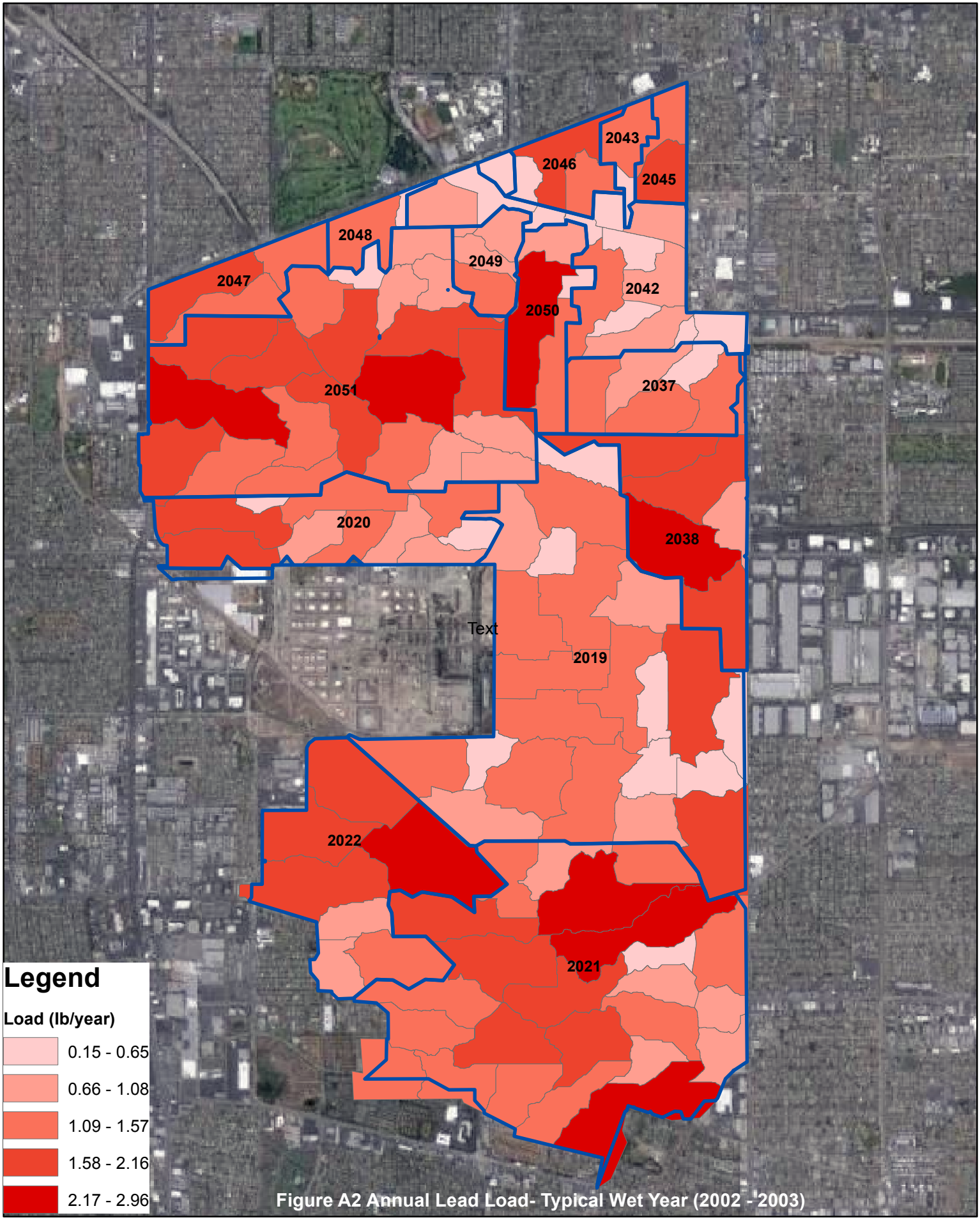

Figure A2 Annual Lead Load- Typical Wet Year (2002 - 2003)

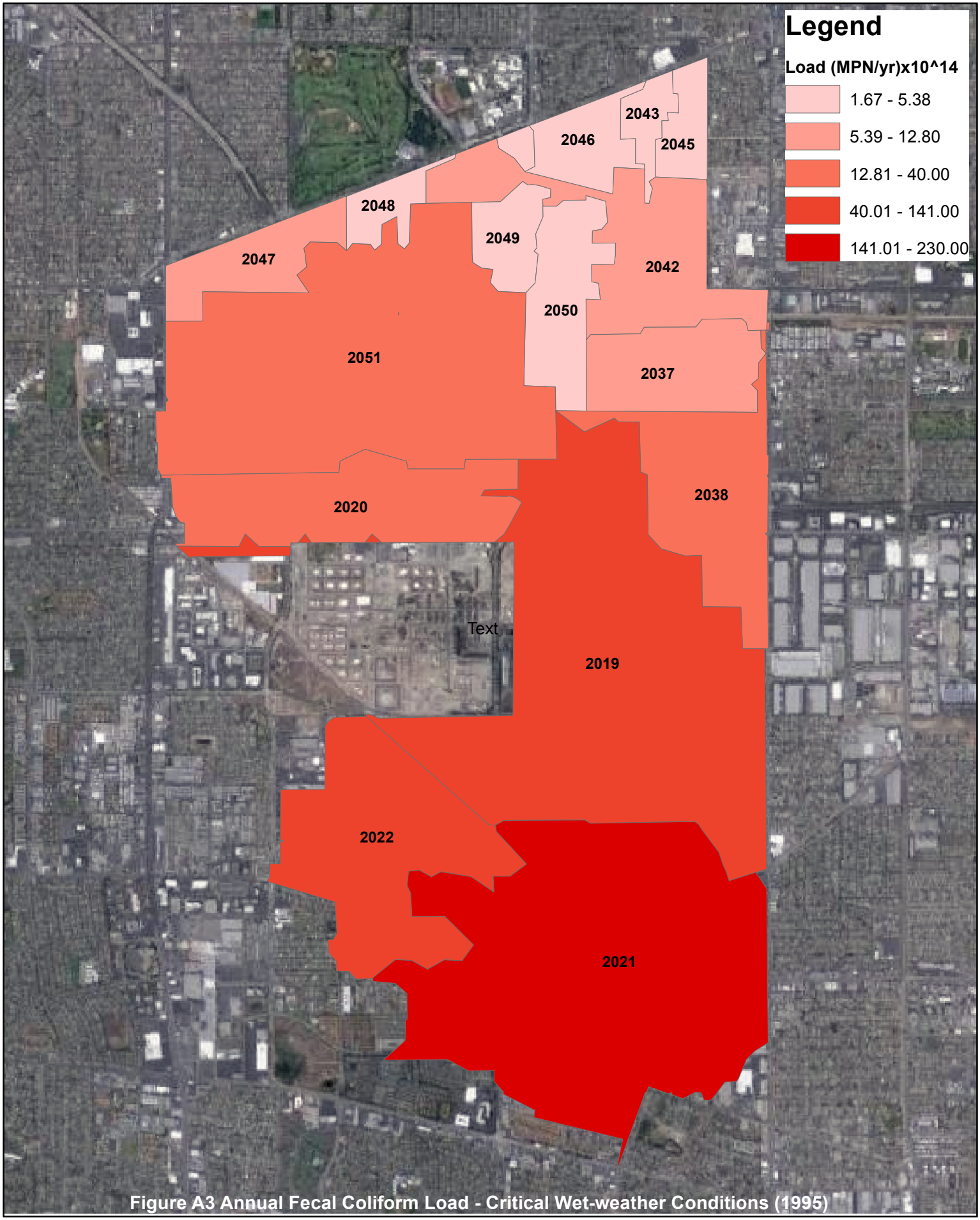

Figure A3 Annual Fecal Coliform Load - Critical Wet-weather Conditions (1995)

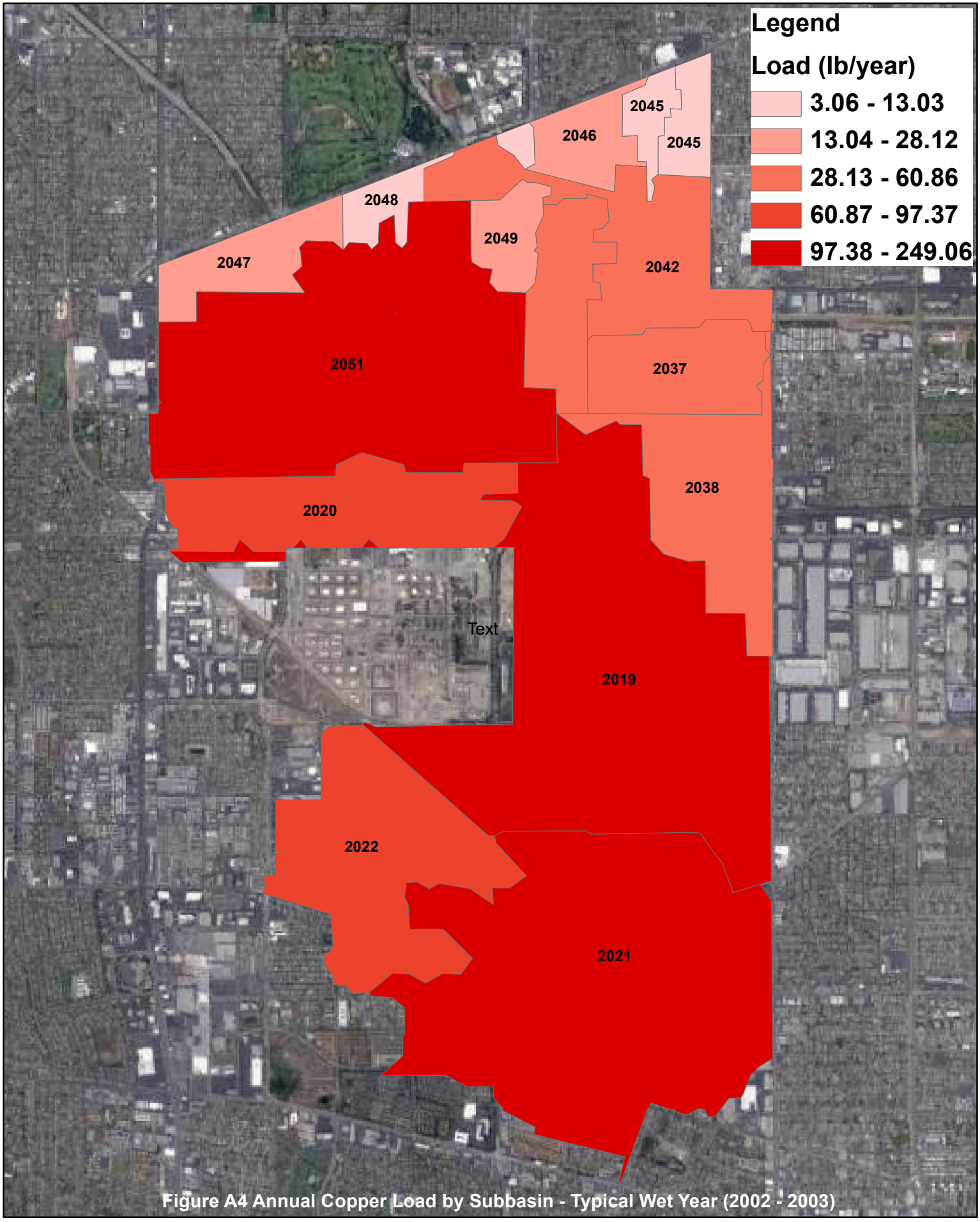

Figure A4 Annual Copper Load by Subbasin - Typical Wet Year (2002 - 2003)

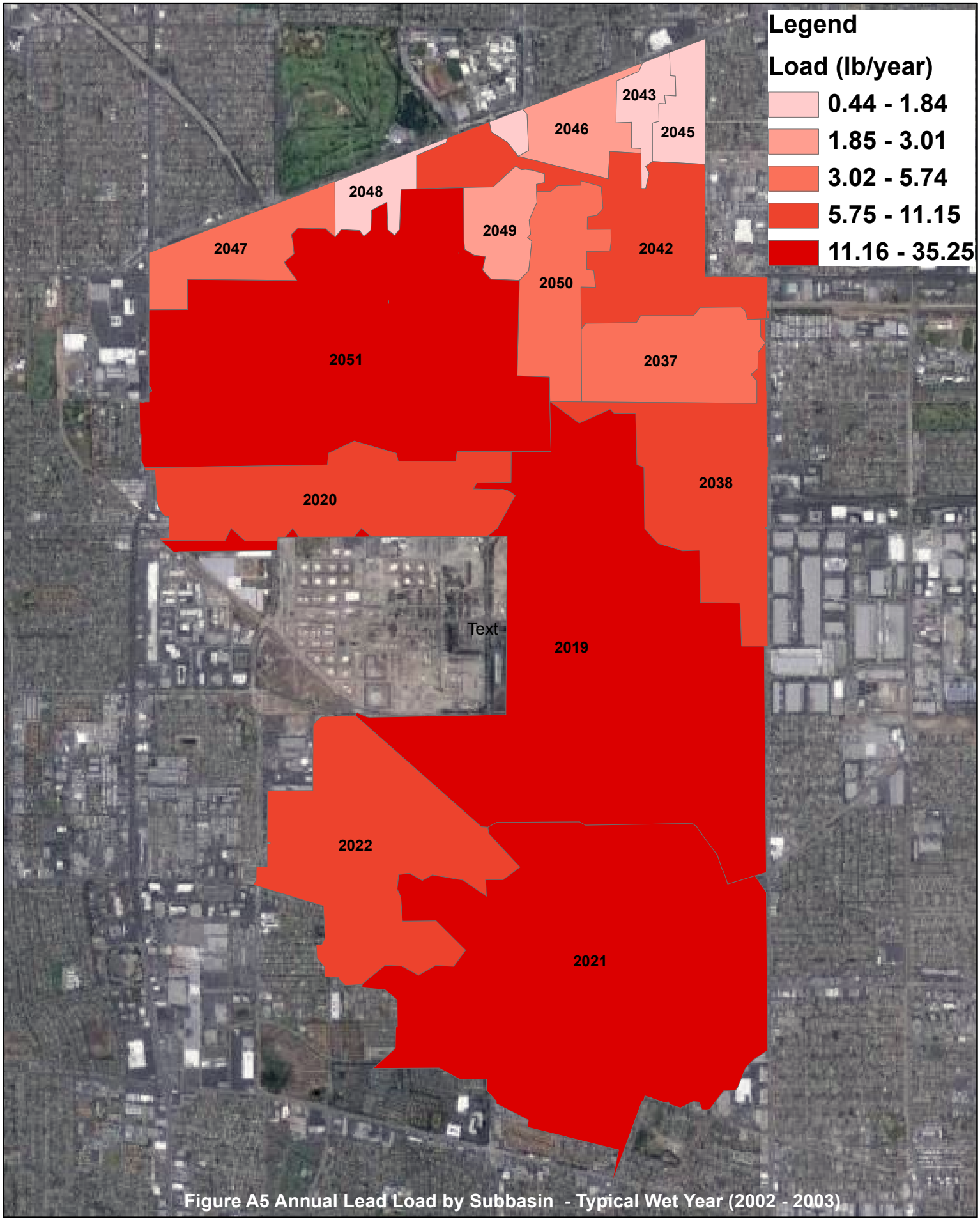

Figure A5 Annual Lead Load by Subbasin - Typical Wet Year (2002 - 2003)

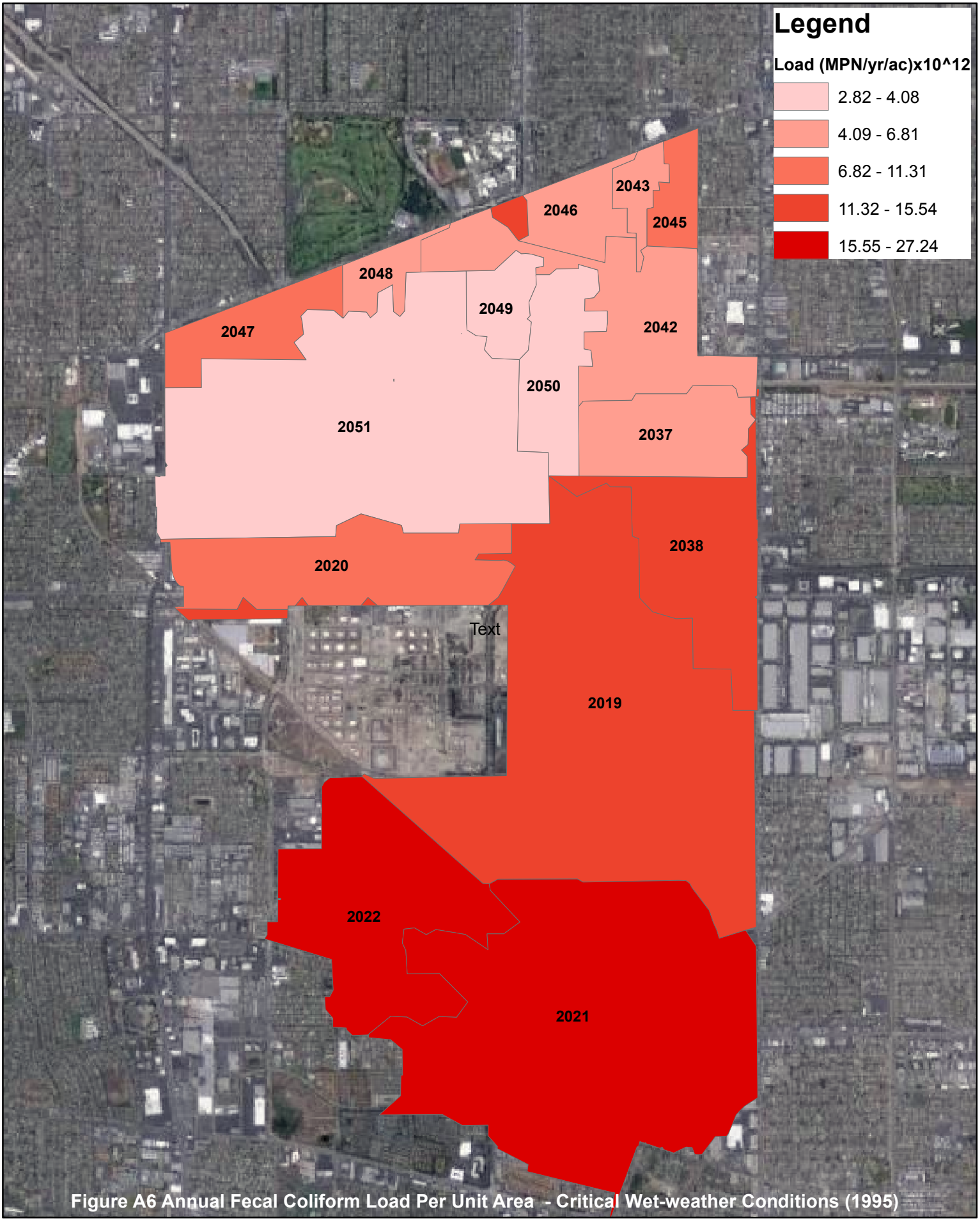

Figure A6 Annual Fecal Coliform Load Per Unit Area - Critical Wet-weather Conditions (1995)

APPENDIX B – CHARACTERISTICS CATCH BASIN INSERTS LITERATURE AND REFERENCES

ARB Contractors

3/24/2014-JTH

					Test Results			
	Laboratory	Date	Date		Conductance	Ph	TSS	Oil & Grease
	Test	Sample	Report	Tech	uMHOS	ph Units	mg/L	mg/L
1	Enviro-Chem	10/9/13	10/21/13	Coyne	609	6.33	322	4.05
2	Enviro-Chem	2/27/14	3/7/14	Coyne	153	7.28	332	2.34
3								
4								
5								
6								

Bench Mark	up to 200	6.5-8.5	up to 100	up to 15
Test-Method	SM 2510B	SM 4500-H+B	SM 2540D	EPA 413.2

Catchbasinfilter.com
Southern California

UltraTech International, Inc.

Heavy Metal Drain Filter - Ultra-Filter Sock®

Heavy Metal Drain Filter is a density polyethylene woven geo - textile sock with media type.

ULTRA-FILTER SOCK ®			
Part#	**Description**	**Dimensions** in (mm)	**Weight** lbs. (kg)
9453	Activated Carbon	108 x 7 x 4 (2,743 x 178 x 102)	40.0 (18.0)
9455	Sorb 44	108 x 7 x 4 (2,743 x 178 x 102)	15.0 (7.0)
9457	Sediment Removal	108 x 7 x 4 (2,743 x 178 x 102)	40.0 (18.0)
9456	Phos Filter	108 x 7 x 4 (2,743 x 178 x 102)	66.0 (30.0)
9454	Heavy Metal Removal	108 x 7 x 4 (2,743 x 178 x 102)	35.0 (16.0)
* Multiple Ultra-Filter Socks can be used in a “treatment train” if the potential for more than one contaminant or a large quantity of a single contaminant is present.			

Media Specifications

Media Type	Capacity Information
Activated Carbon	Each Filter Sock is filled with granular activated carbon. This media is an excellent polishing filter, due to its immense surface area and the wide range of components it is capable of absorbing. Helps with removing odors. Dry Filter Sock Weight of approximately 36 lbs
Heavy Metal Removal Media	Each Filter Sock can remove up to 1145 grams of heavy metals • Removal rates up to 50% per Filter Sock • See Heavy Metal Removal Data Sheet for more information • Dry Filter Sock Weight is approximately 32.5 lbs
Sorb 44	Each Filter Sock can absorb up to 5.33 gallons (20 liters) of hydrocarbon • Dry Filter Sock Weight is approximately 9 lbs
PhosFilter	Each Filter Sock can remove up to 26 lbs of phosphorus with up to 95% efficiency • Dry Filter Sock Weight is approximately 50 lbs
Sediment Removal Media	Recycled rubber material keeps unit in place and allows for maximum water flow • Dry Filter Sock Weight is approximately 40 lbs

* Note – All information is based on a standard 9-foot long Ultra-Filter Sock

Manufacturer: UltraTech International, Inc. All data provided by manufacturer
Authorized Distributor: Catchbasinfilter.com John Commercial Services.

John Commercial Services all rights reserved Catchbasinfilter.com 1/31/2007

Catchbasinfilter.com
Southern California

Heavy Metal Removal Media Data

List of Filterable Metals
Rubidium, Lithium, Potassium, Caesium, Ammonium, Sodium, Calcium, Silver, Cadmium, ***Lead***, ***Zinc***, Barium, Strontium, ***Copper***, Mercury, Magnesium, Iron, Cobalt, Aluminum, Chromium

Experimental Results
Percent Reduction (assumes 1" of head pressure and 15 second exposure time)

Initial Metal Concentration (ppm)	Percent Removal
4.0	30%
.04	50%

Saturation Point
The saturation point of the Heavy Metal Removal Media is 0.07 mg heavy metal/g of Media
This translates to 31.8 g of heavy metal/lb of Media

*Capacity of Different UltraTech Products**

Part Number	Description	Capacity (grams of Metal removed)
9397	Ultra-Drainguard, Heavy Metal Model	**190**
9460	Ultra-HydroKleen Media Filter 285	**285**
9302	Ultra-Downspout Guard (Standard)	**475**
9301	Ultra-Downspout Guard (Large)	**715**
9454	Ultra-Filter Sock (9-foot length)	**1145**

* - Actual results may vary based on initial metal concentration and site flow conditions

Solid Waste Recovery Efficiency +80.0% (Removal of solid particulate @ greater than .05 or 1 millimeter in diameter)
Total Suspended Solids (TSS) capture ++80% w debris catch over outlet.
Filter Test Results Per 22" of Media @ 100% Fill Rate = +80% Oil/Grease HydroCarbons & 60% Total Phosphorus (TP)

1) All flow thru test data completed by independent field test 1/31/2007 Filter Used: UltraTech Heavy metal Filter 9454 diameter 9' Filter Sock Tube 100% Fill Media.
2) Capacity: 4'x 8"
3) Final performance will vary based on open CB inlet drain type, design, grade, outlet, CFM, dimensions, solid waste type, maintenance, filter configuration. Results will vary by site installation.

Manufacturer: UltraTech International, Inc. All data provided by manufacturer
Authorized Distributor: Catchbasinfilter.com John Commercial Services.

Recommended Filter Replacement every 6 months as necessary.

John Commercial Services all rights reserved Catchbasinfilter.com 1/31/2007

CIWMB CATCH BASIN INSERT STUDY
FINAL REPORT

USED OIL RESEARCH, TESTING, AND DEMONSTRATION GRANT

Third Cycle

Grant Number URD3-02-0005

Prepared for:

The California Integrated Waste Management Board

Prepared by:

GeoSyntec Consultants
Portland, Oregon

University of California
Los Angeles

May 24, 2005

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GeoSyntec Consultants and the University of California, Los Angeles (UCLA) performed the research reported herein. The Principal Investigators of this study were Eric W. Strecker of GeoSyntec Consultants and Professor Michael K. Stenstrom of UCLA. GeoSyntec staff that provided significant contributions to the project and final report includes Marc Leisenring, Dan Pankani, Chad Bird, and Andi Thayumanavan. UCLA research staff that provided significant contributions to this study includes Dr. Sim Lin Lau, Dr. Younghan Han, Simon Ha, Min-mo Chung, and Joo-Hyun Khang.

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1 INTRODUCTION

Used motor oil and other oils and greases entering storm drains represent a significant source of pollution to the waters of California, especially in highly urbanized areas, such as the City of Los Angeles. Increasingly, pollutants associated with used motor oil, such as heavy metals and petroleum hydrocarbons, have been identified as primary constituents contributing to the decline of surface water quality in California over the past several decades. Motor oil, including crankcase, transmission, gearbox, and differential lubricating oil, that leaks from automobiles or is disposed of improperly often ends up in storm drains and eventually receiving waters.

Although the use of inlet and catch basin filters has become a significant component of many agencies' non-point pollution control strategies to control oil and grease discharges, only limited third-party performance monitoring and testing has been conducted to quantitatively assess the ability of these technologies to remove oil and grease from stormwater as well as the associated other pollutants. Even fewer studies are available that assess changes in performance as filters are exposed to field conditions and no studies were found that assess the ability of inserts to retain used motor oil after an illegal dumping activity.

The City of Los Angeles has installed several types of oil-absorbent catch basin/inlet inserts in their storm drain system in partial fulfillment of the requirements of NPDES Permit No. CAS004001. These inserts have been installed according to the design requirements of the Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP). However, the effectiveness and long-term performance of many of these inserts at removing and retaining oil and grease, as well as other pollutants is relatively unknown (i.e. limited to vendor reported or claimed performance estimates, which often report percent removals when new or were assessed in only limited studies). Furthermore, the methods used to define performance often vary significantly between vendors, as well as in independent third-party studies. Therefore, the transferability and compatibility of available performance data is extremely limited.

1.1 PROJECT PURPOSE AND GOALS

The purpose of this study was to provide an independent performance assessment of storm drain inlet filter devices at removing oil and grease and associated pollutants from stormwater. The first goal of the study was to assess the stormwater quality issues of oil and grease in the City of Los Angeles and provide a thorough literature review of catch basin insert technologies and methods for evaluating performance as it relates to the removal of oil and grease from urban runoff. The second goal was to evaluate the performance (at various stages of their useable lives) of four (4) different catch basin filters currently used by the City of Los Angeles in removing and retaining used motor oil and associated pollutants from urban runoff, as well as from illicit and accidental dumping activities.

1.2 DOCUMENT ORGANIZATION

After this introductory section, this document is organized into four main sections: Section 2 - Literature Review, Section 3 - Methodology, Section 4 - Results and Discussion, and Section 5 - Summary and Conclusions. Section 2 briefly assesses the current stormwater quality issues of oil and grease in the City of Los Angeles and reviews various catch basin insert technologies and available performance studies. Section 3 outlines the methodologies for evaluating catch basin insert performance for both the field and laboratory components of the study. Section 4 discusses the performance implications of the field observations and summarizes the results of

the laboratory tests. Finally, Section 5 summarizes the overall study and provides recommendations for future research.

In addition to the main text, Appendix A includes detailed maps identifying the location of the catch basins used in the study, Appendix B includes the field inspection photos and notes, and Appendix C provides the extraction method used for the laboratory oil and grease tests.

2 LITERATURE REVIEW

The following subsections provide a brief background of the issues regarding oil and grease in stormwater runoff in urban areas in general, and the Los Angeles area in particular (Section 2.1); a literature review of studies that have evaluated the performance of catch basin inserts at removing oil and grease (Section 2.2); expected ranges of stormwater runoff concentrations, as well as the expected level of treatment of catch basin inserts for oil and grease and total petroleum hydrocarbons (TPH) (Section 2.3).

2.1 BACKGROUND AND IDENTIFICATION OF RESEARCH NEEDS

Oil, grease, and hydrocarbons in urban stormwater runoff originate primarily from leaking vehicles, car maintenance activities, illegal dumping of oil, auto accidents, and spills. Heavy metals in urban stormwater originate primarily from roadway construction materials, deteriorating building surfaces, burning of fossil fuels, and engine wear and leaks and brake pad and tire wear. These pollutants are of environmental concern because nature cannot rapidly degrade or assimilate them. So, even if runoff contains low concentrations of the pollutants, they can accumulate in the environment and have acute and chronic toxic effects on aquatic organisms.[1]

A study conducted by the Pelegrin Research Group in 1997 found that 15% of the residents in Los Angeles County who change their own oil (~20% of the residents) participate in improper disposal, with 1% (of the 20%) disposing of it by dumping directly onto the street, gutter, or storm drain.[2] With an L.A. County population close to 10 million people and assuming 4 gallons of used oil per year are disposed of by people who engage in illegal storm drain disposal, these people are may be contributing about 80,000 gallons of oil per year, directly to the Los Angeles County storm drain system. Leaks from automobiles are likely contributing much more than this, as it was estimated that approximately 64 million gallons of the oil sold in California in the 2000/2001 fiscal year either leaked out of, or was burned in engines.[3] With nearly 30% of the State's population living in Los Angeles, approximately 19 million gallons of this leaked or burned oil likely occurred in L.A. County.

Motor oil that leaks from automobiles is dispersed; resulting in generally low stormwater concentrations, and therefore, the acute environmental impacts of leaked oil is likely less than environmental impacts of illegal dumping activities. For instance, stormwater monitoring by the County of Los Angeles has shown that the land uses associated with the highest average concentrations of oil and grease are commercial (3.3 mg/L) and transportation (3.1 mg/L).[4] In another stormwater characterization study in the City of Santa Monica, average oil and grease

[1] Bosworth, N. 1999. Tertiary Treatment of Urban Stormwater. University of Newcastle. http://www.stormwater-resources.com/library.htm

[2] Pelegrin Research Group (1997). "Los Angeles County Stormwater Segmentation Study-Resident Population." Prepared for the Los Angeles County of Public Works.

[3] California Integrated Waste Management Board (2002). "California's Used Oil Recycling Program." Publication Number 332-97-015.

[4] Los Angeles County Department of Public Works (2002). "Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report" [Online] http://ladpw.org/wmd/npdes/IntTC.cfm.

concentrations were reported as 5.9 mg/L and 8.2 mg/L for commercial and transportation land uses, respectively.[5]

These data represent storm event averages, or more precisely, averages of mean storm event concentrations (multiple grab samples were taken throughout the duration of individual storms, but they were not necessarily flow- or time-weighted composites). However, these data mask the "first flush" phenomenon that can occur during the beginning of storms and/or any illegal oil dumping activities. For many pollutants, approximately 30% of the mass is released during the first 20% of the storm.[6] Therefore, oil and grease concentrations at the beginning of a storm could potentially be much higher than the average storm event concentrations. These data represent storm event averages, or more precisely, averages of mean storm event concentrations

Oil, grease, and hydrocarbons interfere with plant photosynthesis and with reproduction, respiration, and growth and development of aquatic organisms. These chemicals can accumulate in sediments and tissues of fish and other aquatic organisms, potentially causing cancer, mutations, and even death. Furthermore dissolved oxygen levels may become depleted through the degradation of hydrocarbons.[7]

Dissolved metals, that can be associated with motor oils can cause short and long-term toxic effects on aquatic organisms. They can bioaccumulate in animal tissue and affect reproduction rates and life spans of aquatic organisms. Metals deposit in sediments where they negatively impact benthic organisms and their predators.

Oil and grease in stormwater runoff can be free-floating, suspended, or emulsified or can sorb to trash, debris, and particles. Between 83-98% of total hydrocarbons in stormwater runoff are bound to particulate matter, and most of these particles are settleable. Most stormwater studies only report free-floating oil concentrations, which typically range from 2-35 mg/L. Free-floating oil and grease can be removed by sorbent materials, such as those found in catch basin inserts.[8]

In highly urbanized environments, such as the City of Los Angeles, where available space for many traditional Best Management Practices (BMPs) is limited (for example retention ponds, constructed wetlands, or infiltration basins), proprietary devices, such as catch basin filters are often used to capture oil and grease. The manufacturer usually provides some quantitative and/or qualitative measure of the effectiveness of these types of devices at removing pollutants. Inconsistent testing and reporting protocols and the absence of self-imposed testing quality control have generated concerns over the reliability of available performance data. These

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[5] Woodward-Clyde (1998). "Santa Monica Bay Area Municipal Stormwater/Urban Runoff Pilot Project – Evaluation of Potential Catchbasin Retrofits." *Prepared for Santa Monica Cities Consortium c/o City of Santa Monica.*

[6] Ma, S., S. Khan, Y. Li, L. Kim, S. Ha, S. Lau, M. Kayhanian, and M. Stenstrom (2002). "First Flush Phenomena for Highways: How it can be meaningfully defined." *Proc. Ninth Inter. Conf. on Urban Drainage*, E. Strecker and W. Huber, eds., Lloyd Center, Doubletree Hotel, Portland, Oregon, Sept. 8-13, 2002.

[7] Bosworth, N. 1999. Tertiary Treatment of Urban Stormwater. University of Newcastle. http://www.stormwater-resources.com/library.htm

[8] Environmental Protection Agency (EPA). 2002. Storm Water Technology Fact Sheet. Publication # 832-F-02-020. September.

concerns have prompted some agencies to prepare protocols for the verification of proprietary stormwater treatment devices.[9,10,11]

Adoption of these protocols is increasing; however, currently there are few data available on the wide variety of devices currently employed throughout California. (Currently the only stormwater treatment technology certified by the CalCert Program is the AquaShield™ Filtration System, Model SD-100 and the performance claim states the product "removes 92% of oil and diesel fuel in water when influent concentrations are between 1,000 to 2,000 mg/l."[12] These influent concentrations are nearly 3 orders of magnitude greater than typical stormwater concentrations of oil and grease). Independent or "third-party" testing of these devices and detailed effluent quality characterization, can improve estimates of the quality of stormwater reaching receiving water bodies from drainages receiving this type of treatment. Also, an improved understanding of the potential water quality and spill (and intentional dumping) mitigation functionality of catch basin filters, the amount of motor oil captured in the storm drain filters can be estimated. This will help improve the understanding of the fate (mass balance) of motor oil sold in California and the effectiveness of catch basin filter treatment technologies.

Typically in practice, catch basin filters have two intended primary functions: (1) to reduce loading resulting from high concentration flows (typically associated with low flow rates) from spills, significant leaks, and improper disposal to storm or surface drains; and (2) to reduce loading from typical urban stormwater discharges (typically relatively lower concentration at much higher flow rates). An initial review of third party stormwater treatment technology evaluations conducted to-date has shown highly variable results in the performance of filter media at removing oil and grease from stormwater and mitigating high concentration, lower flow discharges. This report will review and report on laboratory and field studies conducted on the effectiveness of catch basin inserts in removing oil, grease, hydrocarbons, and heavy metals from urban runoff.

2.2 CATCH BASIN INSERT PERFORMANCE STUDIES

Several catch basin insert studies have been performed by various third-party researchers and insert manufacturers and vendors. Due to the wide variety of insert configurations, insert types, and site-specific conditions, more studies are still needed to adequately assess the ability of this technology to reduce the amount of oil and grease reaching receiving streams. Also, few studies (if any) have specifically evaluated the ability of catch basin inserts to retain used motor oil that has been illegally dumped directly into the storm drain.

The following studies all determined pollutant removal efficiencies by comparing inlet and outlet concentrations.

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[9] Washington Department of Ecology (2002). "Stormwater Treatment Facility Performance Evaluation Guidance Document." *Washington Department of Ecology*

[10] Bachhuber, James, Steven Corsi, and Roger Bannerman (2002). "ETV Verification Protocol Stormwater Source Area Treatment Technologies, Draft 4.1.' *U.S. EPA Environmental Technology Verification Program.*

[11] CalCert (2001). "Stormwater Best Management Practice Demonstration Tier II Protocol for Interstate Reciprocity." *Endorsed by the States of California, Massachusetts, New Jersey, Pennsylvania, and Virginia* [Online Available, April 2002] http://www.calepa.ca.gov/CalCert/documents/Stormwater.pdf

[12] California Environmental Technology Certification Program (2000). "Evaluation of the AquaShield™ Filtration System." [Online] http://www.calepa.ca.gov/CalCert/CertifiedTech

2.2.1 INTERAGENCY CATCH BASIN INSERT COMMITTEE (ICBIC) LAB STUDY

In a catch basin insert study conducted in Seattle, Washington, oil and grease removals were studied to evaluate changes in removal rates over-time.[13] The study consisted of testing four (4) proprietary filter media in a laboratory (before and after being field conditioned), using influent oil and grease concentrations of 20-90 mg/L at a flow rate of 5-10 gpm. Field conditioning included placing each filter in field catch basins that serviced approximately the same drainage areas and land uses (i.e. parking lots), until approximately 0.75" of rainfall occurred. After field conditioning, the filters were taken to the laboratory to be tested again. The field sites included a vehicle maintenance shop yard, an arterial road, a park-and-ride lot, and an industrial storage yard. Drainage areas ranged from 0.11 to 0.34 acres.

Results of the study showed a significant decline in oil and grease removal rates from when the filters were new, to after two (2) field-laboratory test sequences. Negative removal rates during some of the tests indicated release of oil and grease from the filter media, which indicated the filter had exceeded its holding capacity and, in fact, washout/leaching was occurring. Furthermore, few of the filters were able to produce effluent concentrations below 10 mg/L, even when the filters were new, at the influent concentrations tested. Table 2-1 summarizes the results of this study.

New inserts removed 20 to 90% of petroleum hydrocarbons from water containing 34 to 85 mg/L of oil. For most of the devices tested, performance declined rapidly with use. During the first test, the inserts were removed from the field after two-inches of rain. This test showed that new inserts were able to remove oil and grease by 30 to 90%. After two-inches of rain, the removal efficiency dropped to less than 30%. During the second test, the inserts were removed from the field after 0.5 to 0.75-inches of rainfall. New inserts removed 21 to 85% of oil and grease during this second test. The Stormwater Services devices maintained a removal efficiency of approximately 50%, even after three field tests. In contrast, the Enviro-Drain's removal efficiency was 50 to 60% when in new condition. One Aqua-Net device's removal efficiency increased from 21 to 82% with use, while the other device maintained a removal efficiency of around 35%. None of the devices removed copper, lead, or zinc. Inserts captured between 0 to 41-pounds of sediment during a 120-day period.

For all but one insert, field observations indicated that stormwater could enter the catch basin without passing through the insert. Instead, the water flows between the pavement and the outer edge of the grate frame and then beneath the frame of the insert. Maintenance frequencies depended on site conditions such as oil and grease loading rates. Because accumulation of sediment can clog the filter and prevent further absorption, the authors recommended maintenance ranging from after every rainfall event to after every five-inches of cumulative rain. Because wood-fiber can become saturated and decompose, these types of filters would need to be replaced after a month or two.

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[13] Interagency Catch Basin Insert Committee (1995). "Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater runoff from Developed Sites." Collaborative research team consisting of King County Surface Water Management Division and Department of Metropolitan Services, Snohomish County Surface Water Management Division, Seattle Drainage and Wastewater Utility, and the Port of Seattle.

Table 2-1. Summary of oil and grease removal efficiency of catch basin inserts tested by the Interagency Catch Basin Insert Committee (1995)

Vendor	Device	Media Type	Test Interval	Influent (mg/L)	% Removal New	% Removal Used
All	All		2" rain	35	30-90	<35
Aqua-Net Gullywasher	AN-A	Basket, AbW Wood-fiber	2" rain	35	60	NA
All	All		2" rain	67, 85	21-85	NA
Aqua-Net Gullywasher	AN-AW	Basket, AbW Wood-fiber	0.75" rain	67, 85	21	82
Aqua-Net Gullywasher	AN-AS	Basket, Supersorb Wood-fiber	0.75" rain	67, 85	35	35
Environmental Services Enviro-drain	ED-SAA	Two trays, course screen AbW Wood-fiber	0.75" rain	67, 85	50-60	NA
Stormwater Service	SS-2O SS-3	Sock with polypropylene strips	0.75" rain	67, 85	50	50

NA - not available

2.2.2 SANTA CLARA VALLEY PARKING LOT STUDY

Woodward-Clyde (1996)[14] tested the performance of catch basin inserts manufactured by Aqua-Net, Inc.; Enviro-Drain, Inc.; and Stormwater Services during two (2) storm events. The Aqua-Net Gullywasher consisted of two baskets, with Absorbent W (a natural wood fiber cellulose) pillows between the two baskets. A bag filled with PetroLOK (a polymer and activated carbon absorbent) was placed around the outside basket.

The Enviro-Drain device has three stacked trays, with the middle and bottom trays containing Absorbent W. The Stormwater Services Stream Guard Type II consists of a boot filled with polypropylene strips that directs water into a polypropylene bag. Drainage basin areas draining to the inserts ranged from 0.77 to 2.5-acres.

During the first storm, sediment, leaves, and/or pine needles were observed to cause considerable clogging and bypass of the filter inserts, which limited the performance of the filters. The top tray of the Enviro-Drain and the outer filter of the Gullywasher were easily clogged and the bag of the Stream Guard broke during one storm. The inserts were effective at removing total petroleum hydrocarbons (TPH), but no significant reduction in TSS concentrations were observed. The authors suggested that since the post-filter samples were pumped out of the bottom of a funnel, surface oils might not have been captured. The Enviro-Drain and the Stream Guard removed an average of 90% and 85% of hydrocarbons with influent concentrations of 9.1 and 4.8 mg/L, respectively. Gullywasher only removed an average of 30% of hydrocarbons with an average influent concentration of 1.2 mg/L.

The Aqua-Net gullywasher removed an average of 59.58% hydrocarbons. The authors proposed that the Gullywasher would work better without the additional PetroLOK. No discernible removal of chromium, copper, lead, nickel, or zinc was found.

[14] Woodward-Clyde. 1996. Parking Lot Monitoring Report. Prepared for the Santa Clara Valley Non-point Source Pollution Control Program. June 11.

2.2.3 SACRAMENTO PARKING LOT STUDY

Larry Walker Associates (1998)[15] studied the performance of Fossil Filter manufactured by KriStar Enterprises, Inc., in a one-acre parking lot during three (3) separate storm events. The Fossil Filter is a ring-shaped filter filled with alumina silicate. The filter removed 50% of total petroleum hydrocarbons, 28% of copper, 33% of lead, and 13% of zinc (although for two storms, the zinc concentration increased).

Water bypassed the filter for flows exceeding 0.05 in/hr per watershed acre. It was observed that 60% to 70% of the flow bypassed the filter. In addition, when the grading at the inlet was uneven, bypass flow would occur because the water would not flow evenly through the filter. During a storm in January, it rained 0.56" in 1.5 hours. Samples were not collected at this time, but the insert was full and water with lines of oil and grease was observed flowing into the bypass. The filter media had to be replaced before each storm event due to debris accumulation.

2.2.4 SANTA MONICA BAY STUDY

A full-scale laboratory study conducted as part of the Santa Monica Bay Municipal Stormwater/Urban Runoff Pilot Project evaluated the oil removal efficiencies of three (3) different types of proprietary catch basin filter media. Using an influent free oil (i.e. well mixed, but not emulsified) concentration of 25 mg/L at a flow rate of 15 gpm, the study showed significant removals (69-91%) for all of the media types (when new), during the 90-minute test period.

The study included both full scale and bench scale tests to evaluate the performance of OARS polymer (Abtech), compost, polypropylene, and alumina silicate (Perlite, X sorb) in removing free oil and grease. Oil and grease removal efficiencies averaged 84% for OARS, 81.33% for Perlite (aluminum silicate), 91.5% for Xsorb (aluminum silicate), 50.33% for compost, and 85.25% for polypropylene. No sorbent was effective at removing emulsified oil and grease. The authors concluded that sorbent breakthrough time depends on the mass of oil applied (concentration and flow) and the mass and packing density of the sorbent.

A laboratory study by Lau et al. (2001)[16] showed that metal boxes containing OARS sorbent removed an average of 34.5% of polycyclic aromatic hydrocarbons from water containing 50 ug/L of hydrocarbons. Polypropylene insert devices (DrainPac by United Stormwater) removed an average of 65% of the polycyclic aromatic hydrocarbons. The OARS device removed an average of 71% of oil and grease. The DrainPac had an average oil and grease removal efficiency of 67%.

Lau et al. (2001) also performed a field study to determine the effectiveness of polypropylene and OARS polymer inserts in commercial (1.24 acres) and residential (2.97 acres) areas. Over a six-hour period the OARS sorbent efficiency declined linearly from 85% to 40%, and the polypropylene sorbent efficiency declined linearly from 85% to 50%. The oil and grease concentrations were 19.02 mg/L for the first two hours, 14.0 mg/L for the next two hours, and 10.91 mg/L for the last two hours. Flow bypassing the inserts gradually increased as the inserts became more clogged.

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[15] Larry Walker Associates. 1998. NDMP Inlet/In-line Control Measure Study Report 1997-98. Prepared for County of Sacramento, City of Sacramento, City of Folsom, and City of Galt. June.

[16] Lau, S.L., E. Khan, and M.K. Stenstrom. 2001. Catch Basin Inserts to Reduce Pollution from Stormwater. Water Science and Technology. 44(7): 23-34.

To prevent debris accumulation in the inserts during the dry season, Lau et al (2001) covered two catch basins with plywood and two with wire screen, leaving a 2.5 cm gap at the bottom to allow runoff to enter the basin. These covers prevented 95% of trash and debris from entering the catch basin. Street sweepers were able to remove the material that accumulated at the bottom of the covers without damaging the covers.

2.2.5 CITY OF LOS ANGELES STUDY

During the 1999-2000 and 2000-2001 wet seasons, the City of Los Angeles Stormwater Management Division studied the performance of five (5) different types of catch basin inserts at removing sediments, trash, oil and grease, and metals.[17] Due to a limited number of sampling events (4) and study sites (5), the results of this study were inadequate for a statistically valid assessment of the performance of the inserts studies. However, qualitatively the results of the study found that all of the units were moderately effective at removing oil and grease, suspended solids, and heavy metals. Furthermore, the study indicated that for most insert types, inspection and maintenance should occur before and after each rain event during wet weather and monthly during dry weather to maintain their performance integrity and to minimize leaching of previously captured pollutants.

The study included evaluating the performance of AbTech's Ultra Urban Filter, the Fossil Filter, Remedial Solutions Models CD-300 and SD-100, and United Storm Water's DrainPac Storm Drain Filter. The Ultra Urban Filter is a galvanized steel basket packed with Smart Sponge (synthetic polymers). The Fossil Filter is a fiberglass trough with 4" thick Fossil Rock (an absorbent) between two stainless steel screens. Both Remedial Solution devices are stainless steel with a sediment removal basin and three stacked filtering baskets containing 100% reclaimed material. The DrainPac is a non-woven filter cloth liner filled with polypropylene.

The Fossil Filter was maintained monthly, but was clogged during the first half-hour of light rain. The Remedial Solution devices were maintained weekly during which the filter media were replaced five times during nine months. At a sanitation yard site, the filter collected a total of 16 pounds of plastic, 24 pounds of paper, 7 pounds of grass, and 24 pounds of sediment. At a maintenance yard site, the filter collected a total of 108 pounds of oily sediment and 4 pounds of debris. During three rain events, all the runoff was bypassing the filter due to a gap between the filter and the catch basin opening. No data was collected from the above three filters due to the excessive clogging.

The DrainPac had one cleaning during which 400 pounds of trash, debris, and sediment containing 1,480 mg/kg of oil and grease (the CA limit is 1000 mg/kg for nonhazardous waste disposal) was removed from the device. Due to clogging, data from only one storm event was collected, during which the DrainPac removed 52% of the oil and grease.

During all storm events the AbTech device was filled almost completely with trash and sediment. It captured 302 pounds of sediment and trash. The 8.2% removal of oil and grease was contributed to the large amount of runoff bypassing the filter. Alternatively, the sponge may not have effectively captured pollutants or may have reached its sorption capacity. Oil and grease removal did not increase during the third event, which occurred three days after a cleaning (two maintenances were performed during the study, one occurring after the third rain event).

[17] City of Los Angeles, Stormwater Management Division (2001). "Catch Basin Insert Pilot Study Report and Addendum."

Zinc concentrations increased 45%, which was contributed to leaching by the zinc-coated galvanized steel basket.

2.2.6 CALIFORNIA EPA STUDY

The California EPA (2000)[18] evaluated the AquaShield Filtration System Model SD-100. The AquaShield is a stainless steel structure containing recycled cellulose fibers packed in a nylon mesh bag. The influent concentrations of oil and grease were very high compared to the 2 to 35 mg/L found in stormwater runoff. The concentrations ranged from 1,022 to 2,192 mg/L with an average of 1,477 mg/L. This system removed 92% of the oil and grease.

2.2.7 KING COUNTY STUDY

The Model 3001 StreamGuard™ Insert is designed for oil and grease removal in areas such as parking lots, construction sites, marinas, industrial sites, and vehicle washing facilities. King County Surface Water Management Division of Washington State performed independent testing of this technology and found removal efficiencies of oil and grease at 88% for a StreamGuard installation in a park-and-ride lot. Sea-Tac International Airport installations were also monitored and removal efficiencies were approximately 80% for Total Suspended Solids and 94% for oil and grease.[19]

2.2.8 UNIVERSITY OF CALIFORNIA LOS ANGELES STUDY

Strenstrom et al (2002)[20] performed a series of experiments to evaluate the removal efficiencies of various Kristar (Fossil Filter) catch basin inserts. The target pollutants were oil and grease and suspended solids. The experiments were conducted in a full-scale catch basin located in a laboratory in UCLA. They tested two different types of inserts, namely Flo-Gard™ and Flo-Gard™ High Capacity. Oil and grease influent concentrations were varied from 16 mg/L to 36 mg/L and Total Suspended Solids influent concentrations were varied 65 mg/L to 100 mg/L. Automobile crank case oil and graded fine sand were used to simulate oil and TSS respectively.

They observed oil removal efficiencies of 70% to 80% and sand removal efficiencies of almost 100% for particles 30-mesh (589 to 833 mm) and larger, 20% for particles 60-mesh (250 to 420 mm) and nearly zero for smaller particles.

2.2.9 ROUGE RIVER WATERSHED STUDY

Alsaigh et al (1999)[21] presents the performance of four catch basin insert technologies monitored for a 19 Month period. The devices were installed at two gas station sites in the Cites of Livonia and Westland, Michigan. The devices are the Gullywasher™, the Hydro-Cartridge®, the StreamGuard™ and the Grate Inlet Skimmer Box. Parameters of interest included capital cost,

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[18] California Environmental Protection Agency (EPA). 2000. Evaluation of the AquaShield Filtration System (Model SD-100, Series 576). Environmental Technology Certification Program. January.

[19] New England Environmental Protection Agency(EPA NE) (2003) "Streamguard™ Catch Basin Inserts" http://www.epa.gov/region1/assistance/ceitts/stormwater/techs/streamguardinsert.html

[20] Stenstrom M. K., Lau S. (February, 2002) "Oil and Grease and Particle Removal by KriStar Flo-Gard and Flo-Gard High Capacity Stormdrain Inserts" 12pp http://stormdrainfilters.com/flogard.doc

[21] Alsaigh, R., Boerma, J., Ploof, A. Regenmorter, L. (April 1999) "Evaluation of On-Line Media Filters in the Rouge River Watershed". Task Product Memorandum Nonpoint Work Plan No. URBSW5, Task No.3. Wayne County, MI: 51pp

operations and maintenance costs, and pollutant removal efficiencies. They rank the devices as follows:

- The Gullywasher™ was found to be the most efficient at removing sediment;
- The Hydro-Cartridge® was most efficient in terms of oil removal 9,700(mg/Kg captured /1,000 gallons filtered);
- The Hydro-Cartridge® and the StreamGuard™ were the easiest to maintain;
- The StreamGuard™ had the lowest initial capital cost; and
- The Hydro-Cartridge® had the cheapest replacement inserts.

Table 2-2 presents a summary of insert performance with respect to sediment and oil and grease removal in addition to capital cost.

Table 2-2. Removal efficiency and capital cost summary.

Device	Average Sediment captured / Gallons Filtered (lbs/1,000 gallons)	Average Oil Captured / Gallons Filtered ((mg/Kg)/1,000 gallons)	COST			
			Structure	Media	Approx. Media Replacement Interval	Est. First Year Capital Cost
Hydro-Cartridge	0.19	9,700	$700 - $800	$9	3 months	$736 - $836
StreamGuard	1.11	5,000	n/a	$40-$80	2 months	$240 - $480
Gullywasher	6.60	2,100	$440	$60	3 months	$680
Grate Inlet Skimmer Box	0.39	700	$475	$25	3 months	$575

The authors concluded that all four (4) filters performed well and that filter performance is heavily dependent on site conditions and project objectives.

2.2.10 AbTech Ultra-Urban Filter - Vendor Studies

Summarized below are summaries of several studies by AbTech that evaluate the performance of their Ultra-Urban Filter. [22]

Tucson, AZ

This study included laboratory experiments to determine the effectiveness of the Ultra-Urban Filter, a galvanized steel basket containing Smart Sponge, in removing motor oil and diesel fuel. A 50-50 mixture of motor oil and diesel fuel with a concentration of 28 mg/L was run through the filter. Studies were run with and without debris (leaves, rocks, and twigs) and sediment. The filter removed an average of 83% of the oil and grease. Performance did not decline with the addition of debris and sediment.

Santa Monica, CA

In this study, an Ultra-Urban Filter that had been installed in a residential area for two months during the Santa Monica Bay Municipal/Urban Runoff Pilot Project was evaluated. A 28 to 32 mg/L mixture of motor oil and diesel fuel was run through the filter. The concentration of oil and grease was reduced by an average of 91%.

[22] AbTech. 2003. Detailed Technical Field Test Results: The Ultra-Urban Filter with Smart Sponge. http://www.abtechindustries.com/Test%20Results%20Menu.htm

Seattle, WA

Minton (2002)[23] performed laboratory studies to determine the efficiency of AbTech's Ultra-Urban Filter in removing motor and diesel oil. A new unit's removal efficiency averaged 81%, when the influent concentration was between 10 to 30 mg/L. Performance of the device gradually dropped by 10 to 20% during the 120-minute tests. A device that had been in the field removed 78 to 96% of the 30 mg/L oil and grease.

Springfield, MA

Astro Environmental, LLC (2003)[24] performed field studies of AbTech's Ultra-Urban Filter. The influent contained either 250 mg/L of oil, grease, and vegetable oil or 100 mg/L of motor oil and diesel. The filters removed an average of 95.88% of the oil and grease. An average of 94% of total petroleum hydrocarbons were removed during two tests. The filters also removed 99% of 50 mg/L lead, zinc, and copper. This study suggested vacuuming out the filters prior to the winter season, since one filter accumulated greater than 95-pounds of debris during the fall season.

2.3 EXPECTED HYDROCARBON RUNOFF CONCENTRATIONS AND TREATMENT LEVELS

The Los Angeles County Department of Public Works (LACDPW) has monitored and characterized stormwater runoff since 1994 as part of the requirements of their NPDES Municipal Separate Storm Sewer (MS4) Permit[25]. The first two years of monitoring was done under the 1990 permit, while current monitoring efforts fall under the 2001 Municipal Storm Water Permit adopted on December 13, 2001.

The objectives of the County's monitoring program are: (1) to assess compliance with the NPDES Permit; (2) to measure and improve the effectiveness of the stormwater quality management plans (SQMPs); (3) to assess urban runoff water quality impacts to receiving waters; (4) to characterize stormwater discharges; (5) to identify sources of contaminants; and (6) to evaluate the long-term trends in receiving water quality. The monitoring program was expanded under the 1996 permit to include the Mass Emission, Land Use, and Critical Source Monitoring Programs and new pilot studies such as "Wide Channel" and "Low Flow" analyses. The 2001 permit eliminated the Land Use and the Critical Source components to focus on core monitoring, regional monitoring, and three special studies.

The mean and median TSS, oil and grease, TPH, and dissolved and total metals concentrations obtained from the 1994-2000 monitoring efforts are summarized in Table 2-3. Note that transportation and commercial land uses yield the highest concentrations of petroleum hydrocarbons in urban stormwater runoff in the City of Los Angeles and commercial, transportation, and light industrial land uses all yield high copper and zinc concentrations.

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[23] Minton, G.R. 2002. Technical Review of the AbTech Ultra-Urban Filter. Resource Planning Associates.
[24] Astro Environmental, LLC. 2003. Field Test Results of AbTech Industries Ultra-Urban Filter. http://www.abtechindustries.com/Test%20Results%20Menu.htm.
[25] California Regional Water Quality Control Board, Los Angeles Region (2001). "NPDES Permit No. CAS004001 - Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges Within the County of Los Angeles, and the Incorporated Cities Therein, Except the City of Long Beach."
Los Angeles County Department of Public Works (LACDPW). (August, 2002). "Los Angeles County 2001-2002 Storm Water Quality Monitoring Report" 26pp.

However, the range of oil and grease concentrations from each of the land use types are well below the influent concentrations typically used in catch basin insert studies (~10 to 40 mg/l).

Table 2-3. Summary of 1994-2000 land use results for TPH, oil and grease, and metals.

Land Use Type	Constituent	Units	No. of Samples	No. of Non-Detects	Percent Detects	Mean	Median	CV
Commercial	TSS	mg/L	29	0	100	66	53	0.65
	TPH	mg/l	8	2	75	3.1	2.9	0.63
	Oil and Grease	mg/l	8	1	88	3.3	2.9	0.51
	Dissolved Copper	ug/l	24	3	88	14	11	0.84
	Total Copper	ug/l	24	0	100	39	22	1.57
	Dissolved Lead	ug/l	24	20	17	S.I.D.	S.I.D.	S.I.D.
	Total Lead	ug/l	24	15	38	18	2.5	2.80
	Dissolved Zinc	ug/l	40	4	90	152	130	0.66
	Total Zinc	ug/l	40	0	100	241	192	0.71
Light Industrial	TSS	mg/L	41	0	100	240	129	1.36
	TPH	mg/l	5	1	80	1.7	1.4	0.68
	Oil and Grease	mg/l	5	1	80	1.7	1.4	0.68
	Dissolved Copper	ug/l	37	5	86	20	14	1.07
	Total Copper	ug/l	37	0	100	32	21	1.03
	Dissolved Lead	ug/l	37	32	14	S.I.D.	S.I.D.	S.I.D.
	Total Lead	ug/l	37	18	51	17	5.1	1.88
	Dissolved Zinc	ug/l	51	3	94	407	303	1.18
	Total Zinc	ug/l	51	0	100	639	366	1.53
High Density Single Family Residential	TSS	mg/L	30	0	100	95	61	1.16
	TPH	mg/l	3	0	100	1.3	1.2	0.23
	Oil and Grease	mg/l	3	0	100	1.3	1.2	0.23
	Dissolved Copper	ug/l	32	15	53	8.5	6.7	0.95
	Total Copper	ug/l	32	2	94	15	11	0.57
	Dissolved Lead	ug/l	32	28	13	S.I.D.	S.I.D.	S.I.D.
	Total Lead	ug/l	32	14	56	10	5.4	1.03
	Dissolved Zinc	ug/l	38	30	21	44	25	1.42
	Total Zinc	ug/l	38	13	66	79	66	0.75
Transportation	TSS	mg/L	61	0	100	78	50	1.30
	TPH	mg/l	4	0	100	3.1	2.8	0.47
	Oil and Grease	mg/l	4	0	100	3.1	2.8	0.47
	Dissolved Copper	ug/l	54	0	100	33	27	0.63
	Total Copper	ug/l	54	0	100	56	39	1.15
	Dissolved Lead	ug/l	54	48	11	S.I.D.	S.I.D.	S.I.D.
	Total Lead	ug/l	54	29	46	10	2.5	1.57
	Dissolved Zinc	ug/l	65	5	92	192	152	0.74
	Total Zinc	ug/l	65	0	100	291	218	0.99

Note: The detection limit for TSS is 2.0 mg/L, for both TPH and oil and grease is 1 mg/l, for total and dissolved copper and lead is 5 ug/L, and for total and dissolved zinc is 50 ug/L. S.I.D. = Statistically Invalid Data, not enough data above detection limit collected.

A review of the literature pertinent to the evaluation of catch basin insert efficiencies shows that a good number of the available studies use percent removals as a criterion for evaluating insert performance. A major limitation to this approach is that percent removals can be manipulated by increasing or lowering influent concentrations.

Examples of other methods that have been used to assess BMP evaluation studies include: summation of loads, regression of loads, mean concentration, efficiency of individual storm loads, reference watersheds, and before and after studies (GeoSyntec Consultants, 2002) [26].

One of the most useful methods of evaluating BMP performance is the Effluent Probability Method. For this method, the influent and effluent are first checked to see whether they are statistically significantly different. Then side-by-side cumulative distribution functions of influent and effluent quality (or standard parallel probability plots) are generated to evaluate the nature of the difference. Nonparametric approaches are recommended to estimate the magnitude of the difference, if the influent and effluent concentrations appear to arise from different distributions. As more studies adopt this approach to reporting BMP efficiencies, more data will be available to support values that can be used to estimate reasonable expected effluent concentrations from BMPs such as catch basin inserts. Since the reasonable expected removals for BMPs provided in this section are based on a review of previous studies, we are limited to the use of percent removals.

Among the reviewed studies, catch basin insert efficiencies varied significantly. Vendor publications report oil and grease removal efficiencies of 81% to 99% for new inserts. Third party laboratory studies report removal efficiencies of greater than 50% for oil and grease, and greater than 34% for hydrocarbons. Nearly all of the third-party field studies reported clogging and bypass of the filters, which reduces the filter efficiency. In the worst case, excessive clogging resulted in only an 8.2% removal of oil and grease (which was likely not statistically significant). Unfortunately, nearly all of the studies (third-party or otherwise) used influent oil and grease concentrations that were well above the expected concentrations in urban runoff in the Los Angeles area (i.e., greater than 3 standard deviations above the L.A. County data shown in Table 2-3). Furthermore, the achieved effluent oil and grease concentrations for the studies that actually reported them were typically above or near the expected influent levels. Based on these issues, the expected effluent concentrations from catch basin inserts during stormwater runoff events cannot be adequately assessed. However, the studies do suggest that catch basin inserts will not reliably reduce oil and grease concentrations below about 5-10 mg/l.

As discussed above in Section 2.1, the low oil and grease concentrations typically observed in urban runoff caused by primarily dispersed sources, likely represent less of a threat to receiving waters than the illegal dumping of used oil directly into the storm drain system. Therefore, the ability of catch basin inserts to remove oil from stormwater may not be as important as their ability to retain previously captured oil from illegal dumping activities during high-flow conditions. However, since no studies were found that evaluated the mass of used oil retained following an illegal dumping activity, it is not possible to assess the ability of catch basin inserts to effectively hold oil and grease until maintenance is performed.

[26] GeoSyntec Consultants (April 2002). "A Guidance Manual for Meeting the National Stormwater BMP Database Requirements." ASCE / EPA

3 RESEARCH METHODOLOGY

An integral part of this Catch Basin Insert Performance Study was the selection of catch basin sites and inserts compatible with those sites. This study included the selection of 24 cumulative pollutant capture sites and 12 field-to-laboratory sites. The purpose of the cumulative pollutant capture sites was to assess long-term performance and maintenance requirements, as well as characterize bulk pollutants captured during the study period. The purpose of the field-to-laboratory sites was to numerically evaluate changes in pollutant removals after being exposed to field conditions. The results from both sites were used to qualitatively and quantitatively compare the performance of the four (4) different types of filters tested. The following paragraphs describe the site and catch basin insert selection methodology, the monitoring and testing plan, and the design and construction of the insert testing apparatus.

3.1 STUDY SITE SELECTION

Site selection was an important component of this project because one of the objectives was to evaluate insert performance after being exposed to dry weather conditions and wet weather urban runoff from high oil and grease source areas. These areas have a high potential for receiving significant amounts of motor oil and other petroleum products into drains via illicit dumping and improper vehicle maintenance. The City of Los Angles staff provided an initial map of 52 candidate catch basin sites located in areas believed to be high oil and grease source areas. The suitability of these candidate sites were investigated as part of the second phase of the study. Approximate drainage areas, dominant land uses, catch basin dimensions, and other site constraints were evaluated. Other factors considered for the final site selection included representativeness, personnel safety, ease of access, and security. The following paragraphs describe each of these factors in more detail.

3.1.1 REPRESENTATIVENESS

Sites chosen for catch basin filter performance comparison were selected based on similar sized drainage areas (gross approximation), land use types, and relative proximity to one another. Sites were located in areas that represent highly-developed urban areas of the City of Los Angeles. Drainage areas with known active or planned construction were intentionally avoided.

3.1.2 SAFETY

Site safety is the number one concern for any field investigation. An attempt was made to avoid sites having excessive traffic and high speed limits. For the safety of the monitoring crews who were accessing the sites, only well lit areas with moderate traffic and speed limits below 55 mph were chosen. Areas with excessive pedestrian traffic were also avoided for the general safety of the public and the site crew.

3.1.3 EASE OF ACCESS

This was a low priority; however, whenever possible, sites were chosen that were closer to the UCLA laboratory rather than those that are further away. Also sites that had structures that are easily accessible are favored. For instance, catch basins that were only accessible through a heavy drop inlet grate that required two or more people to lift were avoided.

3.1.4 SECURITY

Vandalism was as issue that was taken into account in the site selection process. Although hard to predict, situations that present opportunities for vandalism were avoided where ever possible.

The catch basin inserts were contained and no equipment was ever left on-site, so the potential for vandalism was low. Nonetheless, well lit open areas were chosen to discourage vandals and criminals alike from interfering with the inserts, the activities of the monitoring crews, or the results of the study. All field monitoring was done in broad daylight.

3.2 CATCH BASIN INSERT SELECTION

The initial list of candidate catch basin inserts consisted of products from nine (9) different vendors with a variety of design configurations and media types. Based on cost, ease of installation and maintenance, number and quality of existing evaluation studies, and the target pollutants, these nine candidate inserts were narrowed down during repeated project team discussions to the following four (4) vendors: Drainworks DrainPac, Suntree Curb Inlet Basket, Kristar FloGard-Plus, and Hydro Compliance Hydro-Kleen. All of these inserts were available in a variety of sizes and configurations, but some designs were more compatible with some individual catch basins than others. The descriptions of the selected catch basin inserts in the manufacturers' words are provided in the next section.

3.2.1 DRAINWORKS INC. – DRAINPAC

The DrainPac™ is a flexible storm drain catchment and filtration liner designed to filter pollutants, debris, and solids prior to discharge into storm drain systems. The DrainPac™ is available in four (4) styles: grate top, curb, and round configurations, as well as new styles designed for outfall, or "end of pipe" applications and drop-in drain applications. Each insert is equipped with a choice of two (2) overflow systems, the hydraulic bypass and the new uninhibited bypass, both of which accommodate heavy rains and potential flooding. A picture of the curb inlet DrainPac™ system is shown in Figure 3-1.

According to the manufacturer, the DrainPac™ can handle flow rates of up to 150 gpm/sq. ft and hold up to 7100 pounds of material. Tests performed at UCLA (not in this study) show removal efficiencies for the DrainPac™ System at 99% for TSS, and 51% to 88% for PAHs. Typical cost for the DrainPac™ System range from about $1000 for a 21-foot wide curb inlet to about $500 for a 4- to 7-foot wide curb inlet. The manufacturer recommends that maintenance be performed at least twice per year (once before the wet season and once after the wet season). Quarterly inspections during dry periods and monthly inspections during wet periods are also recommended. The cost of a yearly maintenance service agreement with the manufacturer is $225 per unit.

Figure 3-1. DrainPac™ catch basin insert.

A full description and a complete list of applications are available at the manufacturer's web site: http://www.drainpac.com/index1.htm.

3.2.2 SUNTREE TECHNOLOGIES INC. – CURB INLET BASKET

The Curb Inlet Basket is a multi-stage, removable filtration basket that was designed to capture everything from hydrocarbons to sediment, grass clippings, and human trash. It is made of durable fiberglass with stainless steel filter screens, backed by heavy-duty aluminum grating. The Curb Inlet Basket telescopes to change size, so that it can fit almost any catch basin. However, custom-shaped units are available from the manufacturer. A picture of the Curb Inlet Basket is show in Figure 3-2.

The cost of the Curb Inlet Basket ranges from $695 to $795. Pricing for custom units can be obtained from the manufacturer[27]. The maintenance of the Curb Inlet Basket can be performed by hand, without the need for heavy equipment. Maintenance entails removing the inlet access cover, lifting out the basket by hand or with a manhole puller and dumping out the contents. The basket is placed back into the catch basin and the sorbent boom is replaced. The manufacturer recommends quarterly maintenance of the basket to remove sediment and debris, along with semi-annual replacement of the sorbent boom. Performance evaluation of the Grate Inlet Skimmer Box System performed by the Reedy Creek Improvement District and Walt Disney Imagineering, reported removal efficiencies of 74% for total suspended solids and 54% for oil and grease.

A full description and a complete list of applications for the Curb Inlet Basket are available at the manufacturer's web site: http://www.suntreetech.com/ .

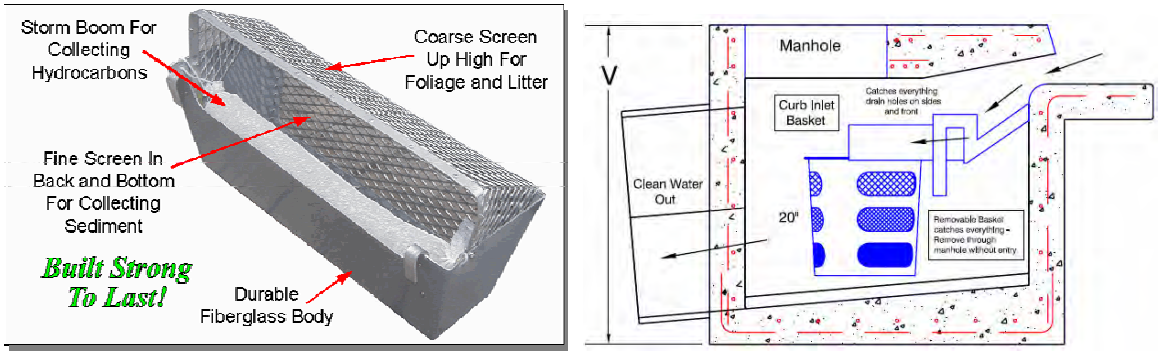


Figure 3-2. Curb Inlet Basket functional details and installed configuration.

3.2.3 KRISTAR ENTERPRISES INC. – FLOGARD+PLUS™

The FLOGARD+PLUS™ is a multipurpose catch basin insert designed to capture sediment, debris, trash, and oils/grease from low (first flush) flows. A high-flow bypass screen allows flows to bypass the device while retaining sediment and larger floatables (debris & trash), and allows sustained maximum design flows under extreme weather conditions. The system is designed for use in areas with low to higher than normal sediment, trash, and debris; and moderately high

[27] August 2003 Catalog. Sun Tree Technologies Inc.

levels of petroleum hydrocarbons such as parking lots, as well as public and private streets.

The cost of the FloGard Plus System ranges from $350 for a 2-foot curb opening installation to about $2,200 for a 15-foot curb opening installation. UCLA conducted tests (not this study) to determine the removal efficiency of the fossil filter FloGard System in October 2000. Oil and grease removal efficiencies were found to range from 70% to 90%. The manufacturer recommends at least three (3) inspections per year, and more in high exposure areas. Maintenance entails removing the device from the inlet and dumping the contents into an approved drum for disposal. Cleaning can also be accomplished with a vacuum truck. Maintenance costs for a curb inlet installation with a 7-foot curb opening ranges from $250 to $375 per annum.

A full description and a complete list of applications for the FloGard Plus System are available at the manufacturer's web site: http://www.kristar.com/fosys.html.

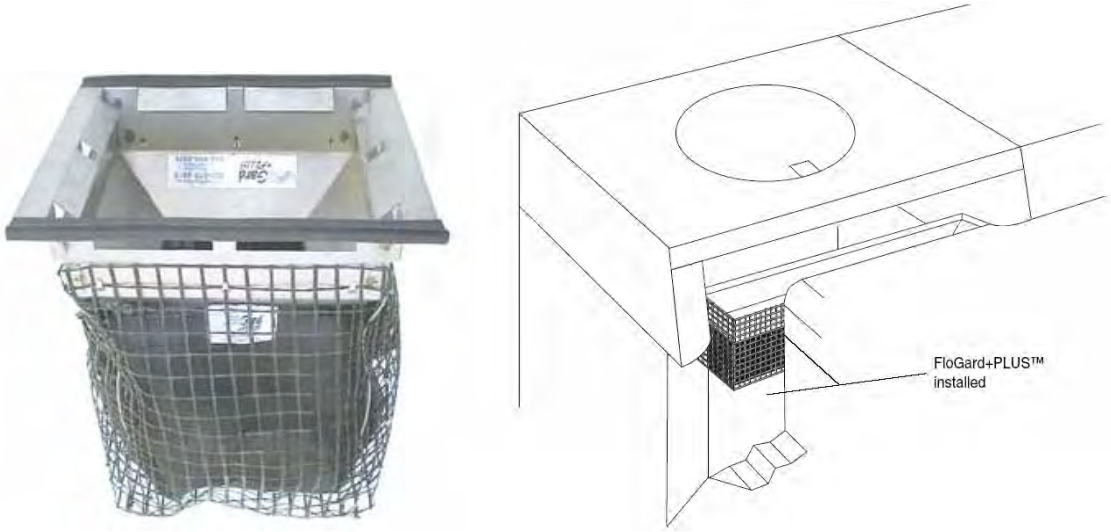


Figure 3-3. FloGard Plus catch basin insert.

3.2.4 HYDRO COMPLIANCE MANAGEMENT INC. – HYDRO-KLEEN

The patented Hydro-Kleen Filtration System is a stormwater compliance technology for use with stormwater catch basins and drains to trap hydrocarbons, metals, sediments, and other contaminants contained in stormwater and other surface runoff. The multi-media filtration system contains design features that effectively filter out hydrocarbons and other contaminants, while alleviating concerns with water flow.

Flows enter the unit and are directed into a pre-settling sedimentation chamber that collects heavy sediments and debris passing through the grate. Water then passes through transition inlets at the top of the sediment chamber into the filtration chamber. The primary media, Sorb-44, traps hydrocarbons through adsorption to a hydrophobic cellulose material. The secondary media is a special blend of activated carbon (AC-10) that removes most remaining hydrocarbons, as well as a variety of other organics, and metals and other contaminants from the runoff. Water then passes through the bottom of the treatment chamber into the catch basin. The system can fit both circular and rectangular catch basin grates. An illustration of the Hydro-Kleen Filtration System is shown in Figure 3-4.

According to the manufacturer, typical cost of a 24-inch square unit is $1150, while a 2-foot by 4-foot unit costs about $2,300. Maintenance costs are typically $300 per year. Maintenance is straightforward and can be accomplished by vacuuming sediment loadings from the sedimentation chamber and replacing the filters. It is recommended that filters be changed every 4 to 6 months, depending on the application. Disposal of the spent media in a typical application may be accomplished through placement into lined landfills, as the filter media is non-leaching. Third part analytical test results obtained from the manufacturer show removal efficiencies of 83% to 95% for BTEX and almost 70% for total suspended solids.

A few examples of current applications of this Hydro-Kleen System include installations by American Airlines, Alcoa, Federal Express, Ford Motor Company, General Motors, Kroger, Seven Eleven, and the US Army. A full description and a complete list of applications are available at the manufacturer's web site: http://www.hydrocompliance.com/.

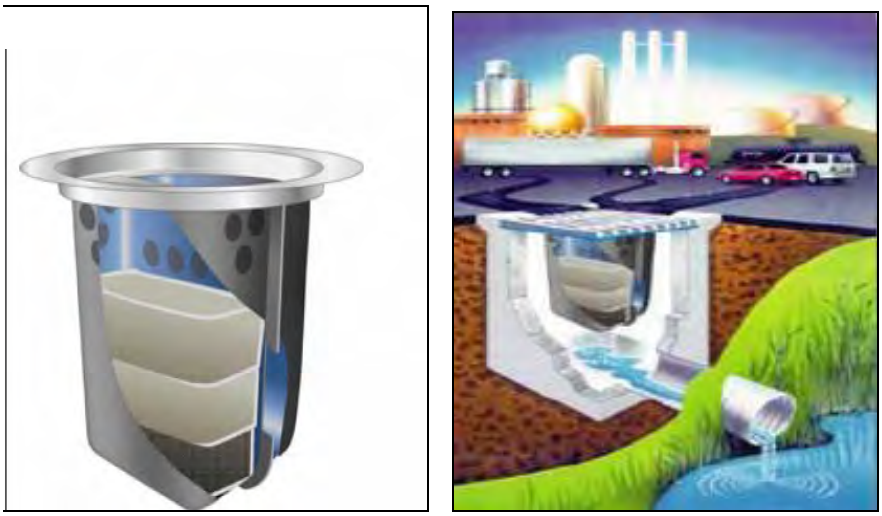


Figure 3-4. Hydro-Kleen Stormwater Filtration System.

3.3 SUMMARY OF THE MONITORING AND TESTING PROCEDURES

As discussed above, four different catch basin insert technologies were selected for this study: DrainPac, Curb Inlet Basket, FloGard-Plus, and Hydro-Kleen. The performance of these inserts was evaluated in two parts: at field-to-laboratory (FL) sites and at cumulative pollutant capture (CPC) sites. The FL sites were used to evaluate the performance of the inserts by performing a series of laboratory tests on them before and after being exposed to field conditions. The CPC sites were used to evaluate the long-term performance of the insert technologies through periodic field inspections during the wet and dry seasons and then collecting the inserts for pollutant capture analyses at the end of the evaluation period or at the end of their useful lives (determined by the inspection team).

A monitoring plan was prepared that outlined the field inspection activities and the laboratory testing procedures. Some elements of the monitoring plan were modified during the course of the study due to circumstances beyond control that caused delays in getting project tasks completed. For instance, the fire disaster that occurred in southern California during the summer

of 2003 left a significant amount of ash covering the area and it was decided that the "first flush" event would not likely represent typical conditions so the project team decided to install and begin conditioning the catch basin inserts during the middle rather than at the beginning of the wet season (2003-2004). Also, the catch basin insert testing apparatus at UCLA had to be relocated because of ongoing construction activities. After it was moved, the apparatus needed to be repaired due to leakage, which caused delays in the laboratory testing. Consequently, the study occurred in two phases: cumulative pollutant capture phase (Feb. 2004 - Oct. 2004) and field-to-laboratory phase (Nov. 2004 - May 2005).

During the course of these two phases of the study, one insert at a CPC site and three inserts at FL sites were replaced by the City of Los Angeles with an alternative insert system without the knowledge of the research team. This alternative system is shown in Figure 3-5 and consists of a screen that covers the entire bottom of the catch basin. Notice that this design provides no oil absorption, but has ample capacity for capturing bulk solids. The loss of the inserts was unfortunate and reduced the number of inserts available for the study.

Figure 3-5. Alternative catch basin insert system installed by the City of Los Angeles.

The following subsections briefly summarize the insert monitoring and testing activities.

3.3.1 FIELD INSPECTIONS

Field inspection of the cumulative capture sites were conducted to:

- Ensure that all inserts were functioning properly
- Detect and eliminate unnatural conditions such as excessive clogging or blockage from oversized objects
- Detect and replace missing, damaged, or defective inserts
- Document the condition of inserts through visual observation, photographs, and field notes

Inserts were installed at all sites between October and November 2003. Field inspections began after in February 2004 and continued through October 2004. Sites designated as FL sites were inspected as if they were CPC sites and were generally inspected at the same frequency as the CPC sites. Field inspections occurred on 2/4/04, 2/27/04, 3/23/04, 6/30/04, 10/21-22/04, and 3/24/05.

Field procedures included inspecting both the drainage structure and the installed insert and noting any observations that required correction such as damaged structures, missing or damaged inserts, blocked inlets, etc. Photographs of the inside of the structure were taken to document any debris that had bypassed the insert as well as debris that had been collected inside the insert structure. Photographs of the installed inlets looking through curb openings were also taken.

During the routine inspections, if any of the insert media appeared to have reached their maximum capacity (e.g., standing water in the insert) or was damaged beyond repair, it was noted, photographed and retrieved for laboratory analysis.

3.3.2 LABORATORY TESTING

The primary objectives of the laboratory tests were to:

- Quantitatively evaluate changes in pollutant removal rates of 4 different types of catch basin filters after being exposed to field conditions.
- Evaluate the quantity of used motor oil captured by catch basin inserts when new and weathered and the potential for captured oil, and associated pollutants, to leach from catch basin inserts.
- Estimate the performance of each proprietary filter tested with respect to the removal and retention of used motor oil and make statistically valid performance comparisons.

Laboratory tests began during the 2004-2005 wet season after new inserts were installed in all of the FL sites. All laboratory testing was performed at UCLA using an apparatus built by Professor Michael Stenstrom (see Section 3.4). Two categories of laboratory tests were conducted including: New Filter Performance Tests and Used Filter Performance Tests.

A large stock of the used motor oil was created for use throughout the study. The total and particulate heavy metals concentrations were measured in the oil stock to determine if the catch basin insert may impact metals removal and if sampling of suspended solids and total metals should be measured in the effluent from the catch basin during the washout experiment.

New Filter Performance Tests. Four unused catch basin insert types from four different manufacturers for controlling gross spills were tested. The tests were conducted by pouring 1 quart of used motor oil directly into each catch basin insert type. The amount that drained through the insert was captured and the volume was measured. The test was continued until the insert ceased to drip measurable amounts of motor oil. Following the drainage period, the catch basin insert was placed in the insert testing flume and exposed to a design flow rate (20 to 25 GPM). Oil and grease washout was monitored over the next 90 minutes taking a total of six grab samples, including at the beginning of flow and then every 18 minutes. Each grab sample was then analyzed for total oil and grease. The extracts of the oil and grease measurements were combined and analyzed for PAHs.

In addition to the spill tests, one example of each insert type was laboratory tested with a sustained flow of introduced pollutants. The test was conducted for 60 minutes at 20 to 25 GPM using tap water dosed with oil and grease and glass beads to simulate sand and clay. Commercially available glass beads (McMaster Carr, Los Angeles, CA) used for “sand blasting” were used for testing. These beads are provided in several sizes. Four grades of beads were mixed to create the fraction shown in Table 3-1. Ten grab samples, one each 6 minutes, were collected for oil and grease analyses. The suspended solids removal was measured by capturing all the particles that passed through the catch basin insert during the 60 minute test, screening

into the same size fractions as used initially, dried and weighed. The influent sand concentration was approximately 200 mg/L and the influent oil and grease concentration was approximately 20 mg/L. To understand the potential removal of heavy metals and PAHs contained in the oil and grease that might be removed by adsorption, the concentrations of both were measured in the used oil. These concentrations can be multiplied by the oil and grease concentrations or removals to estimate the impact of the inserts on removals of metals and PAHs.

Table 3-1. Target particle size percentiles by mass for artificial stormwater TSS concentrations.

Percentile by Mass	Diameter Range	Approximate Target Concentration Range
25%	Passing 40 mesh (430 µm) but retained on 60 mesh (250 µm)	~ 50 mg/L
25%	Passing 60 mesh (250 µm) but retained on 120 mesh (125 µm)	~50 mg/L
25%	Passing 100mesh (150 µm) but retained on 170 mesh (90 µm)	~ 50 mg/L
25%	Passing 170 mesh (90 µm) but retained on 325 mesh (45 µm).	~ 50 mg/L

Used Filter Performance Tests. The UCLA Team placed twelve new inserts into designated catch basins prior to the 2004-2005 rainy season (~early October). At the middle of the 2004-2005 wet season, the field-to-laboratory inserts (9 total) were collected and transported by the Team to the UCLA laboratory (3 inserts were inadvertently removed by the City of Los Angeles in their experimental program). Each insert was placed in the flume and a fine solids capture screen was placed below the insert. After removing large debris such as plastic bags, newspapers, and leaves, it was hydraulically tested starting at a flow rate of 5 GPM. If the insert was not clogged by fine sediment, the flow rate was gradually increased to the flume's maximum capacity (60 gpm) or until the insert bypassed. Depth of water in the insert was recorded as a function of flow rate and the flow rate at which bypass occurred was noted. During this hydraulic capacity testing, fine solids that had been captured by the inserts while out in the field that washed out were collected, but no solids removed from the insert while it bypassed flows were collected. These collected solids were characterized by weighing and sieving.

After completing the capacity testing, the continuous flow testing was begun. The flow was set to the maximum possible without bypassing up to 25 gpm maximum. Grab samples were collected through the 60 minutes to create a composite sample for oil and grease analysis. Solids removal was quantified by collecting solids in a 325 mesh (45 µm) screen below the insert. This was the same screen used in the capacity testing, although it was cleaned to avoid mixing the two types of solids. The solids retained by the fine screen, were weighed and sieved into the four size fractions as shown in Table 3-1.

After all tests were completed, spill tests were performed on the used inserts using the same procedure described for the new filter tests to evaluate any changes in retention capacity after the filters had been used.

3.4 DESIGN AND CONSTRUCTION OF TESTING APPARATUS

The design of the UCLA testing apparatus is based on a curb and gutter flume design used for previous catch basin insert studies conducted by Professor Stenstrom, together in some cases with GeoSyntec staff and is intended to simulate the influent hydraulics of a curb inlet catch basin. A plan view schematic of the testing apparatus is shown in Figure 3-6 and a profile view schematic is shown in Figure 3-7.

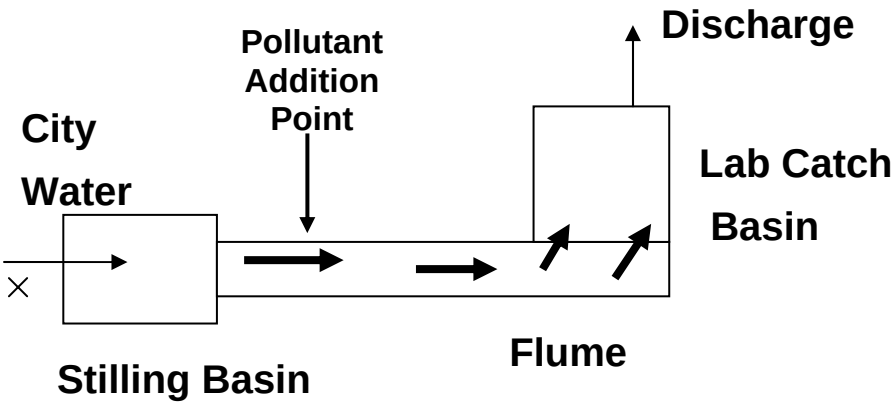


Figure 3-6. Laboratory testing apparatus schematic (plan view).

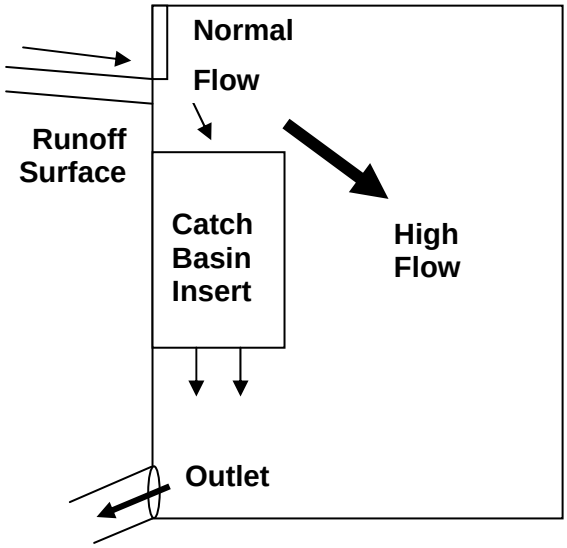


Figure 3-7. Curb inlet schematic (profile view).

As mentioned above, the UCLA testing apparatus was moved from its previous location and needed to be repaired due to leaks and needed to be modified to accommodate the inserts tested in this study. A new stilling basin tank was also installed.

Pictures of the testing apparatus in its new location are shown in below. Figure 3-8 shows a full view of the apparatus prior to and after being upgraded. Figure 3-9 shows the inlet configuration, the new stilling basin, and the catch basin outlet.

Figure 3-8. Testing apparatus prior to upgrade (left) and after upgrade (right).

Figure 3-9. Testing apparatus stilling basin (left) and synthetic catch basin (right).

3.5 PRECIPITATION DURING THE STUDY PERIOD

The sites received runoff from several storm events during both phases of the study, but the amount of rainfall that occurred during the field-to-laboratory phase (2004-2005 wet season) was much greater than during the cumulative capture phase (02/2004 - 10/2004). Figure 3-10 provides daily rainfall totals for 2004 and Figure 3-11 provides daily rainfall totals for 2005 through April for the Downtown Los Angeles USC Campus rain gage. These data are used to qualitatively relate observed conditions to the amount of rainfall between observations.

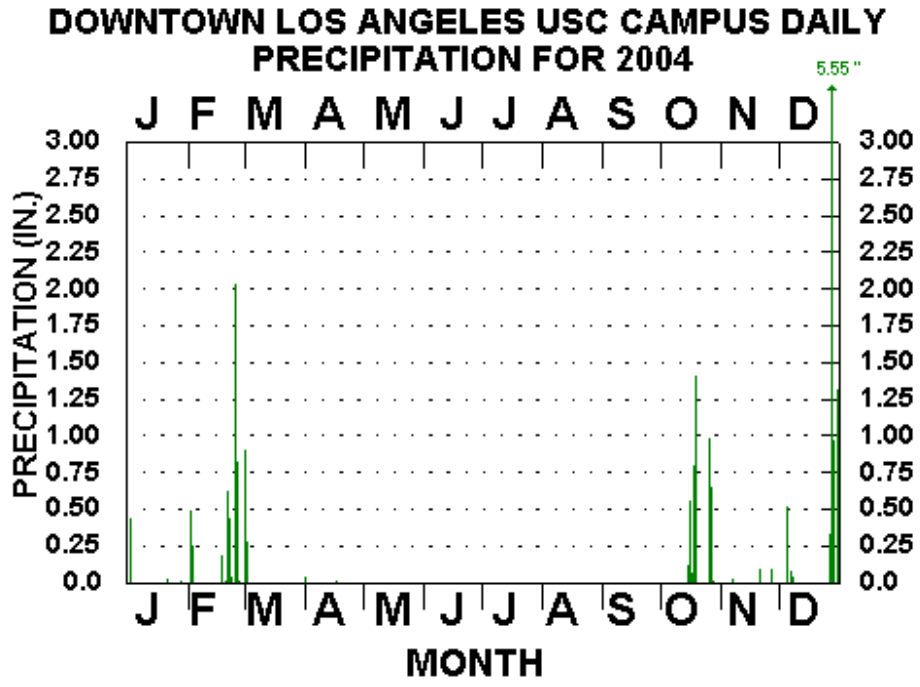


Figure 3-10. 2004 precipitation record for the Downtown USC Campus rain gage. Source: http://home.att.net/~station_climo/

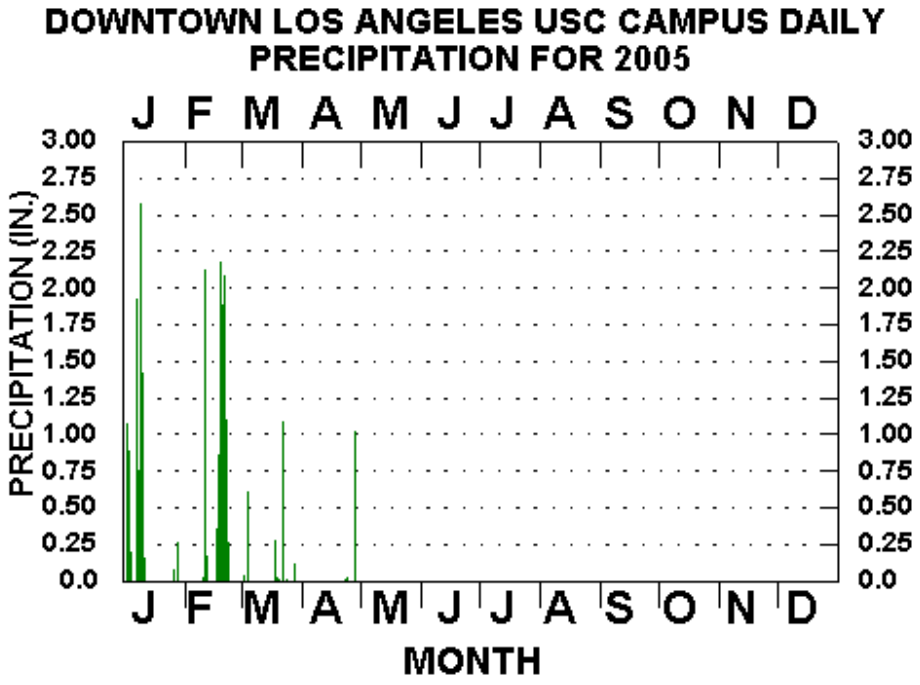


Figure 3-11. 2005 precipitation record for the Downtown USC Campus rain gage. Source: http://home.att.net/~station_climo/

4 RESULTS AND DISCUSSION

The following subsections discuss the results of the field inspections and the laboratory analyses. The cumulative pollutant capture part of the study was based on the field inspections of both the CPC sites and the FL sites.

4.1 FIELD INSPECTIONS

The performance of four catch basin inserts selected for this study was evaluated at twenty-four (24) CPC sites and twelve (12) FL sites during the study period 2003-2005. Location maps of all of sites are provided in Appendix A. Figure A1 includes the locations of all of the CPC sites and Figure A2 includes the locations of all of the FL sites. Figures A3 and A4 are aerial photographs of the FL sites grouped into east and west sites, respectively.

One of the most consistent observations made during field surveys is that almost all inserts installed in the field were quickly overwhelmed with trash and debris, which causes stormwater bypass and resulting in limited contact with the absorptive media. While the capture trash and debris may provide some pollutant retention, without significant stormwater/media contact the ability of these devices to remove oil and grease, as well as other pollutants, is severely limited. No significant attempt was made to maintain the CPC sites; instead the accumulation of trash and debris was simply observed and the inserts were retired shortly after they reached their holding capacity. All field survey photos and observations made during the inspection of CPC and FL sites are provided in Appendix B. As mentioned earlier, the FL sites were treated as CPC sites during the inspections. However some of the FL inserts had not yet been installed by the vendor during the initial field inspections, so there are fewer observations of these sites than the CPC sites provided in Appendix B. Representative photographs and field observations that provide a qualitative indication of the performance of each type of insert selected for this study are provided below. Since these sites have different drainage areas, land use types, and catch basin configurations, the following observations are not meant to be representative of the overall performance of each insert type and should not be construed as a comparative analysis.

The subsections below present some an example site and resulting observations for each of the catch basin insert types. All field notes and photos are provided in Appendix B.

4.1.1 DRAINPAC AT WASHINGTON AND VERMONT

A DrainPac catch basin insert was installed at the southeast corner of Washington Blvd. and Vermont Ave. in January, 2004. This site receives runoff from primarily commercial, multi-family residential, and transportation land uses. Figure 4-1 shows the location of the catch basin in relation to the City of Los Angeles' storm drain system including the direction of surface runoff. Figure 4-2 is an aerial photo of the site showing the surrounding land use activities and Figure 4-3 shows two ground-level photographs taken from the site.

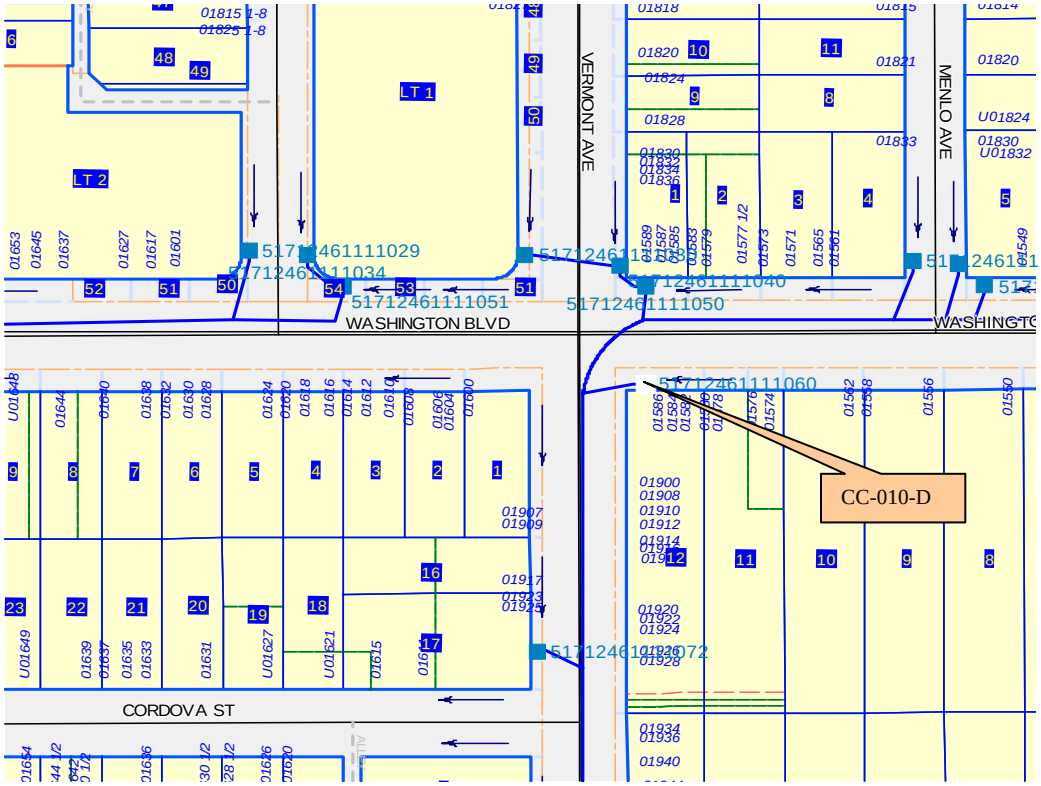


Figure 4-1. Map showing the location of CC-001-D site installed with DrainPac insert.

Figure 4-2. Aerial photo of site CC-010-D.
(Source: http://terraserver.microsoft.com).

Figure 4-3. CC-010-D site photos upstream (left) and to the intersection of Vermont and Washington (right).

The initial site visit (10-24-03) before the installation of the DrainPac indicated that the site was located at a busy intersection with very high trash loading (Figure 4-4a). The first inspection after the installation of the insert was made on 02-04-04 during a small storm event (~0.75"; see Figure 3-10). Although the insert appeared to be operating at full hydraulic capacity, the inflow was still being processed by the insert (Figure 4-4b). The next visit (02-27-04) occurred in less

than a month after a relatively large storm event (>2"). The site examination indicated that some flow bypass had occurred with trash and debris settling at the edge of the insert (Figure 4-4c). Also, standing water indicated the insert was beginning to clog. The site was completely overwhelmed with trash during the fourth visit (03-23-04; Figure 4-4d) and since only one storm (>1") occurred since the previous visit, most of the trash was likely due to wind rather than runoff. The next inspection on 06-30-04 the insert appeared to be completely buried with wind-blown trash (Figure 4-4e). During the last inspection of the site (10-21-04) the insert was retired and captured debris were collected for laboratory tests (Figure 4-4f).

Figure 4-4. Field inspection photos of DrainPac catch basin insert at the intersection of Washington Blvd. and Vermont Ave.

4.1.2 CURB-INLET BASKET AT PORTLAND AND 23RD

The study site CC-008-C located at the intersection of 23rd and Portland St. was installed with a Curb-Inlet Basket. This site receives runoff from high density single family residential land uses. Figure 4-5 shows the location of the catch basin in relation to the City of Los Angeles' storm drain system including the direction of surface runoff. Figure 4-6 is an aerial photo of the site showing the surrounding land use activities and Figure 4-7 shows two ground-level photographs taken from the site.

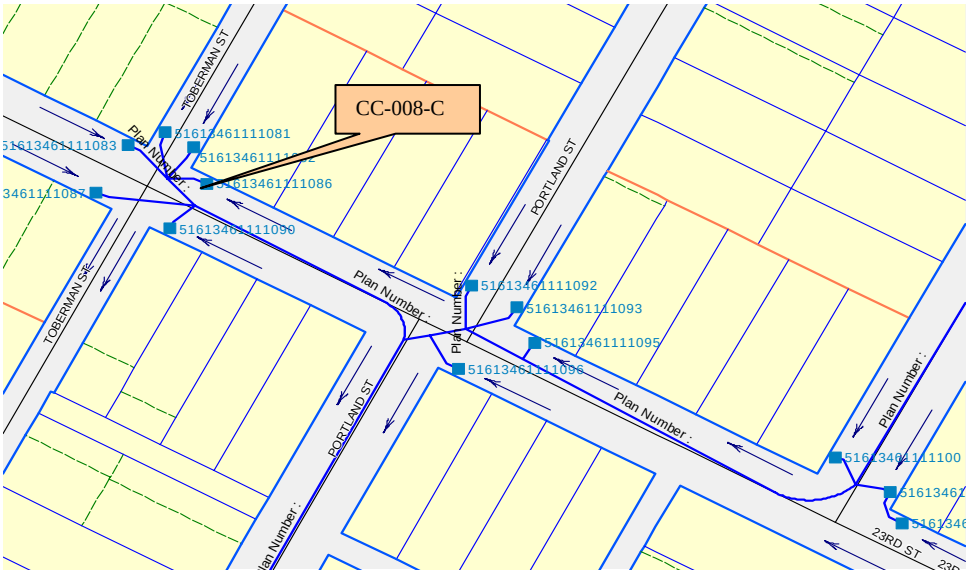


Figure 4-5. Map showing the location of CC-008-C site installed with a Curb-Inlet Basket.

Figure 4-6. Aerial photo of site CC-008-C.
(Source: http://terraserver.microsoft.com).

Figure 4-7. CC-008-C site photos upstream (left) and to the intersection of 23rd and Portland (right).

The initial site survey was completed on 12-10-03 before the installation of the insert. Excessive leafy debris from nearby deciduous trees appears to comprise a significant proportion of the material delivered to this catch basin (Figure 4-8a). The first visit (02-04-04) after insert installation was performed just after one storm event (~0.75"). Some trash and debris along with a notable accumulation of coarse sediment were collected by the insert (Figure 4-8b). However, the insert still had plenty of capacity at this time. During the next visit in less than two months after installation (03-23-04) the insert had accumulated a significant amount of trash, but was still functioning with limited signs of bypass (Figure 4-8c). The site survey conducted on 6-30-04 showed that the insert had reached its full capacity and was overflowing with wind-blown trash and debris (Figure 4-8d). The final site inspection was performed on 10-21-04 after a few inches of rainfall (see Figure 3-10). There was less trash in the insert than the previous visit and the media boom at the lip of the insert was missing its adsorptive material indicating that the insert was cleaned by Los Angeles County maintenance staff prior to the wet season. Since the absorptive media was missing, this insert was retired during this final visit (Figure 4-8e and Figure 4-8f).

Figure 4-8. Field inspection photos showing the condition of Curb-Inlet Basket at the intersection of 23rd St. and Portland (east side).

4.1.3 FLOGARD-PLUS AT 18TH AND FLOWER

The site CC-007-F installed with a FloGard Plus unit is located at the intersection of 18th and Flower Street. This site receives runoff from retail and commercial land uses. However, the close proximity of the I-10 freeway may impact the deposition of airborne debris and particulates. Figure 4-9 shows the location of the catch basin in relation to the City of Los Angeles' storm drain system including the direction of surface runoff. Figure 4-10 is an aerial

photo of the site showing the surrounding land use activities and Figure 4-11 shows two ground-level photographs taken from the site.

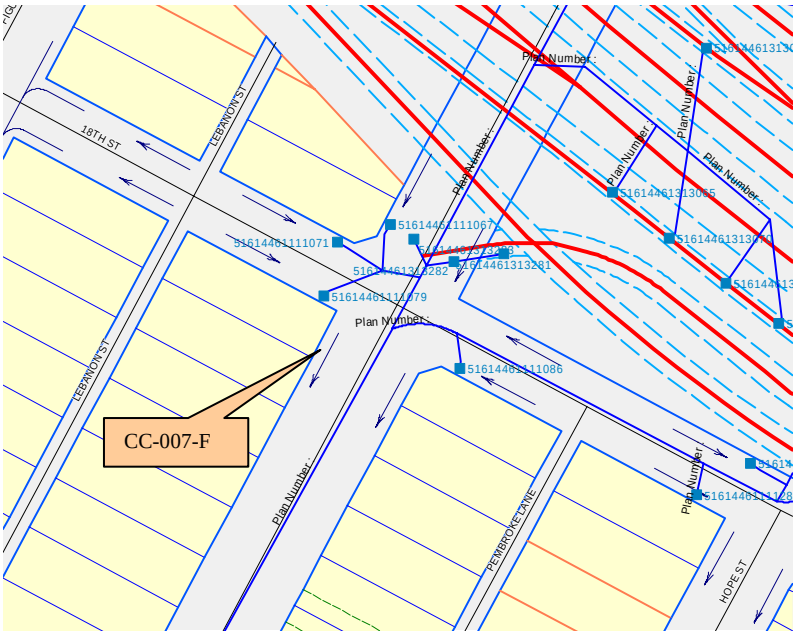


Figure 4-9. Map showing the location of CC-007-F site installed with a FloGard Plus insert.

Figure 4-10. Aerial photo of site CC-007-F.
(Source: http://terraserver.microsoft.com).

Figure 4-11. CC-010-D site photos upstream (left) and to the intersection of 18th and Flower (right).

The initial site visit was conducted on 12-10-03 before the installation of the FloGard Plus. The catch basin appeared to be a shallow unit with relatively low trash loading (Figure 4-12a). However, the first inspection (02-04-04) after installation of the FloGard Plus showed standing water in the unit from the approximately 0.75 inches of rainfall that occurred the night and morning before, indicating the unit may have already begun to clog. The adsorbent boom with amorphous alumina silicate was seen floating in the standing water (Figure 4-12b). The second inspection (02-27-04) of the insert showed slightly more capture of debris and trash and the standing water had drained (Figure 4-12c) even though more rainfall had occurred. During the third inspection, which occurred within a month of installation (03-23-04), the insert was nearly at its volumetric capacity (Figure 4-12d). During the next inspection (06-30-04) the insert showed that the insert reached its capacity and was overflowing with trash. As with the other inserts, the majority of the trash appeared to have been transported by wind rather than runoff (Figure 4-12e). The last inspection was conducted on 10-21-04. Some of the trash appeared to have bypassed after a rain event and some has consolidated in the insert. The insert was retired after this visit and the captured debris was collected for laboratory sieve analysis (Figure 4-12f).

Figure 4-12. Field inspection photos showing the condition of FloGard Plus at the intersection of 18th St. and Flower St. (southwest corner).

4.1.4 HYDRO-KLEEN AT WASHINGTON AND CATALINA

The location of this field survey site, CC-001-H with the Hydro-Kleen insert is near the intersection of Washington and Catalina Streets. This site receives runoff from primarily commercial land uses (auto dealers and repair shops) and transportation (Washington Blvd.). Figure 4-13 shows the location of the catch basin in relation to the City of Los Angeles' storm drain system including the direction of surface runoff. Figure 4-14 is an aerial photo of the site

showing the surrounding land use activities and Figure 4-15 shows two ground-level photographs taken from the site.

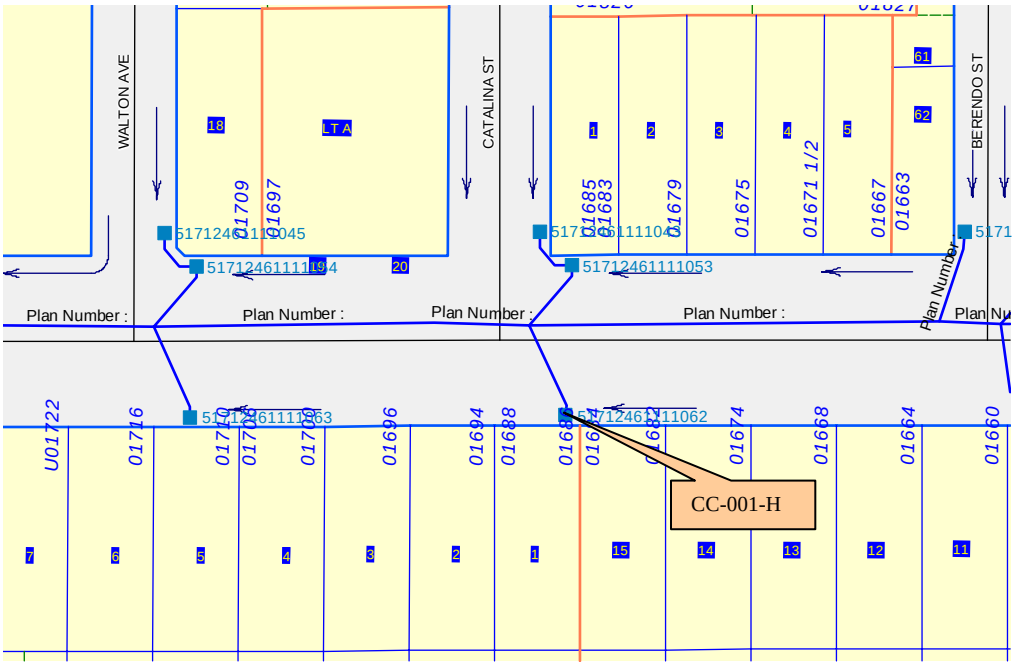


Figure 4-13: Map showing the location of CC-001-H site installed with a Hydro-Kleen insert.

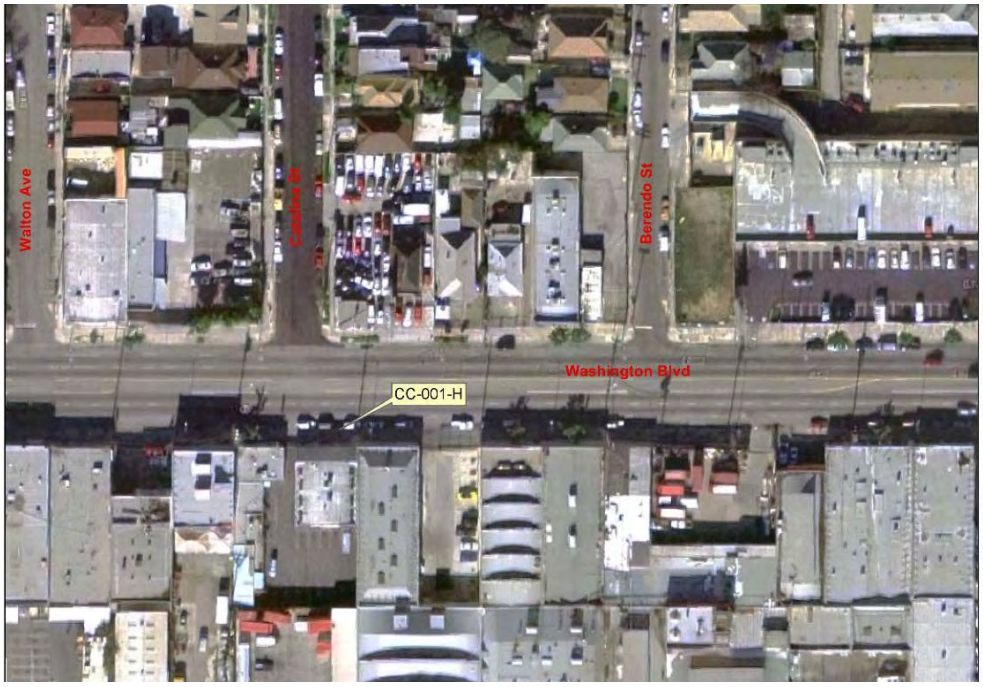


Figure 4-14. Aerial photo of site CC-001-H.
(Source: http://terraserver.microsoft.com).

Figure 4-15. CC-001-H Site Photos Upstream (left) and Downstream (right).

The initial site survey before the installation of the Hydro-Kleen insert occurred on 12/11/03. Examination of the site showed evidence of high trash loadings and a missing catch basin lid (Figure 4-16a). The first inspection after installation of the insert occurred on 02-27-04. Although there was evidence of bypass (Figure 4-16b), the insert appeared to be in good working condition even after a few storms, including an event greater than 2 inches. The missing concrete cover had been replaced prior to the installation of the insert. During the second inspection, it was noticed that the insert was capturing significant amounts of trash (Figure 4-16c). The third inspection was completed after another few months (06-30-04) and although the insert has captured more trash than the last visit it still appeared to be in good working condition (Figure 4-16d). The final inspection was conducted approximately three months later (10-22-04) and the insert had reached its volumetric capacity. There was a significant amount of oily sediment and debris on the curb indicating blockage of the insert. The insert was retired and the captured contents were collected for laboratory analysis (Figure 4-16e and Figure 4-16f).

Figure 4-16. Field inspection photos showing the condition of Hydro-Kleen at the intersection of Washington and Walton.

4.1.5 SUMMARY OF FIELD INSPECTIONS

The field inspections revealed that nearly all of the inserts were quickly overwhelmed with trash after just a couple months and a few inches of rain (3-4 storms). Observations of material hanging over the edge of the inserts and silt build-up on the outside of several of the inserts indicated that flow bypass was common. While these devices are designed to bypass to ensure the road does not flood during large runoff events, bypass was observed at several of the sites during an average size storm event (~0.75 inches). Bypass occurred due to low flow capacity

(presumably due to clogging), as well as improper installation. For example, Figure 4-17 shows a HydroKleen insert bypassing a significant proportion of the inflow during this April 4th, 2004 site visit after only one month in the field. Figure 4-18 shows an improperly installed FloGard that created a lip near the inlet that caused the flow to bypass the insert. In contrast, Figure 4-19 shows two properly installed inserts near capacity, but processing the flow.

Figure 4-17. Relatively low-intensity storm showing bypass (FL-006-H, 2/4/04).

Figure 4-18. Improper installation of insert that caused bypass (CC-003-F, 2/4/04).

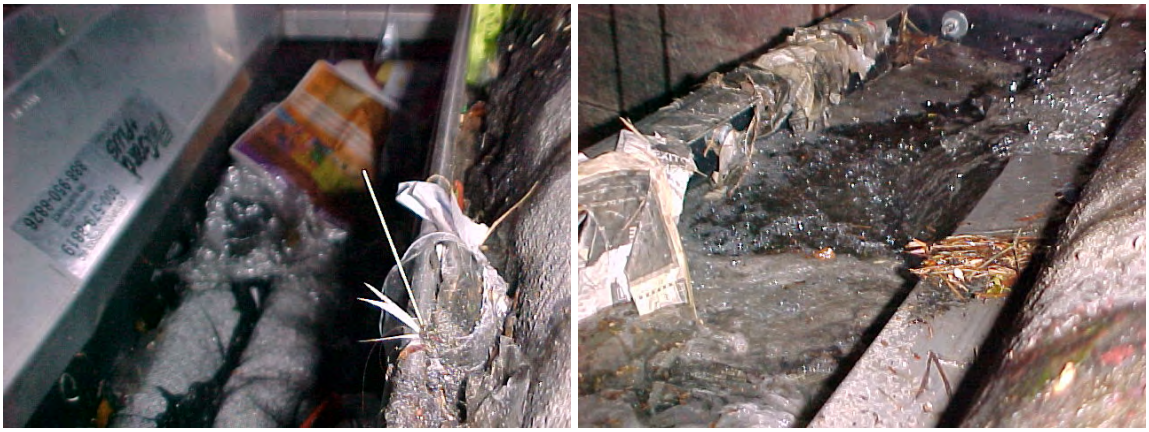


Figure 4-19. Two inserts operating properly during the 2/4/04 event: CC007-F (left) and CC009-D (right).

Two of the sites had screens installed at the curb inlet (FL003-F and CC004-H) as shown in Figure 4-20. These curb inlet screens blocked much of the trash and debris from entering the curb inlet. Consequently, the inserts installed at these locations appeared to show significantly less trash and debris accumulation. While no data yet to support, it is presumed that these simple inlet screens can improve long-term oil retention of any catch basin insert type by reducing the tendency for blinding the absorbent media.

Figure 4-20. Curb inlet screens installed at two sites: FL003-F (left) and CC004-H (right).

In summary, DrainPac appeared to have the largest capacity for trash and debris and was still able to process high flows. HydroKleen, which appears to have the most effective filtration system, has limited trash holding capacity and tends to bypass at relatively low flows (this is investigated further in the laboratory tests in the preceding section). The absorbent materials in both the Curb Inlet and the FloGard inserts were frequently observed to be missing, damaged, or hanging on the outside of the insert. Also, the "sausage" style absorbents in these two devices are such that not all of the flow through the insert will necessarily contact the media, which inevitably affects the absorbent effectiveness of these insert filters.

4.2 LABORATORY TESTS

As mentioned above, the laboratory tests consisted of two categories of tests: new filter tests and used filter tests. The used filter tests occurred after new inserts were conditioned in the field for approximately 4 months after installation in November 2004. The following paragraphs provide details of the testing procedures followed by the results of each test.

4.2.1 TESTING OF NEW FILTERS

Three tests were performed on new filters of each insert type: 1) spill tests, 2) particle capture tests and 3) oil and grease removal tests. All of these tests were conducted using the insert testing apparatus operating at a design flow rate of 20-25 gallons per minute.

4.2.1.1 Spill Tests

This test is designed to assess the ability of a catch basin insert device to capture a gross oil spill. This might occur if a person were to dump oil directly into the catch basin. Evidence of this activity has been observed over the years at many inlet/catch basins and educational activities such as stenciling storm drains have been practiced to teach the public that this is an unacceptable behavior.

In order to simulate a gross dump, 1 liter (~ 1 quart) of used motor oil was poured into each catch basin insert tested. The used motor oil was obtained from two sources and the entire volume was mixed to create a common source of used motor oil for all the tests used in the project.

The inserts were equipped with new media for these tests. Each insert was suspended on two saw horses above an oval shaped, galvanized tub. One liter of used motor oil was poured into the front of the insert and allowed to drip down the front of and then into the insert. The tests were performed at room temperature (18 to 21 ^{o}C) and the pouring was timed and completed over 2 minutes. Figure 4-21 illustrates the laboratory testing procedure for the spill tests.

For all tests on all of the insert types, the oil flowed through the insert and was seen exiting the bottom within 10 seconds of entering the top. The oil was allowed to drip from the insert into the tub. Dripping continued for approximately 10 minutes at which time no new drops formed. The tub was then emptied and the contents were measured. The recovered volume was compared to the original 1 liter and the amount of retained oil was recorded (Table 4-1).

The oil and insert were allowed to dry for two weeks in the laboratory at room temperature. This simulated drying in the field that might occur between an illegal dump and the following rainfall. The inserts were then placed in the catch basin insert flow testing apparatus and tested to determine how much oil would wash out of the inserts during a storm event. The flume was operated at approximately 25 gallon per minute (equivalent to about 0.1 inch/hour storm over a catchment that is about 50 percent impervious) and the entire flow was directed through the insert. Samples were collected for oil and grease analysis by collecting grab samples as the water exited the bottom of the insert.

Six grab samples were collected over 90 minutes. The first grab sample was collected as soon as water exited the bottom of the insert. Samples were analyzed for oil and grease using as solid phase extraction (SPE) procedure (see Appendix C).

Table 4-1. Volume of oil retained within each new insert.

Catch Basin Insert	Volume Retained (ml)
Kristar FloGard	120
Curb Inlet Basket	640
DrainPac	290
HydroKleen	980

Laboratory set up for testing oil spill capture efficiency

1-L of used motor oil

Pouring oil on HydroKleen

Pouring oil on Curb Inlet sorber

Figure 4-21: Laboratory set up for the evaluation of spill control by catch basin inserts.

The ability of each device to retain oil will depend upon the way the oil enters the front. Only the HydroKleen and DrainPac devices ensure that all the oil will be contacted by the oil absorber. However, the DrainPac has sorption surfaces on the bottom but there is too little

sorbent to retain a full liter of used motor oil. The FloGard will have variable results depending on the positions of the oil sorber "sausages" and if they touch the oil and grease flow. The Curb Inlet device has good contact with the oil if the sorber is tightly attached to the leading edge. If the sorber is loose, oil could flow underneath it. Many of the Curb Inlet and FloGard inserts were observed to have loose, damaged, or missing sorbers after the first storm in the field.

Figure 4-22 show the oil and grease concentrations versus time from the flume test. The inserts were not effective in retaining the oil. The bulk of the oil flowed out in the first minute of operating. The first grab sample captured higher oil and grease concentration, but was not effective in capturing a representative sample. The oil was seen to flow out as immiscible packets of oil that did not mix with the water. After the test was complete, the sorbers in the inserts were physically examined. Oil could still be observed on the sorbers as dark spots, shinny areas and areas that felt "slick," but the bulk of the previously retained oil had washed away. The HydroKleen device could not be successfully operated at 25 gallons per minute. Flow was reduced to less than 15 gallons per minute to avoid bypassing.

The catch basin inserts, as configured are not effective in trapping at 1 liter oil spill. They initially retained 30 to 85% but released the oil when water was passed through at rates from 15 to 25 gallons per minute.

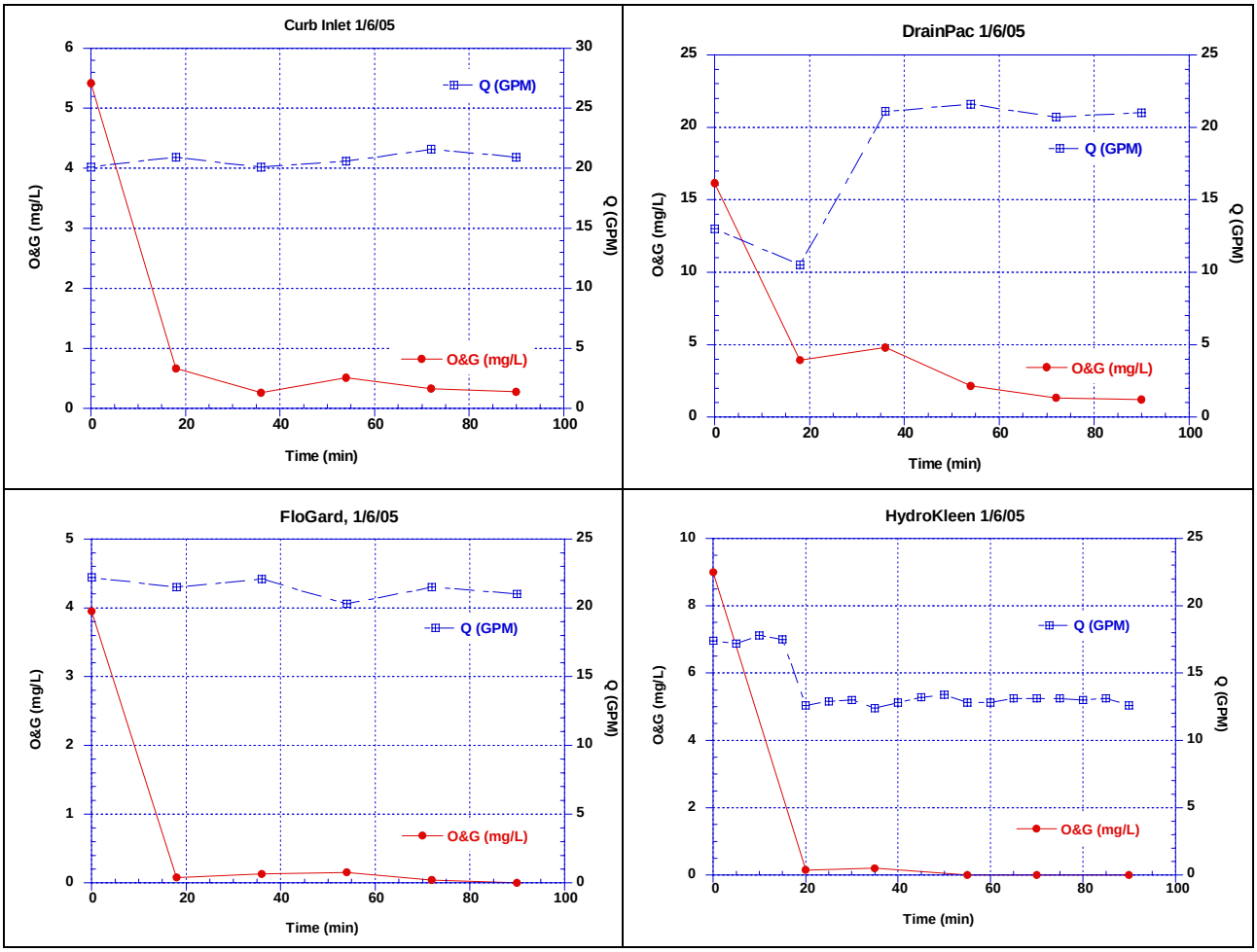


Figure 4-22 Oil & grease wash-out concentration versus time.

4.2.1.2 Particle Capture Tests

The purpose of the particle capture tests was to evaluate the sediment removal performance of the four insert types at removing various particle sizes. Four different particle sizes were used as shown in Table 4-2. To reduce the possibility particle size changing due to abrasion and to minimize oil sediment absorption, glass beads were used to simulate particulate solids. The glass beads were obtained from McMaster Carr in Los Angeles, CA in the four size fractions illustrated in Figure 4-23 and then sieved into the sizes shown in Table 4-2.

Table 4-2. Sieve sizes and corresponding grain sizes used in the particle capture tests.

Sieve Size	Grain Size
> #60	>250µm
> #100	>150µm
> #200	>75µm
Pan	<75µm

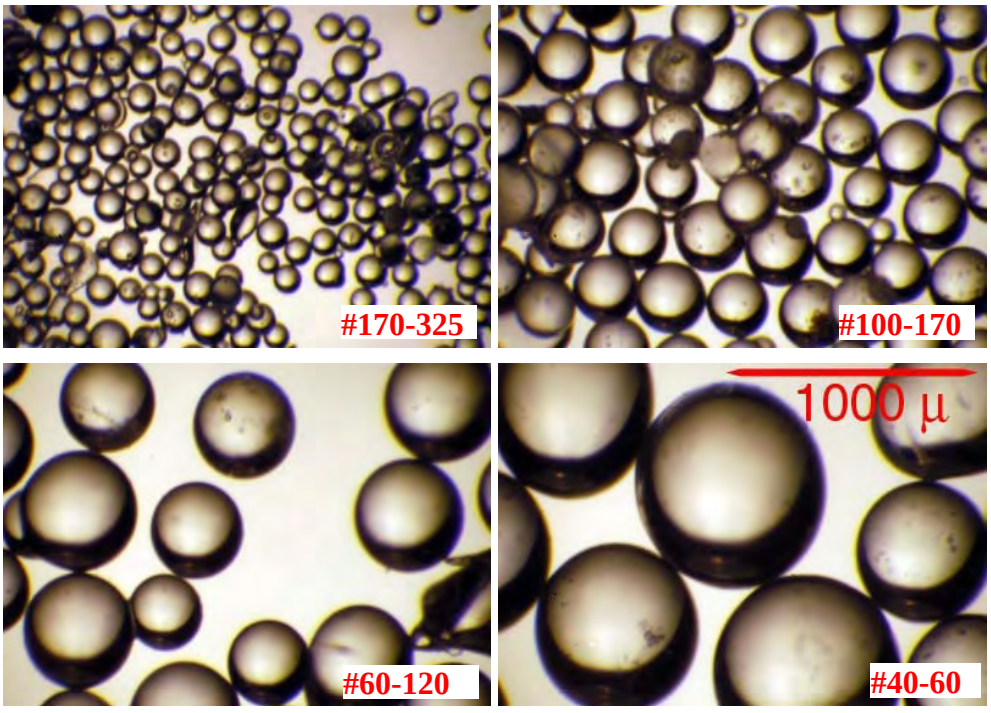


Figure 4-23. Glass blasting beads used for particulate solids removal tests.

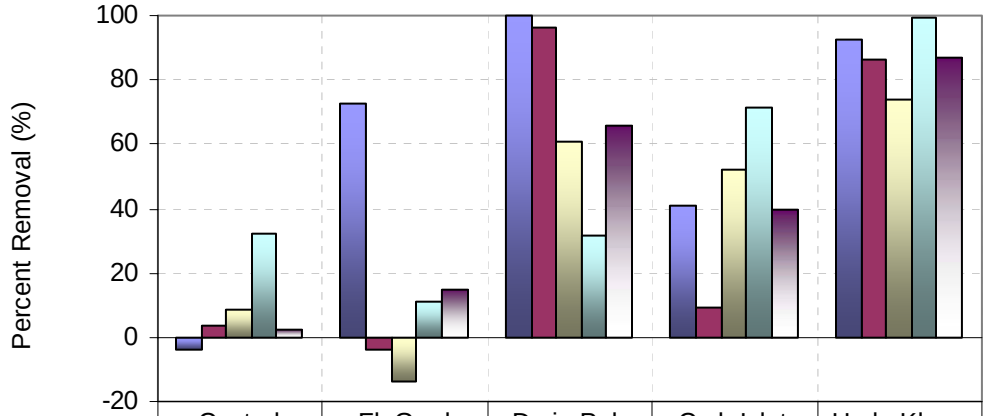
Using the catch basin insert testing apparatus at a design flow rate between 20 and 25 gallons per minute, each insert type was tested to determine its particle capture efficiency. A known mass of particles from each size range was delivered to the influent stream. After flowing through the insert, the effluent was passed through a silk screen to capture all unfiltered particles. Table 4-3 shows the influent and effluent mass in each particle size range for each insert tested. A control test was conducted to evaluate the loss of particles in the system with no insert installed. Notice

that significant losses were observed for the smallest particle sizes, and these occurred via splashing as the flow tumbles down the edge of the catch basin. They are shown as "removal" for the control. Losses occurred by the control was subtracted out of the device tests to account for splash losses. The precision of the tests is probably in the range of +/- 5 to 10%. The "negative" removals shown by the FloGard are within this precision.

Table 4-3. New filter effluent sediment loading by particle size.

Particle Size	Influent (grams)	Effluent (grams)				
		Control	FloGard	DrainPac	Curb Inlet	HydroKleen
>250 µm	266	276	72	0	151	19
150-250 µm	289	279	300	11	272	42
75 - 150 µm	309	283	352	130	160	88
<75 µm	269	182	240	244	102	2
Total	1134	1020	964	386	684	151

The percent removal for each insert type is shown in Figure 4-24. Notice that HydroKleen had the highest removals for most of the particle sizes. However, this insert could not be operated at the 25 gpm design flow rate without bypassing, so the test was conducted at 10 gpm. DrainPac had the next highest removals and was operated at the 25 gpm design flow rate. Curiously, the Curb Inlet Basket removed the smallest particle sizes better than the larger particles, but this is likely due primarily to losses in the testing apparatus since the control test showed about 32 % removal of particles less than 75 microns. FloGard appears to be moderately effective at removing particles greater than 250 microns, but ineffective at smaller sizes.



	Control	FloGard	Drain Pak	Curb Inlet	HydroKleen
>250µm	-3.7	72.7	100.0	41.2	92.5
150-250µm	3.4	-3.5	96.3	9.0	86.0
75-150µm	8.4	-13.7	61.1	52.4	73.7
<75µm	32.5	10.9	31.6	71.5	99.5
Total	2.4	15.0	66.0	39.7	86.7

Figure 4-24. New filter percent sediment mass removal by particle size.

It is important to understand the mechanism of particle removal. The DrainPac and FloGard devices acted as sieves and retained particles at the bottom of the device, and the entire volume of the device is available for particle retention. The Curb Inlet device retained the fine particles in the oil absorbent sausage. It has a screen in the bottom, but this screen is coarser than most of the particles used during the testing. The mass of particles that can be retained in the sausage is low, compared to the volume for particle retention in the DrainPac or FloGard devices. The particles in the sausage are not tightly retained and can be lost into the effluent if the sausage is flexed or moved about. In this regard, the solids removal test for the Curb Inlet device is not as realistic of a test as it is for the other inserts. The solids retained by the HydroKleen are removed by sedimentation in the first compartment. At high flow rate, the turbulence in this compartment was sufficient to resuspend the fine fraction so that it was discharged in the effluent.

A realistic appraisal of the test results suggests that particles removed by DrainPac and FloGard through sieving will be reliably retained. Particles retained by lodging in the sorbers or removed by sedimentation may be lost or resuspended during high flows and/or if the insert is physically moved or disturbed.

4.2.1.3 Oil & Grease Removal Efficiency

The effectiveness of each new insert at removing oil and grease from stormwater was evaluated by delivering a steady stream of used motor oil into the flume operating at 25 GPM and taking influent and effluent samples every 6 minutes for one hour. The influent samples were composited at the end of the experiment because these concentrations were not expected to vary substantially, but the effluent samples were analyzed independently to capture the variability in effluent quality. Table 4-4 shows the oil and grease influent and effluent concentrations for each insert type. Notice that HydroKleen shows the lowest oil and grease effluent concentrations, followed by DrainPac and Curb Inlet Basket, which were comparable. FloGard showed the highest effluent concentrations, but this device also received the highest influent concentration. To evaluate the performance in terms of percent removals, Figure 4-25 shows side-by-side box and whisker plots of the oil and grease reduction percentages. Notice that the 95% confidence intervals of the median percent removal for several of the inserts overlap indicating that the differences in performance are not statistically significant. FloGard does appear to have a lower performance than Curb Inlet and HydroKleen, but is not statistically different from DrainPac.

Table 4-4. New filter oil and grease effluent concentrations versus time.

	DrainPac	FloGard	Curb Inlet	HydroKleen
Influent (mg/L)	**26.3**	**33.5**	**30.1**	**19.5**
Time (min)	Effluent (mg/L)	Effluent (mg/L)	Effluent (mg/L)	Effluent (mg/L)
6	7.3	13.7	12.2	5.4
12	12.0	23.4	11.4	4.7
18	12.8	22.1	13.5	9.1
24	10.0	19.4	13.9	5.1
30	11.0	23.9	12.7	3.3
36	13.9	15.4	8.8	11.8
42	10.3	16.1	10.1	4.5
48	11.2	19.7	11.1	6.8
54	18.8	16.6	9.9	2.4

60	21.1	17.4	12.9	7.5
Median	**11.6**	**18.4**	**11.8**	**5.3**

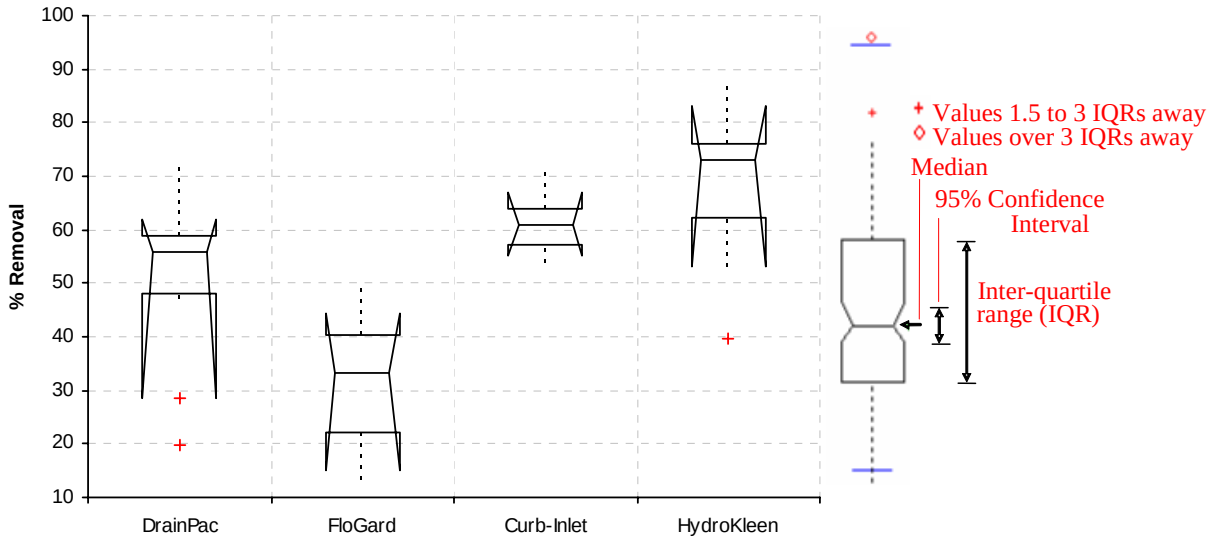


Figure 4-25. Box and whisker plots of oil and grease removal tests with new inserts.

The stock oil solution was analyzed for metals concentration to estimate the potential removals of metals if oil and grease were removed. Table 4-5 provides the metals concentrations in the oil stock solution and the calculated effluent metals concentrations based on the median oil and grease concentrations for each insert. Notice that the effluent metals concentrations are all extremely low; below most analytical method detection limits, with the possible exception of zinc.

Table 4-5. Metals concentrations in oil and the calculated metals removals for each insert type.

Metals	Conc. in Used Motor Oil	Calculated Metals Effluent Concentrations			
		DrainPac	FloGard	Curb Inlet	HydroKleen
	ug/g	ug/L	ug/L	ug/L	ug/L
Cr	0.53	0.006	0.010	0.006	0.003
Ni	1.72	0.020	0.032	0.020	0.009
Cu	21.16	0.245	0.390	0.250	0.112
Zn	501.83	5.821	9.249	5.922	2.645
As	0.03	0.000	0.001	0.000	0.000
Cd	0.04	0.001	0.001	0.001	0.000
Pb	3.36	0.039	0.062	0.040	0.018

4.2.2 TESTING AND ANALYSIS OF USED FILTERS

The used inserts were retrieved from the field and taken to the laboratory for final testing and analysis. The bulk solids captured by the CPC and FL inserts during the cumulative pollutant capture part of the study period was characterized by size and weight. Four tests were performed

on the FL inserts after the field-to-laboratory portion of study, including flow rate tests, solids removal tests, oil and grease removal tests, and used oil spill tests. The following subsections describe the results of these tests and analyses.

4.2.2.1 Captured Bulk Solids Analysis

After the cumulative pollutant capture period of the study, material recovered from the inserts was characterized. The materials captured by all four types of inserts (Catch Basin Inlet, DrainPac, FloGard, and HydroKleen) at various sites were returned to the UCLA campus for analysis. Consisting of primarily coarse sediment, leaves, debris, and litter, the material captured by each insert was weighed wet and then a representative volume of the material was sampled, air dried, sieved into two size fractions using a 1-inch screen, and then weighed. Figure 4-26 includes photographs illustrating this solids analysis procedure.

Figure 4-26. Photos of bulk solids screening process.

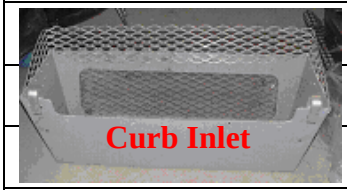
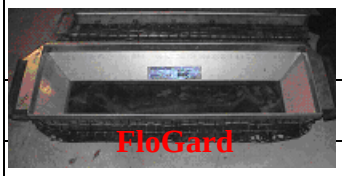
Table 4-6 summarizes the screening results for the CPC inserts and Table 4-7 summarizes the screening results for the FL inserts. Notice that the majority of the material mass was generally smaller than 1-inch. This result supports visual observations that much of the captured material appeared to consist of coarse sediment, degraded trash, and composted debris. Hence, the duration that material is left in an insert appears to have an affect on the particle size distribution of the captured bulk solids. Lead tire weights, cell phones, batteries and other potentially hazardous materials were also found in the retained material. Given the state of decay of the material, all the interesting spiders, worms and insects, and the fact that potentially hazardous material were accumulating in the inserts, it is concluded that if the inserts are allowed to stay in

the field too long, they could likely become a nuisance and a potential public health hazard.

Table 4-6. Accumulated bulk solids screening analysis for CPC inserts.

Catch Basin No.	Total Sample Weight (kg)	Representative Sample Weight (kg)	Representative Sample Volume (L)	Date & Order	After Drying (kg)		Date & Order	% Solids
					1" Sieving	Passed		
CC-008-C	6.2	6.1	8.0	11/15_1	0.9	1.3	11/17_2	35.2
CC-007-C	8.0	7.8	12.0	11/15_2	0.8	3.9	11/17_1	60.3
CC-014-C	28.2	11.3	16.0	11/12_6	0.8	5.3	11/15_2	54.0
CC-014-C2	22.2	8.5	16.0	11/10_4	1.7	4.6	11/12_2	72.9
CC-004-C	17.0	11.8	16.0	11/10_8	1.1	7.8	11/12_4	75.0
CC-002-C	14.3	10.3	16.0	11/10_1	0.9	4.5	11/12_7	51.9
CC-009-D	19.8	13.4	16.0	11/12_5	1.1	7.5	11/15_1	64.2
CC-010-D	37.3	9.7	16.0	11/10_7	4.1	4.0	11/12_1	83.5
CC-009-F	28.4	13.3	16.0	11/12_2	0.3	6.8	11/15_6	53.4
CC-007-F	22.8	4.7	16.0	11/12_4	1.2	1.3	11/15_4	53.2
CC-013-F	29.9	6.2	16.0	11/10_6	1.6	2.9	11/12_3	71.8
CC-003-F	49.5	12.0	16.0	11/10_3	1.8	5.4	11/12_5	59.6
CC-011-F	86.0	30.5	32.0	11/10_2	2.3	23.6	11/12_6	84.6
CC-004-F	55.0	9.9	16.0	11/12_1	0.5	5.3	11/15_7	58.9
CC-003-H	14.8	11.9	16.0	11/8_1	2.3	5.1	11/10_1	62.2
CC-001-H	12.3	9.1	13.0	11/12_3	1.7	3.1	11/15_5	53.0
CC-003-H2	15.4	13.7	16.0	11/10_5	1.2	4.3	11/15_3	40.1

Table 4-7. Accumulated bulk solids screening analysis for FL inserts.

Insert Type	Catch Basin No.	Total Sample Weight (kg)	Total Sample Volume (L)	Date & Order	Sieving (kg)	
					#1 Sieving	Passed
	FL-004-C	0.35	4.0	11/19_1	0.15	0.20
	FL-003-C	0.60	6.0	11/19_2	0.15	0.45
	FL-001-C	2.70	4.0	11/19_3	0.25	2.45
	FL-008-D	0.90	4.0	11/19_5	0.15	0.75
	FL-003-D	1.20	5.0	11/19_6	0.25	0.95
	FL-001-D	1.30	1.5	11/19_7	0.15	1.15
	FL-003-F	3.35	8.0	11/19_8	0.20	3.15
	FL-001-F	5.25	8.0	11/19_9	1.05	4.20
	FL-004-F	0.25	1.0	11/19_10	0.05	0.20
	FL-006-H	1.10	3.0	11/19_4	0.10	1.00
	FL-008-H	0.25	0.5	11/19_11	0.05	0.20
	FL-002-H	0.25	0.2	11/19_12	0.00	0.25

4.2.2.2 Flow Rate Tests

A problem reported with catch basin inserts in the past has been clogging and bypassing. This is to be expected since the fine screens or meshes in some of the devices can be overwhelmed, or "blinded" by debris, as well clogged by sediment. The volume of the insert can also fill with litter and trash so that there is little room for stormwater to accumulate to create sufficient pressure to flow through the screen. During this study, the captured material caused both blinding due to large items, such as plastic bags and newspaper, and clogging due to sediment. The sediment coats the screens at the bottom of the insert and appears as a moist mud layer when the insert is wet. After the insert dries out, the mud layer forms a largely impermeable barrier. Barriers such as this were noted in many of the used inserts. In the case of the HydroKleen, barriers were formed in the top of the second compartment, which prevented stormwater from passing through the sorbent pillows.

In order to evaluate clogging of the used inserts, a flow test was performed. The insert was subjected to low flow at first and the water level in the insert was allowed to stabilize. The depth of water in the insert was then measured. Next the flow was increased and the depth was remeasured. This process was continued until the maximum capacity of the flume was reached (60 GPM), or the insert bypassed. Figure 4-27 shows the results of several tests where the

maximum flow rate achieved without bypass shown at the endpoint. (Note as mentioned above three inserts were replaced by the City of L.A. and were not available to test). All but two inserts bypassed at less than 60 GPM flow (equivalent of about 0.2 inches per hour over a catchment with 70% imperviousness). Both of the FloGards (FL001-F, FL003-F) passed more than 50 GPM before bypassing. One DrainPac (FL001-D) did not bypass at 60 GPM and the other (FL008-D) bypassed at 50 GPM. Three Curb Inlet Basket devices were tested. One bypassed at 20 GPM, another (FL003-C) at 50 GPM (FL001-C), and the final device (FL004-C) did not bypass. The oil sorbent sausage was missing from this particular insert; it was somehow lost during operation in the field or perhaps cleaned out by City maintenance personnel not familiar with project. The HydroKleen devices bypassed at 12 GPM (FL008-H) and 40 GPM (FL001-H).

It was noticed during the suspended solids testing (next subsection) that the hydraulic capacity was further reduced by the accumulation of glass beads.

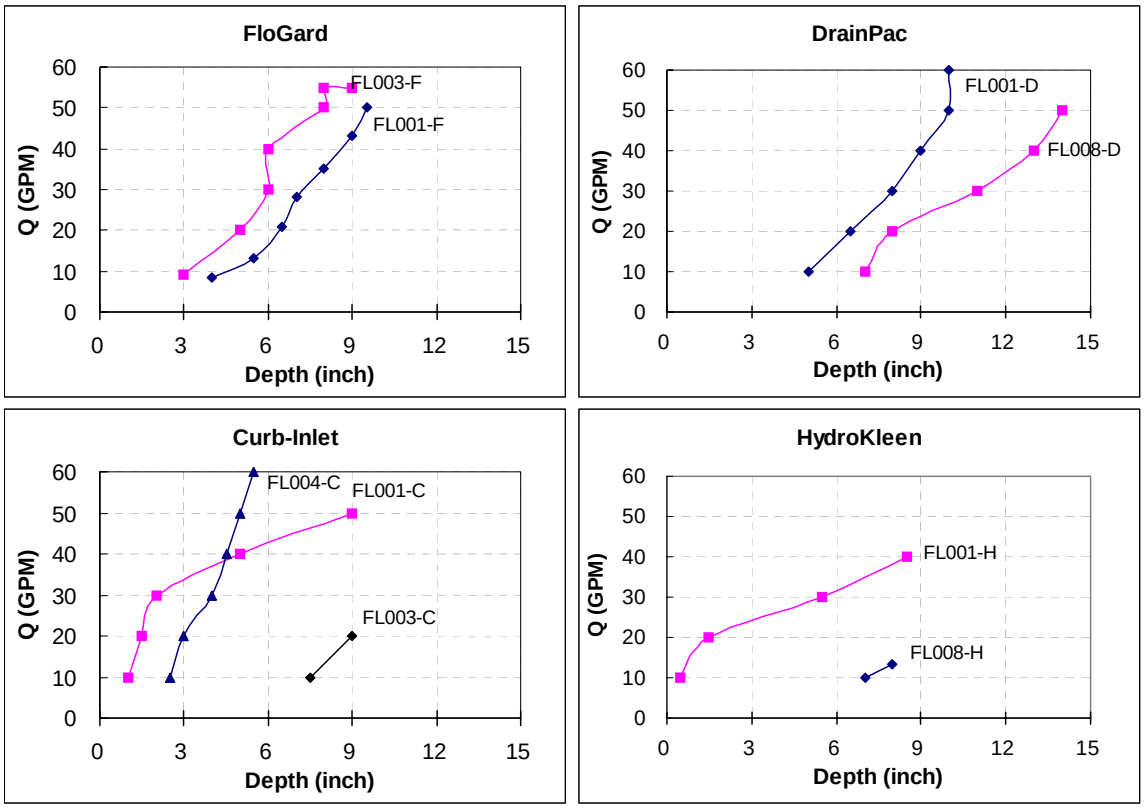


Figure 4-27. Used catch basin insert flow rate tests.

During the flow rate tests sediment particles that washed out of the used inserts were captured and sieved to evaluate the mass of retained particles released during a runoff event. Table 4-8 shows the mass of particles within each size range that were washed out from each insert. Notice that DrainPac and Curb Inlet tended to release the largest amount of particles. However, since the mass particles retained prior to the washout test was not known these results are only useful for a qualitative assessment of the ability of the insert to retain particles.

Table 4-8. Washout of particles from used inserts during the flow rate tests.

Particle Size (microns)	FloGard		DrainPac		Curb Inlet			HydroKleen	
	FL001-F	FL003-F	FL001-D	FL008-D	FL003-C	FL001-C	FL004-C	FL008-H	FL001-H
> 400	9.51 g	3.92 g	5.31 g	44.80 g	10.07 g	5.70 g	8.70 g	8.00 g	0.00 g
250-400	2.10 g	1.83 g	2.43 g	18.70 g	7.98 g	3.59 g	11.03 g	5.67 g	3.50 g
150-25-	2.07 g	1.92 g	1.80 g	18.70 g	6.66 g	2.43 g	12.80 g	4.40 g	0.00 g
75-150	2.58 g	2.55 g	2.76 g	10.32 g	6.40 g	2.62 g	18.20 g	3.42 g	0.00 g
< 75	2.05 g	1.33 g	0.16 g	3.50 g	0.00 g	1.06 g	0.00 g	0.00 g	0.00 g
Total	**18.31 g**	**11.55 g**	**12.46 g**	**96.02 g**	**31.11 g**	**15.40 g**	**50.73 g**	**21.49 g**	**3.50 g**

4.2.2.3 Solids Removal Tests

Suspended solids testing were performed on used inserts in the same manner as the new inserts. Figure 4-28 shows the removal efficiencies of the inserts recovered from the field. The removal rates were better than observed with new inserts likely due to the retained material retained in the filters from the field. This retained material acts as a pre-coat or dynamic membrane and improves removal efficiency at the expense of reduced flow capacity and increased bypass, as noted in the previous section. This improved performance/decreased capacity relationship is shown in Figure 4-28 for the Curb Inlet insert FL003-C and HydroKleen insert FL008-H, where the flow rate was reduced to 5 GPM to avoid bypass. Comparing only the inserts that were successfully tested at 25 GPM, FloGard and DrainPac appear to have the highest removals for the full range of particle sizes. However as mentioned previously for the new filter particulate capture tests, small particles are easily lost in the testing apparatus, so the results for these smaller particles likely over-predict the actual removals.

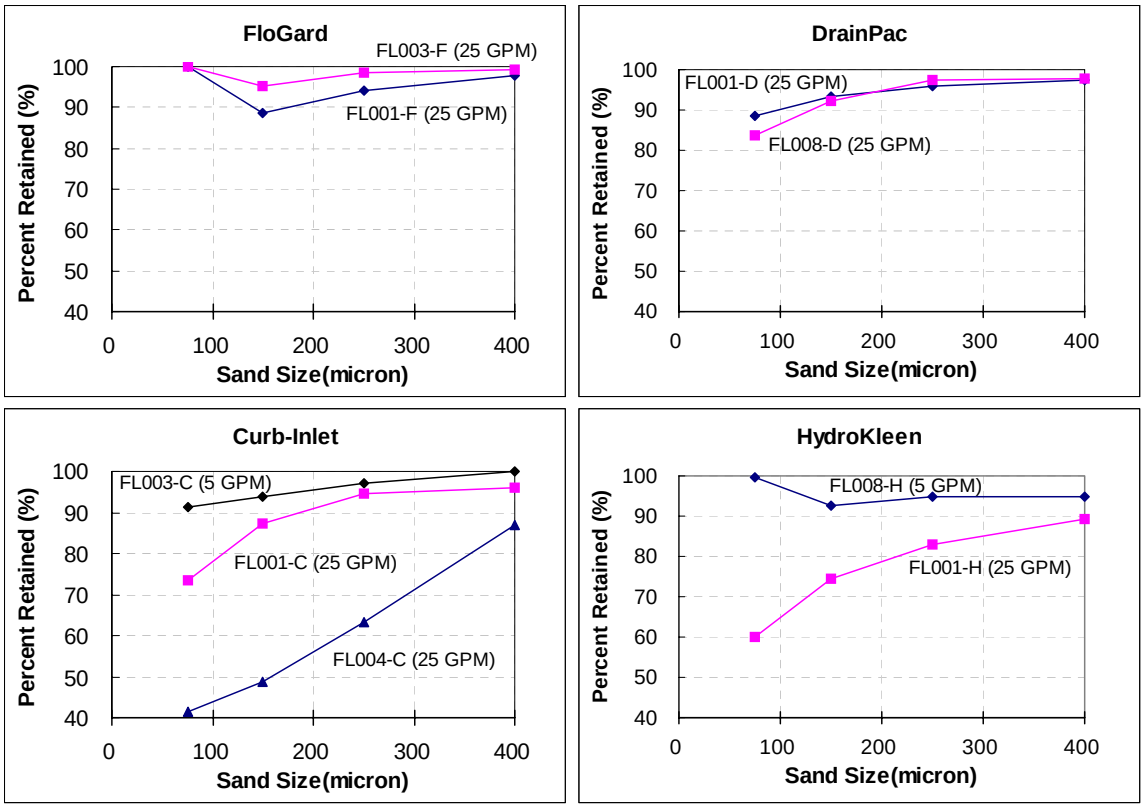


Figure 4-28. Used insert particulate solids removal test.

4.2.2.4 Oil & Grease Removal Tests

The tests were performed in the same way as the tests on the new inserts, except that the maximum flow rate without bypassing was used. Flume testing for oil and grease removal is limited to about 10 GPM minimum due to the oil addition pumps. Below 10 GPM, it is not possible to added motor oil at a low enough flow rate to produce 10 to 25 mg/L concentration range that was desired for the test. Testing at higher oil and grease concentrations would not be representative of the performance at lower concentrations. Consequently, only 6 of the 9 inserts recovered from the FL sites had acceptable flow rates for this test based upon the above testing (see Section 4.2.2.2). (Recall that 3 of the original 12 FL inserts had been removed by the City and were unavailable for the FL tests). Only one of the HydroKleen (FL008-H) units was tested at 10 GPM. The other units (one DrainPac, one Curb Inlet, and one HydroKleen) were not tested because the flow rates were too low.

Table 4-9 shows the oil and grease effluent concentrations for each 6 minute sample collected during the 1-hour test. All inserts were tested at 25 GPM except for HydroKleen, as discussed above, was tested at 10 GPM. As with the test while new, this insert had the lowest overall effluent quality. For the inserts tested at 25 GPM, DrainPac showed the lowest median effluent quality followed by FloGard. Curb Inlet had the highest median effluent quality.

Table 4-9. Used filter oil and grease effluent concentrations versus time.

	DrainPac	FloGard	FloGard	Curb Inlet	Curb Inlet	HydroKleen*
	FL003-D	FL003-F	FL001-F	FL004-C	FL001-C	FL008-H
Influent (mg/L)	**16.33**	**20.72**	**27.65**	**23.91**	**26.43**	**22.25**
Time (min)	Effluent (mg/L)	Effluent (mg/L)	Effluent (mg/L)	Effluent (mg/L)	Effluent (mg/L)	Effluent (mg/L)
6	3.74	5.94	8.7	15.54	23.72	1.02
12	3.12	7.4	9.52	17.36	18.84	1.46
18	4.52	7.72	14.08	14.12	14.84	3.04
24	9.4	7.02	15.86	14.7	25.66	3.68
30	6.66	6.88	10.2	21.66	24.9	6.2
36	8.52	7	6.46	18.36	16.34	5.28
42	7.68	6.6	13.44	15.04	13.94	6.74
48	5.48	8.6	12.78	16.1	19.82	9.38
54	7.02	8.96	9.78	16.92	13.34	7.06
60	4.32	9.92	7.5	12.04	14.3	5.98
Median	**6.1**	**7.2**	**10.0**	**15.8**	**17.6**	**5.6**

* Tested at 10 GPM.

To investigate whether the oil and grease removals are statistically different from one another, Figure 4-29 is a side-by-side box plot of the percent removals of the used inserts. Note that all inserts except for Curb Inlet have overlapping 95% confidence intervals about their median percent removals. The HydroKleen insert slightly outperforms FloGard insert FL003-F, but is not statistically different from FL001-F.

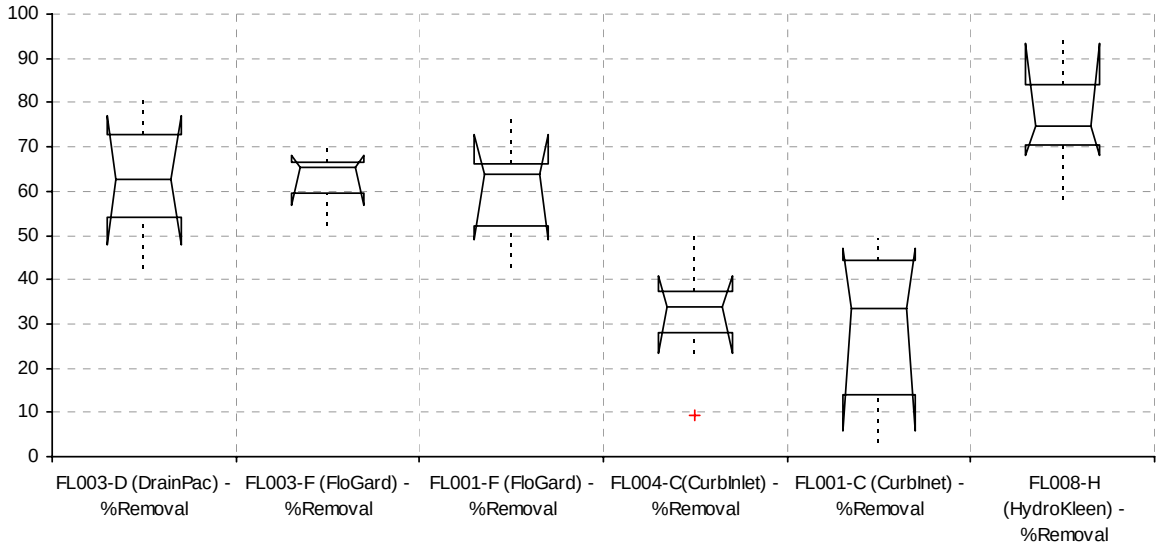


Figure 4-29. Box and whisker plots of oil and grease removal tests with used inserts.

Table 4-10 compares the median oil and grease effluent quality and percent removals for the new and used inserts. Note that the effluent quality is reduced for DrainPac and FloGard, but is slightly increased for Curb Inlet and HydroKleen. However, this difference is not significant due to the variability in the data. In general the removal efficiencies of the used inserts was greater than the new inserts because it is likely that the retained material from the field acts as a sorbent just as the captured material acted as a filter for the particulate solids removal test. However, the percent removals for Curb Inlet decreased. This reduction in performance for the Curb Inlet is likely due to loosely held absorbents after it has been used and is consistent with field observations that indicated the absorbent was easily disturbed causing limited contact with the inflow.

Table 4-10. Comparison of new and used insert oil & grease removal efficiency.

	Median Effluent Quality (mg/L)		Median Percent Removals (%)	
	New	Used	New	Used
DrainPac	11.6	6.1	56.0	62.8
FloGard	18.4	7.2 - 10	33.3	63.9 - 65.2
Curb Inlet	11.8	15.8 - 17.6	60.8	33.8 - 33.5
HydroKleen	5.3	5.6	72.9	74.7

4.2.2.5 Spill Tests on Used Inserts

After the completion of flow, suspended solids removal and oil and grease removal testing, a second series of spill tests was performed to assess how the oil retention capacity of the inserts are affected after they have been field conditioned. One liter of used motor oil was pored through each insert in the same way as performed on the new inserts (see Section 4.2.1.1). The only difference was the condition/age of the insert. In this case the inserts were used and contained removed solids from field testing as well as the glass beads from laboratory testing. The large litter had been removed prior to hydraulic testing. The volume of oil retained for a representative used insert of each type is shown in Table 4-11. For all inserts except the HydroKleen, more oil was retained by the used insert than the clean inserts. This likely is the results of the accumulation of solids and small liter retained in the insert act as sorbents. FloGard, which had the lowest retention capacity of all the inserts while new, showed the largest increase its oil retention capacity after it had been used. DrainPac had the highest retained percentage while used and HydroKleen had the highest retained percentage while new.

Table 4-11. Volume of oil retained within each used insert and the % increase compared to the new insert oil retention.

Catch Basin Insert	Volume Retained (ml)	% Increase from New
FloGard (FL003-F)	630	425%
Curb-Inlet (FL004-C)	460	59%
DrainPac (FL001-D)	730	152%
HydroKleen (FL008-H)	600	-39%

5 RESEARCH SYNOPSIS AND RECOMMENDATIONS

This research was performed to provide an independent performance assessment of storm drain inlet filter devices at removing oil and grease and bulk pollutants from stormwater in the City of Los Angeles. A review of literature found that several researchers have studied the pollutant removal effectiveness of catch basin inserts, but the large variety of devices, the different methods for evaluating performance, and the fact that the technology is continually evolving indicates that there are still data and knowledge gaps in this area of stormwater BMP research.

Four different catch basin insert technologies were selected for testing in this study: DrainPac, Curb Inlet Basket, FloGard, and HydroKleen. The selection was based on the number and quality of existing studies testing these devices, the budgetary and technical feasibility of testing them during the course of this study, and the perceived or advertised ability of these devices to remove and retain oil and grease from stormwater and illicit dumping activities. The performance of the selected inserts was subsequently evaluated in twenty-four CPC (cumulative pollutant capture) sites and twelve FL (field-to-laboratory) sites during the study period of 2003-2005. This was accomplished in two phases. In Phase I, the CPC sites were evaluated for long-term performance of the inserts through periodic field inspections and qualitative and quantitative assessment of accumulated pollutants during the wet and dry seasons. In Phase II, the FL site inserts were evaluated by conducting a series of laboratory tests before and after exposing them to field conditions. Significant conclusions derived from this study are provided below.

5.1 SUMMARY OF RESEARCH CONCLUSIONS

Conclusions Related to Literature Review:

- The limited available data on oil and grease removal indicates that catch basin inserts would provide some removal of oil and grease from stormwater.
- In general, some devices have been tested more thoroughly than others. However due to the variety of configurations and media types among the large number of competing products, it is difficult to comparatively assess their performance.
- Due to the inconsistencies in reporting performance monitoring data and the fact that percent removals (a misleading measure of BMP efficiency) are most often reported, it is not possible to determine the average achievable effluent oil and grease concentrations from catch basin inserts from the existing data.
- It "appears" that oil and grease can only be reduced to about 5-10 mg/L by catch basin inserts. However the available data are too limited to statistically support this assertion. Also, the ability of inserts to retain oil, once it has absorbed to the media has not been thoroughly investigated.

Conclusions Related to Field Inspections:

- In general, catch basin inserts are excellent litter removal devices, although they have limited capacity as compared to the inflow of litter observed.
- In higher litter producing areas in the City of Los Angeles, almost all of the inserts clogged or reached their trash loading capacity very early in the rainy season.
- All manner of litter was collected including paper, plastics, and coarse sediments as well as oil and grease.
- Litter collection interferes with the insert's other desired functions. Excessive accumulation of trash and debris and evidence of clogging at almost all sites would significantly affect oil & grease capture efficiency.
- DrainPac and FloGard have larger capacities and finer screens and therefore retained bulk solids most effectively. Efficient capture of bulk solids consequently helped continued oil capture up until the accumulated debris caused bypass.
- For FloGard, the presence of lip at the curb caused the insert to be bypassed at least on one site.
- Curb-Inlet Basket does not appear to remove sediment except for on the inlet shelf and the insert does not contain a filter fabric. The absorbent boom has low structural integrity because the media was observed to have been washed from the boom.
- HydroKleen, appeared to have the highest potential for removing oil and grease based on the laboratory testing (see below). However, by-passes at low flows and limited capacity for bulk solids (e.g., bulk solids and fine solids caused by-pass to occur quickly) are some of the observed problems for this insert and would limit its actual ability to be effective overall at oil and grease removal. Also, the settling chamber permanently retains water that can breed mosquitoes.

Conclusions Related to Laboratory Tests:

- Retention in the inserts of a gross spill of 1 liter of used motor oil ranged from 10 to 90%. However, most of the captured oil was lost during subsequent flow testing, and in the field, would surely have been lost during the next rain event.
- Apparently, accumulated litter and sediments may help capture of a gross spill of used motor oil up to the point where bypassing occurs.
- Most of the inserts were effectively able to remove particles larger than 250 µm. The DrainPac and FloGard inserts remove solids by sieving. The HydroKleen removes solids by sedimentation in the first compartment and then filtration in the second compartment. Curb Inlet removes small particulates in the absorbent boom and larger particles in mesh screen.
- Smaller particles were sometimes removed by entrapment in sorber "sausages" (Curb Inlet and FloGard) but it is unlikely that this mechanism would be quickly overwhelmed in the field due to the limited capacity for retaining sediments.
- Retention of particles also occurred via settling in the first chamber of the HydroKleen

unit and on the shelf of the Curb Inlet Basket. However, sediments captured by settling appear to be easily lost during high flows.

- Laboratory tests showed that significant "blinding" (e.g., clogging of flow paths) occurred with solids accumulation and resulted in overflow/bypass.
- Trade-offs exist between O&G removal capabilities and capture of litter and solids:
  - Inserts with lots of sorbent for O&G removal have little room for solids and litter and therefore blind more quickly.
  - Inserts with room for litter and solids have less room for sorbents and therefore are less effective for oil and grease removal.
  - Inserts to remove oil and grease in the presence of high loads of litter and solids may not be a good choice.
  - Inserts protected from litter, with devices such as coarse screens installed at the curb, could then be optimized for oil and grease removal by maximizing the volume of sorbents available.

5.2 CHALLENGES, LESSONS LEARNED, AND SUGGESTIONS FOR FUTURE RESEARCH

Some elements of the monitoring plan were modified during the course of the study due to circumstances beyond the research team's control that caused delays in getting project tasks completed. For instance, the catch basin insert testing apparatus at UCLA had to be relocated because of the demolition of a laboratory building, so laboratory testing was delayed. Also, the fire disaster that occurred in southern California during the summer of 2003 left a significant amount of ash covering the area and it was decided that the first events of the season would not likely represent typical conditions. Therefore the project team decided to install and begin conditioning the catch basin inserts during the middle of the wet season rather than at the beginning.

Other significant challenges faced during this study included the initial selection, installation, and tracking of installed inserts. Only approximate drainage areas for the catch basins could be estimated, as it was impossible to determine the rooftop contributing areas. Also, the variety of catch basin configurations (e.g. depth, width, manhole size and shape, etc.) made it difficult to find sites with similar characteristics and in close proximity to one another. Some of these characteristics made installation difficult for some of the inserts, even when detailed field measurements were made. For instance, the plastic lip on the HydroKleen insert had to be trimmed to fit into a couple of the catch basins.

The relative timing of the installations also limited the ability to compare sites. Since the vendors of each insert type installed the inserts, some inserts were installed several weeks after others were installed so the amount of field conditioning differed somewhat between sites. In fact, a couple of the inserts at CPC sites lagged so much that it was decided to switch previously designated FL sites to CPC sites (which were subsequently switched back to FL sites for the field-to-laboratory phase of the study). Choosing new sites or switching sites from CPC to FL was confusing and cumbersome with the original naming convention that was used. It is recommended that if a large number of catch basin sites are to be studied in the future that site is

given a unique site number that is never reused as well as a study number that can be reused when a substitution is made.

Another lesson learned during this study is that it is important to ensure communication is established with the department responsible for maintenance of catch basins (Wastewater Collection Systems Division for the City of Los Angeles). It is clearly evident that the City's Watershed Protection Division, who was a participant in this project and was aware of the location of the study catch basin sites, did not notify the Wastewater Collection Systems Division of this study. While the loss of the four study inserts reduced the amount of data that was obtained from this study, it did not seem significantly change the overall conclusions of the study. However, if the City expects to further its goal of improving the quality of runoff from its storm drain system, it is absolutely vital that these two organizations establish more efficient communication channels.

The litter generation rates at the locations of the inserts used in this study were several times and perhaps ten times greater than observed in the previous studies conducted by the investigators.[5,28] While the field observations indicate that oil generation, particularly from illicit dumping of used oil, was also particularly high in the study area, the large amount of litter often blocked the entrance to the catch basin itself. If further work is preformed to use catch basin inserts to trap oil spills (which appears to be needed in the study area), a modified approach should be taken for areas generating such large amounts of litter. Coarse screens, either with square meshes (~1 inch) or expanded metals screens (although expanded metal is more difficult to clean) should be used to protect the catch basin inserts from excessive litter. Street sweeping can be used to pick up the rejected litter and it was demonstrated in the researchers' previous study that the screens are not damaged by street sweepers and vice versa. While the frequency of street sweeping may need to be increased to avoid complete blockage of the inlet, the frequency of catch basin cleaning may be significantly reduced. Also, if the inserts are protected from litter they can be optimized for oil removal and retention. Much greater masses of sorbents, such as is used in the HydroKleen insert, can be used in the insert to provide more oil sorption capacity while reducing the tendency for clogging.

Curb inlet trash screens have been installed by the City of Los Angeles at a few of the field-to-laboratory study locations. These are expected to keep out large objects that obstruct the inserts and prevent the inserts from functioning properly. A recommendation for further research is to compare the performance of the same insert types with and without curb inlet trash screens.

Catch basin insert vendors are beginning to market curb inlet trash screens. For instance, Kristar Enterprises, the manufacturer for FloGard, is currently marketing a curb inlet trash screen to provide pre-treatment to their catch basin insert devices. United Stormwater, the Los Angeles area representative for DrainPac, also markets curb inlet screens.

[28] Lau, S-L and M.K. Stenstrom, "Best Management Practices to Reduce Pollution from Stormwater in Highly Urbanized Areas," WEF Tech, Chicago, IL, September 30-October 3, 2002.

APPENDIX A- **SITE LOCATION MAPS**

CC-002-C
CC-004-F
CC-004-C
CC-001-H
CC-010-D
CC-003-F
CC-003-H
CC-012-H
CC-007-F
CC-007-C
CC-009-D
CC-009-F
CC-008-C
CC-004-H
CC-004-D
CC-013-F
CC-014-C
CC-014-D
CC-003-H2
CC-014-D2
CC-014-C2
CC-011-F
CC-011-D
CC-007-H

Legend

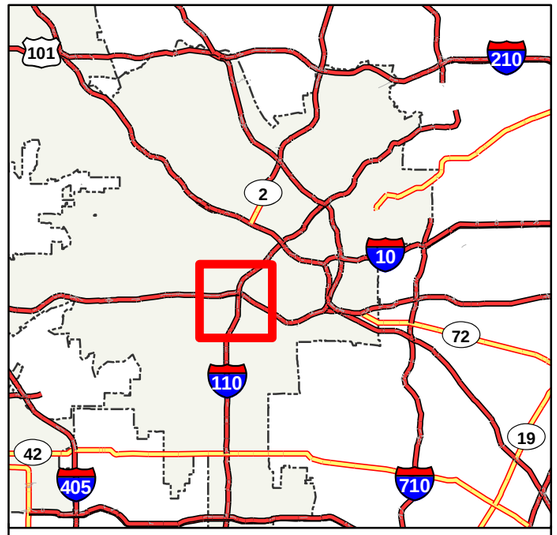
- Limited Access Highway
- Highway
- Ramps
- Local Roads
- Cumulative Pollutant Capture Sites
- City of Los Angeles Boundary

Figure A1

Cumulative Pollutant Capture Catch Basin Insert Sites

May 2005

GeoSyntec Consultants



Legend

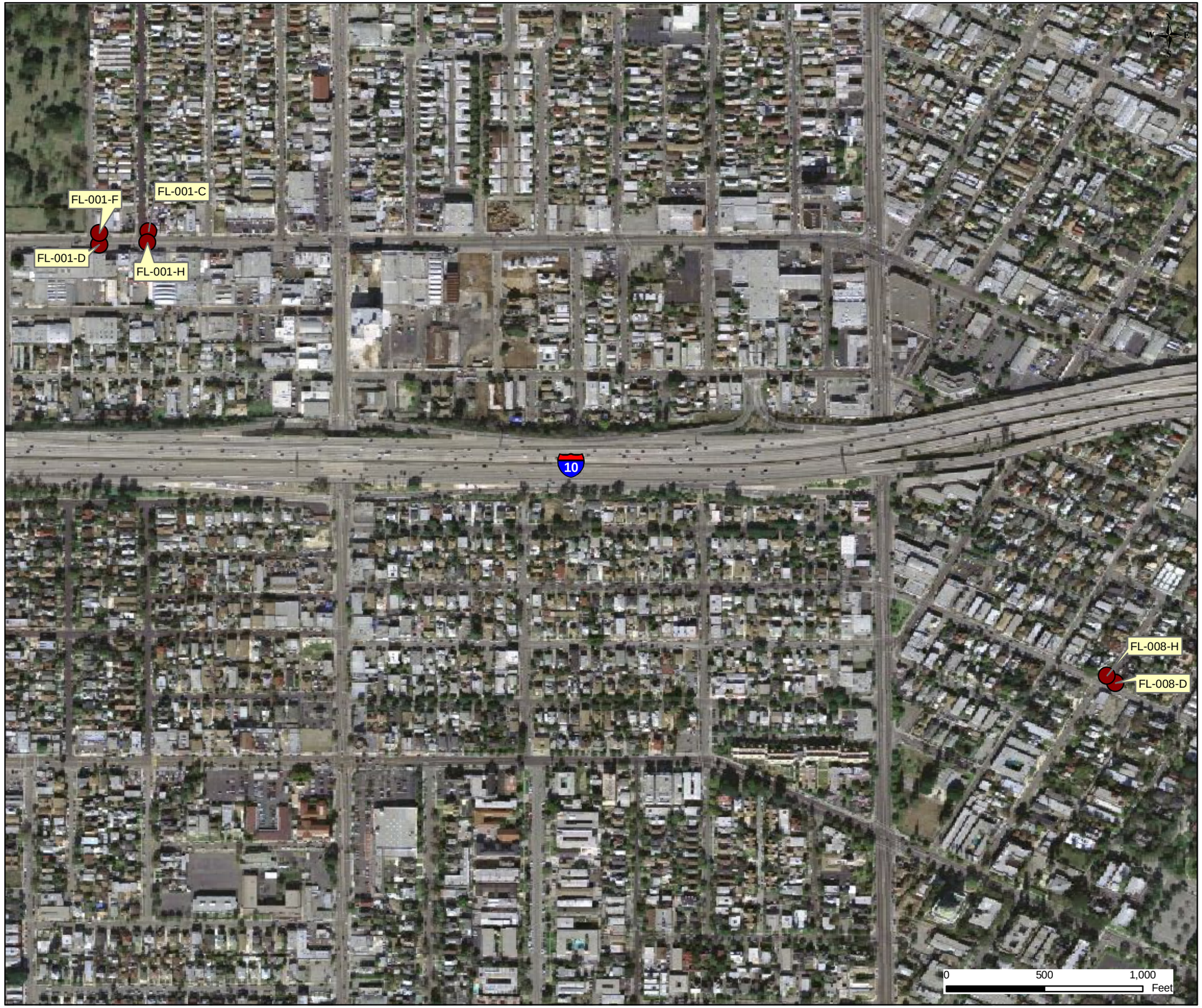
- Limited Access Higwhay
- Highway
- Ramps
- Local Roads
- Field-to-Laboratory Sites
- City of Los Angeles Boundary

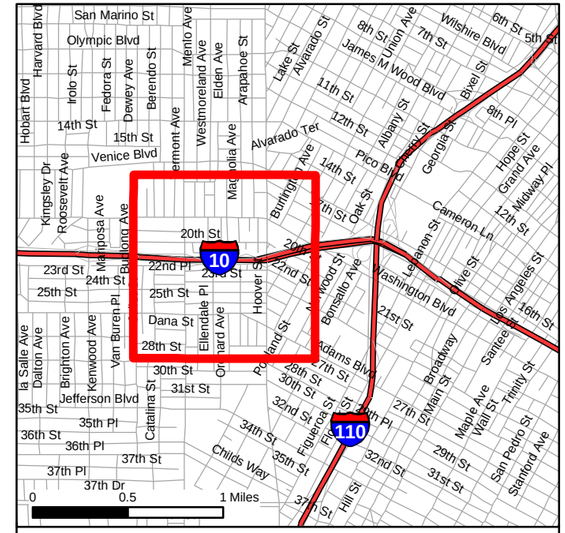
Figure A2

Field-to-Laboratory Catch Basin Insert Sites

May 2005

GeoSyntec Consultants





Legend

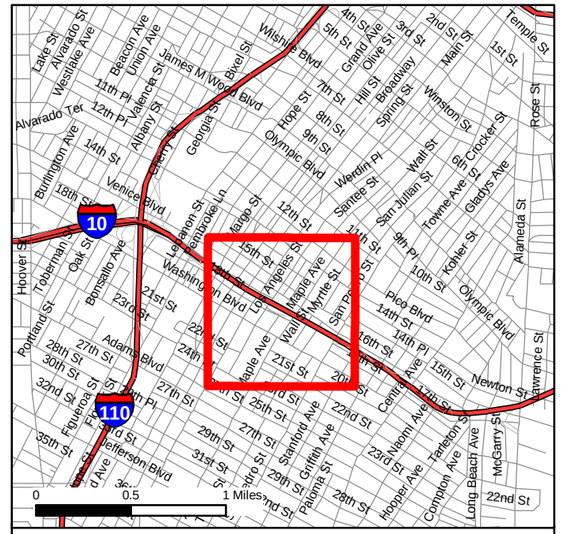
- Field-to-Laboratory Sites
- Local Roads
- Limited Access Higwhay
- Highway
- Ramps

Figure A3

Aerial Photo of West Field-to-Laboratory Catch Basin Insert Sites

May 2005

GeoSyntec Consultants



Legend

- Field-to-Laboratory Sites
- Local Roads
- Limited Access Higwhay
- Highway
- Ramps

Figure A4

Aerial View of East Field-to-Laboratory Catch Basin Insert Sites

May 2005

GeoSyntec Consultants

APPENDIX B - FIELD INSPECTION PHOTOS AND NOTES

Area 1 - Site A

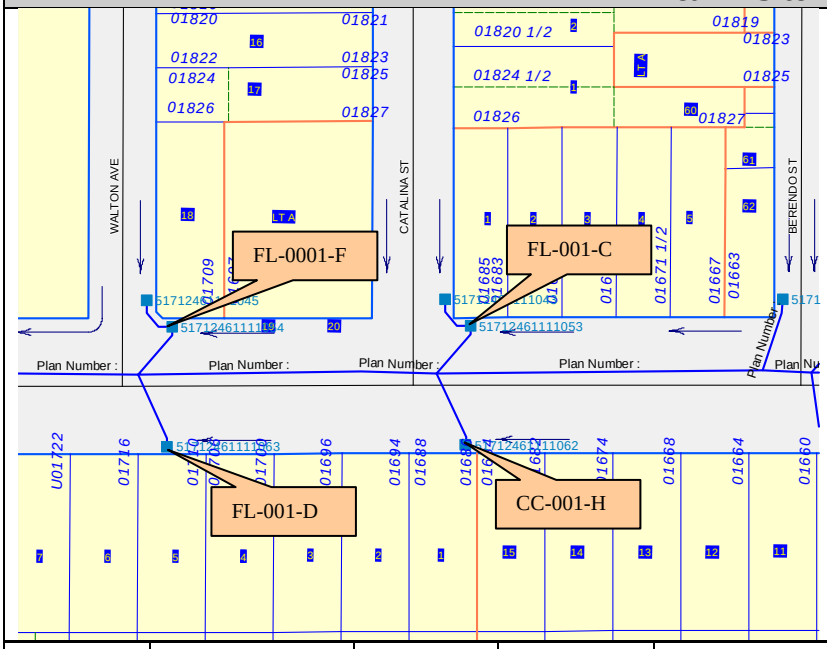


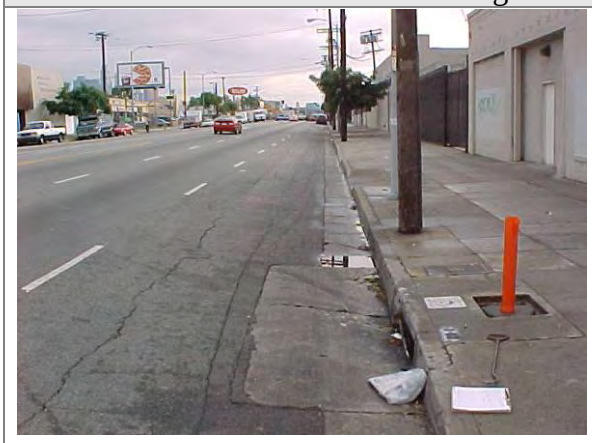
Photo looking east from FL-001-D

Intersection	Washington Blvd. & Walton Ave.
No. of Installations	4

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
FL-001-D	DrainPac	380519	3767123	3.5	3.2	3
FL-001-F	Flogard+Plus	380466	3767357	3.5	3.2	3
FL-001-C	Curb Inlet Basket	380532	3767363	3.5	3.2	3.5
CC-001-H	Hydro-Kleen	380530	3767336	3.5	3.2	3.1

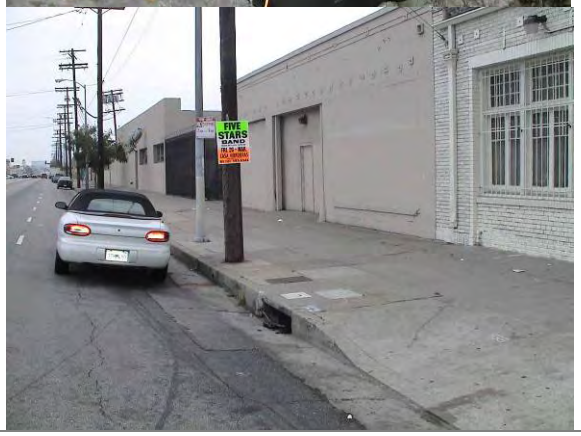
Site : CC-001-H **Location:** Washington and Walton (Area 1 - Site A)

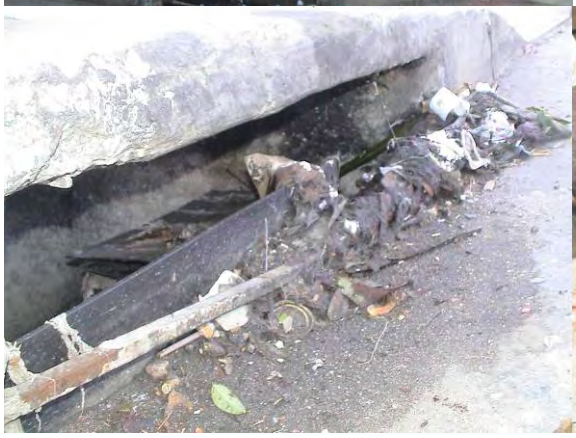
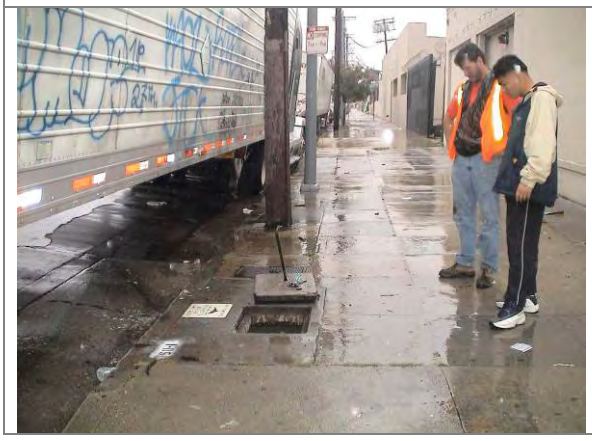
HydroKleen



Date inspected:
12/11/03

Comments:
Initial site visit. Notice the missing cover and damaged inlet.

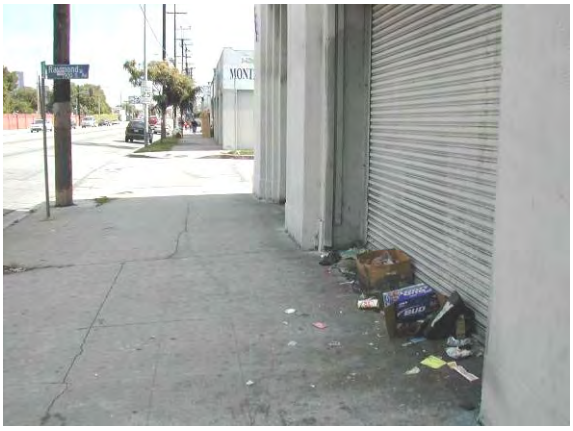
Site : CC-001-H **Location:** Washington and Walton (Area 1 - Site A)	HydroKleen
	**Date inspected:** 2/27/04 **Comments:** After a few storm events this device appears to be in good working order. Notice the missing concrete cover has been replaced.

Site : CC-001-H **Location:** Washington and Walton (Area 1 - Site A)	HydroKleen
	Date inspected: 3/23/04 **Comments:** This site had a significant amount of trash inside the catch basin prior to installation. Now the insert is capturing nearly all of the trash. This was previously a field-to-laboratory site that was switched due to installation timing conflicts.
	**Date inspected:** 10/22/04 **Comments:** Significant oily sediment and debris present at the curb; evidence of blockage.
	**Date inspected:** 03/22/05 **Comments:** It was raining during this visit to retrieve this insert. After this visit, this insert was taken to the laboratory for its final tests.

Site : CC-001-H **Location:** Washington and Walton (Area 1 - Site A)	HydroKleen

Site : FL-001-D **Location:** Washington and Walton (Area 1 - Site A)	
	Date inspected: 2/4/04 **Comments:** This is the first visit after installation and one storm event. Notice water flowing into catch basin appears to be coming from a roof drain. The bottom of this catch basin shows significant oil and grease on the ponded water surface The insert was removed from the catch basin and subsequently transported to the UCLA laboratory for testing during this site visit.

Site : FL-001-D **Location:** Washington and Walton (Area 1 - Site A)

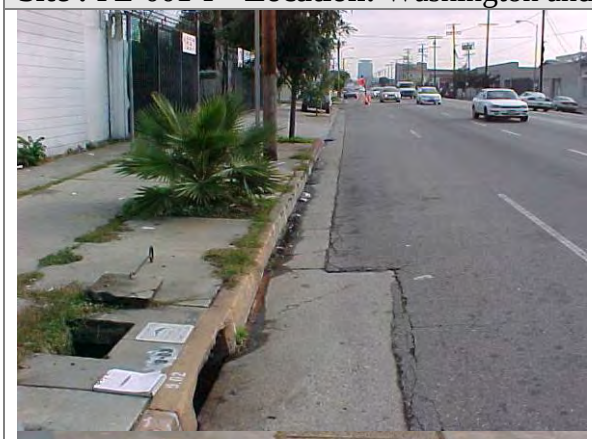
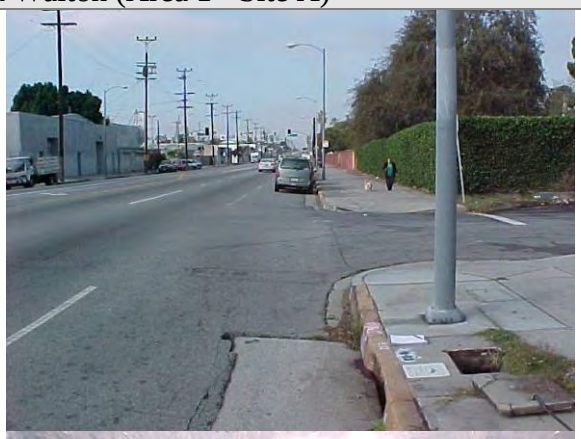


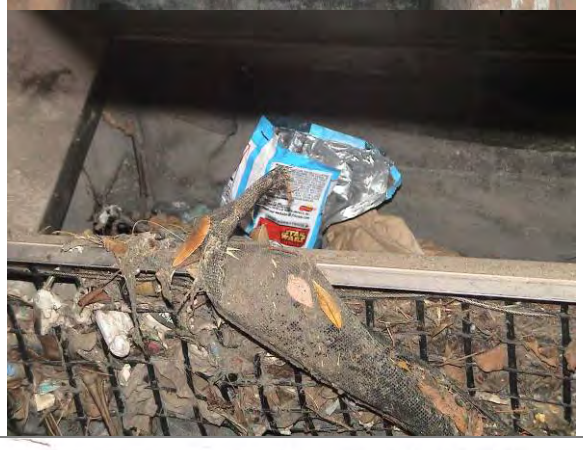
Date inspected: 2/27/04

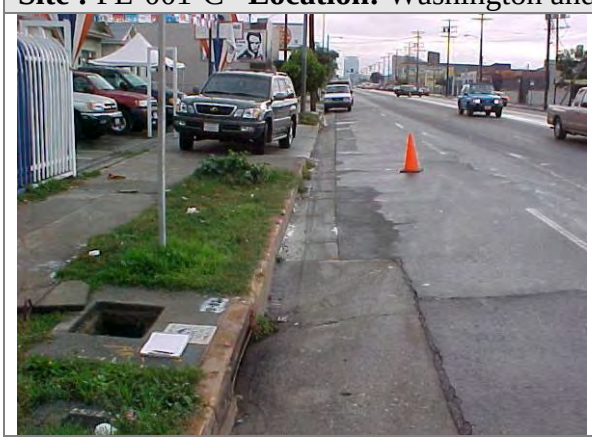
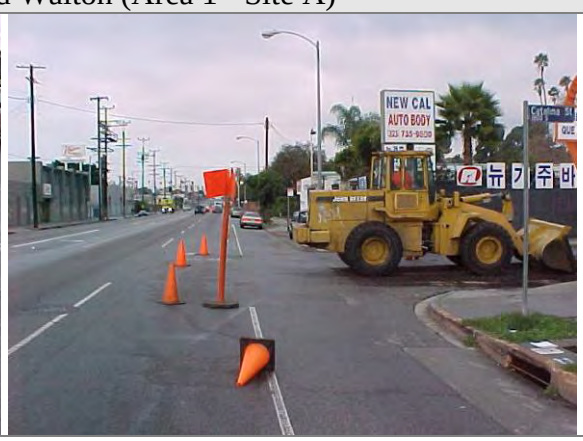
Comments: Note this is not one of the inspections sites. These photos were taken just downstream (west) of the FL-001-D catch basin site. Notice the excessive amount of trash, including used motor oil and oil-soaked debris. Also note this basin had been cleaned by LADPW maintenance personnel only 1-2 months prior to this photo as indicated by the painted month and year.

Date inspected: 03/22/05

Comments: After this visit, this insert was taken to the laboratory for its final tests.

Site : FL-001-F **Location:** Washington and Walton (Area 1 - Site A)	
 	**Date inspected:** 12/11/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is downstream. The catch basin was relatively clean with minor dry weather flows. Note that this catch basin is inline with the storm drain system.
	Date inspected: 2/4/04 **Comments:** This was the first site visit after one storm event. This insert was removed from the site and subsequently transported to the UCLA laboratory for testing.

Site : FL-001-F **Location:** Washington and Walton (Area 1 - Site A)	
	**Date inspected:** **Comments:** This insert showed significant signs of sediment caking. The absorbent was hanging outside the insert. After this visit, this insert was taken to the laboratory for its final tests.
	Date inspected: 10/21/04 **Comments:** During this visit the insert was cleaned and the media was replaced.

Site : FL-001-C **Location:** Washington and Walton (Area 1 - Site A)	
 	**Date inspected:** 12/11/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is downstream. The bottom right photo shows resurfacing activities on Catalina Ave. Note that this catch basin is inline with the storm drain system.

Site : FL-001-C **Location:** Washington and Walton (Area 1 - Site A)

Date inspected:
2/4/04

Comments: This is the first visit after installation and one storm event. An oil pan with automotive fluid was found at the inlet of this catch basin during this visit. No signs of oil inside the insert, but plenty of coarse sediment and some vegetative debris. The insert was removed from the catch basin and subsequently transported to the UCLA laboratory for testing during this site visit.

Date inspected:
03/22/05

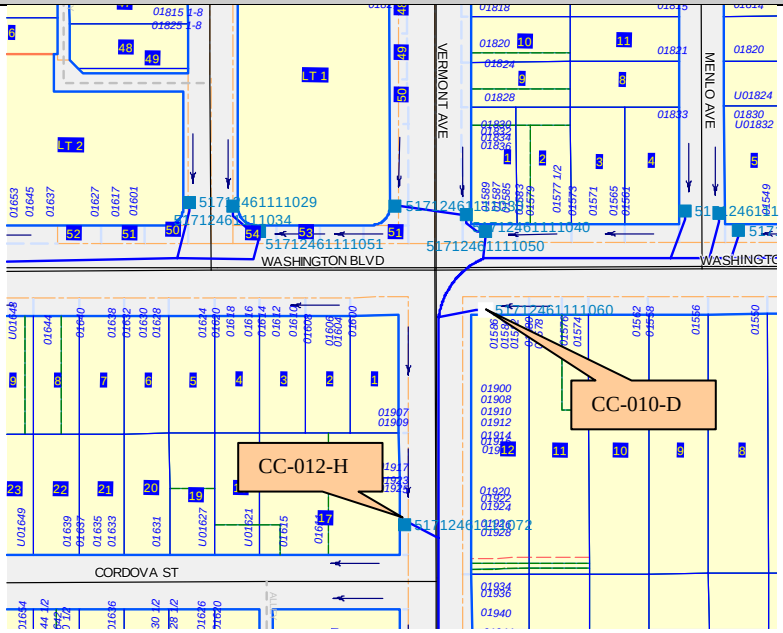
Comments: During this visit, the insert showed significant signs of sediment accumulation and oily sediment. It also appeared to have recently bypassed. After this visit, this insert was taken to the laboratory for its final tests.

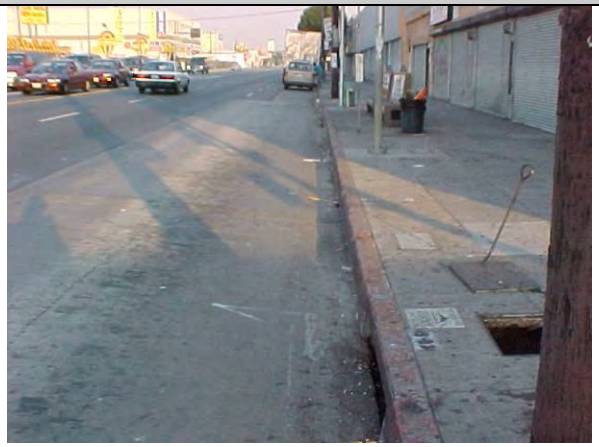
Site : FL-001-C **Location:** Washington and Walton (Area 1 - Site A)

Date inspected:
10/21/04

Comments: These photos were taken immediately after it was installed in preparation for the wet season.

Area 1 - Site B





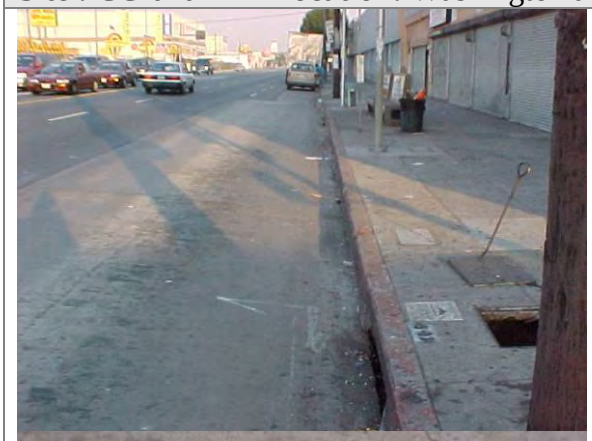
Looking upstream (east) of CC-010-D

Intersection	Washington Blvd. & Vermont Ave. Vermont & Cordova
No. of Installations	2

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-010-D	DrainPac	380866	3767153	3.5	3.2	3.2
CC-012-H	Hydro-Kleen	380849	3767053	3	3.2	5.7

Site : CC-010-D **Location:** Washington and Vermont Ave, SW (Area 1 - Site B)

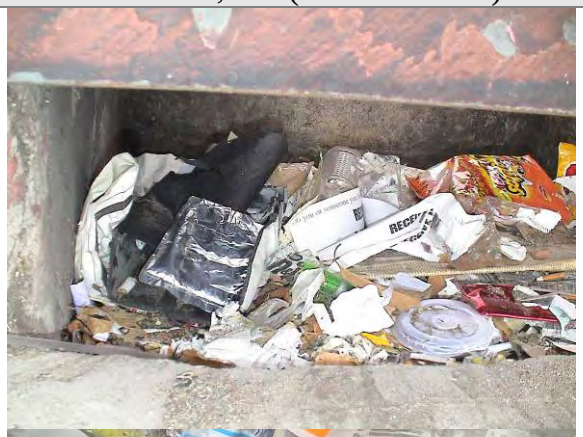
DrainPac

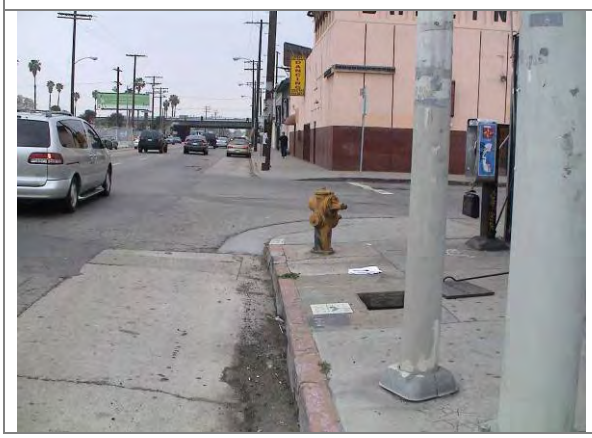


Date inspected:
10/24/03

Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream into the intersection. As shown in the figures, obviously this site is located in a very busy intersection with high trash loading.

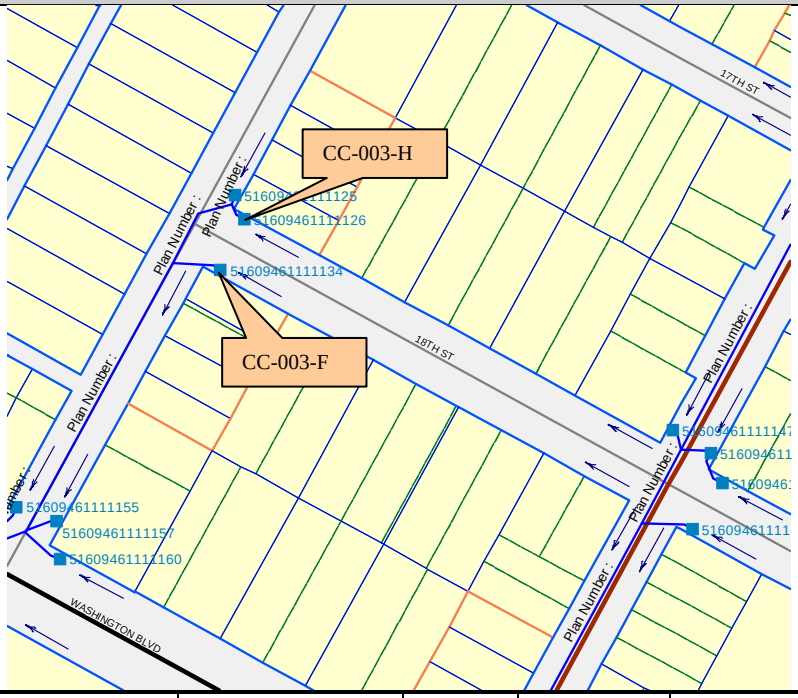
Site : CC-010-D **Location:** Washington and Vermont Ave, SW (Area 1 - Site B)	DrainPac
	Date inspected: 2/4/04 **Comments:** This was the first site visit after installation. It was raining and appeared to be at full hydraulic capacity but still processing the flow.
	Date inspected: 2/27/04 **Comments:** Trash at lip of insert indicates bypass may have previously occurred. Standing water in insert slowly draining indicates the filter media is beginning to clog.
	Date inspected: 3/23/04 **Comments:** This site was completely overwhelmed with trash during this visit. Subsequent events are likely to dislodge larger objects and floatables.

Site : CC-010-D **Location:** Washington and Vermont Ave, SW (Area 1 - Site B)	DrainPac
	**Date inspected:** 6/30/04 **Comments:** The insert is now completely buried by trash. This device will be retired during the next site visit.
	Date inspected: 10/21/04 **Comments:** Some of the trash that was in the insert has been removed and some bypass, but still lots of trash and debris. The insert was retired during this visit.

Site : CC-012-H **Location:** Vermont, N of Cordova, West side (Area 1 - Site B)	Hydro Kleen
	Date inspected: 10/24/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. This deep catch basin had a significant amount of trash.
	Date inspected: 2/27/04 **Comments:** This insert was installed in the second week of February. After about a week and a half, there is already significant trash and debris with signs of bypass.
	**Date inspected:** 3/23/04 **Comments:** After another month in the field this insert has nearly reached its trash loading capacity.

Site : CC-012-H **Location:** Vermont, N of Cordova, West side (Area 1 - Site B)		Hydro Kleen
		Date inspected: 6/30/04 **Comments:** The insert is now overflowing with trash and should be retired during the next site visit.

Area 1 - Site C



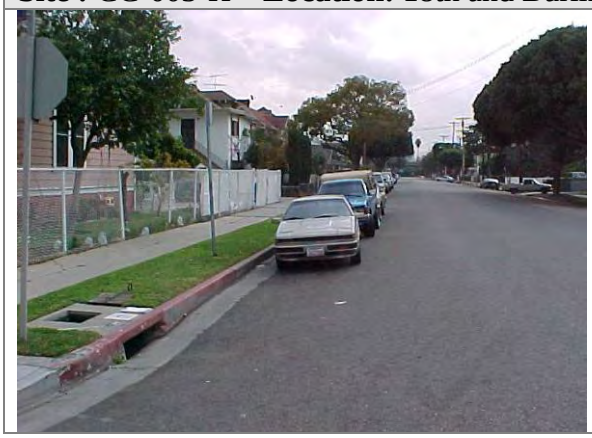
Looking toward intersection from Burlington Ave. (south)

Intersection	18th St. & Burlington Ave.
No. of Installations	2

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-003-H	Hydro-Kleen	381658	3767369	3.5	3.2	2.8
CC-003-F	Flogard+Plus	381649	3767368	3.5	3.2	3

Site : CC-003-H **Location:** 18th and Burlington Ave, S corner (Area 1 - Site C)

HydroKleen



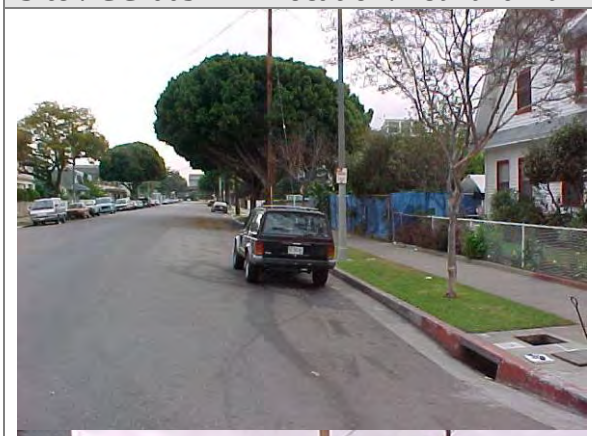
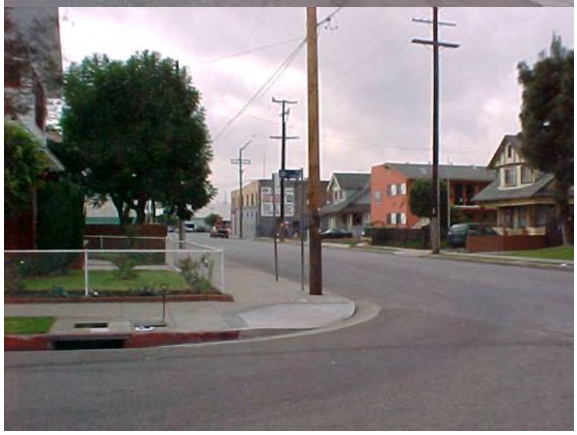
Date inspected:
12/11/03

Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream to the intersection. All residential area. Little trash and debris in catch basin.

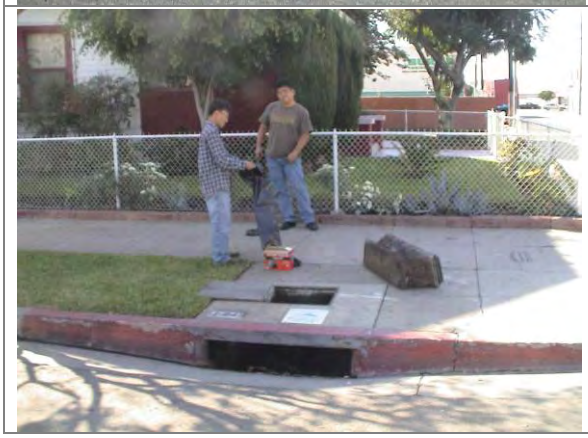
Site : CC-003-H **Location:** 18th and Burlington Ave, S corner (Area 1 - Site C)	HydroKleen
	Date inspected: 2/27/04 **Comments:** As intended by the design, notice the standing water in the sedimentation chamber and the captured trash and debris in the filtration chamber.
	Date inspected: 3/23/04 **Comments:** There was less water during this visit, but there is evidence of recent high flow bypass with the sediment residue on the lid and lip of the insert. The media appears to be beginning to clog.

Site : CC-003-H **Location:** 18th and Burlington Ave, S corner (Area 1 - Site C)	HydroKleen
	Date inspected: 6/30/04 **Comments:** The insert is completely full and the media is likely clogged. The insert will be retired during the next site visit.
	Date inspected: 10/21/04 **Comments:** As before, this insert was filled with material during this visit. The trash was removed for laboratory analysis. This site was converted to an FL site for the next wet season.

Site : CC-003-H **Location:** 18th and Burlington Ave, S corner (Area 1 - Site C)	HydroKleen

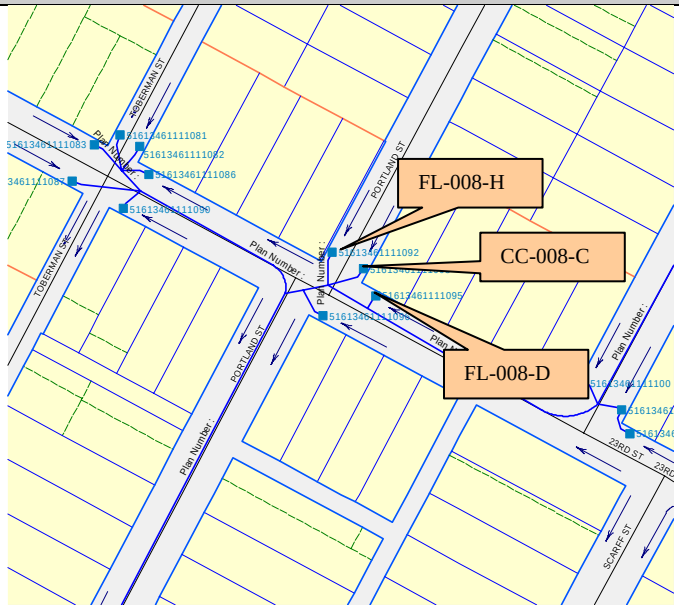
Site : CC-003-F **Location:** 18th and Burlington Ave, N corner (Area 1 - Site C)	Flo-Gard Plus
 	**Date inspected:** 12/11/03 **Comments:** This was the initial site inspection prior to insert installation. Notice the relatively small amount of trash and debris inside the catch basin.

Site : CC-003-F **Location:** 18th and Burlington Ave, N corner (Area 1 - Site C)	Flo-Gard Plus
	Date inspected: 2/4/04 **Comments:** These pictures were taken during an actual storm event. Notice bypass flows along the lip and down the side of the insert. Also notice the absorbent boom floating at the surface of the insert; which is the intention of the design.
	Date inspected: 2/27/04 **Comments:** Notice the significantly greater amount of trash and debris since the last inspection.

Site : CC-003-F **Location:** 18th and Burlington Ave, N corner (Area 1 - Site C)	Flo-Gard Plus
	Date inspected: 3/23/04 **Comments:** The insert is now shown nearly at full capacity.
	Date inspected: 6/30/04 **Comments:** The insert cannot hold anymore trash. Any further loadings will bypass.
	**Date inspected:** 10/22/04 **Comments:** The material in this insert was removed during this visit. New media was inserted and it was converted to an FL site.

Site : CC-003-F **Location:** 18th and Burlington Ave, N corner (Area 1 - Site C)	Flo-Gard Plus

Area 1 - Site D



Looking upstream (southeast) of FL-008-D

Intersection	23rd St & Portland St
No. of Installations	3

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-008-C	Curb Inlet Basket	381765	3766656	3.5	3.2	2.7
FL-008-D	DrainPac	381851	3766453	3.2	3.5	3.0
FL-008-H	Hydro-Kleen	381758	3766660	3.5	3.2	2.7

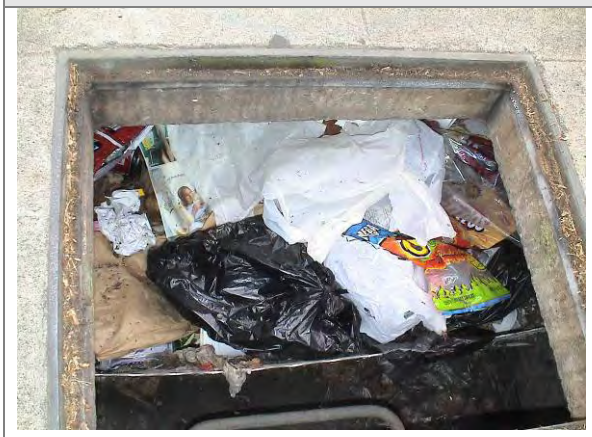
Site : CC-008-C **Location:** 23rd and Portland, East Side (Area 1 - Site D)

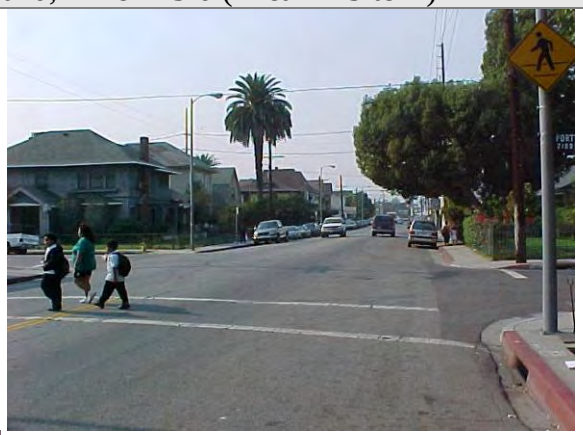
Curb Inlet Basket

Date inspected:
12/10/03

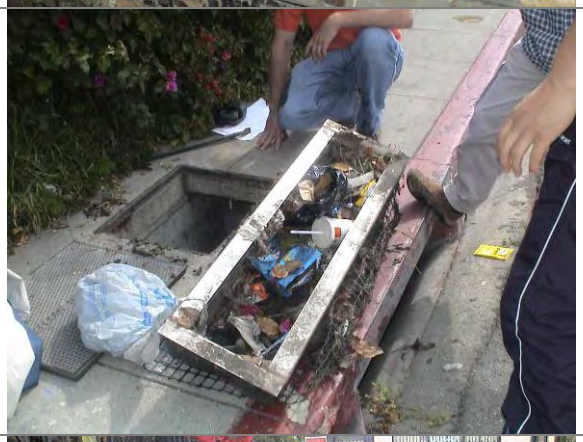
Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream. Nearby deciduous trees appear to deliver excessive leafy debris to this catch basin.

Site : CC-008-C **Location:** 23rd and Portland, East Side (Area 1 - Site D)	Curb Inlet Basket
	Date inspected: 2/4/04 **Comments:** First site visit after installation and one storm event. Some trash and debris accumulation, but still plenty of capacity.
	Date inspected: 3/23/04 **Comments**: Compared to the last inspection, the insert has accumulated significant trash and debris. It now appears to be near capacity and probably should be retired.
	Date inspected: 6/30/04 **Comments:** As before, this insert is full and is beginning to overflow with trash.

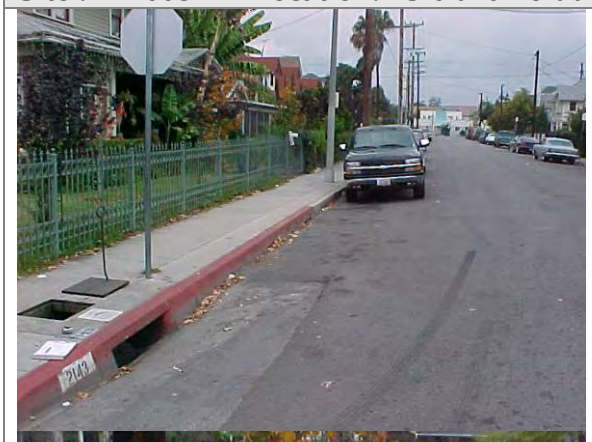
Site : CC-008-C **Location:** 23rd and Portland, East Side (Area 1 - Site D)	Curb Inlet Basket
	**Date inspected:** 10/21/04 **Comments:** This insert was retired during this visit.

Site : FL-008-D **Location:** 23rd and Portland, NE on 23rd (Area 1 - Site D)	DrainPac
	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream.

Site : FL-008-D **Location:** 23rd and Portland, NE on 23rd (Area 1 - Site D)	DrainPac
	Date inspected: 2/4/04 **Comments:** This was the first inspection of this site. Notice the device has accumulated significant trash for only one storm event. This was originally a CC site, but was changed to an FL site due to installation timing conflicts.
	Date inspected: 10/22/04 **Comments:** This FL insert was installed during this visit in preparation for the wet season.

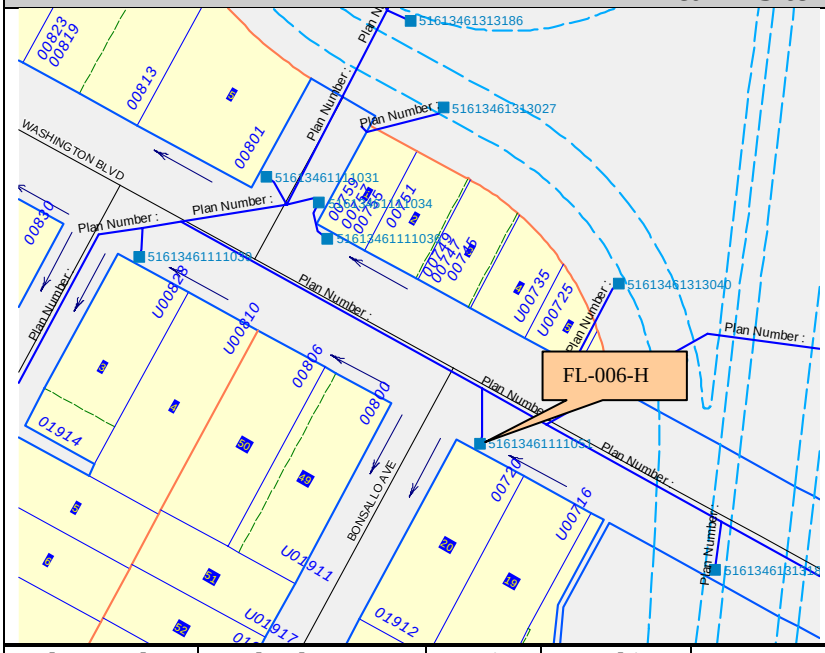
Site : FL-008-D **Location:** 23rd and Portland, NE on 23rd (Area 1 - Site D)	DrainPac
	**Date inspected:** 03/22/05 **Comments:** After this visit, this insert was taken to the laboratory for its final tests.

Site : FL-008-D **Location:** 23rd and Portland, NE on 23rd (Area 1 - Site D)	DrainPac

Site : FL-008-H **Location:** 23rd and Portland, NE on 23rd (Area 1 - Site D)	Hydro Kleen
	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. There is evidence of significant trash loading to this catch basin as shown in the photo.

Site : FL-008-H **Location:** 23rd and Portland, NE on 23rd (Area 1 - Site D)	Hydro Kleen
	Date inspected: 2/4/04 **Comments**: Notice the standing water. This device is actually designed to have standing water in the first chamber to allow for settling. This was originally a CC site, but was changed to an FL site due to installation timing conflicts. It was removed and subsequently transported to the UCLA laboratory during this visit.
	Date inspected: 03/22/05 **Comments:** After a few months in the field this insert did not show significant accumulation. After this visit, this insert was taken to the laboratory for its final tests.

Area 1 - Site E



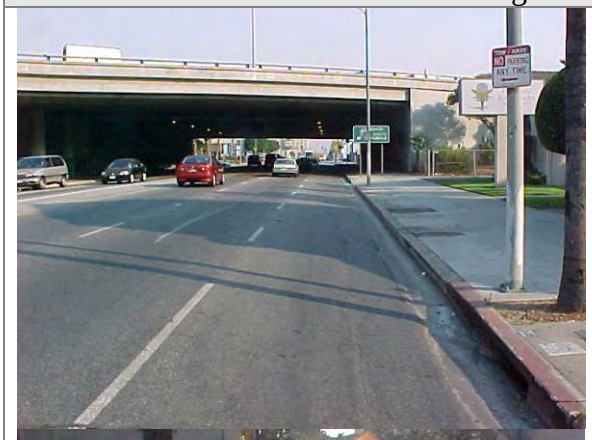
Looking upstream (southeast)

Intersection	Washington Blvd & Bonsallo Ave.
No. of Installations	1

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
FL-006-H	Hydro-Kleen	382356	3766644	3.5	3.2	3.0

Site : FL-006-H **Location:** Washington Blvd & Bonsallo Ave. (Area 1 - Site E)

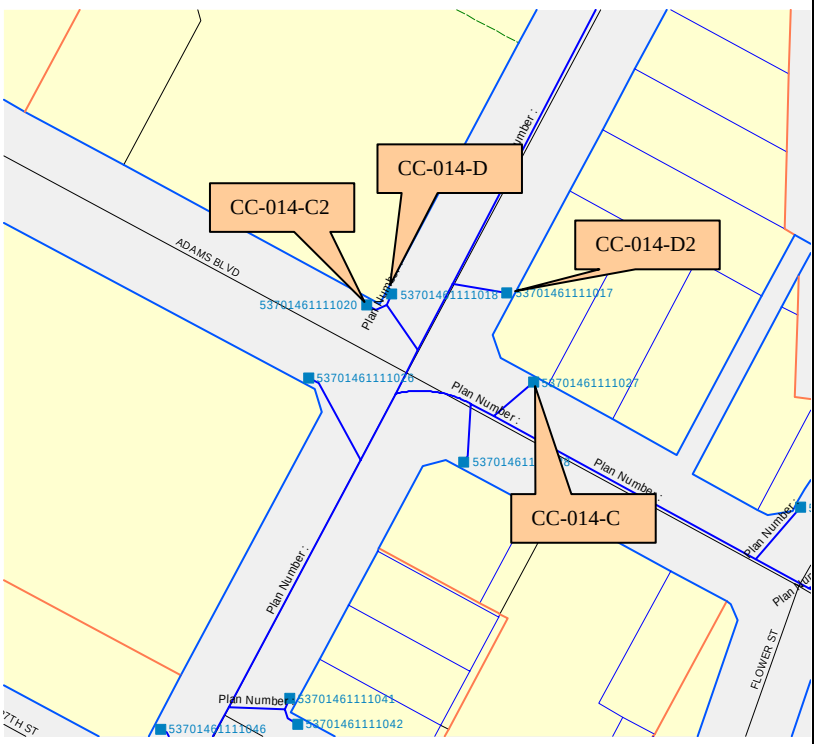
Hydro Kleen

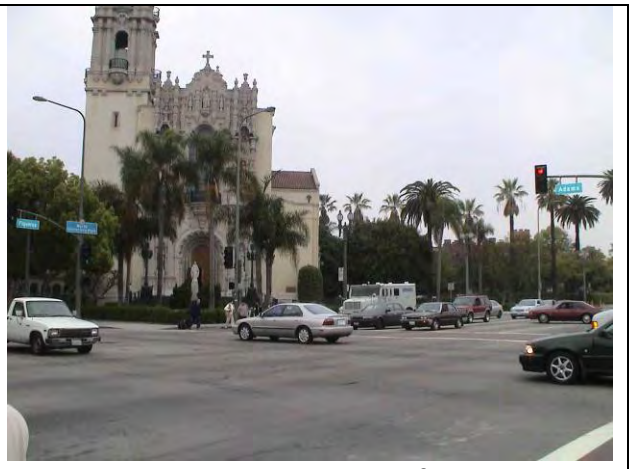


Date inspected:
10/24/03

Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream. Bottom left picture is looking down Bonsallo Ave. Notice the large amount of trash and debris within the catch basin.

Site : FL-006-H **Location:** Washington Blvd & Bonsallo Ave. (Area 1 - Site E)	Hydro Kleen
	Date inspected: 2/4/04 **Comments:** This installation utilizes a weir to route flows into the insert because the inlet width is wider than the insert width. Majority of the flows at this site were found to bypass the insert during this storm event. The insert was removed and transported to the laboratory for testing. Note that the lip of the insert had to be trimmed and notched to fit in this catch basin. It was sealed using black caulking. Thus, upon reinstallation the insert should again be caulked to minimize the chance for bypass.



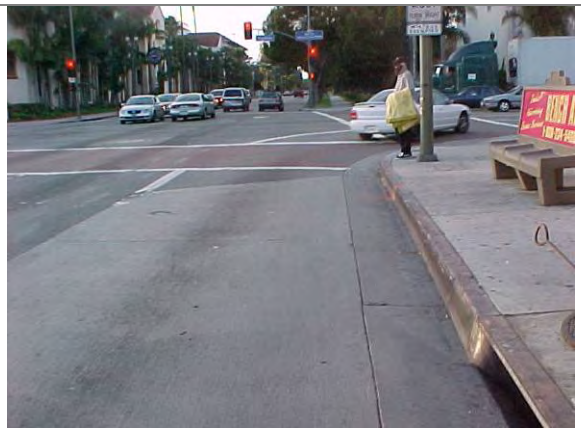
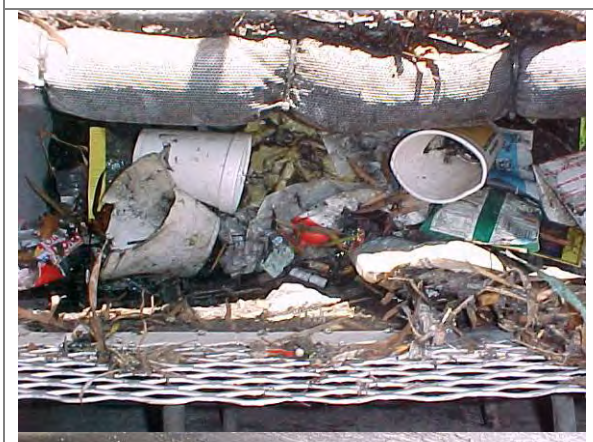
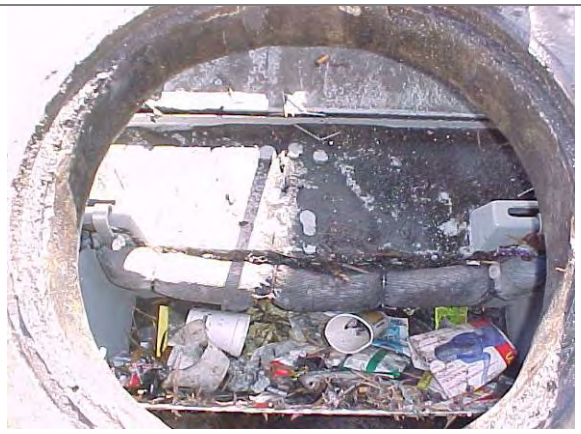
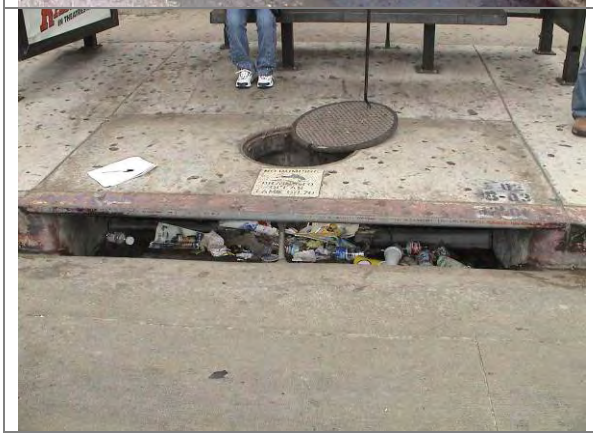


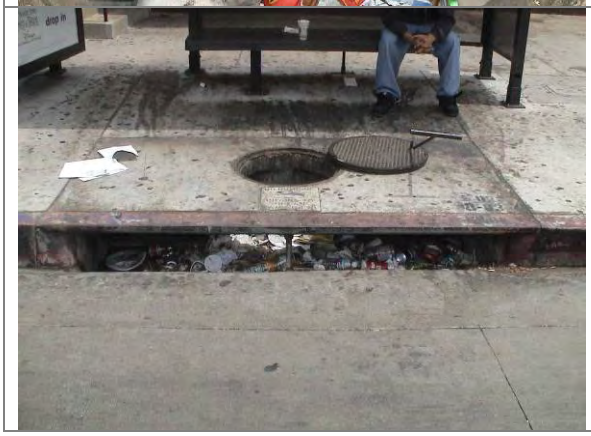
Looking across the intersection from the north east corner.

Looking across intersection from southeast corner.

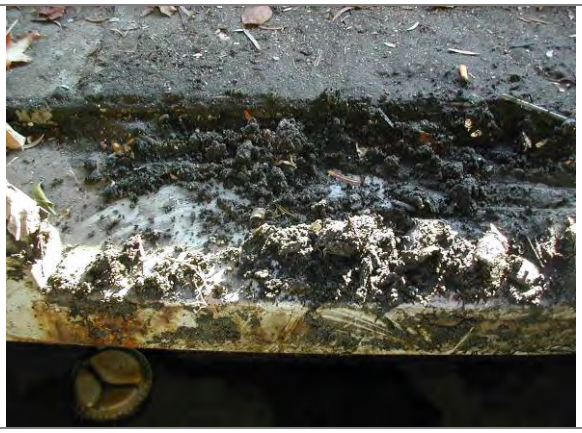
Intersection	Figueroa St. & Adams Blvd.
No. of Installations	4

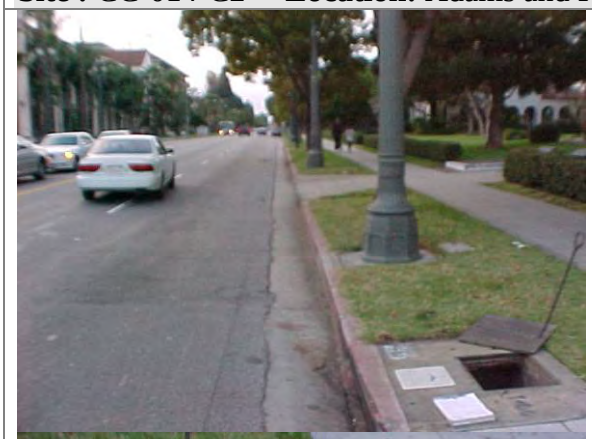
Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-014-C2	Curb Inlet Basket	382170	3766022	3.5	3.2	3.3
CC-014-C	Curb Inlet Basket	382226	3766007	7	3.2	5.9
CC-014-D	DrainPac	382274	3765843	7	3.2	4.6
CC-014-D2	DrainPac	38220	3766028	7	3.1	4

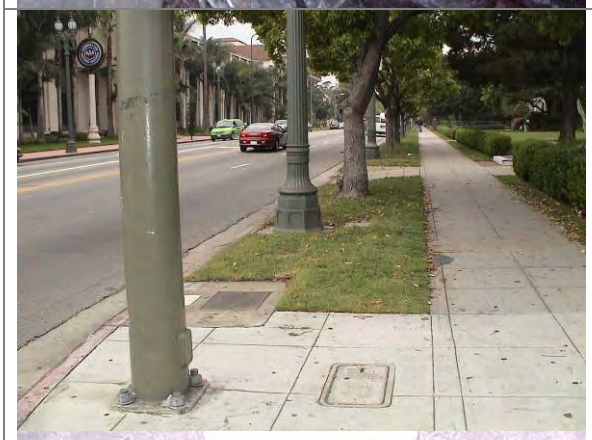
Site : CC-014-C **Location:** Adams and Figueroa St (Area 1 - Site F)	Curb-Inlet Basket
	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right photo is looking downstream. This catch basin is at a bus stop that gets a lot of vehicular and pedestrian traffic.
 	**Date inspected:** 2/4/04 **Comments:** First site visit since installation indicates significant trash loadings at this site.
	**Date inspected:** 2/27/04 **Comments:** Notice this site exhibits very high sediment loadings and evidence of oil and grease.

Site : CC-014-C **Location:** Adams and Figueroa St (Area 1 - Site F)	Curb-Inlet Basket
	Date inspected: 3/23/04 **Comments:** After just two months, this insert is completely filled with mostly anthropogenic refuse and sediment.
	**Date inspected:** 6/30/04 **Comments:** Additional trash has accumulated in the insert and on the sedimentation shelf. This insert should be retired during the next site visit.

Site : CC-014-C **Location:** Adams and Figueroa St (Area 1 - Site F)	Curb-Inlet Basket
	Date inspected: 10/21/04 **Comments:** The insert at this busy intersection has received lots of trash and sediment. The media shown in the lip of the insert appears deflated indicating the absorbent material has been lost during operation. Significant sediment build-up on weir indicates coarse sediment removal is occurring.

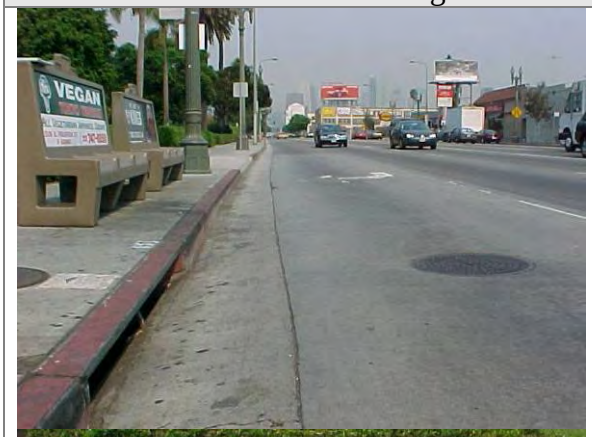
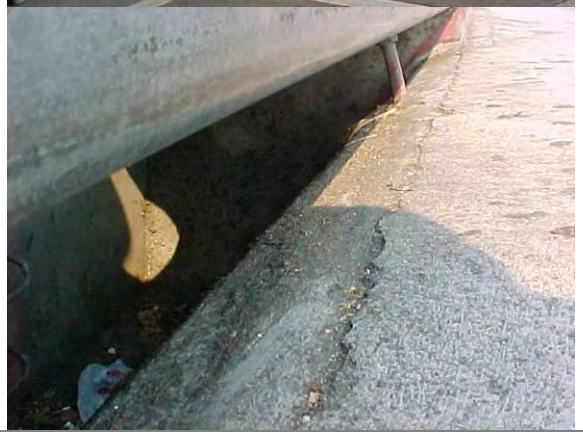
Site : CC-014-C **Location:** Adams and Figueroa St (Area 1 - Site F)	Curb-Inlet Basket
	

Site : CC-014-C2 **Location:** Adams and Figueroa St (Area 1 - Site F)	Curb Inlet Basket
	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right photo is looking downstream toward the intersection. Significant trash and debris loads present at site. Notice the catch basin outlet appears to be nearly clogged.

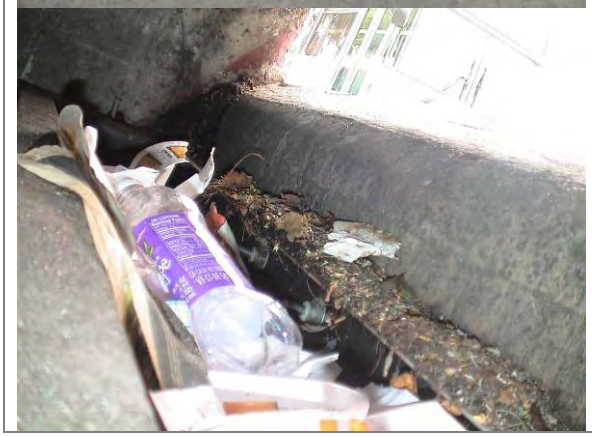
Site : CC-014-C2 **Location:** Adams and Figueroa St (Area 1 - Site F)		Curb Inlet Basket
		**Date inspected:** 2/4/04 **Comments:** First site visit since installation. As compared to CC-014-C across the street, this site contains more leaf litter and sediment than human-generated trash.
		Date inspected: 2/27/04 **Comments:** More trash and debris has accumulated since last visit and some has bypassed insert, but still appears to be slightly below capacity.

Site : CC-014-C2 **Location:** Adams and Figueroa St (Area 1 - Site F)	Curb Inlet Basket
	Date inspected: 3/23/04 **Comments:** The insert is now at capacity and should be cleaned prior to the next wet season.
	Date inspected: 6/30/04 **Comments:** As before, this insert is full and needs to be cleaned. The last cleaning of this catch basin appears to have been Sept. 2003. Notice the build-up of sediment and growth of weeds at the inlet of this catch basin.

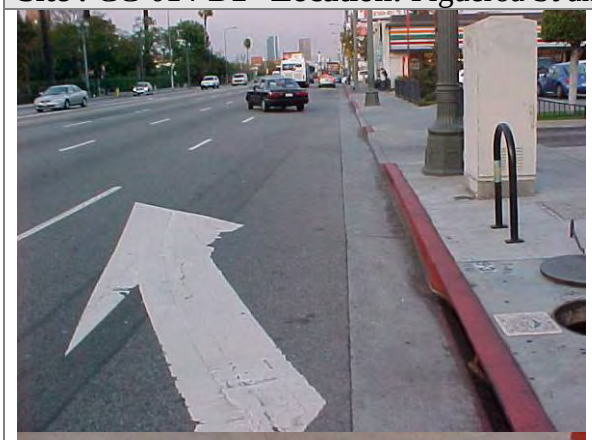
Site : CC-014-C2 **Location:** Adams and Figueroa St (Area 1 - Site F)	Curb Inlet Basket
	Date inspected: 10/22/04 **Comments:** This insert receives mostly sediment, leaves, and pine needles. The media appears to be "deflated" indicating the absorbent material was lost during operation. It was retired after this inspection.

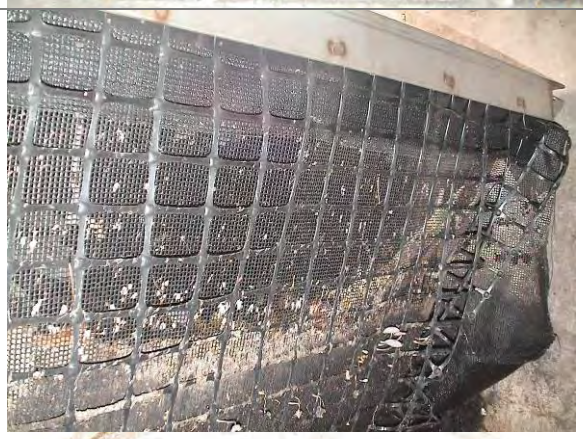
Site : CC-014-D **Location:** Figueroa St and Adams (Area 1 - Site F)	DrainPac
 	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right photo is looking downstream toward the intersection. This site is located at a bus stop.

Site : CC-014-D **Location:** Figueroa St and Adams (Area 1 - Site F)	DrainPac
	Date inspected: 2/4/04 **Comments:** This was the first site visit after installation. The photo on the top left is a "birds-eye" view of the insert. Notice there is still some water from the previous day's storm event. The photo on the top left shows the relatively clean catch basin bottom due to the high capture rate of the insert.
	Date inspected: 3/23/04 **Comments:** Compared to the last inspection there is significantly more trash and debris, but the insert still has capacity and appears to be functioning properly. Only a small amount of bypass is indicated by the limited amount of debris at the bottom of the catch basin.

Site : CC-014-D **Location:** Figueroa St and Adams (Area 1 - Site F)	DrainPac
	**Date inspected:** 6/30/04 **Comments:** Since the last visit a lot more trash has accumulated in the insert and is now nearly at capacity.

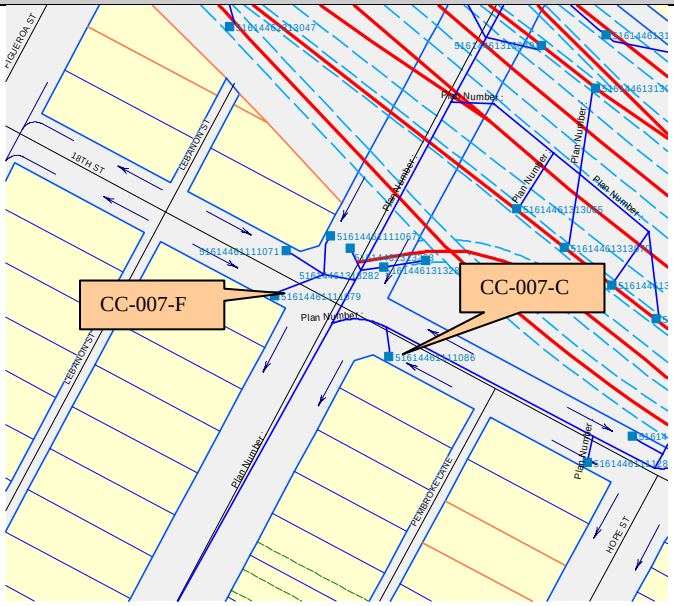
Site : CC-014-D **Location:** Figueroa St and Adams (Area 1 - Site F)	DrainPac

Site : CC-014-D2 **Location:** Figueroa St and Adams (Area 1 - Site F)	DrainPac
	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right photo is looking downstream toward the intersection. This site is located at a bus stop.
	Date inspected: 2/4/04 **Comments:** This is the first inspection after installation and it appears to be functioning well.

Site : CC-014-D2 **Location:** Figueroa St and Adams (Area 1 - Site F)	DrainPac
	**Date inspected:** 3/23/04 **Comments:** After nearly two months, this insert is still functioning well and has remaining capacity.
	Date inspected: 6/30/04 **Comments:** More trash and debris have accumulated since the last visit. However, it appears to still have some remaining capacity.

Site : CC-014-D2 **Location:** Figueroa St and Adams (Area 1 - Site F)	DrainPac

Area 1 - Site G



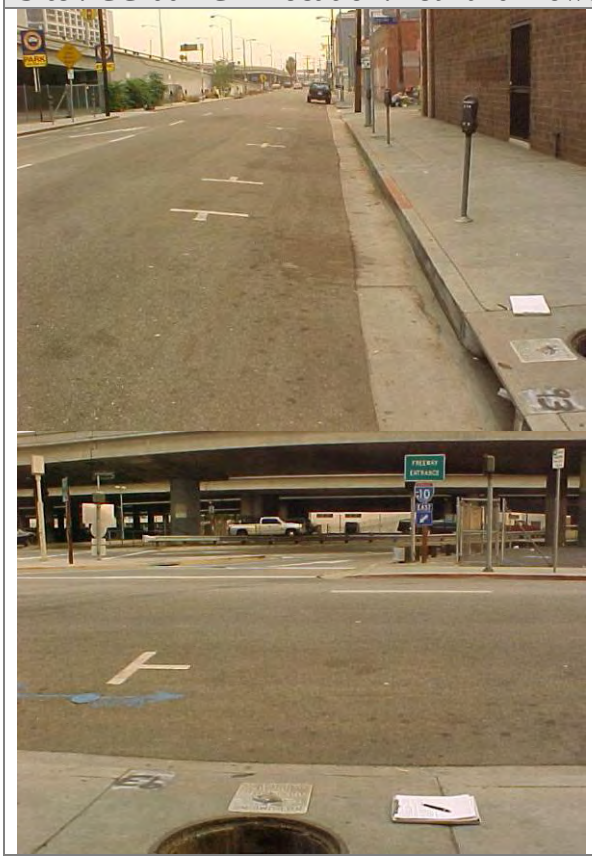
Northwest corner of 18th and Flower St.

Intersection	18th St. & Flower St.
No. of Installations	2

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-007-C	Curb Inlet Basket	382871	3766585	3.5	3.0	6.5
CC-007-F	Flogard+Plus	382771	3766801	3.5	3.2	3.5

Site : CC-007-C **Location:** 18th and Flower St., South East Corner (Area 1 - Site G)

Curb Inlet Basket



Date inspected:
10/24/03

Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream.

Site : CC-007-C **Location:** 18th and Flower St., South East Corner (Area 1 - Site G)	Curb Inlet Basket
	Date inspected: 2/4/04 **Comments:** This visit occurred about a week after installation. Notice the oil collecting on the surface of the absorbent boom.
	Date inspected: 2/27/04 **Comments:** As compared to the last inspection, this insert has received a significant amount of oil; probably from a direct illicit discharge of used motor oil. Notice the puddle of oil on the lip of this insert.

Site : CC-007-C **Location:** 18th and Flower St., South East Corner (Area 1 - Site G)	Curb Inlet Basket
	Date inspected: 3/23/04 **Comments**: This insert is no longer visible due to the excessive trash and debris.
	Date inspected: 6/30/04 **Comments:** As before, this insert is completely overwhelmed with trash and needs to be cleaned. It should be retired during the next site visit.

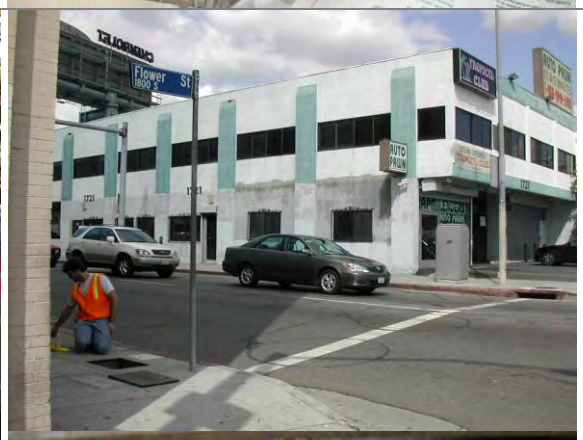
Site : CC-007-C **Location:** 18th and Flower St., South East Corner (Area 1 - Site G)	Curb Inlet Basket
	Date inspected: 10/21/04 **Comments:** The presence of standing water indicates that this insert is clogged. It was retired after this visit.

Site : CC-007-C **Location:** 18th and Flower St., South East Corner (Area 1 - Site G)	Curb Inlet Basket

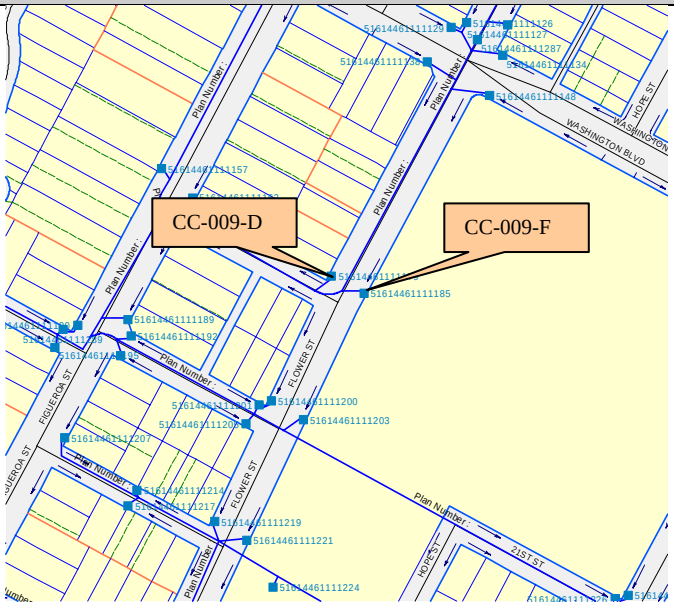
Site : CC-007-F **Location:** 18th St. & Flower St, Southwest corner (Area 1 - Site G)	FloGard
	Date inspected: 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. This is a shallow catch basin with a relatively small amount of trash deposition.

Site : CC-007-F **Location:** 18th St. & Flower St, Southwest corner (Area 1 - Site G)		FloGard
		Date inspected: 2/4/04 **Comments**: Standing water indicates the filter media may be beginning to clog. Notice the floating absorbent boom of amorphous alumina silicate in the picture on the left.
		Date inspected: 2/27/04 **Comments:** Not much changed from last inspection except the standing water had drained and there was slightly more trash and debris.

Site : CC-007-F **Location:** 18th St. & Flower St, Southwest corner (Area 1 - Site G)	FloGard
	Date inspected: 3/23/04 **Comments:** The insert appears to have reached its trash holding capacity and probably should be retired.
	Date inspected: 6/30/04 **Comments:** As before, this insert appears to be at capacity and is currently overflowing with trash. Much of the trash appears to have been transported by wind rather than runoff.

Site : CC-007-F **Location:** 18th St. & Flower St, Southwest corner (Area 1 - Site G)	FloGard
	**Date inspected:** 10/21/04 **Comments:** Appears that significant trash has bypassed the insert. It was retired after this visit.

Area 1 - Site H



Looking upstream (~north) of CC-009F

Intersection	20th St & Flower St
No. of Installations	2

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-009-D	DrainPac	382592	3766501	3.5	3.2	3.7
CC-009-F	Flogard+Plus	382699	3766287	3.2	3.5	5

Site : CC-009-D **Location:** 20th and Flower St., West Side (Area 1 - Site H)

DrainPac

Date inspected:
12/10/03

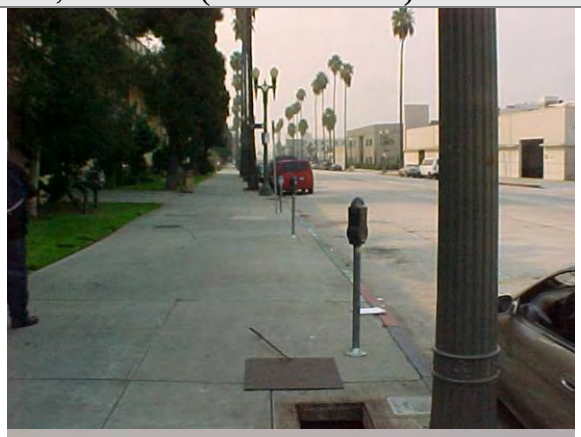
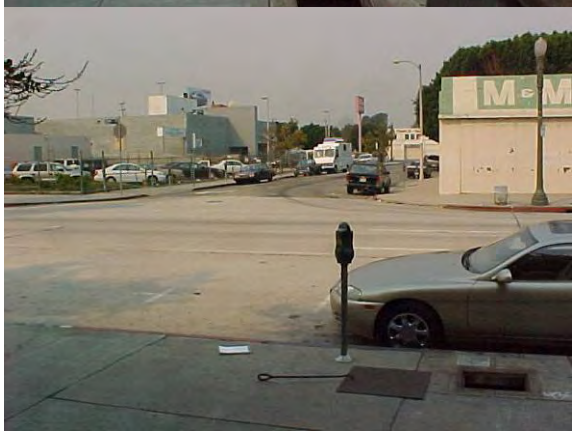
Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream.

Site : CC-009-D **Location:** 20th and Flower St., West Side (Area 1 - Site H)	DrainPac
	Date inspected: 2/4/04 **Comments**: Notice the insert is nearly at its flow capacity during this runoff event, but is still passing the flow.

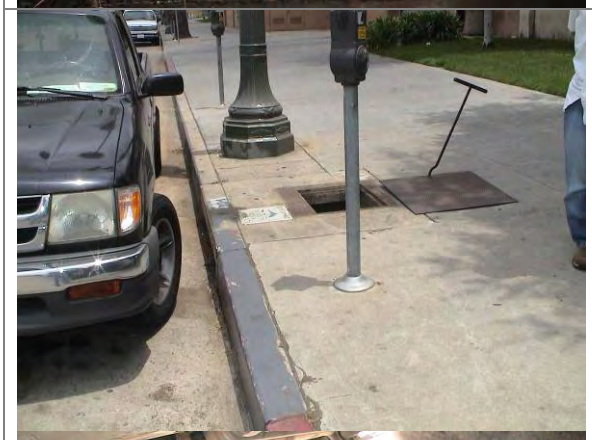
Site : CC-009-D **Location:** 20th and Flower St., West Side (Area 1 - Site H)	DrainPac
	Date inspected: 2/27/04 **Comments:** Very little accumulation of trash since last site visit.
	Date inspected: 3/23/04 **Comments:** There doesn't appear to be a lot of trash, but notice the build-up of fine sediment on the surface of the filter.
	Date inspected: 6/30/04 **Comments:** As compared to the last visit, a significant amount of trash has accumulated in the insert, but it still has remaining capacity. Some wind-blown trash appears to have bypassed the unit.

Site : CC-009-D **Location:** 20th and Flower St., West Side (Area 1 - Site H)	DrainPac
	Date inspected: 10/21/04 **Comments:** Mostly sediment in this insert. Appears to have been cleaned since last visit.

Site : CC-009-F **Location:** 20th and Flower St., East Side (Area 1 - Site H)	Flo-Gard

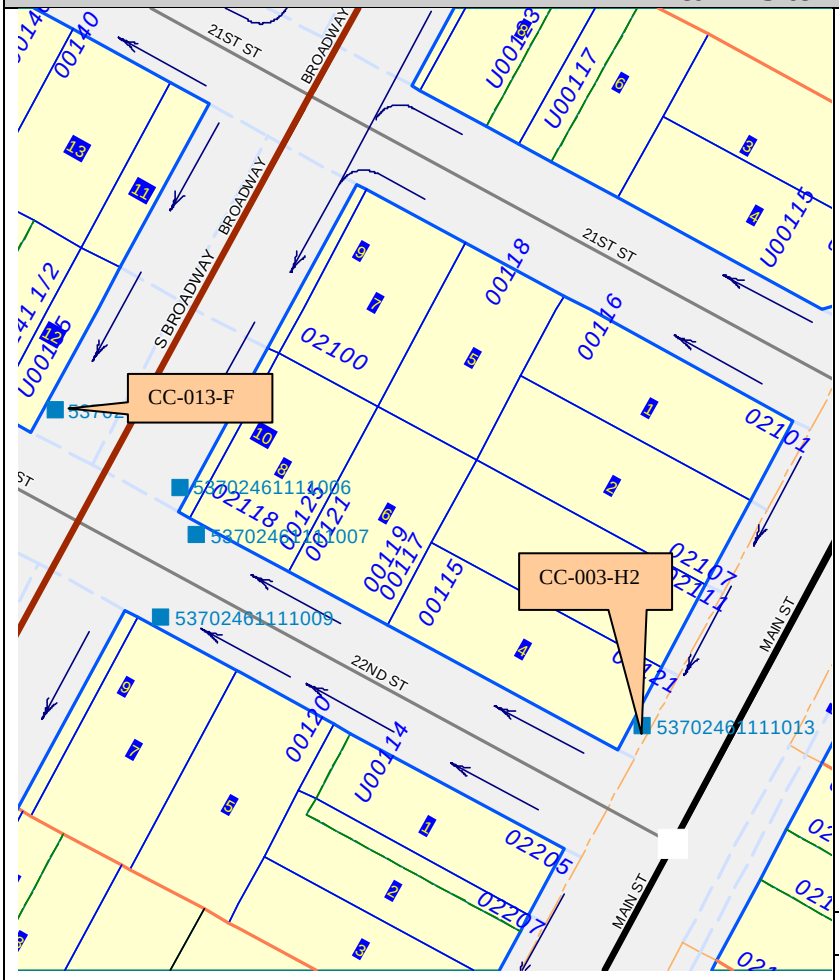
Site : CC-009-F **Location:** 20th and Flower St., East Side (Area 1 - Site H)	Flo-Gard
 	**Date inspected:** 10/24/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream.
	Date inspected: 2/4/04 **Comments:** These pictures were taken during an actual event. The effluent from the insert was relatively clean and the inlet bottom was also relatively clean

Site : CC-009-F **Location:** 20th and Flower St., East Side (Area 1 - Site H)	Flo-Gard
	Date inspected: 2/27/04 **Comments**: Notice the absorbent boom has nearly floated out of the device.
	Date inspected: 3/23/04 **Comments:** A later inspection reveals the debris is still trapped in the insert. The upper portion of the insert appears to be less effective for trapping sediment and small debris, so this insert is at capacity even though it may not appear full. Also, the absorbent is not likely providing much treatment with the way it is hanging out of the basket.

Site : CC-009-F **Location:** 20th and Flower St., East Side (Area 1 - Site H)	Flo-Gard
	**Date inspected:** 6/30/04 **Comments:** The absorbent with this insert appears to have been dislodged.
	Date inspected: 10/21/04 **Comments:** As compared to the last visit, this insert appears have been cleaned and is in good working condition.

Site : CC-009-F **Location:** 20th and Flower St., East Side (Area 1 - Site H)	Flo-Gard

Area 1 - Site I



Looking west from across the street from CC-0130F

Looking south toward CC-003-H2 from Main

Intersection	22nd St and Broadway St. 22nd St. & Main.
No. of Installations	2

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-013-F	Flogard+Plus	383060	3765882	3.5	3.2	3.4
CC-003-H2	Hydro-Kleen	383159	3765836	3.6	3.5	2.7

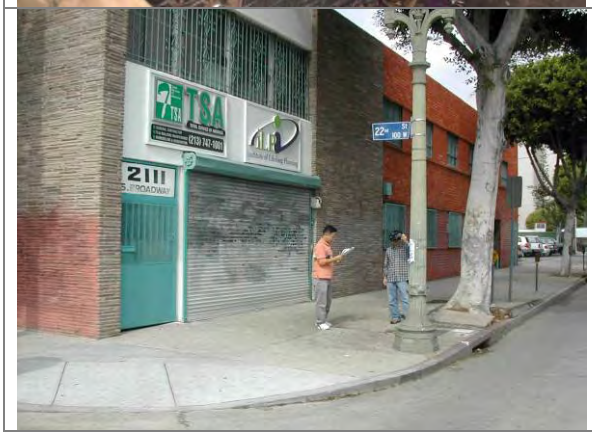
Site : CC-013-F **Location:** 22nd and Broadway St., NW Corner (Area 1 - Site I)

Flo-Gard

Date inspected:
10/24/03

Comments: Initial site visit. Top left photo is looking across the street toward the curb inlet.

Site : CC-013-F **Location:** 22nd and Broadway St., NW Corner (Area 1 - Site I)	Flo-Gard
	Date inspected: 2/4/04 **Comments:** This was the first site visit after installation and one storm event. The insert is already nearly at capacity.
	Date inspected: 2/27/04 **Comments:** About two weeks later, this site was already overwhelmed with leaves and trash.
	Date inspected: 3/23/04 **Comments:** Later inspections still show a lot of the leaves and trash were still trapped in the insert. The insert is completely full at this point and needs to be cleaned.

Site : CC-013-F **Location:** 22nd and Broadway St., NW Corner (Area 1 - Site I)	Flo-Gard
	Date inspected: 6/30/04 **Comments:** As before, this insert is completely overwhelmed with trash and debris and needs to be retired.
	**Date inspected:** 10/21/04 **Comments:** It was retired after this visit.

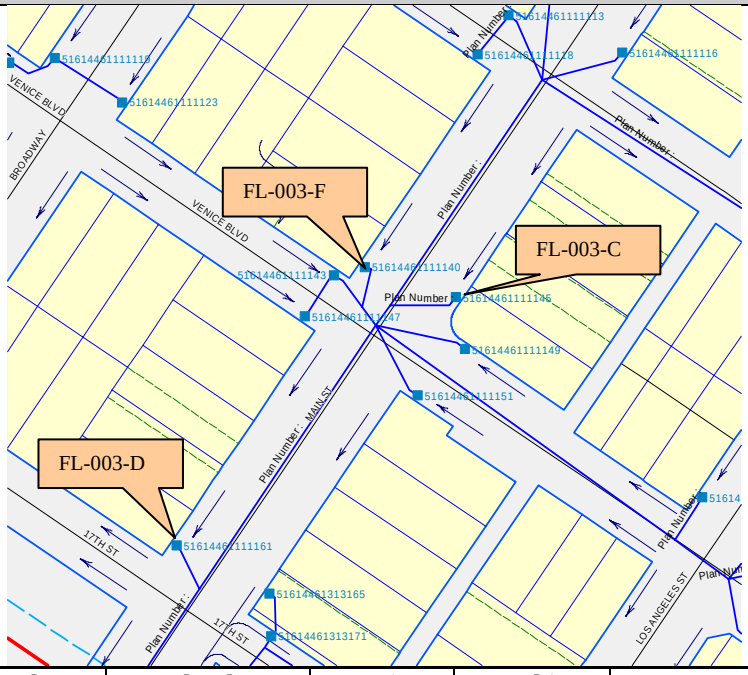
Site : CC-013-F **Location:** 22nd and Broadway St., NW Corner (Area 1 - Site I)	Flo-Gard

Site : CC-003-H2 **Location:** 22nd St. & Main (Area 1 - Site I)	Hydro Kleen
	Date inspected: 10/24/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right photo is looking downstream. Notice about a garbage bag worth of trash had been deposited in the catch basin. This site was originally an FL site, but was changed due to installation timing conflicts.

Site : CC-003-H2 **Location:** 22nd St. & Main (Area 1 - Site I)		Hydro Kleen
		Date inspected: 2/4/04 **Comments:** The insert had not yet been installed at the time of this visit.
		Date inspected: 2/27/04 **Comments:** This site was only briefly inspected during this visit and has been inadvertently overlooked during subsequent site visits because it was thought to be an FL site. The catch basin was cleaned prior to installation of the insert.
		Date inspected: 03/22/05 **Comments:** After this visit, this insert was taken to the laboratory for its final tests.

Site : CC-003-H2 **Location:** 22nd St. & Main (Area 1 - Site I)	Hydro Kleen

Area 1 - Site J



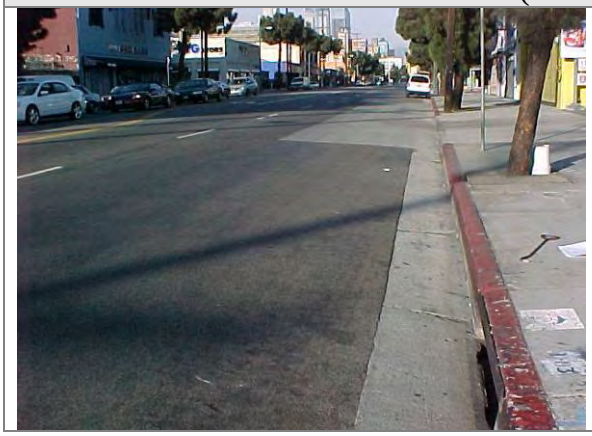
Looking north from FL-003-C

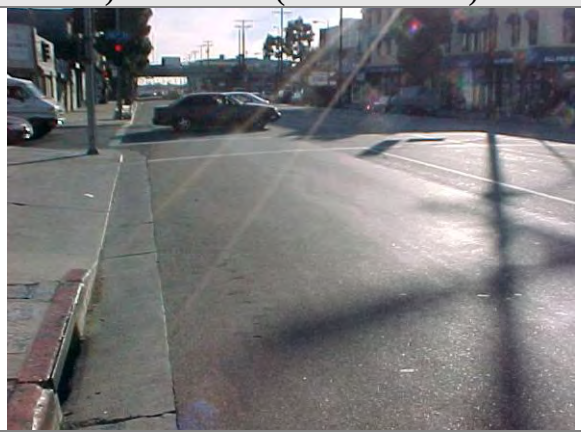
Intersection	16th St. (Venice Blvd) & Main St. 17th St. & Main St.
No. of Installations	3

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
FL-003-D	DrainPac	383386	3766539	3.5	3.2	3
FL-003-F	Flogard+Plus	383452	3766626	3.5	3.2	3.6
FL-003-C	Curb Inlet Basket	383550	3766421	3.5	3.2	3.0

Site : FL-003-C **Location:** 16th St. (Venice Blvd) & Main St. (Area 1 - Site J)

Curb-Inlet Basket

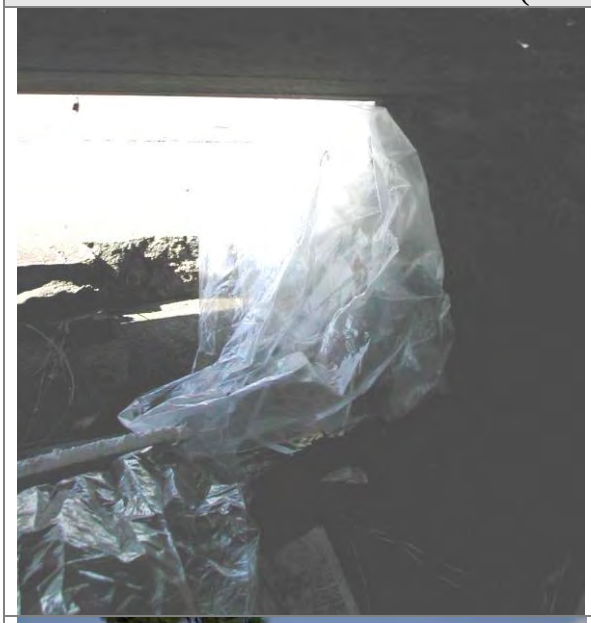




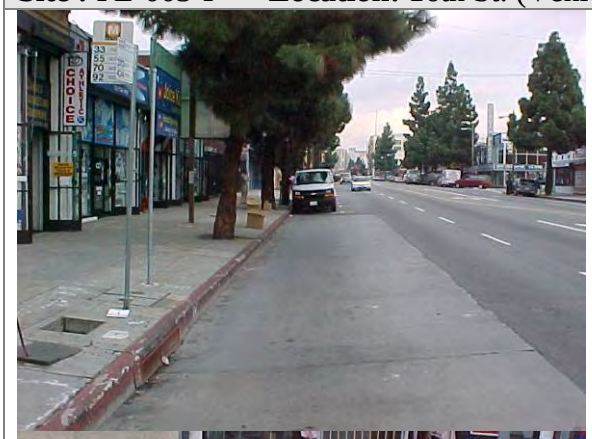
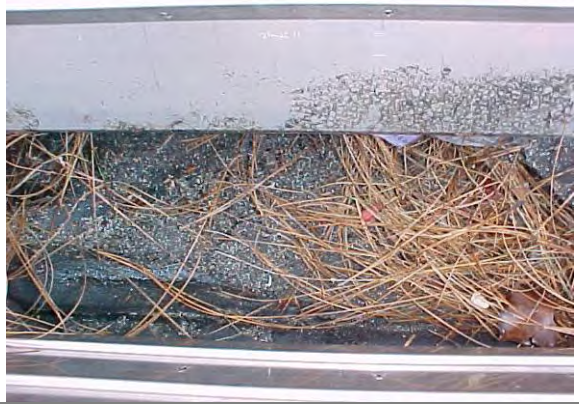
Date inspected:
10/24/03

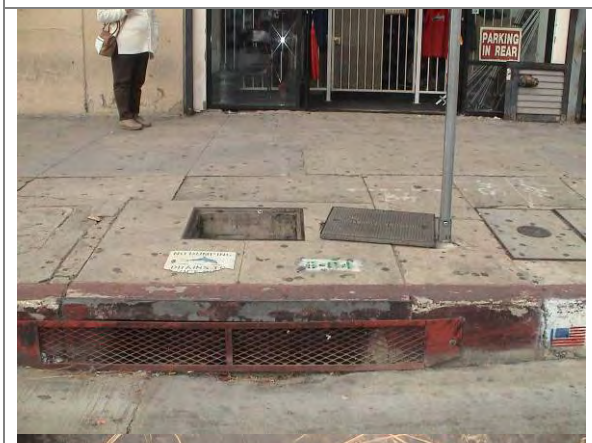
Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream. There is a Chevron gas station on the corner that may be contributing to some of the runoff to this CB.

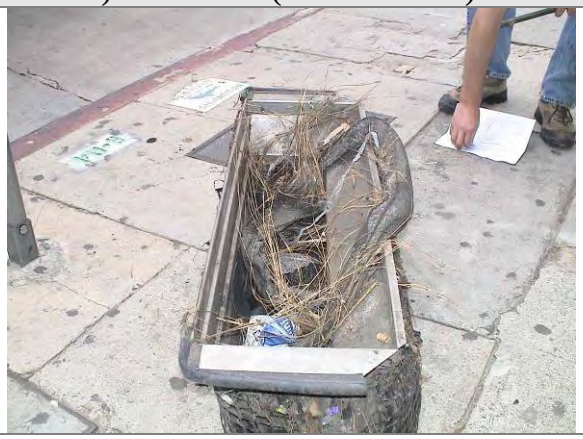
Site : FL-003-C **Location:** 16th St. (Venice Blvd) & Main St. (Area 1 - Site J)	Curb-Inlet Basket
	Date inspected: 2/4/04 **Comments:** Notice the coarse sand accumulating on the shelf of this insert. This may help reduce the chance of clogging, but the plastic bags are the overflow screen. Note the insert has been removed in the bottom picture for subsequent transport to the UCLA testing laboratory.

Site : FL-003-C **Location:** 16th St. (Venice Blvd) & Main St. (Area 1 - Site J)		Curb-Inlet Basket
		**Date inspected:** 2/27/04 **Comments:** Note the insert has been removed for laboratory testing and only the debris shelf and mounting brackets remain.
 		Date inspected: 10/21/04 **Comments:** The contents of this insert were removed and a new absorbent was installed in preparation for the wet season.
		Date inspected: 03/22/05 **Comments:** Since the last visit this insert shows significant accumulation of pine needles and sediment. After this visit, this insert was taken to the laboratory for its final tests.

Site : FL-003-C **Location:** 16th St. (Venice Blvd) & Main St. (Area 1 - Site J)	Curb-Inlet Basket

Site : FL-003-F **Location:** 16th St. (Venice Blvd) & Main St. (Area 1 - Site J)	FloGard Plus
	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. Notice the inlet to this CB has an expanded metal screen, so that only small debris and sediment makes it into the CB.
	**Date inspected:** 2/4/04 **Comments:** This is the first site visit after installation. Notice the relative minor amount of sediment and debris in this insert - mostly pine needles and sand. The bottom of the catch basin is clean. This insert was removed from the CB and subsequently transported to the UCLA laboratory during this visit.

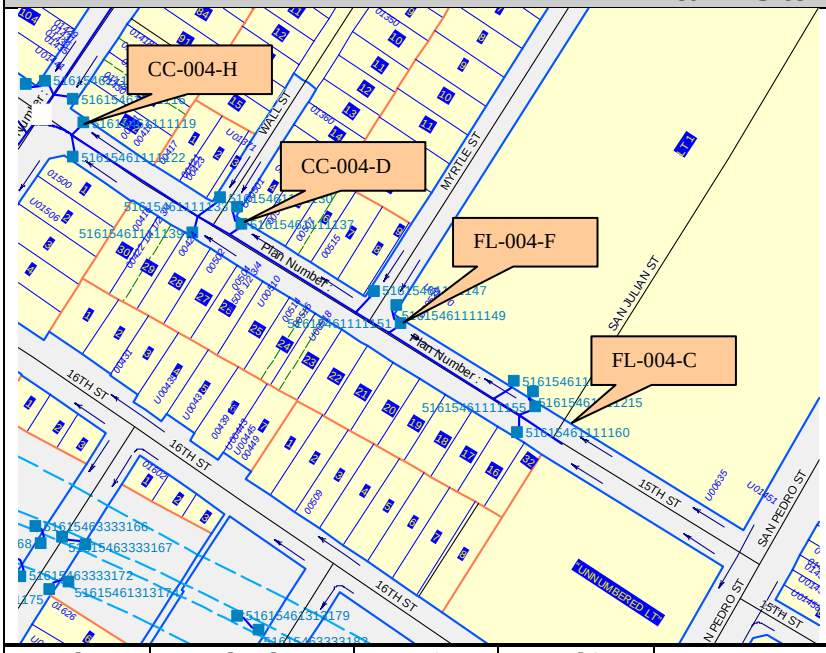
Site : FL-003-F **Location:** 16th St. (Venice Blvd) & Main St. (Area 1 - Site J)	FloGard Plus
	Date inspected: 10/21/04 **Comments:**
	**Date inspected:** 03/22/05 **Comments:** As with many other sites with this insert, the absorbent media is sticking out of the insert. After this visit, this insert was taken to the laboratory for its final tests.

Site : FL-003-F **Location:** 16th St. (Venice Blvd) & Main St. (Area 1 - Site J)	FloGard Plus
	

Site : FL-003-D **Location:** 17th St. & Main St. (Area 1 - Site J)	DrainPac
	Date inspected: 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. This site apparently receives lots of leaf litter and street trash. Notice the outlet in the bottom photo is nearly clogged with debris.
	Date inspected: 2/4/04 **Comments:** This is the first site visit after installation and one rain event. Only a minor amount of debris was found in the insert. This insert was removed from the CB and subsequently transported to the UCLA laboratory during this visit.

Site : FL-003-D **Location:** 17th St. & Main St. (Area 1 - Site J)	DrainPac
	Date inspected: 03/22/05 **Comments:** After this visit, this insert was taken to the laboratory for its final tests.

Area 1 - Site K



Looking east from west side of intersection.

Intersection	15th and Maple St. to San Pedro St.
No. of Installations	4

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-004-D	DrainPac	383876	3766430	7	4.3	3.1
FL-004-F	Flogard+Plus	383940	3766382	3.6	3.2	3.6
FL-004-C	Curb Inlet Basket	384034	3766333	3.5	3.2	3.6
CC-004-H	Hydro-Kleen	383800	3766465	3.5	3.2	3.3

Site : CC-004-D **Location:** 15th and Wall St. (Area 1, Site K)

DrainPac

Date inspected:
12/10/03

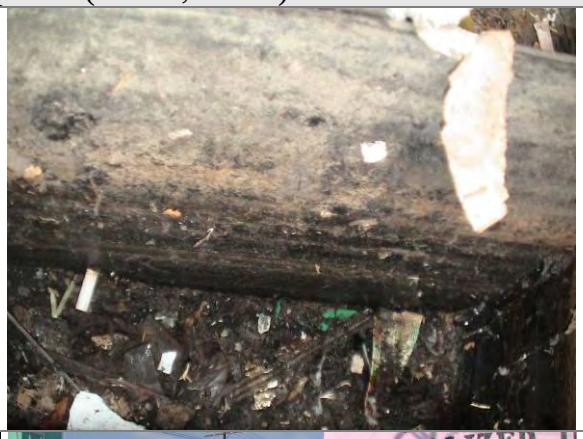
Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream. This was originally an FL site, but was changed to a CC site because the inlet was 7' and the laboratory is set up for 3.5' wide inserts.

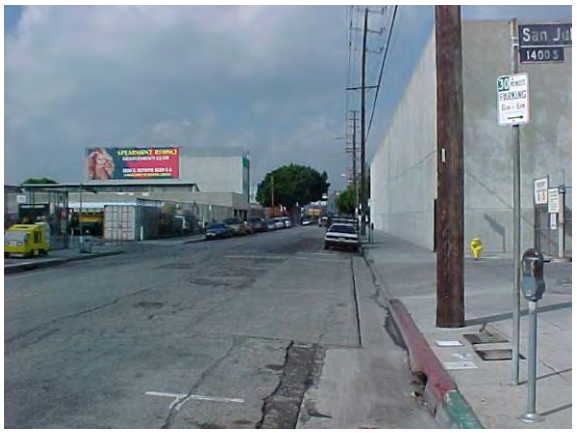
Site : CC-004-D **Location:** 15th and Wall St. (Area 1, Site K)	DrainPac
	Date inspected: 1/30/04 **Comments:** Couple of days after installation. No debris inside of insert.
	Date inspected: 3/23/04 **Comments:** Still relatively clean since last visit; significant capacity remaining.

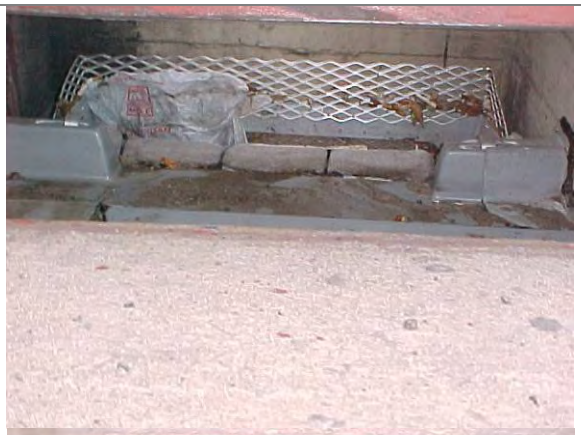
Site : CC-004-D **Location:** 15th and Wall St. (Area 1, Site K)	DrainPac
	Date inspected: 6/30/04 **Comments:** This inserts has not received much additional trash and debris since last inspection and is still well below capacity.
	Date inspected: 10/21/04 **Comments:** As before, this site received a relatively small amount of debris. This site was retired after this visit.

Site : CC-004-H **Location:** 15th and Maple St. (Area 1, Site K)	HydroKleen
	Date inspected: 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. Note that black widows were observed in this catch basin. This site originally was to be an FL site, but it was decided that the screen would not allow for a good comparison between technologies that do not have screens. The overburden of trash loadings now observed for nearly all of the sites indicates that sites with these screens may be among the best for evaluating the performance of catch basin inserts at removing fine sediment and oil and grease.
	Date inspected: 3/23/04 **Comments:** This is the only site that already had a curb screen. Notice how clean the insert is with mostly only water and oil in the sedimentation chamber of the insert.

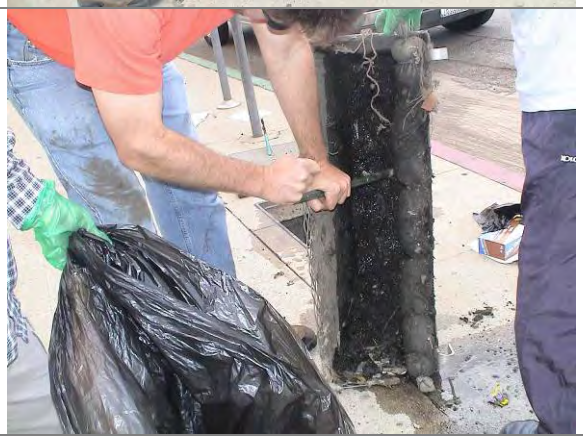
Site : CC-004-H **Location:** 15th and Maple St. (Area 1, Site K)	HydroKleen
	Date inspected: 6/30/04 **Comments:** This insert is still relatively clean and the standing water has nearly all evaporated. This indicates the curb side screen is a very effective method for keeping catch basin inserts in working order.

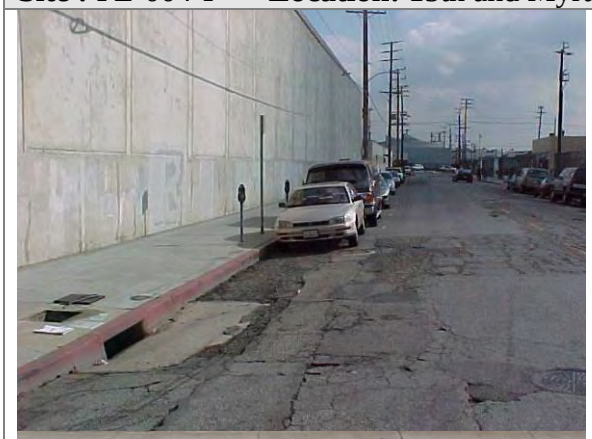
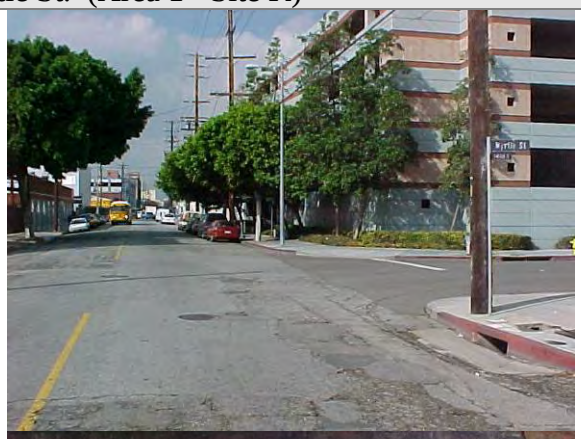
Site : CC-004-H **Location:** 15th and Maple St. (Area 1, Site K)	HydroKleen
	**Date inspected:** 10/21/04 **Comments:** As before, this site showed limited trash accumulation, indicating the effectiveness of the trash screen.

Site : FL-004-C **Location:** 15th and San Julian St. (Area 1, Site K)	Curb-Inlet Basket
	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. This catch basin is located across the street from the LA Unified School District bus storage yard. Notice this catch basin is in-line with the

Site : FL-004-C **Location:** 15th and San Julian St. (Area 1, Site K)	Curb-Inlet Basket
	storm drain system (e.g., there are both inlet and outlet pipes) and there is evidence of dry-weather flows.
	**Date inspected:** 2/4/04 **Comments:** Couple of days after installation and one storm event. Notice the school bus parked in next to curb in the top right photo. This street gets lots of school bus traffic because the LACUSD properties nearby. The bottom left photo shows the shelf and mounting bracket of the insert after removal. The insert was subsequently taken to the UCLA laboratory for testing.

Site : FL-004-C **Location:** 15th and San Julian St. (Area 1, Site K)	Curb-Inlet Basket
	Date inspected: 10/21/04 **Comments:** During this inspection it was noted that the City had installed one of their complete capture devices. Luckily, our insert was compatible with this design and did not get removed.

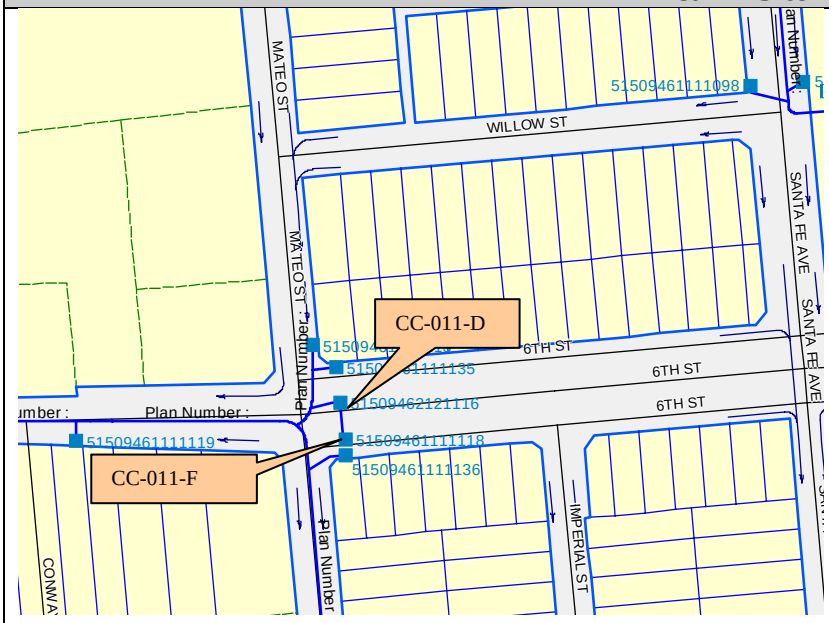
Site : FL-004-C **Location:** 15th and San Julian St. (Area 1, Site K)	Curb-Inlet Basket
	

Site : FL-004-F **Location:** 15th and Myrtle St. (Area 1 - Site K)	Flo-Gard Plus
 	**Date inspected:** 12/10/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. This is an inline catch basin with a small amount of trash and minor dry weather flow.
	Date inspected: 2/4/04 **Comments:** First site visit after installation and one storm event. This catch basin appears to have only received a small amount of trash and debris. The insert was removed and subsequently transported to the UCLA laboratory for testing.

Site : FL-004-F **Location:** 15th and Myrtle St. (Area 1 - Site K)		Flo-Gard Plus
		Date inspected: 10/21/04 **Comments:** The insert at this site was removed by the City and replaced with one of their complete capture devices.
		Date inspected: 03/22/05 **Comments:** After this visit, this insert was taken to the laboratory for its final tests.

Site : FL-004-F **Location:** 15th and Myrtle St. (Area 1 - Site K)	Flo-Gard Plus

Area 2 - Site L



Looking upstream (east)

Intersection	6th St. & Mateo St.
No. of Installations	2

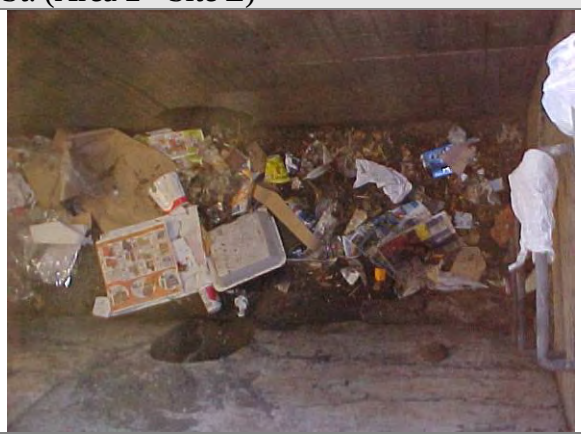
Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-011-D	DrainPac	386309	3766893	7	2.2 (bottom) 4.6 (top)	6.7
CC-011-F	Flogard+Plus	386226	3767081	7	2.8	5.9

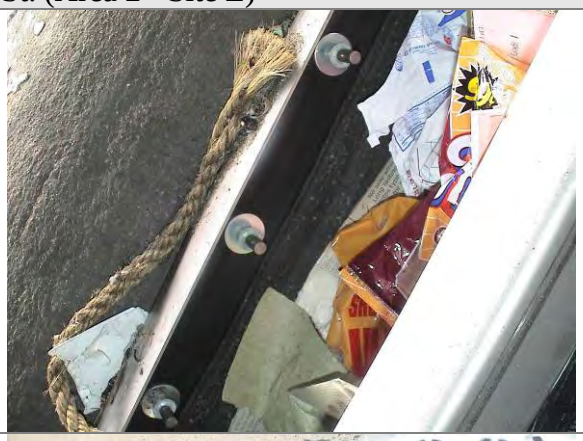
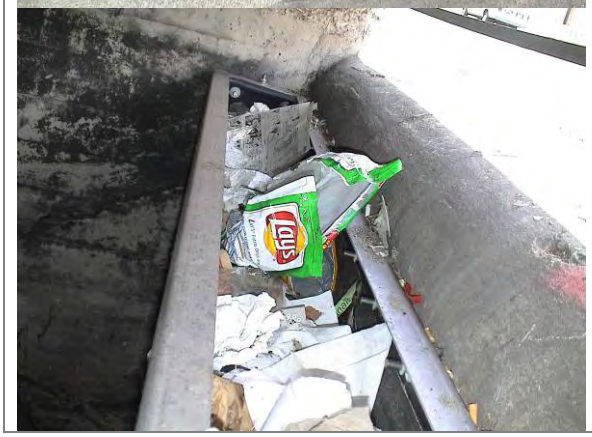
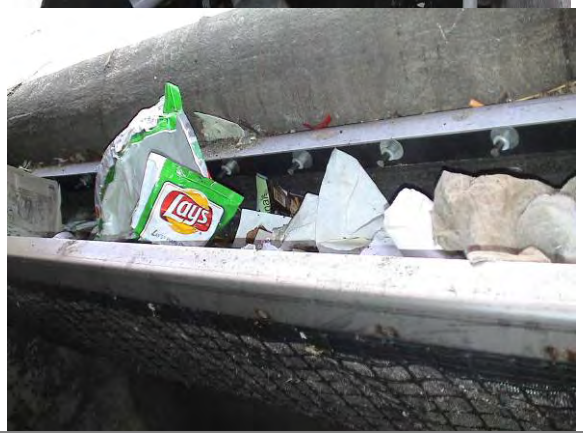
Site : CC-011-D **Location:** 6th and Mateo St. (Area 2 - Site L)

DrainPac

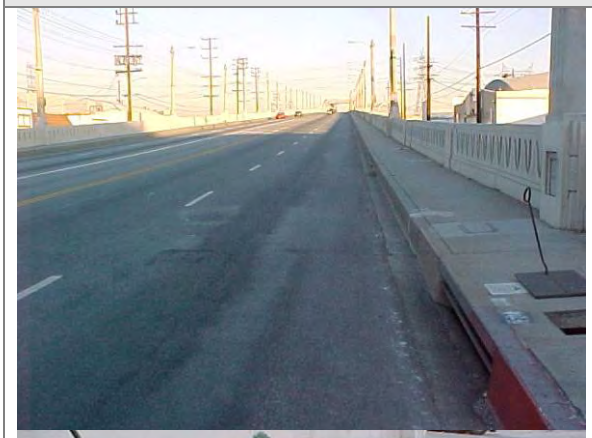
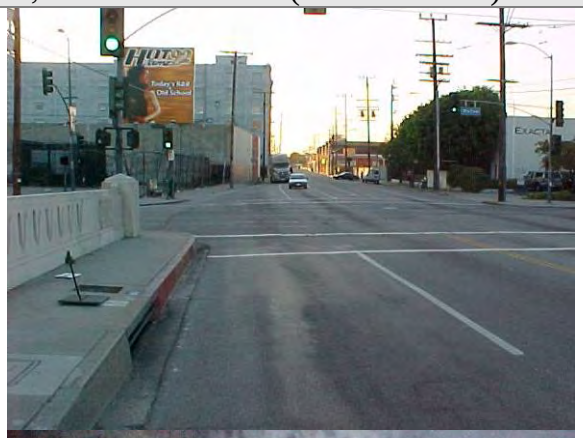
Date inspected:
10/24/03

Comments: Initial site visit. Top two photos are looking upstream; Middle left is looking downstream. Note all runoff to this site is roadway runoff.

Site : CC-011-D **Location:** 6th and Mateo St. (Area 2 - Site L)		DrainPac
		
		Date inspected: 2/4/04 **Comments:** This was the first site visit after installation. Some trash was present, but not nearly at capacity.
		Date inspected: 3/23/04 **Comments:** Significant trash and debris captured in the insert since last visit. Appears to be at capacity and should be cleaned before the next wet season.

Site : CC-011-D **Location:** 6th and Mateo St. (Area 2 - Site L)	DrainPac
  	**Date inspected:** 6/30/04 **Comments:** More trash and debris have accumulated in this insert. It probably should be retired during the next site visit.

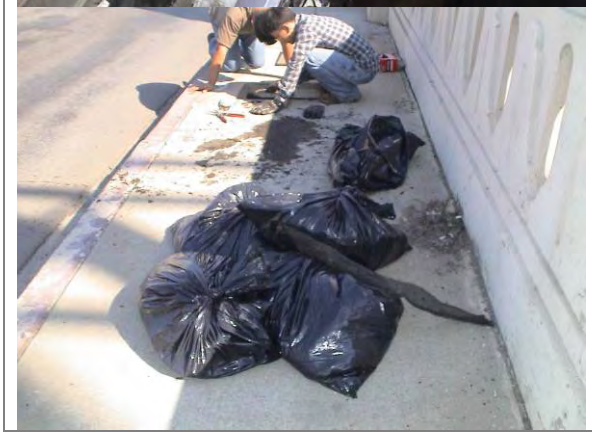
Site : CC-011-D **Location:** 6th and Mateo St. (Area 2 - Site L)	DrainPac

Site : CC-011-F **Location:** 6th and Mateo St., South East Corner (Area 2 - Site L)	FloGard
 	**Date inspected:** 10/24/03 **Comments:** Initial site visit. Top two photos are looking upstream; Middle left is looking downstream. All runoff to this site is roadway runoff. Notice the amount of trash deposited in the catch basin is much less than the catch basin across the street.

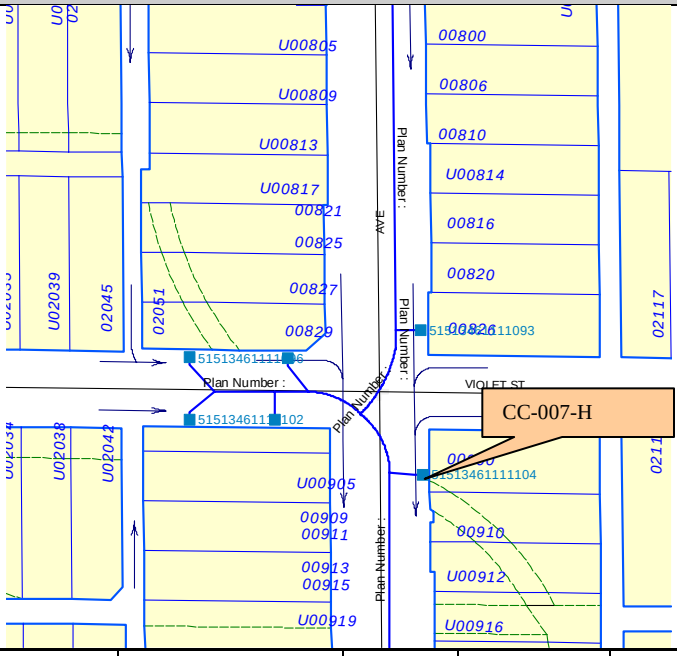
Site : CC-011-F **Location:** 6th and Mateo St., South East Corner (Area 2 - Site L)	FloGard
	Date inspected: 2/4/04 **Comments:** This was the first site visit after installation and one storm event.
	Date inspected: 3/23/04 **Comments:** Notice the upstream insert has collected significantly more trash and debris than the downstream insert, indicating that runoff is the primary transport mechanism. However, wind transport appears to also contribute significantly.

Site : CC-011-F **Location:** 6th and Mateo St., South East Corner (Area 2 - Site L)	FloGard
	Date inspected: 6/30/04 **Comments:** Since the last visit, not much additional trash and debris have accumulated in the insert. Nonetheless, it is nearly at capacity and should be retired.
	Date inspected: 10/22/04 **Comments:** As compared to the last visit, this insert appears to have been cleaned, but still a significant amount of debris had been captured.

Site : CC-011-F **Location:** 6th and Mateo St., South East Corner (Area 2 - Site L)	FloGard



Area 2 - Site M



Looking toward intersection from Santa Fe (looking North)

Intersection	Santa Fe & Violet SE
No. of Installations	1

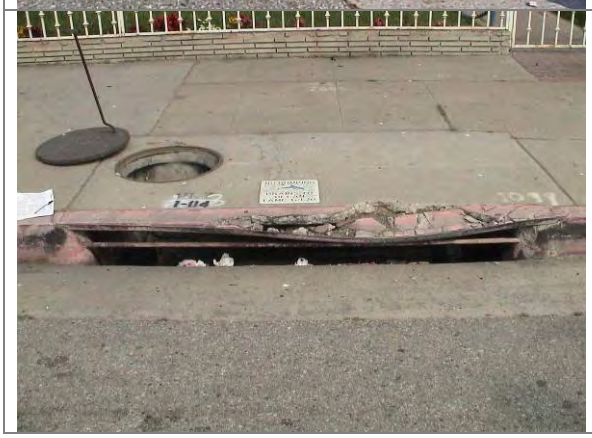
Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-007-H	Hydro-Kleen	386536	3766241	7.0	3.0	4.0

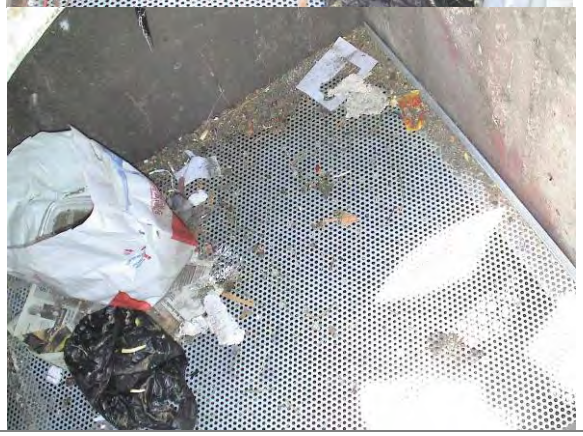
Site : CC-007-H **Location:** Santa Fe and Violet, South East Corner (Area 2 - Site M)

HydroKleen

Date inspected:
10/21/03

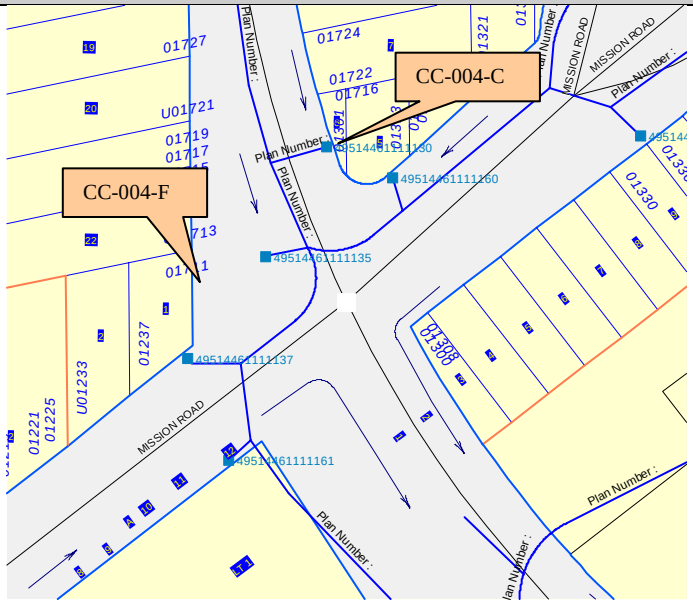
Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream. Notice the damage to the 7' curb inlet.

Site : CC-007-H **Location:** Santa Fe and Violet, South East Corner (Area 2 - Site M)		HydroKleen
		Date inspected: 2/4/04 **Comments:** Two devices were placed in this catch basin to accommodate the larger opening. It appears runoff is reaching both inserts, but the floatable debris is accumulating more on the upstream end (top left photo).
		**Date inspected:** 3/23/04 **Comments**: Evidence of by-pass shown by plastic bag hanging over the top of the insert.

Site : CC-007-H **Location:** Santa Fe and Violet, South East Corner (Area 2 - Site M)	HydroKleen
	**Date inspected:** 6/30/04 **Comments**: Without our knowledge, the insert has been removed and replaced with this trash screening device by the City. Wing Tam is trying to locate our insert so that we can take it to the UCLA laboratory for its final analysis.

Site : CC-007-H **Location:** Santa Fe and Violet, South East Corner (Area 2 - Site M)	HydroKleen

Area 2 - Site N



Looking across street from 004-C (southeast)

Intersection	Mission Rd. & Griffin Ave.
No. of Installations	2

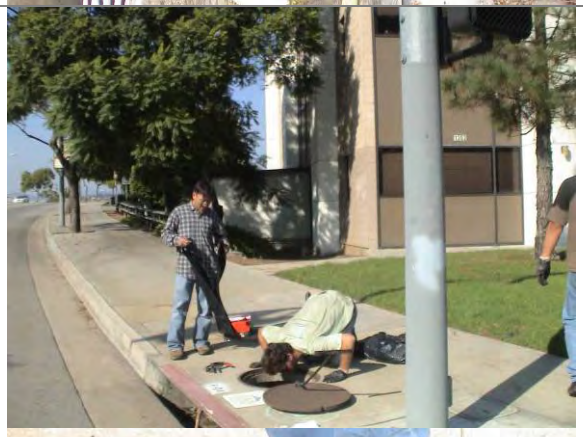
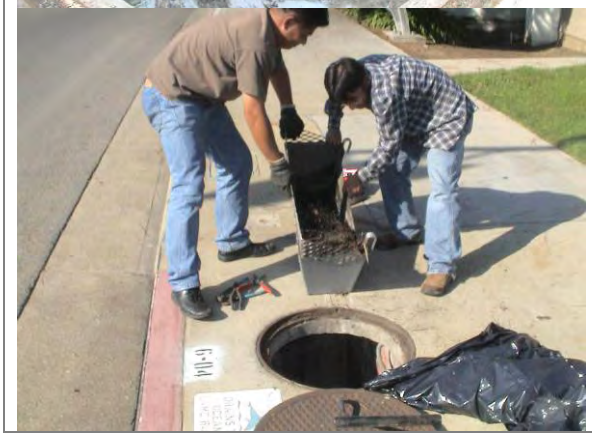
Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-004-C	Curb Inlet Basket	388302	3769613	7	3.1	3.3
CC-004-F	Flogard+Plus	388208	3769792	7	3.1	5

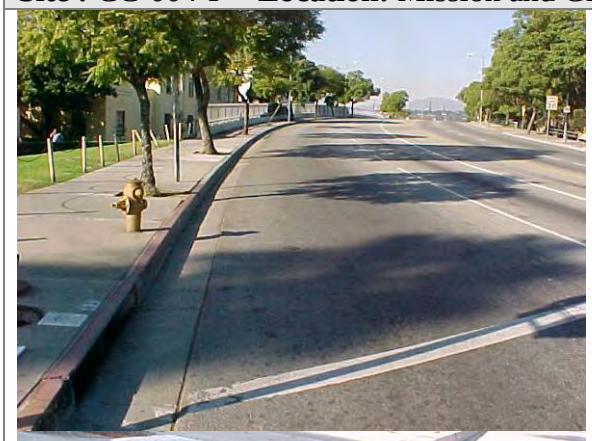
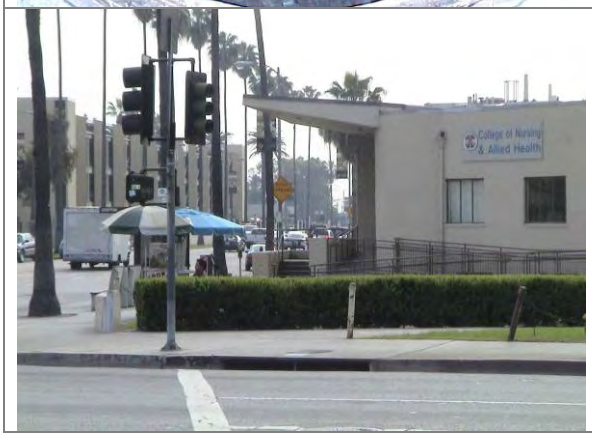
Site : CC-004-C **Location:** Mission and Griffin Ave., NE Corner | Curb-Inlet Basket

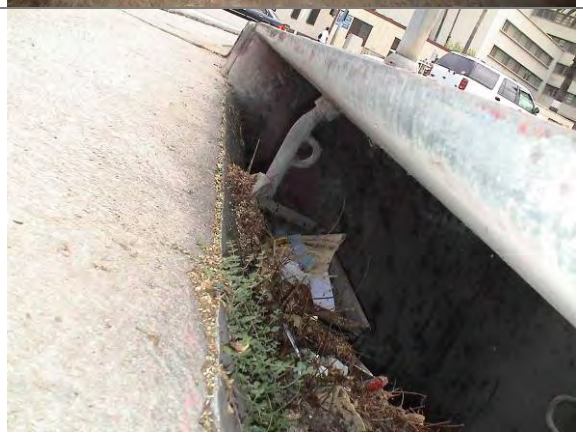
Date inspected:
10/20/03

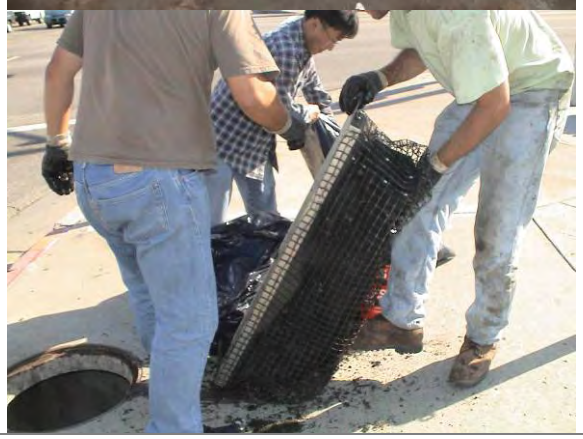
Comments: Initial site visit. Top left photo is looking upstream; top right is looking downstream.

Site : CC-004-C **Location:** Mission and Griffin Ave., NE Corner		Curb-Inlet Basket
		Date inspected: 2/4/04 **Comments:** This visit was shortly after installation.
		Date inspected: 3-23-04 **Comments:** Sediment and pine needle debris have completely filled this insert. However, there is no evidence of clogging or significant bypass.

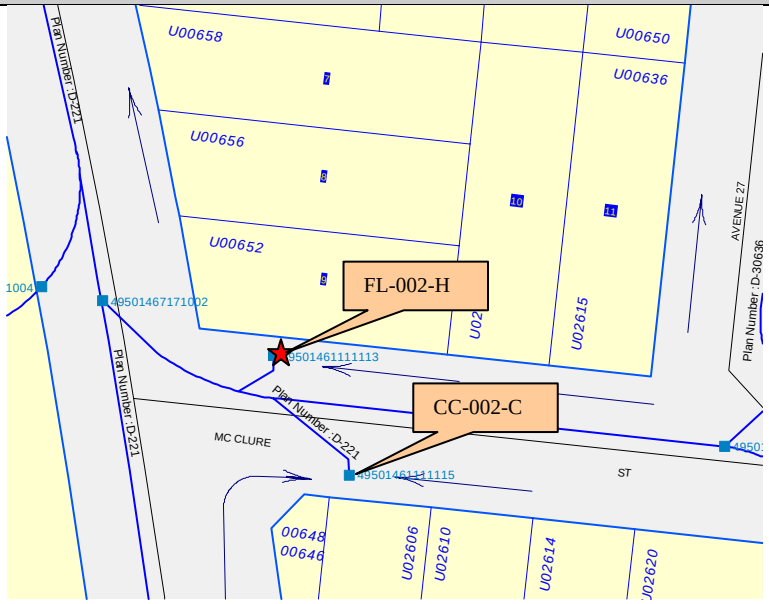
Site : CC-004-C **Location:** Mission and Griffin Ave., NE Corner	Curb-Inlet Basket
	Date inspected: 6/30/04 **Comments:** This insert has recently been cleaned. Notice the absorbent boom is no longer present; probably due to vactor truck.
 	**Date inspected:** 10/22/04 **Comments:** This insert appears to have been recently cleaned and the absorbent boom removed.

Site : CC-004-F **Location:** Mission and Griffin Ave., NW Corner	Flo-Gard
	**Date inspected:** 10/20/03 **Comments:** Initial site visit. Top left photo is looking upstream; top right is looking downstream. There was about 1 garbage bag of trash present in the bottom of the catch basin during this visit. Notice the location of this catch basin is on the edge of the road, not in the middle as shown in the location map above.
	**Date inspected:** 2/4/04 **Comments:** This visit was shortly after installation. The installation consists of two Flo-Gard Plus inserts side-by-side to cover the entire 7' curb opening.

Site : CC-004-F **Location:** Mission and Griffin Ave., NW Corner	Flo-Gard
	Date inspected: 3/23/04 **Comments:** As with the one across the street, this insert is filled with pine needles almost to capacity, but notice only the upstream insert is at capacity.
	**Date inspected:** 6/30/04 **Comments:** Similar to the one across the street, this insert was recently cleaned as indicated by the month and year painted on the curb. However, both installations are at full capacity indicating the insert was not actually cleaned.

Site : CC-004-F **Location:** Mission and Griffin Ave., NW Corner	Flo-Gard
	**Date inspected:** 10/22/04 **Comments:** The upstream insert was at capacity during this visit and the downstream insert about half full. The insert was removed and the contents extracted for laboratory sieve analysis.

Area 2 - Site O

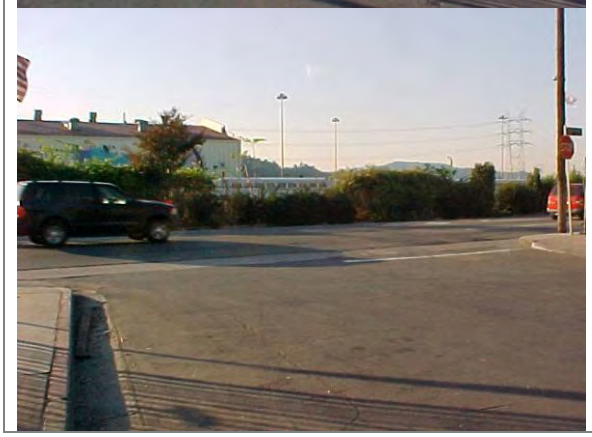


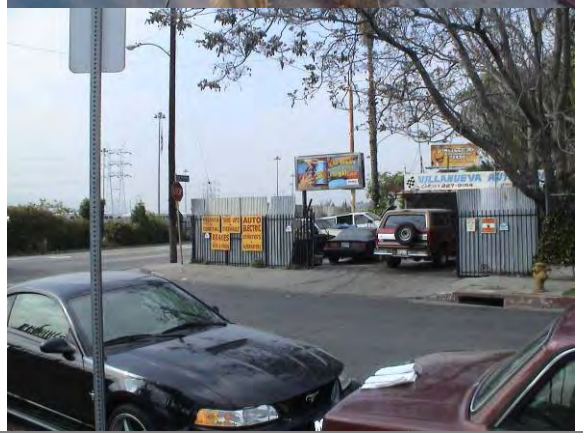
Looking upstream from 002-H (east)

Intersection	Mc Clure St. & San Fernando Rd.
No. of Installations	2

Inlet Number	Technology Type	Easting	Northing	Measurements (see Figure 2)		
				A-Curb Opening	B-Drain inside width	C-Drain inside depth
CC-002-C	Curb Inlet Basket	386929	3772531	3.4	3.2	3.4
FL-002-H	Hydro-Kleen	387010	3772343	3.7	3.2	3.3

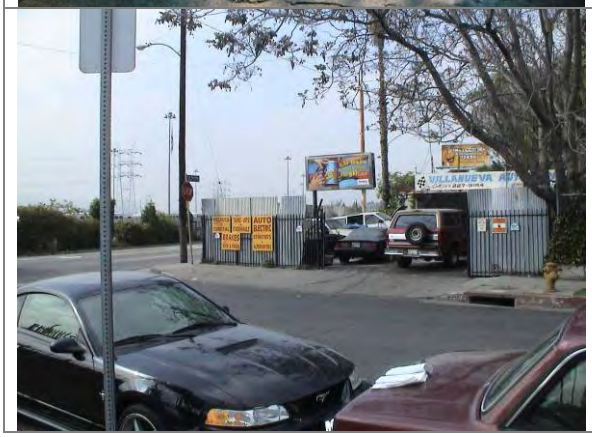
Site : CC-002-C **Location:** McClure and San Fernando Rd., S Corner | Curb-Inlet Basket



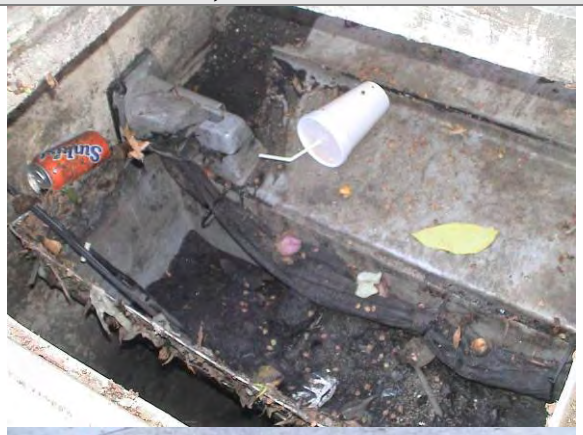


Date inspected:
12/11/03

Comments:
Initial site visit. Top photos are looking upgradient. Auto repair shop across the street; appears to be parking customer's vehicles on street in front off catch basin.

Site : CC-002-C **Location:** McClure and San Fernando Rd., S Corner	Curb-Inlet Basket
	Date inspected: 2/4/04 **Comments:** This site has high sediment and O&G loads. Oil was flowing in the gutter and into this insert during the visit. The picture on the right was taken a few days after installation.
	**Date inspected:** 3/23/04 **Comments:** This insert at this site has collected a lot of sediment and oily residue appears on the absorbent boom and the captured sediment.

Site : CC-002-C **Location:** McClure and San Fernando Rd., S Corner	Curb-Inlet Basket
	Date inspected: 6/03/04 **Comments:** This insert has recently been cleaned by the LADPW staff. Notice the absorbent boom is no longer present. The media may have been sucked out with a vactor truck.
	Date inspected: 10/22/04 **Comments:** This insert was retired after this visit.

Site : CC-002-C **Location:** McClure and San Fernando Rd., S Corner	Curb-Inlet Basket
	

Site : FL-002-H **Location:** McClure and San Fernando Rd., N Corner	Hydro Kleen
	Date inspected: 10/23/03 **Comments:** Initial site visit. Notice the large amount of leaf matter collected in the catch basin. A car repair shop is located next to this site. Top right picture is looking upstream; top bottom picture. Note that this site was originally a CC site, but was changed to an FL site due to installation timing conflicts.

Site : FL-002-H **Location:** McClure and San Fernando Rd., N Corner	Hydro Kleen
	Date inspected: 2/4/04 **Comments:** First site visit after installation and a single storm event. The insert was installed backwards with the filtration chamber before the sedimentation chamber. The media was placed in the sedimentation chamber, which caused it to float out of the chamber during storm flows. This device was removed from this location during this visit.

APPENDIX C- LABORATORY ANALYTICAL METHODS

C.1 Oil and Grease Analysis

Oil and grease was measured using a solid phase extraction (SPE) technique developed earlier by the authors (Lau and Stenstrom, 1997). This technique uses a known volume of sample (generally 500 ml or 1000 ml for this study) which is pumped through an SPE column at a constant but low rate (e.g., 5 ml/min). The oil and grease in the sample is sorbed on the SPE column. After the sample is pumped through the column, it is eluted with a small volume of solvent (5 ml): methylene chloride and hexane. The sample bottle is also washed with a small volume of solvent (isopropanol). The two solvent volumes are combined and placed in a tarred container. The solvents are allowed to dry at 50°C using a gentle nitrogen purge. The residue is weighed. The results are reported as mg/L based upon the original sample volume. This method is not yet a standard method, but is being developed by the US EPA and others as a standard method. It has the advantages of higher recovery, especially for the more volatile components in oil and grease, and using less solvent (the solvents used for traditional oil and grease analyses are usually flammable, toxic and either green house gases or ozone depleting gases). By using different sample volumes is it possible to have low detection limits, and the limit with 500-ml sample volume is typically 0.25 mg/L. This method does not quantitatively measure oil and grease adsorbed to solids, and an alternate technique must be used for particle-bound oil and grease. However, this is not important for this study because no particles were added to the tap water when testing for oil and grease removal.

C.2 Metal Digestion

Samples for metals analysis were prepared by digesting ~ 0.4 grams of used motor oil in 10 ml concentrated nitric acid for 25 minutes using a microwave unit (CEM Corp., Mathews, NC). This is a modified method from SW Method 3051A (US EPA, 1999). Due to the build-up of high pressure from heated motor oil, a specialized digestion vessel, OMNI™, was used for this purpose. The sample initially was heated to 200°C (in 15 min.) and hold at 200°C for 10 min. After cooling, the digested samples were filtered, diluted to 50 ml and analyzed using a using an inductively coupled plasma-mass spectrophotometer (ICP-MS). Appropriate blanks and standards were used to insure quality control.

FloGard Catch Basin Insert Filter

Inlet Filtration

Removes pollutants from runoff prior to entering waterways

Efficient
catches pollutants where they are easiest to catch, at the inlet.

Variable Design
applications with the ability to be retrofitted or used in new projects.

Treatment Train
can be incorporated as part of a "Treatment Train".

No Standing Water
helps to minimize vector, bacteria and odor problems.

Focused Treatment
removes petroleum hydro-carbons, trash, and TSS.

Maximum Flexibility
available in a variety of standard sizes to fit round and square inlets.

Economical
Receive a higher return on investment.

Two-part insert to filter solids and oil/grease

Easy to install, inspect and maintain, even on small and confined sites

By the Numbers*:

- Filter shall remove 80% of total suspended solids (TSS)
- Capture at least 70% of oil and grease and 40% of total phosphorus (TP) associated with organic debris.

**approx. for urban street application*

Catch Basin Filter Test Results Summary

Testing Agency	% TSS Removal	% Oil & Grease Removal	% PAH Removal
UCLA	80	70 to 80	
U of Auckland Tonking & Taylor, Ltd. (for City of Auckland)	78 to 95		
U of Hawaii (for city of Honolulu)	80		20 to 40

Oldcastle Stormwater Solutions™

INLET FILTRATION

Multipurpose Catch Basin Insert designed to capture sediment, debris, trash & oils/grease from low (first flush) flows, even during the most extreme weather conditions.

The FloGard® Catch Basin Insert Filters provide solids filtration through a filter screen of filter liner, and hydrocarbon capture shall be effected using a non-leaching absorbent material contained in a pouch or similar removable restraint. They are recommended for areas subject to silt and debris as well as low-to-moderate levels of petroleum hydrocarbons (oils and grease). Examples of such areas are vehicle parking lots, aircraft ramps, truck and bus storage yards, business parks, residential and public streets.

Catch Basin Filter Competitive Feature Comparison

Evaluation of Catch Basin Filters (Based on flow-comparable units) (Scale 1-10)	Oldcastle Stormwater	Other Insert Filter Types**
Flow Rate	10	7
Removal Efficiency*	80%	45%
Capacity - Sludge & Oil	7	7
Service Life	10	3
Installation - Ease of Handling / Installation	8	6
Ease of Inspections & Maintenance	7	7
Value	**10**	**2**

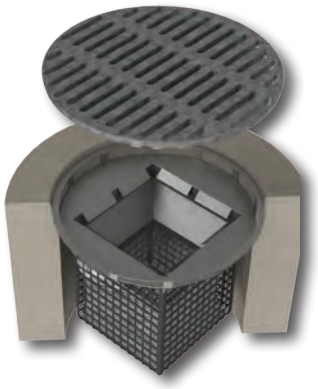
*approximate, based on field sediment removal testing in urban street application **average

Long-Term Value Comparison (Based on flow-comparable units) (Scale 1-10)	Oldcastle Stormwater	Other Insert Filter Types
Unit Value - Initial ($/cfs treated)	10	4
Installation Value ($/cfs treated)	10	7
Absorbant replacement (annual avg ($/cfs treated)	10	2
Materials replacement Value (annual avg ($/cfs treated)	10	10
Maintenance Value (annual avg ($/cfs treated)	10	7
Total first yr ROI ($/cfs treated)	10	5
Total Annual Avg Value ($/cfs treated, avg over 20 yrs)*	**10**	**5**

Captured debris from the Catch Basin Filter, Dana Point, CA

Combination Inlet

Flat Grated Inlet



Circular Frame Catch Basin

Grate Inlet Skimmer Box/Round Curb Inlet Basket - Removal Efficiencies

Numeric Reductions (mg/L)

	Total Suspended Solids mg/L			Total Phosphorus mg/L			Total Nitrogen mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
Site Evaluation - Reedy Creek			74%			57%	24.3	10.4	57%
Creech Engineering Report			73%			79%			79%
Witman's Pond	978	329	66%	18.6	0.452	98%	48.08	9.86	79%
Universal Engineering - 2007 (100 Microns) LATEST REPORT			86%						

	Zinc mg/L			Lead mg/L			Copper mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
UC Irvine						99%			
Longo Toyota	13.7	0.73	95%	1.5	0.2	87%	1.9	0.1	95%

	Ammonia, Salicylate mg/L			Fecal Coliform CFU/100 mL			Cadmium		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
Site Evaluation - Reedy Creek	0.38	0.23	39%						
UC Irvine						33%			94%

	Hydrocarbons mg/L		
Location	Inlet	Outlet	Removal Efficiency
UC Irvine			90%
Longo Toyota	199	10.43	95%

Reedy Creek - Site Evaluation of a Grate Inlet Skimmer Box for Debris, Sediment, and Oil & Grease Removal - 1999 - Independent Test

Creech Engineering Report - Pollutant Removal Testing for a Grate Inlet Skimmer Box - 2001

Witman's Pond - Restoration Project - Massachusetts Dept of Environmental Management - 1998 - Independent Test

UC Irvine - Optimization of Stormwater Filtration at the Urban/Watershed Interface - Dept of Environmental Health - 2005 - Independent Test

Longo Toyota - Field Test - City of El Monte - 2002 - Independent Test

Universal Engineering Sciences - Suspended Soils Retention Study - 2007 - Independent Test

Appendix C

Machado Lake Work Plan

City of Torrance, California

MACHADO LAKE NUTRIENT TOTAL MAXIMUM DAILY LOAD

SPECIAL STUDY WORK PLAN

May 18, 2011

3031 Torrance Boulevard • Torrance, California 90503 • Phone: 310.618.5880 • Fax: 310.618.5891

City of Torrance, California

MACHADO LAKE
NUTRIENT TOTAL MAXIMUM DAILY LOAD

SPECIAL STUDY WORK PLAN

May 18, 2011

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SPECIAL STUDY WORK PLAN

1.0 INTRODUCTION

This Field Sampling Plan (FSP) presents the approach and procedures to implement stormwater sampling activities in 2011 for a Special Study of the City of Torrance (City) storm drains discharging stormwater into Machado Lake. The field study sampling procedures, methods, and analyses for stormwater are described in this document.

1.1 Background

The City is subject to the requirements of the Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) Total Maximum Daily Load (TMDL) per the Los Angeles Regional Quality Control Board's (Regional Board's) Resolution R08-006. Under the Regional Board's resolution, the City shall submit to the Regional Board's Executive Officer a Monitoring and Reporting Plan (MRP) within 1 year of the effective date of the resolution or propose a Special Study Work Plan following the requirements of one of three optional studies. This Special Study Work Plan details the approach proposed by the City to perform Optional Study No. 3, to assess compliance with the Waste Load Allocations (WLA) on a mass basis for total nitrogen and total phosphorus originating from the City's watersheds. The Special Study Work Plan proposes a pre-Best Management Practices (BMP) Implementation Study including field sampling and data collection to be followed by submittals to the Regional Board including a BMP Evaluation and Selection Report, a MRP, and a BMP Implementation Report to be provided at a later date.

Machado Lake is identified on the 1998 and 2002 Clean Water Act 300(d) list of impaired water bodies as impaired due to eutrophic conditions, algae, ammonia, and odors. Resource agencies, local governments, project implementers, the scientific community, environmental groups, decision-makers at the city, county, state, and federal levels, and many others have continued to take meaningful steps towards the restoration of Machado Lake and its basin. Among these efforts, restoration activities are expanding through continued implementation of erosion control, stormwater management, and riparian restoration projects, development of the Machado Lake Nutrient TMDL that is providing a quantitative, science-based approach for pollutant reduction, and a strong research/monitoring effort to evaluate key ecological processes and response to water quality improvement projects.

The Machado Lake Nutrient TMDL allows for the establishment of annual mass-based WLAs for total phosphorus (TP) and total nitrogen (TN) equivalent to monthly average concentrations of 0.1 mg/L TP and 1.0 mg/L TN, based on approved flow conditions. When the concentration based WLAs are met under the approved flow condition of 8.45 hm3, the annual mass of the TP discharged to the lake will be 845 kg and the annual mass of TN discharged to the lake will be 8,450 kg. The City of Torrance mass-based WLA will be proportional to the City owned area in the sub-watershed. The City of Torrance area

accounts for 35.6% of the Machado Lake Watershed. Table 1 lists the interim and final WLAs based on this area.

Table 1 Waste Load Allocations

Responsible Party	Years after TMDL Effective Date	TP (kg)	TN (kg)
City of Torrance	5	3,760	7,370
	9.5 (final WLAs)	301	3,008

1.2 Site Conditions and Characteristics

1.2.1 Study Site Location

The City is located about 15 miles south of Downtown Los Angeles (LA), in southern LA County, just north of the Palos Verdes Hills. The City was incorporated on May 12, 1921, and is just over 20.5 square miles in area. The City is bounded by Redondo Beach on the west and north, Lawndale and Gardena on the north, LA on the east, Lomita to the southeast, and Rolling Hills Estates and Palos Verdes Estates on the south. The City is also bounded by approximately 4,000 feet of Santa Monica Bay coastline. The City's storm conveyance systems are interconnected with neighboring city systems. Neighboring cities located at generally higher elevation such as Rolling Hills Estate and Palos Verde Estate discharge stormwater into the City's and/or LA County's storm conveyance systems located within the City's boundaries. Figure 1 shows a regional location map of the City.

1.2.2 Hydrology and Hydraulics

The Machado Lake subwatershed is located in the southwestern area of the Dominguez Watershed and includes portions of the Cities of Los Angeles, Torrance, Lomita, Rolling Hills, Rolling Hills Estates, Carson, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, and the communities of unincorporated Los Angeles County, including Wilmington and Harbor City. However, much of the Machado Lake watershed consists of the hilly regions of Rolling Hills Estates and Rolling Hills. This portion of the watershed is unique, as it consists of relatively steep hills with drainage into the canyons. The Machado Lake Watershed covers an area of approximately 20 square miles and is itself divided into six primary subdrainage areas. These subdrainages are the Walteria Lake, Project 77/510, Wilmington Drain, Project 643 (72-inch Storm Drain), Project 643 (Figueroa Drain), and Private Drain 553.

Machado Lake, about 40 acres in area and the Machado Lake Wetlands (64 acres) are located within the Ken Malloy Harbor Regional Park in the southeastern corner of the Machado Lake Watershed. Both Machado Lake and the Machado Lake wetlands serve as flood retention basins for the Machado Lake Watershed.

1.2.2.1 Storm Drain

As the area is highly urbanized, drainage is primarily conducted through an extensive network of underground storm drain facilities. The Los Angeles County Department of Public Works maintains the system of storm drains in the City of Rolling Hills Estates. The primary use of the Dominguez Channel and all other open channels in the Dominguez Watershed (including Wilmington Drain, Machado Lake, and Madrona Marsh) is flood protection.

Machado Lake receives urban and storm water runoff from a complex network of storm drain systems. The first of three primary storm drain channels that flow into Machado Lake is the Wilmington Drain. Approximately 65 percent of the runoff from the Machado Lake Watershed flows through the Wilmington Drain into Machado Lake. The other two primary storm drain channels are the Project No. 77 Drain and the Harbor City Relief Drain. Several smaller storm drains also discharges into Machado Lake, including Project No. 643's Figueroa Street Outlet and a 72-inch storm drain outlet. Machado Lake discharges at the southern end by overflowing a concrete dam into the Machado Lake wetland. Water discharges from the wetland through the Harbor Outflow structure and into the West Basin of the Los Angeles Harbor.

The Walteria Lake, located within the City's boundaries, is owned and operated by LA County. It is approximately 1,005 acre-feet in capacity and receives raw stormwater mainly from Rolling Hills Estates and Palos Verdes Estates. Effluent from the lake is pumped at a maximum rate of 57 cubic feet per second (cfs) through a force main system into a 54-inch drain line that lies under Skypark Drive. The discharge eventually leaves the City near the intersection of Crenshaw Boulevard and Amsler Street.

Figure 2 shows the drainage basins and stormwater conveyance infrastructure in the City. The figure also shows nearby communities discharging stormwater into the City's drainage system.

1.2.3 Land Use

The City of Torrance is predominantly residential land use, with concentrations of industrial and commercial uses. This reflects the City's history as a "company town," where homes were built to house the local work force of industries. Residential development covered almost half of the City's land area. Industrial uses occupied the second largest land area, at 22 percent. Commercial and Public/Quasi-Public/Open Space uses represent the third largest land uses in the City, about 12 percent each. Torrance also had a limited supply of vacant land mostly within commercial and industrial areas. Given the built-out character of the community, only minor land use changes from baseline year 2010 conditions will occur over the long term.

Residential uses are located throughout Torrance at varying development densities. The highest residential densities occur along major streets and near major transportation corridors, in older neighborhoods, and in apartment or condominium developments and Planned Development communities around Sepulveda Boulevard and Plaza Del Amo between Hawthorne and Crenshaw Boulevards. The lowest residential densities are largely

located in the western and southern portions of the City. Figure 3 identifies the land uses in Torrance.

1.2.4 Water Quality Issues

Machado Lake, located in the Dominguez Channel watershed in southern LA County, is identified on the 1998 and 2002 Clean Water Act 303(d) list of impaired water bodies as impaired due to eutrophic conditions, algae, ammonia, and odors. The Machado Lake eutrophic, algae, and odor impairments are caused by excessive loading of nutrients, including nitrogen and phosphorus, to Machado Lake (Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Revised Draft – April 2008). Ammonia is found to be at levels below the toxicity standards, but nevertheless, these concentrations contribute to the total nitrogen loading in the Lake. Table 2 provides a summary of the quantifiable loads entering Machado Lake on an annual basis (Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Revised Draft – April 2008). Nutrient flux from the sediments and atmospheric nitrogen deposition are the two directly quantifiable non-point sources included as part of the total nutrient load. The total annual nitrogen and phosphorus loads are estimated to be 24,327 kg and 10,421 kg, respectively.

Machado Lake is located in the Ken Malloy Harbor Regional Park (KMHRP), which is a 231 acres LA City Park serving the Wilmington and Harbor City areas. As shown on Figure 4, the park is located west of the Harbor freeway (110) and east of Vermont Avenue between the Tosco Refinery on the south and the Pacific Coast Highway on the North. Machado Lake is one of the last lake and wetland systems in LA; the area is approximately 103.5 acres in total size. The upper portion, which includes the open water area, is approximately 40 acres and the lower wetland portion is about 63.5 acres. Machado Lake is a shallow polymictic lake; the depth is generally 0.5 to 1.5 meters; the *average* depth is approximately 1.0 meter. The lake was originally developed as part of Harbor Regional Park in 1971 and intended for boating and fishing. Over the years water quality generally declined; boating was stopped and signs were posted warning of the risk of eating fish from the lake.

Table 2 Total Annual Nutrient Load Entering Machado Lake[(1)]

Source	Total N (kg)	Total P (kg)	Ortho-P (kg)	Inorg-N (kg)
External Load	7,587	3,260	737	3,736
Sediment Flux	16,520	7,161	4,963	16,520
Atmospheric Deposition	220			
Total Annual Load	**24,327**	**10,421**	**5,700**	**20,256**

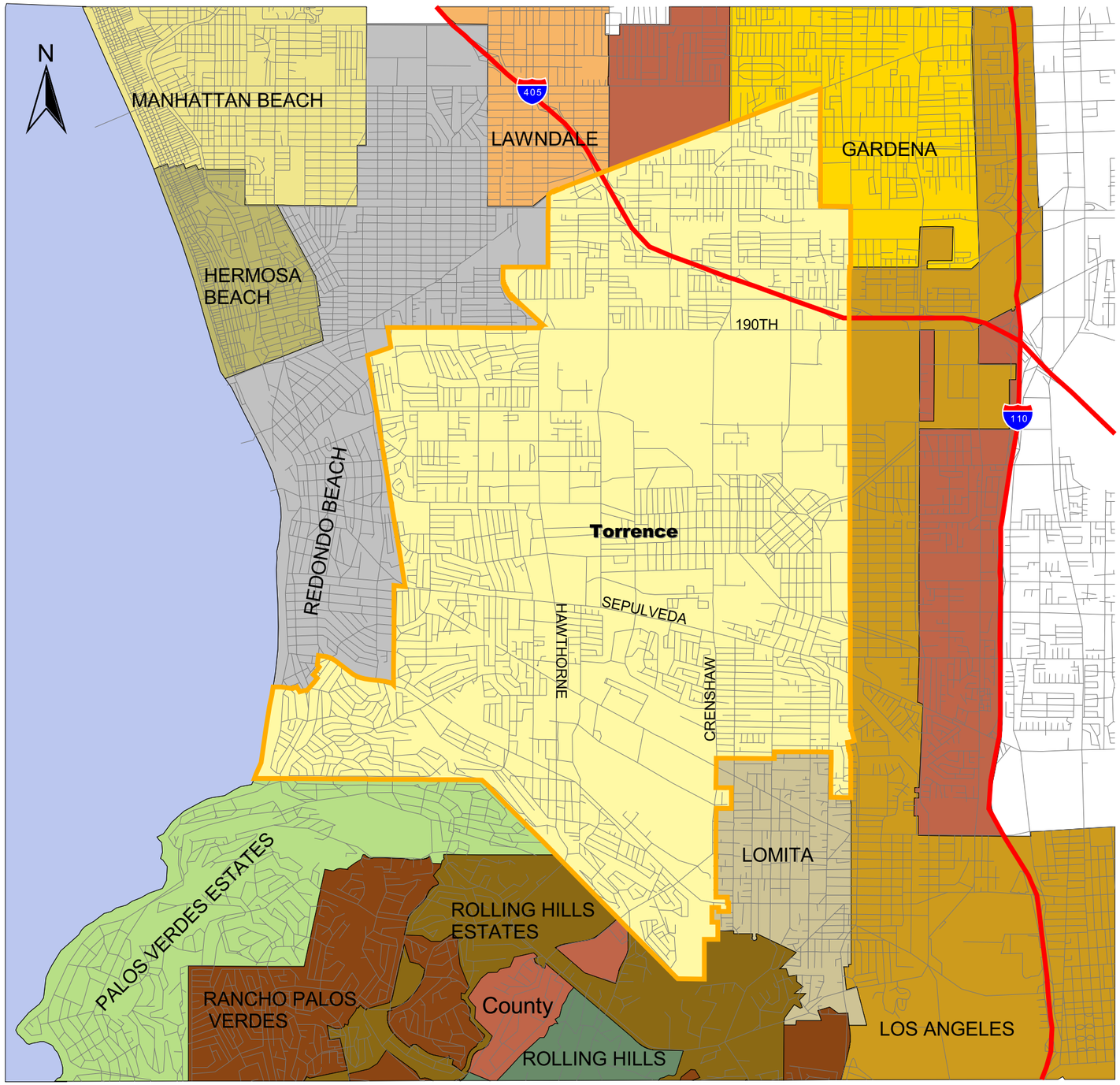
Notes:
1. Source: Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Revised Draft - April 2008.

The dominant land use in the Machado Lake Watershed is high-density single-family residential, accounting for approximately 45 percent of the land use. Industrial, vacant, retail/commercial, multi-family residential, transportation, and educational institutions each account for 5 to 7 percent of the land use, while "all other" accounts for the remaining 23

percent. Machado Lake is a receiving body of urban and stormwater runoff from a network of storm drains throughout the watershed. As indicated on Figure 4, there are three discharge points into Machado Lake from the following storm drain channels:

- Wilmington Drain.
- Project No. 77.
- Harbor City Relief Drain.

Approximately 88 percent of the Machado Lake Watershed drainage area flows through the Wilmington Drain into Machado Lake.



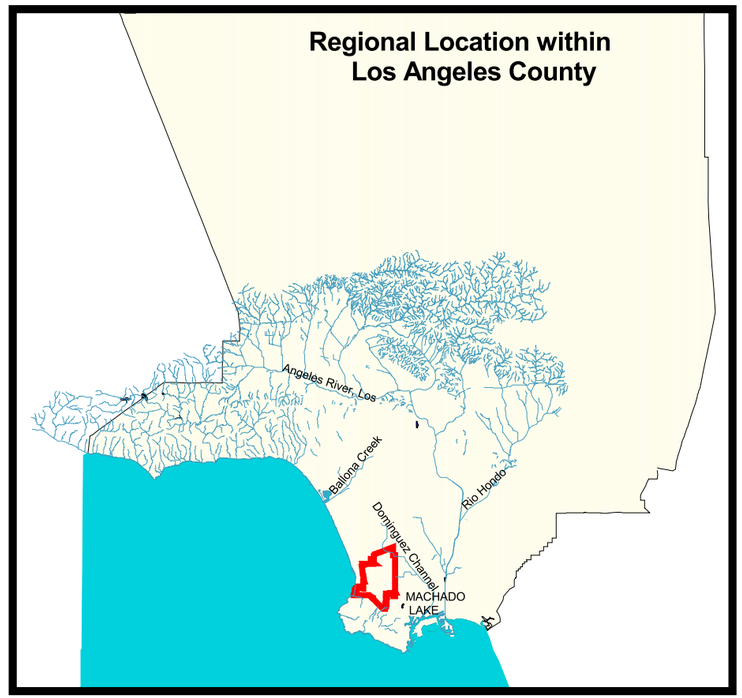


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Figure 1 Regional Map of Torrance

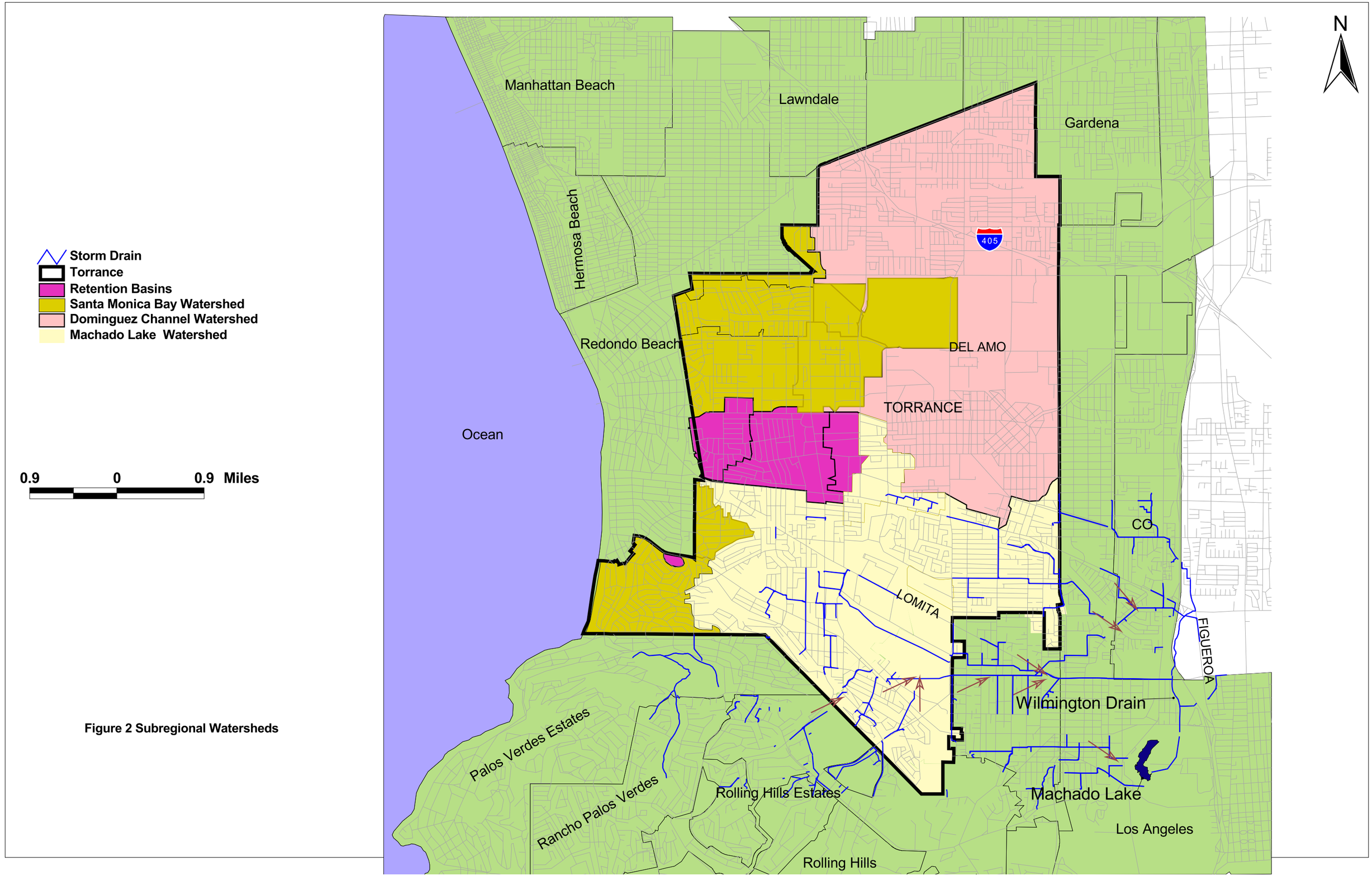


Figure 2 Subregional Watersheds

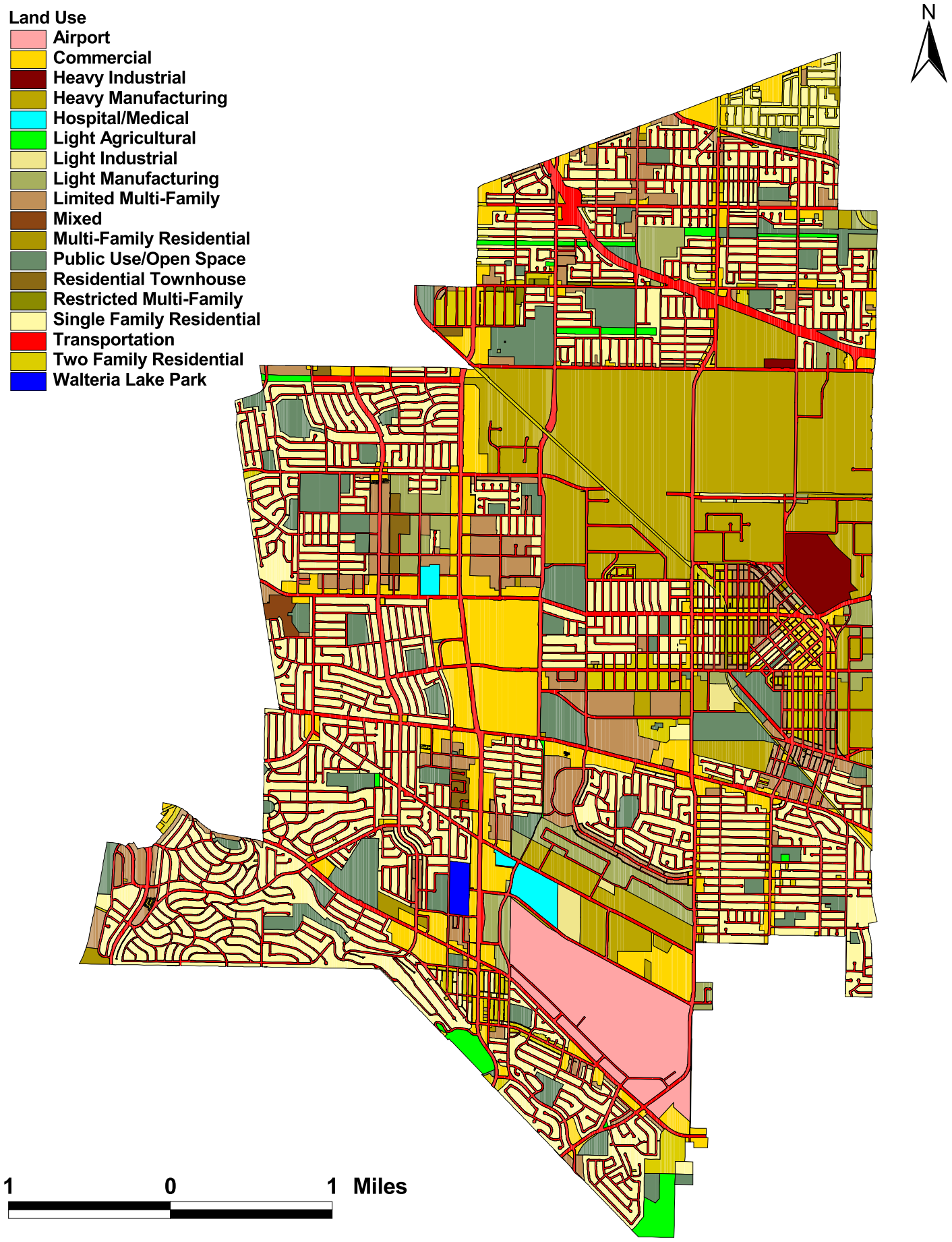


Figure 3 Existing Land Use of Torrance

Figure 4 2007 Satellite Imagery of Machado Lake and Ken Malloy Harbor Park Overview

1.3 Special Study Work Plan

This document provides the overall structure of the Special Study Work Plan with submittals to the Regional Board, as well as providing the initial Pre-BMP Implementation Study Plan (including a proposed field data collection and sampling plan). The Special Study Work Plan addresses the requirements of Optional Study No. 3 to assess compliance with WLAs for total nitrogen and total phosphorus originating from the City's watersheds. The scope of work for this plan includes the following:

- Pre-BMP Implementation Study Period - Including conducting dry weather sampling as outlined within this submittal as well as reviewing water quality models developed by LA County for wet weather events and Machado Lake.
- BMP Evaluation and Selection Study Report - This study report is to be submitted at a later date (see proposed schedule of work plan elements), and will summarize the collected field data and the applicable results obtained from the regional water quality model being developed by LA County for wet weather conditions. The field data and the water quality model data will be used to assess compliance with WLAs under the TMDL. Based on the assessment of compliance, the BMP and Selection Study Report will identify and screen structural BMPs for mitigation to bring the City into compliance with the TMDL.
- Monitoring and Reporting Plan - Subsequent to acceptance by the Regional Board of the findings and conclusions of the City's BMP Evaluation and Selection Study Report, the City will submit an MRP specific to the needs for assessment of future compliance with the TMDL.
- BMP Implementation Report - This report will summarize the monitoring data collected after 12 months of BMP implementation and will provide to the Regional Board an assessment of the success of the structural BMPs implemented by the City to support compliance with the TMDL.

The actual start date for the sampling will be determined following the Regional Board's approval of this Special Study Work Plan. Other conditions that may affect the sampling schedule are weather and equipment conditions and availability. The schedule for the work plan is summarized in Table 3.

The Special Study Work Plan identifies the proposed tasks the City agrees to perform, their timelines, and the roles and responsibilities of various parties in completing the work. The purpose of this document is to serve as a starting point for work planning discussions between the City and the Regional Board.

Table 3 Schedule or Work Plan Elements		
ID	**Work Plan Element**	**Schedule**
1	Special Study Work Plan	May, 2011 (submittal)
2	Regional Board Review/Approval	June, 2011 (approval)
3	Pre-BMP Implementation Study	July, 2011 – July, 2012 (field sampling)
4	BMP Evaluation, Monitoring and Reporting Plan	September, 2011 (submittal)
5	Regional Review/Approval	August, 2012 (approval)
6	BMP Implementation	Nov., 2012 (implementation)
7	BMP Implementation Report	Nov., 2013 (submittal)

2.0 PRE-BMP IMPLEMENTATION STUDY

2.1 Introduction

The Pre-BMP Implementation Study includes a 12-month FSP and evaluation of regional water quality models for wet weather conditions and Machado Lake to assess the City's current compliance with WLAs. The FSP covers sample collection methods, analytical procedures, data analysis and reporting, and health and safety aspects. The FSP will generate a variety of data including discharge rates and flow volumes, the concentrations of chemical parameters, and the measurement of physical parameters. Utilizing the mass balance approach, the data will be used to estimate the mass of nutrients originating from the City as well as nearby agencies discharging stormwater into the City's storm drain system. The data will also be examined for patterns and trends, comparing stormwater quality between different sampling locations over time.

The Pre-BMP Implementation Study will be undertaken once approval is obtained from the Regional Board for the Special Study Work Plan.

The remaining sections of this document contain the FSP providing field sampling methods and analytical procedures that will be used to collect dry weather water quality data and continuous flow data.

2.2 Objectives of the Pre-BMP Implementation Study

The Pre-BMP Implementation Study will provide the City data needed to assess water quality impacts to the City's drainage network. The objective of this study is to support the City's compliance with the Machado Lake Nutrient TMDL by performing Special Study No. 3. Data and information elements that are part of the Pre-BMP Implementation Study include:

1. Dry weather flow data including calculation of continuous volume data and water quality data obtained through field monitoring and sampling (data to be collected by implementing the FSP included within this document).

2. Estimates of wet weather stormwater quality impacts identified using an integrated water quality model developed by the City of Torrance. The water quality model is described in Section 2.2.1.
3. Identification of BMPs that will be implemented by the City to mitigate observed water quality impacts in the City's outflows to Machado Lake.

2.2.1 Pollutant Loading and Analysis Tool (PLAT)

In order to estimate wet weather stormwater quality impacts, the City has developed an integrated watershed modeling tool to simulate watershed hydrology, nutrient, sediment, and contaminant dynamics. This tool called Pollutant Loading and Analysis Tool (PLAT), incorporates existing and commonly used watershed models. The main models used by PLAT are PLOAD, Program for Predicting Polluting Particle Passage thru Pits, Puddles, and Ponds (P8), and U.S EPA SUSTAIN model. PLAT is based on spatially distributed inputs derived from high resolution satellite imagery. PLAT has four main components: pollutant hot-spots characterization, BMP screening, continuous simulation, and BMP design, optimization, and placement. The SUSTAIN model provides an optimization routine that helps identify the appropriate size of BMPs for treating stormwater runoff from respective source areas to meet TMDL reduction goals. The tool has been validated with results from the LA County Watershed Management Model System (WMMS).

3.0 FIELD SAMPLING PLAN

The 12-month FSP is designed to collect continuous flow data and discrete dry weather water quality data to support the overall study objectives summarized in Section 2.

3.1 Sampling Locations and Access

Site selection is a major challenge, given the scarcity of funding for sampling and laboratory analysis. The number of locations to be sampled was decided based on the program objectives, regulatory requirements, and the size and complexity of the drainage sub-basins and conveyance system. In addition, the frequency of sampling at each location was considered.

As a first step in the selection process, the City's watersheds, sub-basins and drainage system network were reviewed. Based on this review, nine locations were identified that could be used to characterize the flows in and out of each subbasin. Four of these locations are needed at a minimum to characterize the flows conveyed to Machado Lake. The final selection of sample locations was based on factors such as site permission, access, clustering, personal safety, equipment safety, and the likelihood that stormwater would flow at the location. Table 4 summarizes the proposed stormwater sampling locations, types, and characteristics. The general sampling locations are depicted on Figure 5. Appendix A shows detailed characteristics of each sampling location.

At a minimum, four sampling locations will meet the objectives of this program. However, the City will sample five additional locations, Tor-S3, Tor-S6, Tor-S7, Tor-S8, and Tor-S9 as shown on Figure 4 because the results will support critical decisions including identifying sources originating outside of the City's boundaries or sources not under the direct control of the City. The sampling locations Tor-S6, Tor-S7, Tor-S8, and Tor-S9 are discharge points for Rolling Hills and Palos Verdes Estates.

The sampling locations are described below.

Tor-S1

This site is located 40 ft north and 80 ft east of the intersection of Plaza Del Amo and Western Avenue. The total upstream drainage area is approximately 63 acres. The drainage area is mainly residential and commercial land use. Residential and commercial land uses represent 36 percent and 33 percent, respectively, of the drainage area. This site is easily accessible and safe for conducting sampling during both dry and wet weather conditions. The storm sewer conveying stormwater to this site is a 36-inch reinforced concrete pipe. This site is one of the four sites that will provide information on the amount of pollutants leaving the City limits.

Sampling Site: TOR-S1

Table 4 Sampling Location Characteristics

Sampling Location Name	Description	Land Use	GPS Coordinates	Associated Upstream Storm Drain Name	Diameter (in) and Material
Tor-S1	Located 40 ft north and 80 ft east of the intersection of Plaza Del Amo and Western Avenue. .	Residential/ commercial	33° 49.3572' 118° 18.5208'	City	36 RCP
Tor-S2	Approximately 50 ft west of 246th Place and Pennsylvania Avenue intersection.	Mixed	33°48.093' 118° 19.5252'	City	33 RCP
Tor-S3	Effluent of Walteria Lake, approximately 100 ft east of Madison St. and Skypark Drive intersection.	Mixed	33°48.6312 118° 20.8674'	Walteria Lake	54
Tor-S4	Approximately 210 ft north and 85 ft east of 236th Street and Western Avenue intersection.	Mostly residential	33° 48.7056' 118° 18.5196'	City	9'-2"Wx11'H RCB
Tor-S5	About 25 ft west of intersection of Bani Avenue and 250th Street (two pipes intersect from south and west).	Residential/ Airport	33° 47.8956' 118° 19.6872'	City	8'-9"Wx9'-7"H RCB
Tor-S6	Approximately 600 ft east of Estates Lane and Crenshaw Boulevard.	Mostly residential	33° 47.1822' 118° 20.43'	Rolling Hills Estates	36 RCP
Tor-S7	About 160 ft south and 280 ft east of Rolling Hills Road and Hawthorne Blvd. intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	Mostly residential	33° 47.6826 118° 20.9232'	Rolling Hills Estates	10'x10' RCB
Tor-S8	About 500 ft northwest of Paseo De Las Tortugas and Mesa St. intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	Mostly residential	33° 48.0522' 118° 21.4254'	Rolling Hills Estates	24 RCP
Tor-S9	About 830 ft east and 120 ft south of Paseo de las Tortugas and Vista Montana intersection. Will monitor dry weather flow originating from Palos Verdes Estates.	Mostly residential	33° 48.2742' 118° 21.7776'	Palos Verdes Estates	42 RCP

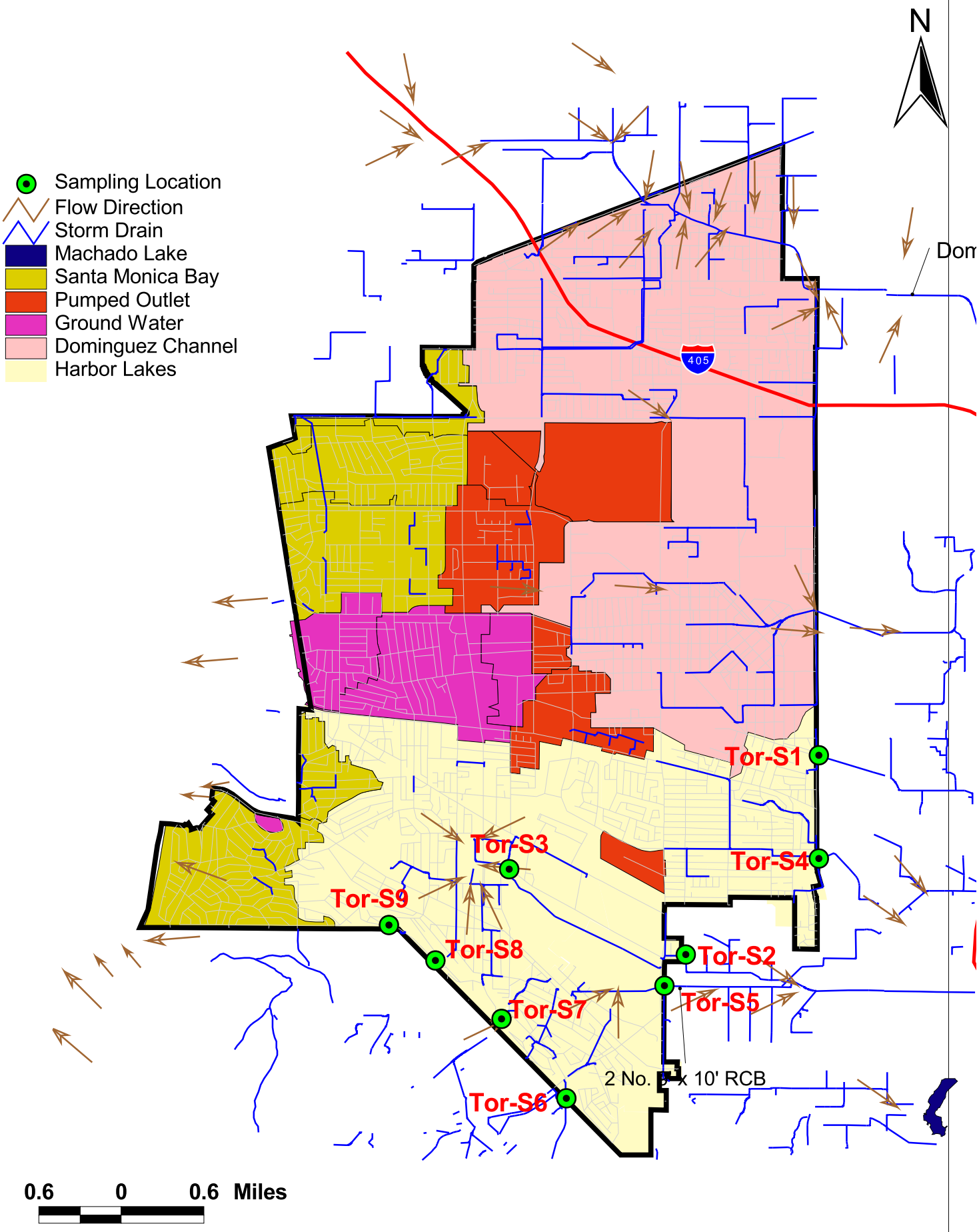


Figure 5 General Location Map of Sampling Locations

Tor-S2

Tor-S2 is approximately 50 ft west of the intersection of 246th Place and Pennsylvania Avenue. The total upstream drainage area is about 2,605 acres. The drainage area is a mixed land use, about 32 percent residential, 10 percent commercial and 11 percent industrial. The Torrance Airport accounts for 12 percent of the drainage area. Tor-S2 is easily accessible and safe for conducting sampling during both dry and wet weather conditions. Stormwater is conveyed to this site through an 8' x 7' reinforced concrete box. This site is one the four sites that will provide information to quantify the amount of pollutants leaving the City limits.

Sampling Site: TOR-S2

Tor-S3

This site, which is approximately 100 ft east of Madison St. and Skypark Drive intersection, will assist the City in characterizing discharges from Walteria Lake. The total upstream drainage area is approximately 2,285 acres. This site is upstream of Tor-S2. Land use is mixed with 37 percent residential, 10 percent commercial and 9 percent industrial. A 54-inch pipe conveys stormwater to this site. The site is easily accessible and safe for all weather sampling.

Sampling Site: TOR-S3

Tor-S4

Tor-S4 is approximately 210 ft north and 85 ft east of 236th Street and Western Avenue intersection. The total drainage area upstream of this sampling location is approximately 1,014 acres. Residential land use represents nearly 60 percent of the drainage area. Commercial and industrial land uses represent only 9 percent of the drainage area. The storm drain serving this site is a 9'-2" x 11' RCB. The site is safe for all weather sampling and it is easily accessible.

Sampling Site: TOR-S4

Tor-S5

This site is about 25 ft west of the intersection of Bani Avenue and 250th Street (two pipes intersect from south and west). This sampling site serves an upstream drainage area of approximately 661 acres. This site is mainly residential and airport land use; residential and airport land uses represent 43 and 24 percent of the drainage area, respectively. The storm drain discharging stormwater to this site is an 8'-9" x 9'-7' RCB. This site is easily accessible and safe for sampling activities.

Sampling Site: TOR-S5

Tor-S6

Tor-S6 is located at approximately 600 ft east of Estates Lane and Crenshaw Boulevard. This site will monitor flow entering the City's storm drain from Rolling Hills Estate. The sampling site is safe and easily accessible.

Sampling Site: TOR-S6

Tor-S7

This site is about 160 ft south and 280 ft east of Rolling Hills Road and Hawthorne Blvd. intersection. It will monitor dry weather flow originating from Rolling Hills Estates. The site is easily accessible and safe for sampling at all weather conditions.

Sampling Site: TOR-S7

Tor-S8

This site is located at about 500 ft northwest of Paseo De Las Tortugas and Mesa St. intersection. It will monitor dry weather flow originating from Rolling Hills Estates. The site is easily accessible and safe for sampling at all weather conditions.

Sampling Site: TOR-S8

Tor-S9

Tor-S9 is about 830 ft east and 120 ft south of Paseo de Las Tortugas and Vista Montana intersection. This site will monitor dry weather flow originating from Palos Verdes Estates. The site is accessible and safe for sampling activities.

Sampling Site: TOR-S9

3.2 Sample Collection Frequency

The City's sampling program consists of three major elements:

1. Monthly sampling during dry weather conditions for all sampling locations. Grab samples will be collected from each sampling location. Dry weather conditions must be preceded by at least 24 hours of no greater than trace precipitation or have an intensity of less than 0.1 inches of rain in a 24-hour period.

2. Samples will be collected from Tor-S3 during four discrete storm events and anytime time the LA County pumps stormwater from the Walteria Lake into the 54-inch storm drain. Pumping schedule will be obtained from LA County.

3. Continuous recording of stage or flow depth during dry weather periods for flow estimation will be collected from the proposed sample locations during dry weather flow conditions.

Regarding Tor-S3, one grab sample for each of the four storm events will be collected under the following conditions:

1. Sampling will occur during a storm event with at least 0.1 inch of precipitation (defined as a "measurable" event). Weather forecasts will be evaluated before deciding whether or not to sample a particular rain event. The monitoring manager will periodically establish a modem connection with each sampling unit to monitor rainfall, flow rates, and sampling activity. The monitoring manager will download stored data from the National Weather Service as needed.
2. Sampling will not occur at a frequency greater than once every 72 hours.
3. Sampling will not occur unless there has been at least 72 hours of continuous dry weather immediately preceding the "measurable" event.
4. Grab samples will be collected from this location during approximately the first 30 minutes to 1 hour of stormwater discharge (where possible).

The intention of the sample collection frequency and stormwater event requirements described above is to collect samples that are representative of runoff conditions from Tor-S3. No samples will be collected from the remaining eight sampling locations during storm events. The City's Pollutant Loading and Analysis Tool (PLAT) will be used to estimate nutrient loading for these sampling location during storm events.

3.3 Selection of Analytical Parameters

The City proposes to use a mass based WLA compliance option to evaluate TMDL compliance. Samples submitted for nutrients will be tested for ammonia-N (NH_3^+), ammonium, nitrite (NO_2), nitrate (NO_3), total Kjeldahl nitrogen (TKN), total phosphorus (TP), and phosphate (PO_4). Water samples submitted for conventional water parameters (general chemistry) will be tested for alkalinity, pH, chloride, total suspended solids (TSS), total solids, dissolved solids, turbidity, dissolved organic carbon (DOC), total organic carbon (TOC), and standard metals. The constituents to be sampled are listed in Table 5.

Table 5 Monitoring Constituents		
Analyte	**Method of Analysis**	**Detection Limits**
NH_3^+	SM 4500-NH_3-H	0.02 mg/l
NO_3	SM 4500-NO_3-F	0.02 mg/l
NO_2	SM 4500-NO_3-F	0.01 mg/l
TKN	EPA 351.3	0.1 mg/l
TP	EPA 365.4	0.06 mg/l
PO_4	SM 4500-P-F	0.01 mg/l
TSS	EPA 160.2	0.5 mg/l
Turbidity	n/a	0.01 NTU

3.4 Continuous Flow Monitoring

Accurate assessment of flow is crucial to pollutant loads assessments and analysis. Continuous flow data will be collected as part of this sampling effort for all nine sampling locations. The primary benefit of these continuous monitoring sites is the ability to gauge the increase in flow due to a storm event and apply concentration data to calculate pollutant loading.

Global Water's FL16 Water Flow Logger will be used for flow data collection. The FL16 Water Flow Loggers will record over 81,000 depth, temperature, water flow and velocity readings in the drainage pipes. The specially engineered, non-fouling water level sensor works in depths as little as ½ inch and allows for deployment in manholes and other difficult to access areas without the need to enter the confined space.

FL16 Water Flow Recorder's user-friendly Windows-based software is tailored specifically for calculating water flows in partially filled sewer and drainage pipes using the Manning's Equation, with pull-down menus for selecting and entering the necessary information. The Water Flow Recorder software has a unique calibration feature which allows users to view calculated water velocity, compare this to actual measured data, and adjust the water flow parameters to calibrate for the water flow conditions of a specific application.

The flow measuring systems will be calibrated before data collection begins and that these will be re-calibrated monthly.

3.5 The Sampling Team

Grab samples from the nine sampling locations will be collected by a contract lab retained by the City. Pre-labeled sample bottles will be provided by the certified laboratory that will be conducting the analyses. The Sampling Team will be responsible for ensuring that all required equipment is ready for field operation. They are also responsible for performing the entire field sampling activities and most of the sampling preparation. Any member of the Sampling Team may recommend canceling sampling if the predicted conditions do not materialize or if health or safety of the team could be imperiled due to site conditions or extreme weather.

4.0 SAMPLE COLLECTION PROCEDURES

This section describes the sampling procedures, record keeping, sample handling, storage, and field quality control procedures that will be used during stormwater sampling.

4.1 Preparation for conducting the sampling

Several things will be done to prepare to conduct stormwater sampling. First, the laboratory to analyze the samples will be contacted. The following information will be sought from the lab:

- Type and size of bottles needed
- Procedures to filling the bottles
- Sample volume requirements
- Labels or additional forms required
- Explanation of the chain of custody form
- Sample preservation requirements and/or holding time restrictions
- Means of sample delivery to the lab
- Overnight delivery requirements
- Costs

Once a lab has been selected the sampling equipment (sampling bottles from a lab, sampling instruments, and personal safety equipment) will be made ready, as well as the field sheet to document the required information. Table 6 lists constituents and sample container requirements.

Field personnel will complete a field condition data sheet. The following items will be listed on the field sampling sheet and included in the stormwater discharge monitoring report:

- Person who conducted the sampling
- Date and time of discharge
- Length of storm event
- Time between sampled storm event and previous storm event (at least 72 hrs)
- Total rainfall during storm event
- Photo documentation

A field data sheet is attached as Appendix B.

4.1.1 Sampling Equipment

Monitoring equipment will be gathered ahead of time because opportunities to sample during rainfall events often come with little advanced notice. The following equipments will be required for the sampling efforts:

- Field forms
- Waterproof pens
- Permanent markers

- Powder-free nitrile gloves
- Clear glass jar for visual examinations
- Sample containers
- Sample preservatives
- Sample container labels
- COC forms
- COC seals
- Ice chests
- Ice
- Foul-weather gear
- Manhole sampler

Table 6 Monitoring Constituents and Sample Container Requirements

Analyte	Container	Volume	Preservation	Holding Time
NH_3^+	Plastic	50 ml	≤ 6°C H2SO4 PH < 2	28 days
NO_3	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	48 hours
NO_2	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	48 hours
TKN	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	28 days
TP	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	28 days
PO_4	Plastic	50 ml	≤ 6°C	48 hours
TSS	Plastic	200 ml	≤ 6°C	7 days

4.2 Sampling Method

Water samples will be collected from storm sewer manhole and outfall sites. All samples will be collected as individual grabs. Samples will be collected directly into sample containers or with a laboratory-supplied container attached to a pole with duct tape or other means. Sampling containers will be held with container openings facing upstream to prevent contamination during sampling. Field personnel will wear powder-free nitrile disposable gloves. Each sample will be given a field identification, tagged, and kept cool at 4 degrees C. Chain-of-custody (COC) procedures will be observed and samples delivered to the laboratory within the allowable holding times for each parameter.

It is assumed that sampling locations will have well-mixed conditions so that single grabs are representative of water quality. Field personnel will record the degree of turbulence or quiescence as well as the dimensions of the conveyance sampled and/or a description of water flowing in the conveyance. Field personnel will also record the date and time of sample collection and the flow rate.

Sampling containers for direct grabs (either by hand or with pole attached to laboratory supplied container) will be pre-cleaned by the laboratory. It will be made certain that if a sample is transferred (either for collection purposes or to form grab-composite samples), that only laboratory-supplied containers are permitted to come in contact with the sample.

4.3 Personal Safety

A Health and Safety Plan approved by the contract lab will be reviewed by the all field personnel before the sampling operations covered in this monitoring plan begin. Personal safety will be of primary concern while conducting all stormwater sampling related activities. All persons involved in the sampling operation will be made aware of the hazards associated with monitoring and should freely voice any concerns if potential hazards become apparent. The Occupational Safety and Health Administration (OSHA) provides regulations and guidance on occupational safety, many of which are directly applicable to the types of activities involved in stormwater monitoring. It is the direct responsibility of each person involved in the monitoring program to read the Health and Safety Plan and adhere to its requirements. The following list provides a few basic health and safety procedures that will help to create a safer sampling environment.

- Do not sample alone, a minimum of two-person field crews will be used for stormwater sampling.
- Do not enter a confined space without proper training, equipment, and surface support.
- Never remove or replace manhole covers with your bare hands or feet.
- Never leave an open manhole unattended.
- Do not start staging or sampling until traffic control has been established.

4.4 Clean Sampling Techniques

Clean sample collection techniques will be followed to minimize the potential for contamination of stormwater runoff samples. Care will be taken during all sampling operations to avoid contamination of the water samples by human, atmospheric, or other potential sources of contamination. The monitoring team should prevent contamination of any of the following items: composite bottles, lids, sample, tubing, and strainers.

4.5 Sample Packing and Shipping

Monitoring personnel will deliver the samples to the laboratory. Sample bottles will be placed in coolers or some other package that is rigid enough to provide protection of the samples and is insulated to keep samples cold. During packing, the sample from one monitoring location will not be separated into separate shipping containers unless bottles of one size need to be shipped together because of container size. If samples from a location are separated a copy of the field-sampling sheet pertaining to the bottles will be enclosed in each shipping container. Prior to shipping, all sample bottles will be recorded on the packing lists, which will include the shipping date and the method of transporting the samples. Samples will be delivered to the analytical laboratory within 4 hours of sampling to ensure the maximum holding time for bacteria of 6 hours is not exceeded.

4.6 Chain of Custody

After samples have been obtained and the collection procedures properly documented, a written record of the COC of each sample will be made. This record ensures that samples will not be tampered with or inadvertently compromised in any way, and it also tracks the requested analysis for the analytical laboratory. COC refers to the documented account of changes in possession that occur for samples.

The COC record tracks the sampling path from origin through laboratory analysis. Information necessary in the COC includes:

- Name of the persons collecting the sample(s).
- Date and time of sample collection.
- Location of sample collection.
- Names and signatures of all persons handling the samples in the field and in the laboratory.
- Laboratory analysis requested and control information (e.g., duplicate or spiked samples etc.) and any special instructions (e.g., time sensitive analyses).

To ensure that all necessary information is documented a COC form will accompany each sample or set of samples. COC forms will be printed on multipart carbonless paper so that all personnel handling the samples may obtain a copy. A COC record should accompany all sample shipments and the sample originator will retain a copy of the forms. When transferring custody of samples the transferee will sign and record the date and time of each transfer. Each person who takes custody will complete the appropriate portion of the chain of custody documentation. A sample COC form to be used for this field sampling is attached as Appendix C.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

5.1 Data Quality Objective

The quality assurance/quality control (QA/QC) program will be implemented to satisfy the data quality objectives of the monitoring program. The primary data quality objectives are to obtain defensible data of acceptable sensitivity and quality to:

- Evaluate the stormwater management program.
- Evaluate stormwater quality.
- Evaluate of BMP as corrective measure.

The analytical laboratory selected for this study will evaluate the accuracy of its sample extraction and/or analytical procedures using spiked samples, which may include matrix spikes (MS), laboratory control samples (LCS) and surrogate spikes. Acceptable spike recoveries must fall within statistically derived laboratory “control limits.” Precision is the agreement among a set a replicate measurements of the same parameter. The analytical laboratory will evaluate precision by performing matrix spike duplicate (MSD), laboratory control sample duplicate (LCSD) and duplicate stormwater sample analyses (typically

performed for inorganic parameters only). The data quality objectives also include obtaining data that are comparable and representative of the water quality conditions at each monitoring location. Comparable data will be collected if comparable sampling, analysis, QA/QC and reporting procedures are implemented throughout the monitoring program. Representative samples will be collected by performing sampling activities compliant with the procedures described in this monitoring plan. Duplicate samples will be collected and the results will be used to evaluate representativeness. Comparability expresses the confidence with which one data set can be compared to another. Data are comparable if collection techniques, measurement procedures, methods, and reporting are equivalent for the samples within a sample set. Data quality assurance objectives are summarized in Table 7.

Table 7 Quality Assurance Objective

Analyte	Units	Precision	Accuracy	Reporting Limit	Completeness
NH_3^+	mg/l	±20%	±30%	0.10 mg/l	90%
NO_3	mg/l	±20%	±30%	0.1 mg/l	90%
NO_2	mg/l	±20%	±30%	0.1 mg/l	90%
TKN	mg/l	±20%	±30%	0.1 mg/l	90%
TP	mg/l	±20%	±30%	0.1 mg/l	90%
PO_4	mg/l	±20%	±30%	0.025 mg/l	90%
TSS	mg/l	±20%	±30%	1 mg/l	90%

5.1.1 Field Quality Control Samples

Field quality control samples will be collected at a 10% frequency in order to provide quality performance information for the sampling program. One in ten samples submitted for analysis will be one of three field QC sample types: field blank; field duplicate; and/or performance evaluation blank. Table 8 lists the quality performance goals that each of the three types of field QC sample types is intended to address.

Table 8 Field Quality Control Sample Types

Quality Performance Goal	Field Blank	Field Duplicate	Performance Evaluation Blank
Minimize false positive results	**X**		**X**
Sample bottles free of contamination	**X**		
No contamination introduced by sampling process	**X**		
Measurement error attributable to sample inhomogeneity		**X**	

5.2 Field Quality Assurance/Quality Control

This section summarizes the QA/QC procedures that will be implemented by field personnel to evaluate sample contamination, sampling precision, and matrix interference.

5.2.1 Equipment Blanks

After the intermediate sample container or scoop is cleaned, an equipment blank will be collected by pouring reagent-grade water into the apparatus. The water will be transferred into sample bottles and analyzed for the full analytical suite.

5.2.2 Field Duplicate Samples

Field duplicate samples will be collected to evaluate the precision and representativeness of the sample collection procedures as well as sample homogeneity. The duplicate sample will be collected using the specified manual grab sampling techniques. Twice the volume required for the analytical suite will be collected with each duplicate sample. For grab samples, intermediate sample containers will be used, and the volume collected will be apportioned equally between the intermediate containers. The water in each intermediate container will be poured into a discrete set of sample bottles. One set of bottles will be labeled with fictitious sample identification and submitted “blind” to the laboratory.

5.2.3 Matrix Spike Samples

MS and MSD analyses will be performed by the laboratory using project samples. Field crews will submit twice the required sample volume for the sample selected as the matrix spike sample. Field personnel will identify the MS/MSD sample on the COC form.

5.3 Laboratory Quality Control

This sub-section summarizes the QC procedures the laboratory will perform and report with the analytical data packages. These procedures are not inclusive of the QA/QC that is required for compliance with the analytical method.

5.3.1 Method Blanks

A method blank is prepared using reagent-grade water, and is extracted and analyzed with each sample batch (typically 20 samples extracted and/or analyzed on a given day). Method blank results are used to identify potential sources of sample contamination resulting from laboratory procedures. Target analytes should not be detected in the method blank above the practical quantitative limit.

5.3.2 Matrix Spike and Laboratory Control Samples

MS, MSDs, LCS, and LCSDs will be performed by the laboratory to evaluate the accuracy of the sample extraction and analysis procedures. MS/MSDs will also be performed to evaluate matrix interference. Matrix interference is the effect of the sample matrix on the analysis, which may partially or completely mask the response of the analytical instrumentation to the target analyte(s). Matrix interference may affect the accuracy of the extraction and/or analysis procedures to varying degrees, and may bias the sample results high or low. The

MS/MSD is prepared by adding known quantities of target analytes to a sample. The sample is then extracted and/or analyzed as a typical environmental sample, and the results are reported as percent recovery.

6.0 DATA MANAGEMENT AND REPORTING

The sampling results will be reported by the laboratory as hard copy and as electronic files. Hard copy data will be entered into an electronic format, and checked at least once by a different person. Electronic submittal of results will be discussed with the analytical laboratory in advance of delivery and its format arranged. A separate record will be generated for each sample analysis.

In addition, the key information such as station ID, sample date and time, name of sampler, name of constituent, all results, units, detection limits, methods used, name of the laboratory, and any field notes will be entered into the database. Additional information, such as compositing of multiple samples, or the use of grab will also be included.

When reporting the laboratory results for each stormwater sample the following information will be provided:

- Sample site.
- Sample date and time.
- Sample number (or identification).
- Sampling technician(s).
- Detection limit and reliability limit of analytical procedure(s).
- Sample results with clearly specified units.

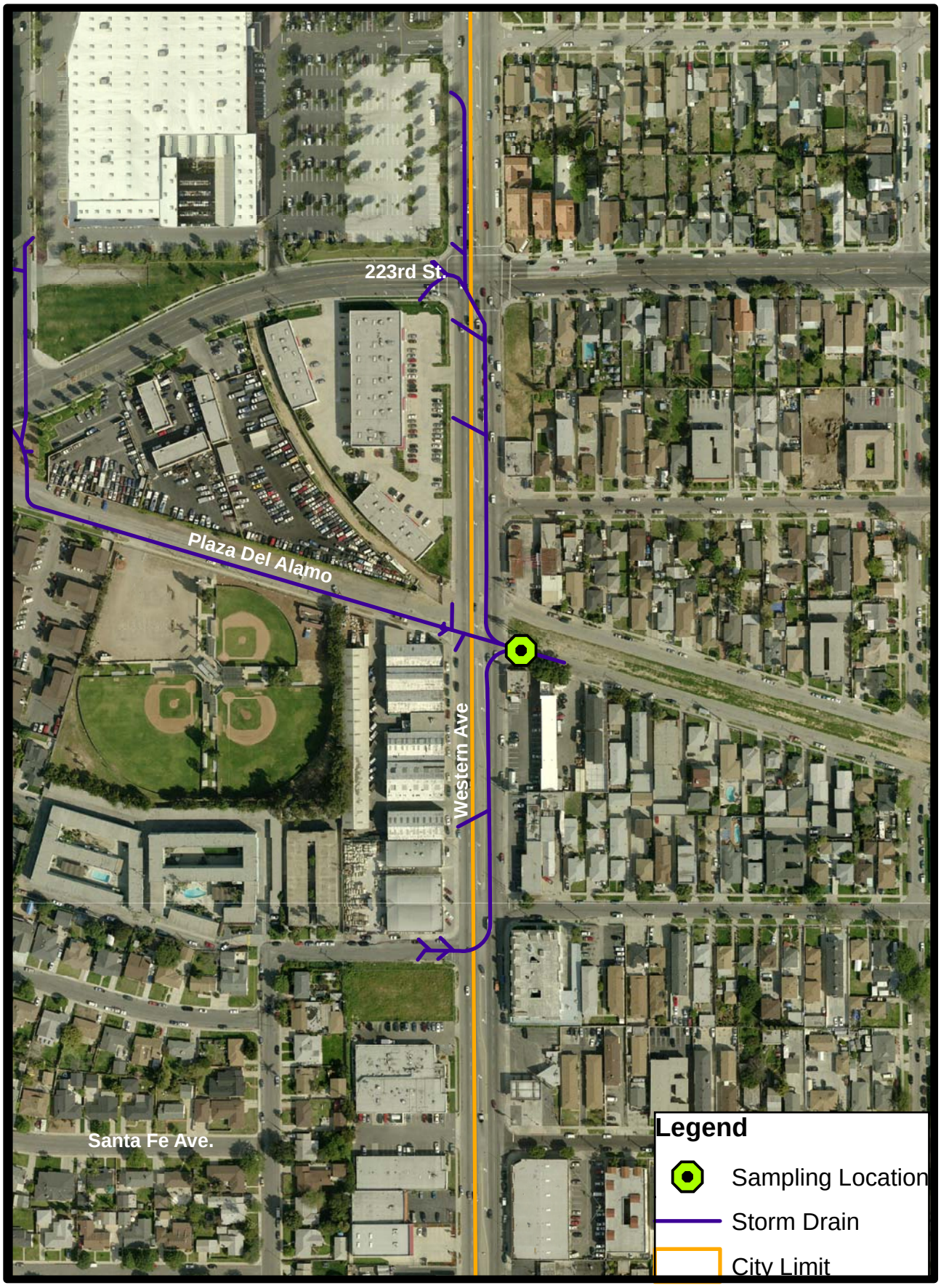
The results of all samples collected under this plan will be submitted to Regional Board in a monitoring report. Monitoring report will include:

- Introduction and background information
- Documentation and summary of each sampling event, including photos
- Electronic copies of field conditions data sheets
- Summary discussion of results
- Tabular results of all samples, including quality assurance quality control samples, in electronic format, (Excel)
- Evaluation data quality based on QAPP requirements.

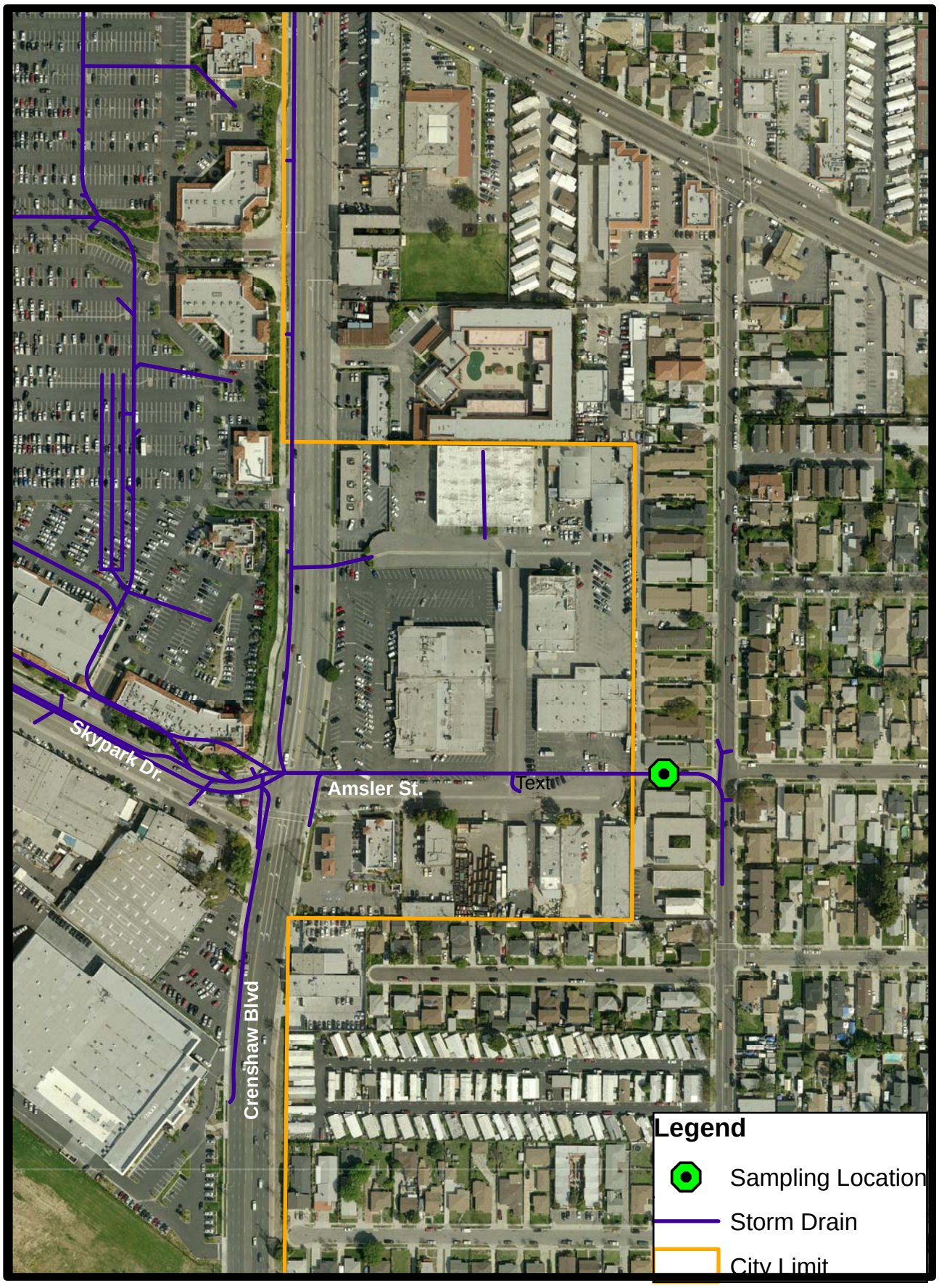
APPENDIX A

Detailed Maps of Sampling Locations

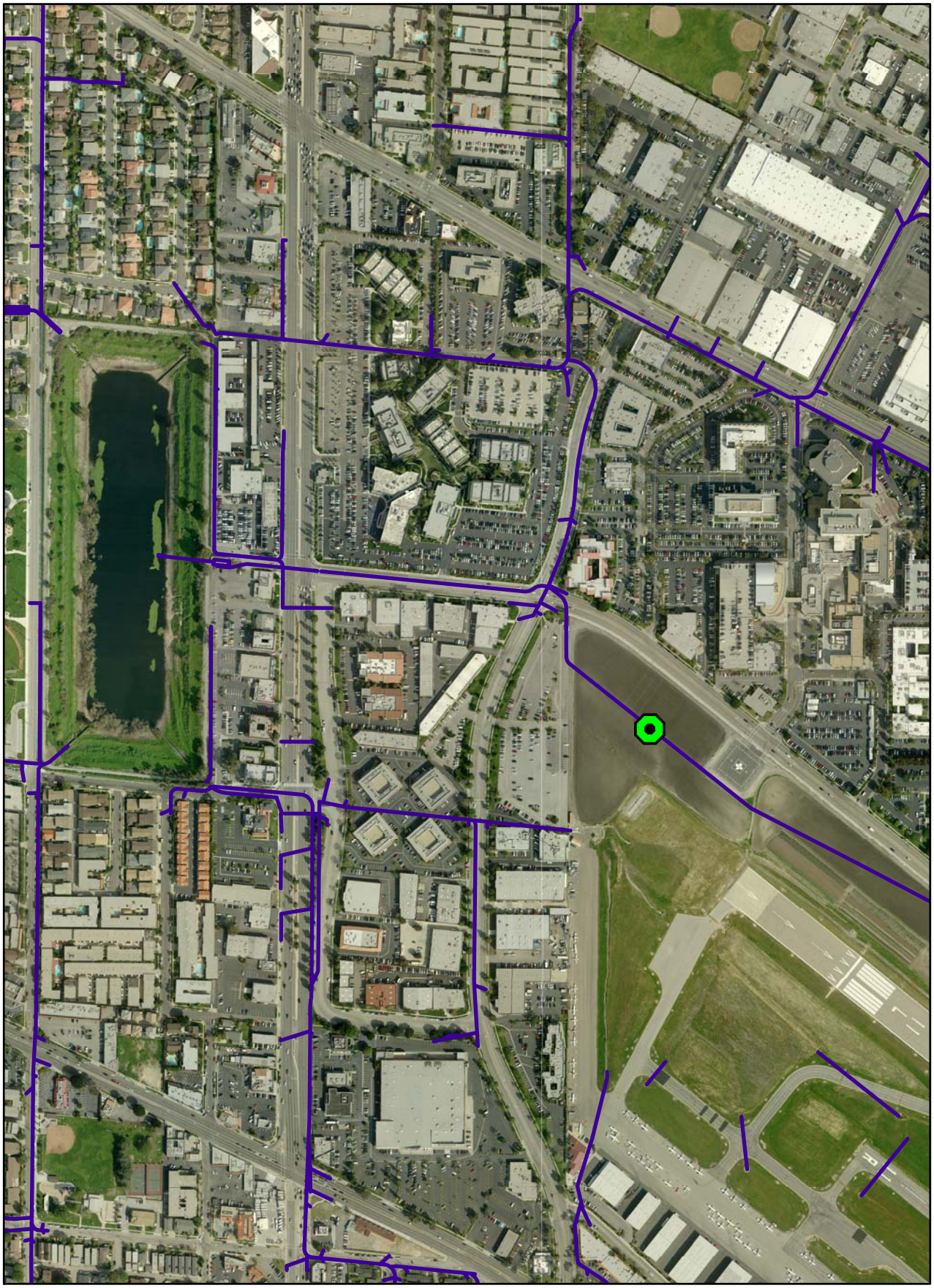
Stormwater Sampling Location - Tor-S1



Stormwater Sampling Location - Tor-S2



Stormwater Sampling Location: Tor-S3



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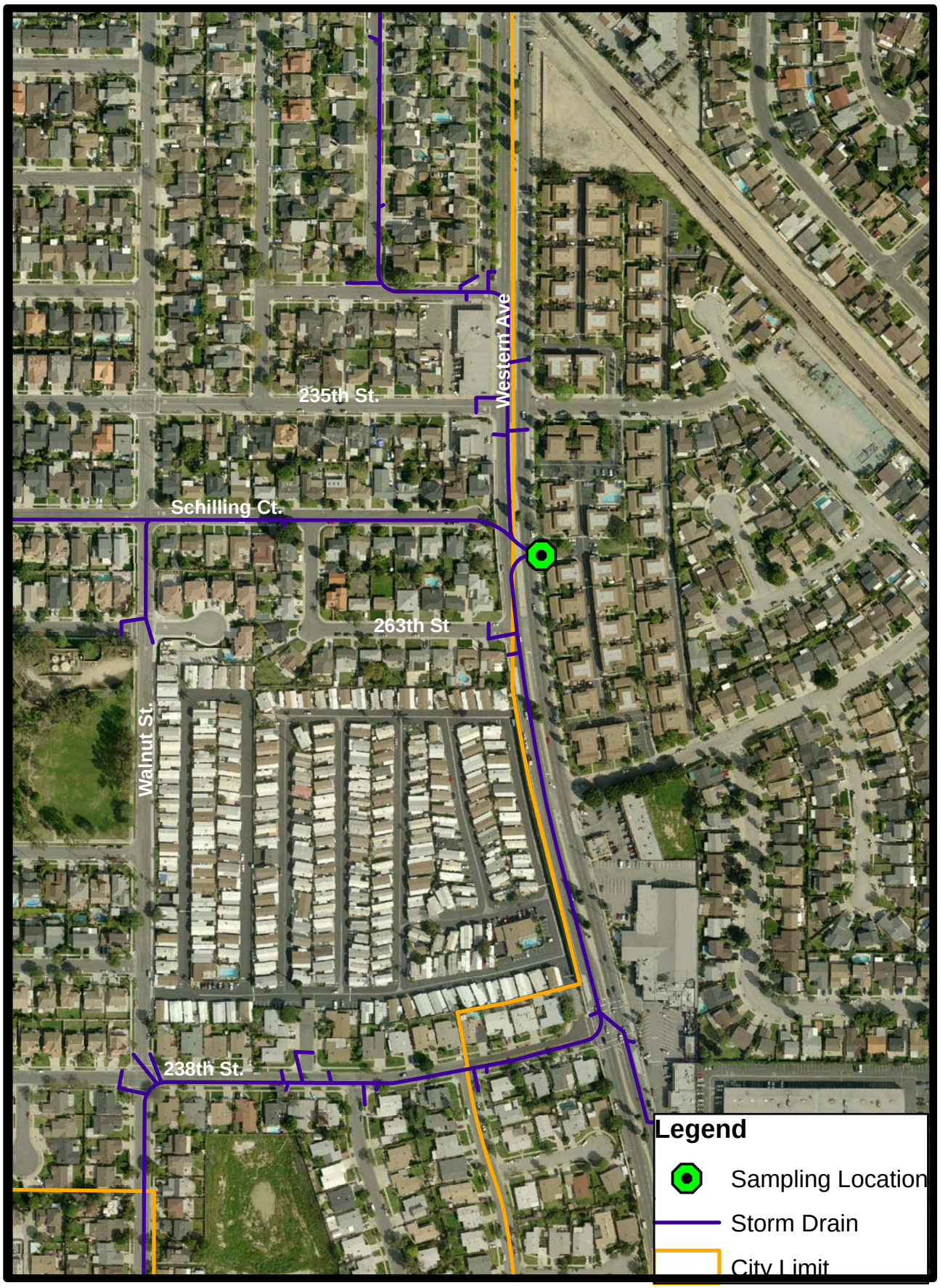
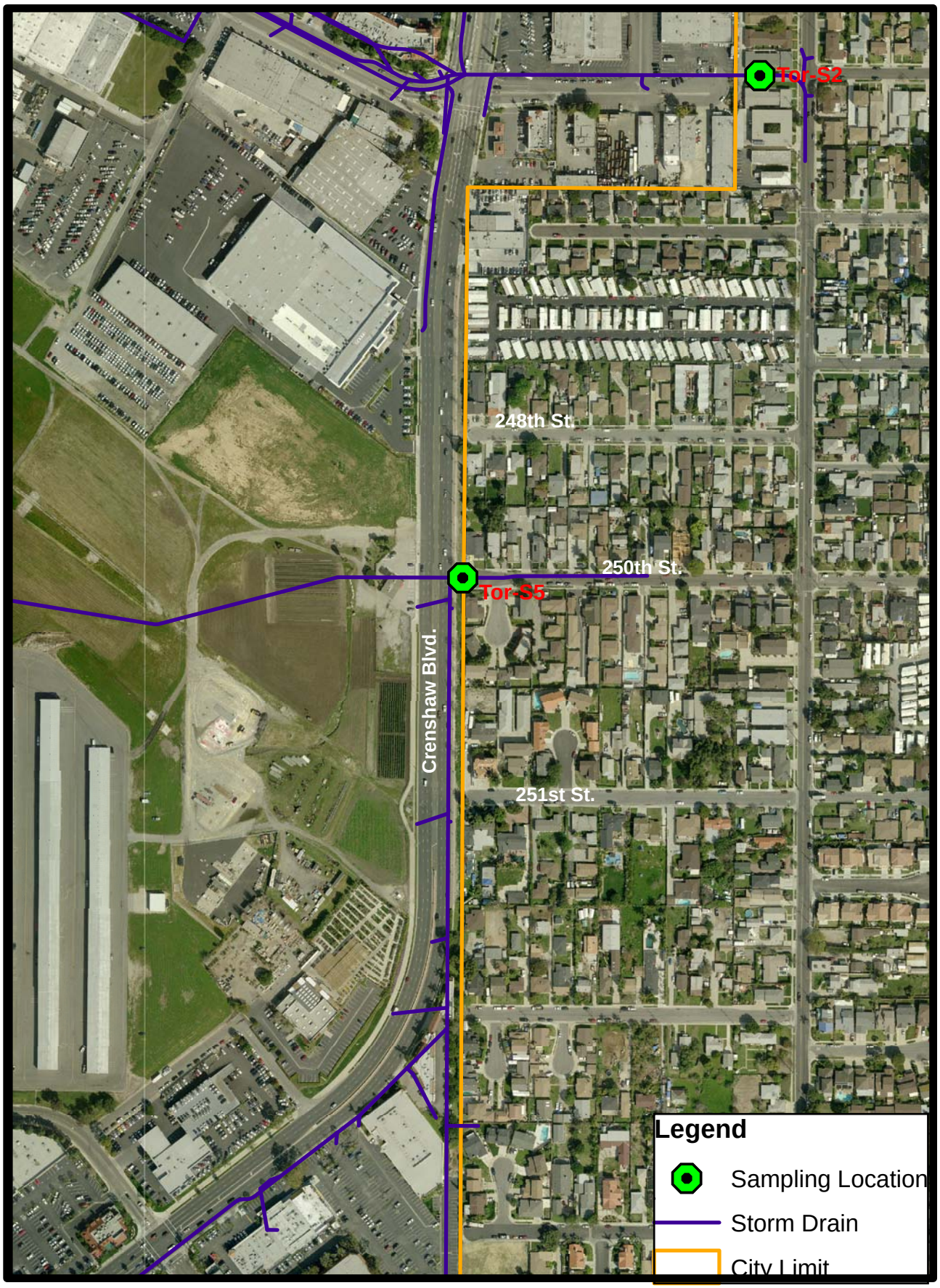
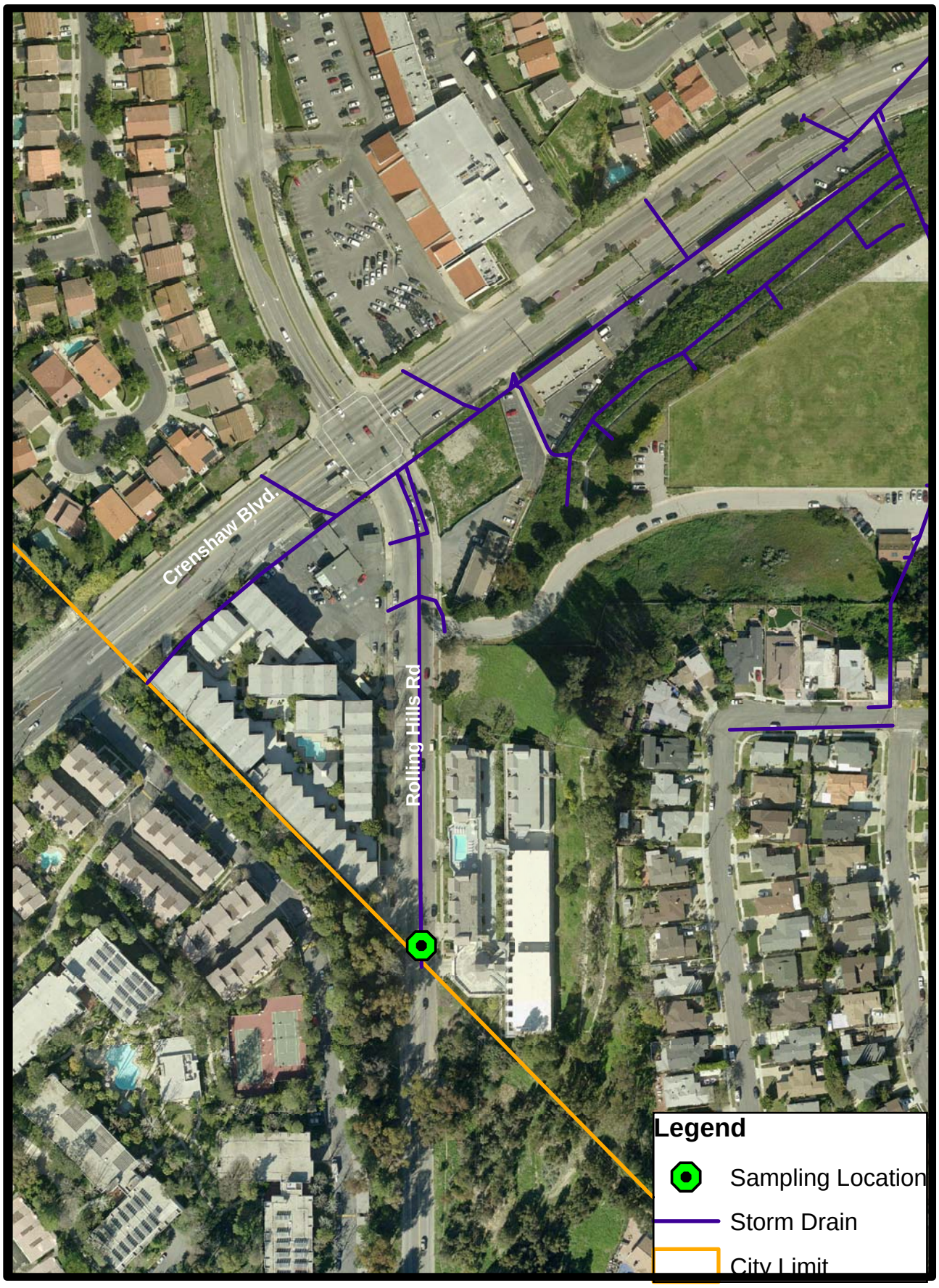


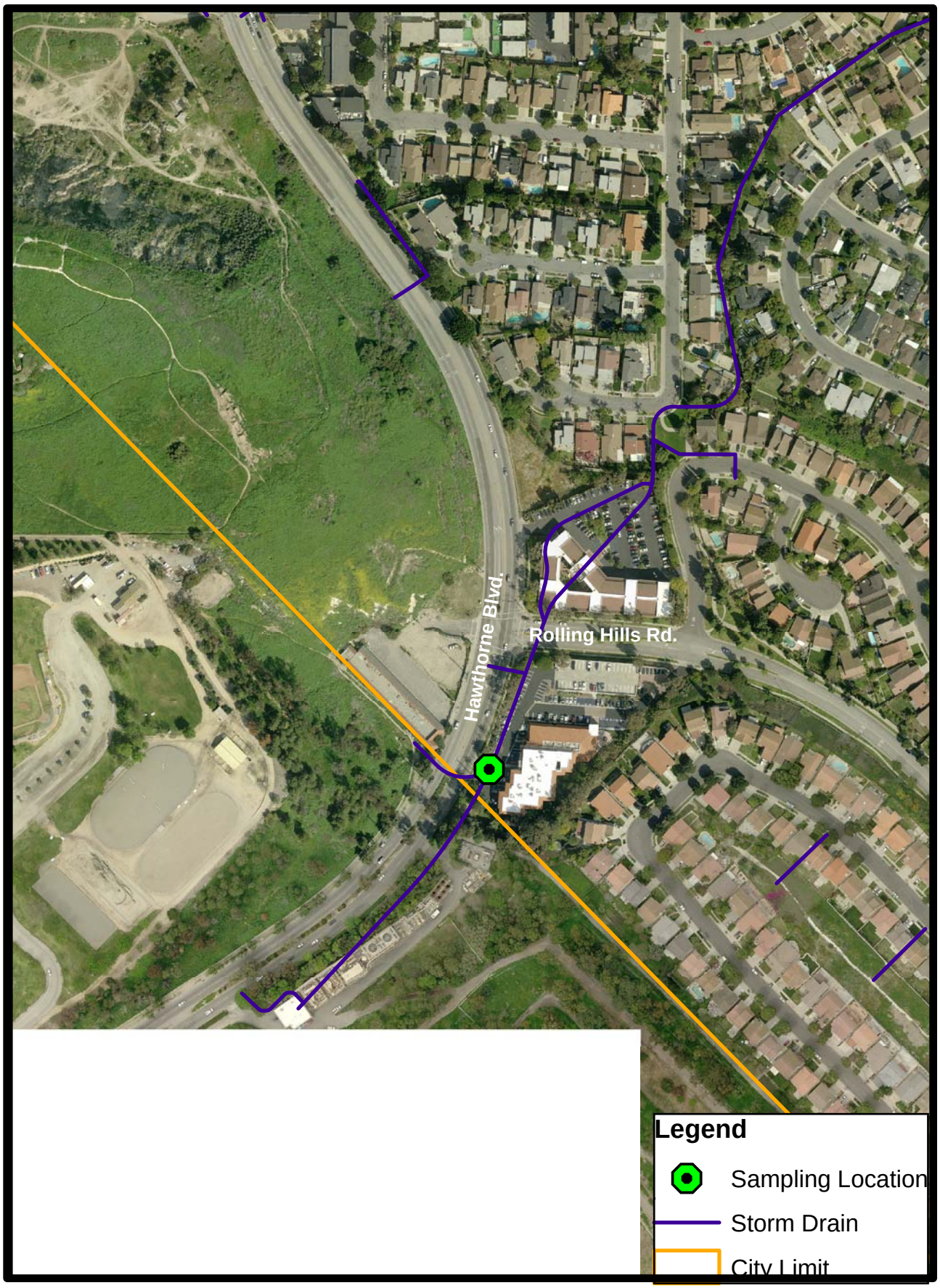
Stormwater Sampling Location - Tor-S5



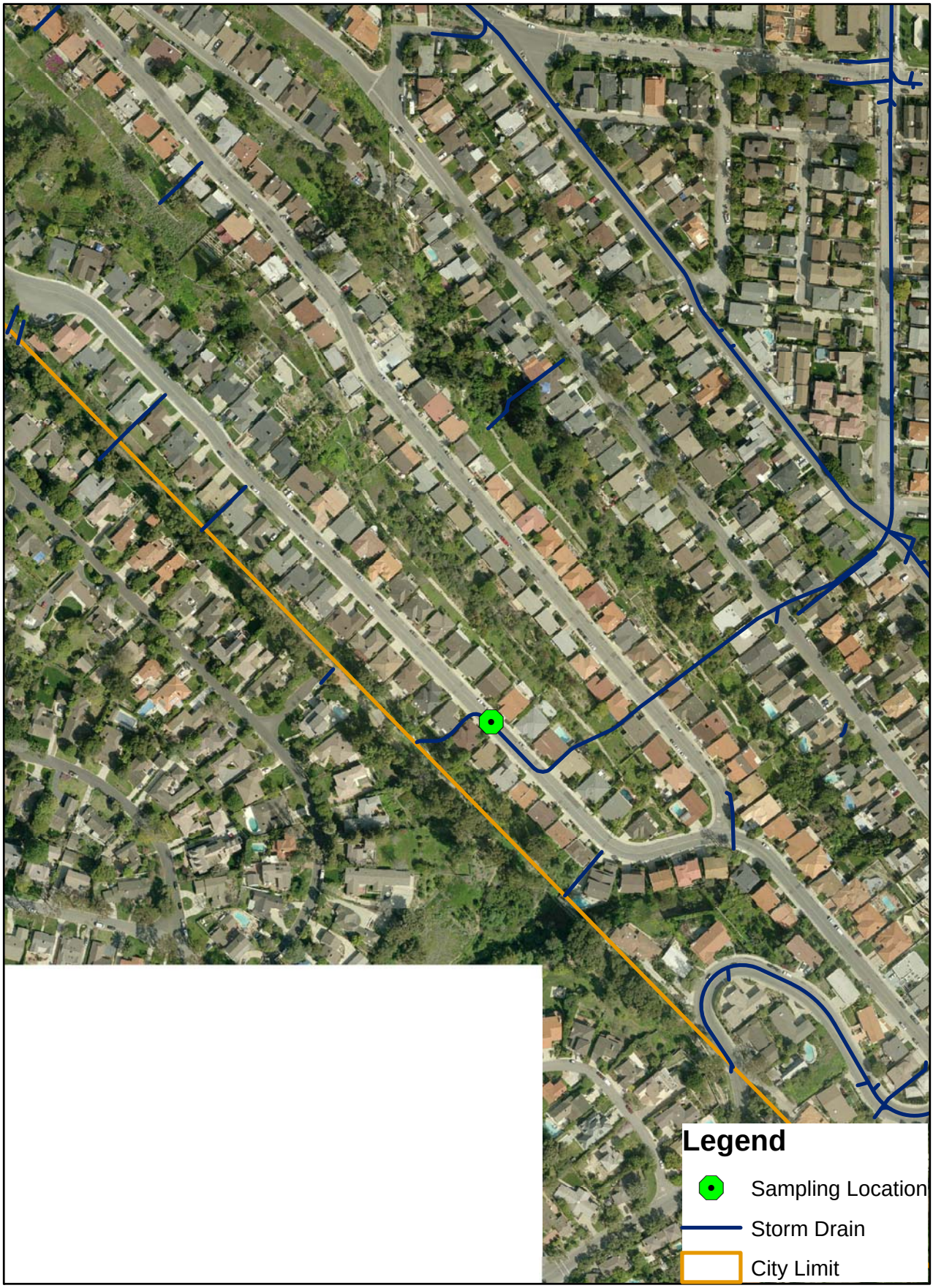
Stormwater Sampling Location - Tor-S6



Stormwater Sampling Location - Tor-S7



Stormwater Sampling Location - Tor-S8



Stormwater Sampling Location - Tor-S9

APPENDIX B

Field Data Sheet

Sampling Field Data

City of Torrance, California

Page_____ of_____

Area Letter & Name or Run #: _____

Run: Scheduled / Makeup / Reopen / Extra

Collected by: _____ **Initiated by:** _____

Date Collected: _____ **Date/time Initiated:** _____

Missed Station	Area Letter	Station #	Military Time	Boat /Land/ Clams/Mussels	Temp °C	Random / Adverse/ Extra	Condition or Adversity	Open or Closed	Wind	Salinity ‰	A-1 MPN/100 ml MF CFU/100ml EC MPN/100 ml	Comments

Remarks:

CHAIN OF CUSTODY:

Relinquished by:	Date, Time & Temp°C	# Samples	Relinquished to:	Received by:	Date, Time & Temp°C	# Samples

Circle Water Quality Lab: Boothbay or Lamoine | **WQ Lab Staff Acceptance:**

Entered by: _____ **Date:** _____

APPENDIX C

Chain of Custody

GENERAL CHAIN-OF-CUSTODY FORM

EVIDENCE/PROPERTY CUSTODY	Tracking Number Investigation ID Number	
NAME OF RECIPIENT FACILITY	LOCATION	
NAME, TITLE AND CONTACT NUMBER OF PERSON FROM WHOM RECEIVED	ADDRESS	
LOCATION FROM WHERE OBTAINED	REASON OBTAINED	DATE/TIME OBTAINED

ITEM NO	QUANTITY	DESCRIPTION OF ARTICLES (Include model, serial number, condition and unusual marks or scratches)

		CHAIN OF CUSTODY		
ITEM NO.	DATE	RELEASES BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	

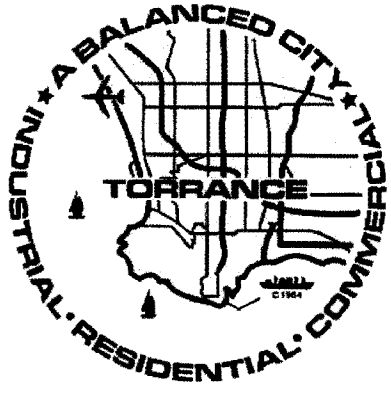
Chain-of-Custody (continued)

ITEM NO.	DATE	RELEASES BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	

FINAL DISPOSAL ACTION
RELEASE TO OWNER OR OTHER (NAME/ORGANIZATION)
DESTROY
OTHER (Specify)
FINAL DISPOSAL AUTHORITY
ON THIS DOCUMENT PERTAINING TO THE INQUIRY/INVESTIGATION INVOLVING;
ITEM(S) (IS)(ARE) NO LONGER REQUIRED AS EVIDENCE AND MAY BE DOSPOSED AS INDICATED ABOVE. *If articles must be retained do not sign, but explain in separate correspondence.*
(Typed or Printed Name & Organization) (Signature) (Date)
WITNESS TO DESTRUCTION EVIDENCE
THE ARTICLES LISTED AT ITEM NUMBERS (WAS)(WERE) DESTROYED BY THE EVIDENCE CUSTODIAN IN MY PRESENCE, ON THE DATE INDICATED ABOVE
(Typed or Printed Name & Organization) (Signature) (pole)

Appendix D

Machado Lake Implementation Plan



City of Torrance, California
Redondo Beach, California

MACHADO LAKE NUTRIENT AND TOXICS TOTAL MAXIMUM DAILY LOAD

BMP IMPLEMENTATION PLAN

October 2014

199 S. Los Robles Avenue • Suite 530 • Pasadena, California 91101 • Phone: 626.535.0180
pw://Carollo/Documents/Client/CA/Torrance/9193A00/Deliverables/Draft Report/BMP-Implementation Plan

CITY OF TORRANCE, CALIFORNIA

MACHADO LAKE – NUTRIENT AND TOXICS TOTAL MAXIMUM DAILY LOAD

CITY OF TORRANCE, CALIFORNIA BMP IMPLEMENTATION PLAN

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LIST OF ABBREVIATIONS

BMP	Best Management Practice
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CGP	Construction General Permit
City	City of Torrance
County	Los Angeles County
CWA	Clean Water Act
DEM	Digital Elevation Model
EMC	Event Mean Concentration
ET	Evapotranspiration
GPS	Global Positioning System
HDSF	high-density single family
HSG	Hydrologic Soil Group
ISA	Impervious Surface Area
kg/yr	kilogram per year
KMHRP	Ken Malloy Harbor Regional Park
LA	Los Angeles
LACFCD	LA County Flood Control District
LID	Low Impact Development
MFR	multi-family residential
LARWQCB	Los Angeles Regional Water Quality Control Board
mg/L	milligram per liter
MRP	Monitoring and Reporting Plan
MS4	Municipal Separate Storm Sewer Systems
MWDSC	Metropolitan Water District Southern California
NPDES	National Pollutant Discharge Elimination System
OC	organochlorine
O&M	Operation and Maintenance
PCBs	polychlorinated biphenyls
PIPP	Public Information and Participation Program
PLAT	Pollutant Load and Analysis Tool
PRD	Permit Registration Documents
RARE	A Basin Plan designation for the aquatic life support category
REC 1	A Basin Plan designation for water contact recreational
REC 2	A Basin Plan designation for water non-contact recreational
SCAQMD	South Coast Air Quality Management District
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WLA	Waste Load Allocation
WMMS	Watershed Management Model System
WTM	Watershed Treatment Model

1.0 INTRODUCTION

This report documents the results of an effort to address impairments in the Machado Lake watershed with a comprehensive, phased approach of best management practice (BMP) implementation for the City of Torrance (City). To develop this plan, BMPs to treat stormwater and dry weather flows to reduce nutrients, sediment, and other pollutants such as metals, bacteria, and toxics were identified and selected. As part of that process, benefits of management activities were estimated, in terms of pollutant load reductions or improvement in water quality, to meet waste load allocations (WLAs) defined by approved total maximum daily loads (TMDLs) established for waters within the Machado Lake watershed. Table 1.1 provides a summary of the various existing and pending TMDLs associated with each body of water the City discharges into.

Table 1.1 Summary of TMDLs for City of Torrance

Body of Water	TMDL Name	Pollutant[1]	Resolution Number	Effective Date
Machado Lake	Nutrient	Nitrogen, Phosphorus	R08-006	11 March 2009
	Trash	Trash	2007-006	6 March 2008
	Toxics	Pesticides, PCBs	R10-008	2 September 2010
Dominguez Channel[1]	Toxics[2]	Copper, Lead, Zinc, DDT, PAHs, PCBs, Chlordane, Dieldrin, Cadmium, Chromium, Mercury	R11-008	Not Yet Effective (Approved by RWQCB on 5 May 2011)
Santa Monica Bay	Debris	Trash, Plastic Pellets	R10-010	Not Yet Effective (Approved by SWQCB 6 December 2011)
	Bacteria	Bacteria	2002-004 2002-022 2006-008	15 July 2003 15 July 2003 6 April 2006

Notes:

(1) Interim, final, and phased Waste Load Allocations (WLA) are listed in Chapter 3 where applicable.
(2) The Resolution Name for what is referred to here as the Dominguez Channel Toxics TMDL is "Los Angeles and Long Beach Harbors Toxic and Metals TMDLs." Dominguez Channel discharges into the Los Angeles and Long Beach Harbors.

The Machado Lake trash TMDL is being addressed this year with the Machado Lake TMDL Project. The process of BMP selection considered cost-effectiveness to promote a practical and implementable plan. This report also includes integrated approaches that consider BMPs that can address multiple pollutants cost-effectively, while considering parallel water resources planning strategies for the watershed.

The report is organized into nine sections that in summary provide the following information:

- Section 1 provides background information on the Machado Lake watershed and its impairments and associated TMDLs.
- Section 2 provides more detailed descriptions of the TMDL implementation area, including the geologic setting, land uses, hydrology, and hydraulics.
- Section 3 characterizes, evaluates, and prioritizes pollutants and their sources within the City's TMDL implementation area.
- Section 4 details an evaluation of existing programs, mainly nonstructural in nature, to address the pollutants of concern.
- Section 5 presents candidate sites for structural BMP implementation and describes the regulatory and permit requirements that might apply to the proposed BMPs and that might affect the timing, feasibility, and cost of management alternatives.
- Section 6 presents a alternatives evaluation of different structural and nonstructural BMP management options.
- Section 7 includes a discussion of the integrated nature of the plan and its relation to other water resources efforts in the region.
- Section 8 documents schedules for implementing BMPs to meet phased WLA schedule.
- Section 9 presents cost estimates for the BMP alternatives.

1.1 Machado Lake Watershed

1.1.1 Geographic Setting

Machado Lake has a total drainage area of approximately 23 square miles and is located within the Dominguez Channel Watershed Management Area, although it is not tributary to the Dominguez Channel. Machado Lake overflows into Wilmington Drain during peak storm events. The lake itself is under the jurisdiction of the City of Los Angeles, while the drainage area is within the jurisdiction of several cities and unincorporated portions of Los Angeles County (County). The lake is located in the Ken Malloy Harbor Regional Park (KMHRP), which is a 231-acre Los Angeles City Park serving the Wilmington and Harbor City areas.

The lake was originally created for inclusion into Harbor Regional Park in 1971, and intended for boating and fishing.

A map of the Machado Lake watershed and the different jurisdictions located within the drainage area is shown on Figure 1.1. The figure includes the boundary of the Machado Lake watershed and major storm drains.

1.1.2 Machado Lake Responsible Agencies

The responsible parties located within the Machado Lake Watershed include the cities of Los Angeles, Torrance, Carson, Lomita, Rolling Hills, Rolling Hills Estates, Rancho Palos Verdes, Redondo Beach, and Palos Verdes Estates, and unincorporated Los Angeles County.

1.1.3 TMDL Implementation Area

The area of Torrance located in the watershed accounts for 30 percent of the total drainage area. The portion of City Redondo Beach is about 0.2 percent of the entire watershed and flows to a City of Torrance catch basin; therefore, this plan also addresses Machado Lake TMDL compliance for the City of Redondo Beach. For the purposes of this report, this area of Torrance and Redondo Beach located within the watershed is called the TMDL Implementation Area.

The Madrona Marsh and Sump watershed discharges stormwater into Walteria Lake watershed. Madrona Marsh Restoration and Enhancement Project installed passive wetland treatment system to treat water in the sump for nutrients. Madrona Sump Dredging Project will remove nutrient and toxic rich sediments, therefore not part of this plan.

1.2 Water Quality Impairments

1.2.1 Designated Beneficial Uses

The existing beneficial uses of Machado Lake, as defined by the Los Angeles Regional Water Quality Control Board (LARWQCB) in the Basin Plan, include recreation (REC 1 and REC 2) and aquatic life support (WARM, WILD, RARE, and WET). The Basin Plan applies the municipal supply (MUN) beneficial use designation to Machado Lake, qualified by an asterisk, as a potential future use. Conditional designations are not recognized under federal law and are not water quality standards requiring TMDL development at this time.

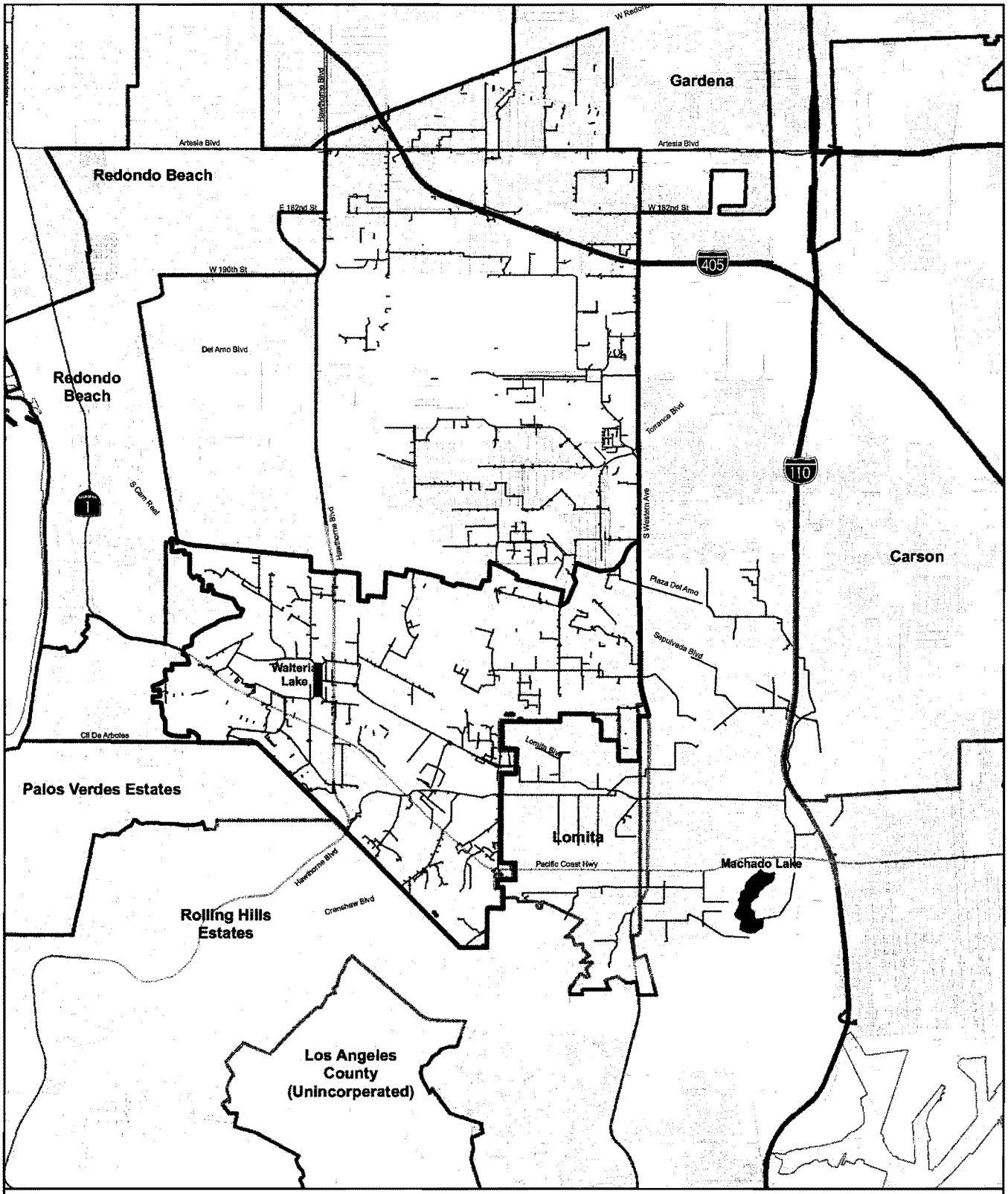

Figure 1.1
Machado Lake Watershed
BMP Implementation Plan
City of Torrance

1.2.2 2010 Section 303(d) List

Section 303(d) of the Clean Water Act (CWA) requires that "Each State shall identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality standard applicable to such waters." The CWA also requires states to establish a priority ranking for 303(d) listed impaired waters and establish TMDLs for such waters. A TMDL is defined as the "sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR 130.2) such that the capacity of the water body to assimilate pollutant loadings (the Loading Capacity) is not exceeded. TMDLs are required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis.

Nutrient enrichment to Machado Lake has resulted in high algal productivity; algal blooms have been observed in the lake during summer months. High nutrient concentrations also contribute to excessive and nuisance macrophyte growth. Algae respiration and decay remove oxygen from the water column, leaving insufficient oxygen for fish and other organisms to breathe. The decay of algal blooms and other eutrophic related impairments can also create offensive odors. This nutrient enrichment, or eutrification of the ecosystem, causes impaired Warm Freshwater Habitat (WARM), Water Contact Recreation (REC 1), and Non-contact Water Recreation (REC 2) beneficial uses in Machado Lake. Because of the high nutrient concentrations, algal blooms, odors and eutrophic conditions, Machado Lake was placed on the Clean Water Act 303(d) list of impaired waterbodies in 1998, 2002, and 2006. A schedule for developing TMDLs in the Los Angeles Region was established in a consent decree (Heal the Bay Inc., et al. v. Browner C 98-4825 SBA) approved on March 22, 1999.

The consent decree combined waterbody-pollutant combinations in the Los Angeles Region into ninety-two (92) TMDL analytical units. In accordance with the consent decree, the Nutrient TMDL addresses nitrogen and phosphorus compounds and related effects for Machado Lake (analytical unit #76).

Machado Lake is listed in the 1998, 2002, 2006, and 2008 Clean Water Act 303(d) lists of impaired water bodies as impaired due to chlordane, DDT, Dieldrin, Chem A, and PCBs in tissue. In addition to these approved 303(d) listings, there are sufficient data to document chlordane, DDT, and PCB impairments in sediment. The impairments were addressed in the Toxics TMDL. Chem A chemicals are bioaccumulative pesticides, which include chlordane and Dieldrin, and were addressed specifically through chlordane and Dieldrin. Clean Water Act 303(d) listing for Machado Lake and Wilmington Drain are presented in Table 1.2. TMDLs have been completed for nutrients, toxics, and trash.

Table 1.2 Water Impairments of Machado Lake and Wilmington Drain	
Water Body	**Impairment**
Machado Lake	Ammonia Algae Eutrophication Odor ChemA Chlordane DDT Dieldrin PCBs Trash
Wilmington Drain	Coliform Bacteria Copper Lead

The Machado Lake Trash TMDL states that agencies can comply *with* the WLAs by installing full capture trash screens on catch basins that discharge to Machado Lake through a progressive eight-year implementation schedule. Full capture trash screen must be installed on 20% of a city's catch basins by March 6, 2012 with 20 percent more each year until 100% of catch basins have trash screens by March 6, 2016.

The City is complying with the TMDL requirements through a joint project with the Cities of Lomita, Carson, Rolling Hills Estates, Palos Verdes Estates, and Rancho Palos Verdes to install Automatic Retractable Screens and/or Connector Pipe Screens onto catch basins that are tributary to the Machado Lake. Work within the City of Torrance also includes the installation of No Parking signs for Street Sweeping within the portion of Torrance tributary to Machado Lake.

1.3 Objectives of the BMP Implementation Plan and Approach

This BMP Implementation Plan outlines the management actions that may be necessary to ultimately attain compliance with the Machado Lake Nutrient and Toxics TMDLs (LARWQCB, 2009), within the Torrance TMDL Implementation Area of the Machado Lake watershed. The BMP Implementation Plan calls for an integrated, adaptive management approach to utilize available resources effectively and efficiently. As new information becomes accessible through monitoring, the continued study of drainage patterns, diagnosis of problem sources, and new technologies for dry and wet weather treatment, the plan may be modified as necessary. Implementation of the management actions described by the plan depends on feasibility, available funding, site-specific conditions, and various other factors.

1.3.1 Focus of the Plan

The Machado Lake BMP Implementation Plan must include implementation methods, a schedule, and proposed milestones to achieve compliance of the TMDL WLAs. The Plan development requires identifying and selecting BMPs to treat stormwater or reduce pollutant loads, as well as developing estimates of benefits in terms of load reductions to meet WLAs. However, the BMP selection process must consider the cost-effectiveness to provide assurance that plans are practical and implementable.

The goal of the implementation plan is to address current TMDLs except trash, with consideration of future potential TMDLs. The nutrients TMDL is considered the primary focus of this implementation plan. A secondary focus is placed on toxics through removal of suspended sediments that toxics are associated with. The third focus is placed on trash because reporting on progress toward the trash TMDL implementation occurs annually and through a separate process. However, proposed BMPs that address trash have the potential to provide added benefit in addressing other pollutants, which is assessed in this implementation plan. Total nitrogen (TN) and total phosphorus (TP) source characterizations are provided in the plan.

This implementation plan includes integrated approaches that consider BMPs that can address multiple pollutants cost-effectively. Additional benefits of BMPs, such as water storage/recharge and reuse, providing recreation space, improved natural habitat, source control and public education, are considered in this implementation plan.

This implementation plan describes management options that are limited to area of the City of Torrance located within the Machado Lake watershed. This area is termed the *TMDL Implementation Area* in this report and is represented in red on Figure 1.1. Some of the proposed nonstructural or programmatic BMPs, such as staff training or education programs, could apply citywide. Rolling Hills Estates watershed is a tributary of Torrance TMDL Implementation Area, and flows directly to Walteria Lake, therefore not addressed in this plan.

1.3.2 TMDL Target

Key factors influencing the level of BMP implementation are the stormwater management targets expected to be achieved. For this project, multiple TMDLs and associated WLAs for stormwater runoff have been established for Machado Lake, which must be considered as a priority for developing the BMP implementation plan. The following provides a summary of applicable wet weather TMDL WLAs and implementation requirements, and methods for translating the requirements into management targets to address wet weather pollution.

1.3.2.1 Nutrients

The Machado Lake Nutrient TMDL was developed by the LARWQCB in 2009. The U.S. Environmental Protection Agency (USEPA) approved the Nutrient TMDL on March 11, 2009, and the approval letter was posted on April 8, 2009. The Nutrient TMDL was developed to address nutrient-related beneficial use impairments including the following Section 303(d) listings: eutrophication, algae, ammonia, and odor.

The City is subject to the requirements of the Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL per the LARWQCB's Resolution R08-006. Under the Regional Board's resolution, the City shall submit to the Regional Board's Executive Officer a Monitoring and Reporting Plan (MRP) within 1 year of the effective date of the resolution or propose a Special Study Work Plan following the requirements of one of three optional studies. The Special Study Work Plan details the approach proposed by the City to perform Optional Study No. 3, to assess compliance with the WLA on a mass basis for total nitrogen and total phosphorus originating from the City's TMDL Implementation Area. The Special Study Work Plan is complete and turned in to the Regional Board.

Resource agencies, local governments, project implementers, the scientific community, environmental groups, decision-makers at the city, county, state, and federal levels, and many others have continued to take meaningful steps towards the restoration of Machado Lake and its basin. Among these efforts, restoration activities are expanding through continued implementation of erosion control, stormwater management, and riparian restoration projects, development of the Machado Lake Nutrient TMDL that is providing a quantitative, science-based approach for pollutant reduction, and a strong research/monitoring effort to evaluate key ecological processes and response to water quality improvement projects. The Machado Lake Nutrient TMDL allows for the establishment of annual mass-based WLAs for Total Phosphorus (TP) and Total Nitrogen (TN) equivalent to monthly average concentrations of 0.1 milligram per liter (mg/L) TP and 1.0 mg/L TN, based on approved flow conditions. When the concentration based WLAs are met under the approved flow condition of 8.45 hm3, the annual mass of the TP discharged to the lake will be 845 kg and the annual mass of TN discharged to the lake will be 8,450 kg. The City of Torrance accounts for 35.6 percent of the Machado Lake Watershed. Table 1.3 lists the interim and final WLAs based on this area.

Table 1.3 City of Torrance Nutrient TMDL Mass-based Waste Load Allocations

Responsible Party	Years after TMDL Effective Date	TMDL Attainment Date[1]	Total Phosphorus (kg/yr)	Total Nitrogen (kg/yr)
City of Torrance	5	March 11, 2014	3,760	7,370
	9.5 (final WLAs)	September 11, 2018	301	3,008

Note:
(1) Effective date of the nutrient TMDL is March 11, 2009.

1.3.2.2 Toxics

Machado Lake is listed as impaired for chlordane, Chem-A, DDT, Dieldrin and PCBs. The LAWQCB adopted the Machado Lake Toxics Total TMDL on September 2, 2010 (LARWQCB, 2010) and was approved by the State Water Quality Control Board and the USEPA. The pollutants listed within the Toxics TMDL include organochlorine (OC) pesticides and polychlorinated biphenyls (PCBs). These pollutants are associated with suspended sediments; therefore, the WLAs were calculated based on the fraction of suspended solids loading produced by each stormwater discharger, and assigned for both dry and wet weather. Compliance is measured either at the storm drain outfall of the permittee's drainage area, at representative storm drain outfalls representing the combined discharge of cooperating parties (if a coordinated compliance option is chosen by multiple permittees), or at an alternative compliance point approved by the Regional Board Executive Officer.

The WLAs assigned to Municipal Separate Storm Sewer Systems (MS4) permittees in the Toxicity TMDL BPA are concentration-based allocations (equal to the sediment numeric targets), and are listed in Table 1.4. The Toxics TMDL requires compliance with these WLAs by September 30, 2019.

Table 1.4 MS4 Permittees Toxics TMDL Waste Load Allocations

	Numeric Target for Sediment	Waste Load Allocation for Suspended Sediment-Associated Contaminants[1]	
Parameter of Concern	Concentration (µg/kg dry weight)	Concentration (µg/kg dry weight) Period	Compliance Averaging Period
Total PCBs	59.8	59.8	3-year average
DDT (all congeners)	4.16	4.16	3-year average
DDE (all congeners)	3.16	3.16	3-year average
DDD (all congeners)	4.88	4.88	3-year average
Total DDT	5.28	5.28	3-year average
Chlordane	3.24	3.24	3-year average
Dieldrin	1.9	1.9	3-year average

Note:

(1) The WLA applies to all MS4 Permittees including the County, Caltrans, General Construction and, industrial Stormwater Permittees, and other non-stormwater NPDES Permittees.

Suspended solids serve as carriers of toxics such as pesticides, dioxins and PCBs. Removal of suspended solids therefore, will also lead to toxics removal. This Plan addresses toxics through the removal of sediments. Removal of toxics is calculated as a fraction of suspended sediments removed by proposed stormwater treatment devices. This Plan relied on toxics data developed from the Domingues Channel Flow Monitoring Program.

Estimated baseline load for toxics is presented in Section 3 of this Plan.

1.3.2.3 Trash

The Machado Lake Trash TMDL became effective in March 2008. The trash monitoring and reporting plan (TMRP) was submitted to the LARWQCB in September 2008, and conditionally approved in December 2008. This BM P Implementation Plan does not specifically address the Trash TMDL because projects to address trash have already been completed or funded.

1.3.3 Scheduled Total Maximum Daily Load

Wilmington Drain, to which all of the County areas drain shown on Figure 1.1, is listed in the 303(d) list as impaired for metals (copper and lead) and bacteria. The additional pollutants of concern listed in Machado Lake are scheduled for TMDL development in 2014 or 2019. This Implementation Plan does not directly address metals or bacteria impairments in Wilmington Drain.

2.0 MACHADO LAKE WATERSHED

The Machado Lake watershed is situated within the Dominguez Channel Watershed Management Area. Machado Lake is separate from Dominguez Channel and discharges, under storm conditions, to the Los Angeles Harbor.

2.1 City of Torrance TMDL Implementation Area

The City is located about 15 miles south of Downtown Los Angeles (LA), in southern LA County, just north of the Palos Verdes Hills. The City was incorporated on May 12, 1921, and is just over 20.5 square miles in area. The City is bounded by Redondo Beach on the west and north, Lawndale and Gardena on the north, LA on the east, Lomita to the southeast, and Rolling Hills Estates and Palos Verdes Estates on the south. The City is also bounded by approximately 4,000 feet of Santa Monica Bay coastline. The City's storm conveyance systems are interconnected with neighboring city systems. Neighboring cities located at generally higher elevation such as Rolling Hills Estate and Palos Verde Estate discharge stormwater into the City's and/or LA County's storm conveyance systems located within the City's boundaries. Figure 2.1 shows an aerial view of the watershed and Figure 2.2 gives an overview of land uses in TMDL Implementation Area.

The TMDL Implementation Area is about 4,239 acres (6.6 square miles), which equals approximately 32 percent of the City of Torrance. The TMDL Implementation Area also includes a very small area of Redondo Beach that drains directly to a Torrance catch basin. The land use category with the largest faction within the TMDL implementation area is residential (43 percent), while open space accounts for about 18 percent. Residential land uses include high-density single family (HDSF), multi-family residential (MFR), and mobile homes. The land uses in the Implementation Area are listed in Table 2.1.

Table 2.1 Land Use in TMDL Implementation Area

Land Use	Acreage	% TMDL Implementation Area
Residential	1,810	43
Commercial	419	10
Industrial	256	6
Transportation	996	23
Open Space	758	18
Total	**4,239**	**100**

Figure 2.1
Overview of TMDL Implementation Area
BMP Implementation Plan
City of Torrance

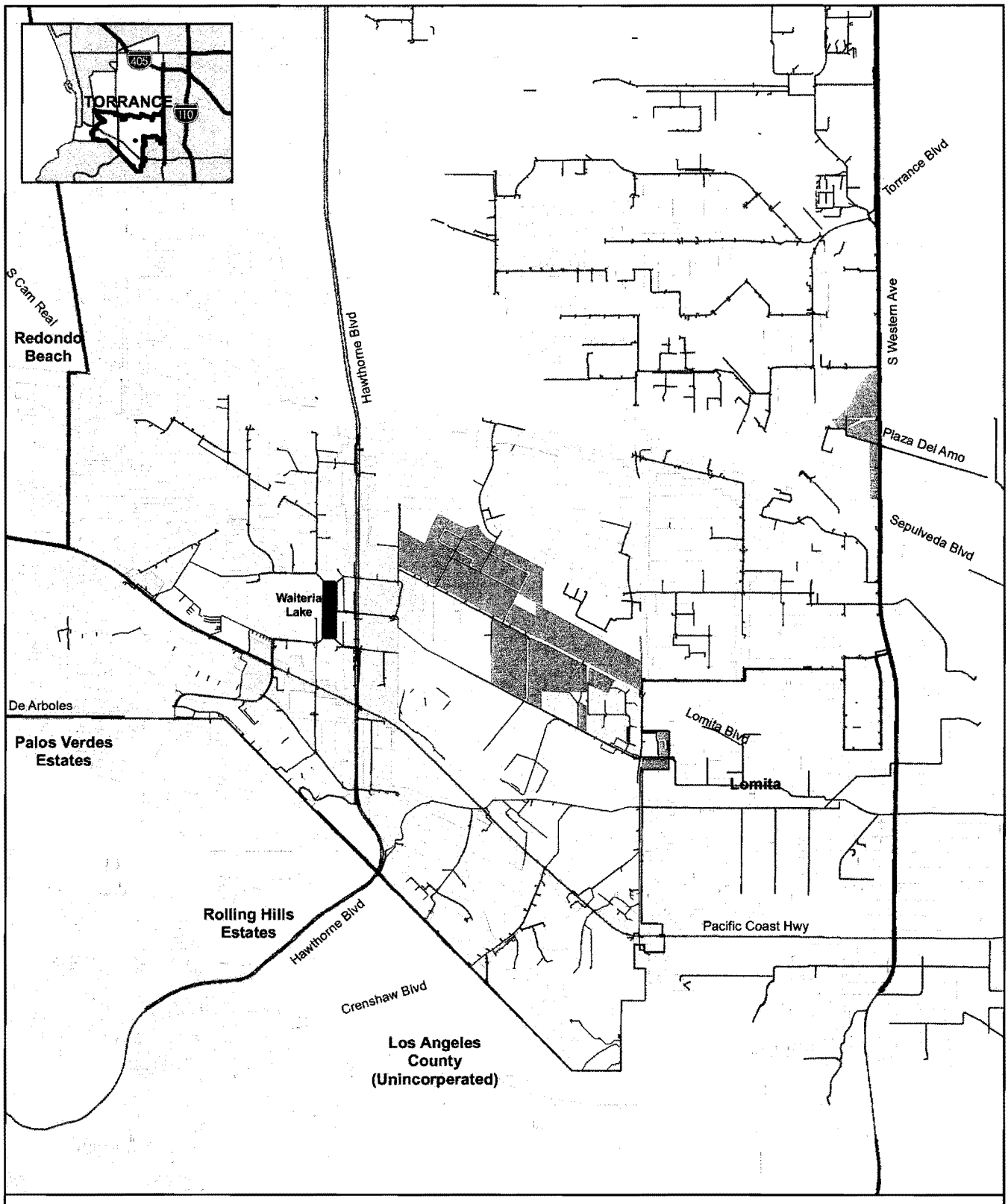

Figure 2.2
Land Use within TMDL Implementation Area
BMP Implementation Plan
City of Torrance

2.2 Geologic Setting and Soil

The soils found within the Machado Lake watershed are predominantly loam and clay. The most common soil type is Ramona Loam, which is observed in the TMDL Implementation Area. Ramona Loam is a compact soil with a large runoff coefficient at high rates of precipitation. Areas such as the Rolling Hills Estates and the lands along Highway 1 are composed of several different classifications of clay and loam. Diablo Clay Loam and Montezuma Clay.

The predominant soil types found in the TMDL Implementation Area are listed by their percentage in Table 2.2. The soil types found across the TMDL Implementation Area are displayed in Figure 2.3.

Table 2.2 Soil Types Distribution

Soil Classification[1]	Percentage of Soil within TMDL Implementation Area
Ramona Loam	21.4%
Yolo Sandy Loam	8.0%
Dublin Clay Adobe	35.3%
Oakley Fine Sand	35.4%
Total	**100.0%**

Note:
(1) LACDPW 2006 Hydrology Manual

2.3 Watershed Hydrology

As shown on Figure 1.1, the Machado Lake watershed is located in the southwestern area of the Dominguez Channel watershed and includes portions of the Cities of Los Angeles, Torrance, Lomita, Rolling Hills, Rolling Hills Estates, Carson, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, and the communities of unincorporated Los Angeles County, including Wilmington and Harbor City. As shown, a large portion of the Machado Lake watershed consists of the hilly regions of Rolling Hills Estates and Rolling Hills. This portion of the watershed is unique, as it consists of relatively steep hills with drainage into the canyons.

Machado Lake is about 40 acres in area, while the Machado Lake wetlands cover an anear of approximately 64 acres. The lake and wetlands are located within the Ken Malloy Harbor Regional Park in the southeastern corner of the Machado Lake Watershed. Both Machado Lake and the Machado Lake wetlands serve as flood retention basins for the Machado Lake Watershed.

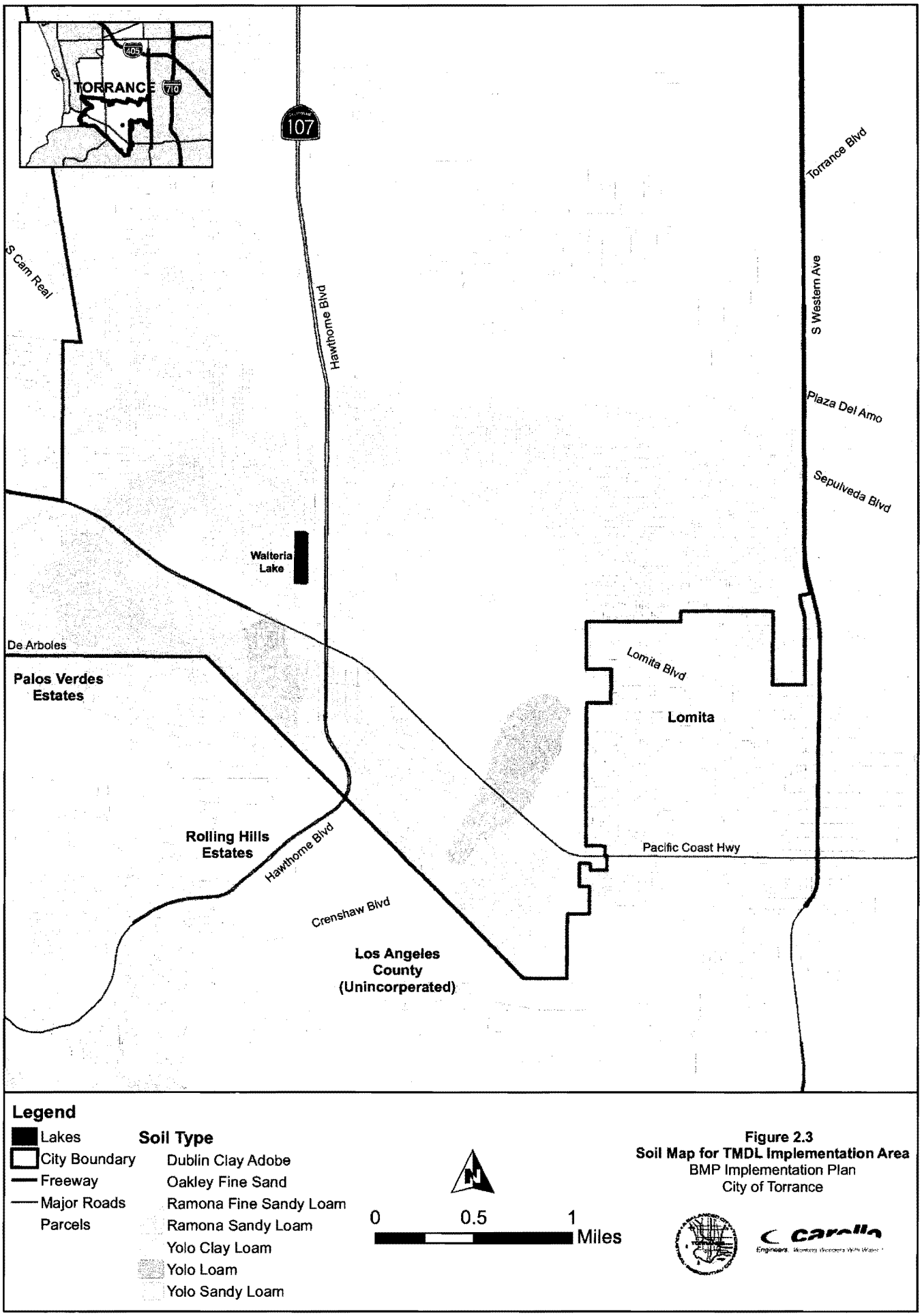

Figure 2.3
Soil Map for TMDL Implementation Area
BMP Implementation Plan
City of Torrance

The Machado Lake watershed can be divided into six primary subdrainage areas. These subdrainages are:

- The Walteria Lake
- Project 77/510
- Wilmington Drain
- Project 643 (72-inch Storm Drain)
- Project 643 (Figueroa Drain)
- Private Drain 553.

2.4 Watershed Hydraulics

As the TMLD implementation area is highly urbanized, stormwater drainage is primarily conducted through an extensive network of underground storm drain facilities. The Los Angeles County Department of Public Works maintains the system of storm drains in the City of Rolling Hills Estates. The primary use of the Dominguez Channel and all other open channels in the Dominguez Channel watershed (including Wilmington Drain, Machado Lake, and Madrona Marsh) is flood protection.

Machado Lake receives urban and storm water runoff from a complex network of storm drain systems. The first of three primary storm drain channels that flow into Machado Lake is the Wilmington Drain. Approximately 65 percent of the runoff from the Machado Lake Watershed flows through the Wilmington Drain into Machado Lake. The other two primary storm drain channels are the Project No. 77 Drain and the Harbor City Relief Drain. Several smaller storm drains also discharges into Machado Lake, including Project No. 643's Figueroa Street Outlet and a 72-inch diameter storm drain outlet. Machado Lake discharges at the southern end by overflowing a concrete dam into the Machado Lake wetland. Water discharges from the wetland through the Harbor Outflow structure and into the West Basin of the Los Angeles Harbor.

The Walteria Lake, located within the City's boundaries, is owned and operated by LA County Flood Control District. It is approximately 1,005 acre-feet in capacity and receives raw stormwater mainly from Rolling Hills Estates, Palos Verdes Estates, and the City of Torrance. Effluent from the lake is pumped at a maximum rate of 57 cubic feet per second (cfs) through a force main system into a 54-inch diameter drain line that lies under Skypark Drive. The discharge eventually leaves the City near the intersection of Crenshaw Boulevard and Amsler Street.

3.0 POLLUTANT SOURCE CHARACTERIZATION AND PRIORITIZATION

This section identifies the potential sources of the pollutants of concern derived from both point and nonpoint sources. The discussion is provided in several parts: modeling results, specific pollutant sources, and a source prioritization. Watershed monitoring results are summarized for reference in Appendix B. The focus of this characterization and prioritization is primarily within the City TMDL Implementation Area. Both wet and dry conditions are discussed. The City's Pollutant Load and Analysis Tool (PLAT) was used to quantify the average annual pollutant loading of nutrients and other pollutants from the TMDL Implementation Area.

3.1 Special Study

To meet the Nutrient TMDL's Optional Study #3 requirements and the aforementioned objectives, the Work Plan outlined an approach that utilized previously existing information to develop mass-based WLAs, and used a combination of water quality sampling and hydrologic modeling to characterize current wet and dry weather loading from the TMDL Implementation Area. Water quality samples were collected monthly at each monitoring location. During the wet season, dry weather sampling events were scheduled seven days after measurable precipitation, or after flow rates had returned to base levels typical of the season, whichever period was shorter.

A total of eight monitoring sites were selected for the Special Study. The characteristics of the monitoring sites are presented in Tables 3.1 and 3.2. Figure 3.1 shows the monitoring sites and associated drainage areas. Drainage areas were determined using GIS layers, provided by the City, of storm drains and the flow paths of Wilmington Drain. Land use calculations were determined using a GIS layer obtained from the City.

Monitoring for nitrogen and phosphorus constituents was performed during the Special Study. The monitoring results for total nitrogen, total phosphorus, and flow rate are displayed on Figure 3.2 and summarized in Table 3.3. The amount of pollutants entering the City from neighboring cities are represented by monitoring locations Tor-S6, Tor-S7 and Tor-S9. Monitoring sites Tor-S1, Tor-S2, Tor-S4 and Tor-S5 measure pollutants and flow leaving the city boundary. The locations of monitoring sites Tor-S1 through Tor-S9 are indicated on Figure 3.1 as S1 through S9.

Table 3.1 Monitoring Sites for the Special Study

Sampling Location Name	Map ID	Description	Primary Land Use	Lat-/ Long-itude	Upstream Storm Drain Name	Diameter (in) and Material
Tor-S1	S1	Located 40 ft north and 80 ft east of the intersection of Plaza Del Amo and Western Avenue. Basin name.	RES	33.82/ 118.31	City	36 RCP
Tor-S2	S2	Approximately 50 ft west of 246th Place and Pennsylvania Avenue intersection.	RES	33.80/ 118.33	City	33 RCP
Tor-S3	S3	Effluent of Walteria Lake, approximately 300 ft west of Hospital Drive and Skypark Drive intersection.	RES	33.81/ 118.35	Walteria Lake	54
Tor-S4	S4	Approximately 210 ft north and 85 ft east of 236th Street and Western Avenue intersection.	RES	33.81/ 118.31	City	9'-2"Wx11'H RCB
Tor-S5	S5	About 25 ft west of intersection of Bani Avenue and 250th Street (two pipes intersect from south and west).	RES	33.80/ 118.33	City	8'-9"Wx9'-7"H RCB
Tor-S6	S6	Approximately 600 ft east of Estates Lane and Crenshaw Boulevard.	RES	33.79/ 118.34	Rolling Hills E.	36 RCP
Tor-S7	S7	About 730 ft south of Rolling Hills Road and Madison Street intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	RES	33.79/ 118.35	Rolling Hills E.	10'x10' RCB
Tor-S8	S8	About 1,000 ft south of 244th Street and Ocean Avenue intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	RES	33.80/ 118.36	Rolling Hills E.	24 RCP
Tor-S9	S9	About 830 ft east and 120 ft south of Paseo de las Tortugas and Vista Montana intersection. Will monitor dry weather flow originating from Palos Verdes Estates.	RES	33.80/ 118.36	Palos Verdes Estates	42 RCP

Figure 3.1
Special Study Sampling Locations
BMP Implementation Plan
City of Torrance

Table 3.2 Monitoring Site Drainage Areas and Majority Land Use			
Monitoring Site	**Map ID (on Figure 4)**	**Drainage Area (ac)**	**Predominant Land Use**
Tor-S1	S1	154	Residential
Tor-S2	S2	248	Residential
Tor-S3	S3	2,115	Residential
Tor-S4	S4	852	Residential
Tor-S5	S5	797	Residential
Tor-S6, Tor-S7 and Tor-S9 drainage basin outside City of Torrance			

Table 3.3 Total Flow (gallons) and Total Mass (kg) of Nitrogen and Phosphorous			
Monitoring Site	**Total Annual Flow (Gallons) [1]**	**Total Nitrogen (kg)**	**Total Phosphorous (kg)**
Walteria Lake Pumping Event (May 29 through June 5, 2012)			
Tor-S3[3]	5,557,715	30.5	4
Total Flow Leaving the City			
Tor-S1	114,947	0.6	0.1
Tor-S2	1,530,700	8.3	1.8
Tor-S4	2,079,514	13	1.5
Tor-S5	79,603,481	3,610	553
TOTAL	**83,328,643**	**3,632**	**557**
Total Flow Entering the City			
Tor-S6	134,162	0.7	0.1
Tor-S7	7,480,023	57	4.8
Tor-S9	1,337,848	6.5	1.6
TOTAL	**8,952,033**	**63.99**	**6.5**
Flow Generated from TMDL Area	**68,818,895**	**3,533**	**546**

Note:
(1) Discharge from Walteria Lake During Pumping (March 7 and December 31, 2012).

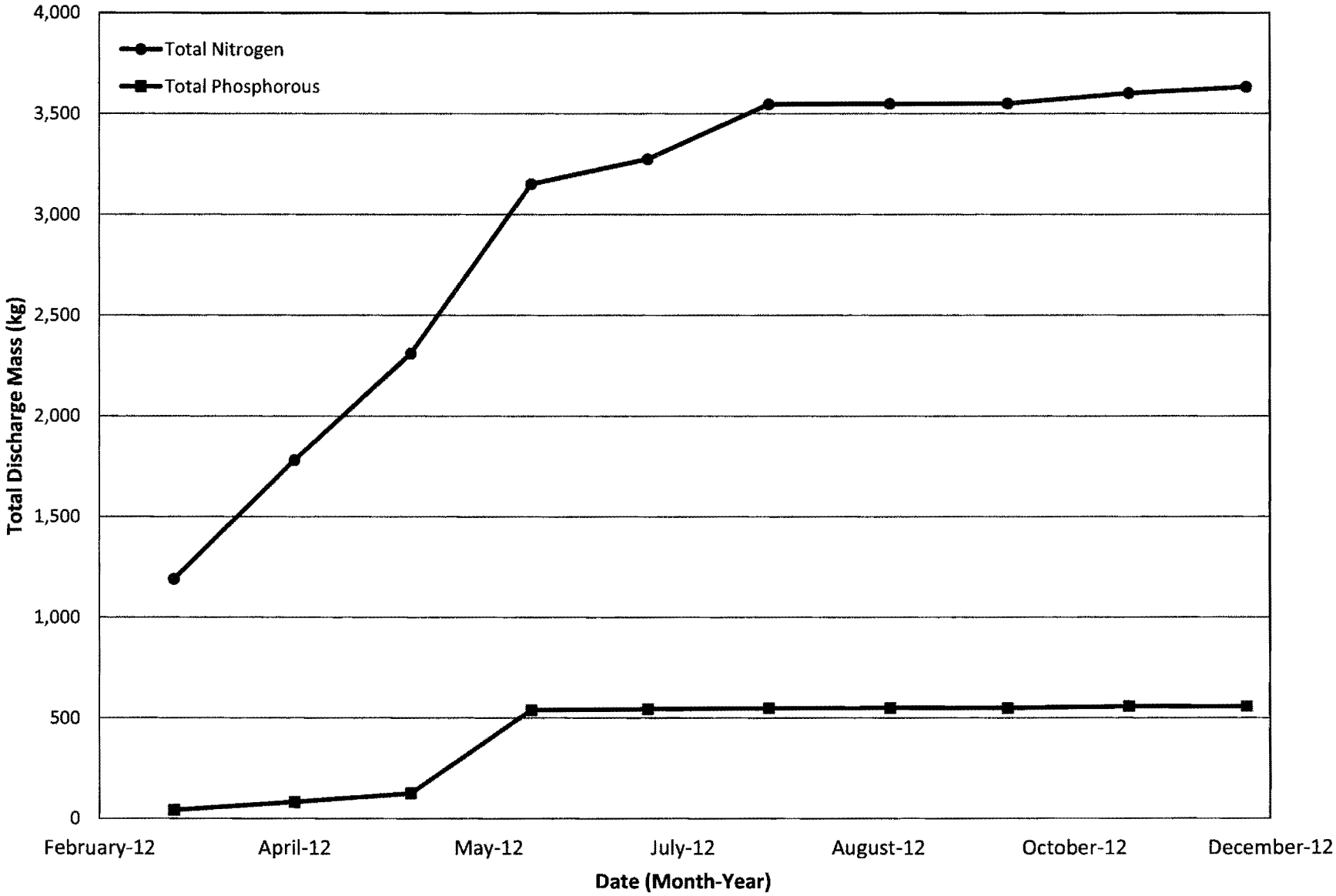

Figure 3.2 - Cumulative Nutrient Load Leaving City Boundary

The water quality sampling data were reviewed to identify whether site location or the timing of events affected the concentrations observed. The data set was reviewed in this way by constituent group, constituent, and, as necessary, constituent fraction (e.g., total and dissolved phosphorus). An analysis of sample variance showed that neither the site location nor event timing had any significant affect on the concentrations of the constituents measured during the study.

3.2 Dry Weather Loading

Dry weather can also be a significant source of pollutant loading. However, results of the stormwater sampling indicate that dry weather flows are insignificant and therefore no further modeling was performed.

3.3 Wet Weather Loading

The City developed a Stormwater Quality Master Plan (SQMP) in 2011 to address increasingly stringent regulatory requirements and stormwater related issues caused by continued development pressure. As part of the SQMP, the portion of the Machado Lake Watershed within the City was modeled utilizing a tool referred to as the Pollutant Loading and Analysis Tool (PLAT), a module linking a number of publicly available models including: USEPA's PLOAD, the Program for Predicting Pollution Particle Passage thru Pits, Puddles, & Ponds (P8),USEPA's SWMM 5.0, and USEPA's SUSTAIN. WMMS and N-SPECT model (Nonpoint Source Pollution and Erosion Comparison Tool) were used to validate PLAT model results. The PLAT was initially calibrated to WMMS model output obtained from the Los Angeles County. PLAT is based mainly on spatially distributed inputs derived from high-resolution satellite imagery.

There are many models that might be suitable for use in conducting the evaluation for Implementation Area. Because Torrance has previously used PLAT as a watershed modeling and basin planning tool, the modeling efforts in the Implementation Area utilized PLAT methodology. In addition, the PLAT modules were selected based on the following model capabilities:

- Dynamic continuous long-term simulation for modeling runoff and pollutant loadings and concentrations in discharges and receiving waters from lands in a watershed system
- Can represent rainfall, runoff , and groundwater processes of urban and natural watershed systems
- Can represent variability in pollutant loadings, based on land use, soil hydrologic group, and slope among other parameters
- Employs a BMP process based approach or empirically based BMP approach

- Includes decision support to evaluate cumulative BMP performance on a watershed scale

3.3.1 Pollutant Loading and Analysis Tool (PLAT)

Even though PLAT was developed before the guidelines (RWQCB, 2014) for developing a Reasonale Assurance Analysis (RAA) was published, only few enhancements were made to meet RAA modeling requirements. The enhancements include converting the original XP-SWMM model (a proprietry software) to EPA SWMM 5.0 model. The general concept of PLAT methodology is presented on Figure 3.3. PLAT methodology is comprised of three main evaluations:

1. Model Calibration/verification – In the absence of field data specific to Torrance, LA County WMMS and N-SPECT models were used to calibrate/validate some modules of PLAT.

2. Annual load estimation and initial BMP Screening. – impervious cover information derived from satellite imagery, event mean concentration (EMC) and PLOAD model were used to compute annual pollutant load, characterize pollutant hotspots, and perform initial BMP screening analysis to select BMPs for detailed aevaluation.

3. Detailed Load and BMP Evaluation – Uses EPA SWMM 5, P8 and SUSTAIN models for comprehensive water quality modeling to identify priority subbasins based on BMP need, BMP sizing and optimization, and evaluation of management alternatives.

The following paragraphs summarize the modules used in PLAT.

3.3.1.1 Annual Load Estimation and Initial BMP Screening Analysis

Satellite remote sensing imagery is the primary source of data used in this analysis. PLOAD, a spreadsheet model, is among one of the models that is most commonly used to estimate pollutant loadings on an annual average basis for any user-specified pollutant. Impervious cover and land cover information extracted from satellite imagery is used in conjunction with PLOAD to compute annual pollutant load for the TMDL Implementation Area.

3.3.1.1.1 PLOAD

The PLOAD model was originally developed to calculate pollutant loads for urban and suburban watersheds, which was subsequently adopted by the USEPA for watershed management planning and was integrated into the BASINS model (USEPA 2001). PLOAD determines pollutant load from a watershed based on watershed land-use data, percent imperviousness, and pollutant export coefficients or event mean concentrations (EMC) values based on either observed data or available literature. It is commonly used to estimate pollutant loadings on an annual average basis for any user-specified pollutant.

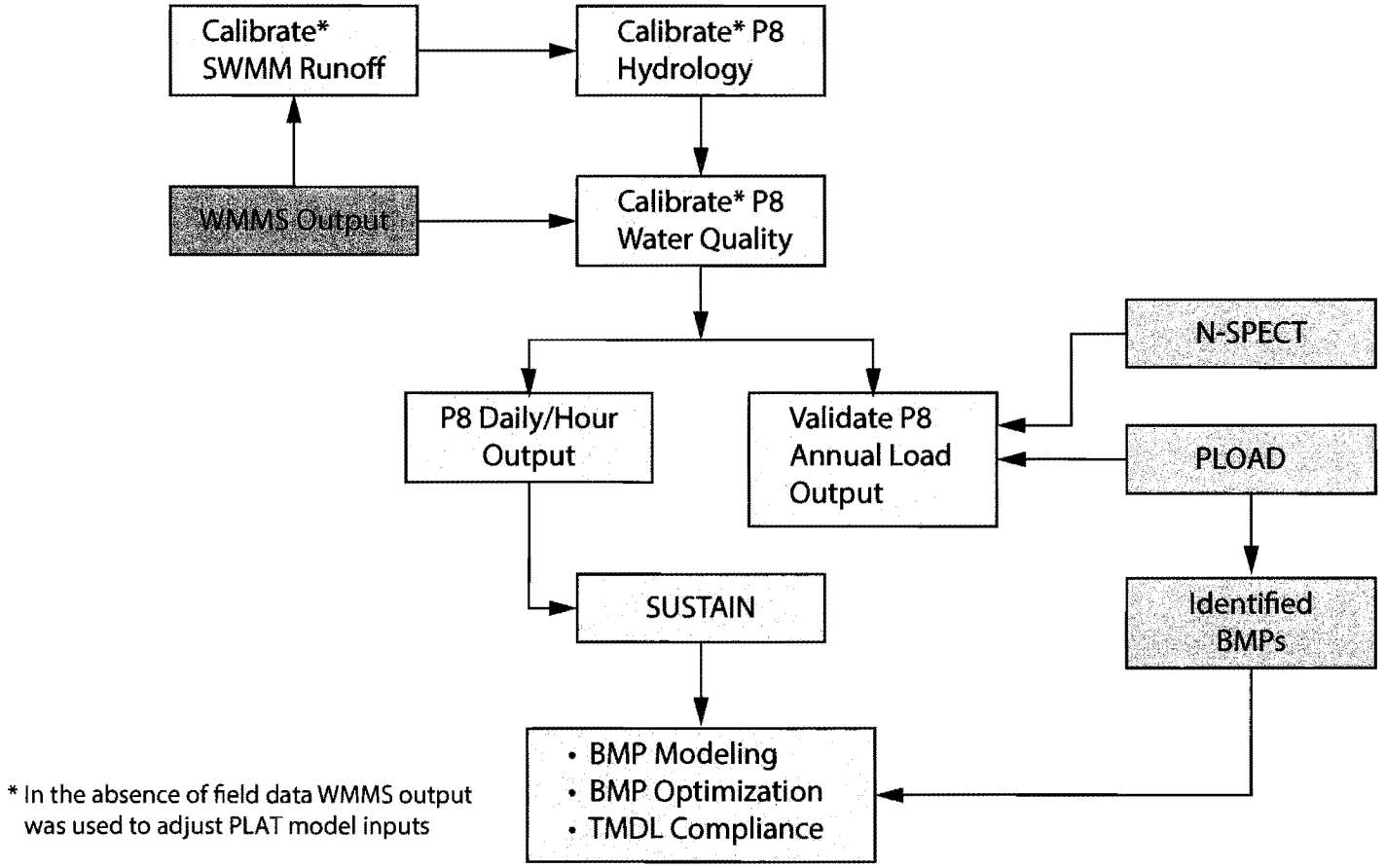

Figure 3.3 General Concept of PLAT Analysis

However, PLOAD does not have the ability to estimate conveyance, e.g., it cannot evaluate changes in peak flow or water quality due to transport. The model also cannot accurately be applied to assess loading for short time intervals. Unlike other models such as P8, it also cannot be used to locate and size BMPs.

3.3.1.1.2 Satellite Remote Sensing

Satellite remote sensing information provides an effective way for monitoring land use/land cover changes in urban areas through mapping variations in anthropogenic impervious surfaces. Impervious surface area (ISA) is considered a key indicator of environmental quality and is also used to identify extent of urban land use because it is highly related to urban land use categories and development density (Xian and Crane, 2005). In addition, ISA can be measured fast and economically by using multi-temporal satellite remotely sensed information. The longtime records available from land remote sensing data makes it possible to quantitatively estimate spatial and temporal variations of land use/cover conditions.

Ground surveys are expensive and generally not practical for mapping impervious surfaces of large areas such as the City's service area. While Global Positioning System (GPS) is useful for assisting in collecting field data, it is not easily implemented for mapping large areas either. Remote sensing, in the form of aerial photography, has been an important source of land use-land cover information for many years and impervious surface area can be readily interpreted from aerial photographs (Draper and Rao, 1986). However, the cost of aerial photography acquisition and interpretation of cover types is prohibitively expensive for large geographic areas. An alternative is to acquire the needed information from digital satellite imagery such as the Landsat Thematic Mapper or Enhanced Thematic Mapper Plus, WorldView, IKONOS, and QuickBird. This approach has several advantages:

1. The synoptic view of the sensor provides large area coverage,
2. The digital form of the data lends itself to efficient analysis,
3. The classified data are compatible with geographic information systems (GIS), eliminating the need to digitize interpreted information, and
4. Land cover maps can be generated at considerable less cost than by other methods.

A number of studies have demonstrated the feasibility of using multispectral satellite data to classify impervious surface area in urban environments. In this study, a high-resolution WorldView satellite imagery acquired on July 10, 2010 was used for ISA mapping.

DigitalGlobe's WorldView-2, the world's newest high-resolution commercial color imaging satellite, was launched on October 8, 2009 from Vandenburg Air Force Base in California. WorldView-2 is the first high-resolution satellite with 8-multispectral imaging bands. It can simultaneously collect panchromatic imagery (black and white) at 0.46 m grid resolution

and multispectral imagery at 1.84 m grid resolution. The satellite provides full-color images for enhanced spectral analysis, mapping and monitoring applications, land-use planning, disaster relief, exploration, defense and intelligence, and visualization and simulation environments. The combination of WorldView-2's increased agility and high altitude enables it to typically revisit any place on earth in 1.1 days.

3.3.1.1.3 Impervious Surface Area Mapping

Impervious area was determined based on satellite imagery. As part of this project, the City purchased high-resolution satellite data from WorldView captured on July 10, 2010. The imagery was selected to minimize the impact of cloud cover and atmospheric effects. The imagery was geometrically and radiometrically corrected using standard methods. Terrain correction using the USGS 1-arc second National Elevation Dataset was performed to improve geolocation accuracy. The geo-rectified satellite imagery is shown in Appendix C.

An image processing model was developed whereby impervious surfaces were extracted from the imagery based on user-defined variables. Within the study area, five image samples, distributed throughout the watershed and encompassing all general land uses were input to the model. Each of the sample images were classified as either pervious or impervious cover. The output was put into GIS for further analysis.

A ground-truth dataset was created by generating a stratified random sample of points across the study area and classifying the points as either pervious or impervious. This step was accomplished via photo interpretation of current high-resolution vertical and oblique color aerial photography.

The completed impervious cover map after image classification and statistical analysis is shown on Figure 3.4. The percentage of impervious surface area is depicted as a continuous variable, ranging from 0 to 100 percent imperviousness based on redness. Areas shaded in deep red have the highest percentage of imperviousness, while areas shaded in light pink have the lowest percentage of imperviousness. Figure 3.5 shows the average percent subbasin imperviousness derived from Figure 3.4.

To confirm that satellite imagery can be used to accurately classify the percent impervious surface area, the satellite estimates were compared to measurements made from aerial photographs provided by the City. The location where the comparison was made is shown on Figure 3.4. Figure 3.6 shows the correlation between the percent imperviousness between these two sources. The results indicate that there is a strong relationship between aerial photograph measurements and satellite-derived estimates. Based on the comparison, an impervious cover map was created using satellite imagery for the entire study area.

Imperviousness (%)

High : 100

Low : 0

% Impervious Comparison Area

Figure 7
Percent Impervious Cover Map Derived from World View 2 Satellite Imagery
BMP Implementation Plan
City of Torrance

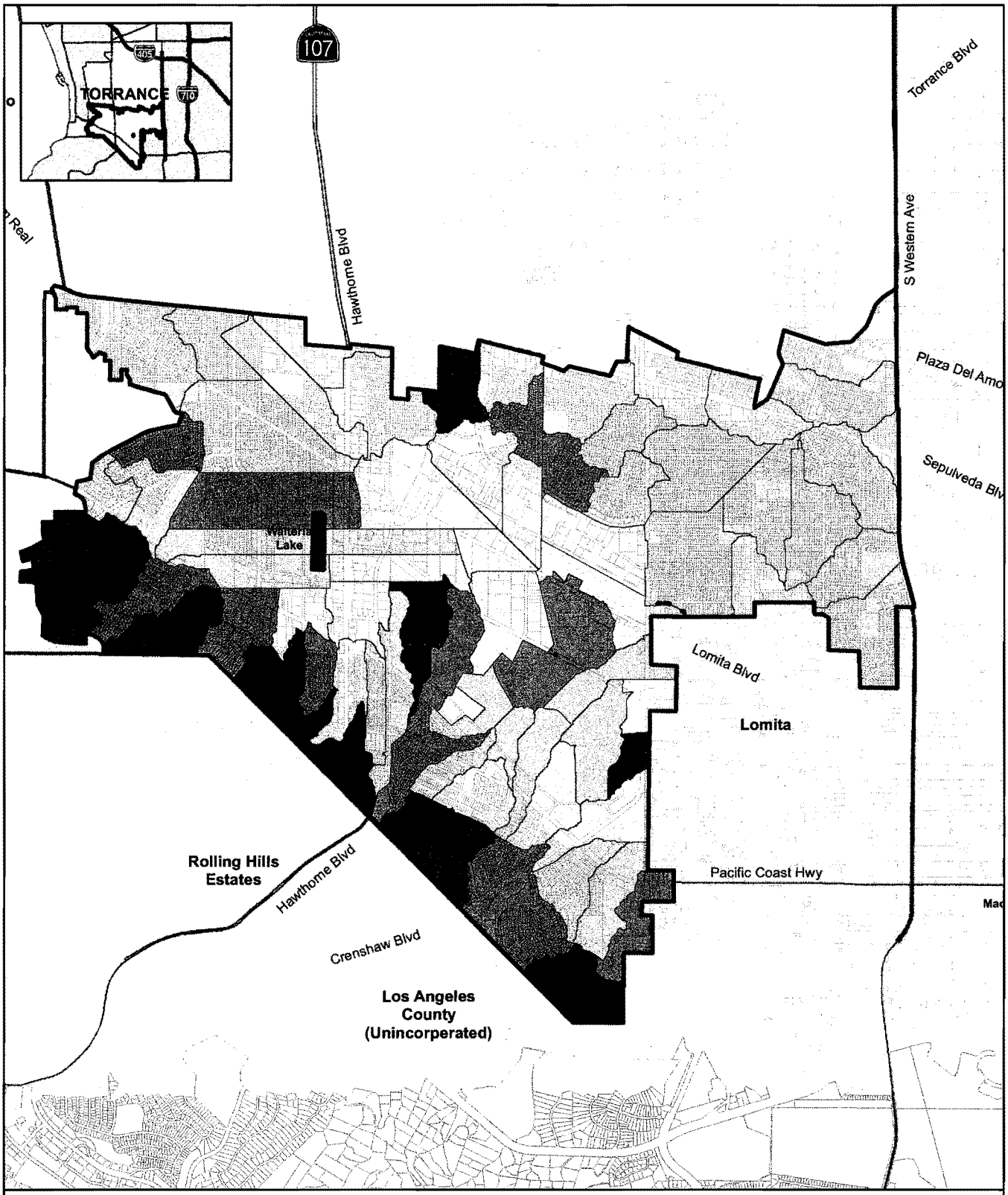

Figure 3.5
Subbasin Imperviousness from Worldview 2 Satellite Imagery
BMP Implementation Plan
City of Torrance

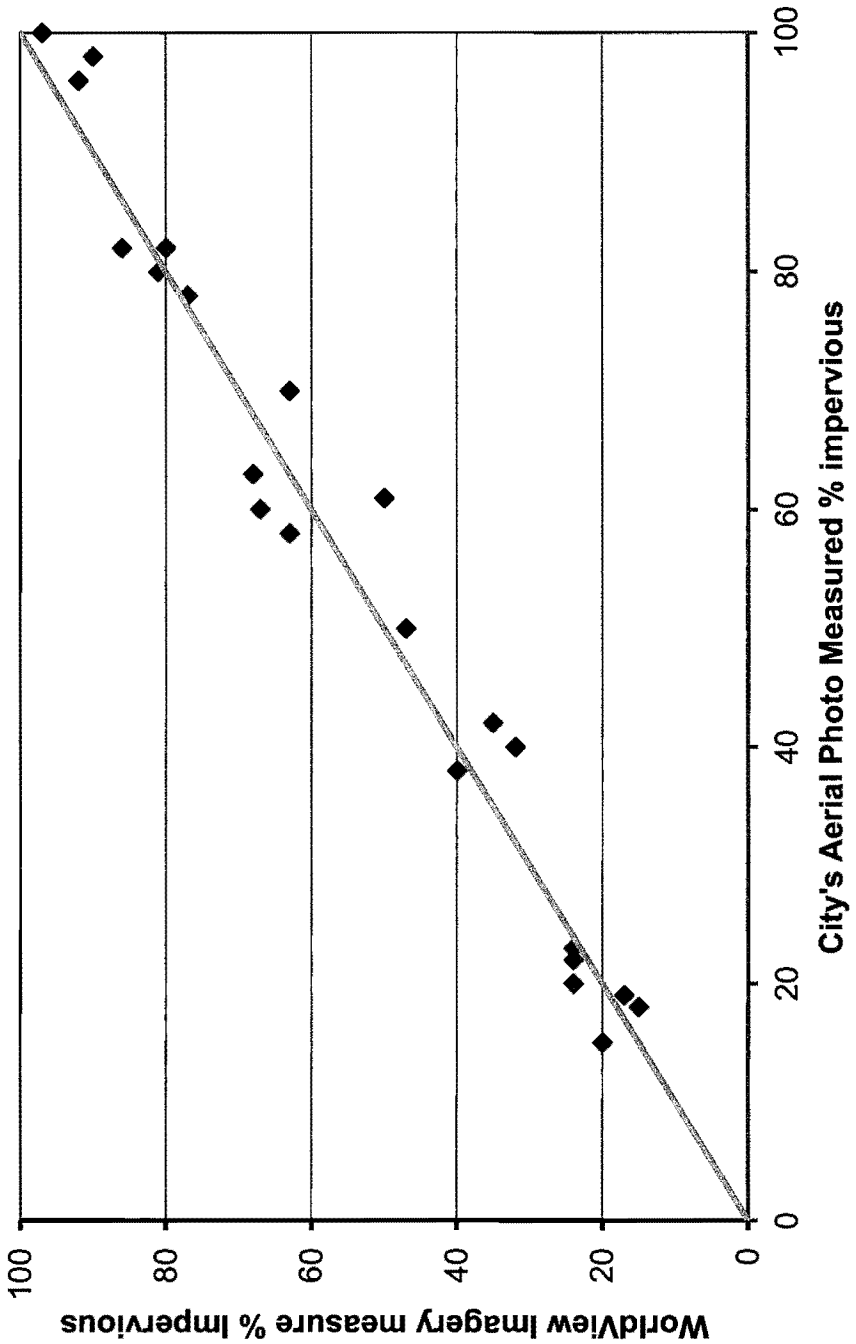

Figure 3.6 - Percent Imperviousness Comparison - Aerial Photo vs Satellite Imagery

3.3.1.2 PLAT Detailed Load and BMP Evaluation Modules

The main objective of the Detailed BMP Evaluation is to overcome the limitations of PLOAD. The Detailed BMP Evaluation modules use the results of the initial BMP Screening by PLOAD to limit computational time by avoiding modeling BMPs that may not work.

Under the current PLAT structure, subcatchment hydrology must be simulated externally. For this project, an external surface water management model (SWMM 5.0) was developed to simulate hydrographs for the study basins, and these hydrographs were subsequently imported into the P8 and SUSTAIN models. The City's original XP-SWMM model was exported to SWMM 5.0 for use in this analysis to meet RAA modeling requirement. This section describes the linkages between the SWMM, P8 and SUSTAIN models, and provides a step-by-step process of the modeling methodology.

The general steps for model development and calibration are listed below and illustrated on Figure 3.7.

1. Converted XP-SWMM model EPA SWMM 5.0 model to simulate runoff and routing for study basins.

2. Calibrated SWMM model runoff volume and timing to flow data extracted LA County WMMS model .

3. Using the calibrated SWMM model, developed unit-area surface water hydrographs (not including stream baseflow) to characterize runoff from each subcatchment by land use (commercial, residential, or forest) and land cover (pervious or impervious) for the 1-year calibration period.

4. Developed unit-area pollutographs for the calibration period by applying event mean concentrations (EMCs) from each land use to the unit-area hydrographs (not including stream baseflow).

5. Built P8 and SUSTAIN land and conveyance module using unit-area hydrographs, pollutographs, and calibrated routing parameters from the SWMM model for the 1-year calibration period.

6. Confirmed flow calibration was maintained by comparing runoff files from calibrated SWMM model to those from P8 and SUSTAIN.

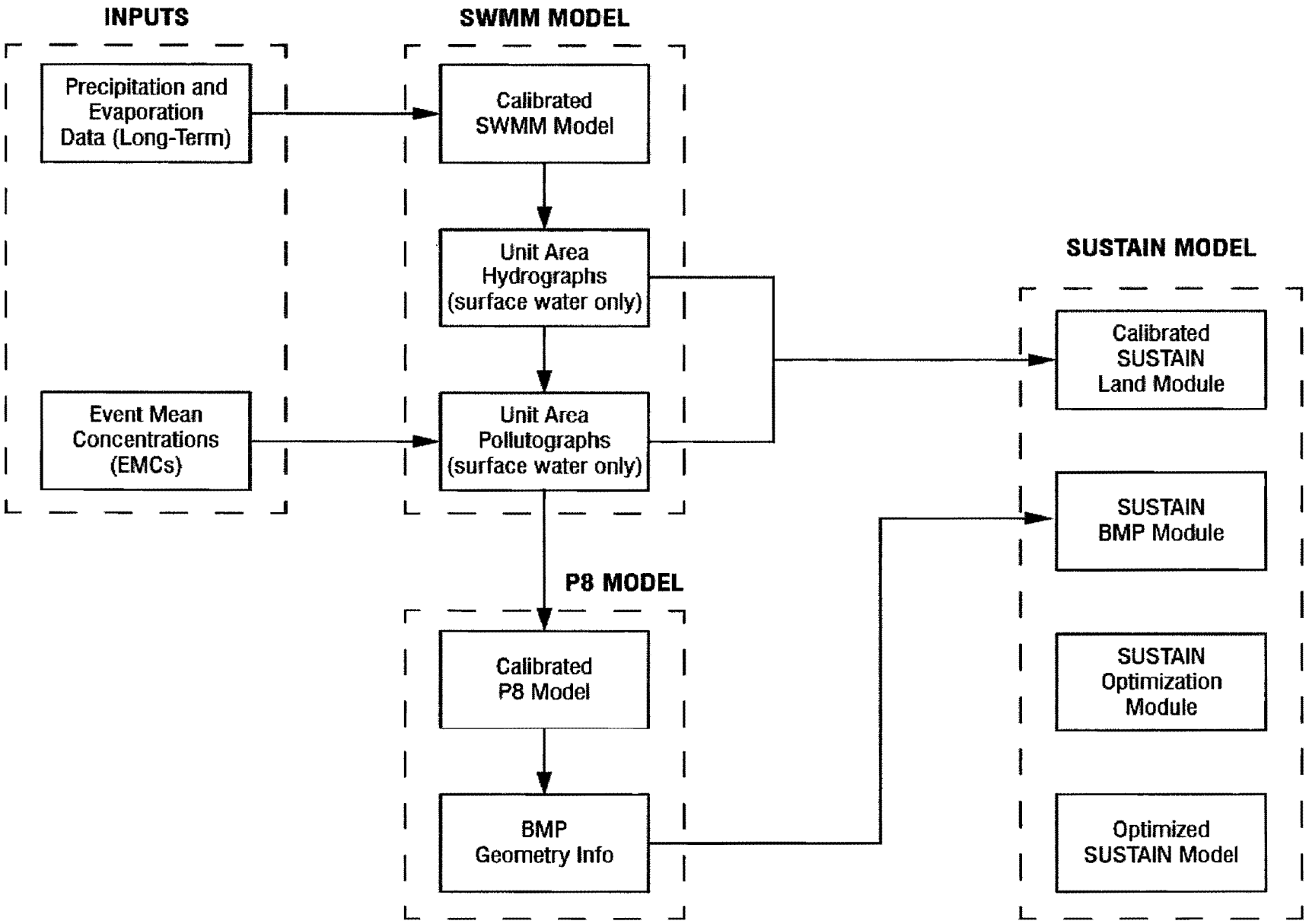

Figure 3.7 SWMM, P8 and SUSTAIN Model Development and Calibration/Verification

3.3.1.2.1 EPA SWMM 5.0

The original XP-SWMM model runoff volume and timing was calibrated to one year flow data extracted from WMMS. XP-SWMM is not a public domain software and therefore the model will be converted to EPA SWMM 5.0. The conversion will not result in any significant loss of accuracy since they computationally use similar engines. EPA SWMM 5.0 (SWMM) is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from user-prescribed land uses. SWMM has been widely used, since its initial development in 1971. GIS is used for the spatial component of the analysis in addition to visualization.

Infiltration was simulated in the SWMM 5.0 model using the Horton Infiltration equation. This equation is used to represent the exponential decay of infiltration capacity of the soil that occurs during rainfall or snowmelt events. The soil infiltration capacity is a function of the following variables: Fo (maximum or initial value of infiltration capacity), Fc (minimum or ultimate value of infiltration capacity), k (decay coefficient), and time. These infiltration parameters are used for the generation of runoff from the individual sub-drainage basins.

The actual values of Fo, Fc, and k are dependent upon soil, vegetation, and initial moisture conditions prior to a rainfall or snowmelt event. Because it was not feasible to obtain this detailed information for each sub-drainage basin through field samples, infiltration assumptions were made based on the soil types throughout the study area. Composite infiltration parameters (Fo and Fc) were calculated for each sub-drainage basin based on the fraction of each soil type within each individual sub drainage basin. Global databases containing the infiltration parameters for each sub-drainage basin were developed and imported into the SWMM 5.0 model.

The values of Fo, Fc, and k applied for each Hydrologic Soil Group are summarized in Table 3.4. The values shown in the table are based on suggested values in the *Storm Water Management Model, Version 4: User's Manual*, U.S. EPA, 1988. The Fo and Fc values were determined for each sub-drainage basin by calculating a weighted average based on the given soil groups within each basin.

Table 3.4 Horton Infiltration Parameters

Hydrologic Soil Group	F_o (in/hr)	F_c (in/hr)	k (1/sec)
A	5.0	0.38	0.00115
B	3.0	0.23	0.00115
C	2.0	0.10	0.00115
D	1.0	0.03	0.00115

3.3.1.2.2 P8 - Urban Catchment Model

The P8 model is designed to predict the generation and transport of runoff pollutants in urban watersheds. It consists mainly of methods derived from other tested urban runoff models, including SWMM, HSPF, D3RM, and TR-20.

The P8 model was developed to design and evaluate development runoff treatment control combinations for pollutant removal efficiency. Although, due to its simplicity, the P8 model has inherent limitations, this model is highly suitable for planning level studies and scenario testing. Model components include stormwater runoff assessment, surface water quality analysis, and routing through structural controls. The model applications include development and comparison of stormwater management plans, watershed-scale land-use planning, site planning, and evaluation for compliance, effectiveness of BMPs, and selection and sizing of management practices.

In P8, continuous water balance and mass balance calculations are performed on a user-defined system consisting of watersheds, devices (runoff storage/treatment areas, BMPs), particle classes, and water quality components. Simulations are driven by continuous hourly rainfall and daily air temperature time series data. The model simulates pollutant transport and removal in a variety of BMPs, including swales, buffer strips, detention ponds (dry, wet, and extended), flow splitters, and infiltration basins (offline and online), pipes, and aquifers.

3.3.1.2.3 SUSTAIN

To overcome the limitations of P8, the SUSTAIN model is employed to comprehensively size and place BMPs, perform optimization analysis, and assess TMDL compliance. Input for SUSTAIN is derived by P8 and SWMM.

The SUSTAIN model is public domain software developed by USEPA. SUSTAIN includes algorithms for simulating urban hydrology, pollutant loading, and treatment processes packaged from multiple models that individually address such processes. Users have the option to import time series data from external watershed models (e.g., Hydrologic Simulation Program Fortran (HSPF) or SWMM instead of performing new land simulations in SUSTAIN.

3.3.1.3 Model Calibration/Verification

In the absence of field data specific to Torrance, LA County WMMS and N-SPECT models were first used to calibrate and validate some modules of PLAT. Annual load computed by PLOAD and P8 modules were compared to WMMS and N-SPECT output.

The Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT) is a complex yet user-friendly geographic information system (GIS) extension that helps coastal managers and local decision makers predict potential water-quality impacts from nonpoint source

pollution and erosion. Input data includes land cover, elevation, precipitation, and soil characteristics to create the baseline information.

3.3.2 Average Annual Wet Weather Load

The annual average loadings generated by PLAT for each sub area in the TMDL Implementation Area are presented in Table 3.5. The data used in the model represent general observations in the Los Angeles Harbor/Dominguez Channel Watershed, which includes the Machado Lake subwatershed, and specific monitoring data from the TMDL Implementation Areas. Monitoring conducted as per the TMDL requirements was used to refine the PLAT modeling results in the Machado Lake watershed, as appropriate.

Table 3.5 PLAT Annual Average Loads by Sub Area

Sub Area	Area[(1)] (ac)	TSS (kg/yr)	TN (kg/yr)	TP (kg/yr)	Toxics (g/yr)
Baseball Field	155	15,650	28	4	1.19
Walnut Sump	923	71,451	127	22	5.44
Walteria Lake[(2)]	2,118	2,989	38	7	0.23
Airport	975	72,305	4,168	619	5.51
Airport Southeast	70	2,897	4	0.9	0.22
Total	**4,241**	**165,292**	**4,365**	**653**	**12.59**

Notes:
(1) Area from PLAT
(2) Load entering Airport Sub Area

3.4 Summary of Sources

The information about pollutant loading from the TMDL Implementation Area in the Machado Lake watershed can be compared with the TMDL allocations. A summary of the pollutant loading from the TMDL Implementation Area, the Final TMDL allocations and ultimate required reductions are presented in Table 3.6.

The annual loading from the TMDL Implementation Area currently complies with the interim limit of total nitrogen, 7,370 kg/yr and total phosphorus of 3,760 kg/yr as listed in Table 3.6 of this report. Final nutrient WLAs are supposed to be attained by September 11, 2018.

According to Table 3.6, 54 percent of total phosphorus load and 31 percent of total nitrogen load must be removed by the City to meet the final nutrient WLAs.

Table 3.6 Calculated Annual Loading Rates to Machado Lake				
Constituent	**Annual Loading[1] (kg/yr)**	**Final Allocation (kg/yr)**	**Required Reduction (kg/yr)**	**Required Reduction[2] (%)**
Total Nitrogen	4,365	3,008	1,357	31
Total Phosphorus	653	301	352	54
Toxics Constituent	**Annual Loading[1] (g/yr)**	**Final Allocation (g/yr)**	**Required Reduction (g/yr)**	**Required Reduction[2] (%)**
Total PCBs	10.74	9.88	0.00	8
Total DDT	0.83	0.87	0.00	0.0
Dieldrin	0.66	0.54	0.12	18
Chlordane	0.36	0.31	0.05	14

Notes:
(1) The annual loading from the TMDL Implementation Area complies with the interim limit of total nitrogen, 7,370 kg/yr and total phosphorus of 3,760 kg/yr as listed in Table 3.
(2) Percent of pollutant amount that is required to be removed.

3.5 Pollutant Source Characterization

The locations and density of pollutant sources in the TMDL Implementation Area are keys to understanding where BMPs and other implementation components should be focused. Typical sources for the pollutants of concern (nutrients) are fertilizers (residential and agricultural), atmospheric deposition, wastewater, leaking sewers, septic systems, animal operations, pets, native geology. The following sections provide a description of these sources.

3.5.1 Sanitary Sewer and SSOs

When sanitary sewers overflow or leak, they can release raw sewage into the environment. Many sanitary sewer networks in the United States were installed decades ago and are in need of replacement. Aging systems are a major source of sanitary sewer leakage. Severe weather, improper system operation and maintenance (O&M), clogs, and root growth can contribute to sanitary sewer leaks and overflows. Overflows can affect nearby waters and also back up into streets and basements (USEPA 2009). Raw sewage contains high concentrations of bacteria and nutrients from human and kitchen waste, as well as organic chemicals and metals.

Chemicals are present in sewage water from household use of cleaners, disinfectants, personal care products, treated swimming pools, and pharmaceuticals. Personal care products and pharmaceuticals have recently been scrutinized for their potential to be

harmful endocrine disrupting chemicals (Boyd et al. 2004). Chemicals from laboratory sinks are also present in raw sewage (USEPA 2009).

3.5.2 Agricultural Operations

Agricultural land use is limited in the TMDL Implementation Area and therefore are not a significant source of nutrients.

3.5.3 Atmospheric Deposition

Atmospheric deposition of pollutants—either directly to a waterbody surface or indirectly to the watershed land surface—can be a large source of contamination to surface waters near urban centers. While this atmospheric source ultimately becomes a part of stormwater, it is important to understand the pathways from initial source (e.g., industrial facility emitting metals into the air) and transport (from air to land to water) processes. Direct dry deposition to waterbodies in the TMDL Implementation Area is not a significant factor because of the small water surface on which to receive direct deposition. Pollutants also exist in wet deposition, which occurs during rain and snowfall. In California, wet deposition is not a significant source of pollutants in comparison to dry depositions because there are so few rain events (Lu et al. 2003).

3.6 Pollutant Source Prioritization

To help develop implementation strategies, a prioritization of pollutant loading by sub area and potential sources was developed. The effort is concentrated on wet weather loading, with the assumption that BMPs targeted for the watershed would be designed to treat both wet and dry weather flows that drain to the BMP.

Wet weather loads generated from the TMDL Implementation Area were converted to area loads (e.g., pounds per acre per year [lb/ac/yr]) for use in the pollutant source prioritization. This provides a normalized view for targeting management in that it shows where the rates are highest. Area loads for each constituent were then ranked with a score 1 through 4 by sub area. Values were assigned quartiles as follows:

- A score of 1 for the lowest 25th quartile[1],
- A score of 2 for values between the 25th and 50th quartile,
- A score of 3 for values between the 50th and 75th quartile, and
- A score of 4 for the highest quartile.

The final rankings for wet weather area-based loads in Table 3.7.

[1] A quartile is one of the 4 subdivisions that have been grouped into four equal sized sets based on their statistical rank.

Table 3.7 Wet Weather Load Ranking by TMDL Implementation Area (Area Loads)					
TMDL Implementation Area	**Parameter Score**			**Total Score**	**Priority Rank**
	TSS	**TN**	**TP**		
Airport	4	4	4	12	1
Walnut Sump	4	2	3	9	2
Baseball Field	3	3	3	9	2
Airport Southeast	1	2	2	5	3
Walteria Lake	2	1	1	4	4
Rank: 1 – Highest Priority 4 – Lowest Priority					

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4.0 DEVELOPMENT OF NONSTRUCTURAL SOLUTIONS

The Implementation Plan uses an integrated approach to address multiple pollutants, using both structural and nonstructural solutions. The following are the proposed nonstructural BMP opportunities to control the contribution of pollutants to the maximum extent practicable.

A comprehensive program has been developed and ready to be implemented to reduce or eliminate the amount of pollutants in stormwater and urban runoff. This program meets a variety of regulatory requirements, including those of the LARWQCB adopted Order R4-2007-0042 for municipal stormwater and urban runoff discharges within the County (LARWQCB 2007b). An evaluation was conducted to identify opportunities for improvements to existing programs and new programs that would help meet TMDL WLAs and to determine the level of success in implementing these programs. Existing nonstructural BMPs are described in Section 4.1.1 and new nonstructural BMPs are proposed in Section 4.1.2. Considered holistically, these existing, improved, and new programs are expected to contribute to the reduction of TMDL pollutant loads and contribute to meeting WLAs.

4.1 Nonstructural Solutions

In general, nonstructural solutions include pollution prevention actions and source control activities that prevent or minimize the amount of pollution entering urban runoff. Pollution prevention actions seek to control constituents of concern before their release to the environment. Typical pollution prevention actions include conservation and reuse activities. Source control activities target pollutants from specific sources to reduce or eliminate the concentrations of those pollutants entering the municipal separate storm sewer systems (MS4). Typical source control activities include, but are not limited to:

- Issuance of local ordinances
- Street sweeping
- Product bans by either the State or Federal government

For pollution prevention and source control measures to be effective, the parties involved need to be educated about the measures, incentives should be provided to use the measures, and enforcement should be available to ensure the measures are implemented. Both pollution prevention and source control measures are proposed as complementary components of nonstructural solutions, which may provide more effective treatment at a lower cost than many structural solutions.

4.1.1 Existing Nonstructural BMPs

The following provides a summary of existing nonstructural BMPs that were evaluated to determine if enhancements could be made to specifically support TMDL implementation. A summary of the City's existing nonstructural BMPs relevant to nutrients and sediment reduction and flow reductions are presented in Table 4.1. The description provides an overview of relevant programs that could directly support stormwater pollution control.

Table 4.1 Ongoing Nonstructural Solutions Conducted by City of Torrance

Non-structural Solution	BMP Type	Description
Public Information and Participation Program	Education	Encompasses several outreach campaigns. Those that most directly address nutrients are the Smart Gardening Program, pet waste outreach, and fats, oils and grease outreach.
Industrial/ Commercial Facilities Control Program	Enforcement	Tracks, inspects, and ensures compliance with permits for industrial and commercial facilities. Controls pollutant transport.
Development Planning	Source Control	Focuses on mitigating the long-term hydrologic and pollutant effects of the built environment and changes in land use. Includes establishing requirements for post-construction BMPs, reviewing plans to ensure that proposed drainage plans meet water quality and hydrologic performance standards, and ensuring long-term operation and maintenance of post-construction BMPs.
Development Construction Program	Enforcement	Addresses runoff from public and private construction projects through the use of stormwater pollution prevention plans (SWPPPs), training of staff engaged in construction activities, and compliance inspections. Through runoff prevention, controls the transport of nutrients and toxics.
Public Agency Activities Program	Source Control	Applies BMPs to infrastructure and facility operation and maintenance activities of Public Agencies to reduce pollutant sources. This includes sewer system maintenance, corporation yard, and recreational facility management.
Illicit Connections/Illicit Discharge Program	Enforcement	IC/ID removal prevents the discharge of a variety of pollutants including nutrients and toxics from entering the storm drain system.
Catch Basin Clean Out	Source control	Catch basins are cleaned at least annually, with higher priority catch basins cleaned semi-annually or quarterly. For industrial catch basins, the optimal cleaning frequency appears to be between quarterly and semiannual; for residential catch basins, the optimal frequency appears to be annual. For commercial catch basins, the optimal frequency is semiannual.
Catch Basin Inserts[1]	Source Control	In an effort to reduce trash as part of the Machado Lake Trash TMDL, catch basin inserts could be installed in portions of watershed. Catch Basin Inserts proposed with Machado Lake Trash TMDL Project.

Table 4.1 Ongoing Nonstructural Solutions Conducted by City of Torrance

Non-structural Solution	BMP Type	Description
Street Sweeping	Source Control	Curbed streets are swept weekly with vacuum sweepers in the city. Much of Torrance is not signed for street sweeping. This will be corrected with Machado Lake Trash TMDL Project.
Impervious Cover Disconnection	Source Control	Employ rooftop disconnection techniques.
County Ordinance No. 2008-000S2U	Enforcement	Prohibits wash down of paved surfaces, irrigation runoff, and requires car washing BMPs.
Restaurant Training	Education	An education program that includes restaurant BMP guidelines, a watershed model showing the potential for oil and grease to affect the watershed, a PowerPoint presentation, and collateral material for restaurant owners, including posters, buckets with BMPs printed on them, and brochures. Torrance does this as part of Clean Bay Certification Program.
County Ordinance Title 10 Animals, Chapter 10.40.060, B.	Enforcement	Requires pet owners to pick up and properly dispose of their pet's waste.

Notes:
(1) Although normally considered structural BMPs, for the purposes of the model, catch basin inserts were accounted for as a nonstructural BMP
(2) Torrance has ban on smoking in Public Parks and Torrance Beach.

Enhancements to the existing nonstructural BMPs and additional nonstructural BMPs can be considered and are discussed in the following section.

4.1.2 Potential Nonstructural BMPs

Potential nonstructural BMPs may include new nonstructural solutions and enhancements of existing nonstructural solutions. Specific sources of nutrients and toxics and their associated nonstructural solutions are listed in Table 4.2. The nonstructural solutions listed in Table 4.2 are detailed in Table 4.3. Sanitary sewer maintenance is covered in other areas of the Implementation Plan. Note that the costs presented in Table 4.3 are per year, and total implementation costs include an estimated rate of inflation of 3 percent over the life of the program.

Table 4.2 Potential Nonstructural Solutions by Pollutant Source

Pollutant Source	Associated Potential Nonstructural Solution(s)
Irrigation overflow	• Smart Gardening Program, with evapotranspiration controller irrigation enhancement • Public Agency Activities Program – landscape and recreational facilities management focus
Landscape fertilizer	• Smart Gardening Program • Public Agency Activities Program – landscape and recreational facilities • management focus • Development Planning – post construction BMPs
Catch basins[1]	• Development Planning – post construction BMPs • Catch basins[1] • Catch basin clean outs – increased frequency • Catch basin inserts – install inserts where other structural BMP retrofits options are infeasible due to ownership/space constraints. Inserts should be selected that are capable of removing nutrients.
Streets and parking lots	• Street and parking lot sweeping – more efficient sweepers and increased frequency
IC/ID	• More aggressive identification and removal of illicit connections • Add stencils and re-stencil storm drains, as needed
Sewage	• Public Agency Activities Program – sewer systems maintenance, overflow, and spill prevention focus • Public Information and Participation Program – fats, oils, and grease outreach • Recreation Vehicle Sewage Disposal Sites – Public Information
Horse manure	• Public outreach
Pet waste	• Public outreach, providing bags and receptacles at parks, etc.
Green waste	• Public outreach
Sediment	• Industrial/Commercial Facilities Control Program • Development Planning • Public Agency Activities Program – materials storage facilities/corporation yards management focus

Note:
(1) Although normally considered structural BMPs, for the purposes of the model, catch basin inserts were accounted for as a nonstructural BMP

Table 4.3 Proposed New and Enhanced Non-Structural BMP Descriptions

Non structural Solution	Description	New/Enhanced Program	Targeted Pollutant	Annual Cost
Add stencils and re-stencil storm drains, as needed	Audit storm drains to determine where stencils are not present or are faded. Efforts should initially be focused in Island 1 where field investigations noted faded or missing storm drain labels	Enhanced: Public Agency Activities Program	Nutrients and toxics	$5K per year
Catch basin clean outs	Modify program to use more aggressive techniques and increase frequency to clean 60% of catch basins monthly and 40% of catch basins semi-annually.	Enhanced: Public Agency Activities Program	Nutrients and toxics	$100K per year
Catch basin inserts[1]	Expand installation of trash catch basin inserts to cover more areas in the city; catch basin inserts should be capable of removing trash, nutrients, and toxics. As an example, Kristar's FloGard Perk Filter has been approved by Washington Dept of Ecology's TAPE program 5 as "basic treatment" meaning that third party monitoring data has validated its ability to remove at least 80% TSS and 50% TP. Regular maintenance is necessary to retain pollutant removal performance	Enhanced: TMDL Implementation	Nutrients and toxics	$20K (includes yearly O&M)
Downspout disconnection program	Establish a downspout disconnection program to incentivize the disconnection of residential rooftop downspouts. See Section on Integrated Water Resource Considerations for additional information, page 36	New	Nutrients and toxics	$50K/ year
Fats, oils, and grease outreach	Target restaurants and residents in the TMDL Implementation Area for additional FOG outreach to educate them about the potential of sewage overflows caused by FOG blockages	Enhanced: PIPP	Nutrients	$5K/ year
Green waste outreach	Target residents and institutional land uses in TMDL Implementation Area for additional proper management of green waste.	New	Nutrients	$5K/ year

Table 4.3 Proposed New and Enhanced Non-Structural BMP Descriptions

Non structural Solution	Description	New/Enhanced Program	Targeted Pollutant	Annual Cost
Horse manure outreach	Target residents for outreach about horse manure management.	New	Nutrients	$5K/ year
Illicit connection removal	Enhance program so that 40% of the system is surveyed and 20% of identified IC is removed	Enhanced: ID/IC Program	Nutrients and toxics	$75K $2,500/illicit connection removal[2]
Industrial/ Commercial Facilities Control Program	Enhancement may include more in-depth training for inspectors and staff that addresses nutrient and toxics specific BMPs. Strengthening partnerships with enforcing agencies may also improve enforcement escalation procedures	Enhanced: Industrial Commercial Facilities Program	Nutrients and toxics	$5K/ year
Landscape and recreational facilities management	Enhancements are similar to the Smart Gardening Program, with application to landscape and recreational facilities managed by the City. The enhancements include switching to non-phosphorus organic fertilizers or using no fertilizer, adding soil amendments to lawns, converting a goal of 25% of lawn to native vegetation and using ET controllers. Outreach may include trainings for City staff that manage or maintain landscape and recreational facilities	Enhanced: Public Agency Activities Program	Nutrients and toxics	$10K/ year
Materials storage facilities/ corporation yards management	Training for City staff in charge of materials storage facilities and corporation yards with focus on activities and materials that may contribute to nutrient and toxic pollution to storm drain	Enhanced: Public Agency Activities Program	Nutrients and toxics	$5K/ year
Oil pump ESC outreach	Work with oil pump parcels located throughout the TMDL Implementation Area to ensure that sediment does not leave the site during the wet season.	New	Nutrients and toxics	$10K/ year
Pet waste outreach	Target residents, pet stores, and animal shelters in TMDL Implementation Area for additional pet waste outreach	Enhanced: PIPP	Nutrients	$50K/ year

Table 4.3 Proposed New and Enhanced Non-Structural BMP Descriptions

Non structural Solution	Description	New/Enhanced Program	Targeted Pollutant	Annual Cost
Post construction requirements for new development and redevelopment	This program may be enhanced with additional training for Development Planning Staff. The focus would be education in planning for and maintaining post-construction BMPs that are effective in reducing nutrients toxics, and runoff	Existing: Development Planning Program	Nutrients and toxics	$25K
Sewer system maintenance, overflow, and spill prevention	Enhance sewer system maintenance and target staff working in the TMDL Implementation Area for SSO response and spill prevention training. This program includes outreach to reduce inputs (fertilizers, pesticides, water, etc.) to landscape, controlling nutrient sources and irrigation runoff.	Enhanced: Public Agency Activities Program	Nutrients	$20K • $1,700/mi to clean sewer pipe
Smart Gardening Program	Field investigations showed evidence of lawn irrigation runoff in the majority of residential neighborhoods in all three Islands. This program should aggressively target the population within the TMDL Implementation areas. This program may be additionally enhanced to include evapotranspiration (ET) controllers to further reduce irrigation runoff. It may also encourage residents to change to non-phosphorus organic fertilizers or use no fertilizer, add soil amendments to lawns, and convert lawn to natural vegetation.	Enhanced: Public Agency Activities Program	Nutrients and toxics	$60K/ year
Street and parking lot sweeping	Increase frequency of sweeping to 2x/weekly	Enhanced: Public Agency Activities Program	Nutrients and toxics	$80K/ year4

Notes:
(1) Although normally considered structural BMPs, for the purposes of the model, catch basin inserts were accounted for as a nonstructural BMP.
(2) Source: Marcoux, 2004 and Brown et al., 2004
(3) Source: WERF, 1997
(4) Source: Modified from Ramsey-Washington Metro Watershed District, 2005.
(5) Source: Washington State Department of Ecology's Technology Assessment Protocol - Ecology (TAPE) program reviews performance evaluation reports on new stormwater treatment technologies and determines whether or not the technologies meet Ecology's performance standards. http://www.ecy.wa.gov/programs/wq/stormwater/newtech/

4.2 Public Information and Participation Program

The County of Los Angeles Department of Public Works' Countywide Stormwater/Urban Runoff Public Education, Used Motor Oil and Used Oil Filter Recycling, Household Hazardous Waste/Electronic Waste Collection, and Smart Gardening programs help achieve the Public Information and Participation Program (PIPP) public outreach mandates and address nutrients and toxics pollution. Public community events, paid media campaigns, media relations efforts, and distribution of collateral materials are part of the standard public outreach practices for the above-mentioned environmental education programs. Visit www.CleanLA.com for information about these programs.

The Smart Gardening Program consists of learning centers and workshops that educate homeowners about conservation (of fertilizers, pesticides, water, etc.) when gardening and landscaping, which reduces the amount nutrients and toxics in the environment. The Smart Gardening Program could be enhanced to help facilitate TMDL implementation by identifying learning centers and/or holding workshops in TMDL Implementation Area.

Tip cards with Smart Gardening Program information could be tailored to address specific concerns (discontinuing irrigation overspray as a pollutant transport mechanism, controlling excess nutrients from fertilizer, pesticide alternatives, etc.) and sent to residences within TMDL Implementation Area.

4.3 Nonstructural Solutions Recommendations

As a result of the review of the existing programs that address the TMDL pollutants, the following are recommended enhancements and additional BMPs that would offer additional water quality benefits and contribute to TMDL implementation:

- **Enhancing the Smart Gardening Program** so it would extend the reach of the water conservation and pollution-prevention messages to the Machado Lake watershed.
- **Conducting TMDL-specific stormwater training** that emphasizes activities and BMPs that can cause or mitigate the TMDL pollutants of concern.
- **Enhancing commercial and industrial facility inspections** to avoid that activities associated with these businesses become new sources of pollutants.
- **Improving enforcement escalation procedures** to more effectively address known sources of pollution.
- **Improving street sweeping technology** to more effectively reduce sediment-bound pollutants from road surfaces.
- **Reducing irrigation return flow** through a variety of water conservation initiatives.

The remainder of the discussion and analysis pertaining to nonstructural solutions focuses on those seven recommended BMPs, which are expected to contribute substantially to reductions in pollutant loads. Table 4.4 shows the extent to which each BMP enhancement or new BMP addresses the TMDLs. All the proposed BMPs address nutrients and toxics; TMDL-Specific Stormwater Training addresses trash.

Table 4.4 Summary of Recommended Nonstructural Solutions

	Condition		TMDL Pollutant Addressed		
Nonstructural BMP	**Wet Weather**	**Dry Weather**	**Nutrient**	**Trash**	**Toxics**
Enhancements to Existing BMPs					
Smart Gardening Program Enhancements	√	√	◗	○	◗
TMDL-Specific Stormwater Training	√	√	◗	◗	◗
Enhancement of Commercial and Industrial Facility Inspections	√	√	◗	○	◗
Enforcement Escalation Procedures	√	√	◗	○	◗
Improved Street Sweeping Technology	√	√	◗	○	◗
New BMP					
Reduction of Irrigation Return Flow	√	√	●	○	◗

√ - applicable; ◗ - about half as effective, ○ - effective

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5.0 DEVELOPMENT OF STRUCTURAL SOLUTIONS

Meeting WLAs for the TMDL Implementation Area will take advantage of the nonstructural BMPs, but structural solutions will provide the majority of the necessary load reductions required. However, structural BMPs are also the most costly, so careful consideration was made in identifying opportunities for structural BMPs and collecting appropriate information to make cost-effective decisions regarding implementation.

Identification and assessment of opportunities for structural BMPs were focused on publicly owned land in the TMDL Implementation Area. Both distributed and centralized structural BMPs were considered. Distributed structural BMPs refer to those practices that provide the control and/or treatment of stormwater runoff at the site level. Typical BMPs in this category include, but are not limited to the following:

- Porous pavement
- Grassed swales
- Bioretention
- Water-harvesting systems
- Catch basin filters
- Practices that can be implemented on individual parcels or in the parkway to store, infiltrate, and treat runoff from that parcel.

Centralized BMPs refer to stormwater treatment, storage, or infiltration facilities that provide benefits on a larger scale (e.g., regional). Such projects can include neighborhood-scale or larger-scale facilities such as:

- Spreading grounds
- Flood control facilities
- Park space that provides treatment/infiltration of runoff from nearby areas.

The BMPs presented above are all not equally suitable to all site conditions and performance goals across watersheds. Consequently, several important site specific factors were considered when identifying those BMPs to include in the project analysis.

The following sections describe the process used to assess opportunities for implementing structural BMPs; both distributed and centralized. Section 6 describes the evaluation of BMP alternatives using an optimization process.

5.1 Summary of Structural Solutions

A phased approach is necessary for implementing structural solutions. The first priority was given to approaches that do not require obtaining land tenure, which may be projects within publicly owned right-of-ways or programs that encourage private owners to implement structural BMPs within their own properties. The next phase will involve public acquisition of property on which structural solutions can be implemented. The creation of public-private partnerships to implement structural solutions will also be considered. A summary of the pollutant removal mechanisms and capabilities of structural BMPs is provided in Table 5.1.

Table 5.1 Pollutant removal mechanisms and capabilities of structural BMPs

Structural BMP	Pollutant Removal Mechanism	Total Nitrogen	Total Phosphorus	Toxics[1]
Infiltration Basin	Infiltration	H	H	H
Detention Basin	Settling	M	M	M
Constructed Wetland	Biological Uptake, Settling	M	H	H
Catch Basin Inserts	Settling, Filtration	L	M	M
Bioretention	Adsorption, Settling, Biological Uptake, Infiltration	M	H	H
Porous Pavement	Infiltration	M	H	H

Notes:
H: high; M: medium; L: low
Scoring modified from International BMP Database, 2010.
(1) Performance data is not widely available for this pollutant class; assumed that removal efficiency would be similar to sediments since these pollutants are largely associated particulates
(2) Phosphorus index of fill soils in bioretention areas will cause a high total phosphorus outflow; high TP removal efficiency is dependent on the fill soils having a low P-index
(3) Nitrogen removal by bioretention areas can be increased using a design variation that creates an anaerobic zone below the drainpipe.

5.2 Assessment of Opportunities for Distributed Structural BMPs

It was not feasible within the TMDL Implementation Plan to identify and size each distributed structural BMP in the TMDL Implementation Area. Rather, within specific classifications of land characteristics (e.g., impervious roads, land use, soil type), general assumptions were established that provide insight regarding the types and benefits of distributed BMPs that can be implemented at a larger scale. That resulted in identifying key distributed structural BMP projects that could be considered for TMDL implementation planning.

Two major categories of distributed structural BMPs were identified, which were based on site characteristics and the types of BMPs determined feasible: 1) catch basin distributed BMPs and 2) other distributed BMPs on public land. The following provides detailed discussions for these categories and the proposed projects for TMDL implementation.

5.2.1 Catch Basin Distributed BMPs

Storm drain systems in developed areas typically begin with inlets at the street level. Stormwater inlets have a variety of names, and there are regional differences in terminology. In California, storm drain inlets are routinely called catch basins.

As discussed in Section 3, roads represent a major source of TMDL pollutant loads, and therefore treating road runoff is considered a key strategy for multi-pollutant TMDL implementation. Because of the number and spatial distribution of catch basins in the TMDL Implementation Area, they represent an excellent opportunity for treating pollutants in addition to trash.

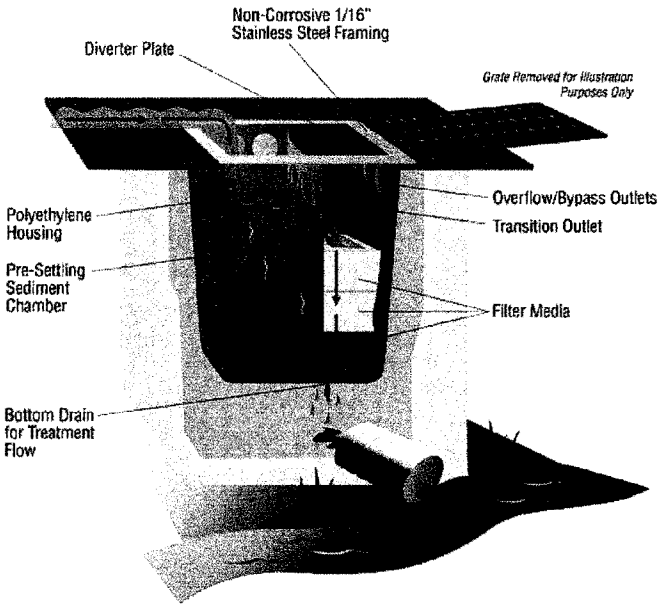


Figure 5.1 Example of Catch Basin Filter Inserts

5.2.1.1 Catch Basin Filter Inserts

Catch basin filter inserts, as illustrated on Figure 5.1, are devices designed specifically to capture trash, oil/grease, other floatables, sediment, organics, and other pollutants—can offer additional pollutant removal benefits. On the basis of a synthesis of available studies, catch basin filter inserts are expected to treat and remove a significant fraction of sediment (and associated metals and toxics) with treatment focused on runoff from the transportation network. The treatment efficiency of catch basin filter inserts for bacteria is poorly studied and unknown but is likely to be very low unless the insert has a design element targeting bacteria. Such devices tend to have a 1- to 3-year warranty and would need maintenance or replacement after that. Catch basin inserts can replace full capture devices upon installation depending on whether the space they occupy is compatible with the full capture device. Some devices (such as the Abtech Smart Sponge™) can be installed in tandem with existing full capture devices.

Implementing catch basin filter inserts throughout the TMDL Implementation Area is highly applicable because of the high density of catch basins. The TMDL Implementation Area

includes almost 811 catch basins, which equates to approximately 1 catch basin every 200-300 lineal feet of stormdrain. The distribution of catchbasins within the TMDL implementation area is summarized in Table 5.2.

Table 5.2 Summary of Catch Basins by Subwatershed

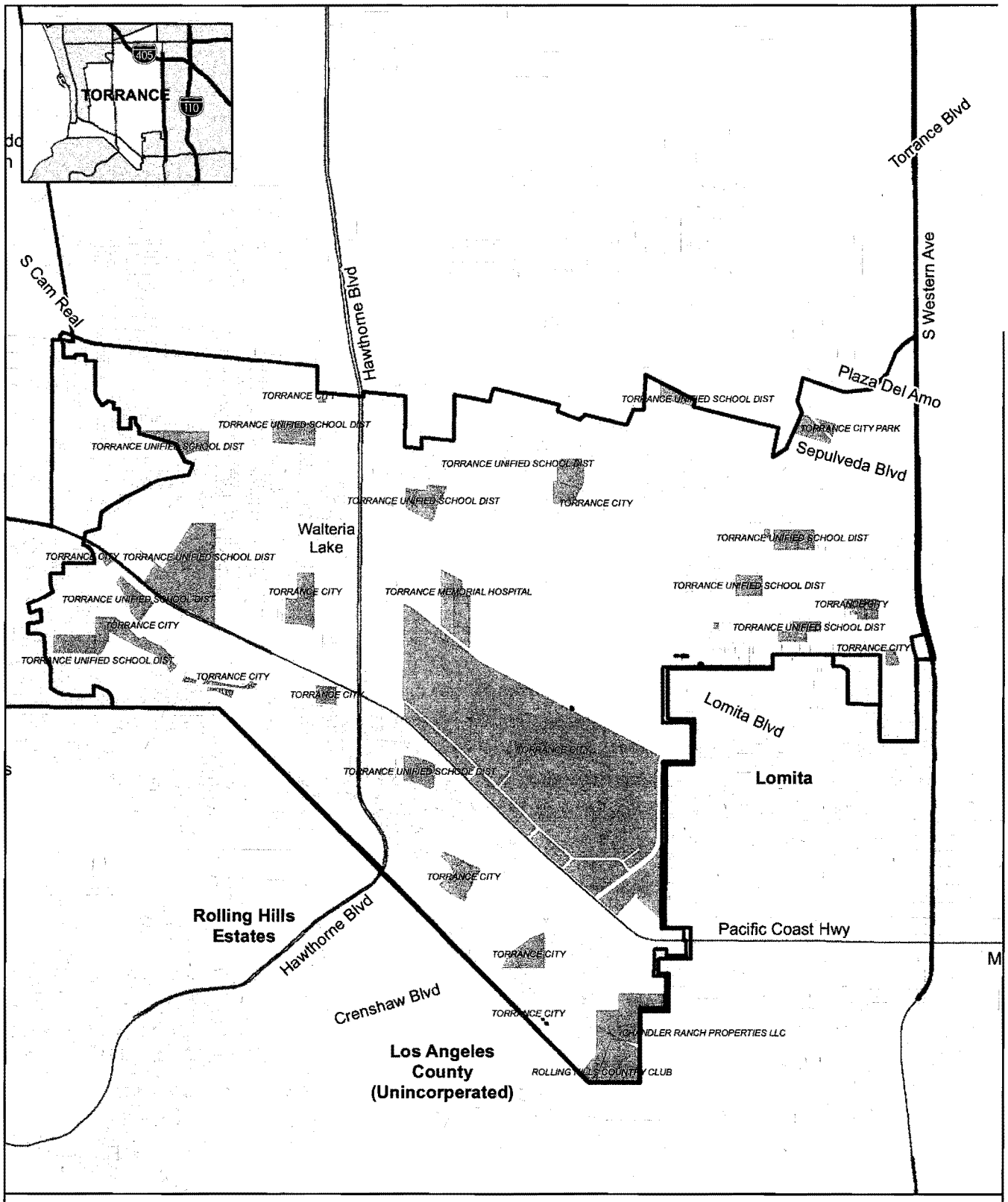
Subwatershed	Storm Drain Length (mi)	Number of Catch Basins	Catch Basin Density (CB/mi)
Walteria Lake	25	373	15
Airport	14	173	12
Walnut Sump	9	242	27
Baseball Field	1.4	23	17
Total	**50**	**811**	**16**

Notes:
(1) Based on count from City's storm drainage atlas maps

The City is currently in the process of installation of full capture devices for compliance with the trash TMDL. Implementing catch basin filter inserts would require retrofitting or replacing the full capture devices that have been installed. For the TMDL Implementation Plan, implementing catch basin inserts is assumed to focus on replacing existing full capture devices with catch basin filter inserts, which is a more resource intensive, conservative approach. During actual implementation, other more cost-effective approaches for full capture device retrofit could be employed. The schedule for implementing catch basin inserts in the TMDL Implementation Area considers maximizing the operational period of installed full capture devices, thus improving the return on the investment. Implementing catch basin inserts would involve internal planning, conducting a pilot study to gain approval from the LARWQCB for attaining the trash TMDL requirements (for cases where full capture devices are being retrofitted or replaced), installing the devices, and maintaining the sediment-removal insert as part of the existing catch basin maintenance activities.

5.2.1.2 Other Distributed BMPs on Public Land

Before stormwater enters the storm drain systems, opportunities are available for the storage, infiltration, and treatment of runoff within publicly owned right-of-ways or parcels. Such areas include road right-of-ways or other properties owned by public agencies for various purposes (e.g., parks, schools, storage, and utilities). Figure 5.2 shows the publicly owned parcels within the TMDL Implementation Area. In combination with road right-of-ways, this area represents a significant opportunity for on-site stormwater treatment.



Legend

- Publicly Owned Parcels
- Project Area
- City Boundary
- Freeway
- Major Roads
- Parcels

0 0.5 1 Miles

Figure 5.2
Publicly Owned Parcels in TMDL Implementation Area
BMP Implementation Plan
City of Torrance

Engineers

5.2.2 Low Impact Development

The County of Los Angeles adopted a low impact development (LID) ordinance on January 1, 2009, which directly influences the selection and use of structural BMPs. New development and future redevelopment within the City are subject to LID requirements. The requirements are intended to result in runoff quantities and quality that mimic the runoff from undeveloped areas, up to and including runoff from a 50-year design storm event.

Development projects with four or fewer residential units are required to implement two LID BMP alternatives as specified in the County LID Standards Manual. LID BMP alternatives include, but are not limited to the following measures:

- Disconnecting impervious areas
- Installing porous pavement
- Dry wells
- Conforming to landscaping and irrigation requirements
- Installing green roofs

Developments with five or more units or nonresidential developments are required to provide infiltration for excess runoff volume. Runoff from these developments that mimics the natural hydrograph must meet treatment requirements. Redevelopment projects where at least 50 percent of the impervious surfaces are altered must mitigate the entire project area. Redevelopment projects that alter less than 50 percent of the impervious area only need to mitigate the alteration.

Implementation of LID BMPs within the TMDL Implementation Area provides an opportunity to reduce the loading of pollutants by reducing concentrations of pollutants in runoff and reducing the volume of runoff.

Both development and redevelopment are largely driven by the strength of the economy. Currently, the rate of development is near a historic low and as a result, estimates for gains from LID and the schedule for those gains are difficult to quantify. As part of the adaptive management implementation, the effects of implementing LID BMPs through development and redevelopment will be tracked though the monitoring and reporting program. Increased levels of development or redevelopment should result in decreases in pollutant loading from the TMDL Implementation Area, reducing the need for additional structural controls. Stagnation of development in the TMDL Implementation Area may lead to an extended schedule or require additional structural controls to attain TMDL WLA levels.

5.3 Assessment of Opportunities for Centralized Structural BMPs

To identify, evaluate, and ultimately select the optimal combination of centralized structural BMPs to address pollutant load reductions for the TMDL Implementation Area, key information was required. Investigations were performed to identify and assess potential sites for placing centralized structural BMPs on public land. Priority locations of centralized structural BMPs were publicly owned properties to reduce the need for land acquisition. Additional consideration was made regarding the necessity for implementing centralized structural BMPs on private land. Results of this assessment provided information necessary to support TMDL implementation planning.

5.3.1 Site-Screening Methodology

An initial analysis was conducted to identify all publicly owned parcels in the TMDL Implementation Area. That initial screening resulted in approximately 24 parcel groups as shown on Figure 5.2. The 24 parcel groups included any publicly owned land with no analysis of the suitability for a centralized BMP. Most of the sites provide adequate space for a centralized BMP. They are not too steep, or are within a feasible distance of a stormwater drainage system.

Additional screening was performed to further narrow potential sites for additional investigation. Additional field investigations were performed for identified locations to assess site and drainage area characteristics and identify the ideal BMP that could be constructed at the site.

Subsequently, GIS analysis was performed of land ownership parcels and site characteristics to identify potential sites for centralized BMP placement on publicly owned parcels. Considerations in the analysis included the following:

- **Land cost**—Land costs were minimized by identifying publicly owned parcels.
- **Percent impervious**—Areas with higher percent imperviousness would produce more runoff during typical rain events. Higher impervious areas were targeted for greater potential volume reduction and water quality improvements.
- **Space requirements**—Sites were evaluated to determine if space is available to implement an appropriately sized BMP.
- **Watershed treatment area**—The size of the TMDL Implementation Area drainage area for each site was evaluated on the basis of available storm drain or Digital Elevation Model (DEM) data. Sites were identified that provide sufficient space for BMPs to adequately treat/store/infiltrate runoff from their respective drainage areas.

- **Soil type**—Soil type was evaluated as an initial estimate of the infiltration rate and capacity of the soils. Sites with infiltration rates suitable for infiltration BMPs were further investigated.

- **Slope**—Slopes of sites were considered on the basis of DEM or other available topography data sets. Sites with moderate slopes (less than 10 percent for GIS purposes) were considered for centralized BMPs. Slope was verified in the field investigation, and sites where the slope is inappropriate for a centralized BMP were eliminated.

- **Multi-benefit use**—Sites were identified that could serve multiple purposes. For instance, some stormwater practices, such as infiltration basins or grassed swales, could serve a dual purpose of stormwater management and community park space. Several parks could be altered to provided stormwater treatment and storage.

Those criteria were evaluated to identify sites where centralized BMPs would be feasible. Sites that could provide enough space to effectively treat the drainage area associated with the site, that have soils suitable for infiltration, and that are publicly owned (to reduce land acquisition costs) were preferred. Sites that could provide a multi-benefit use, such as parks or parking lots where belowground storage could be used, were considered ideal. From the GIS screening analysis, a list of potential locations for centralized BMPs was developed to address stormwater runoff from the TMDL Implementation Area.

This GIS screening and additional field investigations narrowed the potential sites to the following five sites (which are also depicted on Figure 5.3):

- Airport 1 – A1
- Airport 2 – A2
- Airport 3 - A3
- Walnut Sump
- Baseball Field

Details regarding the proposed structural BMP improvements are presented in subsequent subsections, while general observations and strategies used to develop these BMP concepts are described below.

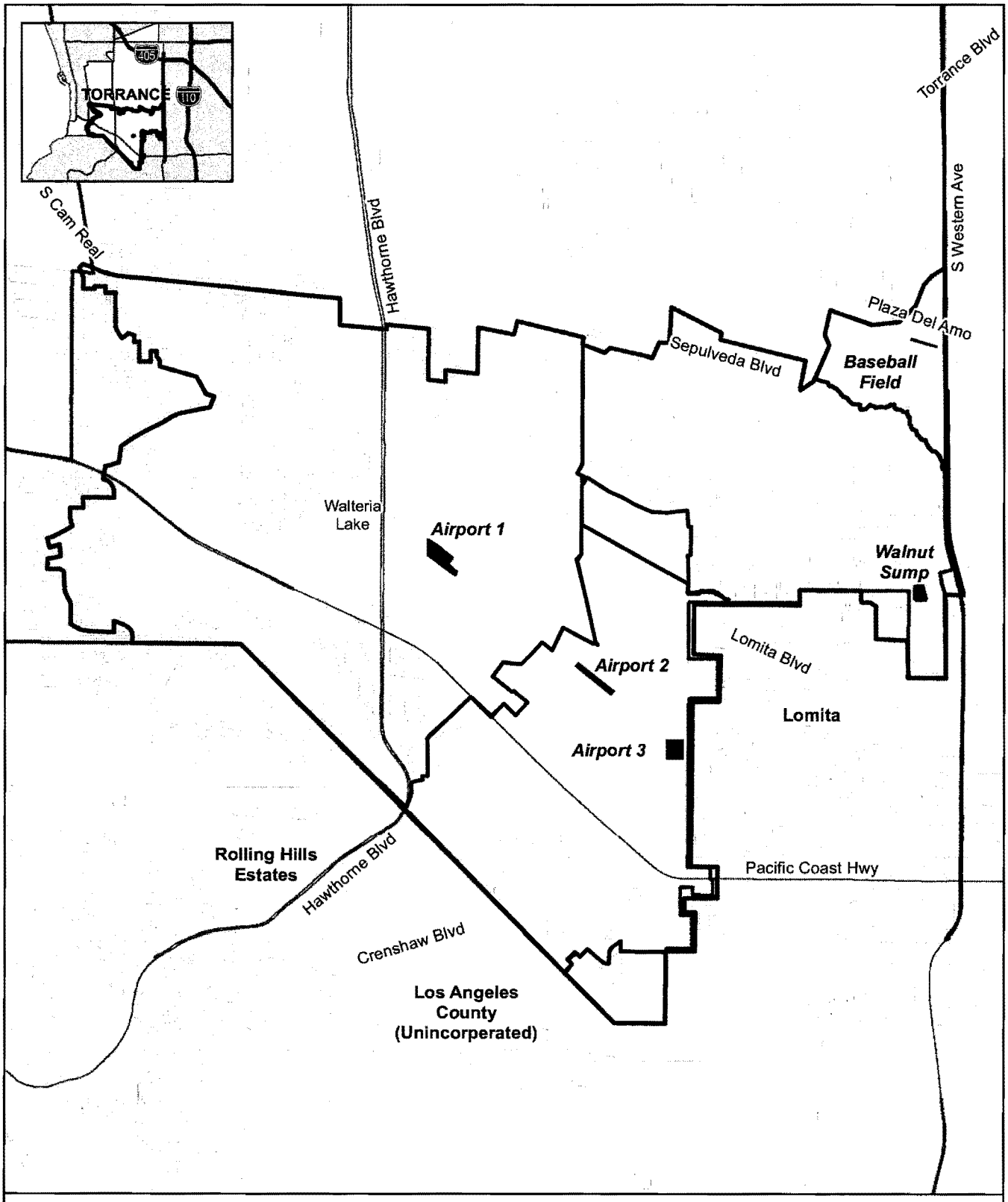


Figure 5.3
Potential BMP Sites within TMDL Implementation Area
BMP Implementation Plan
City of Torrance

Because existing site layouts and features can have an effect on where and what type of BMPs can be installed on a site, site layouts and on-site structures were photographed and documented to support evaluation of the site for centralized BMPs. The considerations included the following:

- **Effects on surrounding areas**—Any nearby structures, including storm drains and utilities, were documented. Any effects that could occur to surrounding structures because of settlement issues were noted.
- **Maintenance/accessibility**—Every BMP must be maintained at some level for the BMP to continue to function as it was designed. BMPs were considered that maximize access for maintenance purposes.
- **Research potential**—Research of stormwater BMPs is ongoing and necessary to fill existing data gaps and to continue to support the City in developing BMP standards. Monitoring protocol would be considered and incorporated into the design of each BMP that is implemented.

The individual site characteristics and summary of field investigations and BMP recommendations are described below. The description includes results of field tests to evaluate infiltration rate, water table depth and soil quality; more detailed maps of potential BMP sites; and photographs of the watershed treatment area and available BMP area for each site. Centralized structural BMP options for the sites were narrowed down to specific BMP types and sizes during the process of evaluating nonstructural and structural solutions.

The watershed treatment areas for each of the five identified sites, unless otherwise noted, are residential with concentrated or dispersed density configurations. Residential areas are known to generate high levels of nutrients, such as nitrogen and phosphorus, typically from over fertilization and excess irrigation. Detergents used to wash cars in residential areas can contain high levels of phosphorus. Residential areas are also a source for metals and bacteria. While the largest portion of the watershed treatment areas are residential, there are also institutional and commercial areas in many of the watersheds. Institutional and commercial areas are typically a source of metals, nutrients, and PAHs. Additional pollutant source discussion is included in each site discussion where additional detail is required.

On the basis of observed conditions at all the potential BMP sites, two types of centralized BMPs could be implemented in the open space at the five sites: underground storage/infiltration basins and extended dry detention/infiltration basin. Three of the potential BMP sites, A1, A2 and A3 are located at the Torrance Airport, one at Walnut Sump and the last site is located under the road near Torrance Baseball Field. The sites were also selected to eliminate or minimize the need for pump stations. Each centralized BMP is suitable for treating nutrients, toxics, metals, and other pollutants typically delivered with suspended sediment (e.g., organic pesticides, PAHs) in stormwater. Infiltration basins

require high infiltration rates and are not designed to store water for extended periods. Underground storage/infiltration systems are suitable in areas with hydrologic soil group (HSG) C soils and soils in the lower range of HSG B where infiltration is possible but could take longer.

The five potential sites investigated do not have hard surface areas such as tennis courts, basketball courts, playgrounds, skateboard parks, and parking areas. These potential sites do not require a structural foundation and therefore could be used for belowground storage and treatment. Storm chambers installed below these surfaces would provide additional treatment while still allowing the areas to be used for recreation and parking.

The type and size of the BMP were determined through further optimization analysis and reported in Section 6. The BMPs are planned to infiltrate water within a few days, reducing possible public health risks from stagnant water such as mosquitoes and drowning. An infiltration basin could still be used for recreation and open space activities between storm events and during the dry season. Belowground BMPs could have overlying space available for recreation or parking regardless of the weather.

Each of the investigated potential centralized BMP sites has ample open space to provide access for maintenance. Observed maintenance at each potential site includes regular mowing similar to the required maintenance for an aboveground-centralized BMP. To maintain infiltration functionality, sediment would need to be removed when infiltration rates are reduced twenty-five to fifty percent from the design infiltration rate. Infiltration rates can be restored by removing accumulated sediment and disking or aerating the surface. Sediment from belowground BMPs would have to be removed annually or as needed.

Considering current usage, ample space would be available for construction activities at each investigated site. While the focus of each of the potential centralized BMPs is TMDL compliance, implementing such BMPs also aligns with several integrated water resources planning objectives. In addition to the intended BMP objective of water quality improvement, a centralized BMP at each of the proposed sites would contribute to flood protection, water conservation, groundwater replenishment, and improved aesthetics.

5.3.2 Utility Search

Prior to recommending a potential BMP site, a utility search was conducted. Known utilities companies contacted for utility information regarding the project area include:

- Sempra – Gas utility
- Southern California Edison – Electric utility
- Metropolitan Water District of Southern California (MWDSC)

Utility information obtained from the companies were included in the database created for this project. Analysis of the utility information indicates that there appears to no potential conflict with the proposed projects. The utility information is included in Appendix D.

5.3.3 Geotechnical Investigation

Accurately identifying the Hydrologic Soil Group (HSG) of the existing soils is also an important first design step in computing BMP design treatment volume and appropriate runoff reduction credit. The initial screening of the on-site soils was conducted to identify basic soil characteristics related to stormwater management, such as the HSG and other features relevant to construction activities (e.g., erosion and sediment control). Also, through the initial screening areas where more detailed soil investigation and field determinations may be needed to refine the limits of the different HSGs as defined in the soil survey were identified. The initial screening also included the identification of locations deemed suitable for infiltration BMPs and therefore further detailed geotechnical investigations.

Due to concern regarding infiltration rates at the Torrance Airport, a geotechnical investigation of this site was conducted using three soil borings. Details of this subsurface investigations are summarized in Appendix E. In summary, it can be concluded that the boring logs indicate that the top layer below surface at the Airport consists of a thin layer of silty sand followed by sandy clay, alluvium, and clay deposits. At depths ranging from 25 to 45 feet below surface, a sand layer is present. This layer would be most suitable for infiltration of stormwater. Hence, substantial excavation would be required to install the underground infiltration galleries at this site, which results in higher cost and difficult access for maintenance. More details regarding this BMP site is provided in the next section.

5.3.4 Torrance Airport Basin

The Torrance Airport Basin is about 60 percent impervious with a concentrated impervious configuration and moderate road density. There are three proposed BMP sites all located at Torrance Airport (A1, A2, and A3). These are open areas and are well maintained, suggesting the use of fertilizers that have high levels of nutrients and some metals, such as copper, adding another source of nutrients and metals to the stormwater runoff from the area.

For the purposes of BMP implementation in this area, the drainage basin is subdivided into four treatment subcatchments, AS1, AS2, AS3, and Walteria Lake, shown on Figure 5.4. Stormwater runoff from these four subcatchments could be diverted to the three potential sites; A1, A2 and A3 for treatment. The subcatchments were delineated based on drainage characteristics and storm drain layout. Stormwater runoff from AS3 could be treated at A3, AS2 stormwater would be diverted to A2 and Walteria Lake discharge diverted to A1 for treatment.

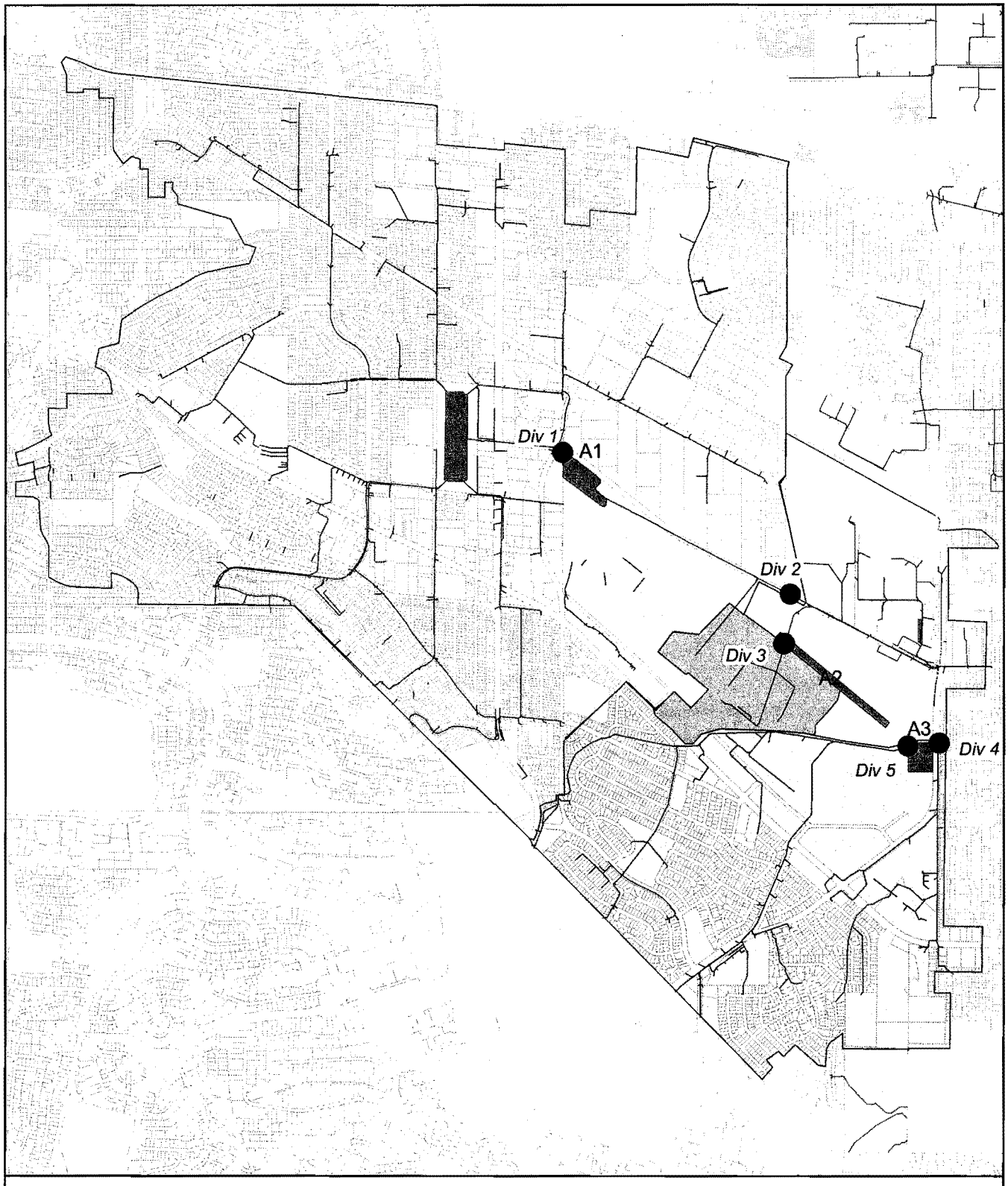


Figure 5.4
Torrance Airport Drainage Area Map
BMP Implementation Plan
City of Torrance

Based on the storm drain layout, it is not costeffective to divert stormwater from AS1 to any of the three BMP sites. Therefore, non-structural BMPs will be considered for this subcatchment.

The Walteria Lake subcatchment is served by Walteria Lake, which acts as an extended wet detention basin. Stormwater is pumped from the lake through a 54-inch diameter force main. During big storms and/or pumping conditions, there is a high potential for sediment resuspension. This may lead to high pollutant discharge into Machado Lake. To prevent pollutant discharge into Machado Lake and thereby meet WLAs, discharge from Walteria Lake could be diverted at two locations into potential BMP sites A1 and A2 as shown on Figure 5.5. However, A1 and A2 are designed based on Torrance watershed only. Additional capacity to treat flow volume pumped from Walteria Lake is not part of this report. A1 could be expanded with financial participation from the LA County Flood Control District (LCFCD).

5.3.4.1 Subcatchment Volume Associated with 85th Percentile, 24 Hour Storm

Wherever feasible, the City wants to capture and retain all non-stormwater runoff and all stormwater runoff from the 85th percentile, 24 hour storm event for the drainage area tributary to the BMP site. The applicability of the three BMP sites to capture and treat the 85th percentile runoff volume for each subcatchment was investigated. The total surface area and volume requirements for each potential BMP site is summarized in Table 5.3. As shown in the table, the potential BMP sites A1, A2 and A3 have adequate surface area to implement underground storage/infiltration system to treat stormwater generated from their respective subcatchments. The total depth of the proposed underground storage/infiltration system would range between 4 and 8 feet.

Table 5.3 Summary of BMP Requirements –Torrance Airport

BMP Site	Drainage Area Treated (ac)	Percent Imperviousness	Treatability[1]	Water Quality Volume (ac-ft)	Water Quality Flow (cfs)	BMP Capacity (ac-ft)
A1	NA[2]	NA	NA	NA	57	22.4
A2	86	45	6.7%	1.5	10.8	12.0
A3	640	59	66.1%	28.3	97.6	32.8

Notes:
(1) Treatability: Fraction of impervious surface in subcatchment treated by BMP
(2) Only effluent discharged from Walteria Lake subcatchment.

Legend

- Diversions
- New Conveyance
- Inflitration/Recharge
- Storm Drains

N

0 1,000 2,000 Feet

Figure 5.5
Conceptual Layout of Torrance Airport Underground Storage/Infiltration BMP
Stormwater Recharge Project
City of Torrance

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The three sites were also evaluated to determine if the soils at the sites meet infiltration requirements. Based on geotechnical evaluation, BMP site A3 is the least feasible site to implement underground storage/infiltration due to the presence of a thick clay layer. Infiltration system at the site will have to very deep and will be costly. Therefore, underground storage/infiltration system would be implemented at site A3 only when additional treatment is required after installation of BMPs at sites A1 and A2. Sites A1 and A2 have enough capacity to capture and infiltrate the 85th percentile runoff from subcatchments AS2 and AS3. The total capacity of sites A1 and A2 is approximately 34.4 ac-ft. Therefore, AS2 and AS3 can be designated as 85th Percentile Basins.

5.3.4.2 Torrance Airport Basin Treatment Scenarios

Table 5.4 shows a summary of the pollutant load generated from subcatchments AS1, AS2 and AS3. These three subcatchments represent approximately 23 percent of the Implemetation Area. However, they generate about 95 percent of the total phosphorus load generated from the entire Implementation Area. Therefore, for the City to meet the TMDL requirements, stormwater generated from these subcatchments must be managed using watershed-based strategies that combine structural and institutional or non-structural BMPs.

Table 5.4 Torrance Airport Subcatchment Pollutant Load Summary

	Pollutant Load (kg/yr)			
Subcatchment	**TSS**	**TP**	**TN**	**Toxics**
AS1	19,627	168	1,131	1.50
AS2	4,694	41	273	0.36
AS3	47,984	411	2,765	3.66

Subcatchment AS1

Stormwater generated from subcatchment AS1 will be treated soley with non structural BMPs. Non-structural BMPs recommended for implementation in AS1 include:

- Street sweeping – toxics and other pollutants released to the urban environment during dry weather conditions are likely to adsorb on street sediments, which provide mechanism for metals to reach downstream waterbodies. Street sweeping removes sediment, debris, and other pollutants from road and parking lots surfaces. Street sweeping is also proposed in subcatchments AS2 and AS3.

- Catch Basin Filter Inserts/Cleanouts – continuation of catch basin cleaning programs will contribute to removal of sediments prior to entering the storm drains. The

pollutant removal mechanisms of catch basin inserts are: screening, sedimentation, flotation, and absorption. Debris and large particles are removed by screening; smaller particles and sediment along with associated hydrocarbons, metals, nutrients, toxics and pathogens are removed by settling; and hydrocarbons that are not associated with sediment are removed by absorption.

This Implementation Plan through modeling which is discussed in Section 6 proposes combined efficiencies of non-structural BMPs 30% for sediment, 10% for phosphorus and 23% for nitrogen. Toxics removal is assumed to be directly related to sediment removal efficiency. The assumptions underlying the modeling efforts are discussed in Section 6.

Subcatchment AS1 has a total drainage area of about 249 acres with average imperviousness of about 60 percent. Stormwater runoff from AS1 will be captured by a total of 57 catch basin filter inserts. All the 57 catch basins will be retrofitted to allow the installation of full capture filters. Table 5.5 presents the expected outcome after implementation of non-structural BMPs in subcatchment AS1.

Table 5.5 Torrance Airport Basin - Summary of Load Reduction from Quantified BMPs for Subcatchment AS1

	Load (lb/yr)			
BMP Scenario	**TSS**	**TP**	**TN**	**Toxics**
Before BMP	19,627	167.8	1,131	1.50
After BMP[1] (Load reduction)	13,739	151	871	1.05
% Load Reduction	30	10	23	30

Note:
(1) Load reduction by combined non-structural BMPs

Subcatchments AS2 and AS3

Both non structural and structural BMPs are recommended for subcatchements AS2 and AS3. Street sweeping and storage/infiltration system will be implemented in these two subcatchments. The storage/infiltration system will be implemented in phases at BMP sites A1 and A2. In phase 1 an 8 feet deep underground storage/infiltration system will be implemented at Site A2. The implementation of underground storage/infiltration system in Phase 2 will depend on the effectiveness of the Phase 1 BMP. The Implementation Plan calls for an integrated, adaptive management approach to utilize available resources effectively and efficiently. If through continued study of drainage patterns, diagnosis of problem sources, and new technologies for dry and wet weather treatment, it is realized that more treatment is needed in the Airport treatment area, BMP site A1 will be considered for implementation of additional storage/infiltration system in Phase 2.

In Phase 1, runoff generated from subcatchments AS2 and AS3 will be treated at Site A2. Under this phase, two options have been identified and illustrated on Figures 5.6A and 5.6B. In Option 1, stormwater runoff will be diverted from Crenshaw Blvd and Amsler Street, and pump through a 14-inch forcemain to another diversion system at Crenshaw Blvd and 250th Street. From here, the stormwater will flow by gravity to the infiltration system at Site A2. To improve infiltration in this area, the infiltration system should be located at a depth not less than 40 feet from the ground surface.

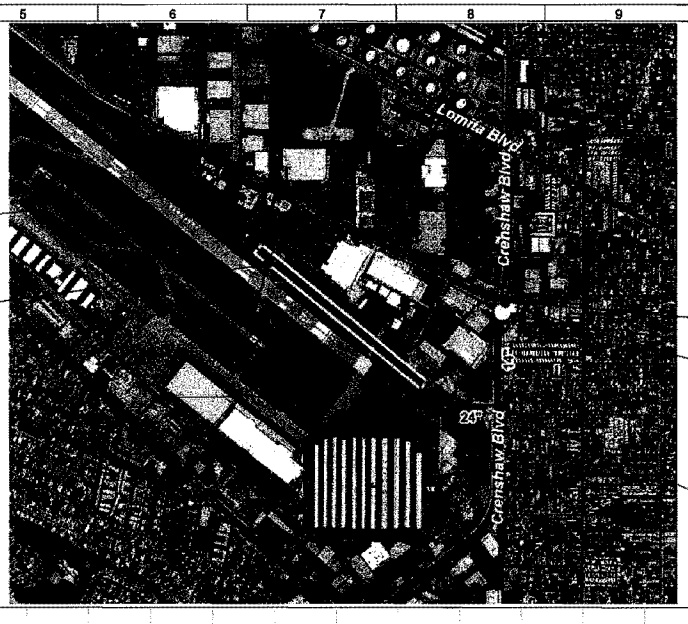
Option 2, which is the preferred option, stormwater diverted from storm drains at Crenshaw Blvd. and Amsler St. and Crenshaw and 250th Street will flow by gravity into the infiltration system at Site A2. Stormwater from Crenshaw Blvd. and Amsler Street will be conveyed through a 21-inch diameter to Crenshaw and 250th Street. From here, the stormwater will be conveyed through a 24-inch diameter pipe to the infiltration system for treatment. Table 5.6 presents the the expected outcome after implementation of non-structural and structural BMPs to treat stromwater runoff from subcatchments AS2 and AS3.

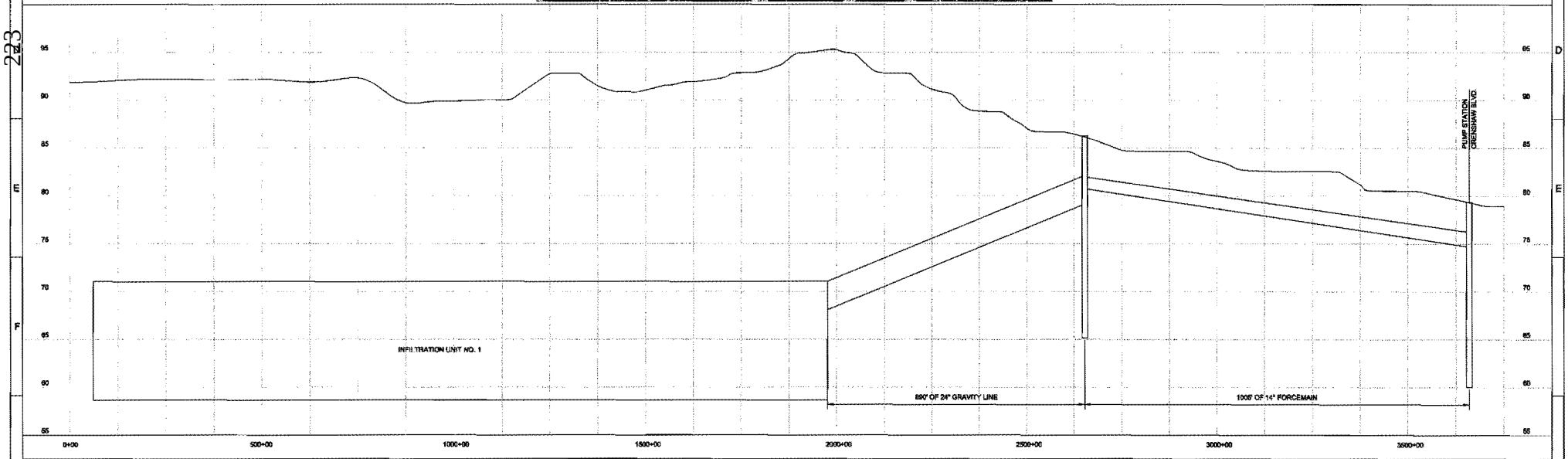
Table 5.6 Torrance Airport Basin - Summary of Load Reduction from Quantified BMPs for Subcatchments AS2 and AS3.

	Load (lb/yr)			
BMP Scenario	**TSS**	**TP**	**TN**	**Toxics**
Before BMP	52,677.8	451.3	3,037.5	4.02
After BMP[1] (Load reduction)	48,779.6	321.3	2,308.5	3.72
% Load Reduction	92.6	71.2	76.0	92.6

Note:
(1) Load reduction by combined non-structural and structural BMPs

The storage requirements summarized in Table 5.3 were incorporated into the water quality model to simulate the effectiveness of the BMPs. All assumptions used in the pre-BMP model scenario were retained. The simulations do not include non-structural BMPs such as street sweeping and catch basin inserts. The nonstructural BMPs were evaluated separately.





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PLAN AND PROFILE OPTION 1

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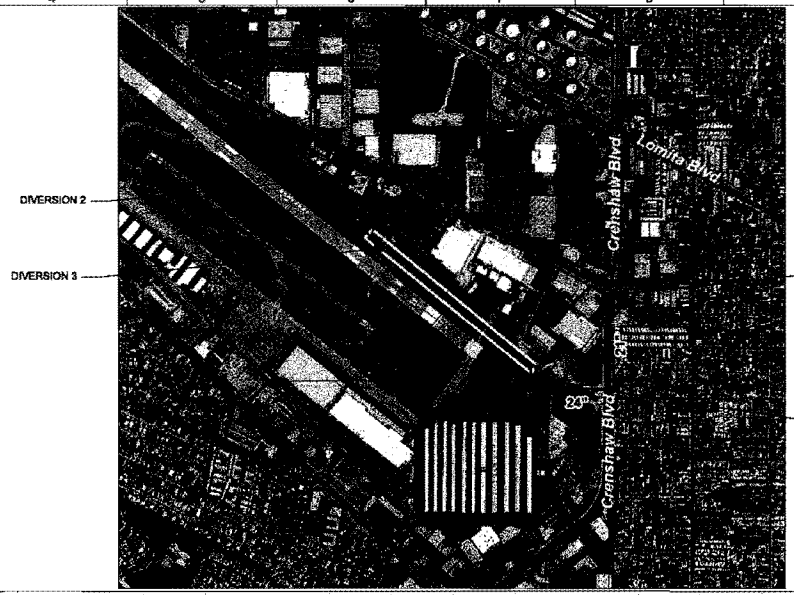

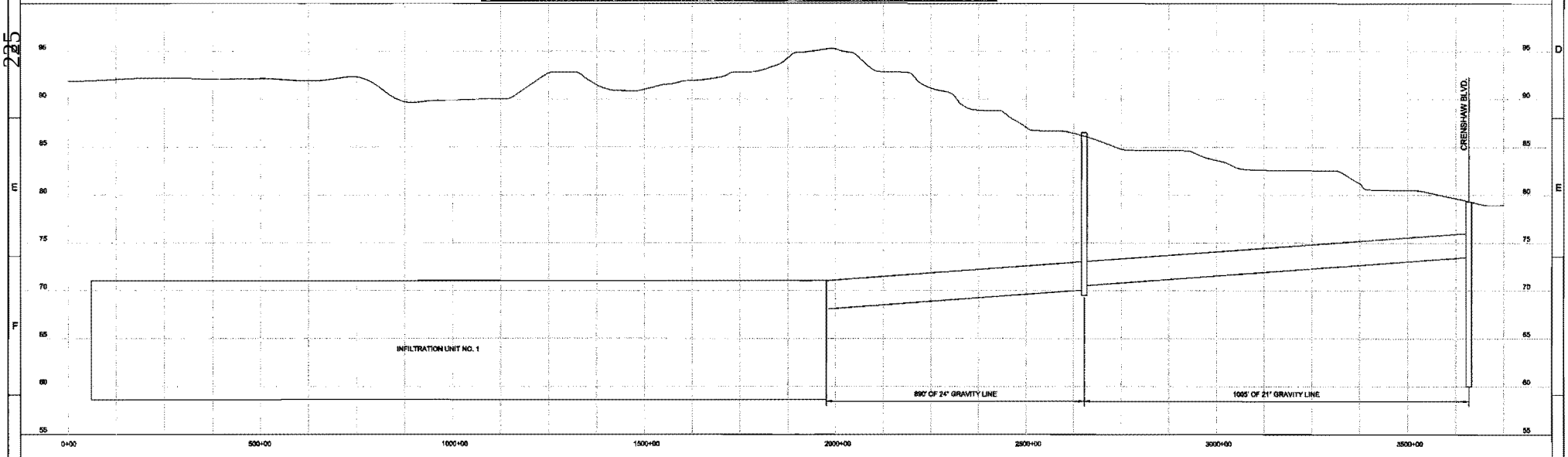

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PLAN AND PROFILE OPTION 2

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5.3.4.3 Recommended BMP Implementation in Torrance Airport Basin

The Torrance Airport subcatchments, AS1, AS2 and AS3 represent approximately 23 percent of the Implemetation Area. However, they generate about 95 percent of the total phosphorus and 44 percent of sediment load generated from the entire Implementation Area. The City has to implement BMPs to treat stormwater generated in this area in order to comply with the established TMDLs in the Machado Lake Watershed.

In addition to street sweeping, catch basin filter inserts and other non-structural BMPs discussed earlier, two potential sites, A1 and A2 are recommended for implementation of underground storage/infiltration system as part of Option 2 shown on Figure 5.7. The sites were selected based on space availability, soil conditions, and cost effectiveness. These non-structural and structural BMPs can be implemented in three phases.

In Phase 1, an eight feet deep underground storage/infiltration system will be installed at Site A2 to receive stormwater runoff through 21- and 24-inch diameter gravity pipes. Since this Plan calls for an adaptive management approach to utilize available resources effectively and efficiently, if through continued study of drainage patterns, diagnosis of problem sources, and new technologies for dry and wet weather treatment, it is realized that more treatment is needed in the Airport treatment area, BMP site A1 will be considered for implementation of additional storage/infiltration system in Phase 2. Phase 3 will consist of installing 57 catch basin inserts in subcatchment AS1.

In addition to contributing to meeting the TMDL reduction requirement of improving water quality, a centralized BMP at Torrance Airport would provide additional water supply resources benefits. A centralized BMP at Torrance Airport would be designed to increase infiltration providing additional groundwater replenishment to the groundwater basin. Storage provided by the BMP would reduce potential flooding in the watershed treatment area. Further benefits could be determined during implementation.

5.3.5 Walnut Sump Basin

The watershed treatment area that could be treated by the Walnut Sump is about 62 percent impervious with a concentrated impervious configuration and moderate road density. For treatment purposes, this area is divided into three subcatments, WS-1 and WS-2 and WS-3 as shown on Figure 5.8. WS-3 includes drains into SD 1040 shown on Figure 5.8. Two treatment options have been identified for this treatment area. Both options include street sweeping. Option No. 1 will use the existing Walnut Sump to treat about 100 percent of the stormwater generated from subcatchments WS-2 and WS-3 shown on Figure 5.8. If more treatment is needed in this area in order to achieve TMDL compliance Option No.1 could be expanded to include 50 catch basin inserts in WS-1. The catch basins will be retrofitted to allow the installation of full capture filter to capture fine sediments and other pollutants. Walnut Sump, which will receive stormwater from this treatment basin, has adequate capacity to store and infiltrate the 85th percentile 24-hour runoff as shown in Table 5.6.

Legend

- Diversions
- New Conveyance - Gravity Lines
- Inflitration/Recharge
- Storm Drains

0 1,000 2,000 Feet

Figure 5.7
Recommended BMP
at Torrance Airport
Stormwater Recharge Project
City of Torrance

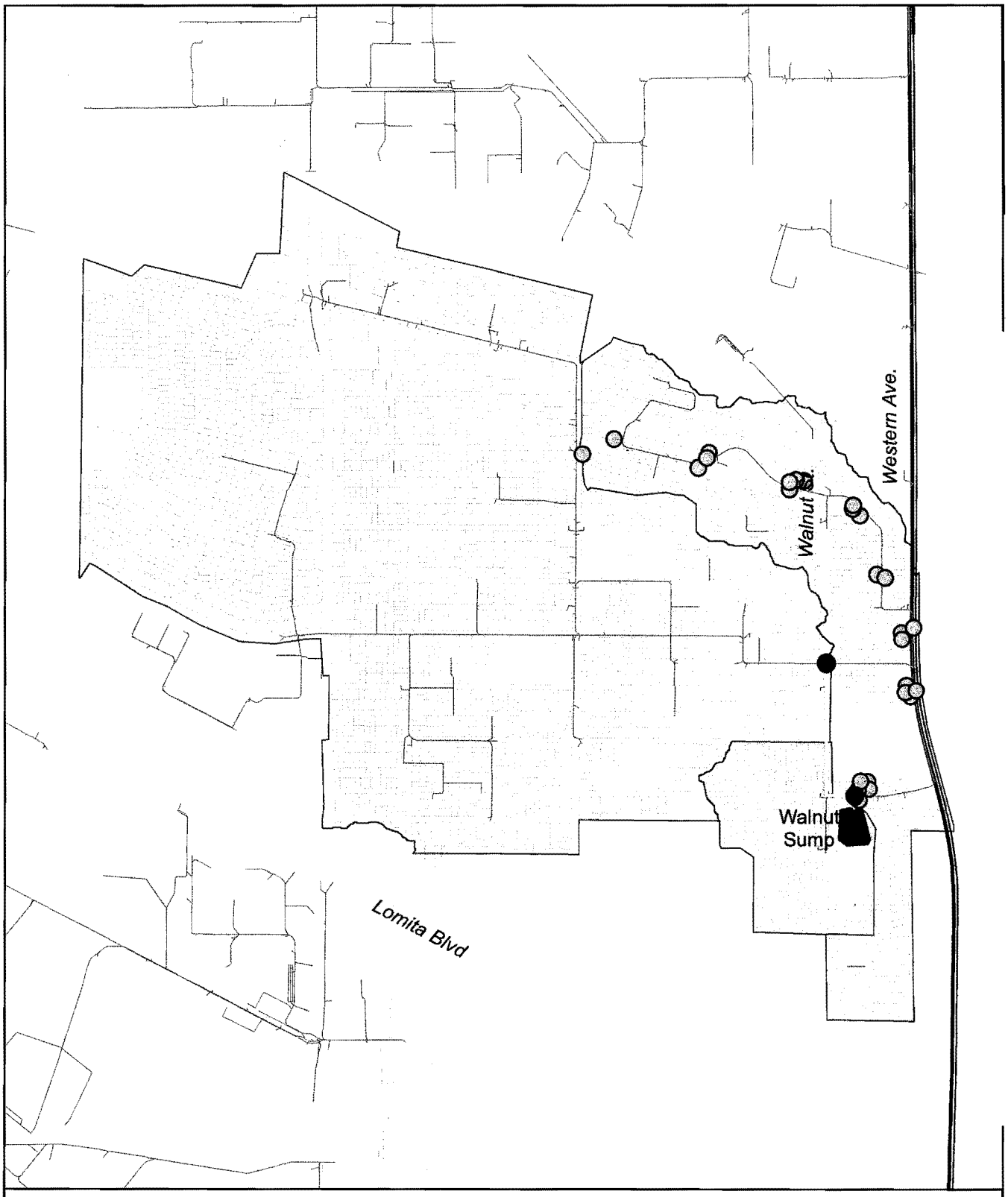

Figure 5.8
Drainage Map of Walnut Sump Treatment Area - Option No. 1
Stormwater Recharge Project
City of Torrance

In Option No. 1, stormwater runoff from subarea WS-3 will be diverted to Walnut Sump in Phase 1. Phase 2 will consist of installing 50 catch basin filters in WS-1. In Phase 3, stormwater from WS-2 will be diverted from the existing 9.2' x 11' RCB" storm drainpipe at 235th St. and Walnut St. through a new 60-inch diameter gravity pipe to a stormwater lift station to be located at Sur La Brea Park at Walnut Street. From the lift station, stormwater will be pumped through a 24-inch diameter forcemain to Walnut Sump pre-treatment area for further removal of heavy sediments, oil, grease, and floatable wastes. Hydrodynamic Separator unit will be used for the pre-treatment. The pretreated stormwater runoff will then be conveyed to the Walnut Sump main storage area for storage and infiltration

Option No. 2 consists of catch basin inserts only in WS-1 and WS-2 to capture fine sediments and other pollutants as shown on Figure 5.9. Under this option, stormwater from WS-1, WS-2 and WS-3 will be treated by a total of 150 catch basins retrofitted to allow the installation of full capture screens.

Figure 5.10 shows the conceptual layout of both options, while Figure 5.11 and Figure 5.12 show design concept details of both options. Figure 5.13 shows the details of the proposed Walnut Sump storage/infiltration system. Table 5.6 summarizes the storage requirements for this treatment basin.

Table 5.6 Summary of BMP Requirements – Walnut Sump

Option	Drainage Area Treated (ac)	Percent Imper-viousness	Treat-ability	Water Quality Volume (ac-ft)	Water Quality Flow (cfs)	Walnut Sump Capacity (ac-ft)	No. of Catch Basin Inserts
Option No. 1	742	61	79%	39.5	111	50	50-
Option No. 2	922	62	100%	-	-	-	150

The storage requirements summarized in Table 5.6 were incorporated into the water quality model P8 to simulate the effectiveness of the BMPs. All assumptions used in the pre-BMP model scenario were retained. The simulations do not include non-structural BMPs such as street sweeping and catch basin inserts. The results of the simulation runs are summarized in Table 5.7.

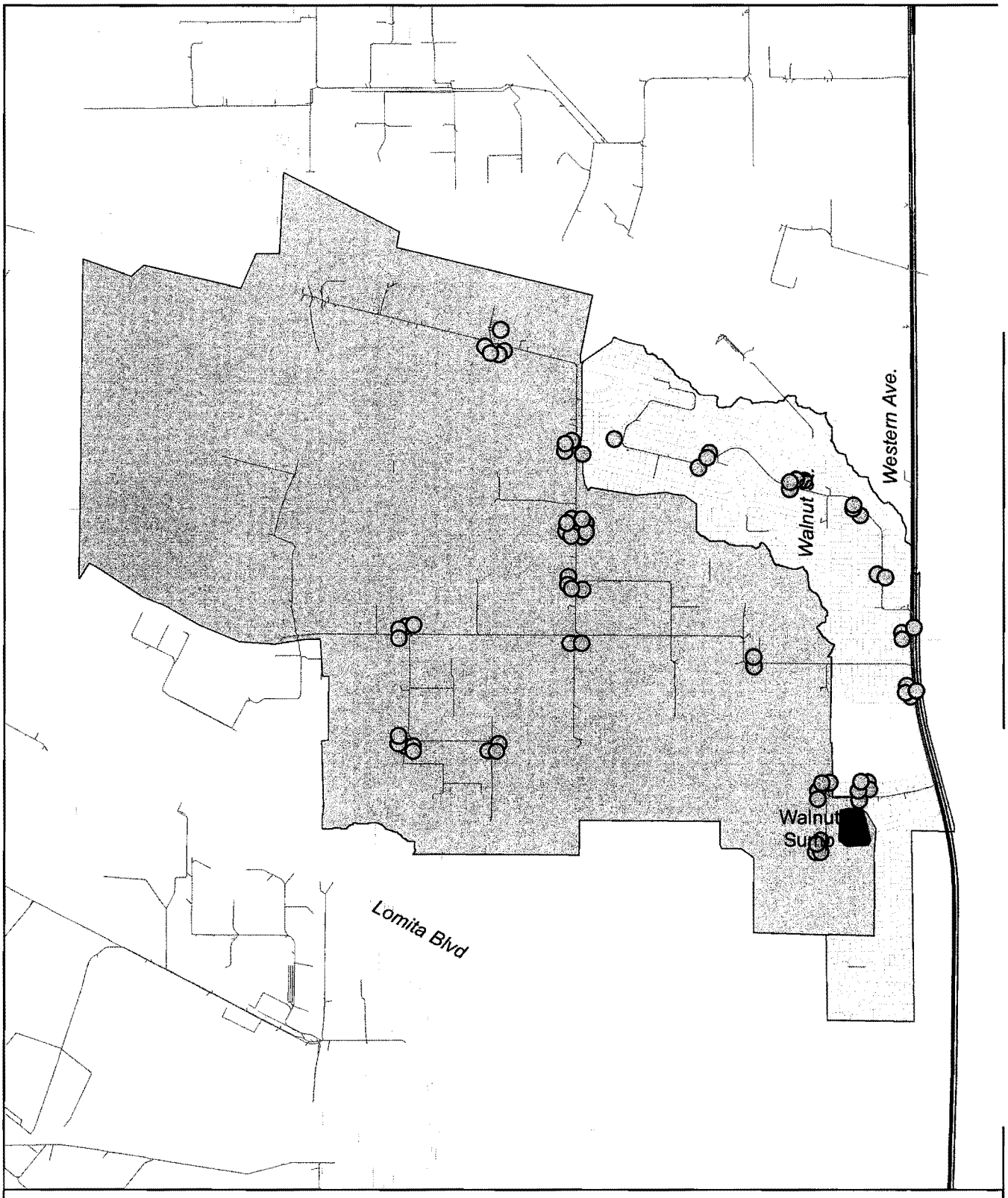

Figure 5.9
Drainage Map of Walnut Sump Treatment Area - Option No. 2
Stormwater Recharge Project
City of Torrance

Legend

- Diversions
- Pump Station
- Conveyance
- Walnut Sump
- Storm Drains

0 200 400 Feet

Figure 5.10
Conceptual Layout of Walnut Sump Aboveground Storage/Infiltration BMP
Stormwater Recharge Project
City of Torrance

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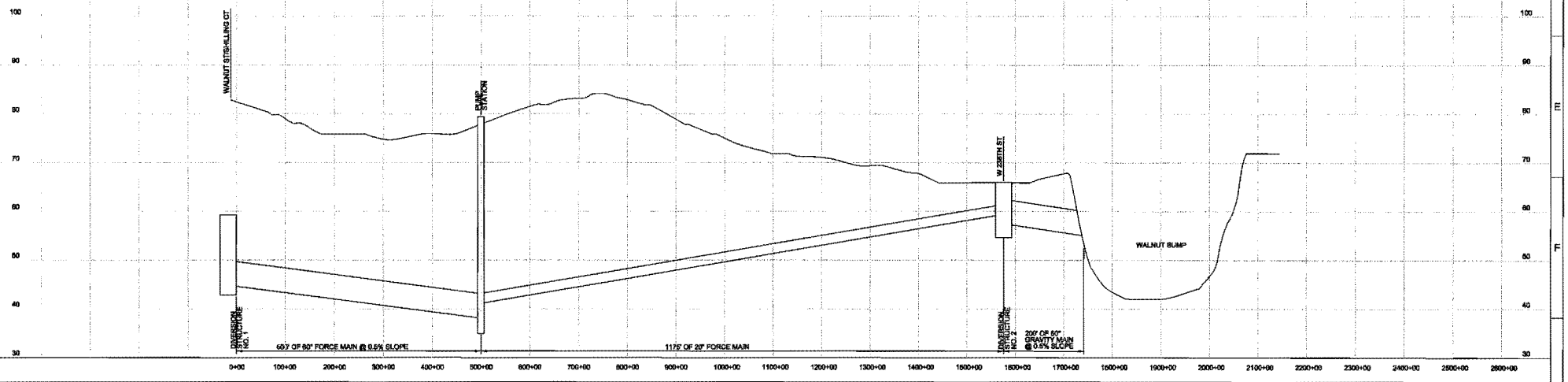

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PLAN AND PROFILE OF WALNUT SUMP TREATMENT SYSTEM

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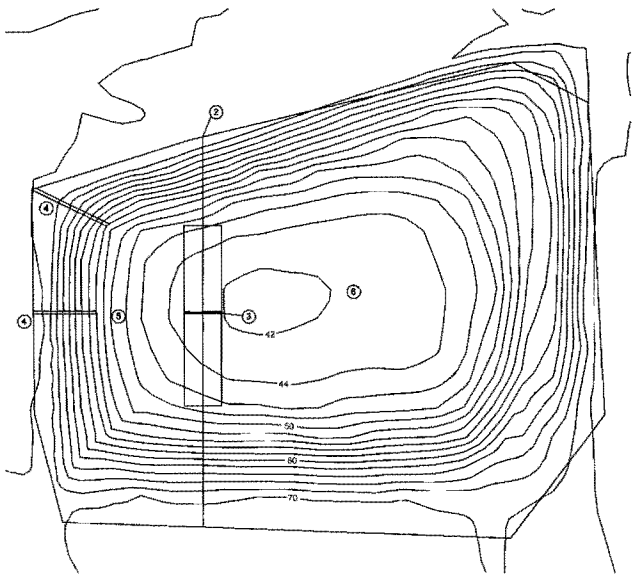
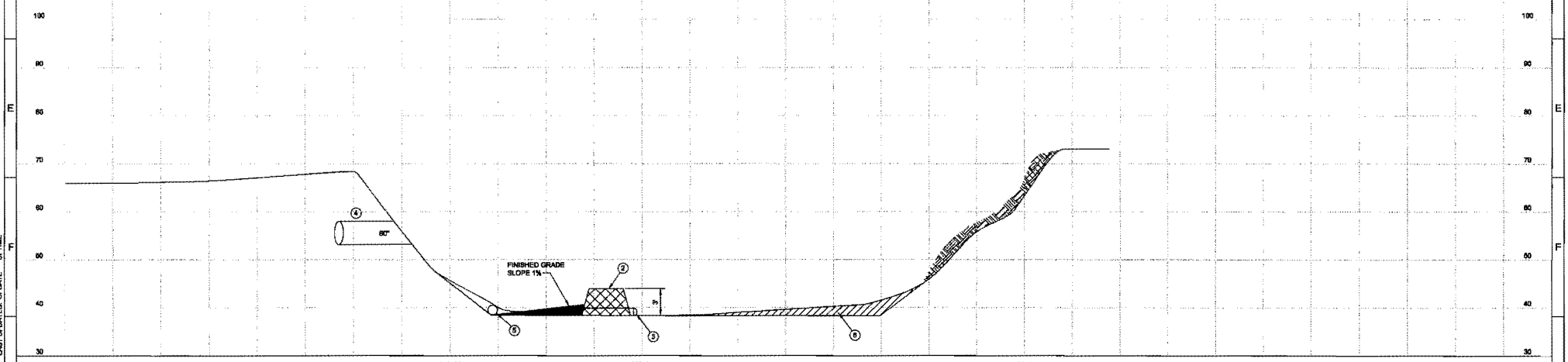


1. RIPRAP APRON
2. EARTH BERM ACROSS ENTIRE WIDTH OF INFILTRATION BASIN
3. 8" GRAVITY MAIN
4. INLET PIPE
5. UPSTREAM PRETREATMENT (INSTALL ARS UNIT)
6. DROUGHT TOLERANT VEGETATION



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DETAILS OF WALNUT SUMP STORAGE/INFILTRATION BMP PLAN AND PROFILE

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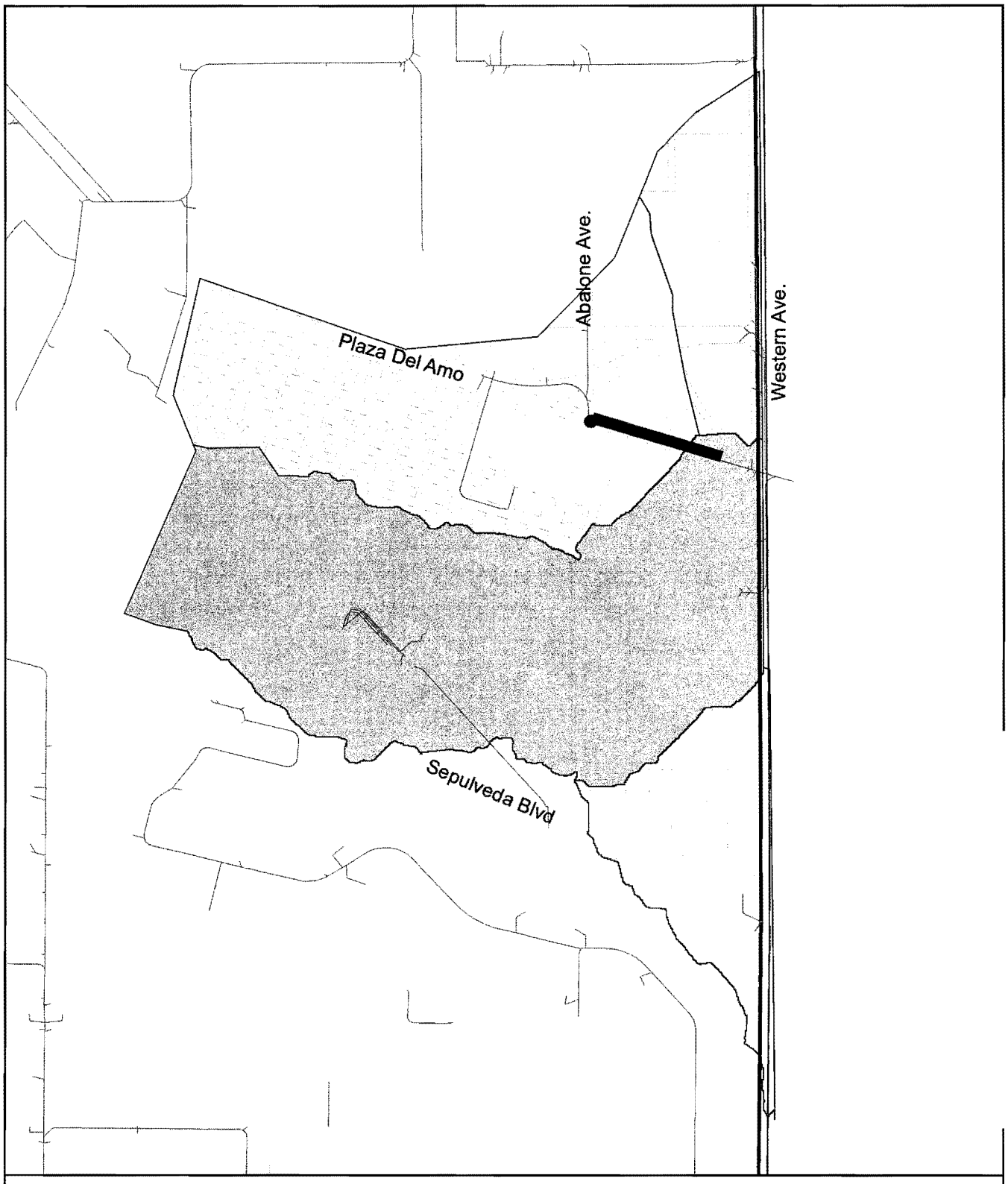


Figure 5.13
Drainage Map of Baseball Field Treatment Area
Stormwater Recharge Project
City of Torrance

Table 5.7 Walnut Sump - Summary of Load Reduction from Quantified BMPs				
	Load (lb/yr)			
BMP Scenario	**TSS**	**TP**	**TN**	**Toxics**
Before BMP	71,451	22	127	5.44
After BMP[1]	66,164	15.9	97.7	5.04
% Load Reduction	92.6	72.1	76.9	92.6

Note:
(1) Load reduction by combined non-structural and structural BMPs

5.3.5.1 Recommended BMP Implementation at Walnut Sump

The overall objective of the Implementation Plan is compliance with the Machado Lake nutrients and toxics TMDLs. The primary objective for this project location, therefore, is to remove toxics and nutrients from the existing storm drain in subcatchment WS-2. These objectives may in general be met by implementing Best Management Practices (BMPs) or a combination thereof. In addition to street sweeping and other non-structural BMPs, the structural BMP proposed for the Walnut Sump drainage area includes the following elements:

- Stormwater lift station.
- 60-inch diameter gravity main
- 24-inch diameter force main
- Flow diversion facility.
- Hydrodynamic separator.
- Above ground storage/infiltration area – Walnut Sump
- Overflow piping.

The implementation will carried out in phases as listed below:

1. Phase I – Divert flow from storm drain 1040
2. Phase II – Install catch basin filters in WS-1
3. Phase III – Diversion and pump station for WS-2

In addition to contributing to meeting the TMDL reduction requirement of improving water quality, a centralized BMP at walnut Sump would provide other water resources benefits.

A centralized BMP at this location would be designed to increase infiltration providing additional groundwater replenishment to the groundwater basin. Storage provided by the BMP would reduce potential flooding in the watershed treatment area. Further benefits could be determined during implementation. For example, the actual BMP design could

include additional vegetation that would enhance habitat area in the area and Public Education.

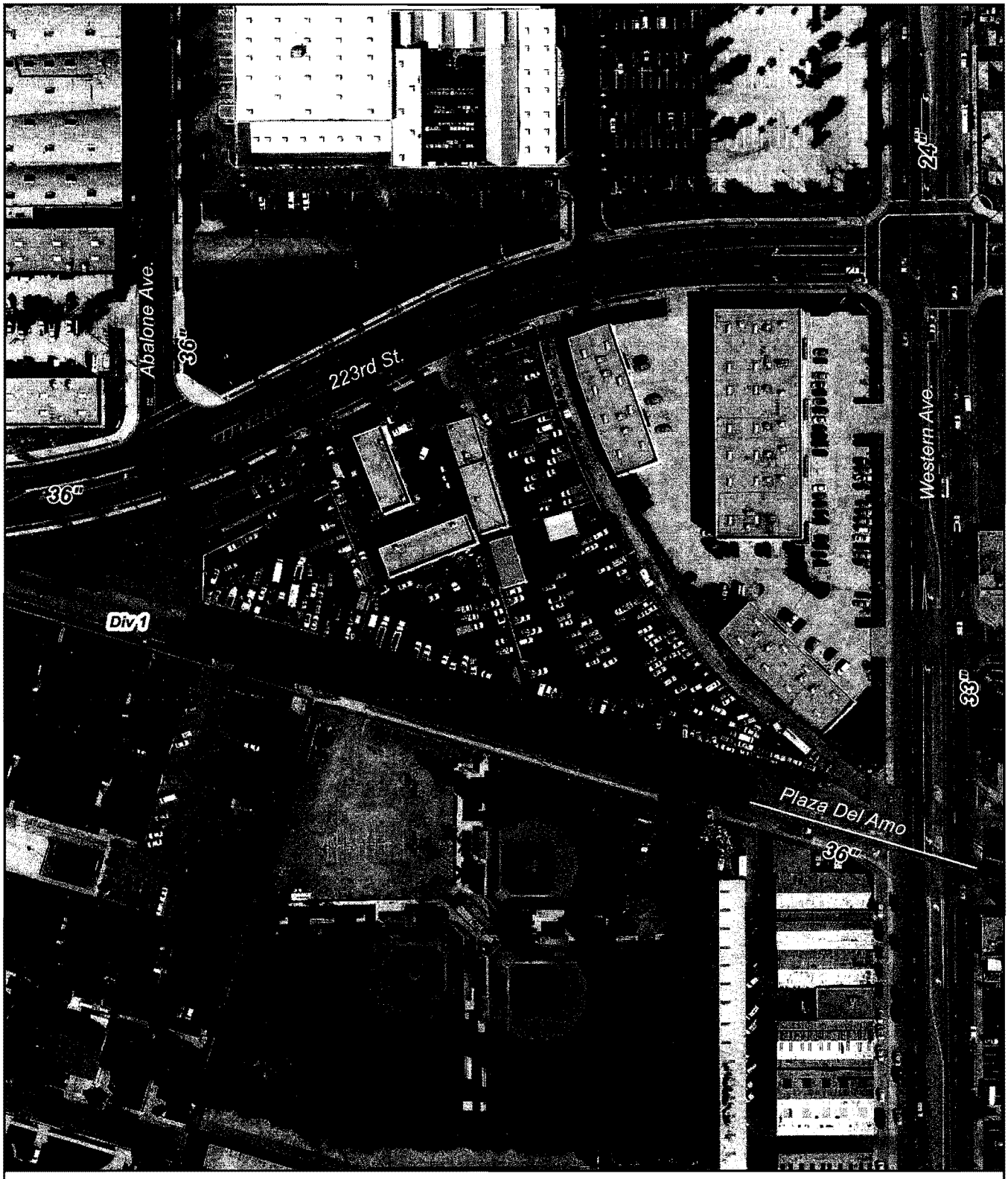
5.3.6 Baseball Field Basin

The watershed treatment area that could be treated by the Baseball Field underground storage/infiltration system is about 60 percent impervious with a concentrated impervious configuration and moderate road density. This treatment area has adequate surface area, about 0.73 acres to treat all the water quality volume generated from this drainage basin. Two treatment options have been identified for this basin. Option No. 1 will treat about 31 percent of the stormwater generated from this area with underground storage/infiltration system. Thus, under this option, only stormwater runoff from sub area BB-S3 shown on Figure 5.13 will be treated with the storage/infiltration system. Stormwater generated from the remaining Sub areas; BB-S1, BB-S2, and BB-S4 will be captured by 19 catch basins retrofitted to allow full capture filters. Option No. 2 will treat the water quality volume generated from the entire treatment area, BB-S1, BB-S2, BB-S3, and BB-S4. Figure 5.13 shows the drainage map of this treatment area and Figure 5.14 is the conceptual layout of this treatment system.

In Option No. 1, stormwater will be diverted from the existing 36-inch diameter pipe at Plaza Del Amo and Western Avenue through a short diversion pipe into the BMP system. Option No. 2 will be considered for implementation when through monitoring and modeling it is found out that more treatment is needed in this subarea. Option No. 2 will capture stormwater runoff generated from BB-S1, BB-S2, BB-S3, and BB-S4. Stormwater runoff will be diverted from existing drain at Plaza Del Amo and Western Ave. into Unit B2. This option also includes the installation of 23 full capture filter screens. Figure 5.14 shows conceptual layout and detail design concept of both options. Table 5.8 summarizes the storage requirements for this treatment basin. Table 5.9 shows the load reduction associated with each option. Figure 5.15 shows the plan and profile of these two options.

Table 5.8 Summary of BMP Requirements – Baseball Field

Option	Area Treated (ac)	Percent Imperviousness	Treatability	Water Quality Volume (ac-ft)	Water Quality Flow (cfs)	BMP Capacity (ac-ft)
Option No. 1	39	63	26.3	0.67	6.0	2.9
Option No. 2	148	65	100	2.54	22.8	6.0

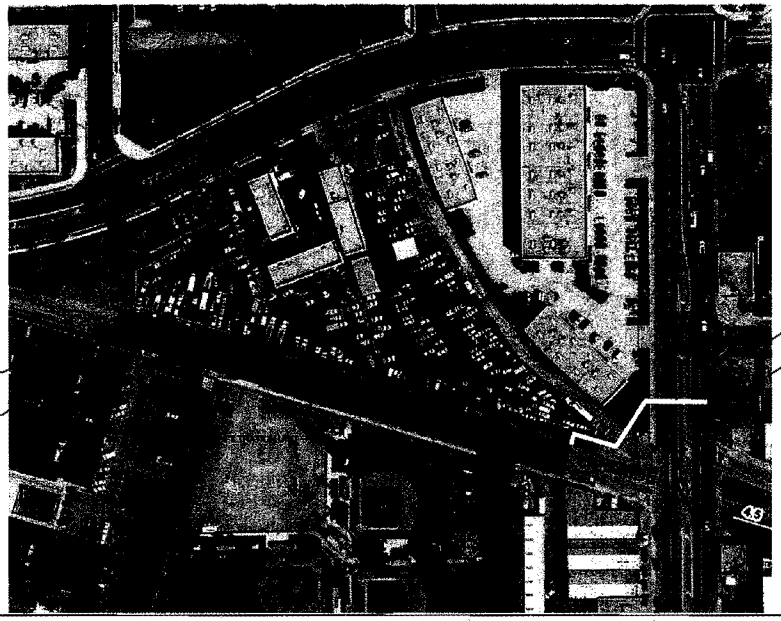


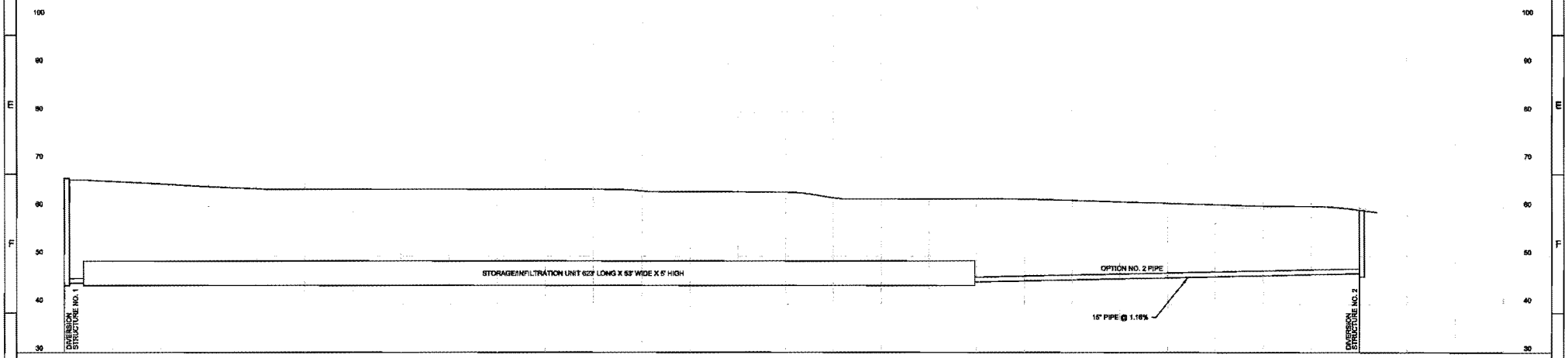
Legend

- Diversions
- Storm Drains
- Infiltration/Recharge
- New Conveyance

0 150 300 Feet

Figure 5.14
Conceptual Layout of Baseball Field Underground Storange/Infiltration BMP
Stormwater Recharge Project
City of Torrance





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DETAIL DESIGN CONCEPT OF BASEBALL FIELD
BMP TREATMENT SYSTEM

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Table 5.9 Walnut Sump - Summary of Load Reduction from Quantified BMPs				
	Load (lb/yr)			
BMP Scenario	**TSS**	**TP**	**TN**	**Toxics**
Option 1				
Before BMP	71,451	7	38	1.19
After BMP[1]	63,091	4.97	27.36	1.05
% Load Reduction	88.3	71	72	88.3
Option 2				
Before BMP	71,451	7	38	1.9
After BMP[1]	65,806	5.04	28.12	1.1
% Load Reduction	92.1	72	74	92.1

Note:
(1) Load reduction by combined non-structural and structural BMPs

In addition to contributing to meeting the TMDL reduction requirement of improving water quality, a centralized BMP at Baseball Field would provide other water resources benefits. A centralized BMP at this location would be designed to increase infiltration providing additional groundwater replenishment to the groundwater basin. Storage provided by the BMP would reduce potential flooding in the watershed treatment area. Further benefits could be determined during implementation. This BMP could be constructed without interfering with baseball field.

5.4 Additional Structural Options for TMDL Implementation

Through additional monitoring, pollutant source characterizations, and site investigations throughout the duration of the TMDL implementation schedule, additional options for structural BMPs could be identified that can enhance or replace those BMPs identified in this plan. This is especially true for dry weather, when flows are highly variable throughout the storm drain system, and specific areas could require special methods treating storm drain flows before they discharge to receiving waters. For storm drains with particularly high dry weather flows and associated pollutant loads where other nonstructural or structural BMPs are not providing a remedy, specific mechanical BMPs can be implemented. Such BMPs could include diversions to wastewater treatment plants or on-site treatment facilities that provide ultraviolet disinfection or other forms of treatment.

Likewise, for wet weather, certain mechanical BMPs can be installed in problem storm drains where other nonstructural and structural BMPs are not providing a solution. Several

stormwater BMPs are available for this purpose, which are based on a range of technologies that continue to evolve through continued research and development. This TMDL Implementation Plan is intended to be iterative and adaptive to allow for modifications as additional studies of the drainage system and diagnoses of problem sources are achieved and as new technologies for dry and wet weather treatment continue to emerge.

5.5 Regulatory Requirements and Environmental Permits

Consultation with regulatory agencies and the acquisition of permits is required before project components can be constructed. The following sections summarize regulatory permits and approvals relevant to the implementation of the Water Quality Enhancement Projects in the Machado Lake watershed.

5.5.1 Environmental Assessment

In accordance with the California Environmental Quality Act (CEQA), local agencies are required to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. Every development project that requires discretionary governmental approval will require at least some environmental review pursuant to CEQA, unless an exemption applies. The Water Quality Enhancement Projects discussed in the previous section will likely require the preparation of a Negative Declaration.

5.5.2 U.S. Army Corps of Engineers

Section 404 of the Federal Clean Water Act regulates the discharge of dredged, excavated, or fill material in wetlands, streams, rivers, and other waters of the United States. The U.S. Army Corps of Engineers (USACE) is the federal agency authorized to enforce Section 404 and issue permits for certain authorized activities conducted in these waters. Based on the proposed area for the projects, it is unlikely that a Section 404 permit will be required. If required and jurisdictional, Section 404 permitting could potentially be completed under the nationwide permit program. Coverage under the nationwide program can be authorized within three to four months from the time the permit application is deemed complete.

5.5.3 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS), Department of the Interior, is responsible for administering the Federal Endangered Species Act, which prohibits activities affecting threatened and endangered species unless authorized by a permit from the USFWS. The Endangered Species Program is charged with issuing permits for activities that could potentially affect native endangered or threatened species, including Incidental Take Permits associated with Habitat Conservation plans. The USACE will consult with USFWS regarding endangered species issues as part of the Section 404 process. A biological resources report for the project site may be required as part of the permit application package to the USACE.

5.5.4 California Department of Fish and Game

The regulatory functions of the California Department of Fish and Wildlife (CDFW) include the review of CEQA documents as a responsible agency. In addition, CDFW issues streambed or lakebed alteration agreements for projects with impacts to waters of the State, issues permits for take of threatened and endangered species for authorized activities, approves and permits the take of birds, mammals, reptiles, amphibians, non-game fish, and plants for scientific or educational purposes, and the take of threatened, endangered, or candidate species for management purposes. The Water Quality Enhancement Projects may require a CDFW Code Section 1602 Streambed Alteration Agreement.

5.5.5 State Water Resources Control Board

Construction activities disturbing one or more acres must obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges of Stormwater Associated with Construction Activity Water Quality Order No. 2009-0009-DWQ (Construction General Permit, or CGP). Construction activity subject to this permit includes clearing, grading, and disturbances to the ground such as stockpiling or excavation. To obtain coverage under the CGP, the City will designate a Legally Responsible Person to electronically file Permit Registration Documents (PRDs) with the State Water Resources Control Board (SWRCB). PRDs include a Notice of Intent, Risk Assessment, Site Map, Stormwater Pollution Prevention Plan (SWPPP), annual fee, and certification. A project-specific SWPPP will need to be developed and implemented to reduce polluted discharges from entering the storm drain system and local receiving waters during construction activities. The CGP requires all permitted dischargers to develop and implement a SWPPP that:

- Identifies all pollutant sources including sources of sediment that may affect the quality of stormwater discharges associated with construction activity from the construction site.
- Identifies and eliminates non-stormwater discharges.
- Specifies BMPs to reduce or eliminate pollutants in stormwater and authorized nonstormwater discharges from the site during construction.
- Incorporates BMP inspection and maintenance routines.
- Identifies a sampling and analysis strategy and sampling schedule for discharges that have been discovered through visual monitoring to be potentially contaminated by pollutants not visually detectable in runoff.

The City or construction contractor will need a Qualified SWPPP Developerto prepare the SWPPP, and then a Qualified SWPPP Practitioner will need to implement the plan during construction. The SWPPP must address the use of appropriately selected, correctly installed, and properly maintained pollution control BMPs.

5.5.6 Regional Water Quality Control Board, Los Angeles Region

Under Section 401 of the Clean Water Act, applicants for Section 404 Permits must first obtain a Water Quality Certification documenting that the proposed activity will comply with state water quality standards. If the project is determined to be under USACE jurisdiction, a Section 401 Water Quality Certification will be required for the project.

If the project is not under USACE jurisdiction, the LARWQCB may require coverage under Waste Discharge Requirements instead. Protection of beneficial uses during construction and operation are key issues. Construction dewatering may be necessary because of high groundwater. Dewatering activities will require coverage under the General NPDES Permit and Waste Discharge Requirements of Discharges from Construction and Project Dewatering to Surface Waters in Coastal Watersheds of Los Angeles and Ventura Counties. To obtain permit coverage, a Report of Waste Discharge and application must be filed with LARWCQB at least 30 days prior to discharge.

Even though the installation of Water Quality Enhancement Projects is generally encouraged by the LARWQCB, concerns may be raised with the potential of projects using on-site infiltration of stormwater to affect the water quality of the underlying groundwater. Prior to implementing projects such as infiltration basins/trenches, flow through planters, porous pavement, etc., the City would need to conduct a technical analysis evaluating the possibility of groundwater impacts. The analysis will determine the depth to groundwater, its designated beneficial uses, and the historical uses of the site. There are cases where projects may be infeasible – if the depth to groundwater is less than 5 feet from the surface, if drinking water wells are present within 100 feet of the proposed infiltration site, or if the site is a brown field with potential pollutant mobilization through the soil, etc. Consultation with LARWQCB staff is recommended.

5.5.7 South Coast Air Quality Management District

Construction activities in the South Coast Air Basin are subject to South Coast Air Quality Management District's (SCAQMD) Rule 403. Rule 403 sets requirements to reasonably regulate operations that periodically may cause fugitive dust emissions into the atmosphere by requiring actions to prevent, reduce, or mitigate fugitive dust emissions. The construction contractor will need to implement dust control measures during project construction.

6.0 EVALUATION OF NONSTRUCTURAL AND STRUCTURAL SOLUTIONS

As shown in the previous sections, a number of nonstructural and structural BMP options were identified that can support TMDL implementation. An evaluation of those practices was performed, including optimizing the most cost-effective combination of BMPs to support meeting WLAs for the TMDL Implementation Area. The evaluation analysis for the Nutrient and Toxics TMDLs uses an integrated approach, considering reductions for both classes of pollutants. The evaluation analysis uses the identified suite of structural and nonstructural projects discussed in Sections 4 and 5 to determine the set of actions that will most likely be implemented in an effort to achieve the TMDL requirements. The analysis is a demonstration of how the identified projects may achieve compliance. As the implementation is an adaptive management process, the precise suite of actions and the timing may be changed to use resources more cost effectively. The adaptive management approach will allow changes in the type and quantity of structural and nonstructural BMPs to ensure cost effective measures are being implemented. Flexibility in the schedule and makeup of the Implementation Plan are key to adaptive management.

The quantification analysis is based on the reductions from both nonstructural and structural BMPs that work together to reduce the concentration and load of constituents. Generally nonstructural BMPs consist of pollution prevention activities and source control activities that reduce the amount of the constituent entering the MS4 system, ultimately reducing the concentration in stormwater. Nonstructural activities also encourage the effective use of water, aiming to reduce dry-weather flows. In this way, nonstructural activities reduce the constituent load entering structural BMPs located downstream of the sources.

Removal of suspended sediments by the proposed BMPs will be used a surrogate to assess compliance of Toxics. Toxics removal will be estimated as a fraction of suspended solids removed by the BMPs.

6.1 Evaluation of Structural Solutions

6.1.1 Watershed Modeling and Optimized BMP Selection Approach

Watershed modeling tools linked to a BMP simulation system were used to evaluate and optimize quantitative load reduction scenarios to address TMDL implementation efforts in the TMDL Implementation Area of the Machado Lake watershed. The watershed model is based on existing commonly used to simulate and evaluate BMPs Brief descriptions of the watershed model and BMP simulation model is provided below.

6.1.1.1 P8 - Hydrologic Modeling Using a Continuous Simulation Model

The P8 watershed modeling system utilizes a modeling approach that has been used to support numerous TMDL developments throughout the country. The P8 model is a continuous simulation model and generates runoff characteristics based on rainfall, soil characteristics and infiltration rates, evapo-transpiration, antecedent conditions, and land use specific pollutant loading characteristics. Meteorological data from 2005 to 2013 were used to calibrate the model. Existing meteorological data, hydraulic data, land use information, and monitoring data were used to calibrate each sub-watershed to most accurately simulate the runoff and pollutant load.

The P8 model simulates hydrology, sediment, and general water quality were combined with a stream fate and transport model. Wet-weather loading estimates are developed using the modeled constituents including TN, TP, TSS, and Toxics. Based on the model results from 2005 to 2013, a daily or average annual load was calculated for TSS, TN, TP, and Toxics. Annual load results were compared with the WLAs to calculate the load reduction needed to meet those WLAs and presented in Table 3.5.

6.1.1.2 Optimization BMP Design Approach

The optimization BMP design approach uses GIS information and time-series data for watershed runoff flows and pollutant concentrations (generated by the watershed model), integrates a process-based BMP simulation, and applies optimization techniques for the most cost-effective BMP planning and selection.

Based on comprehensive site evaluation and financial analysis, the City selected five sites for centralized BMP Implementation. Optimization of BMP design approach was therefore not comprehensively performed.

6.1.1.3 BMP Simulation Process

The BMP simulation system uses process-based simulation for BMP function and removal efficiency and accepts flow and water quality time-series data generated internally by P8 as input data. Process-based simulation of BMPs provides a technique that is sensitive to local climate and rainfall patterns. BMP effectiveness can be evaluated and estimated over a wide range of storm conditions, site designs, and flow routing configurations.

The storage/infiltration BMPs used in the study included underground and aboveground storage/infiltration systems. The primary benefits of these BMPs are storage and infiltration, which enable runoff volume and rate reduction. These type BMPs also provide water quality benefits via filtration, settling of sediment, and pollutant decay.

The PLAT was used to estimate the average annual load of TN, TP, and TSS from the TMDL Implementation Area. The model-calculated annual loadings for these constituents are presented in Table 3.5. Additionally, the final WLA and the resulting required reduction

for nutrients are included in Table 3.5. The model's estimate for current annual loading of nitrogen is less than the interim WLA, but would require a 30 percent reduction to meet the final WLA. The current loading of phosphorus estimated by the PLAT is also less the interim WLA, but would require a 54 percent reduction in average phosphorus loading by 2018. Load reductions of TSS are are used to estimate toxics removal.

6.2 Nonstructural Quantification Analysis

The Watershed Treatment Model (WTM) is used to assess the effectiveness of nonstructural BMPs on the dry weather and annual loading of nutrients and suspended solids from the TMDL Implementation Area. The WTM was developed by the Center for Watershed Protection with funding by the USEPA in June 2010. The WTM is a spreadsheet-based model that calculates annual pollutant loads and runoff volumes and accounts for the benefits of a full suite of stormwater treatment practices to determine reductions in pollutant loads. The WTM is used for the TMDL Implementation Area in the Machado Lake watershed to determine the accumulated effectiveness of implementing dry weather BMPs for the control of nutrients and suspended solids.

The WTM uses both environmental inputs (e.g., area of land use types, soil types, etc.) and inputs about BMPs. Environmental inputs are used to determine current loads and inputs about BMPs determine the percent reduction in loads.

6.2.1.1 Illicit Connection Removal

Illicit connections to storm drains are sources of a variety of pollutants including nutrients. This source control is applicable to residential and commercial areas in the TMDL Implementation Area. However, the load reduction impact of such program is dependent on the presence and extend of illicit connections in the TMDL Implementation Area. The costs of a field investigation, water sample analysis, and illicit connections trace or to confirm reconnection to the sewer system (via dye, video, or smoke testing) can be highly variable and depend on the extent and nature of the problem. Literature review indicates that the cost of removal of one illicit connection and its reconnection to the sewer system is roughly $2,500 (Marcoux, 2004 and Brown et al., 2004), which makes this is an expensive option. However, the City's NPDES Permit already requires inspection of the storm drain system for illicit connections and removal of the connections, and increased effort to identify illicit connections would enhance the City's illicit connection program. For the purposes of this evaluation, it was assumed that:

- 0 percent of residents have illicit connections. Previous audits conducted by the City did not found any illicit connections.
- 10 percent of businesses have illicit connections,
- 40 percent of the sanitary sewer is surveyed for illicit connections,
- 20 percent of illicit connections are corrected.

Assumptions were based on best professional judgment because the number of illicit connections varies depending on local habits, municipal outreach, and enforcement. The number of illicit connections identified and corrected would be dependent on the resources the City can allocate to this program.

6.2.1.2 Catch Basin Cleanout

Regular catch basin cleanout prevents pollutants from flowing through and into the storm drain system. Sediment, debris, and gross particulate matter are the targeted pollutants with the cleanout of catch basins, but removal of particulate-bound pollutants, including nutrients and toxics, occurs through the physical removal of sediments. Catch basin cleanouts can be prioritized as follows:

- Priority A: These catch basins are cleaned quarterly.
- Priority B: These catch basins are cleaned semi-annually.
- Priority C: These catch basins are cleaned annually.

Review of the City's program showed that most catch basins were Priority C. However, the model only allows input of semi-annual or monthly cleanouts. Therefore, semi-annual cleanouts were selected. Other inputs were based on best professional judgment. The assumption of semiannual cleanouts may overestimate current load removal and therefore underestimate the percent reduction in loads that could be achieved from increased cleanout frequency.

For the purposes of this evaluation, it was assumed that:

- The impervious area drains to the catch basins;
- Catch basins are currently cleaned semi-annually;
- In the future, 60 percent of catch basins will be cleaned quarterly; and
- In the future, 40 percent of catch basins will be cleaned semi-annually.

6.2.1.3 Street Sweeping

Street sweeping uses mechanical pavement cleaning practices to minimize pollutant transport to receiving water bodies. Sediment, debris, and gross particulate matter are the targeted pollutants, but removal of other particulate-bound pollutants, such as nutrients and toxics, can be accomplished simultaneously.

The City's Permit requires that the City prioritize street sweeping as follows:

- Priority A: These streets and/or street segments shall be swept at least two times per month.
- Priority B: Each street and/or street segments is swept at least once per month.
- Priority C: These streets and/or street segments shall be swept as necessary but in no case less than once per year.

For the purposes of this evaluation, it was assumed that:

- Publicly owned roads and parking lots are currently swept weekly.
- All roads in TMDL Implementation Area are currently swept with vacuum sweepers.
- The future program will use vacuum sweepers.

City roads are currently being swept weekly. However, the majority of streets lack proper no-parking signage to allow street sweeping trucks to effectively sweep along the curbs. The City is implementing a signage program to allow enforcement on non-parking days and increase the effectiveness of the current street sweeping program. The City uses both mechanical and the more effective vacuum sweepers. The street sweeping cost (including O&M) of vacuum street sweepers is $360/curb mile based on a monthly sweeping frequency (in 2005 dollars) (Shilling, 2005).

6.2.1.4 Residential Irrigation and Fertilizer Reduction

Over irrigation leads to runoff, increasing flows within the stormwater system. Additionally, urban irrigation runoff can be high in TSS and nutrients. The nutrients in urban irrigation runoff are typically from fertilizers, which are often overused. Effective outreach can teach residents not to overwater and to test the soil to determine the appropriate amount of fertilizer to apply. In addition, evapotranspiration (ET) controllers have been successfully used to reduce irrigation runoff. The cost of this outreach is highly dependent on the approach, which could vary from internet outreach sites to homeowner incentives to educational displays at retail stores.

For the purposes of this evaluation, it was assumed that:

- Half of runoff from the TMDL Implementation Area is dry weather flow.
- An irrigation reduction program would reduce irrigation flows by 20 percent.
- Enhanced outreach of television and radio spots would be necessary to reach and convey the message of controlling irrigation and using proper amounts of fertilizer.

6.2.2 Results of Watershed Treatment Model

The results of the above combined inputs to the WTM are listed in Table 6.1. The reductions are based on percent of dry weather load and the percent of annual runoff load (e.g., street sweeping has benefits in both wet and dry weather). These reductions are considered approximate estimates due to the environmental characterization assumptions made for the model and the assumptions listed in the previous sections.

Table 6.1 Estimated Reductions in Nutrients and TSS from Non-Structural BMPs

	Percent Reduction[1]			
Flow Condition	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Toxics**
Dry Weather Runoff	21%	15%	33%	33%
Annual Runoff	23%	10%	26%	26%

Note:
(1) Load reductions as predicted by the Watershed Treatment Model with inputs discussed in Section 6.2.

WTM requires a number of inputs to assess current conditions and the effectiveness of specific source controls. The WTM is the best available tool for modeling and estimating reductions because there is very little reliable literature about load reduction in stormwater through implementation of nonstructural BMPs. WTM results will need to be compared with and used in conjunction with stormwater quality and quantity data to evaluate the effectiveness of the nonstructural BMPs.

As shown in Table 6.1, the use of nonstructural BMPs is estimated to reduce TP loading by 10 percent on an annual basis. Therefore, the remaining 44 percent of the required 54 percent reduction (see Table 11) will need to be through the use of structural BMPs. Similarly, structural BMPs need to remove the remaining 8 percent of the required 31 percent of TN removal as calculated with the models and assumptions stated in this report.

6.3 Structural Quantification Analysis

The PLAT calculates the distribution of structural BMPs to provide the required load reductions at the optimal cost. In setting the load reductions levels for structural BMPs in the PLAT, the anticipated reductions through implementation of non-structural BMPs are subtracted from the total load reductions necessary to achieve the TMDL WLAs. Structural BMPs considered in the PLAT include rainwater capture and reuse, bioretention, porous pavement, and centralized treatment. The initial recommendations for structural BMPs optimized by the PLAT are presented in Table 6.2.

Table 6.2 Optimized Sizing of Centralized BMPs from PLAT[1]					
			Centralized BMP Needed (ac-ft)		
Sub Area	Total Area (ac)[1]	Impervious Area (%)	Aboveground	Underground	Total BMP Treatment Capacity (ac-ft)
Airport - AS2	86	45	n/a	1.5	12.0
Airport - AS3	640	59	n/a	28	38.0
Airport - Walteria	391	60	n/a	20.5	22.4
Walnut Sump	-	-	39.5	n/a	50
Baseball Field	-	-	n/a	1.0	2.9

Note:
(1) Overall removal load reduction percentages: TSS=90%; TP=68%, TN=70%; Toxics=90%.

The final mix of BMPs will depend on funding available for installation and the measured gains in nutrients and toxics reductions as projects are implemented. Refinements to the model based on Machado Lake watershed water quality and quantity monitoring may also change the amounts and relative distributions of BMPs in future reconsideration of the Nutrients TMDL.

6.3.1 Retrofit through Redevelopment

Additionally, the City will adopt an ordinance requiring LID components when greater than 50 percent of the impervious area is modified. Residential areas within the TMDL Implementation Area are generally established with low levels of redevelopment. The commercial and industrial areas may experience a moderate rate of redevelopment and would be subject to the City's LID ordinance.

For purposes of this evaluation, it is assumed that 15 percent of the 675 acres commercial, industrial, and institutional area in the area will experience redevelopment over the course of the Implementation Plan. In addition, the rate of redevelopment is assumed to be 2.5 percent per year between 2013 and 2018. This rate is based on the levels experienced in the TMDL Implementation Area of LA County over the past 20 years and is expected to be similar in the TMDL Implementation Area over the life of the Implementation Plan.

Future rate of redevelopment are largely a function of the economic health of the region as a whole and is outside the control of the City. In the future, if the levels of LID through redevelopment becomes more significant that assumed for this study, it could be possible, that less structural BMPs are required in the TMDL Implementation Area to meet the WLAs.

6.4 Quantification Analysis Results

A summary of the required BMP capacity volumes and identified volumes though City projects, redevelopment, and identified opportunities is presented in Table 6.2. The remaining BMP capacity (i.e., the BMP capacity not identified through retrofit of City lands, conceptual opportunities, or redevelopment) may be provided through private installation of BMPs or the installation of structural BMPs within leased properties or acquisition of land within the TMDL Implementation Area. Leasing land area will require negotiation with lessees on properties where leases will expire during the implementation period. Private installation of BMPs may occur through incentive programs, or ordinances. Stormwater fees may be developed to provide a funding mechanism for future BMPs and fund (not oversee) the programs discussed in the BMP Implementation Plan. To attain the WLAs, it may not be necessary for the City to acquire land outside the Implementation Area to implement BMPs. Successful implementation of the programs to attain WLAs will require the multi-departmental detailed planning which is beyond the scope of the BMP Implementation Plan. The BMP Implementation Plan is rooted in an adaptive management approach, allowing the City to assess the true effectiveness of non-structural BMPs, and monitoring to better refine the annual average load of the pollutants of concern. To attain WLA, City may need to work with LACFCD and Rolling Estates to expand Project A1 at the Torrance Airport.

6.5 Quantification Analysis Conclusions

Due to the reasonable amount of existing publicly owned land within the TMDL Implementation Area in the Machado Lake watershed, centralized structural BMPs can be implemented in areas currently owned by the City. This avoids lengthy negotiations between landowners and the City, incentive programs, City ordinances, and stormwater fees may need to be developed and instituted, and land acquisition may be necessary.

The monitoring program will provide stormwater sampling data to assess the site-specific level of nutrients associated with the sediment leaving TMDL Implementation Area. The measured pollutant levels from the monitoring program may provide more site-specific pollutant loading scenarios from the watershed, which would help reevaluate reductions required to meet the WLAs. Currently, TP is the limiting constituent driving the number of BMPs. Additionally, the Nutrients TMDL is due to be reevaluated by 2016, and the reevaluation will include the information from special studies and the results of monitoring programs. The Nutrients TMDL reevaluation may be used to refine the loading capacity of Machado Lake, ultimately changing the WLAs. If, through monitoring, the loadings from the TMDL Implementation Area reveal that nonstructural BMPs are more effective than assumed by the WTM, or the levels of constituents in the runoff from TMDL Implementation Area are lower than currently thought to exist, BMP implementation will need to be adjusted accordingly.

6.6 Reasonable Assurance

The main objective of this implementation plan is capture 85th percentile runoff and infiltrate it, wherever possible. This is in addition to non-structural BMPs including enhanced street sweeping, public education and catch basin filter inserts. The City is already performing street sweeping and public education. The proposed BMPs have sufficient capacity to capture and infiltrate the 85th percentile runoff. The expected phosphorus removal is summarized in Table 6.3. The cost per phosphorus load removed by each of the proposed BMPs is shown on Figure 6.1 and Figure 6.2 shows the expected phosphorus removal throughout the implementation period.

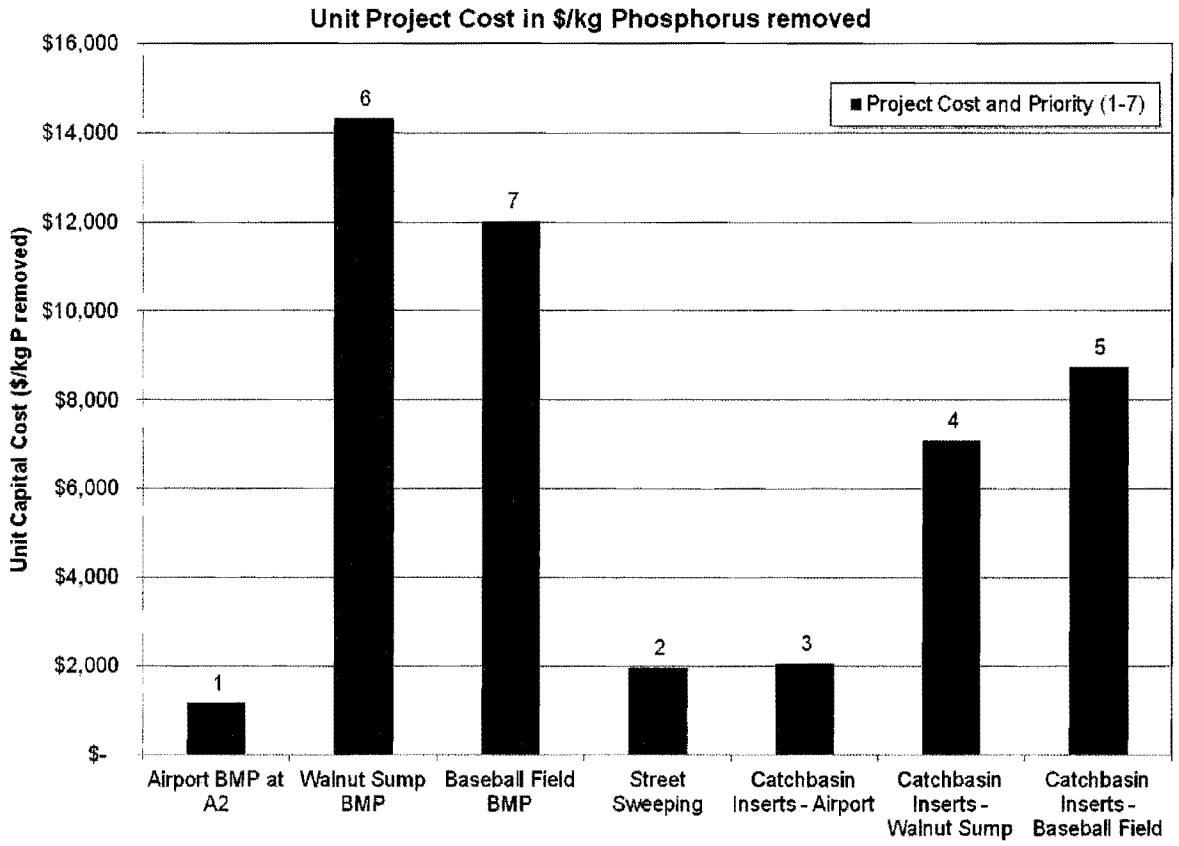

Figure 6.1 Cost per TP Load Removed By Each BMP

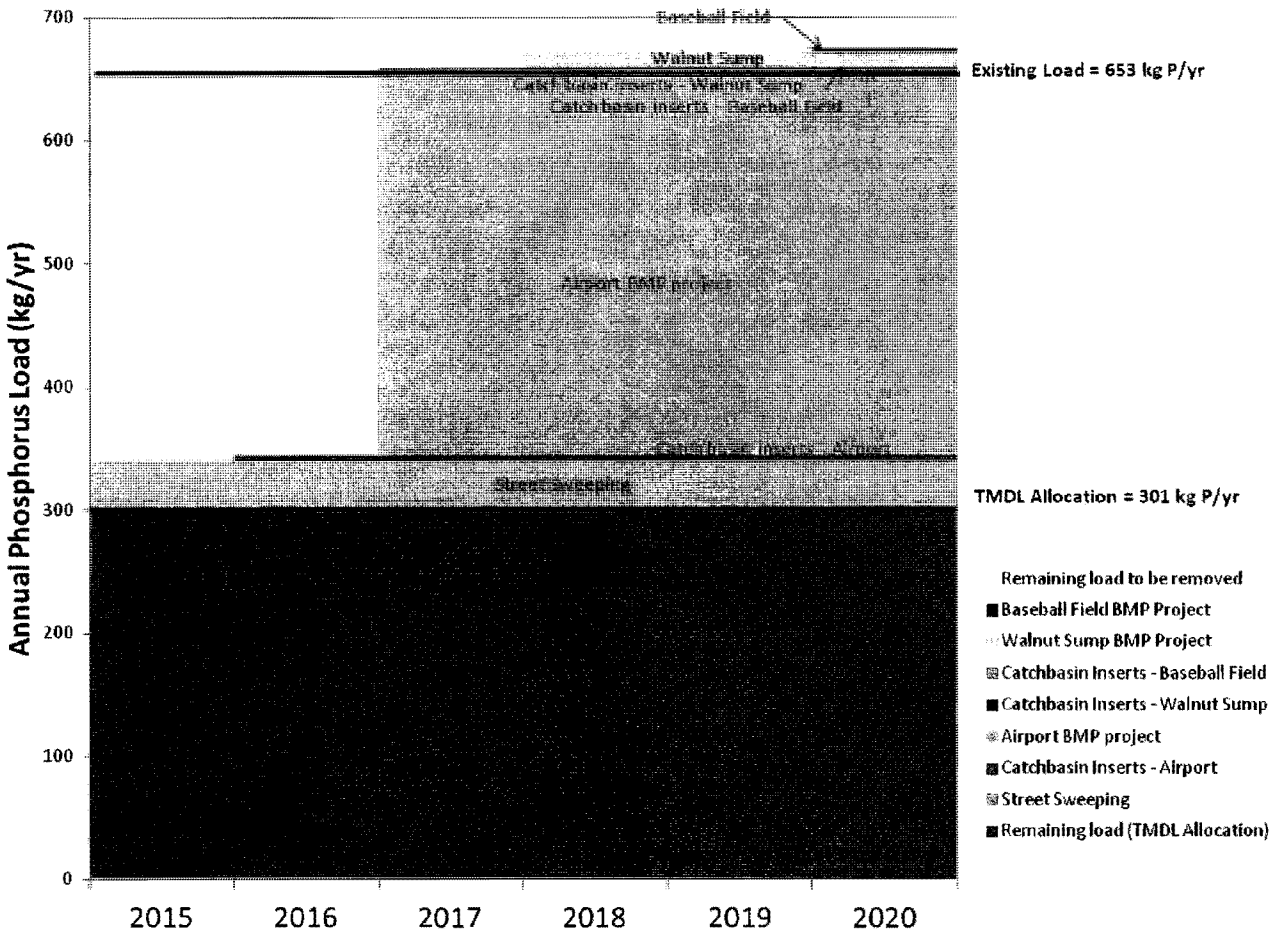

Figure 6.2 Expected TP Removal throughout the Implementation Period

Table 6.3 Summary of Expected Phosphorus Removal

					BASELINE LOAD AND LOAD REDUCTION												
Project Location	Subcatchment	Drainage Area (ac)	Total No. of Catchbasins	Proposed No. of Catchbasins	Baseline Load for TP (kg/yr)	Load Reduction from Structural BMPs (kg/yr)	Load Reduction from Street Sweeping (kg/yr)	Load Reduction from Catch Basin Inserts (kg/yr)	Total Load Reduction (kg/yr)	Strucutual BMPs Captial Cost	Street Sweeping Captial Cost	Catch Basin Inserts Captial Cost	Total Capital Cost	$/kg removed	30
	AS1	391	57	57	167.8	6.7	5.0	5.1	16.8	$ 128,500	$ 138,293	$ 125,400	$ 392,193	$ 766	
Airport	AS2	86	0	0	40.8	27.6	2.9	0.0	30.5	$ 7,031,000	$ 30,417	$ -	$ 7,061,417	172328.431	
	AS3	640	0	0	410.5	278.9	28.7	0.0	307.6		$ 226,362	$ -	$ 226,362	$ -	
	Subtotal	***1,045***	***173***	***57***	***619.1***	***313.2***	***36.6***	***5.1***	***354.9***	***$ 7,159,500***	***$ 369,606***	***$ 125,400***	***$ 7,679,972***	***$ 173,094***	***$ -***
Walnut Sump	WS-1	742	50	50	17.7	0	1.2	1.3	2.5	$ 125,000	$ 262,438	$ 110,000	$ 497,438		
	WS-2	181	192	0	4.3	12.9	0.3	0	13.2	$ 3,488,000	$ 64,018	$ -	$ 3,552,018		
	Subtotal	***923***	***242***	***50***	***22.0***	***12.9***	***1.5***	***1.3***	***15.7***	***$ 3,613,000***	***$ 326,456***	***$ 110,000***	***$ 4,049,456***	***$ -***	***$ -***
Baseball Field	BB-S1	16	5	5	0.4	0	0.03	0.1	0.13		$ 5,659	$ 11,000	$ 16,659	$ -	
	BB-S2	50	9	9	1.3	0	0.09	0.2	0.28		$ 17,685	$ 19,800	$ 37,485		
	BB-S3	39	4	0	1.0	2.1	0.07	0.0	2.19	$ 500,000	$ 13,794	$ -			
	BB-S4	50	5	5	1.3	0	0.09	0.1	0.20		$ 17,685	$ 11,000	$ 28,685		
	Subtotal	***155***	***23***	***19***	***4.0***	***2.1***	***0.3***	***0.4***	***2.8***	***$ 500,000***	***$ 54,822***	***$ 41,800***	***$ 82,828***	***$ -***	***$ -***
Walteria Lake	WL	***2,118***	***0***	***0***	***7.0***	***0***	***0.5***	***0***	***0.5***	***0***	***$ 749,116***	***$ -***	***$ 749,116***		
Totals		4,241	438	126	652	328	39	6.8	374	11,272,500	1,500,000	277,200	12,561,372	173,094	0

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7.0 MULTI-BENEFITS ANALYSIS

This BMP Implementation Plan outlines the management actions that may be needed to ultimately attain the WLAs of the Machado Lake Nutrient TMDL (LARWQCB, 2009) in the City's TMDL Implementation Area of the Machado Lake watershed. Although the primary intention of the proposed structural and nonstructural BMPs is to reduce nutrients load to Machado Lake, the ancillary benefits include water supply improvement, community enhancement, and sediment reductions. This section describes the additional benefits that may be achieved as the management actions are implemented. It should be noted that they do not necessarily benefit the City directly.

7.1 Water Supply

7.1.1 Irrigation Reduction

Irrigation reduction is a proposed nonstructural BMP. Irrigation reduction has the direct water supply benefit of reducing the amount of potable water used for irrigation. Irrigation reductions could be achieved through outreach to residents and implementation of evapotranspiration controllers. Irrigation reductions will be aided by Ordinance No. 2008-0052U, which prohibits runoff from lawns and landscaping on to hardscape (streets, sidewalks). This ordinance also limits fertilizer running onto the street, thus reducing nutrient loads to stormwater. Field monitoring data show that irrigation runoff is insignificant and therefore the City may continue to monitor this in the future.

7.2 Community Enhancement Benefits

Water quality improvements benefit the community at large. These benefits include aesthetics, increases in property value, enhanced recreation opportunities, enhanced water supply, and lower costs for landscape maintenance. Ecosystem benefits are also realized from the improvements. Runoff reduction contributes to water conservation, provides habitat benefits through the reduction of the artificial dry weather flows, and reduces the cost of landscape maintenance. Improvements in Machado Lake water quality will provide the community with enhanced recreational opportunities. Water quality improvements are likely to improve wildlife viewing and fishing opportunities at the lake. Enhancements in habitat directly benefit the wildlife and provide habitat refuge in a highly urbanized area.

7.3 Toxics TMDL and Reduced Sediment to Machado Lake

Best management practices proposed to reduce nutrients in the Machado Lake BMP Implementation Plan include practices that will reduce sediment loads, especially as the WLAs for Toxics were assigned as a fraction of the suspended sediment loading to Machado Lake. Current sediment loading to the lake is estimated at 38,400 kg/yr.

Reduction of sediment loading will provide for improved water quality in the lake, and will reduce future needs to dredge the lake.

Structural and nonstructural BMPs capture and remove sediment (TSS) from the watershed. Street sweeping and catch basin cleanouts are nonstructural practices that directly remove sediment loads from the watershed and manage them for proper disposal. Nonstructural practices also address the sources of sediment in the watershed, the public outreach, development construction, new development, and public works elements of the City's stormwater management program play a role in encouraging erosion control and reducing sediment inputs to the storm drainage system. Underground storage/infiltration systems are structural BMPs that prevent conversion of pervious areas to impervious cover during development. These practices reduce the quantity and rate of runoff from developed areas, thereby reducing the demand on the storm drain system. The expected reductions in sediment loading for dry and annual weather flows are listed in Table 7.1.

Table 7.1 Estimated Reductions in Stormwater TSS Loads

Flow Condition	Percent Reduction in TSS[1]
Dry Weather Flow	31%
Wet Weather Flow	92.1%

Note:
(1) Reductions based on nonstructural and Structural BMPs removal within the TMDL Implementation Area.

7.4 Multi-Benefit Summary

Precise benefit quantification is difficult given the absence of site-specific information and uncertainty about BMP performance and efficiencies. A summary of the ancillary benefits to the proposed structural and nonstructural BMPs within the Machado Lake Watershed are listed in Table 7.2.

Table 7.2 Summary of Multi-Benefits of the Implementation Plan BMP Strategies

BMP	Aesthetics	Capture and Reuse	Flood Protection	Groundwater Recharge	Habitat	Property Value	Water Conservation	TSS Reduction
Under Storage/Infiltration			✓	✓	✓		✓	✓
Aboveground Storage/Infiltration	✓		✓	✓	✓	✓		✓
Irrigation Reduction					✓		✓	
Street Sweeping	✓							✓
Pet Waste Management	✓				✓			
Illicit Connection Removal	✓				✓		✓	
Catch Basin Clean Out			✓					✓
Catch Basin Inserts								✓

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8.0 IMPLEMENTATION SCHEDULES

The estimated implementation schedules for the nonstructural and structural projects proposed as possible solutions to comply with WLAs from the TMDLs are discussed below. The schedules presented herein are sufficient for long-term planning. Through adaptive management and based on the future monitoring results and response of Lake Machado, the implementation schedules may be modified to reflect the increased knowledge of the watershed. Actual schedule for Implementation of BMPs will occur as funding becomes available.

8.1 TMDL Schedule

The nutrient TMDL implementation schedule consists of a phased approach, with interim WLAs to be met by March 11, 2014 and full compliance by September 11, 2018. The schedules for required actions for both the Nutrient TMDL is outlined in Table 8.1.

Table 8.1 Schedule or Work Plan Elements for Nutrients

ID	Work Plan Element	Schedule
1	Effective Date	March 11, 2009
2	Submit Monitoring Plan	September 12, 2011
3	Begin Monitoring and Implementation	60-days from approval
4	Information Item to LARWQCB on Implementation Progress	March 11, 2013
5	Interim Limits Apply (TP: 3,760 kg/yr and TN: 7,370 kg/yr)	March 11, 2014
6	LARWQCB to Reconsider TMDL	September 11, 2016
7	Final WLA applicable (TP: 301kg/yr and TN: 3,008 kg/yr)	September 11, 2018

The Toxics TMDL defines milestones for achieving compliance as follows:

- By March 22, 2011, Municipal Separate Storm Sewer (MS4) and 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 stormwater NPDES permittees shall provide a written final report to the Regional Board outlining how they will achieve the WLA for sediment in the Machado Lake.
- 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.

8.2 Load Reduction Schedule

The Nutrient TMDL contains a phased compliance schedule, with interim limits effective in the first quarter of 2014 and final allocations effective the third quarter of 2018.

8.3 Nonstructural Schedules

An estimated schedule for the nonstructural BMPs described in Section 4 Nonstructural Solutions is summarized in Table 8.2. The schedule accounts for the planning and design of the nonstructural BMP programs and the long-term implementation of the programs.

8.4 Structural Schedules

An estimated schedule for completing the structural BMPs described in Section 5 is presented in Table 8.3. The schedule includes meeting planning and permitting requirements, preparing engineering design documents, bidding and constructing the BMPs and ongoing operations. The timeframe for funding has not been included in this schedule. In addition to the projects noted in the Table, the schedule accounts for the ongoing redevelopment activities that are expected to occur in the TMDL Implementation Area. The schedule also accounts for the ongoing opportunities to retrofit BMPs whether they are on public right-of-ways or private properties.

As discussed in Section 5.3.3, a geotechnical investigation was conducted at the Torrance Airport due to concern regarding infiltration rates at this BMP site. Details of this subsurface investigation are summarized in Appendix E. In summary, it can be concluded that the boring logs indicate that the top layer below surface is not suitable for infiltration and that substantial excavation (25-24 feet below surface) will be required to reach a sand layer that would typically yield higher percolation rates.

To verify if the proposed underground infiltration would work properly at this location, it is recommended that the City take a phased approach. First, it is recommended that the City conduct some percolation testing at the depth of the sand layer. If results are acceptable, it is then recommended that the City implement the project at Site A1 first, where the sandy layer is closest to ground surface (25 below ground surface) and then monitor the performance over multiple years. If the project meets expectations or if design alternations can overcome any identified issues, it is recommended that the City implement projects A2 and A3, where the sandy layer starts at 40 and 45 feet below surface, respectively.

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Table 8.2 Proposed Implementation Schedule for Nonstructural Solutions						
Structural Project	Duration (months)	Timeline				
		2014	2015	2016	2017	2018
Catch Basin Cleanouts						
Purchase Advanced cleaning Technology (steam cleaning), as needed						
Focus on Problem Areas	3 - 6					
Increase Frequency of Cleanouts	Ongoing					
Catch Basin Inserts						
Install Catch Basin Inserts in Implementation Area	Ongoing					
Downspout Disconnection Program						
Planning & Assessment	8 - 12					
Implementation	24					
Fats, Oils and Grease Outreach						
Focus on Residents in TMDL Implementation Area	8 - 12					
Continuation of Existing FOG Outreach	Ongoing					
Green Waste Outreach						
Planning & Assessment	8 - 12					
Implementation	24					
Illicit Connection Removal						
Survey System in TMDL Implementation Area	24					
Implementation	24 - 36					

Table 8.2 Proposed Implementation Schedule for Nonstructural Solutions

Structural Project	Duration (months)	Timeline				
		2014	2015	2016	2017	2018
Impervious Cover Reduction						
Assess Feasibility of Reducing Existing Impervious cover	8 - 12					
Implementation, if appropriate	24					
Industrial/Commercial Facilities Control Program						
Nutrients and Toxics Specific Training	3 - 6					
Outreach to Facilities to Improve Onsite Source Control Activities	8 - 12					
Continuation of Existing I/C Facilities Program	Ongoing					
Pet Waste Outreach						
Planning & Assessment	8 - 12					
Implementation of Pet Waste Bag Dispenser Stations in TMDL Implementation Area	8 – 12					
Focus on TMDL Implementation Area Resident Outreach	24					
Continuation of Existing Pet waste Outreach	Ongoing					
Post Construction Requirements						
Specialized Nutrient, Toxics and Runoff Reduction Training for Staff	3 - 6					
Require Implementation of BMPs that Effectively Remove Nutrients and Toxics for Redevelopment Projects in County Islands	Ongoing					
Sewer System Maintenance						
Specialized Training for Staff	3 - 6					
Focus maintenance in County Islands	8 - 12					

Table 8.2 Proposed Implementation Schedule for Nonstructural Solutions						
Structural Project	Duration (months)	Timeline				
		2014	2015	2016	2017	2018
Smart Gardening Program						
Planning & Assessment	8 - 12					
Implementation	Ongoing					
Street and Parking Lot Sweeping						
Planning & Assessment	8 - 12					
Upgrade/Purchase More Effective Street Sweepers, as needed	3 - 6					
Conduct Residential Outreach	8 - 12					
Increase Frequency of Sweeping	ongoing					

Table 8.3 Implementation Schedule for Structural Projects

Structural Project	Cost[1]	Duration (months)	Timeline				
			2014	2015	2016	2017	2018
Torrance Airport							
Phase 1 – Install Underground Storage/Infiltration System at Site A2							
Planning and Permitting	$0.02m	15 -24	$0.01m	$0.01m			
Engineering Design Documents	$0.20m	8 - 12	$0.1m	$0.1m			
Bidding and Construction	$1.78m	6 - 12		$0.75m	$1.03m		
Operations	n/a		n/a	n/a	n/a	n/a	n/a
Subtotal	**$2.0m**		**$0.11m**	**$0.86m**	**$1.03m**	n/a	n/a
Phase 2 – Install Underground Storage/Infiltration System at Site A1							
Planning and Permitting	$0.05m	12			$0.05m		
Engineering Design Documents	$0.50m	8 - 12			$0.5m		
Bidding and Construction	$4.47m	6 - 12			$2.0m	$2.47	
Operations	n/a					n/a	n/a
Subtotal	**$5.0m**				**$2.55m**	**$2.47m**	n/a
Phase 3 Catch Basin Filter Inserts							
Subtotal	$129k	12					$128.5km
Grand Total Airport	**$7.2m**		**$0.11m**	**$0.86m**	**$3.58m**	**$2.47m**	**$128.5k**
Walnut Sump							
Phase 1 Divert Stromwater From Stormdrain 1040							
Planning and Permitting	$5.63k	6		$5.63k			
Engineering Design Documents	$56.3k	6		$56.3k			
Bidding and Construction	$0.5m	12			$0.5m		
Operations						n/a	n/a
Subtotal	**$0.56m**			**$61.93k**	**$0.5m**	n/a	n/a

Table 8.3 Implementation Schedule for Structural Projects

Structural Project	Cost[1]	Duration (months)	Timeline				
			2014	2015	2016	2017	2018
Walnut Sump							
Phase 2 – Install Catch Basin Filters in WS-1							
Planning and Permitting	$1. 5k	6		$1.5k			
Engineering Design Documents	$12.5k	6		$12.5k			
Bidding and Construction	$111k	12		$111k			
Operations	n/a		n/a	n/a	n/a	n/a	n/a
Subtotal	**$125k**			**$125k**	n/a	n/a	n/a
Phase 3 – Aboveground Storage/Infiltration System at Walnut Sump							
Planning and Permitting	$0.03m	12				$0.03m	
Engineering Design Documents	$0.36m	12				$0.36m	
Bid/Construct	$2.54m	12 - 18				$1.04m	$1.5m
Operations	n/a					n/a	n/a
Subtotal	**$2.9m**					$1.43m	$1.5m
Grand Total Walnut Sump	**$3.6m**			**$186.93k**	**$0.5m**	**$1.43m**	**$1.5**
Baseball Field							
Phase 1 Divert Stromwater From Stormdrain 1040							
Planning and Permitting	$6k	12				$5k	
Engineering Design Documents	$66k	8 - 12				$66K	
Bidding and Construction		6 - 12					$0.59m
Operations							n/a
Grant Total Baseball Field	**$0.66m**					**$70k**	**$0.59m**

Notes:
1. Cost estimate by project phase are assumed to be as follows: Planning and Permitting is 1% of Project Cost; Engineering Design Documents is 10% of Project Cost; Bidding and Construction is 89% of Project Cost.

9.0 COST ESTIMATES

The cost estimates for the proposed actions outlined in the Implementation Plan are presented in this section. At the planning level, the costs provided will allow an order of magnitude effort necessary to implement structural and nonstructural BMPs in the Machado Lake Watershed to meet the WLAs of both the Nutrient and Toxics TMDLs using the current information on the loading from the TMDL Implementation Area and effectiveness of implementing BMPs. Changes to the TMDLs, the model estimated loads through watershed specific monitoring, or assumed effectiveness of identified BMPs will result in a change in the required BMPs and their associated costs. Cost estimates presented are at the level of detail necessary for planning and strategic decision-making. The BMPs are to be distributed uniformly across the TMDL Implementation Area, and site-specific issues that may result in excessive costs are likely to occur in a portion of the installations. Costs presented in here cannot consider site-specific issues and are likely to underestimate the final costs for applying the identified BMPs throughout the TMDL Implementation Area.

9.1 Best Management Practices Cost Estimates

The nonstructural costs estimates are presented in Table 9.1. An assumed 3 percent rate of inflation is used in the cost estimates to determine the cost estimates. Of the BMPs discussed in Section 4, the impervious cover reduction and sanitary sewer maintenance are not included in Table 8.3, as the impervious cover reduction ultimately is a component of the structural BMP program, and the sanitary sewer maintenance is required under the collection system permit.

Table 9.1 Nonstructural Best Management Practice Cost Estimates.

Program	Annual Cost ($)[1]
Catch Basin Cleanouts	1,500,000
Catch Basin Inserts	2,200,000
Downspout Disconnection Program	200,000
Fats, Oils and Grease Outreach	100,000
Green Waste Outreach	100,000
Illicit Connection Removal	200,000
Industrial/ Commercial Facilities Control Program	100,000
Pet Waste Outreach	500,000
Post Construction Requirements	50,000
Sewer System Maintenance	500,000
Smart Gardening Program	500,000
Street and Parking Lot Sweeping	1,500,000
Total	**7,450,000**

Note:
(1) Program costs through 2018 using 3% rate of inflation

Structural cost estimates are listed in Table 9.2. Implementation costs for the conceptual projects do not include engineering design, permitting, construction, building materials, or O&M. Information on these can found in Appendix F. The details of the five conceptual designs are presented in Section 5. As per the quantification analysis, structural BMPs are required in addition to the conceptual projects and projects situated on County lands. Typical costs for the additional projects are used to estimate the cost of projects on leased or private parcels. The costs do not reflect the costs of negotiation with landowners or the cost of land acquisition. The costs for additional projects are subject to change to reflect the specific site conditions. Detailed cost estimates can be found in Appendix F.

Table 9.2 Program Cost Estimates of Structural Best Management Practices

Structural Best Management Practice	Estimated Cost ($)
Walnut Sump	**$3,613,000**
1. Phase 1 – Flow Diversion at Stormdrain1040	$563,000
2. Phase 2 - Catch Basin Filter Inserts in WS-1	$125,000
3. Phase 3 – Aboveground Storage/Infiltration System	$2,925,000
Baseball Field (Option 1)	**$661,000**
Torrance Airport	**$7,160,000**
1. Phase 1 - BMP at Site A2	$2,029,000
2. Phase 2 - BMP at Site A1	$5,002,000
3. Phase 3 – Catch Basin Filter Inserts in Subcatchment AS1	$129,000
TOTAL	**11,434,000**

9.2 Cost Schedule

The schedule for implementation to achieve the TMDL WLA, requiring 54 percent reduction in phosphorus load, is summarized in Table 6.3. The schedules for nonstructural, structural, redevelopment, and leased property projects were used to distribute the implementation costs over time, ending in 2018, the compliance point for the Nutrients TMDL. The implementation path represented by Table 6.3 is a method of compliance with the Nutrients TMDLs. As the adaptive management and reevaluation of the Nutrient TMDL progresses, the required levels of pollutant loading and the compliance timeline may change. The actual costs and timing of implementation will depend on the specific site characteristics, special studies, and actual effectiveness of installed BMPs.

Appendix E

Walteria Basin Supplementary Information

The Walteria Flood Control Basin (Walteria Basin) is a man-made basin located in the City of Torrance. The basin was built in 1962 by the Los Angeles County Flood Control District (LACFCD). Walteria Basin has a perimeter of approximately one mile and extends to an approximate depth of 100 feet. Walteria Basin's watershed is approximately 2,287 acres (Figure D-1). By jurisdictional area, the basin's watershed is 92.61% Torrance, 7.35% Palos Verdes Estates and 0.04% Redondo Beach.

The primary function of Walteria Basin is to provide flood protection. During storm and dry weather conditions Walteria Basin receives runoff from the surrounding watershed. Water in the basin is discharged during the dry season to pump out accumulated dry weather flows and after storm events to maintain flood protection for the adjacent communities. The discharge is pumped through the Project No. 584 stormdrain and flows through the drainage network where it eventually discharges to Wilmington Drain. Wilmington Drain is a soft-bottom open channel maintained by the LACFCD. Surface water in Wilmington Drain can flow via gravity or an unmanned pump station into Machado Lake. To ensure the downstream capacity is available for other storm flows, the Walteria Basin is only pumped down after runoff in the watershed subsides.

In October 2014, the LACFCD and the City of Torrance commenced a Special Study Monitoring Program analyzing Walteria Basin (Special Study). The objective of the Special Study is to:

- Compare the mass of pollutants entering Walteria Basin and the mass of pollutants discharged.
- Assess inflow and outflow compared to TMDL waste load allocations.

As part of the Special Study, the LACFCD is monitoring the 4 inlets to Walteria Basin. The City of Torrance is monitoring the discharges from Walteria Basin during pumping events. The Special Study will span 2 years, and preliminary results will be available late 2015.

Pending results of the Special Study, an appropriate Regional Project will be identified. A variety of BMPs are currently being investigated including:

- Application of aluminum sulfate to Walteria Basin.
- A diversion of the outflows from Walteria Basin to the Torrance airport for infiltration to groundwater (more can be read in City of Torrance's BMP Implementation Plan, page 60).
- Use of water collected in Walteria to irrigate a nearby park or open space.

As the Special Study is completed in late 2016, funding and selection of appropriate BMPs will be determined. A BMP implementation strategy for Walteria Basin will be refined and reported through adaptive management.

Figure D-1. Walteria Lake Watershed

Appendix F

City of Torrance Stormwater Quality Master Plan

City of Torrance

STORMWATER QUALITY MANAGEMENT PLAN

FINAL
December 2011

199 SOUTH LOS ROBLES AVENUE • SUITE 530 • PASADENA, CALIFORNIA 91101 • (626) 535-0180 • FAX (626) 535-0185

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City of Torrance

Stormwater Quality Management Plan

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LIST OF ABBREVIATIONS

Abbreviation	Description
ac	Acre
ACP	Asbestos Cement Pipe
af	Acre Foot
APWA	American Public Works Association
BMPs	Best Management Practices
BPA	Basin Plan Amendment
Carollo	Carollo Engineers, Inc.
CC	Construction Cost
CDS	Continuous Deflective Separation
CEQA	California Environmental Quality Act
cfs	Cubic Feet per Second
CIP	Capital Improvement Program
City	City of Torrance
CMP	Corrugated Metal Pipe
CRWQCB	California Regional Water Quality Control Board
CWA	Clean Water Act
DCIA	Directly Connected Impervious Area
DDF	Depth Duration Frequency
DEM	Digital Elevation Model
EMC	Event Mean Concentration
ENR	Engineering News Record
ETM+	Enhanced Thematic Mapper Plus
fps	Feet per Second
gpm	Gallons per minute
GIS	Geographic Information System
GPS	Global Positioning System
HSPF	Hydrologic Simulation Program Fortran
ICM	Impervious Cover Model
ISA	Impervious Surface Area
KMHRP	Ken Malloy Harbor Regional Park
LACDPW	Los Angeles County Department of Public Works
LACFD	Los Angeles County Flood Control District
LAWQCB	Los Angeles Water Quality Control Board
LID	Low Impact Development
LSWPPP	Local Stormwater Pollution prevention Program
µg/kg	Micrograms per Kilogram (dry weight)
µg/l	Micrograms per Liter
MEP	Maximum Extent Possible
mg/l	Milligrams per Liter
MRP	Monitoring and Reporting Plan
MS4	Municipal Separate Storm Sewer System
N-SPECT	Nonpoint Source Pollution and Erosion Comparison Tool
NCDC	National Climactic Data Center
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NRCS	Natural Resources Conservation Service
NSQD	National Stormwater Quality Database
NRCS	Natural Resources Conservation Service

Abbreviation	Description
PAH	Polycyclic Aromatic Hydrocarbons
PLAT	Pollutant Loading and Analysis Tool
PVC	Polyvinyl Chloride
RCB	Reinforced Concrete Box
PS	Point Source
QAPP	Quality Assurance Project Plan
RCP	Reinforced Concrete Pipe
RWQCB	Regional Water Quality Control Board
SCS	Soil Conservation Service
SDMP	Storm Drain Master Plan
SPI	Subbasin Priority Index
SQMP	Stormwater Quality Management Plan
SUSMP	Standard Urban Storm Water Mitigation Plan
TDH	Total Dynamic Head
TKN	Total Kjeldahl Nitrogen
TM	Thematic Mapper
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorous
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
VCP	Vitrified Clay Pipe
WAG	Watershed Authority Groups
WDR	Waste Discharge Requirements
WMMS	Watershed Management Modeling Systems
WLA	Waste Load Allocation
WQFI	Water Quality Fee Initiative
XP SWMM	Name of hydraulic modeling software

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ES.1 INTRODUCTION

The City of Torrance (City) faces an increasingly complex set of challenges in managing stormwater runoff and nonpoint source pollution. A combination of growth and regulatory programs, including the National Pollutant Discharge Elimination System (NPDES) Permits and Total Maximum Daily Load (TMDL) requirements, place very specific land-use and stormwater management demands on the City. Given the continued development pressure and increasingly stringent regulatory requirements, it has become necessary for the City to develop this Stormwater Quality Master Plan (SQMP). The SQMP includes modeling and analysis of various land-use and stormwater Best Management Practices (BMPs) scenarios and provides quantitative comparisons of a range of management options. This quantitative information will be used in selecting the most effective and efficient solutions to manage stormwater runoff and nonpoint source pollution. Identification of cost-effective solutions is critical given the limited financial resources available to meet multiple regulatory requirements. The results of the quantitative analysis aids the City in a broad range of land-use planning activities in addition to compliance with specific regulatory programs.

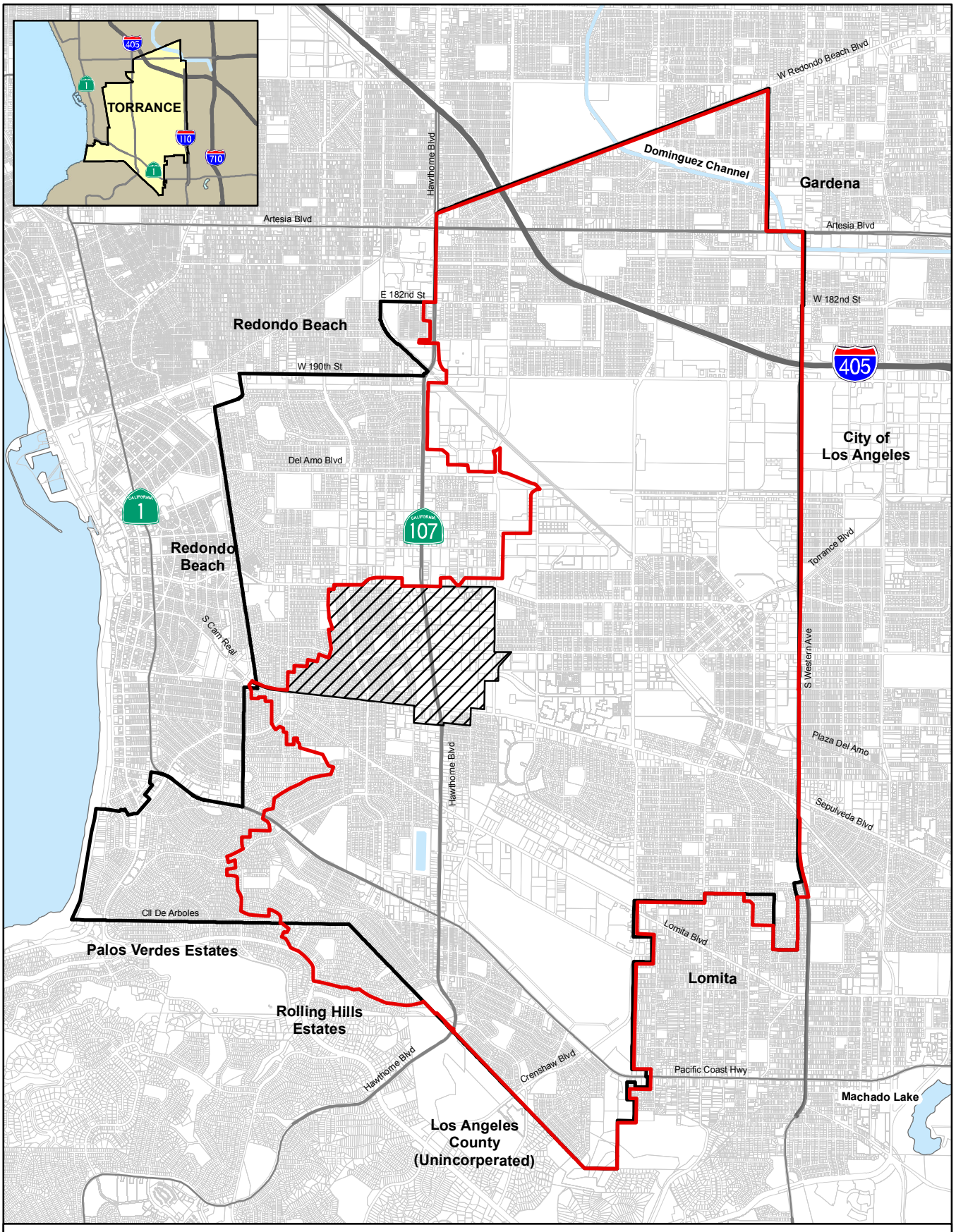
The main focus of this SQMP is to assess changes in stormwater runoff volume and pollutant loading in the City. Analysis parameters include total suspended solids (TSS), total nitrogen (TN), and total phosphorus (TP). These evaluated parameters were used as indicators to predict pollutant loading of various constituents. This analysis was used to identify the BMPs to be developed to treat stormwater pollutants, meet regulatory compliance requirements opportunities, and express the City's renewed commitment to the use of environmentally responsible, cost-effective, and sustainable solutions.

ES.2 BACKGROUND

The City completed previous Stormwater Drainage Master Plans in 1960 and 1997. While the City is built out, the increased requirements associated with stormwater quality have led the City to develop this SQMP to assist the City in complying with regulatory requirements in an efficient and cost-effective manner.

ES.3 STUDY AREA

The study area of this report consists of the City's stormwater service area as shown in Figure ES.1. It should be noted that water quality analyses for areas that are part of the Santa Monica Bay watershed have been conducted in previous studies, including the Stormwater Basin Enhancement Program (Carollo, 2008). The recommendations from those studies were incorporated within this SQMP and separate analysis for the Santa Monica watershed was therefore not part of this study.



Legend

- Study Area
- Retention Basin (Excluded, TMDLs Not Applicable)
- City Boundary
- Freeway
- Major Roads

0 0.25 0.5 1 Miles

Figure ES.1
Study Area
Stormwater Quality Master Plan
City of Torrance

ES.4 WATERSHEDS AND SUBBASINS

The City is divided into various drainage basins that comprise four watersheds, as shown on Figure ES.2. Each drainage basin has a system of conveyance facilities to collect and dispose runoff.

Santa Monica Bay Watershed

The Santa Monica Bay Watershed is located in western Los Angeles County and includes watersheds for several creeks discharging to the Santa Monica Bay, stretching from the Malibu Creek Watershed to the Palos Verdes Peninsula Watersheds.

Dominguez Channel Watershed

The Dominguez Channel Watershed is located in southern Los Angeles County and overlies portions the City, the City of Los Angeles, Carson, Lomita, Rolling Hills, Rolling Hills Estates, Rancho Palos Verdes, Redondo Beach, Palos Verdes Estates, and unincorporated Los Angeles County. Overall, the watershed is about 110 square miles in size, with about 19 square miles residing within the City's boundary.

Harbor Lakes Sub-Watershed/Machado Lake Sub-Watershed

Stormwater flow from the City's Walteria and Harbor Lakes subbasins is directed to Machado Lake, which discharges to the Los Angeles Harbor (west of the Dominguez Channel inlet).

Machado Lake is located within the Machado Lake Sub-Watershed, which is approximately 20 square miles and positioned within the larger 110-square-mile Dominguez Channel Watershed. The sub-watershed is located in southern Los Angeles County and includes all, or a portion of, the following communities: City of Los Angeles, Torrance, Carson, Lomita, Rolling Hills, Rolling Hills Estates, Rancho Palos Verdes, Redondo Beach, Palos Verdes Estates, and Los Angeles County.

Groundwater Replenishment Retention Basins

Several areas within the City do not discharge stormwater outside the City's boundary. These areas are referred to as retention basins. Rather than discharging stormwater to other bodies of water, stormwater is recharged into the groundwater basin through infiltration at retention sumps, also referred to as retention basins.

ES.5 REGULATIONS

The City is a permittee under the Los Angeles County Municipal Separate Storm Sewer System (MS4) permit and discharges stormwater accordingly. The City is subject to several existing and pending Total Maximum Daily Loads (TMDL) regulations that are associated with the various water bodies to which the City discharges stormwater to.

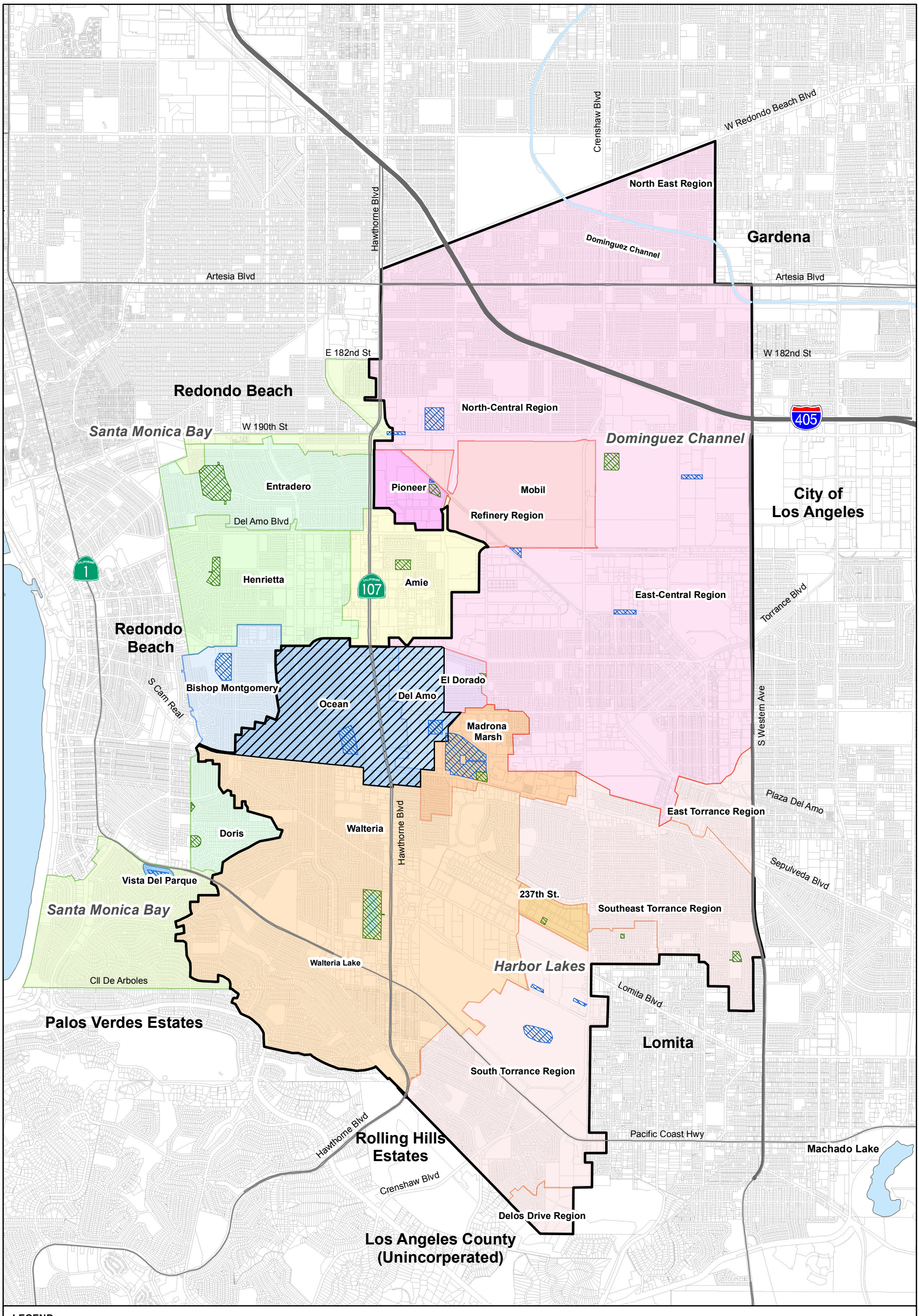
The specific TMDLs applying to the waters the City discharges stormwater to were implemented as a result of a consent decree resulting from the National Resources Defense Council's (NRDC) 1998 lawsuit against the EPA and the RWQCB's 1996 and 1998 water quality assessments which identified over 700 potential pollutant waterbody combinations requiring TMDLs. As a part of the consent decree, a 13-year schedule was established (between 1999 and 2012) for implementation of the TMDLs, which were consolidated from the 700 potential pollutant waterbody combinations into 92 TMDLs. The list of TMDLs has been modified in the intervening years.

Table ES.1 provides a summary of the various existing and pending TMDLs associated with each body of water the City discharges to. Compliance dates are also discussed in Chapter 3. It should be noted that areas of the City replenishing groundwater through retention basins are not subject to TMDLs, and thus do not require BMPs.

Table ES.1 Summary of TMDLs for City of Torrance

Body of Water	TMDL Name	Pollutant[(1)]	Resolution Number	Effective Date
Machado Lake	Nutrient	Nitrogen, Phosphorus	R08-006	11 March 2009
	Trash	Trash	2007-006	6 March 2008
	Toxics	Pesticides, PCBs	R10-008	2 September 2010
Dominguez Channel[(1)]	Toxics[(2)]	Copper, Lead, Zinc, DDT, PAHs, PCBs, Chlordane, Dieldrin, Cadmium, Chromium, Mercury	R11-008	Not Yet Effective (Approved by RWQCB on 5 May 2011)
Santa Monica Bay	Debris	Trash, Plastic Pellets	R10-010	Not Yet Effective (Approved by SWQCB 6 December 2011)
	Bacteria	Bacteria	2002-004 2002-022 2006-008	15 July 2003 15 July 2003 6 April 2006

Notes:
1. Interim, final, and phased Waste Load Allocations (WLA) are listed in Chapter 3 where applicable.
2. The Resolution Name for what is referred to here as the Dominguez Channel Toxics TMDL is "Los Angeles and Long Beach Harbors Toxic and Metals TMDLs." Dominguez Channel discharges into the Los Angeles and Long Beach Harbors.



LEGEND

Watersheds

Groundwater Replenishment
- Bishop Montgomery
- Del Amo
- Ocean
- Vista Del Parque

Dominguez Channel
- Surface Drainage
- El Dorado
- Mobil
- Pioneer

Santa Monica Bay
- Surface Drainage
- Amie
- Doris
- Entradero
- Henrietta

Harbor Lakes
- Surface Drainage
- 237th St.
- Madrona Marsh
- Walteria

Others
- Bodies of Water
- Study Area
- Excluded from Study Area
- Detention Basins
- Retention Basins
- Parcels

0 0.2 0.4 0.8 Miles

Figure ES.2
Watershed and Basin Layout
Stormwater Quality Master Plan
City of Torrance

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In addition, additional internal costs are anticipated to the City related to reissuance of the Los Angeles County MS4 permit in the near future. Changes associated with the reissuance are discussed in Chapter 3. The following are anticipated cost impacts to the City associated with reissuance of the MS4 permit:

- Increased cost of the City's development projects
- Increased time for City staff to review and inspect development plans
- Increased time for City staff to track and inspect BMPs implemented as a part of development and redevelopment
- Potentially, increased operations and maintenance efforts for BMPs associated with developments
- Increased cost for water quality monitoring
- Increased cost to track data and prepare annual report

More details regarding stormwater regulations are described in Chapter 3 of this report.

ES.6 WATER QUALITY EVALUATION

Predictions of pollutant levels within the City's stormwater discharge are developed using several stormwater models. The model development is discussed in Chapters 6, while the the water quality analysis results are described in Chapter 7.

Based on a combination of satellite imagery, land use maps, imperviousness, and topography, pollutant loads of TSS, TP, and TKN were estimated for the City's entire stormwater watershed. Based on the results, the following five subbasins were identified as high-priority areas:

- Subbasin DC-S4: Wilson Park and Torrance Blvd. Median
- Subbasin DC-S3: ExxonMobil Detention Basin (existing basin)
- Subbasin DC-S2: Wilson Park, El Prado Park, and Torrance Blvd. Median
- Subbasin HL-S3: Torrance Airport and intersection of Crenshaw/Skypark
- Subbasin HL-S2: De Portola Park

These high priority areas are shown on Figure 7.16 and are shaded in pink on Figure ES.6. This prioritization was used to phase improvements discussed in the following section.

ES.7 CAPITAL IMPROVEMENT PROGRAM

Based on the analysis discussed in Chapter 7, recommendations were made to meet water quality objectives for the Harbor Lakes and Dominguez Channel watersheds under two conditions, full treatment of wet weather flows and low flow diversion of dry weather flows. Additionally, recommendations to meet stormwater capacity criteria are discussed in Chapter 8. In addition, recommended stormwater quality projects from previous studies for the Santa Monica Bay are included in the list of proposed projects in this SQMP.

CIP by Project Category

The recommended CIP is based on implementation of low flow diversion stormwater quality improvements, capacity improvements, and miscellaneous improvements. The cost of wet weather stormwater quality improvements are presented for information purposes only. As shown in Table 9.8 the total estimated cost of the dry weather CIP is nearly $112 million. If wet weather improvements are implemented in lieu of the low flow diversion (dry weather) improvements, the total CIP would increase to $185 million.

Table ES.2 Recommended CIP Summary

Improvement Category	Capital Cost ($ million)	Source
Low Flow Diversion Water Quality Projects	$47.1	Table 9.4
Capacity Improvement Projects	$54.4	Table 9.6
Miscellaneous Improvement Projects	$10.4	Table 9.7
Total Cost of Recommended Dry Weather CIP	**$111.9**	n/a
Wet Weather Water Quality Projects	$120.2	Table 9.5
Total Cost of Wet Weather CIP[(1)]	**$185.0**	**n/a**

Notes:
1. Does not include Low Flow Diversion Improvement Projects to avoid double counting.

CIP Phasing

The recommended improvements were divided into five phases.

- Phase 1 consists of water quality recommendations within high priority subareas discharging to the Harbor Lakes watershed. The compliance with the interim targets in the Machado Lake Nutrients TMDL is required by March 2014, while compliance with the final targets is required by September 2018. Implementation of this phase will need to be initiated prior to 2014. Phase 1 also includes implementation of recommendations from previous studies for the Santa Monica Bay watershed, currently under design.

- Phase 2 consists of water quality recommendations within high priority subareas discharging to the Dominguez Channel watershed. The first compliance deadline for the Dominguez Channel Toxics TMDL is in 2017, thus Phase 2 should be implemented prior to 2017. The schedule for potential TMDLs for Dominguez Channel, such as a nutrient or bacteria TMDL, are not yet developed, but would be anticipated after the Toxics TMDL.
- Phase 3 consists of water quality recommendations within the remaining subareas of Harbor Lakes. Installation of street sweeping within areas of the City discharging to the Santa Monica Bay watershed are also included in Phase 3.
- Phase 4 consists of water quality recommendations within the remaining subareas of Dominguez Channel.
- Phase 5 consists of stormwater capacity improvements. The water quantity improvements are not driven by a TMDL related deadline. Chapter 9 provides details on all of the recommended projects for both the wet weather and low flow diversion recommendations, including the stormwater capacity improvements.

The breakdown of costs for each of project phase is summarized in Table ES.3.

Table ES.3 Capital Cost by Planning Phase and Project Type

Category	Phase 1 ($M)	Phase 2 ($M)	Phase 3 ($M)	Phase 4 ($M)	Phase 5 ($M)	Total ($M)
BMPs	$10.5	$5.7	$2.4	$6.0	$0.0	$24.6
Diversion Structures	$0.3	$0.7	$0.8	$0.7	$0.0	$2.4
Storm Drains and Force Mains	$1.5	$6.7	$4.9	$13.3	$54.4	$80.7
Street Sweeping	$0.2	$0.2	$0.3	$0.3	$0.0	$1.0
Pump Stations	$0.0	$1.5	$0.8	$0.9	$0.0	$3.1
Valves and Site Piping	$0.0	$0.0	$0.1	$0.0	$0.0	$0.1
Total	**$12.4**	**$14.7**	**$9.2**	**$21.2**	**$54.4**	**$111.9**

As shown in Table ES.3, the capital cost for Phase 1 is estimated at $12.4 M while the capital cost associated with the remaining phases is estimated at $99.5 M. Figure ES.3 presents the capital costs for each identified phase. The overall CIP cost is estimated at $111.9 million and includes stormwater capacity as well as water quality recommendations.

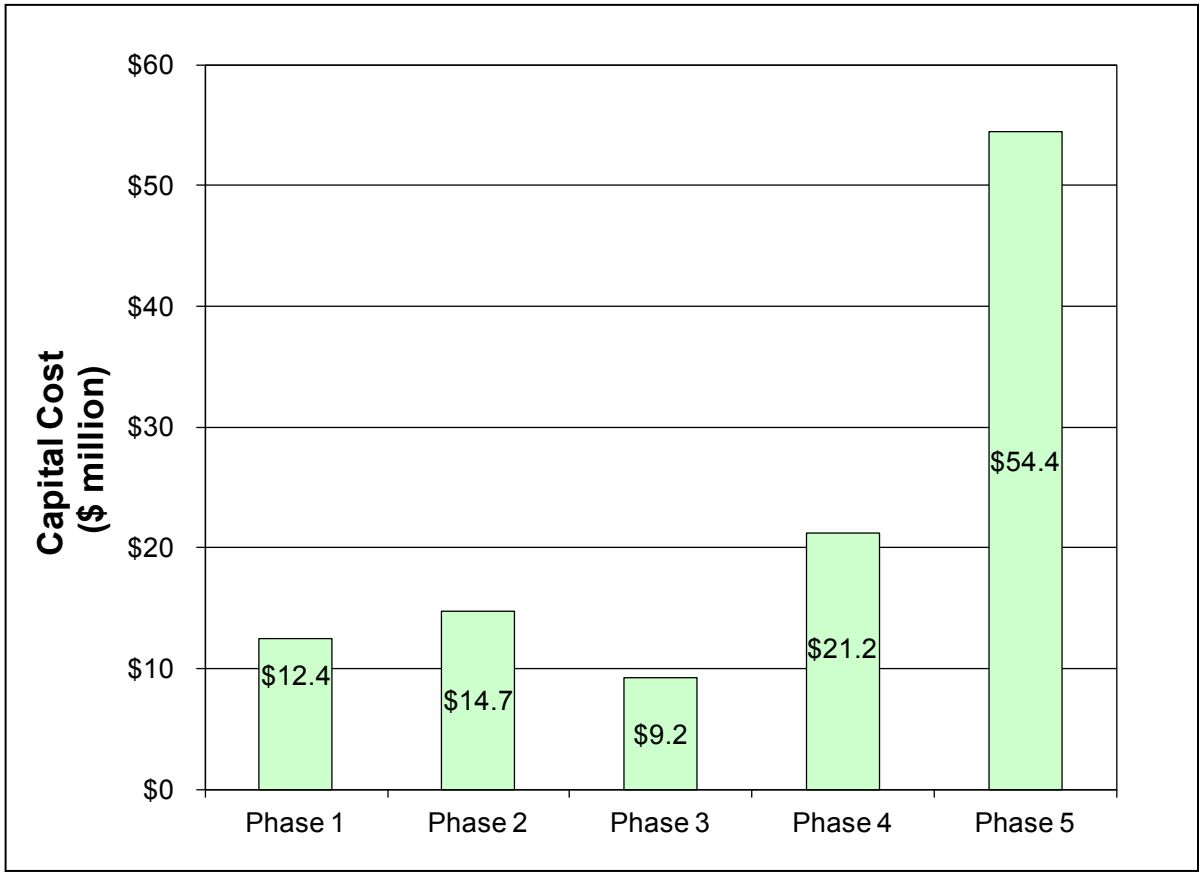


Figure ES.3 Capital Cost by Phase

Locations for improvements included in the CIP are shown on Figure ES.6.

CIP by Watershed

The breakdown of capital costs for the improvements included in the CIP by watershed are included in Table ES.4.

Table ES.4 Capital Cost by Planning Phase and Watershed

Watershed	Phase 1 ($M)	Phase 2 ($M)	Phase 3 ($M)	Phase 4 ($M)	Phase 5 ($M)	Total ($M)
Dominguez Channel	$0.0	$14.7	$0.0	$21.2	$28.0	$63.9
Harbor Lakes	$2.3	$0.0	$8.9	$0.0	$11.5	$22.8
Walteria Lake	$0.0	$0.0	$0.0	$0.0	$14.9	$14.9
Santa Monica Bay	$10.1	$0.0	$0.3	$0.0	$0.0	$10.4
Total	**$12.4**	**$14.7**	**$9.2**	**$21.2**	**$54.4**	**$111.9**

As shown in Table ES.4, the Dominguez Channel watershed includes the majority of the recommended improvements at $63.9 million, with the Harbor Lakes and Walteria Lake watersheds including $22.8 million and $14.9 million, respectively. Santa Monica Bay includes an estimated $10.4 million of recommended improvements.

CIP by Project Type

The distribution of project cost by project type is graphically presented on Figure ES.4.

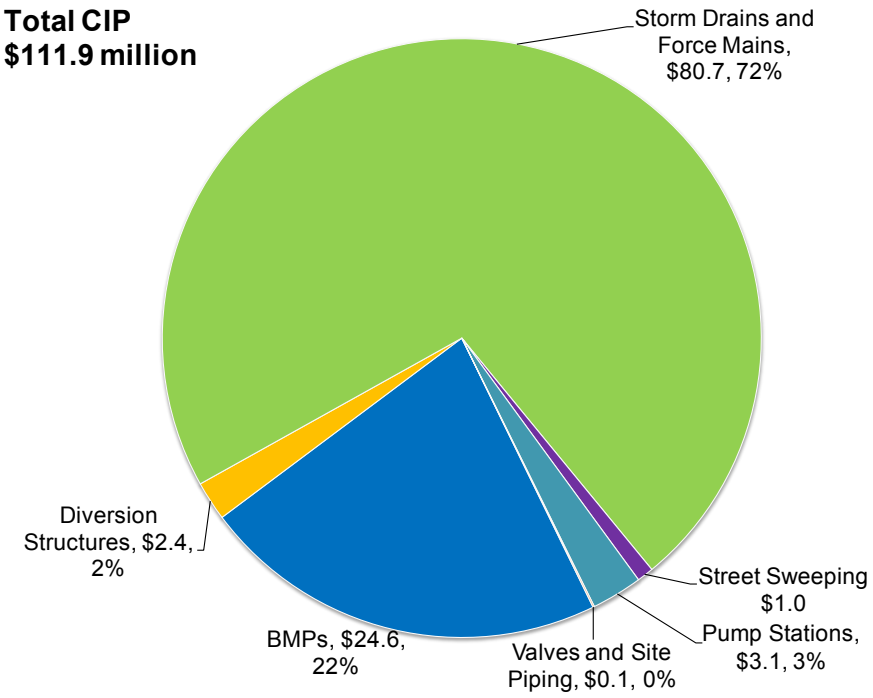


Figure ES.4 Capital Cost by Project Type

As shown on Figure ES.4, pipelines, including storm drains and force mains represent the most significant component of the CIP, accounting for about 72 percent of the total CIP cost. BMPs account for 22 percent. Pump stations, diversion structures, street sweeping signs, and valves and site piping make up the balance of the CIP, accounting for about 6 percent.

Figure ES.5 shows the cost breakdown between improvements recommended for water quality and water quantity. As shown, water quality improvements represent the bulk of the CIP, with about 51 percent of the total CIP cost. Water capacity improvements represent the remaining 49 percent of the CIP.

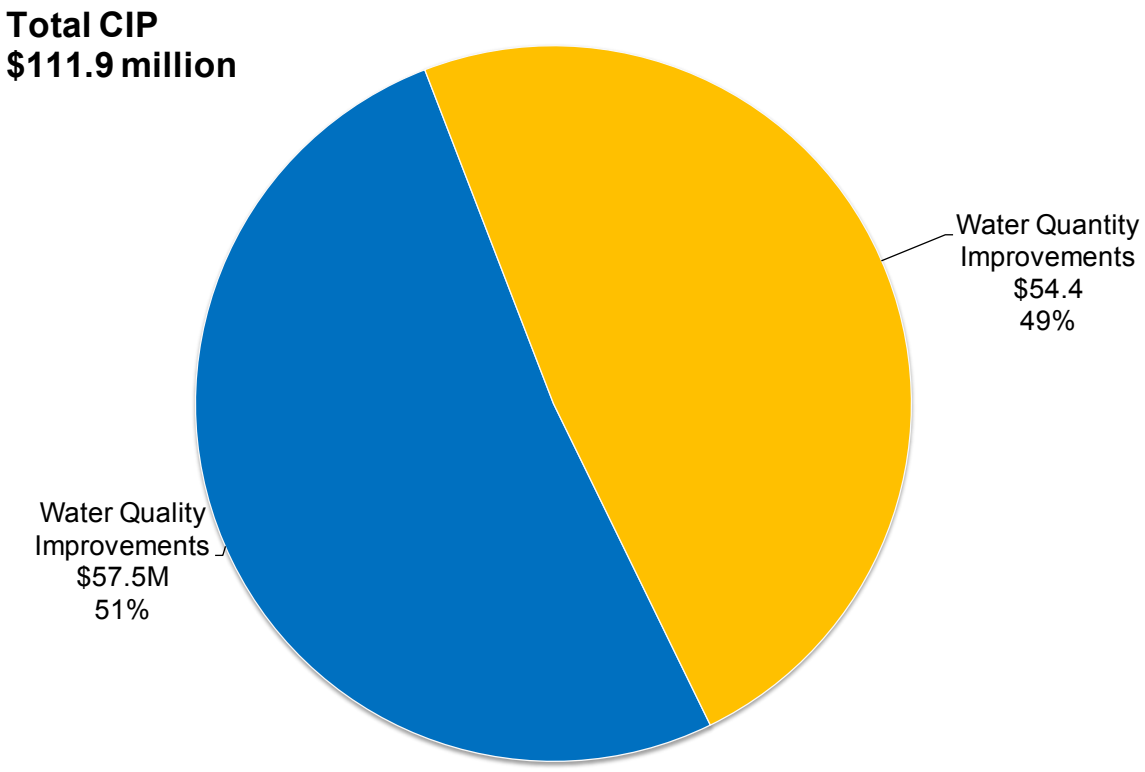
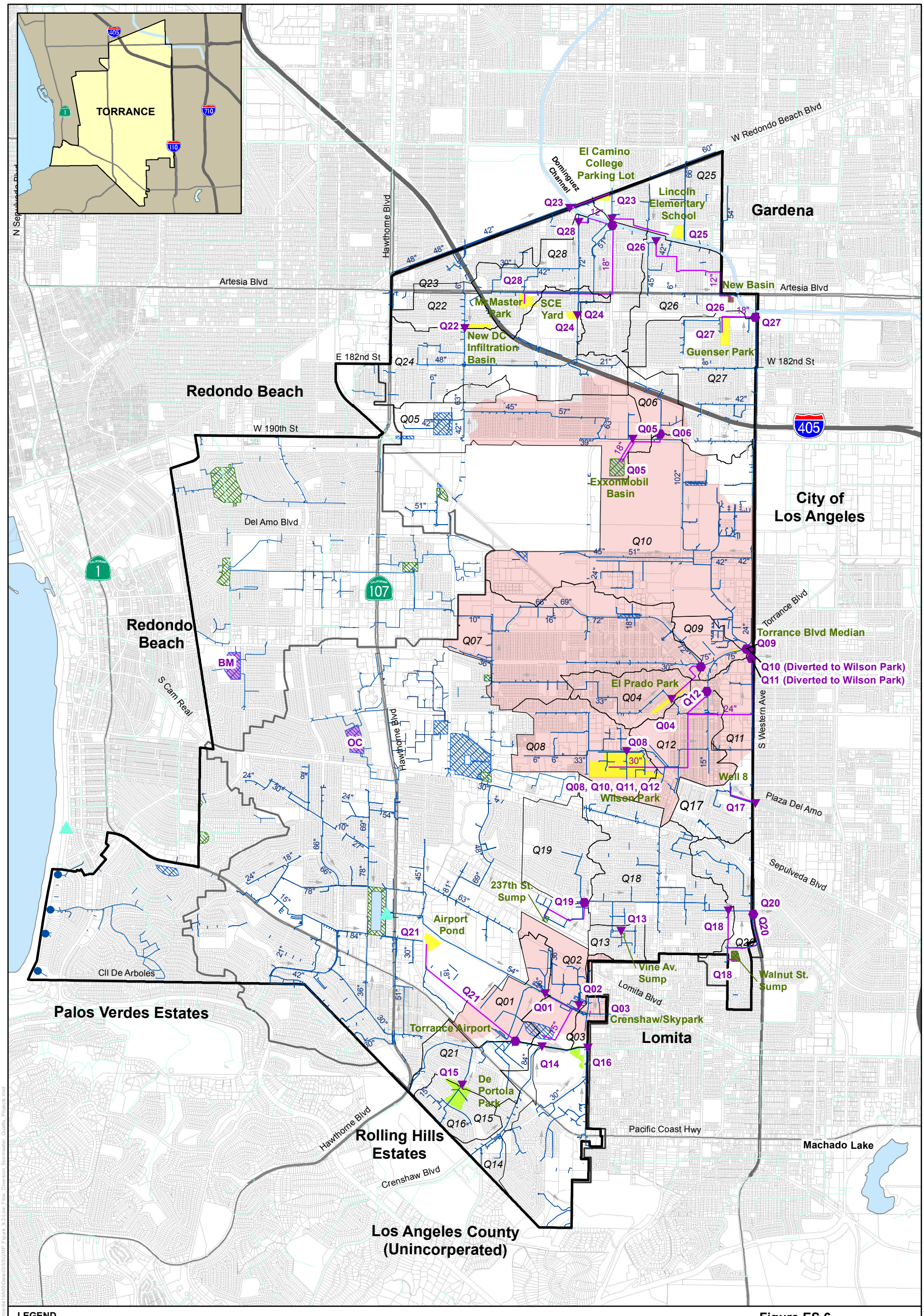


Figure ES.5 Capital Cost by Category

The location of the stormwater quality improvements included in the CIP are depicted on Figure ES.6, while the alignments of the stormwater capacity improvements are shown on Figure ES.7. Detailed information for each project is included in tables Chapter 9.

In addition, Chapter 9 includes a financial plan that describes the anticipated cost impacts to the City and the potential for a parcel based fee for recovering these costs.



LEGEND

CIP Projects

- Diversion Structure
- Low Flow Diversion Pump Station
- BMP Tributary Area (ID in Italics)
- Diversion Pipelines
- City Boundary
- Additional BMP Locations

Retention and Detention Basins

Type
- Detention Basin
- Retention Basin

Recommended BMP Locations

by Type
- Infiltration
- Wetlands
- Retention
- HDS
- None (Use Existing Facility)
- High Priority Subareas
- Study Area

Existing Pump Stations

by Owner
- LACDPW

Existing BMPs

by Type
- Continuous Deflective Separator
- Bodies of Water

Storm Drains
- City's Stormwater System
- LACDPW System
- Flow Direction
- Freeway
- Major Roads

Note:
Not all proposed diversion structures and site piping shown due to scale of map.

0 0.2 0.4 0.8 Miles

Figure ES.6
Low Flow Diversion
Stormwater Quality
CIP Projects
Stormwater Quality Master Plan
City of Torrance

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ow\RHX-PROP.PW_Carollo local Carollo\Documents\Client\CA\Torrance\8418A00\Data\GIS\SSCMP_Figure_9.2-Low_Flow_Diversion_Stormwater_Quality_Projects.mxd

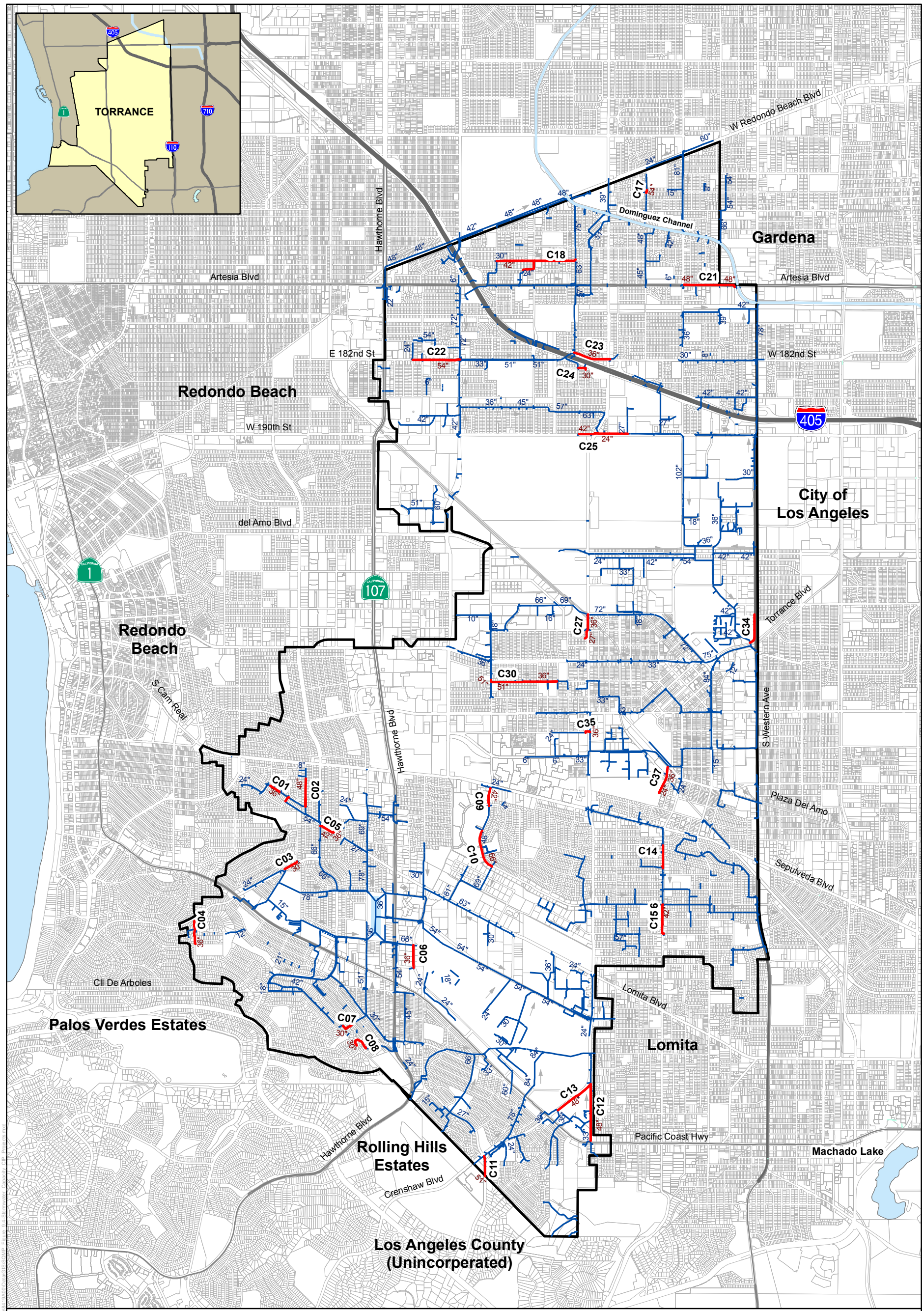


Figure ES.7
Stormwater Capacity
CIP Projects
Stormwater Quality Master Plan
City of Torrance

1.1 INTRODUCTION

The City of Torrance (City) faces an increasingly complex set of challenges in managing stormwater runoff and nonpoint source pollution. A combination of growth and regulatory programs, including the National Pollutant Discharge Elimination System (NPDES) Permits and Total Maximum Daily Load (TMDL) requirements, place very specific land use and stormwater management demands on the City. Given the continued development pressure and increasingly stringent regulatory requirements, it has become necessary for the City to develop this Stormwater Quality Master Plan (SQMP). The SQMP includes modeling and analysis of various land use and stormwater Best Management Practices (BMPs) scenarios and provides quantitative comparisons of a range of management options. This quantitative information will be used in selecting the most effective and efficient solutions to manage stormwater runoff and nonpoint source pollution. Identification of cost-effective solutions is critical given the limited financial resources available to meet multiple regulatory requirements. The results of the quantitative analysis will be of use to the City in a broad range of land use planning activities in addition to compliance with specific regulatory programs.

The main focus of this SQMP is to assess changes in stormwater runoff volume and pollutant loading in the City. Analyses were conducted to predict loading of pollutants including total suspended solids (TSS), total nitrogen (TN), and total phosphorus (TP). These pollutants were used as indicator contaminants (e.g., metals are primarily associated with TSS). This analysis was used to identify the BMPs to be undertaken to treat stormwater pollutants, meet regulatory compliance requirements opportunities, and express the City's renewed commitment to the use of environmentally responsible, cost-effective, and sustainable solutions.

This study consists of three key steps:

1. An assessment of land use and imperviousness in the City.
2. An associated pollutant load with the land use for total phosphorus, total nitrogen, total suspended solids, and water volume.
3. Identification of current and necessary BMPs to improve water quality to meet regulatory requirements.

1.2 AUTHORIZATION

The City retained Carollo Engineers, Inc. (Carollo) to prepare this SQMP to aid in the planning of its stormwater management system.

This report is prepared in accordance with the consulting engineers' agreement for the NPDES Storm Drain Master Plan (SDMP) project between the City and Carollo dated October 29, 2008. This report presents findings of the SDMP.

1.3 BACKGROUND

The City completed previous SDMPs in 1960 and 1997. While the City is built out, the increased requirements associated with stormwater quality have led the City to develop this SQMP to assist the City in complying with regulatory requirements in an efficient and cost-effective manner.

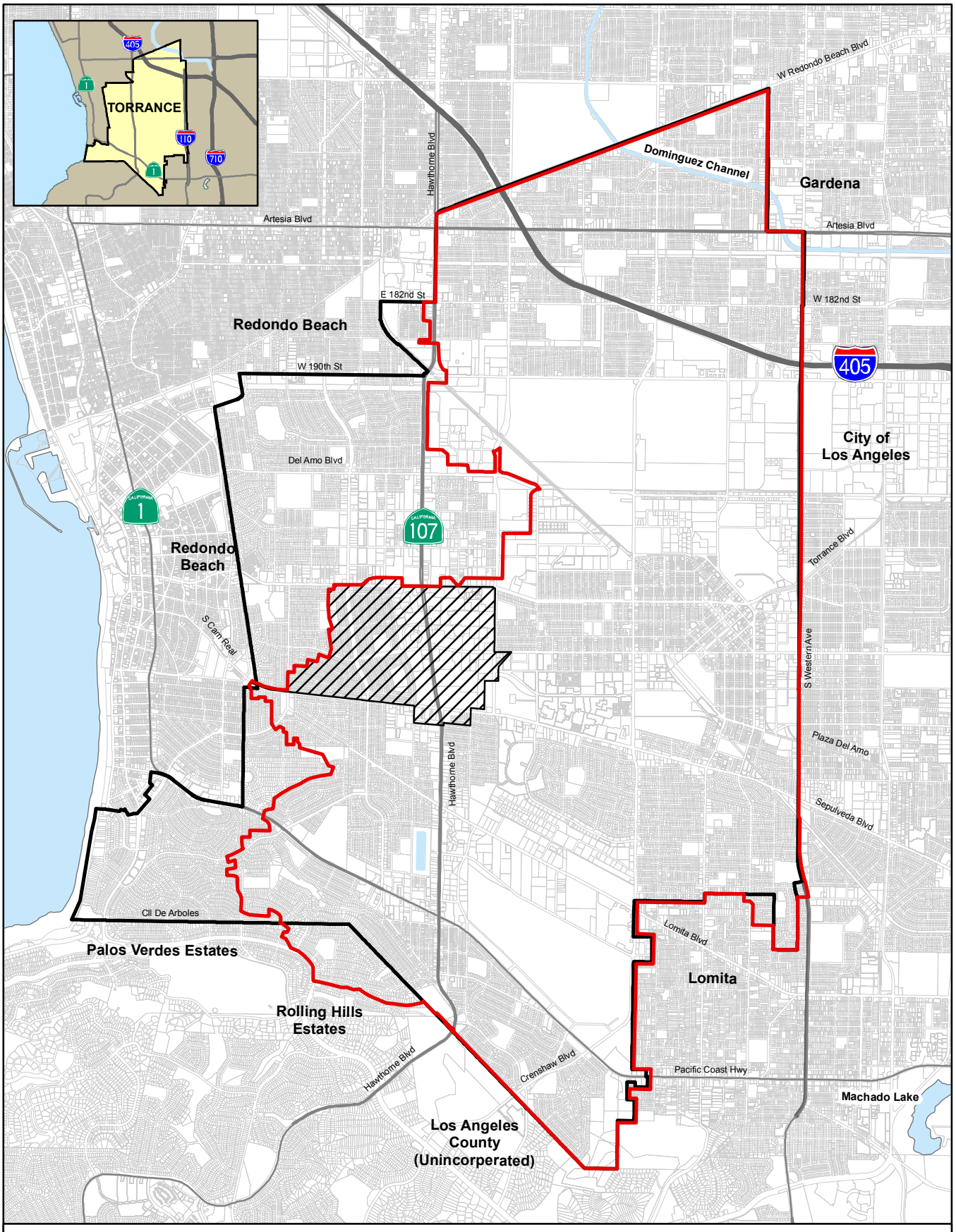
The 1997 SDMP identified capacity-related deficiencies in 48.8 miles of storm drains and developed a 66-year phased capital improvement program (CIP) for replacement of deficient storm drains to meet an annual budget of $1.5 million. The plan also identified improvements for 10 of the City's detention and retention basins with an estimated improvement cost of $26.3 million.

Torrance was a relatively mature community, with few natural areas to develop, when the last SDMP was prepared in 1997. However, since that time, there have been many redevelopment and residential improvement projects, including home additions, patios, driveways, and pools, that increased the proportion of hardscape area in the City. While the existing drainage conveyance system is modern and was appropriately designed, these more intensive land use utilization patterns have led to an increase in the impervious area, decreased percolation, shorter times of concentration, higher runoff volumes, and the potential for exceeding the flood control system capacity.

For community safety and well-being, the 1997 SDMP was updated based on the general plan land use patterns and impervious factors derived from high-resolution satellite imagery. The SQMP developed during this study is a living document that will assist the City to verify the integrity of its flood control facilities, evaluate the efficiency of the drainage network, identify areas of possible deficiency, and prioritize improvements to the system.

1.4 STUDY AREA

The study area of this report consists of the areas of the City's stormwater service area. Water quality analyses for areas that are part of the Santa Monica Bay watershed have been conducted in previous studies. Therefore, there was no further analysis conducted for these areas as part of this study. The recommendations from those studies are incorporated within this SQMP. As will be discussed in Chapters 2 and 5, portions of the City's service area fall within retention basin watersheds, for which TMDLs are not applicable and thus these portions of the City's service area are excluded from this SQMP. While watersheds are discussed in more detail in Chapters 2 and 5, Figure 1.1 outlines the study area as well as the regional location of the City.



Legend

- Study Area
- Retention Basin (Excluded, TMDLs Not Applicable)
- City Boundary
- Freeway
- Major Roads

0 0.25 0.5 1 Miles

Figure 1.1
Study Area
Stormwater Quality Master Plan
City of Torrance

1.5 REPORT ORGANIZATION

Chapter 1 - Introduction
This chapter presents the purpose of this report, describes the background and study area, and discusses the content of each chapter of the report.

Chapter 2 - Service Area
This chapter presents a description of the City's service area and various aspects of the area served including climate, land use, population, soil types, watershed basins, and subbasins.

Chapter 3 - Stormwater Regulations
This chapter identifies the regulations that govern the collection and discharge of stormwater by the City, including current and anticipated stormwater regulations.

Chapter 4 - Planning and Evaluation Criteria
This chapter summarizes the analysis criteria used in the qualitative and quantitative system analysis, as well as planning criteria used in development of the CIP.

Chapter 5 - Existing Stormwater System
This chapter provides a brief overview of the City's existing stormwater collection system including descriptions of the existing collection network, discharge points, stormwater volumes, as well as known system deficiencies.

Chapter 6 - Model Development
This chapter discusses the technical procedure used to develop the stormwater models including descriptions of the City's previous hydraulic model, the various data sources used to update the model, the loading of the model, and the details of the calibration process.

Chapter 7 - Water Quality Evaluation
This chapter describes water quality analyses used to identify water pollution problems in the study area and presents results of those analyses. Recommendations are provided for identified water pollution deficiencies.

Chapter 8 - Water Quantity Evaluation
This chapter provides details on the hydraulic evaluation of the conveyance capacity of the City's stormwater collection system and presents results of that analysis. Recommendations are provided for any identified conveyance deficiencies.

Chapter 9 - Capital Improvement Program
This chapter provides planning-level cost estimates for the improvements recommended in Chapters 7 and 8. This CIP includes a phased implementation schedule with three phases.

1.6 ACKNOWLEDGEMENTS

Carollo wishes to acknowledge and thank City staff for their support and assistance in completing this report, with special gratitude extended to John Dettle. Staff instrumental in contributing to this SQMP includes the following.

Public Works Director	Robert Beste, P.E.
Engineering Manager	John Dettle, P.E.

The following Carollo staff members were involved in the preparation of this report:

Principal-in-Charge	Graham Juby, Ph.D., P.E.
Project Manager	Inge Wiersema, P.E.
Project Lead	Sam Darkwah, Ph.D., P.E.
Project Support	Brian Brenhaug, P.E.
Graphics and Mapping	Li-Chen Wang

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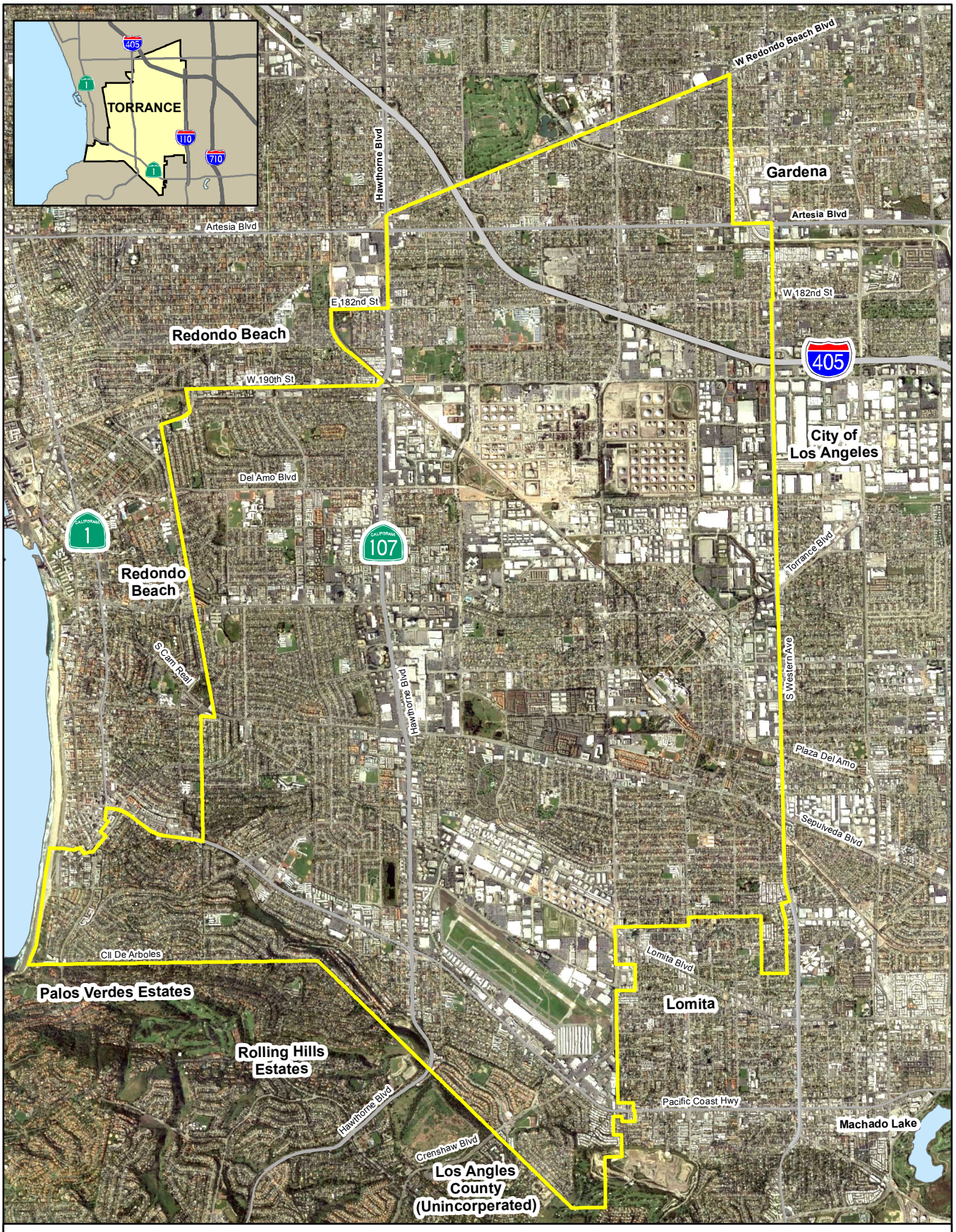
2.1 SERVICE AREA

The City of Torrance (City) is located about 15 miles south of Downtown Los Angeles, in southern Los Angeles County, just north of the Palos Verdes Hills. The City was incorporated on May 12, 1921, and is just over 20.5 square miles in area. The City is bounded by Redondo Beach on the west and north, Lawndale and Gardena on the north, the City of Los Angeles on the east, Lomita to the southeast, and Rolling Hills Estates and Palos Verdes Estates on the south. The City is also bounded by approximately 4,000 feet of Santa Monica Bay coastline (i.e., Torrance Beach). The City's storm conveyance systems are interconnected with neighboring city systems. Neighboring cities located at generally higher elevation such as Rolling Hills Estates and Palos Verde Estates discharge stormwater into the City's and/or Los Angeles County's storm conveyance systems located within the City's boundaries.

As the area is highly urbanized drainage is primarily conducted through an extensive network of underground storm drain facilities, but also includes several open channels, the largest of which is the Dominguez Channel traversing the City's northeast corner. The primary use of the Dominguez Channel and all other open channels in the Dominguez Watershed (including Wilmington Drain, Machado Lake, and Madrona Marsh) is flood protection. Satellite imagery of the City's service area is shown on Figure 2.1. The Los Angeles County Department of Public Works maintains the system of storm drains in the City of Rolling Hills Estates.

Machado Lake receives urban and stormwater runoff from a complex network of storm drain systems. The first of three primary storm drain channels that flow into Machado Lake is the Wilmington Drain. Approximately 65 percent of the runoff from the Machado Lake Watershed flows through the Wilmington Drain into Machado Lake. The other two primary storm drain channels are the Project No. 77 Drain and the Harbor City Relief Drain. Several smaller storm drains also discharge into Machado Lake, including a 72-inch storm drain outlet and the Figueroa Street Outlet (known as the Project No. 643 Drain). Machado Lake discharges at the southern end by overflowing a concrete dam into the Machado Lake wetland. Water discharges from the wetland through the Harbor Outflow structure and into the West Basin of the Los Angeles Harbor.

Walteria Lake, located within the City's boundaries, is owned and operated by Los Angeles County. It is approximately 1,005 acre-feet in capacity and receives raw stormwater mainly from Torrance, Rolling Hills Estates, and Palos Verdes Estates. Effluent from the lake is pumped at a maximum rate of 57 cubic feet per second (cfs) through a force main system into a 54-inch drain line that lies under Skypark Drive.



Legend

- City Boundary
- Bodies of Water

0 0.25 0.5 1 Miles

Satellite Imagery from WorldView for July 10, 2010

Figure 2.1
Service Area
Stormwater Quality Master Plan
City of Torrance

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The discharge eventually leaves the City near the intersection of Crenshaw Boulevard and Amsler Street tributary to Machado Lake.

2.2 LAND USE

The City's General Plan (Torrance, 2010), adopted in April 2010, defines the distribution of land use types throughout the City and the maximum allowable densities of residential land use categories. The City is nearly built out and has only a few vacant areas remaining. However, the City's General Plan projects that the City's population will continue to increase. To accommodate this future growth, portions of the City will redevelop at higher densities. This densification process is typical in Southern California due to limited space and high land cost. Table 2.1 presents the land use categories from the General Plan along with total area for each land use category. Land use distribution is shown on Figure 2.2.

Table 2.1 Land Use Categories – City of Torrance (2010)

Land Use	Density	Area[(1)] (acres)	Percentage of Total
Residential	**(du/ac)**		
Low Density (R-LO)	0.0 - 9.0	4,002	30.4%
Low-Medium Density Residential (R-LM)	9.1 - 18.0	420	3.2%
Medium-Density Residential (R-MD)	18.1 - 31.0	606	4.6%
Medium-High Density Residential (R-MH)	31.1 - 44.0	274	2.1%
High-Density Residential (HDR)	44.1+	5	0.0%
Subtotal - Residential		**5,307**	**40.3%**
Commercial	**FAR**		
General Commercial (C-GEN)	Max 0.6[(2)]	825	6.3%
Commercial Center (C-CTR)	Max 1.0	402	3.1%
Residential Office (R-OF)	Max 0.6[(2)]	41	0.3%
Subtotal - Commercial		**1,268**	**9.6%**
Industrial			
Heavy Industry (I-HVY)	Max 0.6	859	6.5%
Light Industry (I-LT)	Max 0.6	527	4.0%
Business Park (I-BP)	Max 0.6	881	6.7%
Subtotal - Industrial		**2,267**	**17.2%**

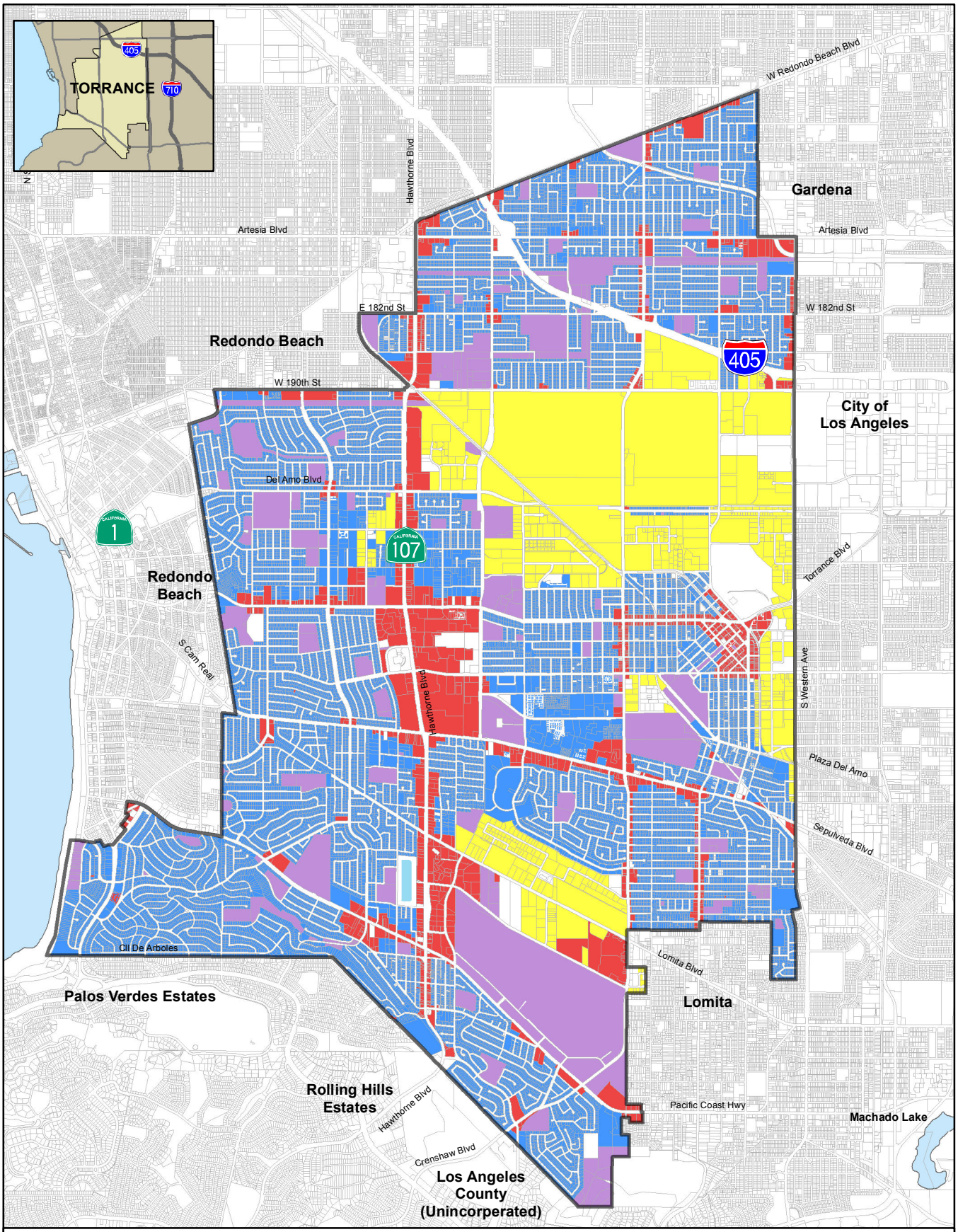
Table 2.1 Land Use Categories – City of Torrance (2010)

Land Use	Density	Area[1] (acres)	Percentage of Total
Open Space, Public, and Quasi-Public	**FAR**		
Public / Quasi-Public / Open Space (PUB)	-	1,218	9.3%
Hospital / Medical (HM)	Max 0.6[3]	62	0.5%
Airport (AIR)	-	313	2.4%
Subtotal - Open Space, Public, and Quasi-Public		**1,593**	**12.1%**
Other (ROW)	-	73	0.6%
Subtotal - Other		**73**	**0.6%**
SUBTOTAL		**10,508**	**79.9%**
Not Included in General Plan[4] (Streets)		2,646	20.1%
TOTAL		**13,154**	**100.0%**

Notes:
Source: City 2009 General Plan (Torrance, 2010).
1. Area based on Land Use Plan.
2. For mixed-use projects, maximum FAR is 1.0. For R-OF, residential density is 18.1 – 31 du/ac.
3. Maximum of 1.0 FAR for hospital-adjacent medical office land uses. Hospital land uses may exceed maximum FAR with approval of the Planning Commission or City Council.
4. Based on difference between total General Plan land use acreage and total City boundary acreage. Assumed to consist of street right-of-way.

The City is predominantly residential land use, with concentrations of industrial and commercial uses. This reflects the City's history as a "company town," where homes were built to house the local work force of industries. Residential development covered about 40 percent of the City's land area. Industrial uses occupied the second largest land area, at 17 percent. Commercial and Public/Quasi-Public/Open Space uses represent about 10 percent and 12 percent, respectively. Land uses not included in the General Plan, such as streets, represent about 20 percent of the City's land area. Torrance also had a limited supply of vacant land mostly within commercial and industrial areas. Given the built-out character of the community, only minor land use changes from baseline year 2010 conditions will occur over the long term.

Residential uses are located throughout the City at varying development densities. The highest residential densities occur along major streets and near major transportation corridors, in older neighborhoods, and in apartment or condominium developments and Planned Development communities around Sepulveda Boulevard and Plaza Del Amo between Hawthorne and Crenshaw Boulevards. The lowest residential densities are largely located in the western and southern portions of the City.



Legend

General Plan Land Use

- Public/Open Space/Airport
- Industrial
- Commercial
- Residential
- Bodies of Water
- City Boundary

0 0.25 0.5 1 Miles

Figure 2.2
Land Use Map
Stormwater Quality Master Plan
City of Torrance

2.3 POPULATION

The City's population for year 2010 is estimated at 145,438 people (USCB, 2011). Future population projections for the City were obtained from the General Plan and are presented in Table 2.2.

Table 2.2 Historic and Projected Population

Year	Population[1]
1960	100,991
1970	134,584
1980	129,881
1990	133,107
2000	137,946
2010[2]	145,438
2020	151,286
2030	157,029

Notes:
1. Historic and projected population from General Plan (Torrance, 2010) for all years except 2010.
2. 2010 population from 2010 Census (USCB, 2011).

As shown in Table 2.2, the City's population grew from 100,991 in 1960, when the City's first stormwater master plan was completed, to 137,946 in 2000, just after the previous stormwater master plan. Between 2010 and 2030, the City is anticipated to grow by about 11,591, an average annual growth rate of about 0.38 percent, reflecting the built-out conditions within the City.

2.4 CLIMATE

The City's climate is characterized by warm summers and slightly cooler winters. The climate data for the City is presented in Table 2.3.

As shown in Table 2.3, the summer temperatures tend to be around 70 to 80 degrees F, while temperatures during winter tend to be around 50 to 60 degrees F. The warmest month of the year is August with an average maximum temperature of 79 degrees F, while the coldest months of the year are December and January with an average minimum temperature of 45 degrees F. Temperature variations between night and day tend to be moderate throughout the year with an average difference of about 20 degrees F.

Table 2.3 Historic Climate Data

Month	Average Max. Temperature (°F)	Average Min. Temperature (°F)	Average Total Precipitation (in)
January	65.8	44.2	3.09
February	66.5	45.8	3.25
March	67.4	47.3	2.04
April	69.6	49.8	0.83
May	71.6	53.4	0.18
June	73.8	56.7	0.06
July	77.6	60.2	0.02
August	78.6	61.0	0.06
September	78.0	59.5	0.22
October	75.4	55.4	0.42
November	71.5	48.9	1.31
December	67.0	45.0	2.18
Annual Average	**71.9**	**52.3**	**13.66**

Notes:
Source: Western Regional Climate Center (WRCC, 2011). Period of Record from 1/1/1932 to 12/31/2010.

The annual average precipitation in the City is about 14 inches. As shown in Table 2.3, the majority of the rainfall occurs in the months November through March. February is typically the wettest month with an average rainfall of about 3.25 inches.

2.5 SOIL TYPES

Soils play a pronounced role in the hydrology and runoff processes in a watershed. Soils invariably affect natural and constructed conveyance systems.

The Natural Resources Conservation Service (NRCS) classifies soil into four hydrologic soil groups. The soils are classified on the basis of water intake at the end of long duration storms after prior wetting, an opportunity for swelling, and without the proactive effects of vegetation. The hydrologic soil groups are:

A. Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels. Soils included in this group often have loamy sand, sandy loam, loam to silt loam textures. These soils have a high rate of water transmission.

B. Soils having moderate infiltration rates when thoroughly wetted and consisting of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures, such as loam, silt loam, silt, or sandy clay loam. These soils have a moderate rate of water transmission.

C. Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes the downward movement of water or soils with moderately fine to fine texture, such as loam, silt loam, sandy clay loam, slay loam, and silty clay loam. These soils have a slow rate of water transmission.

D. Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with high swelling potential, soils with permanent high water table, soils with clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. Soils included in this group have clay textures. These soils have a very slow rate of water transmission.

Each soil group is associated with the typical infiltration soil properties as listed in Table 2.4, and graphically depicted on Figure 2.3.

Table 2.4 Infiltration Rates for NRCS Hydrologic Soil Groups

Soil Group	Soil Type within City	Maximum Infiltration Rate (in/hr)	Minimum Infiltration Rate (in/hr)
A	Sand, Sandy Loam	2.0	0.065
B	Sandy Loam, Loam	1.5	0.050
C	Clay Loam, Clay	1.0	0.035
D	Clay	0.5	0.020

2.6 WATERSHEDS AND SUBBASINS

The City is divided into basins within four watersheds, as shown on Figure 2.4. Each drainage basin has a system of conveyance facilities to collect and dispose runoff. Basins within each of the four watersheds are discussed in more detail below.

Excluding the extreme southern section and western beach areas, the City is relatively flat, but naturally drains toward the southeast and into the Dominguez Channel and Harbor Lakes and Machado Lake area, which are maintained by the Los Angeles County Department of Public Works. Over the years, some of the City's watershed boundaries have shifted with changing drain alignments and the elimination of some of the retention basins. Figure 2.4 outlines the watersheds within the City, including the upstream watershed affiliated with each watershed to more accurately portray the actual study area.

The City's storm conveyance systems are interconnected with neighboring city systems. Neighboring cities located at generally higher elevation such as Rolling Hills Estate and Palos Verde Estate discharge stormwater into the City's and or Los Angeles County's storm conveyance systems located within the City's boundaries.

2.6.1 Retention Basins

Stormwater discharge from the City's retention basins, consisting of the Bishop Montgomery, Del Amo, Ocean, and Vista del Parque basins, is directed to retention basins where it percolates into the groundwater basin. There is no discharge from these basins. Portions of the City within the retention basins total about 1 square mile and represent about 7 percent of the City's total surface area.

2.6.2 Santa Monica Bay Watershed

The Santa Monica Bay Watershed is located in western Los Angeles County and includes watersheds for several creeks discharging to the Santa Monica Bay, stretching from the Malibu Creek Watershed to the Palos Verdes Peninsula Watersheds, and encompasses about 40 square miles. Six of the City's basins shown on Figure 2.4 are a part of the Santa Monica Bay watershed. Portions of the City within the Santa Monica Bay Watershed total about 3 square miles and represent about 8 percent of the Santa Monica Bay Watershed and about 15 percent of the City's total surface area.

Three of the City's basins, the Amie Avenue Detention Basin (Amie Basin), the Henrietta Detention Basin (Henrietta Basin), and the Entradero Detention Basin (Entradero Basin), drain into a Los Angeles County Department of Public Works (LACDPW) storm drain, called the Herondo Drain, which conveys stormwater into the Santa Monica. Recommendations were made for the basins discharging into the Herondo Drain as a part of a 2008 study titled "Predesign of BMPs for Detention Basins Tributary to Santa Monica Bay CIP No. I-102" (Carollo, 2008).

As a part of implementing Best Management Practices (BMPs) to comply with the Santa Monica Bay Bacteria TMDLs, dry weather flows from Amie Basin are pumped through a force main and discharged to the Dominguez Channel. As discussed in Chapter 1, basins that are a part of the Santa Monica Bay watershed are excluded from the study area for analysis within this report since water quality recommendations were made in previous studies.

2.6.3 Dominguez Channel Watershed

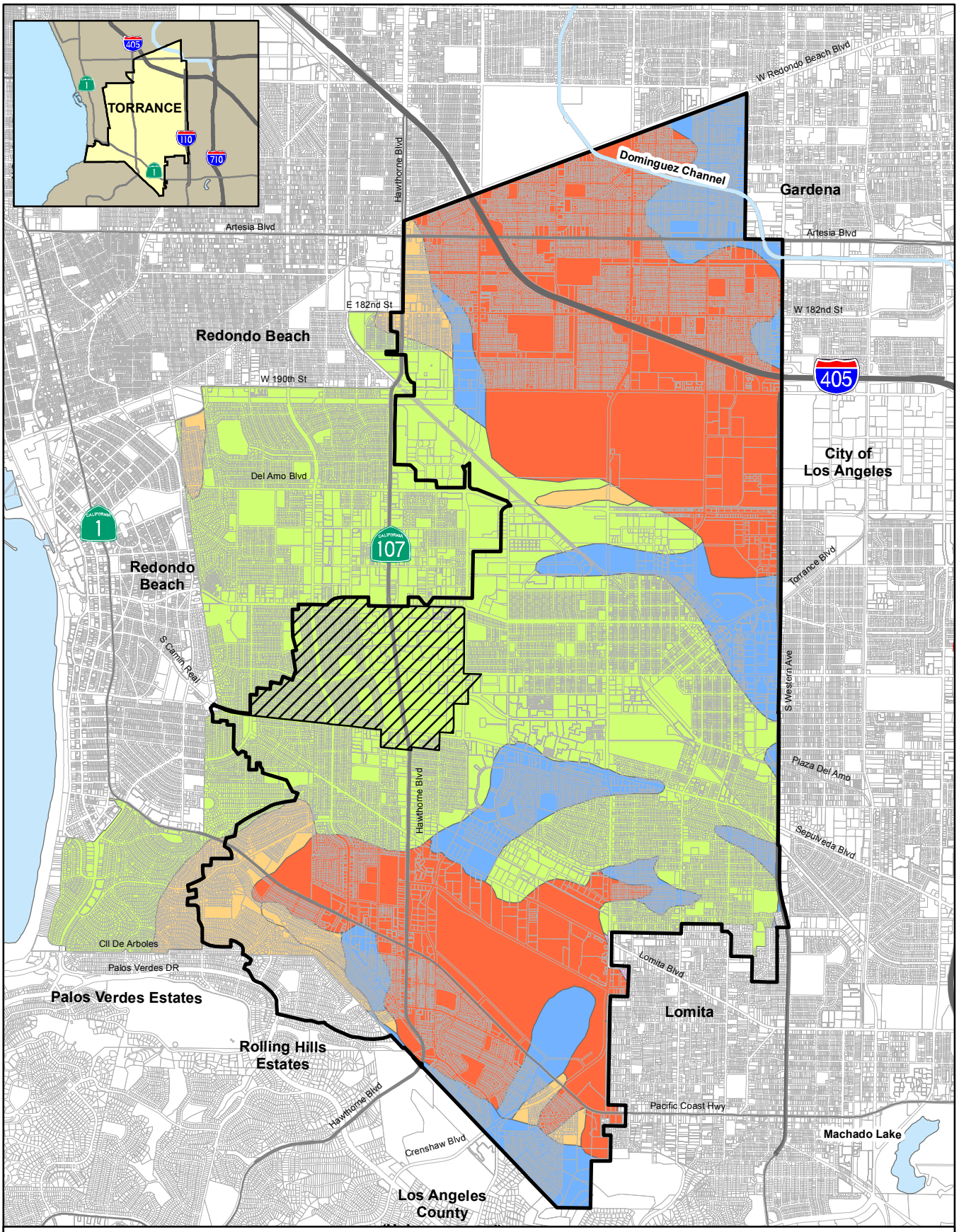
The Dominguez Channel Watershed is located in southern Los Angeles County and overlies portions the City, the City of Los Angeles, Carson, Lomita, Rolling Hills, Rolling Hills Estates, Rancho Palos Verdes, Redondo Beach, Palos Verdes Estates, and unincorporated Los Angeles County. Overall, the watershed covers about 133 square miles of land and water, with about 9 square miles residing within the City's boundary (excluding the Harbor Lakes/Machado Lake sub-watershed). Portions of the City within the Dominguez Channel Watershed represent about 10 percent of the Dominguez Channel Watershed (excluding the Harbor Lakes/Machado Lake sub-watershed) and about 44 percent of the City's total surface area.

Stormwater discharge within the City's basins of the Dominguez Channel Watershed is collected and discharged to the Dominguez Channel, which traverses the northeast corner of the City as shown on Figure 2.3. The channel is under the jurisdiction of the Los Angeles County Department of Public Works.

The Dominguez Watershed drains the following regions of the City:

- **Northeast Region** - Drains south into northeastern Torrance from southern Gardena, then enters the Dominguez Channel, which drains out of Torrance near the intersection of Western Avenue and Artesia Boulevard. The tributary area is bordered on the north by Compton Boulevard, on the east by Western Avenue and the Dominguez Channel forms the approximate Western and southern borders. This area slopes slightly to the south and consists primarily of residential, light commercial, and public use zones. Discharge is conveyed into the Dominguez Channel at multiple inlets in the channel.

- **North-Central Region** - The tributary area for the second drainage region is bordered on the north and south by the Dominguez Channel and an irregular divide located between 185th and 190th streets, while the eastern and western divides runs along Crenshaw and Hawthorne Boulevards, respectively. Region 2 is primarily residential and light commercial zones and slopes gently to the northeast and into the Dominguez Channel, which drains out of the City near the intersection of Western Avenue and Artesia Boulevard. Discharge is conveyed into the Dominguez Channel at multiple inlets in the channel.



Legend

by Soil Type

- Clay (Group C and D)
- Clay Loam (Group C)
- Loam (Group B)
- Sand (Group A)
- Sandy Loam (Group A and B)

- Study Area
- Excluded from Study Area
- Parcels
- Bodies of Water

0 0.25 0.5 1 Miles

Figure 2.3
Soil Map
Stormwater Quality Master Plan
City of Torrance

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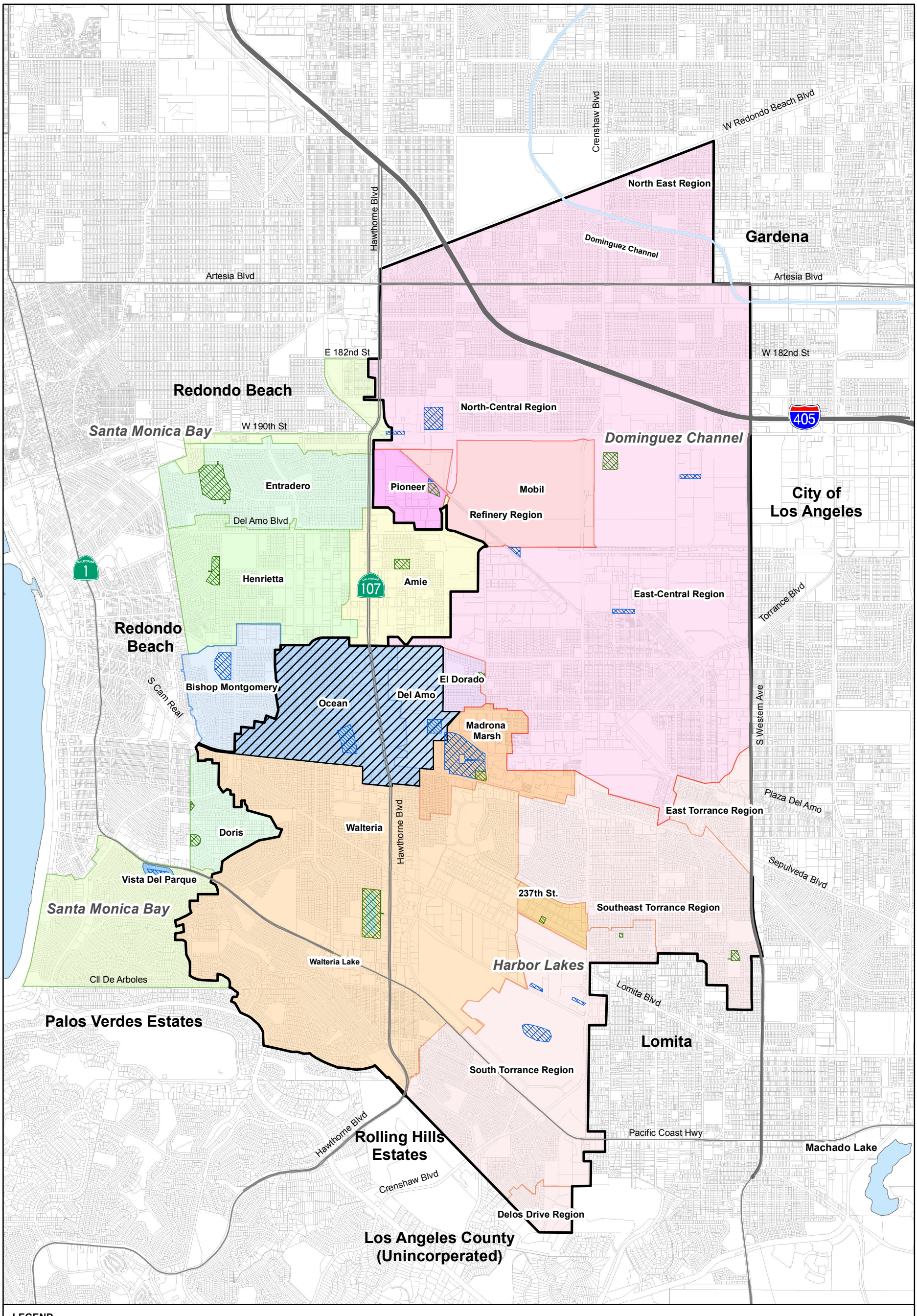

LEGEND

Watersheds

Groundwater Replenishment
- Bishop Montgomery
- Del Amo
- Ocean
- Vista Del Parque

Dominguez Channel
- Surface Drainage
- El Dorado
- Mobil
- Pioneer

Santa Monica Bay
- Surface Drainage
- Amie
- Doris
- Entradero
- Henrietta

Harbor Lakes
- Surface Drainage
- 237th St.
- Madrona Marsh
- Walteria

Others
- Bodies of Water
- Study Area
- Excluded from Study Area
- Detention Basins
- Retention Basins
- Parcels

0 0.2 0.4 0.8 Miles

Figure 2.4
Watershed and Basin Layout
Stormwater Quality Master Plan
City of Torrance

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- **East-Central Region** - The tributary area for Drainage Region 3 is south of the Dominguez Channel and west of Western Avenue. The western border runs south along Crenshaw Boulevard to 182nd Street then follows an irregular divide southeast to about 195th street and Western Avenue. The area is primarily residential and light commercial and slopes gently to the northeast and east, draining into the Dominguez channel and exiting the City south of the intersection of Western Avenue and Artesia Boulevard.
- **Refinery Region** - Drainage Region 4 is south of Regions 2 and 3, along the irregular border between 185th and 190th Streets with an equally irregular southern border near Plaza Del Amo. The western and eastern borders run near Hawthorne Boulevard and Western Avenue and includes the main commercial and industrial sections of Torrance with a significant residential contribution from areas located west of Cabrillo Avenue and south of Maricopa Street. The tributary area is mostly a rolling topography that drains to the east and collects in the channel that leaves the City at Western Avenue and 212th Street, before joining the Dominguez Channel near the intersection of the San Diego Freeway and Avalon Boulevard. The dominant features of the area are the Mobil Oil Refinery, its large detention basin (southeast of the intersection of Crenshaw Boulevard and 190th Street) and the pumped discharge from the Pioneer Avenue basin on the west side. Runoff entering the Mobil basin requires visual inspection for contamination prior to discharge, preventing integration of the runoff from this private sump into the regional drainage system, and illustrating how privately controlled facilities can affect regional drainage.

2.6.4 Harbor Lakes Sub-Watershed/Machado Lake Sub-Watershed

Stormwater flow from the City's Walteria and Harbor Lakes subbasins is directed to Machado Lake, which discharges to the Los Angeles Harbor (west of the Dominguez Channel inlet).

Machado Lake is located within the Harbor Lakes/Machado Lake sub-watershed, which is approximately 40 square miles and positioned within the larger 133-square-mile Dominguez Channel Watershed. The sub-watershed is located in southern Los Angeles County and includes all, or a portion of, the following communities: City of Los Angeles, Torrance, Carson, Lomita, Rolling Hills, Rolling Hills Estates, Rancho Palos Verdes, Redondo Beach, Palos Verdes Estates, and Los Angeles County. Portions of the City within the Harbor Lakes/Machado Lake sub-watershed total about 7 square miles and represent about 20 percent of the Harbor Lakes/Machado Lake sub-watershed and about 34 percent of the City's total surface area.

The dominant land use in the Harbor Lakes/ Machado Lake sub-watershed is high-density single-family residential, accounting for approximately 45 percent of the land use. Industrial, vacant, retail/commercial, multi-family residential, transportation, and educational

institutions each account for 5 to 7 percent of the land use, while "all other" accounts for the remaining 23 percent. Machado Lake is a receiving body of urban and stormwater runoff from a network of storm drains throughout the watershed. There are three discharge points into Machado Lake from the following storm drain channels:

- Wilmington Drain.
- Project No. 77.
- Harbor City Relief Drain.

Approximately 88 percent of the Machado Lake Sub-Watershed area flows through the Wilmington Drain into Machado Lake.

Stormwater discharge within the City's Walteria basin is collected through the stormwater collection system at Walteria Lake in the southwest of the City before being discharged through the Wilmington Drain along with discharge from the remaining basins of the Harbor Lakes watershed, including discharge from Palos Verde Estates and Rolling Hills Estates. As mentioned previously, the Wilmington Drain discharges to Machado Lake, ultimately discharging to the Pacific Ocean.

The Harbor Lake Watershed drains the following regions of the City:

- **South Torrance -** Within Torrance, the South Torrance region primarily drains the area on the eastern side of the Municipal Airport, but the watershed reaches to the crest of the Palos Verdes Hills, far into the communities of Rolling Hills and Rolling Hills Estates. This area is primarily low density residential, with some commercial and agricultural areas in the steep canyons. Most of the area on the extreme south side of Torrance is also steep, but the slope flattens in the commercial area near the airport. The runoff from this area discharges through two large Los Angeles County storm drains that leave the City at the intersection of Crenshaw Boulevard and 250th Street then descend eastward, through Lomita, to the Harbor Lakes Area.
- **Delos Drive -** An area in the extreme southeast corner consists mostly of open area zones with natural drainage. The major City drain in this area was damaged during the flooding of 1995 and was replaced by the City in 1996.
- **East Torrance -** The East Torrance region drains the small residential and light industrial area around Sepulveda Boulevard and Western Avenue and slopes to the east where it eventually enters the Harbor Lakes Area.
- **Southeast Torrance -** The Southeast Torrance region consists primarily of the residential area north of Lomita, south of Plaza del Arno, west of Western Avenue and east of Gamier Street and Juniper and Telo Avenues. The area includes the Vine and Walnut Street basins, which have been bypassed by Los Angeles County drainage facilities and their continued dedication to drainage will be further investigated in Chapter 7 of this report. The terrain is irregular with many small hills and basins; however, the flows are eventually collected in the County storm drain system and discharge to the Harbor Lakes Basin and Los Angeles Harbor.

Chapter 3

STORMWATER REGULATIONS

This chapter provides an overview of the regulations affecting the collection and discharge of stormwater from the City's service area. It includes an overview of ordinances related to stormwater within the City, a discussion of each of the specific requirements for discharge to watersheds, and a discussion of the City's NPDES permit. This chapter concludes with a discussion of non-compliance issues and a corrective action plan based on the results of this Stormwater Quality Master Plan (SQMP). Note that while some discussion on discharge requirements for Santa Monica Bay is included in this chapter, basins that are a part of the Santa Monica Bay watershed are excluded from the study area of this report and the analysis and recommendations within this report do not cover these areas since the basins that are a part of the Santa Monica Bay watershed were evaluated in previous studies with associated recommendations.

3.1 CITY ORDINANCES

City of Torrance (City) Code Section 410 dictates the City's requirements for stormwater pollution control. Section 410.1.060 requires Best Management Practices (BMP) for individual premises regarding sweeping of parking lots and restriction of discharging industrial and commercial wastes and other pollutants in violation of the City's MS4 permit. The City also requires areas of new development or redevelopment meeting specific criteria not required to submit a Standard Urban Stormwater Mitigation Plan (SUSMP) to develop and submit a site-specific plan to mitigate adverse effects of stormwater quality.

In addition, the City requires that construction sites follow BMPs listed in City Code Section 411.1, including restricting runoff containing sediment, oil, grease, and construction waste from leaving construction sites, preventing erosion, covering of excavated soil during precipitation, and utilization of a temporary sediment barrier.

The City does not currently have an ordinance requiring low impact development (LID). As will be discussed later, it is recommended that the City adopt a LID ordinance to limit the impact of future development on existing stormwater quality and capacity problems.

3.2 STORMWATER DISCHARGE TO IMPAIRED WATER BODIES

States are required to designate impaired water bodies that do not meet water quality standards after pollution point sources have installed pollution control technologies in Section 303(d) of the Clean Water Act (CWA). Action plans, called Total Maximum Daily Loads (TMDL) are used to set load allocations for constituents in impaired water bodies. In California, development of TMDLs is administrated by Regional Water Quality Control Boards (RWQCB) and approved by the Environmental Protection Agency (EPA).

In general, TMDLs consist of:

- Assessment of the water body to establish the pollutant load under existing conditions
- Defining the allowable pollutant load to maintain beneficial uses of the water
- Identification of pollutant sources (both point sources and non-point sources)
- Allocation of the allowable pollutant load to the pollutant sources, with associated pollutant reductions (this will often require monitoring to establish a baseline WLA and an associated monitoring and report plan)
- Development of an implementation plan to realize the allocated pollutant reductions
- Monitoring and scheduled compliance dates with associated target pollutant reductions

TMDLs generally include provisions for re-evaluation of the loading and allocations within the compliance schedule. After development, TMDLs are incorporated into the applicable Basin Plan. As a Basin Plan amendment, the TMDL requires approval from the SWRCB, the Office of Administrative Law (OAL), and the EPA after adoption by the RWQCB.

The specific TMDLs applying to the waters the City discharges stormwater to were implemented as a result of the RWQCB's 1996 and 1998 water quality assessments which identified over 700 potential pollutant waterbody combinations requiring TMDLs and a consent decree resulting from the National Resources Defense Council's (NRDC) 1998 lawsuit against the EPA. As a part of the consent decree, a 13-year schedule was established (between 1999 and 2012) for implementation of the TMDLs, which were consolidated from the 700 potential pollutant waterbody combinations into 92 TMDLs. If the listed TMDLs are not implemented within the prescribed schedule by the RWQCB, the EPA will be required to establish federal TMDLs for the listed waters.

Several of the bodies of water the City discharges stormwater to are designated as CWA Section 303(d) impaired water bodies, including Santa Monica Bay, Machado Lake, Long Beach Harbor, Los Angeles Harbor, and portions of the Dominguez Channel (SWQCB, 2006).

The TMDLs resulting from the consent decree can be divided into two groups, TMDLs issued by the EPA and TMDLs issued by the RWQCB. In addition, TMDLs can be grouped by receiving water body. This grouping is summarized in Table 3.1, while the status and year of issue is summarized in Table 3.2.

Table 3.1 TMDL grouped by Agency and Receiving Water Body		
Agency	**Receiving Water Body**	**TMDL**
EPA	Santa Monica Bay	Sediment Toxicity (Eliminated)
		DDT
		PCB
		Metals
		Pesticides (eliminated 2003)
	Wilmington Drain	Copper
		Lead
	Dominguez Channel	Ammonia
		Coliform
RWQCB	Machado Lake	Toxics
		Nutrients
		Trash
	Santa Monica Bay	Debris (Trash and Plastic Pellets)
		Bacteria (dry weather)
		Bacteria (wet weather)
	Dominguez Channel(1)	Toxics and Metals

Notes:
1. Dominguez Channel (DC) discharges into the Los Angeles Harbor; thus TMDLs may apply to dischargers to the DC even though the Body of Water is listed as Los Angeles Harbor.

TMDLs established or under development that are applicable to the bodies of water that the City discharges stormwater to are listed in Table 3.3.

As shown in Table 3.3, six TMDLs are currently identified as applicable to the City's stormwater discharge. The relevant resolutions and basin plan amendments (BPA) are included in Appendix B, while each TMDL is discussed in more detail in the following sections.

Table 3.2 Status Summary of Relevant TMDLs

Body of Water	TMDL Name	Pollutant	Status	Date
Santa Monica Bay	Bacteria	Bacteria	Effective	2003
	Metals	Metals	Delisted	2003
	Chlordane	Pesticides	Delisted	2006
	PCBs + DDT	PCBs	In Development[1]	2011
	Debris	Trash + Plastic Pellets	Adopted	2010
Dominguez Channel[2]	Bacteria	Bacteria	In Development	-
Los Angeles Harbor	Coliform	Bacteria	Effective	2005
	Pesticides	Pesticides	Adopted[3]	2011
	PAHs	PAHs	Adopted[3]	2011
	Metals	Metals	Adopted[3]	2011
Machado Lake	Nutrients	Nutrients	Effective	2009
	Trash	Trash	Effective	2008

Notes:
1. The EPA released a draft TMDL for this pollutant on December, 9, 2011 (EPA, 2011).
2. Dominguez Channel (DC) discharges into the Los Angeles Harbor; thus TMDLs may apply to dischargers to the DC even though the Body of Water is listed as Los Angeles Harbor.
3. The pollutants listed here are being addressed under the Los Angeles and Long Beach Harbors Toxics and Metals TMDL, also referred to in this report as the Dominguez Channel Toxics TMDLs.

Table 3.3 Applicable TMDLs for City of Torrance

Body of Water	TMDL Name	Pollutant	Resolution Number	Effective Date
Machado Lake	Nutrient	Nitrogen, Phosphorus	R08-006	11 March 2009
	Trash	Trash	2007-006	6 March 2008
	Toxics	Pesticides, PCBs	R10-008	2 September 2010
Dominguez Channel[(1)]	Toxics[(1)]	Copper, Lead, Zinc, DDT, PAHs, PCBs, Chlordane, Dieldrin, Cadmium, Chromium, Mercury	R11-008	Not Yet Effective (Approved by RWQCB on 5 May 2011)
Santa Monica Bay	Debris	Trash, Plastic Pellets	R10-010	Not Yet Effective (Approved by SWQCB 6 December 2011)
	Bacteria	Bacteria	2002-004 2002-022 2006-008	15 July 2003 15 July 2003 6 April 2006

Notes:
1. The Resolution Name for what is referred to here as the Dominguez Channel Toxics TMDL is "Los Angeles and Long Beach Harbors Toxic and Metals TMDLs." Dominguez Channel discharges into the Los Angeles and Long Beach Harbors.

3.2.1 Machado Lake Nutrient TMDL

Machado Lake, located in the Dominguez Channel Watershed in southern Los Angeles County, is identified on the 1998 and 2002 Clean Water Act 303(d) list of impaired water bodies as impaired due to eutrophic conditions, algae, ammonia, and odors. The Machado Lake eutrophic, algae, and odor impairments are caused by excessive loading of nutrients, including nitrogen and phosphorus, to Machado Lake (LAWQCB, 2008). Ammonia is found to be at levels below the toxicity standards, but nevertheless, these concentrations contribute to the total nitrogen loading in the lake. Table 3.4 provides a summary of the quantifiable loads entering Machado Lake on an annual basis (LAWQCB, 2008). Nutrient flux from the sediments and atmospheric nitrogen deposition are the two directly quantifiable non-point sources included as part of the total nutrient load. The total annual nitrogen and phosphorus loads are estimated to be 24,327 kg and 10,421 kg, respectively.

Machado Lake is located in the Ken Malloy Harbor Regional Park (KMHRP). Serving the Wilmington and Harbor City areas, the KMHRP, a City of Los Angeles park, encompasses 231 acres. The park is located west of the Harbor Freeway (California State Route 110) and east of Vermont Avenue between the Tosco Refinery on the south and the Pacific Coast Highway on the North. Machado Lake is one of the last lake and wetland systems in City of Los Angeles; the area is approximately 103.5 acres in total size. The upper portion, which includes the open water area, is approximately 40 acres and the lower wetland portion is about 63.5 acres. Machado Lake is a shallow polymictic lake; the depth is generally 0.5 to 1.5 meters; the average depth is approximately 1.0 meter (polymictic lakes lack thermal stratification due to shallow depth, allowing the water to mix throughout the depth of the lake). The lake was originally developed as part of Harbor Regional Park in 1971 and intended for boating and fishing. Over the years water quality generally declined; boating was stopped and signs were posted warning of the risk of eating fish from the lake.

Table 3.4 Total Annual Nutrient Load Entering Machado Lake

Source	Total N (kg)	Total P (kg)	Ortho-P (kg)	Inorg-N (kg)
External Load	7,587	3,260	737	3,736
Sediment Flux	16,520	7,161	4,963	16,520
Atmospheric Deposition	220			
Total Annual Load	**24,327**	**10,421**	**5,700**	**20,256**

Notes:
Source: Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Revised Draft - April 2008 (LAWQCB, 2008).

Within the TMDL, the City is identified as a point source for nutrients and is assigned a concentration based interim and final Waste Load Allocation (WLA). The WLAs within the TMDL Basin Plan Amendment (BPA) are assigned on a concentration basis, with the point of compliance within Machado Lake. The Machado Lake Nutrient TMDL requires the City to submit a Monitoring and Reporting Plan (MRP) within 1 year of the effective date of the resolution or propose a Special Study Work Plan following the requirements of one of three options for special studies. The City proposed a Special Study Work Plan (SSWP), allowing the City to assess compliance with the WLA on a mass basis. Assessment of compliance on a mass basis allows the City to demonstrate compliance through reductions in pollutant load rather than the resulting concentration in the discharge body of water. Compliance is demonstrated through monitoring reports based on sampling data at the stormdrain outfall of the City's stormwater system. Table 3.5 presents the WLA assigned to the City on a mass basis.

Table 3.5 City WLA for Machado Lake Nutrients TMDL			
Phase	**Compliance Deadline[(1)]**	**Phosphorus WLA (kg)**	**Total Nitrogen WLA (kg)**
1	11 March 2014	3,760	7,370
2	11 October 2018	301	3,008

Notes:
Source: Special Study Work Plan (included in Appendix B).
1. Compliance deadlines are based on the effective date of 11 March 2009. Phase 1 is required to be implemented by 5.0 Years after Effective Date while Phase 2 is required to be implemented by 9.5 Years after Effective Date.

As shown in Table 3.5, the City's WLA is phased, with initial reductions in pollutant loading to the interim targets by 2014 and reductions in pollutant loading to the final targets by 2018. The timeline for preparation and implementation of the MRP is shown in Table 3.6 along with the compliance deadlines from Table 3.5.

3.2.2 Machado Lake Trash TMDL

The Machado Lake Trash TMDL requires that trash be eliminated in Machado Lake and on its shoreline, through either assessment and collection or installation of full capture systems on discharges to the lake.

The City is identified as a point source for trash based on being a permittee under the Los Angeles County Municipal Separate Storm Sewer System (MS4) NPDES permit. Based on the Machado Lake TMDL, the City's Waste Load Allocation (WLA) is zero trash, meaning no trash may be discharged to the lake through the City's storm drains that discharge stormwater to the lake. The City is required to develop a Trash Monitoring and Reporting Plan (TMRP) describing the methodologies that will be used to assess and monitor compliance with the TMDL. The timeline for implementations of the TMRP and the schedule for compliance with the TMDL is presented in Table 3.7.

Table 3.6 Machado Lake Nutrients TMDL Schedule

Task Description	BPA Task[1]	Schedule from Effective Date	Compliance Deadline[2]
Interim WLAs Apply[3]	1	On Effective Date	11 March 2009
Submit MRP or work plan for Optional SSWP Option 3 to RWQCB	5, 7	1 year	11 March 2010
Submit Optional SSWP Options 1 or 2 work plans to RWQCB	8	1.5 year	11 October 2010
Submit Optional SSWP Option 3 final report to RWQCB	15	2.5 years	11 October 2011
Submit MRP plan and TMDL Implementation plan to RWQCB	16	2.5 years	11 October 2011
Begin monitoring and implementation of TMDLs	17	60 days from approval of MRP and TMDL Implementation plan	*February 2012*
Submit annual monitoring reports	18	from approval of MRP and TMDL Implementation plan	*December 2012* (and annually thereafter)
Interim WLAs apply	21	5 years	11 March 2014
Submit Optional SSWP Option 1 and 2 final reports to RWQCB	19	6 years	11 March 2015
Final WLAs apply	23	9.5 years	11 October 2018

Notes:
Source: Machado Lake Nutrients TMDL (RWQCB, 2011), included in Appendix B.

1. The BPA establishes 23 tasks. Tasks with requirements for the City's selected options for compliance or targeted WLA reductions are included in this table. Task 22 consists of reevaluating the TMDLs and potentially adjusting the WLAs, and would occur 7.5 years from the effective date (11 October 2016). This task is assigned to the RWQCB and thus not a compliance deadline for the City, but may impact the City's final WLA.
2. Compliance deadlines are based on the effective date of 11 March 2009. Approval of MRP assumed to require 2 months. Dates in italics are based on an assumed approval date.
3. On the effective date, interim concentration-based WLAs apply to the MS4 permittees with a point of compliance in Lake Machado. The interim total phosphorous WLA is 1.25 mg/L (consistent with the 5 year interim WLA) while the interim total nitrogen WLA is 3.50 mg/L (slightly higher than the 5 year interim WLA of 2.45 mg/L).

Table 3.7 Machado Lake Trash TMDL Schedule

Task Description	BPA Task[1]	Schedule from Effective Date	Compliance Deadline[2]
Submit TMRP	1	6 months	6 September 2008
Submit Results of TMRP, Recommend Trash Baseline WLA, Propose Prioritization	3	2 years from RWQCB approval of TMRP	*November 2010*
20% Reduction from Baseline WLA	4	4 years	6 March 2012
40% Reduction from Baseline WLA	5	5 years	6 March 2013
60% Reduction from Baseline WLA	7	6 years	6 March 2014
80% Reduction from Baseline WLA	8	7 years	6 March 2015
100% Reduction from Baseline WLA	9	8 years	6 March 2016

Notes:
Source: Machado Lake Trash TMDL (RWQCB, 2011), included in Appendix B.
1. The BPA establishes nine tasks. Tasks with requirements for the City or targeted WLA reductions are included in this table. Task 6 consists of evaluating the effectiveness of the effectiveness of full capture systems installed to achieve the 40 percent goal and reevaluate the WLA. This task is assigned to the RWQCB and thus not a compliance deadline for the City.
2. Compliance deadlines are based on the effective date of 6 March 2008. Approval of TMRP assumed to require 2 months. Dates in italics are based on an assumed approval date.

As shown in Table 3.7, compliance with the WLA of zero trash is phased over eight years in 20 percent increments. The City will need to begin implementation of BMPs to reduce the baseline WLA prior to its first compliance deadline of 6 March 2012.

As a part of Phase 3, the City implemented a pilot program to test potential BMPs, including catch basin inserts and trash screens. Advantages and disadvantages of the various BMPs were described in a conceptual report previously developed by Carollo for the City (Carollo, 2008), included in Appendix B. Based on results of the pilot program, the City has elected to focus its efforts on expanding its street sweeping activities to fully sweep streets (currently, the City sweeps the center of each street as street sweeping signage has not yet been established throughout the City's service area). The additional operational cost associated with the expanded street sweeping program are included in the capital improvement program presented in Chapter 9.

3.2.3 Machado Lake Toxics TMDL

The Machado Lake Toxics TMDL addresses several pesticides and PCBs to protect beneficial uses of Machado Lake. The Machado Lake Toxics TMDL was approved by the LAWQCB on September 2, 2010.

The Machado Lake Toxics TMDL specifically addresses pesticides and PCBs found in fish tissue. Specific pollutants addressed include DDT, PCBs, chlordane and dieldrin (as well as Chemical Group A, referring to bio-accumulating pesticides predominately represented by chlordane and dieldrin). These pollutants bind with soil particles and are thus transported with soil within stormwater runoff.

The City is identified as a point source for the identified pollutants based on being a permittee under the Los Angeles County Municipal Separate Storm Sewer System (MS4) NPDES permit. Based on the Machado Lake Toxics TMDL, the City's WLAs are listed in Table 3.8.

Table 3.8 Concentration Based WLAs for Machado Lake Toxics TMDL

PCBs (µg/kg)	DDT (µg/kg)	DDE (µg/kg)	DDD (µg/kg)	Total DDT (µg/kg)	Chlordane (µg/kg)	Dieldrin (µg/kg)
59.8	4.16	3.16	4.88	5.28	3.24	1.9

Notes:
Source: Machado Lake Toxics TMDL, Resolution Number R10-08, Basin Plan Amendment (LAWQCB, 2010).
1. WLA for suspended sediment associated contaminants based on dry weight; WLAs are applied with a three-year averaging period.

As a point source, the City is required to conduct WLA compliance monitoring, consisting of samples of suspended solids in the City's stormwater discharge. The monitoring is to be conducted in two phases. Phase 1 consists of sampling during three wet weather events, including the first large storm event of the season, for two years. Phase 2 consists of sampling one wet weather event every two years.

The monitoring is to be conducted based on a Monitoring and Reporting Plan and Quality Assurance Project Plan, with annual or biennial reports submitted to the RWQCB. The BPA also requires the Los Angeles County Flood Control District to monitor Wilmington Drain through bed sediment sampling, inspections, and operation of BMPs. Table 3.9 presents relevant milestones for implementation of the TMDL.

Table 3.9 Machado Lake Toxics TMDL Schedule

Task Description	BPA Task[1]	Schedule from Effective Date	Compliance Deadline[2]
Submit MRP and QAPP	7	6 months	11 September 2011
Conduct Phase 1 Monitoring	9	Monitor for 2 years from RWQCB approval of MRP	*November 2011 to November 2013*
Submit Implementation Plan	10	6 months after completion of monitoring	*May 2014*
Begin Implementation Actions to Attain WLAs	11	60 days from plan approval	*September 2014*
Achieve WLAs for Pesticides and PCBs	12	-	30 September 2019

Notes:
Source: Machado Lake Toxics TMDL (RWQCB, 2011), included in Appendix B.

(1) The BPA establishes 12 tasks. Tasks with requirements for the City or targeted WLA reductions are included in this table.

(2) Compliance deadlines are based on the effective date of 2 September 2010. Approval of MRP and implementation plan assumed to require 2 months. Dates in italics are based on an assumed approval date.

As shown in Table 3.9, the City is required to achieve compliance with the WLAs for this TMDL by 30 September 2019. Certain tasks within the schedule, including the timeline for monitoring, submission of the implementation plan, and implementation actions, is tied to the approval of the MRP rather than the effective date and depend on the schedule for monitoring (which is dependent on storm events). Thus, compliance deadlines for some tasks can only be approximated.

3.2.4 Dominguez Channel Toxics TMDL

In addition to the TMDLs applicable to Machado Lake (which is considered a part of the Dominguez Channel watershed), an additional TMDL to regulate toxics is applicable to the City's stormwater discharges to the Dominguez Channel watershed.

The Los Angeles Water Quality Control Board (LAWQCB) has placed the Dominguez Channel on the State's 303(d) list of impaired water bodies for several constituents including pesticides, metals, bacteria, and organic compounds. There are two reaches of Dominguez Channel currently listed on the 303(d) list. The first reach is the estuary portion of the channel, which stretches from the mouth at Los Angeles Harbor to Vermont Avenue in Gardena. This reach is downstream of the City's discharge points. The second reach stretches from Vermont Avenue to just north of the Highway 105 corridor where the channel becomes a network of subsurface storm drains. This reach extends through the northeast corner of the City.

The Los Angeles and Long Beach Harbors Toxic and Metals TMDLs was adopted by the board on 5 May 2011. However, it has not yet been approved by the State Water Resources Control Board (SWRCB), California Office of Administrative Law, or the EPA. A hearing before the SWRCB is scheduled for January 2012, and EPA approval is currently anticipated around March 2012.

The City is assigned WLAs for the identified pollutants based on being a permittee under the Los Angeles County MS4 NPDES permit.

A February 2009 draft report describing the calibration of a system to support the development of the Los Angeles and Long Beach Harbors Toxic and Metals TMDL is included in Appendix B along with the adopted resolution and basin plan amendment. Table 3.10 presents the freshwater metals interim WLAs for Copper, Lead, and Zinc based on the WLAs found in the Los Angeles and Long Beach Harbors Toxic and Metals TMDL.

Table 3.10 Concentration Based WLAs for Dominguez Channel Toxics TMDL

Pollutant	**WLA**
Freshwater Toxicity Interim Allocation	***(TUc)***
Toxicity	2
Freshwater Metals Interim Allocation	***(µg/l)***
Copper	207.51
Lead	122.88
Zinc	898.87
Interim Sediment Allocations (for DC Estuary)	***(mg/kg sediment)***
Copper	220.0
Lead	510.0
Zinc	789.0
DDT	1.727
PAHs	31.60
PCBs	1.490
Freshwater Toxicity Final Allocation	***(TUc)***
Toxicity	1
Freshwater Metals Final Allocation	***(g/day)***
Copper	1,300.3
Lead	5,733.7
Zinc	9,355.5

Table 3.10 Concentration Based WLAs for Dominguez Channel Toxics TMDL	
Pollutant	**WLA**
Torrance Lateral Wet Weather Unfiltered Water WLA	***(µg/l)***
Copper	9.7
Lead	42.7
Zinc	69.7
Torrance Lateral Sediment WLA	***(mg/kg sediment)***
Copper	31.6
Lead	35.8
Zinc	121
Final Metals and PAHs WLAs (for DC Estuary)	***(kg/year)[(1)]***
Copper	22.4
Lead	54.2
Zinc	271.8
PAHs	0.134
Final WLA for DDT and PCBs (for DC Estuary)	***(g/year)[(1)]***
DDT	0.250
PCBs	0.207
Final Sediment WLAs for Metals (for DC Estuary)	***(mg/kg sediment)[(2)]***
Cadmium	1.2

Notes:
Source: Los Angeles and Long Beach Harbors Toxic TMDL, Basin Plan Amendment.
1. For MS4 permitees, mass based WLAs are based on share of area. WLAs shown are total mass WLA. The BPA did not establish the share of area for each permittee.
2. The BPA also specifies WLA for Chromium and Mercury; however, these are applicable only to the Consolidated Slip and Fish Harbor.

The Basin Plan Amendment (BPA) also includes mass-based WLAs for the ExxonMobil Refinery, which falls within the City's boundary. The mass based WLAs for the ExxonMobil Refinery are presented in Table 3.11.

Table 3.11 Mass Based WLAs for ExxonMobil Refinery		
Total Copper (kg)	**Total Lead (kg)**	**Total Zinc (kg)**
1.36	5.98	9.75

Note:
Source: Los Angeles and Long Beach Harbors Toxic TMDL, Basin Plan Amendment.

As an assigned responsible party, the City must develop a MRP and Quality Assurance Project Plan (QAPP). The MRP must be submitted for public review 20 months after the effective date. Monitoring will need to begin six months after approval of the MRP. Monitoring will consist of sampling of water and suspended solids at the outlet of storm drains discharging to the Dominguez Channel.

In addition, fish and sediment samples will be taken in the Dominguez Channel Estuary. Water and suspended solids are to be sampled during a single dry weather event and two wet weather events, including the first large storm of the year. Sediment and fish tissue are to be sampled every two years. While the assigned responsible parties are individually responsible to conduct water, suspended solids, sediment, and fish tissue sampling, they may collaborate to minimize costs, in which case the development of the MRP must be coordinated between the various assigned responsible parties. Coordination of monitoring for two superfund sites located east of the City discharging stormwater into the Torrance Lateral are discussed individually in the BPA. Decisions regarding these two sites may impact the approval, review, and coordination of the City's monitoring and implementation plans.

Implementation is divided into three phases for the responsible parties identified for the Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary. The objective of Phase 1 is to reduce the amount of sediment transport being discharged to the Dominguez Channel and is planned to consist of watershed-wide implementation actions, including non-structural and structural BMPs. Phase 2 is anticipated to include implementation of additional BMPs and remedial actions as well as site-specific cleanup actions. Phase 3 is anticipated to include implementation of secondary and additional remediation actions. Table 3.12 presents several tasks pertinent to the City and the associated schedule.

Table 3.12 Dominguez Channel Toxics TMDL Schedule

Task Description	BPA Task[1]	Schedule from Effective Date	Compliance Deadline[2]
Submit MRP	1	20 months	*December 2013*
Submit Implementation Plan and Contaminated Sediment Management Plan	5	2 years	*April 2014*
Submit annual monitoring reports to LAWQCB	4	15 months after monitoring begins (and annually thereafter)	*November 2015*
Submit annual implementation reports to LAWQCB	7	3 years (and annually thereafter)	*April 2015*
Complete Phase 1	8	5 years	*April 2017*
Submit updated Implementation Plan and Contaminated Sediment Management Plan	9	5 years	*April 2017*
Report on status of implementation and remaining efforts associated with Phase 2	11	5 years	*April 2017*
Complete Phase 2	12	15 years	*April 2027*
Complete Phase 3	13	20 years	*April 2032*
Demonstrate attainment of WLAs	14	20 years	*April 2032*

Notes:
Source: Dominguez Channel Toxics TMDL (RWQCB, 2011), included in Appendix B.

1. The BPA lists 14 tasks; tasks with specific requirements of the City are presented here.
2. The effective date is not yet established; the compliance schedule is estimated using an assumed effective date of April 2012 (based on EPA approval in March 2012). Approval of MRP assumed to require 2 months. Dates in italics are based on an assumed approval or effective date.

As shown in Table 3.12, the scheduled implementation of the Dominguez Channel Toxics TMDL is planned for 20 years after the effective date. Since the BPA is still pending review by the SWRCB and the EPA, the effective date has not yet established and a compliance schedule cannot be projected.

3.2.5 Santa Monica Bay Debris TMDL

The Santa Monica Bay Debris TMDL requires no trash or plastic pellets in Santa Monica Bay. The City is identified as a point source for trash based on being a permittee under the Los Angeles County Municipal Separate Storm Sewer System (MS4) NPDES permit. Based on the Santa Monica Bay Nearshore and Offshore Debris TMDL, the City's Waste Load Allocation (WLA) is zero trash, meaning no trash may be discharged to the bay through the City's storm drains. The TMDL requires that the City utilize any compliance strategies within its authority to eliminate discharge of trash. As a part of the trash portion of the TMDL, the City is required to develop and implement a Trash Monitoring and Reporting Plan (TMRP). The City may achieve compliance through implementation of full capture systems, partial capture systems, or institutional controls. If the City achieves compliance through full capture systems, installation of the capture devices is required over an eight-year period. If the City achieves compliance using the partial capture systems, or institutional controls, compliance must be demonstrated through a mass balance analysis.

As a part of the TMRP, the City can either develop a site-specific baseline WLA for trash or use the default Baseline WLA of 807 gallons per square mile per year assigned in the BPA. The TMRP establishes details on frequency, location, and reporting format for monitoring, and establishes a metric (examples given in the BPA include weight, volume, or number of pieces of trash) for measuring the amount of trash discharged by the City.

The second component of the Debris TMDL requires no plastic pellets in Santa Monica Bay. The TMDL identifies industrial facilities handling plastic pellets as being the point sources for plastic pellets discharged through the stormwater system. Several industrial facilities within the City handle plastic pellets, and thus are subject to the WLA for plastic pellets within the Santa Monica Bay Debris TMDL. The City, having industrial facilities handling plastic pellets within its jurisdiction, is required to prepare a Plastic Pellet Monitoring and Reporting Plan, which details monitoring, inspection, and establishes actions to address plastic pellet spills.

The Debris TMDL was adopted by the RWQCB on November 5, 2010, and approved by the SWRCB on December 6, 2011. The OAL and EPA have not yet approved the Debris TMDL. Table 3.13 presents the anticipated compliance dates based on the tasks outlined in the BPA and an assumed effective date of March 2012.

Table 3.13 Santa Monica Bay Debris TMDLs Schedule

Task Description	BPA Task[1]	Schedule from Effective Date	Compliance Deadline[2]
Submit TMRP	1a	6 months[3]	*September 2012*
Implement TMRP	2a	6 months after RWQCB approval	*May 2013*
Submit PMRP	1b	18 months	*September 2013*
Adopt ordinance banning plastic bags, smoking in public places, and single use polystyrene food containers (Optional; provides three year extension to Task 10)	11	3 years from RWQCB adoption date	5 November 2013
Submit results of implementing TMRP and PMRP, recommend baseline WLA, and propose prioritization of BMPs.	3	20 months from RWQCB approval	*Trash: July 2014 Plastic Pellets: July 2015 (annually thereafter)*
Implement PMRP	2b	4 years	*March 2016*
Achieve 20 percent reduction from Baseline WLA	4	4 years	*March 2016*
Achieve 40 percent reduction from Baseline WLA	5	5 years	*March 2017*
Achieve plastic pellet WLA	6	5 years	*March 2017*
Achieve 60 percent reduction from Baseline WLA	8	6 years	*March 2018*
Achieve 80 percent reduction from Baseline WLA	9	7 years	*March 2019*
Achieve 100 percent reduction from Baseline WLA	10	8 years	*March 2020*

Notes:
Source: Santa Monica Bay Debris TMDL BPA, included in Appendix B.

1. The BPA lists 11 tasks; tasks with specific requirements of the City are presented here. In addition, the RWQCB may reevaluate WLAs five years after the effective date (*March 2017* based on an assumed effective date of March 2012).
2. The effective date is not yet established; the compliance schedule is estimated using an assumed effective date of March 2012 (based on EPA approval in February 2012). Approval of MRP assumed to require 2 months. Dates in italics are based on an assumed approval or effective date.
3. The BPA notes that if the TMRP is not approved within nine months of the effective date, the Regional Board will establish appropriate monitoring plans.

As shown in Table 3.13, monitoring to establish the trash Baseline WLA (if the City does not elect to use the default baseline) is anticipated to begin in 2013, with results submitted to the RWQCB in 2014. Implementation of the trash related BMPs is anticipated on a phased basis between 2016 and 2020. Implementation of the plastic pellet monitoring is anticipated to begin in 2016, with the full plastic pellet WLA achieved in 2017.

3.2.6 Santa Monica Bay Bacteria TMDLs

Santa Monica Bay is currently listed on the California State Water Resources Control Board (SWRCB) 303 (d) listing of impaired water bodies due to excessive levels of bacteria. At times, these levels in the bay exceed the State's ocean water quality standards for public water-contact areas and result in beach closures.

In order to address these water quality issues, the LARQCB adopted Resolution 2002-004, which incorporated a dry-weather TMDL for bacteria, and Resolution 2002-022, which incorporated a wet-weather TMDL for bacteria at Santa Monica Bay beaches. Both of these TMDLs went into effect on 15 July 2003. Attachment A to Resolution 2002-022 includes the use of the State's "single sample" bacteriological standards as water quality objectives that apply to stormwater discharges entering the bay.

Each bacteria TMDL limits the number of days each year for which bacterial indicators exceed specified levels under their respective conditions. Separate TMDLs cover dry weather and wet weather and the Bacterial TMDLs include separate limitations on the number of days for summer dry weather, winter dry weather, and wet weather. These limitations are based on individual beach monitoring locations.

The implementation plans were approved in separate resolutions of the LARQCB by jurisdictional group. The City falls within Jurisdictional Group 6, whose implementation plan was approved as Resolution 2006-007. It should be noted that Resolution 2002-022 included the City in both Jurisdictional Group 6 and 7, but the resolutions approving the implementation plans only included the City in Jurisdictional Group 6.

Table 3.14 presents the scheduled compliance dates for both TMDLs. The wet weather bacteria TMDL allowed agencies to pursue either an integrated water resources approach or demonstrate compliance by themselves. Agencies pursuing an integrated water resources approach were given an additional eight years to achieve compliance.

Table 3.14 Santa Monica Bay Bacteria TMDLs Schedule		
Task Description	**Schedule from Effective Date**	**Compliance Deadline[(2)]**
Dry Weather Bacteria TMDL		
Submit Monitoring Plan and identify discharges with Report of Waste Discharge	120 days	12 November 2003
Achieve compliance with allowable exceedances days during summer dry weather	3 years	July 2006
Achieve compliance with allowable exceedances days during winter dry weather	6 years	July 2009
Wet Weather Bacteria TMDL – Integrated Approach		
Achieve 10 percent of required exceedance-day reductions	6 years	July 2009
Achieve 25 percent of required exceedance-day reductions	10 years	July 2013
Achieve 50 percent of required exceedance-day reductions	15 years	July 2018
Achieve compliance with allowable exceedances days	18 years	July 2021
Wet Weather Bacteria TMDL – Non-Integrated Approach		
Achieve 25 percent of required exceedance-day reductions	6 years	July 2009
Achieve 50 percent of required exceedance-day reductions	8 years	July 2011
Achieve compliance with allowable exceedances days	10 years	July 2013

Notes:
Source: Santa Monica Bay Bacteria TMDLs, included in Appendix B.
1. The BPAs established 12 tasks; relevant tasks are included in this table.
2. Compliance deadlines are based on the effective date of 15 July 2003.

3.3 REGIONAL NPDES REGULATIONS

Surface water discharges are regulated via National Pollutant Discharge Elimination System (NPDES) permits issued by the applicable RWQCB. Stormwater discharges from Municipal Separate Storm Sewer Systems (MS4) are required to be permitted under the NPDES Stormwater Program.

3.3.1 Los Angeles County MS4 Permit

Waste Discharge Requirements (WDR) for the City's municipal stormwater and urban runoff discharges are specified in NPDES Permit CAS004001, known as the Los Angeles County MS4 Permit. This permit covers municipal stormwater and urban runoff for Los Angeles County, 84 of the cities within Los Angeles County, and Los Angeles County Flood Control District.

Los Angeles County's MS4 permit was last issued in 2001 (LAWQCB Order 01-182), with additional TMDL provisions incorporated in 2006 (LAWQCB Order R4-2006-0074), 2007 (LAWQCB Order R4-2007-0042), and 2009 (LAWQCB Order R4-2009-0130). The permit was again amended in April 2011 to remove the TMDL provisions incorporated in 2006; there is a reissue scheduled for 2012. LAWQCB is anticipating a new permit structure with more interrelated management methods and has stated that water quality will be the key driver for the reissued permit. A copy of the Los Angeles County's 2001 MS4 permit is included in Appendix B.

Historically, the Los Angeles County MS4 permit has been structured as a single unified permit due to the highly interconnected stormwater system in Los Angeles County. The permit includes standard and special provisions for all permittees, and specific watershed-based TMDL requirements, such as the Trash TMDL for the Los Angeles River watershed.

Under the MS4 permit, the City is required to comply with applicable water quality standards to the "maximum extent possible (MEP)." Where MEP requires that municipal permits "shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system design and engineering methods, and such other provisions as the administrator or the State determines appropriate for the control of such pollutants."

The major components of the MS4 permit are discussed in the following paragraphs.

Discharge Prohibitions

The City's MS4 permit requires the City to effectively prohibit non-stormwater discharges to the stormwater system with the exception of certain specific types of non-stormwater discharges. Some of the exempt non-stormwater discharges include non-stormwater discharges permitted separately, discharges from natural flows, fire fighting, landscape irrigation runoff, discharge from drains and condensation, non-commercial car washing,

sidewalk rinsing, releases associated with the potable water system and dewatering of fountains, ponds, and swimming pools under certain dechlorination conditions. It should be noted that some of these discharges, such as the rinsing of sidewalks, are currently prohibited by the City's water conservation ordinance.

Receiving Water Limitations

The City is required to implement control measures to reduce pollutants within discharges to eliminate violations of water quality standards on receiving waters. If discharges are causing or contributing to exceeding water quality standards for the receiving water, the City must submit a Receiving Water Limitations Compliance Report.

Stormwater Quality Management Program Implementation

The City is required to implement a Stormwater Quality Management Program, either through participation in the countywide program or development of a local program. In either case, the City must implement or require the implementation of a combination of BMPs in order to reduce pollution. As a part of implementation of the Stormwater Quality Management Program, the City supplies a voting representative to a Watershed Management Committee, which facilitates cooperation between the various permittees in the MS4 permit.

Special Provisions

The City's MS4 permit includes six additional programs that are considered special provisions. There programs are briefly described below.

Public Information and Participation Program: As a part of the MS4 permit, Los Angeles County is required to implement a Public Information and Participation Program to educate the City's businesses and residents on the impacts of stormwater pollution on the receiving waters and the measures to resolve the problems caused by stormwater pollution and change waste disposal and runoff pollution generation behaviors of the City's businesses and residents, involving the various socio-economic groups within the City. Some of the specific measures required as a part of the public information program include adding notices to storm drains and establishing a countywide hotline for reporting illicit discharges of non-stormwater to the stormwater system. Some components of this program can also be implemented by the City. Specific requirements of the City include conducting educational activities within its jurisdiction, participation in countywide stormwater education events, update Los Angeles County with contact information for the City's appropriate staff responsible for stormwater public education, and provide outreach materials to the public.

Industrial and Commercial Facilities Program: The City must implement an Industrial and Commercial Facilities Program to require implementation of pollutant reduction and control measures at industrial and commercial facilities within its jurisdiction. This program

consists of tracking, inspecting, and ensuring compliance at facilities representing "critical sources of pollutants in stormwater."

Development Planning Program: The City must implement a Development Planning Program, which requires that development and redevelopment projects maximize pervious surfaces, minimize discharge to impervious surfaces, and incorporate BMPs to reduce stormwater pollution loads. The permit includes specific design criteria for development and redevelopment projects and requires approval of a Standard Urban Stormwater Mitigation Plan (SUSMP) approved by the RWQCB for certain categories of development. As a part of the Development Planning Program, Los Angeles County was required to develop a technical manual to design and site BMPs (last updated in August 2010 and included in Appendix C). As a part of this provision, the City is required to include consideration of stormwater quality impacts into its CEQA review process, include policies and management considerations related to stormwater quantity and quality in any General Plan updates, and annually train City development planning staff on stormwater related development planning requirements.

Development Construction Program: In addition to the Development Planning Program, the City is required to implement a Development Construction Program to control runoff related to construction activities from construction sites using BMPs. For construction sites over one acre in size, the City must also require submittal of a Local Stormwater Pollution Prevention Plan (LSWPPP), and inspect all construction sites to ensure that the LSWPPP is being implemented. Additional requirements are made for sites larger than five acres in size.

Public Agency Activities Program: In order to limit the impact of stormwater pollution from public agencies, the City is required to implement a Public Agency Activities Program. This program consists of specific considerations for ten areas related to public agencies. Some of the specific requirements include planning for sewer system discharges, documenting the application of fertilizers at parks, frequency the City is required to clean catch basins, and frequency of street sweeping.

Illicit Connections and Illicit Discharges Program: The City is required to implement an Illicit Connections and Illicit Discharges Program to eliminate all illicit connections and discharges to the stormwater system. As a part of this program, the City must document, track, and report illicit connections and illegal discharges. The permit states the required planning and response times for any investigations into illicit connections and illegal discharges.

Standard Provisions

This section of the permit describes the requirements for the City to comply with the permit, the method of reporting, the review process, authority for inspection, continued operations and maintenance, and the conditions by which the permit may be modified.

TMDL Provisions

The permit includes TMDL provisions for Trash in the Los Angeles River watershed. As discussed in Section 3.3.1, additional TMDLs are applicable to bodies of water in which the City discharges stormwater, including the Machado Lake Nutrient and Trash TMDLs and the Santa Monica Bay Debris TMDL. However, these TMDLs were removed from the MS4 permit in April 2011; current plans schedule the TMDLs to be incorporated into the reissued permit in 2012.

3.3.2 Ventura MS4 Permit and Reissuance of Los Angeles MS4 Permit

The Ventura County MS4 Permit was reissued by the LAWQCB in July of 2010 (as Order R4-2010-0108). Since the Los Angeles County MS4 Permit is in the process of being updated for reissue in 2012, regionally, the Ventura County MS4 Permit has been looked to as a precursor to the type of changes that may be made to the Los Angeles County MS4 Permit.

The Ventura County MS4 Permit is included in Appendix B. Some of the key differences between the reissued Ventura County MS4 Permit and the current Los Angeles County MS4 Permit include:

- The Industrial and Commercial Facilities Program is also applicable to nurseries.
- New development and redevelopment projects meeting specific criteria are required to limit effective impervious area to 5 percent (or, if technically infeasible, limit effective impervious area to 30 percent with mitigation).
- The establishment of water quality mitigation criteria for use in new development and redevelopment projects.
- Track and inspect BMPs implemented as a part of development and redevelopment projects.
  - Establish a GIS tracking system for BMPs implemented as a part of development and redevelopment projects.
  - Inspect once after construction, once every 2 years, and receive annual reports for any BMPs not owned by the City.
- Applicable TMDLs adopted by the LAWQCB, OAL, and EPA are incorporated into the permit as water quality based effluent limits (a total of eight TMDLs were included). The permit includes discussion of monitoring requirements for each TMDL, but the monitoring section notes that the monitoring requirements are intended to be consistent with the TMDL.

In addition, the LAWQCB has indicated that the reissuance of the Ventura County MS4 permit added provisions for hydromodification controls and refocused monitoring further upstream in watersheds. The permit includes separate provisions for onsite retention and prevention of hydromodification, but a single BMP can satisfy both provisions.

The Ventura County MS4 permit also considers potential TMDLs, requiring permittees to "implement all necessary control measures to reduct pollutant(s) which cause of continue to cause or contribute to water quality impairments, but for which TMDLs have not yet been developed or approved" (LAWQCB, 2009).

The LAWQCB has expressed intent to complement local efforts, as some of the permittees covered by the Los Angeles County MS4 Permit have enacted Low Impact Development (LID) ordinances. Thus, some of the permit requirements within the reissued Los Angeles MS4 permit may be watershed specific and may not be uniformly applied to all permittees.

While the limitation of effective impervious area for new developments and redevelopment projects represents the most significant difference identified above, the cost of implementing this provision will fall primarily on the developer and thus private enterprises. Impacts to growth and economic development are beyond the scope of this study. The City should expect limited additional costs related to plan checking and inspection, as well as increased costs for City projects falling within the criteria for development or redevelopment.

More significant direct impacts for the City are anticipated for the provisions related to the tracking and inspection of BMPs implemented as a part of development and redevelopment projects. Currently, the City is required to track and inspect BMPs associated with industrial sites. It is anticipated the City can expect a similar level of effort for development and redevelopment sites (on a per site basis). In addition, if the responsibility for operations and maintenance of individual BMPs implemented by new developments and redevelopments to comply with the limitation of effective impervious area fall upon the City, significant operations and maintenance costs could be incurred.

As a part of the Ventura County MS4 permit development process, an economic analysis of the impact of the new requirements on public agencies was conducted and is documented in "Economic Considerations of the Proposed Order" (LAWQCB, 2008b) and the "Stormwater Cost Survey" (CSUS, 2005). This analysis did not quantify the economic impact of not implementing the new permit, or the economic impact to residents, residential developments, and commercial interests. The basis of these studies was a survey and developed unit cost ranging between $18 and $45 per household for estimated costs of the stormwater program for six selected cities within California. However, this study did not take into account the specific increased requirements of the Ventura MS4 permit, but rather attempted to estimate the overall cost of implementation of the stormwater permit. In addition, the relevant requirements of the MS4 permit for each of the surveyed cities was not evaluated or discussed.

In addition, the TMDLs incorporated into the MS4 permit represent significant capital expenses in the form of BMPs, and significant ongoing annual costs for operations and maintenance of BMPs as well as monitoring programs to demonstrate compliance. While

the City would need to fund these programs based on the BMP requirements, their inclusion in the MS4 permit associates these costs with complying with the MS4 permit.

In summary, the anticipated internal cost impacts to the City of reissuance of the Los Angeles County MS4 permit include increased time for City staff to review and inspect development plans, increased time for City staff to track and inspect BMPs implemented as a part of development and redevelopment, and potentially increased operations and maintenance efforts for BMPs associated with developments.

3.4 NON-COMPLIANCE ISSUES

As will be discussed in the water quality evaluation in Chapter 7, without additional BMPs the City's pollutant loading is predicted to exceed the City's eventual WLA for the Machado Lake Nutrient TMDL. Table 3.15 presents the model prediction of pollutant loading for the City's subbasins discharging to the Harbor Lakes and Walteria Lakes watersheds.

Table 3.15 Machado Lake TMDL Compliance

Condition	Phosphorus WLA		Total Nitrogen WLA	
	(kg)	(lb)	(kg)	(lb)
WLA 5.0 Years after Effective Date[(1)]	3,760	8,289	7,370	16,248
WLA 9.5 Years after Effective Date[(1)]	301	664	3,008	6,632
Pollutant Loading Predicted by Model[(2)]	1,324	2,919	7,665	16,899

Notes:
1. From Table 3.5.
2. Average of PLOAD and N-SPECT models from Table 7.3.

As shown in Table 3.15, the City's pollutant loading for discharges to Machado Lake are predicted to exceed the WLAs for nitrogen under the 5 year deadline and the WLAs for both phosphorus and nitrogen under the 9.5 year deadline.

Trash TMDLs are in effect for Machado Lake and are anticipated to become effective for Santa Monica Bay (as a part of the Santa Monica Bay Debris TMDL) sometime in 2012. Both TMDLs have a WLA assigned to the City of zero, with phased compliance over several years. Assuming the City does not choose to apply the default baseline WLA, the level of non-compliance will be established during the monitoring to establish a baseline WLA.

The Santa Monica Bay Debris TMDL also includes a WLA related to discharge of plastic pellets. The City is assigned a WLA of zero for plastic pellets. The level of non-compliance will be established during the monitoring to establish a baseline WLA and associated preparation of the implementation plan.

The Machado Lake Toxics TMDL became effective in 2011 and is currently in the monitoring phase. This monitoring phase is intended to establish a baseline WLA and the level of non-compliance. Since many of the pollutants covered by this TMDL bind to sediment, within analysis conducted as a part of this report TSS will be used as an indicator constituent with the selection of BMPs to cover toxics covered by this TMDL.

The Los Angeles and Long Beach Harbors Toxic and Metals TMDL, anticipated for approval by the SWRCB and EPA sometime in 2012, includes several WLAs. Initial monitoring to establish baseline WLAs is anticipated to occur from 2013 to 2014. The level of non-compliance will be established during the monitoring to establish a baseline WLA. Since many of the pollutants covered by this TMDL bind to sediment, TSS will be used in this report as an indicator constituent for with the selection and sizing of BMPs to meet the Toxics TMDL requirements.

If additional TMDLs are added in the future for other bodies of water which the City discharges stormwater into, similar analysis will be required.

Compliance with the Santa Monica Bay related provisions of the City's MS4 permit and Santa Monica Bay TMDLs was evaluated as a part of previous studies.

3.5 CORRECTIVE ACTION PLAN AND SCHEDULE

In order to meet the water quality criteria associated with the WLAs assigned to the City, the current constituent levels within the City's stormwater discharges will need to be reduced. As a part of the water quality analysis in this study, BMPs are recommended to reduce the constituent levels within the City's stormwater discharges in order to meet the required WLAs and achieve compliance. Chapter 7 will include siting and recommendations related to water quality compliance.

Through the "Predesign of BMPs for Detention Basins Tributary to Santa Monica Bay" (Carollo, 2008), the City investigated and evaluated alternatives to satisfy the MEP, MS4, and TMDL requirements in order to reduce bacterial loadings to the Santa Monica Bay. Study recommendations have been implemented through installation of Continuous Deflective Separation units on several storm drains discharging to Torrance Beach.

As detailed in the City's MS4 permit, the City is required to perform operations and maintenance on BMPs to maintain functionality. Routine inspection and cleaning of BMPs is required to maintain the treatment capacity and water quality benefits associated with each BMP. For privately owned BMPs, this maintenance will need to be required of the individual owner. For BMPs owned and operated by the City, the City will need to adequately budget for this effort.

The City is required to inspect BMPs on a regular basis. The City's current MS4 permit requires this for BMPs implemented by industrial sites. The City will need to include

inspection of BMPs implemented to meet the WLAs as a part of compliance. As mentioned in Section 3.3.2, it is anticipated that, if development and redevelopment LID provisions are included in the City's reissued MS4 permit, the number of BMPs the City is required to routinely inspect will increase dramatically.

Each of the WLAs associated with the water quality TMDLs include provisions for monitoring and sampling. In addition, it is anticipated that watershed monitoring requirements may be increased in the future as a part of the City's reissued MS4 permit. Thus, it is anticipated that the City's monitoring and reporting requirements and costs will increase in the future. The monitoring information will be used to refine the City's water quality model in order to design corrective BMPs for implementation.

A summary of the TMDL schedules is presented in Figure 3.1.

3.6 SUMMARY

A summary of each of the TMDLs discussed in this chapter is provided in Table 3.16. As shown in Table 3.16, the City is subject to several TMDLs in each watershed and for each of the various water bodies to which it discharges stormwater. Chapter 7 of this report includes BMP recommendations to comply with the TMDLs for the Dominguez Channel watershed. In addition, additional internal costs are anticipated to the City related to reissuance of the Los Angeles County MS4 permit. These cost impacts include:

- Increased cost of the City's development projects
- Increased time for City staff to review and inspect development plans
- Increased time for City staff to track and inspect BMPs implemented as a part of development and redevelopment
- Potentially, increased operations and maintenance efforts for BMPs associated with developments.

Estimates for these costs are presented in the Capital Improvement Program found in Chapter 9.

Table 3.16 Summary of TMDL Requirements

Body of Water	TMDL Name	Constituent	WLA	Watershed
Machado Lake	Nutrient	Total Nitrogen	3,008 kg(1)	Dominguez Channel
		Total Phosphorous	301 kg(1)	Dominguez Channel
	Trash	Trash	None	Dominguez Channel
	Toxics	PCBs	59.8 µg/kg	Dominguez Channel
		DDT	4.16 µg/kg	Dominguez Channel
		DDE	3.16 µg/kg	Dominguez Channel
		DDD	4.88 µg/kg	Dominguez Channel
		Total DDT	5.28 µg/kg	Dominguez Channel
		Chlordane	3.24 µg/kg	Dominguez Channel
		Dieldrin	1.9 µg/kg	Dominguez Channel
Dominguez Channel	Toxics and Metals	Various	Various	Dominguez Channel
Santa Monica Bay	Debris	Trash	None	Santa Monica Bay
		Plastic Pellets	None	Santa Monica Bay
	Bacteria	Summer Dry Weather	0 Days Exceedance	Santa Monica Bay
		Winter Dry Weather	1 Days Exceedance	Santa Monica Bay
		Wet Weather	17 Days Exceedance	Santa Monica Bay

Notes:
1. Dominguez Channel (DC) discharges into the Los Angeles Harbor; thus TMDLs may apply to dischargers to the DC even though the Body of Water is listed as Los Angeles Harbor.
2. Based on 9 year mass based compliance level as developed in Special Study Work Plan.

Figure 3.1TMDL Compliance Schedule

LETTER-SIZED (8.5x11) FIGURE

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Chapter 4

PLANNING AND EVALUATION CRITERIA

This chapter presents the planning and evaluation criteria used to develop the stormwater model development for the City of Torrance (City) and to identify system deficiencies of the City's existing stormwater system. The planning and evaluation criteria discussed in this chapter includes hydraulic, hydrologic, and water quality criteria. A summary of the criteria discussed herein is included at the end of this chapter.

4.1 HYDRAULIC CRITERIA

4.1.1 Water Surface Elevation

The hydraulic model was used to predict the water surface elevation at each model node. When modeled water surface elevation exceeds overflow elevation, flooding is predicted to occur.

4.1.2 Gravity Storm Drains

Within the hydraulic modeling software (XP SWMM), flow through gravity pipelines is calculated using the Manning equation, and based on the flow, cross-sectional area, hydraulic radius, and slope input during model development.

Pipeline sizing is primarily based on capacity during stormwater events. Pipelines are selected so that they do not exceed capacity during stormwater events, indicated by the water surface elevation exceeding overflow elevation at model nodes. When a pipeline exceeds capacity during stormwater events, it is upsized to the next standard size.

The minimum size for new stormwater pipelines, excluding service laterals, is 12 inches in diameter. The standard pipeline diameter sizes used include 12 inches, 15 inches, 18 inches, 21 inches, 24 inches, 30 inches, 36 inches, 42 inches, 48 inches, 54 inches, 60 inches, 66 inches, 72 inches, 78 inches, 84 inches, and 90 inches.

4.1.3 Force Mains

For segments where pressurized flow occurs, headloss is modeled using the Hazen-Williams formula in place of the Manning equation. Friction factors were selected based on pipeline material and age. For force mains, a maximum velocity of 10 feet per second (fps) was used as the evaluation criteria; flows exceeding this are an indication that the pipeline segment may be deficient.

4.1.4 Natural Channels

Natural channels with velocities exceeding 5 fps have the potential for erosive conditions. Any natural channel segments with predicted velocities above 5 fps will be identified as candidates for channel stabilization and restoration.

4.1.5 Pump Stations

Pump stations included in the hydraulic model are based on the hydraulic characteristics of pump stations at each detention basin. Capacity of the pump stations was evaluated as a part of the evaluation of capacity of the detention basins. No additional evaluation criteria were utilized.

4.2 HYDROLOGIC CRITERIA

Many hydrologic criteria were obtained from the Los Angeles County Department of Public Works' 2006 Hydrology Manual (LACDPW, 2006). This document provides design flood parameters and procedures in the planning and design of local drainage and flood control systems. The hydrologic analysis of the City's storm drainage system was based on the recommendations of this document, as applicable to local drainage issues. This section describes the hydrologic characteristics of the City and the design storms that were used for the development of this SWMP.

4.2.1 Precipitation Characteristics

The City's wet season occurs from November through March. The mean annual precipitation in the City is approximately 13.7 inches. The Depth-duration-frequency (DDF) curves, for 50-year storm events, were obtained from the Los Angeles County Hydrology Manual (LACDPW, 2006).

4.2.2 Design Storms

The Los Angeles County Low Impact Development Standards Manual (LAC, 2009) recommends use of an 85th percentile 24-hour runoff event for calculation of the design storm to size BMPs. This SWMP has used this criterion for the sizing of the City‘s BMPs.

Rainfall data were used to generate the basis for stormwater evaluations. Data are generally characterized by amount (inches), intensity (inches per hour), frequency, duration (hours), spatial distribution (location variance), and temporal distribution (time variance). Rainfall data were needed for two parts of the evaluations: design storm simulations, and pollutant loading projections.

Long-term rainfall data is needed to establish the average annual rainfall volume for pollutant loading projections. The National Climatic Data Center (NCDC) keeps rainfall records in daily or hourly intervals for major rain gages. In the City, these records are compiled for the Torrance Airport from 1946 to the present (NCDC, 2010). This site is located in the south of the City, within the Walteria basin.

The depth of rainfall in inches for a specific return period and storm duration is the most basic parameter needed in the design and analysis of a stormwater management system. For the water quantity design storm events, the Soil Conservation Service (SCS) Type II 24-hour distribution was used to construct the 2-, 5-, 10-, 25- and 100-year storm events. The rainfall depth for the 50-year storm event was obtained along with multiplication factors for the 2-, 5-, 10-, 25- and 100-year storm events from the Los Angeles County Hydrology Manual (LACDPW, 2006) and are presented in Table 4.1.

Table 4.1 Rainfall Volumes

Return Interval (years)	Annual Exceedances Probability (%)	Rainfall Multiplication Factor[1,2]	Rainfall Depth[1] (inches)
2	50%	0.387	2.3
5	20%	0.584	3.5
10	10%	0.714	4.3
25	4%	0.878	5.3
50	2%	-	6.0
100	1%	1.122	6.7

Notes:
1. Source: Los Angeles County Hydrology Manual (LACDPW, 2006).
2. Multiplied by 50-year storm event to calculate other years.

The Natural Resources Conservation Service (NRCS), which was formerly known as the Soil Conservation Service (SCS), has developed 24-hour hyetographs with shapes that are typical for various geographic locations within the United States. The SCS Type 1A curve was used for this study. The SCS Type 1A rainfall distribution is illustrated on Figure 4.1, both cumulatively and incrementally.

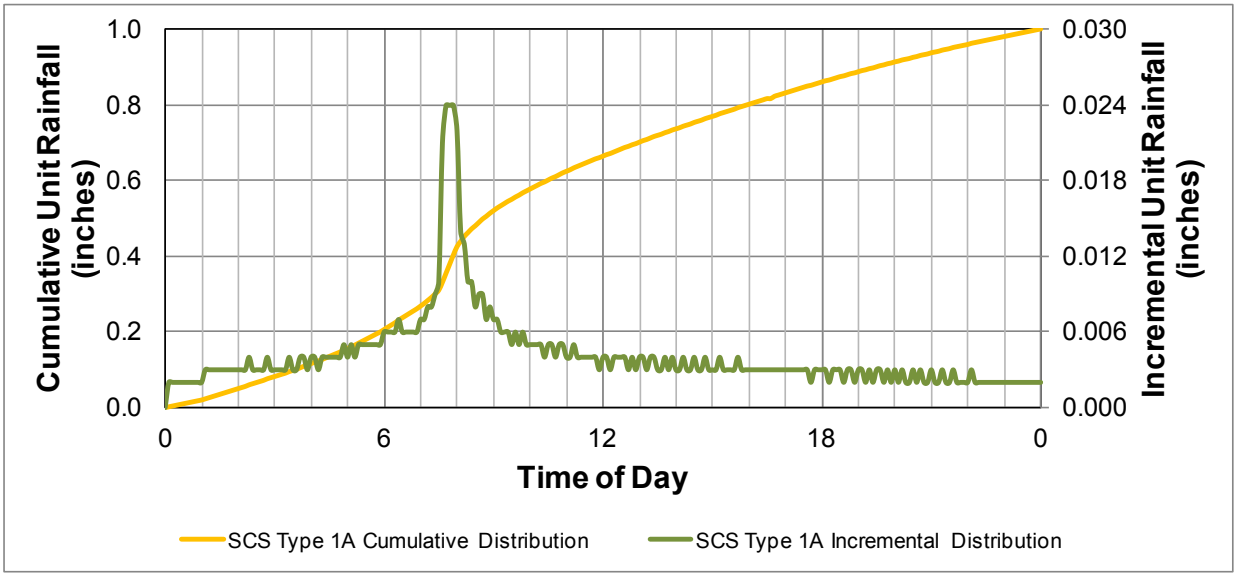


Figure 4.1 Design Storm Distribution

4.2.3 Soil Imperviousness

For stormwater modeling, the key factor relating land use to runoff is "effective percent imperviousness." Rainfall on impervious surfaces is not subject to losses by infiltration into the soil; the only losses in impervious areas are due to depression storage. All initial losses for impervious areas, typically 0.02 to 0.08 inches, are assumed to be satisfied by precipitation preceding the design storm.

An impervious surface, in the context of watershed management, refers to any material that prevents the infiltration of water into the soil. While pavement and rooftops are the most prevalent and easily identified types of impervious surface, other types include sidewalks, patios, bedrock outcrops, and compacted soil.

The basin proportion of effective or directly connected impervious area is related to land use, stormwater drainage system configuration, and recurrence interval. If runoff from an impervious area flows directly into a concentrated flow path, e.g., a gutter, it is considered directly connected; if it flows over a pervious area before becoming a concentrated flow, it is considered unconnected. For the City's service area, effective percent imperviousness was determined based on analysis of satellite imagery. This process is discussed in more detail in Chapter 6.

4.3 WATER QUALITY CRITERIA

To effectively manage stormwater pollution in and from the City's service area, the analysis will need to include multiple water quality pollutants. Pollutants of concern consist of any pollutants that exhibit one or more of the following characteristics:

1. Existing loadings or historic deposits of the pollutants are impacting the beneficial uses of receiving waters.
2. Elevated levels of the pollutants are found in sediments of receiving waters or have potential to bioaccumulate.
3. Detectable inputs of the pollutant are at concentration or loads considered potentially toxic to humans and/or flora and fauna.

The pollutants of concern for water quality analysis are those that are anticipated or potentially could be generated from the City at concentrations (based on water quality data collected from land uses similar as those of the City) that exhibit the above characteristics. Identification of the pollutants of concern considered land uses, current 303(d) listings, and Total Maximum Daily Loads (TMDLs) in the Dominguez Channel and Machado Lake discussed in Chapter 3, as well as pollutants that have potential to cause toxicity or bioaccumulate in the City's receiving waters.

Pollutants associated with urban runoff can be generally categorized as sediments, trash, debris, nutrients, trace metals, pesticides, petroleum hydrocarbons, and pathogens. Each of these pollutants categories are described in the proceeding sections of this chapter.

4.3.1 Sediments

Excessive erosion, transport, and deposition of sediment in surface waters can result in significant water quality problems. Sediment, typically expressed in total suspended solids (TSS) or turbidity imbalances impair waters' designated uses, and also impair aquatic life. Excessive sediment can cause taste and odor problems in drinking water supplies and block water intake structures. Many common stormwater pollutants such as phosphorus, some heavy metals, and hydrocarbons are often found strongly attached to sediment particles. For these reasons, sediment is considered a pollutant of concern for this study.

4.3.2 Trash and Debris

Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic debris (such as leaves, grass cuttings, and food waste) are general waste products on the landscape that can be entrained in urban runoff. The presence of trash and debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a water body and thereby lower its water quality. Additionally, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions, which

results in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

A component of debris is plastic pellets. Plastic pellets are formed from raw plastic resin and used in plastic manufacturing, and can enter the stormwater system through routine handling or spillage at facilities which process, transports, recycles, or manufacture plastics. Plastic pellets represent a potential danger to marine life through release of additives within the plastic and the ability of the plastic pellets to absorb or transport toxics, such as PCBs and DDT (HTB, 2010). EPA notes that the toxic effects of ingestion of plastic pellets is currently unknown, recommending further study (EPA, 2011b).Currently, the City tracks 13 industrial facilities within its service area that handle plastic pellets.

4.3.3 Nutrients

Nutrients such as nitrogen and phosphorus are essential for the proliferation of plants and animals. However, an excess of these nutrients in surface waters can over-stimulate biological growth, which can cause algal blooms and lead to eutrophication. Eutrophication is a natural aging process of surface waters and is usually accelerated by human activities. Changes in algae, benthic, and fish communities can develop from eutrophication due to excessive nutrient input; extreme eutrophication can cause hypoxia or anoxia, resulting in fish kills. Urban areas have several sources of nutrients, which are mainly from fertilizers in lawn runoff, pet waste, failing septic systems, and atmospheric deposition from industry and automobile emissions.

Unlike nitrogen, phosphorus only occurs in combined form in nature. Phosphate compounds are the most common forms of phosphorus found in water and they include orthophosphate, polyphosphate, and organic phosphate. The soluble form of phosphorus, orthophosphate, is readily available to plants and microorganisms. Phosphates are contained in animal waste, fertilizers, pesticides, detergents, and naturally in rocks. The most likely sources of phosphate in urban stormwater are runoff from lawns and landscaped areas, and industrial and commercial effluent.

Because nutrients are common urban stormwater pollutants and downstream receiving waters are currently impaired for nutrients, these constituents are considered pollutants of concern for this study. The nutrient forms of most concern are nitrate-nitrogen, ammonia, Total Kjeldahl Nitrogen (TKN), and dissolved phosphorus. However, the impact assessment will also consider total nitrogen and total phosphorus, since numeric benchmarks are available for comparison to these constituents.

4.3.4 Trace Metals

The primary sources of trace metals in stormwater are typically from commercially available metals used in transportation (e.g., automobiles), buildings, and infrastructure. Metals are also found in fuels, adhesives, paints, and other coatings. Copper, lead, and zinc are the

most prevalent metals typically found in urban runoff. Other trace metals, such as cadmium, chromium, and mercury, are typically not detected in urban runoff or are detected at very low levels (LADPW, 2000). Metals are of concern because of the potential for toxic effects on aquatic life and the potential for groundwater contamination. High metal concentrations can lead to bioaccumulation in fish and shellfish and affect beneficial uses of receiving waters. These metals are considered to be pollutants of concern for the analysis; this classification is attributable to the Dominguez Channel being listed as impaired for copper, lead, and zinc in addition to the prevalence of those same metals in urban stormwater . While copper and zinc are often found in both dissolved and particulate forms in urban runoff, dissolved lead is rarely detected (LADPW, 2000). As such, the impact assessment will only consider total lead concentrations and loads; however, both total and dissolved concentrations and loads will be considered for copper and zinc. The Dominguez Channel was listed for chromium in 2002; however, this listing was removed from the 2006 303(d) list. (LACDPW) Since this metal is rarely detected in stormwater at concentrations of concern, it will be addressed qualitatively.

4.3.5 Pesticides

Pesticides (including herbicides, insecticides, and fungicides) are chemical compounds commonly used to control insects, rodents, plant diseases, and weeds. Excessive application of a pesticide may result in runoff containing toxic levels of its active component. Pesticides may be generally classified as organochlorine pesticides or organophosphorus pesticides, the former is associated with persistent bioaccumulative pesticides (e.g., Dichlorodiphenyltrichloroethane (DDT) and the latter with legacy pesticides), which have been banned. The City's receiving waters are currently listed as impaired for several pesticides including chlordane, DDT, and dieldrin. Due to insufficient data to model pesticides from the City's land uses, this pollutant cannot be analyzed with the model. Instead, a qualitative assessment of potential impacts to pesticides is provided.

4.3.6 Petroleum Hydrocarbons

The sources of oil, grease, and other petroleum hydrocarbons in urban areas include spillage fuels and lubricants, discharge of domestic and industrial wastes, atmospheric deposition, and runoff. Runoff can be contaminated by leachate from asphalt roads, wearing of tires, and deposition from automobile exhaust. Additionally, do-it-yourself auto mechanics may dump used oil and other automobile-related fluids directly into storm drains.

Petroleum hydrocarbons, such as polycyclic aromatic hydrocarbons (PAHs), can bioaccumulate in aquatic organisms from contaminated water, sediments, and food and are toxic to aquatic life at low concentrations. Hydrocarbons can persist in sediments for long periods of time and result in adverse impacts on the diversity and abundance of benthic communities. Hydrocarbons can be measured as total petroleum hydrocarbons (TPH), oil and grease, or as individual groups of hydrocarbons, such as PAHs. The City's receiving waters are currently listed as impaired for PAHs including benzo(a)pyrene, chrysene,

phenanthrene, and pyrene. Due to insufficient data for modeling PAHs from the City's land uses, a qualitative assessment of potential impacts to PAHs is provided in Chapter 7. The generation of PAHs at concentrations that would pose a risk to humans and/or flora and fauna are not anticipated.

4.3.7 Pathogens (Bacteria, Viruses, and Protozoa)

Elevated levels of pathogens (such as bacteria, viruses, and protozoa) are typically caused by the transport of domestic animal, wildlife, or human fecal wastes from the watershed. Runoff that flows over land, such as urban runoff, can mobilize pathogens, including bacteria and viruses. Even runoff from natural areas can contain pathogens (e.g., from wildlife). Other pathogen sources in urban areas include pets and leaky sanitary sewer pipes. The presence of pathogens in runoff can impair receiving waters and contaminate drinking water sources. Elevated pathogens are typically caused by the transport of animal or human fecal wastes from the watershed. Historically, an indicator organism, such as fecal coliform, has been used for pathogens due to the difficulty of monitoring for pathogens directly. More recently, the scientific community has questioned the use of coliform as an indicator organism. Scientific studies show no correlation between coliform as an indicator organism and pathogen levels; therefore, total and fecal coliform may not indicate a significant potential to cause human illness (Paulsen and List, 2003). For lack of a better alternative, and because the Dominguez Channel is listed as impaired for coliform, these indicators will still be assessed with respect to the City's potential to impact pathogen levels in receiving waters. Pathogens will be assessed qualitatively because there are no statistically reliable data for these indicators to use in land use-based annual loads modeling.

4.3.8 Summary of Pollutants of Concern

The evaluation approach for each pollutant category is summarized in Table 4.2.

Table 4.2 Summary of Pollutants of Concern

Pollutants	Evaluation Approach	
	Modeled	Qualitative Analysis
TSS	√	
Turbidity		√
Nutrients	√	
Trace Metal (Copper, Lead, and Zinc)	√	
Petroleum hydrocarbons		√
Pesticides		√
Trash and Debris		√
Pathogens		√

As shown in Table 4.2, the stormwater hydraulic model was used to evaluate the TSS, nutrients, and trace metals. Based on availability of reliable data, a qualitative analysis was provided for the other pollutant categories.

4.4 SUMMARY OF EVALUATION CRITERIA

Table 4.3 summarizes the evaluation criteria for this study. Note that water quality criteria listed are targets and interim targets may apply (as discussed in Chapter 3).

Table 4.3 System Evaluation Criteria

CATEGORY Parameter	Evaluation Criteria		Source
HYDRAULIC CRITERIA			
Water Surface Elevation	> Overflow Elevation		
Gravity Storm Drains	Capacity[1]		
Force Mains - Velocity	10	fps	
Natural Channels - Velocity	5	fps	
Pump Stations	Capacity[1]		
HYDROLOGIC CRITERIA			
Design Storms			LACDPW
	2	year	
	5	year	
	10	year	
	25	year	
	50	year	
	100	year	
Imperviousness	Generated from Satellite Imagery	WorldView	
WATER QUALITY CRITERIA			
Sediments			
TSS			
Turbidity	Qualitative Analysis		
Trash and Debris			
Trash (Machado Lake)	No Trash	Machado Lake TMDL	
NUTRIENTS			
Nitrogen	3,008	kg	Machado Lake TMDL
Phosphorous	301	kg	Machado Lake TMDL
Trace Metals			

Table 4.3 System Evaluation Criteria

CATEGORY Parameter	Evaluation Criteria		Source
Copper (Dominguez Channel)	207.51	µg/l	LALB Harbor Waters TMDL
Lead (Dominguez Channel)	122.88	µg/l	LALB Harbor Waters TMDL
Zinc (Dominguez Channel)	898.87	µg/l	LALB Harbor Waters TMDL
Pesticides	Qualitative Analysis		
Petroleum Hydrocarbons	Qualitative Analysis		
Pathogens	Qualitative Analysis		

Notes:
1. Evaluated for whether capacity is exceeded or not.

Chapter 5

EXISTING STORMWATER SYSTEM

The stormwater system within the City of Torrance's (City's) service area consists of approximately 60 miles of storm drains, about 2,000 catch basins, and 2 miles of open channels. While most of the small- and medium-diameter stormwater drains and catch basins are maintained by the City, many of the large-diameter stormwater drains and channels are maintained by the Los Angeles County Department of Public Works (LACDPW). In addition, many smaller drains and catch basins are the responsibility of individual property owners.

5.1 WATERSHED OVERVIEW

The City's service area falls within two watersheds, the Dominguez Channel watershed and the Santa Monica Bay watershed. Although it is technically a part of the Dominguez Channel watershed, the Machado Lake Sub-Watershed discharges into Los Angeles Harbor rather than the Dominguez Channel. A portion of the City's service area falls within the Machado Lake Sub-Watershed. The Walteria Subbasin discharges in the Machado Lake Sub-Watershed. Delineation of the subbasins into subareas is discussed in greater detail in Chapter 6.

5.2 COLLECTION SYSTEM

The City's collection system includes an interconnected network of storm drains, open channels, and force mains that collect stormwater and direct it toward discharge locations.

5.2.1 Catch Basins

While not evaluated as a part of this project, the 1997 Storm Drain Master Plan (SDMP) estimated that the City owns and maintains about 1,400 catch basins within its service area, while LACDPW maintains about 1,000 catch basins within the City's service area. The tentative Los Angeles County Municipal Separate Storm Sewer System (MS4) permit estimated about 2,000 catch basins within the City's service area.

5.2.2 Storm Drains

According to the 1997 SDMP, the City's storm drains include about 59 miles of storm drains and laterals, ranging from 6 to 102 inches in diameter. The majority of the City's storm drains are constructed from reinforced concrete pipe (RCP), with some pipeline segments constructed from corrugated metal pipe (CMP), asbestos cement pipe (ACP), vitrified clay pipe (VCP), and polyvinyl chloride (PVC) and some constructed as reinforced concrete box (RCB) structures. In addition, the 1997 SDMP estimated that about 51.6 miles of storm drains are maintained by LACDPW.

5.2.3 Open Channels and Ditches

The City's stormwater system also includes about 9,000 feet of channeled drains, including six channels, a ditch, a wash, and a marsh. In addition, LACDPW maintains three channels: the Dominguez Channel, which traverses the northeast corner of the City's service area; a drainage channel southwest of the ExxonMobil Refinery, which drains the industrial facilities in the area; and about 2,000 feet of channels in the vicinity of South Torrance High School.

5.2.4 Force Mains

Discharge from many of the City's detention basins is conveyed through force mains into other storm drain lines.

5.3 STORM DRAIN RETENTION/DETENTION BASINS

The City's stormwater system includes 12 active retention and detention basins that are used to store stormwater. These basins are described in the two following subsections. It should also be noted that the City's stormwater system included eight additional basins that are no longer in use as a part of the stormwater system.

5.3.1 Detention Basins

The City's stormwater system includes nine active detention basins as listed in Table 5.1.

Table 5.1 Active Detention Basins

Basin Name	Volume (af)	Surface Elevation (ft-MSL)	Discharge Type	Discharge Body	Discharge Capacity (cfs)
Entradero	85	78	Gravity	Herondo Drain	107.0
Henrietta	101	66	Pumped	Herondo Drain	60.0
Amie Avenue	135	70	Pumped	Herondo Drain / Dominguez Channel(1)	13.0
Susana/Doris Way	18	55	Pumped	Santa Monica Bay	80.0
Walteria Lake	1,005	64	Pumped	Machado Lake	57.0
Madrona Marsh	81	75	Pumped	Walteria	30.0
El Dorado Street	14	75	Pumped	Harbor Lakes	5.0
Pioneer Avenue	45	81	Pumped	ExxonMobil Refinery detention basin	9.5
Total	**1,484**				

Note:
(1) The Amie Avenue detention basin discharges dry weather flows to the Dominguez Channel watershed. Existing outlet capacity of force main and pump station to the Herondo Drain is 13 cfs according to the Santa Monica Bay Predesign of BMPs (Carollo, 2008).

It should be noted that Walteria Lake, though listed in Table 5.1, is owned and operated by Los Angeles County. Not listed in Table 5.1 is the ExxonMobil Refinery detention basin, which is privately owned and discharges to the Dominguez Channel. Each of the basins is discussed in more detail below.

Entradero Basin

Entradero Basin is bounded by Towers Street on the north, Halison Street on the south, Ronald Avenue on the west, and Surgess Street on the east. The basin has 25.6 acres of surface area with a tributary area of 463 acres. The basin has an available volume of approximately 85 acre-feet and receives water from three inlets and the Entradero Channel. The basin has an existing outflow capacity of 107 cubic feet per second (cfs) (48,000 gpm). Stormwater is discharged to LACDPW Project Number 1105, which drains through Redondo Beach into the Santa Monica Bay via outlet SMB6-1. This basin has earthen slopes and existing trees and vegetation. It has five baseball fields constructed for little league throughout the basin. In addition, the basin has a residential park and a dog park on the north end. Flows from the Entradero Channel are directed to the sump area by makeshift berms.

Henrietta Basin

Henrietta Basin is located at Henrietta Street between Edgemere Drive and Sara Drive. The basin has 6.9 acres of surface area with a tributary area of 594 acres. The basin has an available volume of approximately 101 acre-feet and receives runoff pumped from the Amie Basin and local stormwater through two additional inlets. The basin has an existing outflow capacity of 60 cfs (26,900 gpm) and the water flows into the outlet and to the Los Angeles County Flood Control District Project No. 1105, which drains through Redondo Beach into the Santa Monica Bay via outlet SMB6-1. This basin has earthen slopes, existing trees, vegetation, and fauna.

Amie Avenue Basin

Amie Basin is located at Spencer Street between Hawthorne Boulevard and Prairie Avenue. The basin has 4.3 acres of surface area with a tributary area of 396 acres. With an available volume of 135 acre-feet and an existing outflow capacity of 13 cfs, runoff from the basin is pumped via a 24-inch diameter force main and gravity line to the Henrietta Basin; or is diverted to the Dominguez Channel through a 10-inch diameter pipeline. The basin has steep sloped concrete walls and an unlined bottom with three inlets. Currently, the basin consists of two small ponds. The basin's dry-weather flow includes the start-up water from two "desalters" located in the drainage area that treat well water.

Susana Avenue and Doris Way Basins

The Susana Avenue and Doris Way Basins are located along the City's west boundary between Pacific Coast Highway and Palos Verdes Boulevard. Runoff from the area west of Seaside Elementary School is collected at these basins. Susana Avenue Basin also collects some runoff from the area of the City north of Palos Verdes Boulevard. The Doris Way Basin consists of two baseball fields. The basins have a combined volume of about 18 acre-feet and an existing outflow capacity of 80 cfs. The basins have 3.5 acres of surface area with a tributary area of about 273 acres. Discharge from the Susana Avenue Basin is conveyed by a pipeline to the Doris Way Basin, from which flow is discharged through a pipeline into the LACDPW storm drains within Redondo Beach, ultimately discharging to the Santa Monica Bay.

Walteria Lake

Walteria Lake is located west of Hawthorne Boulevard, between 234th Street and 238th Street. The basin has 26 acres of surface area with a tributary area of 2,287 acres. Walteria Lake is owned and operated by LACDPW and has a volume of about 1,005 acre-feet. LACDPW maintains a 57 cfs pump station that discharges stormwater from the lake into Machado Lake through the 54-inch diameter Wilmington Drain.

Madrona Marsh

Madrona Marsh is located north of Sepulveda Boulevard between Madrona Avenue and Maple Avenue. The basin is a vernal marsh consisting of natural habitat and is used as a nature preserve. The basin consists of about 6.5 acres of surface area with a tributary area of 251 acres. With an available volume of 81 acre-feet and an existing outflow capacity of 30 cfs, runoff from the basin is pumped via a pipeline to Walteria Lake.

El Dorado Street Basin

El Dorado Street Basin is located about half a mile north of Madrona Marsh, east of Maple Avenue and north of El Dorado Street. The basin is surrounded by trees, consisting of about 0.13 acres of surface area with a tributary area of 64 acres. With an available volume of 14 acre-feet and an existing outflow capacity of 5 cfs, runoff from the basin is pumped via a pipeline into the City's storm drain system discharging into LACDPW's stormdrain system at the east boundary of the City near Torrance Boulevard.

Pioneer Avenue Basin

Pioneer Avenue Basin is located northwest of Prairie Avenue south of the railroad north of Del Amo Boulevard. The basin collects runoff from the surrounding industrial park to the west and is located west of the ExxonMobil Refinery. The basin consists of about 2.8 acres of surface area with a tributary area of 120 acres. With an available volume of 45 acre-feet and an existing outflow capacity of 9.5 cfs, runoff from the basin is pumped to the ExxonMobil Refinery detention basin, located about a mile to the east. The ExxonMobil Refinery detention basin is privately owned and discharges to the Dominguez Channel.

5.3.2 Retention Basins

In addition to the nine detention basins, the City's stormwater system includes three active retention basins that are used to percolate stormwater into the groundwater basin. There are no discharges from these basins. Table 5.2 lists the City's three active retention basins along with volume and location.

Table 5.2 Active Retention Basins

Basin Name	Volume (af)	Design Surface Elevation (ft-MSL)	Location
Bishop Montgomery	122	84	Palos Verdes Boulevard and Torrance Boulevard
Ocean Avenue	229	79	Ocean Avenue and Sepulveda Boulevard
Del Amo Center	86	75	Madrona Avenue and Plaza Del Amo
Total	**437**		

The City worked with the RWQCB to recognize the tributary areas to these basins as sub-regional BMPs for permit and TMDL compliance. Since these basins do not discharge to Section 303(d) listed impaired bodies of water, TMDLs are not applicable to stormwater discharge from the tributary areas to these basins.

It should be noted that the Del Amo Center retention basin, though listed in Table 5.2, is privately owned.

5.4 STORM DRAIN PUMP STATIONS

As mentioned in Section 5.3.1, seven of the City's detention basins discharge stormwater using pump stations. Table 5.3 presents capacities and discharge bodies for each of the City's pump stations.

As shown in Table 5.3, the City's pump stations have a combined capacity of nearly 300 cfs.

Table 5.3 Pump Stations

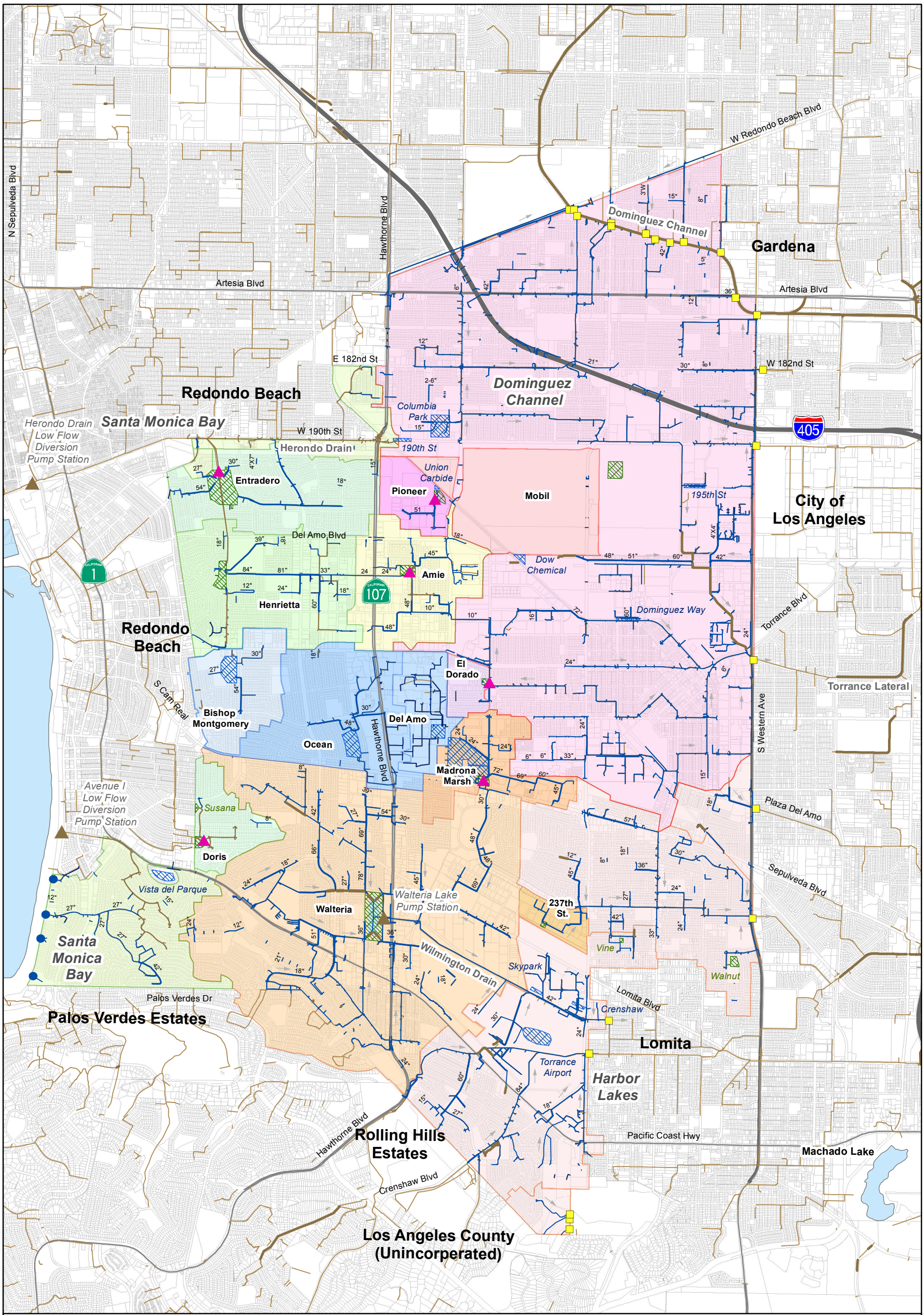
Basin Name	Discharge Body	Capacity (cfs)
Entradero	Herondo Drain	100.0
Amie Avenue	Dominguez Channel	8
Susana/Doris Way	Santa Monica Bay	80
Walteria Lake	Machado Lake	57
Madrona Marsh	Walteria	30
El Dorado Street	Harbor Lakes	5
Pioneer Avenue	ExxonMobil Refinery detention basin	10
Total		**290**

5.5 DISCHARGE LOCATIONS

The City's stormwater system discharges into LACDPW storm drains at several locations which are indicated on Figure 5.1. As shown in this figure, these points of discharge are primarily located along the east boundary of the City's service area. In addition, there are several discharge locations along the Dominguez Channel in the northeast portion of the City.

The stormwater collection system shown on Figure 5.1 also shows how stormwater is routed throughout the City. In general, the routing is as follows:

- Stormwater from the east side of the City is ultimately routed to the Long Beach and Los Angeles Harbors via the Dominguez Channel and Machado Lake.
- Stormwater from the west side of the City, stormwater discharge is routed to Santa Monica Bay.
- Stormwater from the northwest areas of the City's service area that are within the Santa Monica Bay watershed, is routed through LACDPW's Herondo Drain, which discharges stormwater into the Santa Monica Bay at the Redondo Beach King Harbor Marina and Pier. The Herondo Drain is also equipped with a low flow diversion pump station, which diverts dry weather flows into the sewer system.
- Stormwater from the southwest areas of the City's service area that are within the Santa Monica Bay watershed, is either directly discharged into Santa Monica Bay at Torrance Beach, passing through one of several Continuous Deflective Separation (CDS) units or is routed into LACDPW's storm drain network within Redondo Beach, which passes through the Avenue I Low Flow Diversion Pump Station, diverting dry weather flows to sanitary sewer.


N Sepulveda Blvd
Hawthorne Blvd
Artesia Blvd
W Redondo Beach Blvd
Dominguez Channel
Gardena
Artesia Blvd
E 182nd St
W 182nd St
Redondo Beach
Santa Monica Bay
Herondo Drain
Low Flow
Diversion
Pump Station
W 190th St
Herondo Drain
Columbia
Park
Dominguez
Channel
190th St
Union
Carbide
Pioneer
Mobil
195th St
City of
Los Angeles
405
Entradero
Del Amo Blvd
Amie
Dow
Chemical
Henrietta
Redondo
Beach
Dominguez Way
Torrance Blvd
El
Dorado
Torrance Lateral
S Cam Real
Bishop
Montgomery
Del Amo
Hawthorne Blvd
Ocean
Madrona
Marsh
S Western Ave
Avenue I
Low Flow
Diversion
Pump Station
Susana
Doris
Plaza Del Amo
Vista del Parque
Walteria Lake
Pump Station
Walteria
237th
St.
Sepulveda Blvd
Santa
Monica
Bay
Vine
Walnut
Wilmington Drain
Skypark
Lomita Blvd
Crenshaw
Palos Verdes Dr
Palos Verdes Estates
Lomita
Torrance
Airport
Harbor
Lakes
Pacific Coast Hwy
Machado Lake
Hawthorne Blvd
Rolling Hills
Estates
Crenshaw Blvd
Los Angeles County
(Unincorperated)
LEGEND
Watersheds
Groundwater Replenishment
Bishop Montgomery
Del Amo
Ocean
Vista Del Parque
Dominguez Channel
Surface Drainage
Eldorado
Mobil
Pioneer
Santa Monica Bay
Surface Drainage
Amie
Doris
Entradero
Henrietta
Harbor Lakes
Surface Drainage
237th St.
Madrona Marsh
Walteria
Facilities
Storm Drains
(Thickness Related to Size)
Open Channels
LACDPW Stormwater System
Flow Direction
Detention Basin
Retention Basin
Pump Stations
by Owner
LACDPW
City
Continuous Deflective Separator
Discharge to Storm Drain
Others
Bodies of Water
Parcels
0 0.2 0.4 0.8
Miles
Figure 5.1
Existing Stormwater System
Stormwater Quality Master Plan
City of Torrance
carollo
Engineers...Working Wonders With Water™

Chapter 6

MODEL DEVELOPMENT

6.1 METHODOLOGY

Detailed water quantity (hydrologic and hydraulic) and water quality models were developed to analyze the water quantity and water quality response of the City of Torrance's (City's) stormwater system. Development of the models included the following major components:

- Develop new hydrologic and hydraulic models.
- Develop pollutant-loading tool for the water quality analysis.
- Extract impervious information from satellite imagery.

After development of the model, calibration of the model was performed by comparing the model results to Los Angeles County's watershed model results.

Following model development and calibration, analysis was conducted by simulating design storms to identify problem areas for flood control and water quality, and by recommending solutions for flooding and water quality. This process will be discussed in more detail in Chapters 7 through 9.

6.2 MODEL SOFTWARE SELECTION

Levels of detail in stormwater computer models range from planning-level models, which calculate runoff hydrographs and route flows, to more sophisticated design, operational, and water quality models, which evaluate complex hydraulic structures, flood elevations, and water quality parameters. More complex models require calibration using verification data (rainfall, runoff, streamflow, and water quality) and detailed system information including overflow elevations, stream cross-sections, as-built information for hydraulic structures, base flow measurements, and outfall conditions (river stage or tidal elevation). Separate models were selected for portions of the water quality and water quantity analysis.

6.2.1 Water Quantity

As is typical for a master plan, the project team and City staff determined a planning level model was appropriate for the stormwater quantity analysis. A significant amount of additional data collection would be required to construct the more complex operational-level model. Specifically, all channels and culverts should be surveyed, and flow and rainfall gauges installed on major tributaries. Future model enhancements are anticipated as data becomes available, and the software used is capable of including operational and water quality analyses.

XPSWMM (XP Software, Inc.) was selected as the model to use for this study. The following factors were considered:

- Watershed characteristics.
- Availability of required data.
- Cost of and time for setting up and running.
- Potential model enhancement to incorporate complex hydraulics.
- Potential model enhancement for flood level evaluation.
- Potential model enhancement to simulate water quality.
- Potential for the City to use as an ongoing planning, design, and operational tool.

XPSWMM was judged the most appropriate and cost effective means to analyze current conditions and future needs.

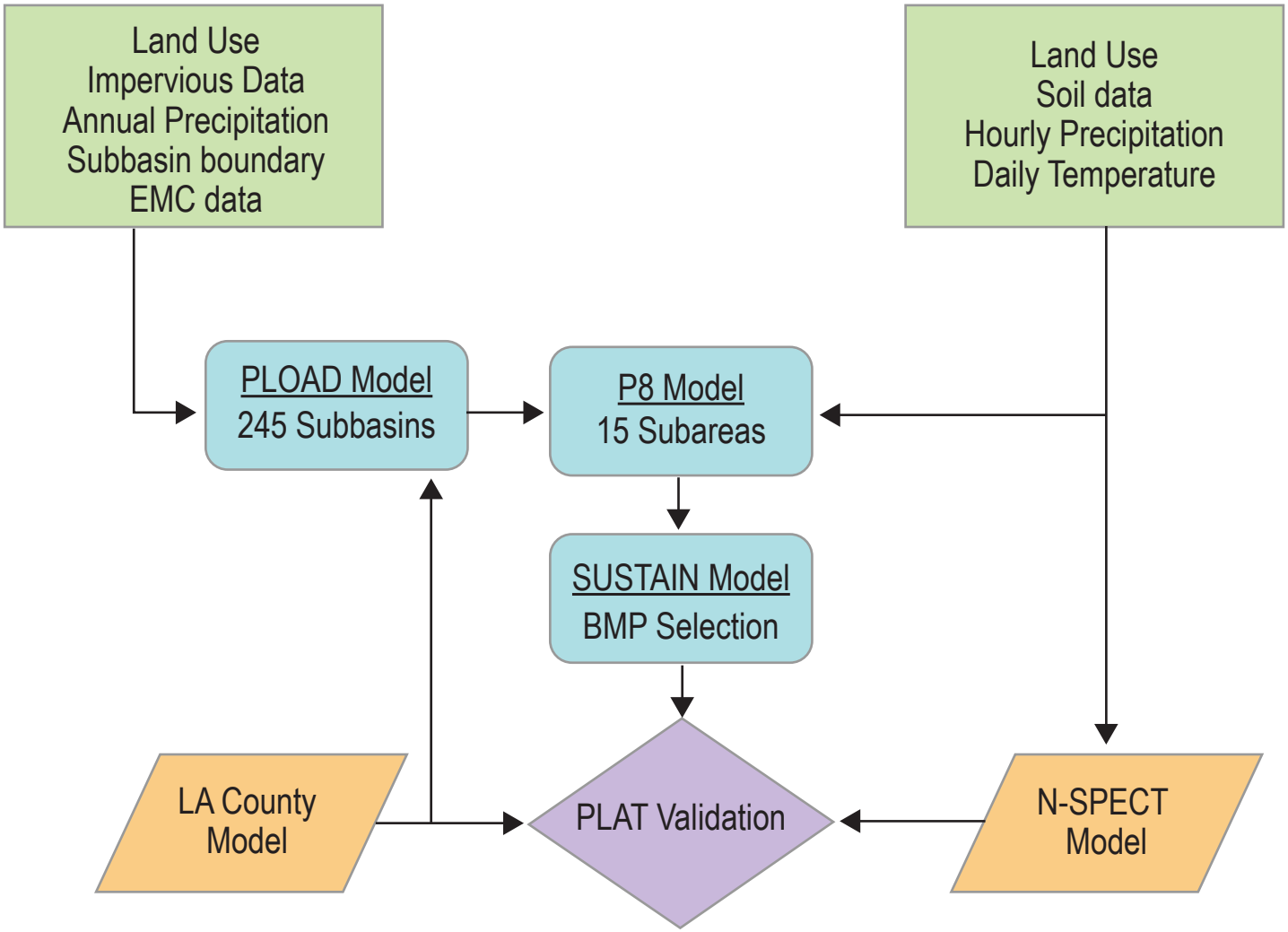
6.2.2 Water Quality

A number of commonly used and well-documented models were selected and used for water quality modeling and analysis. The models were combined to create a tool for the City to analyze pollutant loadings. The tool called PLAT (Pollutant Loading and Analysis Tool) refers to a collection of commonly used watershed models. The main models are PLOAD, Program for Predicting Pollution Particle Passage thru Pits, Puddles, & Ponds (P8), and SUSTAIN models. Two other models, Los Angeles County Watershed Management Modeling Systems (WMMS) and N-SPECT (Nonpoint Source Pollution and Erosion Comparison Tool) are employed for validation. A schematic of PLAT is presented on Figure 6.1.

As shown on Figure 6.1, land use, imperviousness, and precipitation information are used in conjunction with PLOAD model to generate annual pollutant load for each of the three watershed studied.

PLAT has five main components:

1. Extraction of hydrologic and water quality parameters from satellite imagery
2. Pollutant loading
3. Pollutant prioritization.
4. BMP screening.
5. BMP design and optimization.



SCHEMATIC OF PLAT

FIGURE 6.1

The Los Angeles County WMMS model was used to calibrate PLOAD model, verify PLAT outputs, and assess total maximum daily load (TMDL) compliance. The Non-Point Source Pollution and Erosion Comparison Tool (N-SPECT) was used to verify pollutant loads computed by PLOAD and P8. The functions of each of the models used to develop PLAT are summarized in Table 6.1. Each PLAT component is discussed in detail in the following paragraphs.

Table 6.1 Functions of PLAT Components

Model	Function
Satellite Remote Sensing	1. Derive impervious cover information. 2. Pollutant prioritization.
PLOAD	1. Estimate pollutant loading using simple method. 2. Identify pollutant loading hot spots. 3. Screen structural BMPs. 4. Calibrate P8 model.
P8	1. Generate and route pollutant loading. 2. Screen and conduct preliminary BMP sizing. 3. Conduct flow diversion scenarios. 4. Conduct both storm event based and continuous simulation. 5. Generate input data for SUSTAIN.
SUSTAIN	1. Conduct BMP optimal siting. 2. Detailed BMP sizing. 3. BMP optimization. 4. Assess TMDL compliance.
Los Angeles County WMMS Model	1. Calibrate PLOAD model. 2. Verify SUSTAIN results. 3. Assess TMDL compliance.
N-SPECT	1. Validate PLOAD and P8 pollutant load estimates.

6.2.3 Satellite Remote Sensing

Satellite remote sensing information provides an effective way for monitoring land use/land cover changes in urban areas through mapping variations in anthropogenic impervious surfaces. Impervious surface area (ISA) is considered a key indicator of environmental quality and is also used to identify extent of urban land use because it is highly related to urban land use categories and development density (Xian and Crane, 2005). In addition, ISA can be measured fast and economically by using multi-temporal satellite remotely sensed information. The longtime records available from land remote sensing data makes it possible to quantitatively estimate spatial and temporal variations of land use/cover conditions.

Ground surveys are expensive and generally not practical for mapping impervious surfaces of large areas such as the City's service area. While GPS is useful for assisting in collecting field data, it is not easily implemented for mapping large areas either. Remote sensing, in the form of aerial photography, has been an important source of land use-land cover information for many years and impervious surface area can be readily interpreted from aerial photographs (Draper and Rao, 1986). However, the cost of aerial photography acquisition and interpretation of cover types is prohibitively expensive for large geographic areas. An alternative is to acquire the needed information from digital satellite imagery such as the Landsat Thematic Mapper (TM) or Enhanced Thematic Mapper Plus (ETM+), WorldView, IKONOS, and QuickBird. This approach has several advantages:

1. The synoptic view of the sensor provides large area coverage,
2. The digital form of the data lends itself to efficient analysis,
3. The classified data are compatible with geographic information systems (GIS), eliminating the need to digitize interpreted information, and
4. Land cover maps can be generated at considerable less cost than by other methods.

A number of studies have demonstrated the feasibility of using multispectral satellite data to classify impervious surface area in urban environments. In this study, a high-resolution WorldView satellite imagery acquired on July 10, 2010 was used for ISA mapping. Examples are presented in Figure D.4 of Appendix D.

DigitalGlobe's WorldView-2, the world's newest high-resolution commercial color imaging satellite, was launched on October 8, 2009 from Vandenburg Air Force Base in California. WorldView-2 is the first high-resolution satellite with 8-multispectral imaging bands. It can simultaneously collect panchromatic imagery (black and white) at 0.46 m grid resolution and multispectral imagery at 1.84 m grid resolution. The satellite provides full-color images for enhanced spectral analysis, mapping and monitoring applications, land-use planning, disaster relief, exploration, defense and intelligence, and visualization and simulation environments. The combination of WorldView-2's increased agility and high altitude enables it to typically revisit any place on earth in 1.1 days.

6.2.4 PLOAD

The PLOAD model was originally developed to calculate pollutant loads for urban and suburban watersheds, which was subsequently adopted by the United States Environmental Protection Agency (USEPA) for watershed management planning and was integrated into the BASINS model (USEPA 2001). PLOAD determines pollutant load from a watershed based on watershed land-use data, percent imperviousness, and pollutant export coefficients or event mean concentrations (EMC) values based on either observed data or available literature. It is commonly used to estimate pollutant loadings on an annual average basis for any user-specified pollutant.

However, PLOAD does not have the ability to estimate conveyance, e.g., it cannot evaluate changes in peak flow or water quality due to transport. The model also cannot accurately be applied to assess loading for short time intervals. Unlike other models such as P8, it also cannot be used to locate and size Best Management Practices (BMPs).

In order to use PLOAD to determine the pollutant load from a watershed, a watershed nutrient budget is developed from various point and non-point sources (NPS) based on watershed land use data, percent imperviousness, and pollutant export coefficients or event mean concentration (EMC) values based on either observed data or available literature. The PLOAD models NPS loads using either the export coefficient method or the simple method, each of which is described as follows. As will be discussed in Section 6.3.2.1, PLAT will utilize the simple method.

6.2.4.1 Export Coefficient Method

The export coefficient method calculates loads for each specified pollutant type by subbasin using the following equation:

$$L_p = \sum_1^u (L_{pu} * A_u) \quad (6.1)$$

where, L_P is the pollutant load in pounds, L_{PU} is the export coefficient for land use type 'U' in pounds per acre per year, and A_U is the area of land use type 'U' in acres.

6.2.4.2 Simple Method

The simple method calculates pollutant loads using two equations (Equations 2 and 3). First, the runoff coefficient for each land use type must be derived with the equation:

$$R_{vu} = 0.05 + 0.009 * I_u \quad (6.2)$$

Where, R_{VU} is the runoff coefficient for land use type 'U', and I_U is the percent of imperviousness area associated with land type 'U'. The percent impervious is extracted from an impervious terrain factor table.

The pollutant loads are then calculated using the following equation:

$$L_p = \sum_1^u \left(\frac{2.72 * P * P_j * R_{vu} * C_u * A_u}{12}\right) \quad (6.3)$$

where, L_P is the pollutant load in pounds, P is the precipitation in inches per year, P_j is the ratio of storms producing runoff, the typical value for which is 0.9, R_{VU} is the runoff

coefficient for land use type 'U', C_U is the event mean concentration for land use type 'U' in milligrams per liter, and A_U is the area of land use type 'U' in acres.

6.2.5 P8 - Urban Catchment Model

The P8 is designed to predict the generation and transport of runoff pollutants in urban watersheds. It consists mainly of methods derived from other tested urban runoff models, including SWMM, HSPF, D3RM, and TR-20. As described in Section 6.2.1, XPSWMM was selected to model water quantity for this Stormwater Quality Master Plan (SQMP). Although XPSWMM has the capability to model water quality, it requires considerable information about the existing drainage system, as well as particle and component data that is not readily available for the City's stormwater system. Furthermore, typical BMPs such as swales are not as easily incorporated into an XPSWMM model in order to evaluate their effectiveness.

The P8 model was developed to design and evaluate development runoff treatment control combinations for pollutant removal efficiency. Although, due to its simplicity, the P8 model has inherent limitations, this model is highly suitable for planning level studies and scenario testing. Model components include stormwater runoff assessment, surface water quality analysis, and routing through structural controls. The model applications include development and comparison of stormwater management plans, watershed-scale land-use planning, site planning, and evaluation for compliance, effectiveness of BMPs, and selection and sizing of management practices.

In P8, continuous water balance and mass balance calculations are performed on a user-defined system consisting of watersheds, devices (runoff storage/treatment areas, BMPs), particle classes, and water quality components. Simulations are driven by continuous hourly rainfall and daily air temperature time series data. The model simulates pollutant transport and removal in a variety of treatment devices (BMPs), including swales, buffer strips, detention ponds (dry, wet, and extended), flow splitters, and infiltration basins (offline and online), pipes, and aquifers. Water quality components include total suspended solids (TSS) (five size fractions), total phosphorus (TP), total Kjeldahl nitrogen (TKN), copper, lead, zinc, and hydrocarbons (Huber et al. 2006). In addition, pollutants can be added or modified by the user and the dataset is easily populated with National Urban Runoff Program (USEPA, 1983) 50th or 90th percentile data on particles and components.

6.2.6 SUSTAIN

To overcome the limitations of P8, the SUSTAIN model is employed to comprehensively size and place BMPs, perform optimization analysis, and assess TMDL compliance. Input for SUSTAIN is derived by P8.

The SUSTAIN model is public domain software developed by USEPA. SUSTAIN includes algorithms for simulating urban hydrology, pollutant loading, and treatment processes

packaged from multiple models that individually address such processes. Users have the option to import time series data from external watershed models (e.g., Hydrologic Simulation Program Fortran (HSPF) or SWMM instead of performing new land simulations in SUSTAIN.

6.3 MODEL CREATION

This study involves independent models for water quantity and water quality evaluations. This section describes technical procedures used to develop the stormwater models to perform the drainage system evaluations.

Relevant GIS databases, aerial photographs, record drawings, and pipeline plan and profile drawings were provided by the City for development of the two models. The watershed inventory, which consisted of collecting, compiling, and evaluating existing data applicable to the SQMP, was conducted. A data search was conducted to identify information to be used by the project team. The digital and hard copy information collected and compiled during the study is provided below:

1. Existing and future land use
2. Record drawings
3. Pipeline plan and profile drawings
4. Aerial photograph
5. Land parcel information
6. Contour data
7. Drainage maps
8. WorldView-2 satellite imagery

As part of the study evaluation processes, numerous new data sets were developed using GIS technology to organize the drainage structures and key results of the study.

6.3.1 Water Quantity

The RUNOFF block of XPSWMM was used to simulate the hydrology or quantity of stormwater runoff that flows overland in each subbasin during a particular storm event. The RUNOFF block output data was generated by the model based on the input parameters listed as follows:

- Area of subbasin.
- Width of subbasin.
- Directly connected impervious area (DCIA) or effective impervious area.
- Ground slope.

- Surface roughness.
- Soil infiltration.
- Rainfall

A discussion of each of these parameters is included in the following paragraphs.

6.3.1.1 Watershed and Subbasin Delineation

Watersheds and subbasins form natural hierarchical dissections of landscapes. Delineation of watersheds and subbasins was accomplished using a digital elevation model (DEM), a collection of discrete elevation points at regularly spaced interval generated from the City's ground elevation contours. Watersheds and subbasins are readily calculated from a DEM across a wide range of spatial scales, provided the DEM represents surface drainage accurately. In order to generate subbasins from a DEM, terrain surfaces are dissected into small, essentially planar, elements bounded by contour lines and flow lines. This produces a natural discretisation of the landscape that reflects the convergence and divergence of surface water flow, simplifying hydrologic analyses.

As an initial part of model development, the study area was divided into 245 subbasins as shown on Figure 6.2. The subbasin boundaries were automatically generated in ArcView GIS. The receiving waters, areas, and number of subbasins per watershed are summarized in Table 6.2.

Table 6.2 Watershed and Subbasin Delineation Summary

Watershed	Receiving Water	Area (ac)	Number of Subbasins
Dominguez Channel	Dominguez Channel	4,878	115
Walteria Lake	Machado Lake via Harbor Lakes network	2,109	49
Harbor Lakes	Machado Lake	2,067	43
Del Amo	Groundwater	169	5
El Dorado	Detention	64	2
Mobil	Detention	474	10
Pioneer	Detention	124	3
Madrona Marsh	Detention	254	6
Ocean	Retention	489	11
237th Street	Detention	69	1
Total	**n/a**	**10,697**	**245**

The subbasins shown on Figure 6.2 form the basis of further delineation based on the type of analysis performed, thus the number of subbasins used by each model is different. The subbasins shown on Figure 6.2 were used pollutant load estimation using PLOAD.

The PLOAD subbasins were further divided into smaller subbasin for water quantity analysis within XPSWMM. The delineation was based on locations and number of stormdrain inlets. These subbasins are shown in Appendix D on Figure D.1. P8 subbasins were derived by combining a number of the PLOAD subbasins and are shown in Appendix D on Figure D.3.

6.3.1.2 Impervious Area

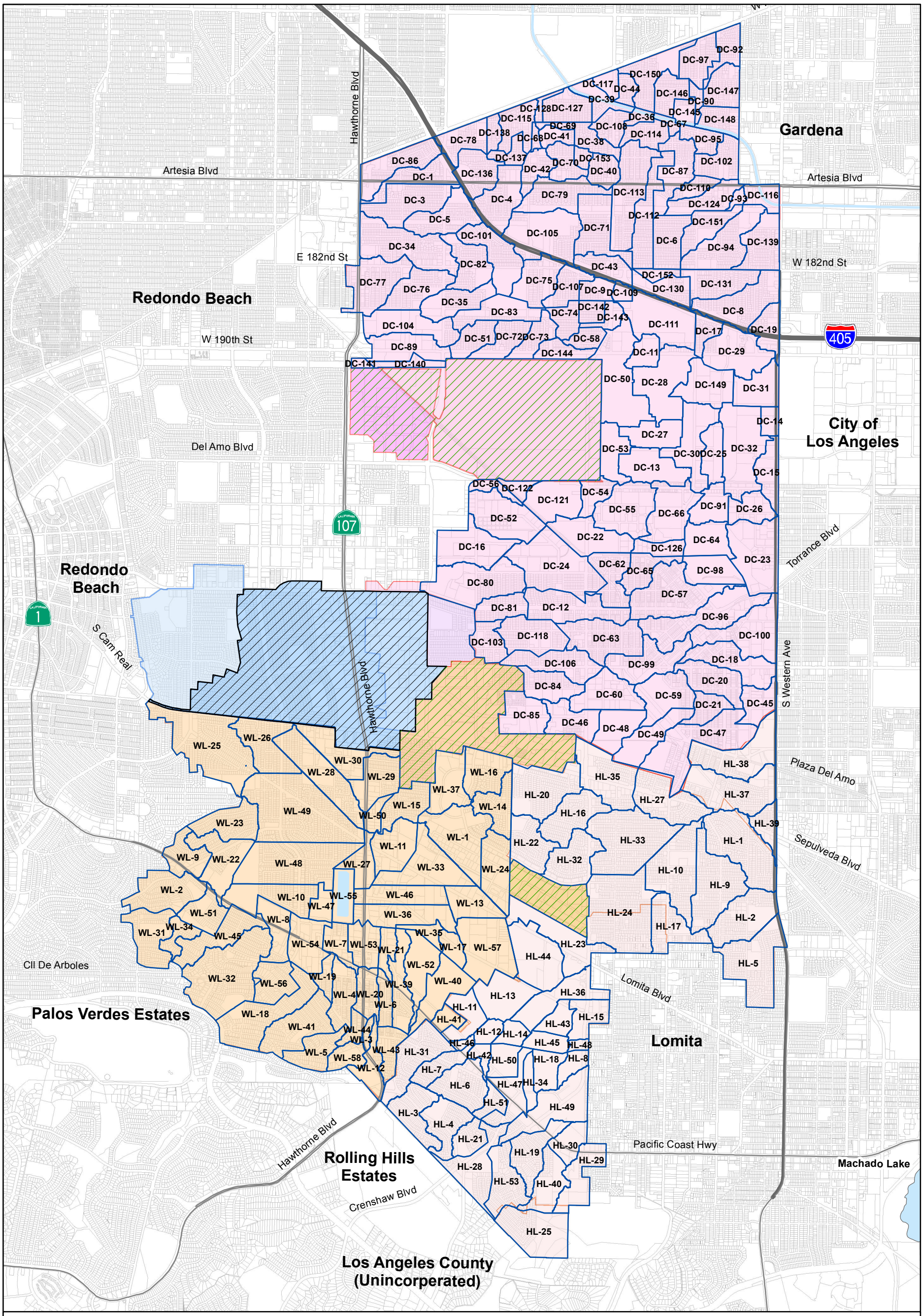
Impervious area was determined based on satellite imagery. As part of this project, the City purchased high-resolution satellite data from WorldView captured on July 10, 2010. The imagery was selected to minimize the impact of cloud cover and atmospheric effects. The imagery was geometrically and radiometrically corrected using standard methods. Terrain correction using the USGS 1-arc second National Elevation Dataset was performed to improve geolocation accuracy. The geo-rectified satellite imagery is shown in Appendix D on Figure D.4.

An image processing model was developed whereby impervious surfaces were extracted from the imagery based on user-defined variables. Within the study area, five image samples, distributed throughout the watershed and encompassing all general land uses were input to the model. Each of the sample images were classified as either pervious or impervious cover. The output was put into GIS for further analysis.

A ground-truth dataset was created by generating a stratified random sample of points across the study area and classifying the points as either pervious or impervious. This step was accomplished via photo interpretation of current high-resolution vertical and oblique color aerial photography.

The completed impervious cover map after image classification and statistical analysis is shown in Appendix D on Figure D.5. The percentage of impervious surface area is depicted as a continuous variable, ranging from 0 to 100 percent imperviousness based on redness. Areas shaded in deep red have the highest percentage of imperviousness, while areas shaded in gray have the lowest percentage of imperviousness.

To confirm that satellite imagery can be used to accurately classify the percent impervious surface area, the satellite estimates were compared to measurements made from aerial photographs provided by the City. The location where the comparison was made is shown in Appendix D on Figure D.4. Figure 6.3 shows the correlation between the percent imperviousness between these two sources. The results indicate that there is a strong relationship between aerial photograph measurements and satellite-derived estimates. Based on the comparison, an impervious cover map was created using satellite imagery for the entire study area.



Legend

- PLOAD Subbasin Boundary
- Excluded From Study Area (Retention Basin)
- Modeled as Point Source in PLOAD

Watersheds

Groundwater Replenishment

- Bishop Montgomery
- Del Amo
- Ocean
- Vista Del Parque

Harbor Lakes

- Surface Drainage
- 237th St.
- Madrona Marsh
- Walteria

Dominguez Channel

- Surface Drainage
- Eldorado
- Mobil
- Pioneer

Other

- Bodies of Water
- Parcels

0 0.2 0.4 0.8 Miles

Figure 6.2
Watershed and Subbasin Delineation for PLOAD
Stormwater Quality Master Plan
City of Torrance

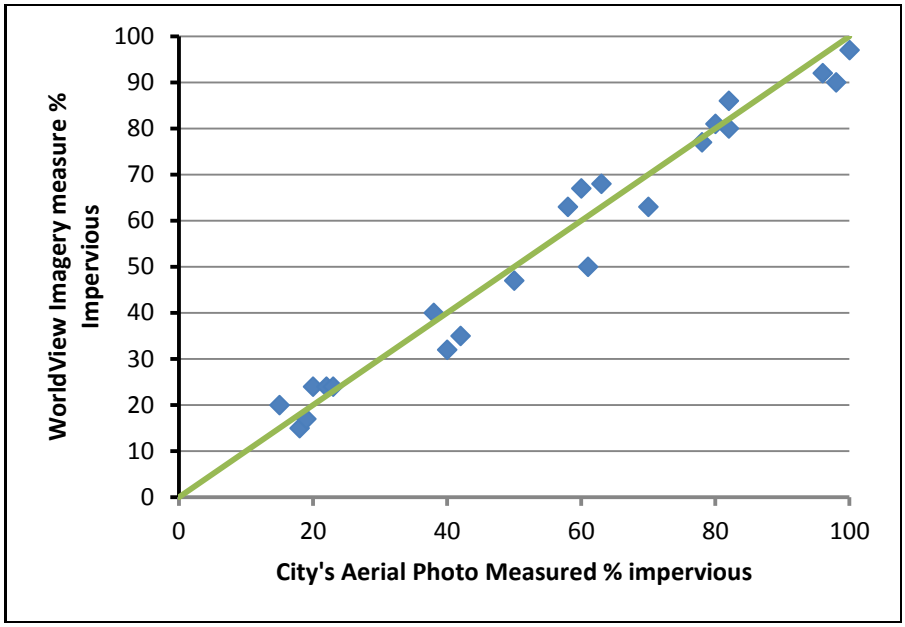


Figure 6.3 Percent Imperviousness Comparison

To determine impervious cover in a subbasin, the average watershed/subbasin impervious cover was determined by digitally intersecting subbasins and impervious cover GIS data layers and then calculating an area-weighted average impervious cover percentage for each subbasin and for the overall watershed. Average impervious cover percentage is presented by watershed in Table 6.3 and graphically shown by subbasin on Figure 6.4.

Table 6.3 Imperviousness Range by Watershed

Watershed ID	Description	Percent Imperviousness		
		Minimum	Mean	Maximum
DA	Del Amo	75	79	83
DC	Dominguez Channel	32	67	91
HL	Habor Lakes	31	59	86
WL	Walteria Lake	26	55	83
PVE	Palos Verdes Estates & Others	1	20	54
MB	Mobil	50	65	80
MM	Madrona Marsh	39	61	73
OC	Ocean	50	65	84
PI	Pioneer	76	81	87
PO	237th Street	69	69	69
RB	Redondo Beach	59	67	84

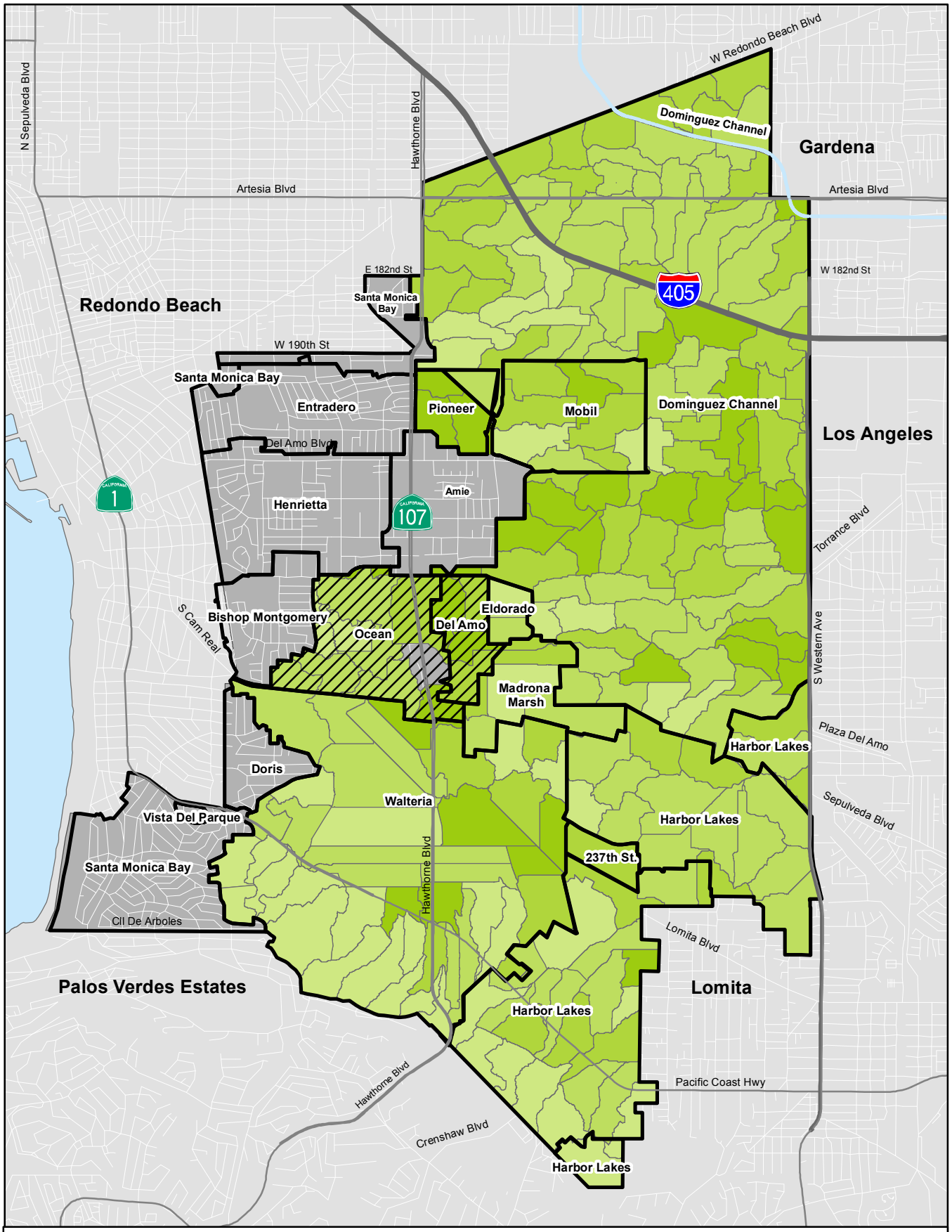


Figure 6.4
Percent Imaperviousness by Subbasin
Stormwater Quality Master Plan
City of Torrance

The imperviousness derived from the satellite imagery represents the total impervious area in a subbasin. However, SWMM RUNOFF requires percent directly connected impervious area (DCIA) values to estimate the volume of runoff. DCIA refers to the impervious areas that are directly connected to stormwater conveyance systems, such as stream channels and storm sewers, with no opportunity for infiltration. The total imperviousness derived from the satellite imagery was converted to DCIA values using the equation developed by USGS. The equation is stated as follows:

$$\%DCIA = 3.6 + 0.43I \quad (6.4)$$

Where:

I = percent total impervious area.

6.3.1.1 Width of SWMM Hydrologic Unit (SWMM Subbasin)

The width of each SWMM subbasin was used by the model to estimate the flow from the furthest point in the drainage area to the outlet. Determining this physical width of overland flow is a difficult process as it depends on storage and shape effects of the subbasin. Therefore, it is commonly used as a calibration parameter to account for the impact of the drainage system within each subbasin on flow travel time. As a result of inadequate data for calibrating the runoff from each subbasin, the subbasin width was not considered as a calibration parameter in this analysis. As recommended in SWMM User's Manual, the width was estimated first by determining the maximum length of overland flow and dividing the area by this length.

6.3.1.2 Ground Slope

Ground slopes were determined using the DEM and ArcView GIS. An average overland flow path slope is required for each subbasin within SWMM RUNOFF. This value was automatically determined through intersection of subbasin areas with the DEM. The elevation grid was intersected with the subbasins and the slope of each grid cell within the subbasin was calculated. Using the number of cells within each subbasin, the average basin slope was calculated. To verify this procedure, subbasin slopes for selected subbasins were manually estimated using available ground contour elevations and following SWMM guidelines. The results proved to be very similar, with the automated GIS procedure being repeatable.

6.3.1.3 Storm Type and Volume of Rainfall

As discussed in Chapter 4, total 24-hour rainfall volumes for each of the storm recurrence intervals (2-, 5-, 10-, 25-, 50-, and 100-year) for the City were determined from the Los Angeles County Hydrology Manual (LACDPW, 2006). The 24-hour storm volumes for each of these events is listed in Table 4.1, and served as sizing criteria for the analyses of the respective drainage system components (pipes, open channels, and regional detention facilities). The maximum rainfall depth for the 100-year storm is 6.7 inches. The 10-year storm, with a rainfall depth of 4.3 inches, was used as the design storm for storm drains.

The table depicts the volume of rainfall over a 24-hour period. How the volume is distributed over the 24-hour period is provided in the form of a rainfall distribution curve (hyetograph), which is a volume versus time graph of the storm. The shape of the hyetograph is very important in that it shows at what hour the peak(s) occur, as well as the peak intensities for the storm event. The shape of the hyetograph will influence the flow patterns of the rainfall after it hits the ground.

The Soil Conservation Service or SCS (now known as the Natural Resources Conservation Service or NRCS) has developed 24-hour hyetographs with shapes that are typical for various geographic locations within the United States. The SCS Type 1A curve was used. This SCS Type 1A portrays the anticipated distribution of rainfall over the 24-hour period for the Table 4.1 storms, with the area under the distribution curve totaling 100 percent of the storm volume.

The hydraulics portion of XPSWMM was used to simulate the drainage systems, which consist of enclosed pipes and ditches. The conveyance system is comprised mostly of enclosed pipes and ditches. The input data for the SWMM model used to define these features includes pipe diameter, material, inverts, and lengths, channel inverts, channel cross sections, and overflow elevations. For the enclosed pipe, the overflow elevation was defined as the rim elevation, and for the ditches, the overflow was defined as the top of bank. The drainage network defined in the model is based on the City's system, maps, GIS database and manhole inventory.

6.3.1.4 BMP Sizing

The BMPs are sized separately for wet and dry flow events. For wet weather flows, BMPs are sized based on the 85th percentile rainfall event, consistent with LACDPW's recommendation for BMP sizing.

For dry weather flows, the BMPs are sized based on empirical data (i.e., typical dry weather flows within stormwater systems). For most of the City, dry weather flows are calculated based on factor of 15 gpm per acre. For higher density areas within the City, a factor of 50 gpm per acre was used.

6.3.1.5 Pipeline Network

For most of the stormwater system, pipeline diameters and attribute information were developed from GIS data, stormwater atlas maps, and record drawings. Once the network was completed, the elements were populated with the necessary attribute information, such as pipeline diameters and conduit shapes.

The model includes approximately 144 miles of pipeline, including 63 miles of pipeline owned by the City, 58 miles of pipeline owned by Los Angeles County, 19 miles of private storm drains, and about 4 miles of pipeline owned by other entities.

6.3.1.6 Model Nodes

For most of the stormwater system, the City's existing stormwater model was used to determine invert elevation. Invert elevation were applied to each model node based on the record drawings. Where record drawing information was not available, the City's DEM was used to estimate the invert elevation.

6.3.1.7 Detention and Retention Basins

As discussed in Chapter 5, the City has three active retention basins and nine active detention basins. The detention basins were modeled as reservoir elements based on their capacity, elevation, and layout. The retention basin watersheds were excluded from analyses, as they do not discharge to bodies of water and TMDLs are not applicable.

6.3.1.8 Pump Stations

As discussed in Chapter 5, seven of the City's twelve active basins use pump stations to discharge stormwater. These pump stations were modeled as a pump element and downstream force main within the hydraulic model. The pump elements are controlled based on level within the source basin.

6.3.2 Water Quality

One common objective of this project is to be able to predict the impact of different point and nonpoint source loading under various planning scenarios on surface water resources. For this effort, PLAT was developed to estimate nonpoint source loading based on existing conditions in the watersheds in the study area. Because the main goal of this study is to investigate impacts on surface water quality, the three main parameters considered are TSS, TP, and Total Nitrogen (TN and TKN).

6.3.2.1 PLOAD Model Set Up

PLOAD is used to establish the pollutant loading. Pollutant sources are generally grouped into two categories: (1) point sources, such as discharges from permitted dischargers; and (2) NPS, such as stormwater runoff from urban and rural areas.

Point Source Load

The PLOAD model accounts for the point source pollutant load directly in units of pounds per year (lb/yr) for each pollutant generated by a point source. For the City's service area, most of the point source dischargers are industrial permitees. Stormwater effluent data obtained from industrial permitees (e.g., the ExxonMobil Refinery) only detail metal and hydrocarbon pollutants, which are beyond the scope of this study. EMCs were developed for each subwatershed based on the point source dischargers located within the subwatershed. The EMCs for these subwatersheds were developed using the Los Angeles County WMMS output.

Nonpoint Source Load

PLOAD calculates loading for nonpoint source pollution using various inputs. These inputs include:

- Annual rainfall
- Subwatershed boundaries
- Land use category
- EMC values (the event mean concentration for a storm event)
- Pollutant loading rate
- Amount of impervious area associated with each land use category. This information was derived from satellite imagery.
- Point Source load (in lb/yr)

In the PLOAD model, annual nonpoint pollutant loads may be calculated for each subbasin using either the pollutant export coefficient or the USEPA's simple method. The simple method is applied in PLAT.

Resulting Pollutant Loading

A summarized breakdown of the land use makeup of each watershed is provided in Table 6.4. Resulting pollutant EMC are shown for each land use type in Table 6.5. The City's general plan layer is used to overlay the land uses shown in Table 6.5 onto the subbasins to allocate the NPS pollutant load.

6.3.2.2 P8 Model Set Up

The main objective of using P8 a component of PLAT can be summarized as follows:

- Continuous simulation with hourly output
- Urban stormwater BMPs and wetland simulation
- Data needs can be filled with available information
- Requires moderate effort to set up, calibrate, and apply.
- Easily incorporate field sampling data for assessing BMP effectiveness
- Continuous water balance and mass balance

The main input data required for P8 model set up include watershed data, climate, and stormwater devices such as BMPs. The watershed data include subbasin area, which were derived from the P8 subbasins (Appendix D), SCS curve number (CN), percent imperviousness, impervious coefficient and depression storage. The SCS CN numbers, which are used to convert excess rainfall to runoff, were computed from the City's land use and soil coverage. The SCS CN for the study area ranges between 78 and 90.

Table 6.4 Land Use Distribution by Watershed

Watershed	Residential	Commercial	Industrial	Open Space, Public, and Quasi-Public	Total Acreage
Del Amo	1%	98%	0%	1%	116.8
Dominguez Channel	45%	10%	31%	14%	3,563.2
Harbor Lakes	52%	17%	6%	25%	1,735.5
Walteria	49%	25%	8%	17%	1,845.5
Mobil	0%	0%	100%	0%	440.8
Madrona Marsh	58%	23%	0%	19%	213.5
Ocean	51%	41%	0%	8%	360.9
Pioneer	0%	33%	64%	3%	123.3
237th Street	12%	6%	82%	0%	56.3
Total					**3,563.2**

Notes:
Source: General Plan Land Use GIS Layer and Watershed Boundary. It should be noted that Amie, Bishop Montgomery, Henrietta, Santa Monica Bay, Entradero, Doris, El Dorado, and Vista del Parque were excluded from this analysis.

Hourly precipitation data is required by the P8 model. In order to evaluate a normal annual pollutant load, a normal year of hourly precipitation data is necessary. The closest station with hourly climate data was in Long Beach. A 'normal year' of hourly data was created using the Long Beach hourly data as a basis. The Long Beach hourly rainfall data was first normalized to the Long Beach total annual rainfall. Hourly rainfall for Torrance was then derived by multiplying the normalized hourly rainfall by 13.66, which is the average annual rainfall in Torrance. Long Beach average monthly temperature was used in the evapotranspiration function in P8.

All of the proposed field sampling locations for the Machado nutrient TMDL is represented in P8 as model nodes. This will make analysis of sampling data using P8 fairly straightforward.

6.3.2.3 SUSTAIN Model Set Up

The main purpose of SUSTAIN as a component of PLAT is for determining the most cost effective options for the placements of BMPs. Input data to SUSTAIN was compiled from P8 output MODEL CALIBRATION.

Table 6.5 Imperviousness and Pollutant EMC by Land Use Type

Land use	Imperviousness (%)	Pollutant Event Mean Concentration (mg/L)						
		DP	TKN	NH_3-N	NO_3-N	NO_2-N	TSS	TP
Mixed	48	0.20	2.70	0.58	0.71	0.10	69.06	0.26
Walteria Lake Park	23	0.06	0.81	0.08	1.11	0.05	164.68	0.11
Airport	55	0.36	1.81	0.23	0.75	0.09	75.35	0.44
Commercial	84	0.30	3.37	0.91	0.58	0.14	67.40	0.41
Single Family Residential	56	0.29	2.80	0.36	1.04	0.09	104.65	0.39
Limited Multi-Family	67	0.16	1.86	0.38	1.73	0.08	46.35	0.19
Heavy Industrial	83	0.28	3.07	0.48	0.86	0.09	229.37	0.44
Light Industrial	82	0.28	3.07	0.48	0.86	0.09	229.37	0.44
Light Manufacturing	81	0.28	3.07	0.48	0.86	0.09	229.37	0.44
Multi-Family Residential	68	0.16	1.86	0.38	1.73	0.08	46.35	0.19
Two Family Residential	63	0.29	2.80	0.36	1.04	0.09	104.65	0.39
Heavy Manufacturing	83	0.28	3.07	0.48	0.86	0.09	229.37	0.44
Hospital/Medical	76	0.27	1.62	0.26	0.63	0.08	103.02	0.31
Light Agricultural	26	0.06	0.81	0.08	1.11	0.05	170.45	0.11
Public Use/Open Space	37	0.06	0.81	0.08	1.11	0.05	164.68	0.11
Residential Townhouse	65	0.29	2.80	0.36	1.04	0.09	104.65	0.39
Restricted Multi-Family	73	0.16	1.86	0.38	1.73	0.08	46.35	0.19
Transportation	95	0.36	1.81	0.23	0.75	0.09	75.35	0.44

Notes:
DP = Dissolved Phosphorus; TKN = Total Kejdahl Nitrogen, TSS = Total suspended Solids; TP = Total Phosphorus; NH_3-N = Ammonia Nitrogen; NO_3-N = Nitrate Nitrogen; NO_2-N = Nitrite Nitrogen
(1) Pollutant EMCs obtained for each land use category from were developed from Los Angeles County stormwater monitoring data or the NSQD .

6.3.3 Methodology

This City model was calibrated with data from the Los Angeles County WMMS model for both water quantity and quality. Two years of continuous simulation output from WMMS was received from the Los Angeles County for model calibration and comparison.

6.3.4 Calibration Data

6.3.4.1 Water Quantity

The continuous rainfall data used in WMMS simulation was input to the XPSWMM stormwater quantity model to simulate the WMMS results. The subbasin widths were adjusted slightly in XPSWMM to more closely match the WMMS results. The effective imperviousness or percent DCIA values and subbasin areas were not adjusted. Four subbasins were selected from the WMMS model to use for comparison of model results between the two models.

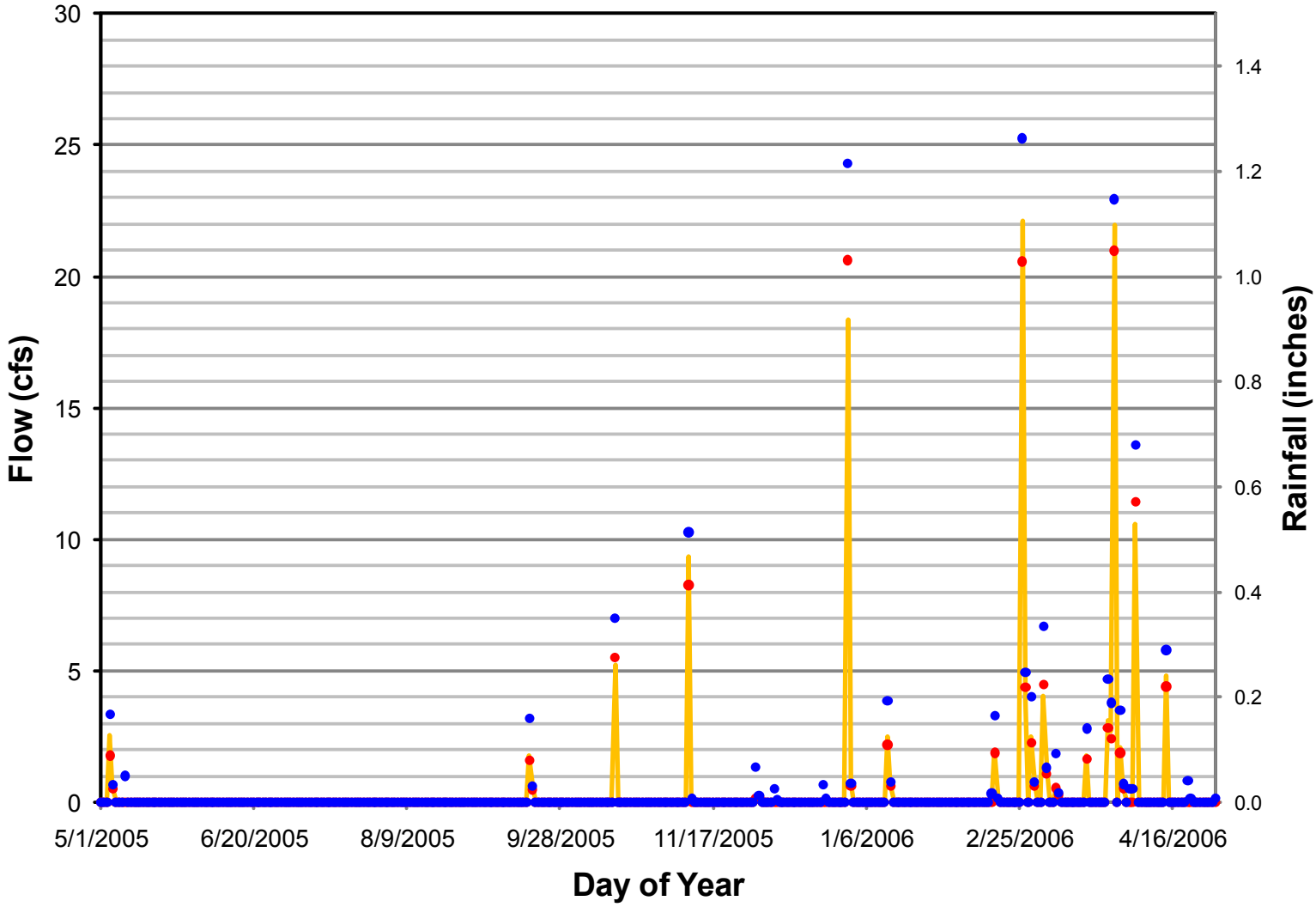
6.3.4.2 Water Quality

Los Angeles County stormwater monitoring data was used to calibrate the PLOAD model pollutant characteristics files to more closely approximate the pollutant runoff from similar land uses. Where data was missing, the National Stormwater Quality Database (NSQD) values were used. Table 6.5 lists the stormwater concentrations by land use obtained from the Los Angeles County stormwater monitoring data and the NSQD and used for the calibration along with the average percent imperviousness associated with each land use category. The amount of imperviousness associated with each land use was derived by intersecting the City's land-use coverage and the impervious information derived from the WorldView satellite imagery. The level of calibration performed under the current analysis is adequate for NPS characterization and BMP screening.

6.3.5 Calibration Results

A comparison of model results from the XPSWMM stormwater quantity model and the WMMS model results is presented for the selected subbasins in Figure 6.5 through Figure 6.8. Since the subbasins within the WMMS model do not coincide with subbasins within the City's model, the extents of the subbasins within the WMMS model are shown in Figure 6.9 along with the model subbasins selected for the calibration.

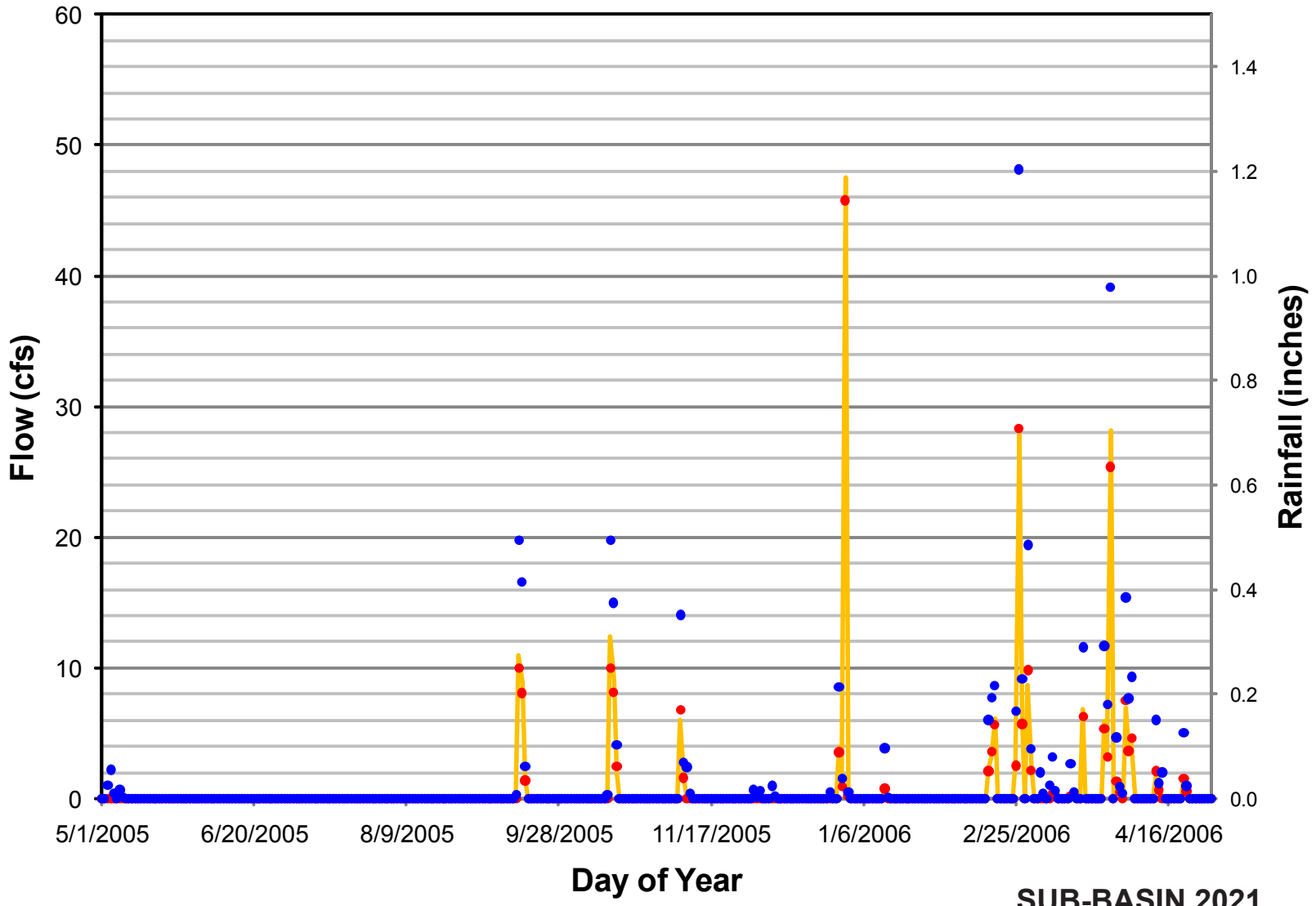
The water quality calibration results are summarized in Table 6.6 for the P8 subbasins. Since WMMS subbasins in most cases do not match P8 subbasins, drainage area ratios were used to derive the results shown in Table 6.6. Water quality model calibration results are shown in Figures D.6 through D.11 of Appendix D.



SUB-BASIN 2051
WATER QUANTITY
CALIBRATION COMPARISON

FIGURE 6.5

20-TORRANCE7-11F6.6-8419A00.AI



SUB-BASIN 2021
WATER QUANTITY
CALIBRATION COMPARISON

FIGURE 6.6

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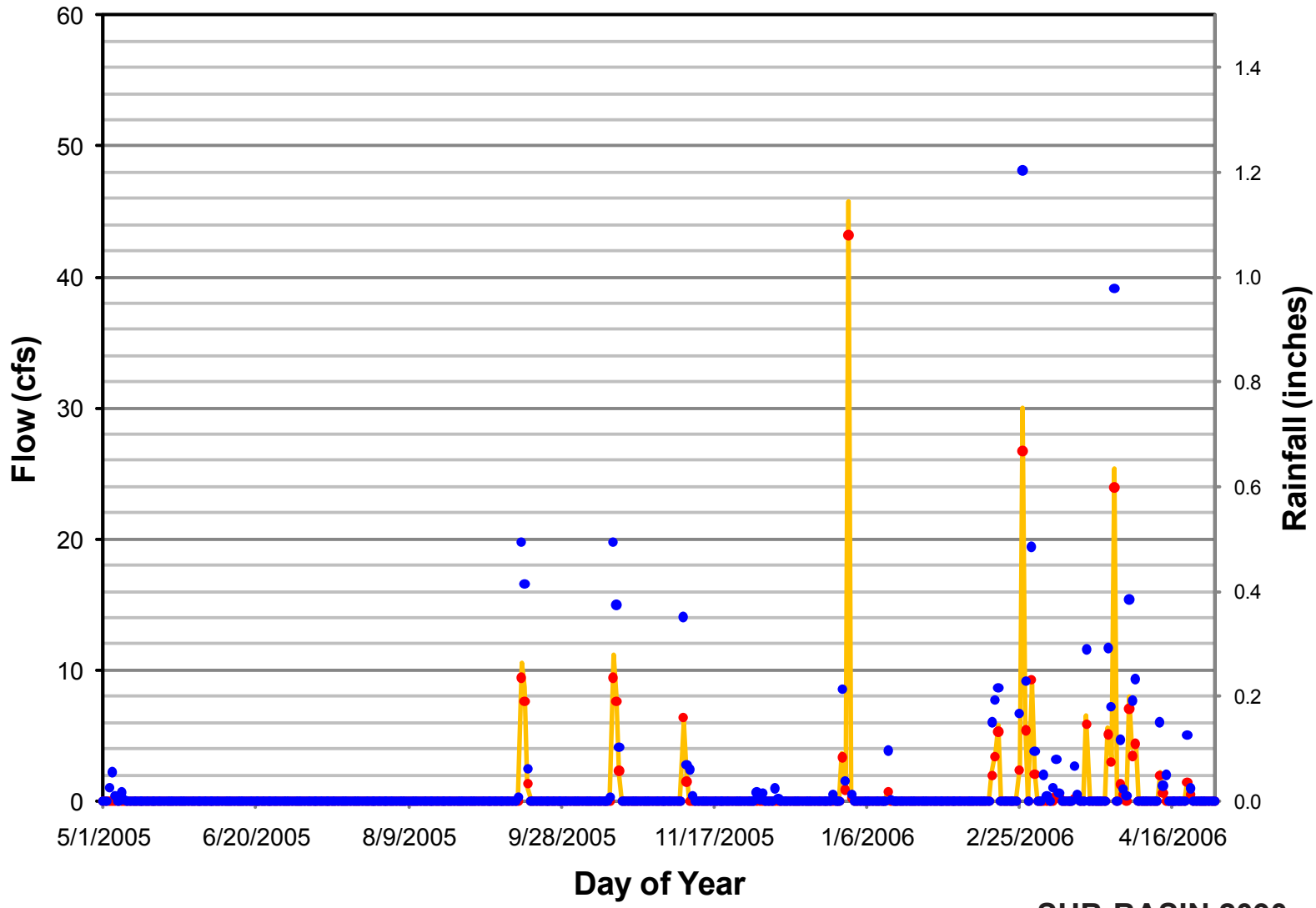
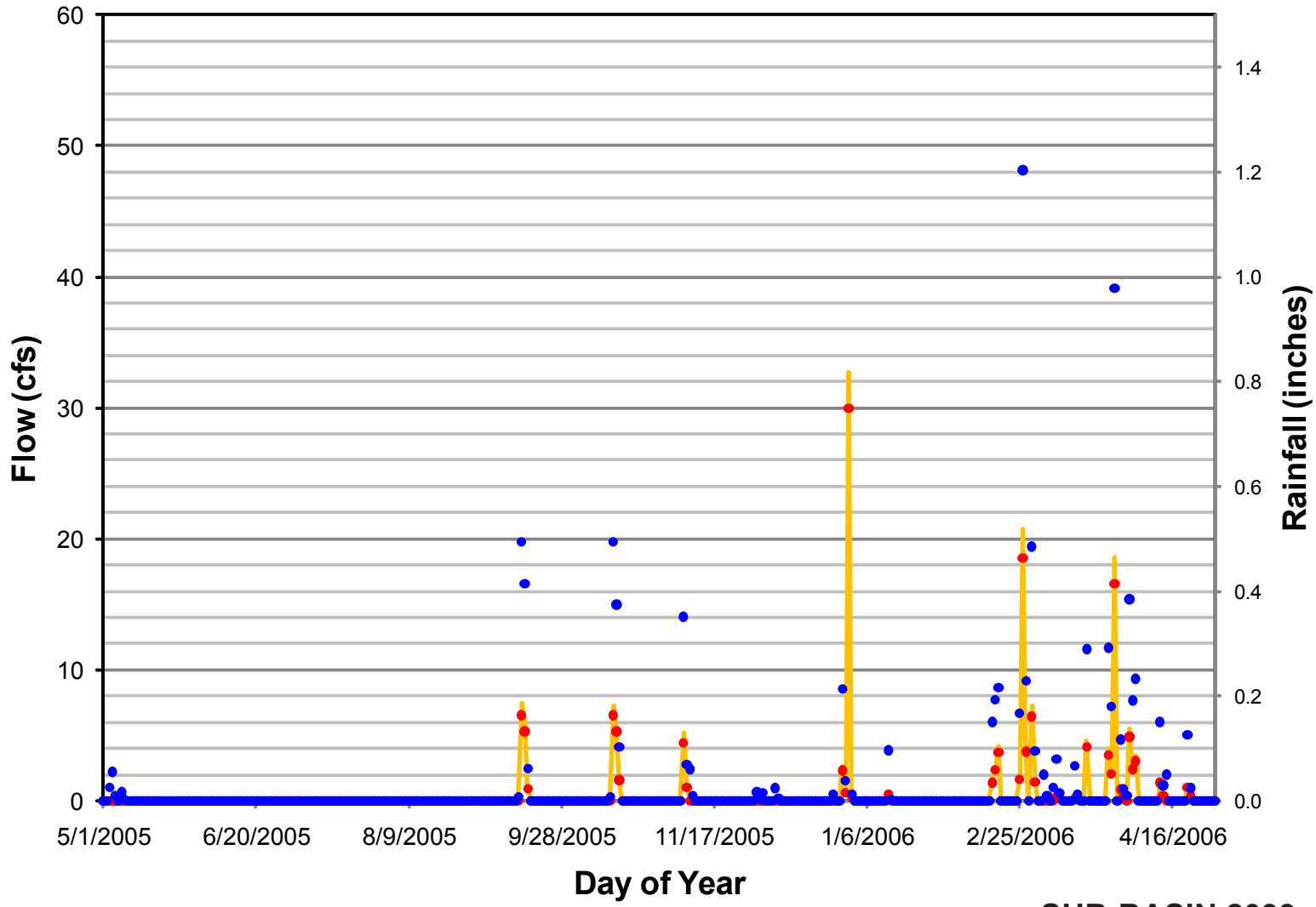
CITY OF TORRANCE



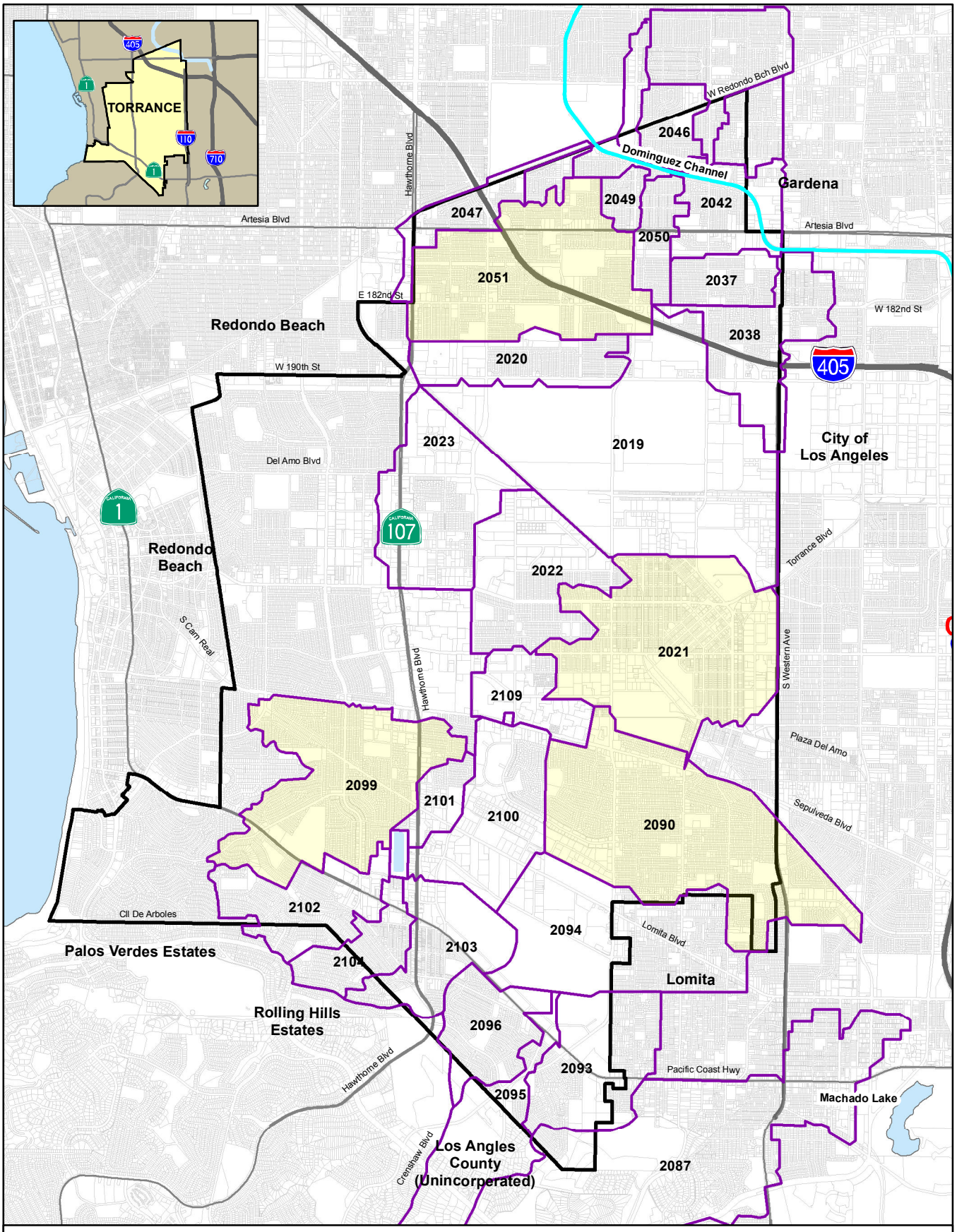
SUB-BASIN 2090
WATER QUANTITY
CALIBRATION COMPARISON

FIGURE 6.7



SUB-BASIN 2099
WATER QUANTITY
CALIBRATION COMPARISON

FIGURE 6.8



Legend

- Los Angeles County WMMS Model Subbasins (Labeled by Subbasin ID)
- Subbasins Selected for Calibration
- City Boundary
- Freeway
- Major Roads

0 0.25 0.5 1 Miles

Figure 6.9
Calibration Subbasin Comparison
Stormwater Quality Master Plan
City of Torrance

Table 6.6 P8 Calibration Results

County Basin ID	County Basin Area (ac)	City Basin Area (ac)	TSS Load (lb/yr)		TN Load (lb/yr)		TP Load (lb/yr)	
			County[1]	City[2]	County[1]	City[2]	County[1]	City[2]
2019	1,451.02	978.88	44,440.00	46,850.85	1,493.50	1,125.92	1,050.19	873.69
2020	294.81	259.57	9,779.63	8,034.90	286.72	255.31	236.20	218.45
2021	971.37	1,002.45	62,373.67	74,113.35	1,207.16	1,247.20	1,090.60	1,102.51
2022	485.57	384.86	33,209.65	35,822.00	637.95	508.52	456.06	383.77
2037	158.18	165.49	2,560.07	2,728.70	113.06	120.55	94.04	103.11
2038	393.00	395.60	11,747.96	10,213.20	407.74	411.22	400.26	306.79
2042	337.24	246.69	8,083.38	9,453.98	313.18	230.35	253.09	165.86
2043	359.20	38.81	7,739.58	5,998.29	296.65	35.66	268.56	22.81
2044	75.06	11.69	5,143.94	3,462.89	73.33	12.32	68.38	13.30
2045	145.92	51.86	3,293.06	2,597.13	130.68	48.43	115.17	29.48
2046	143.13	78.91	2,854.70	2,618.26	108.90	68.85	106.03	49.16
2047	169.25	108.92	11,078.18	13,054.99	164.60	129.44	161.63	82.57
2049	66.30	68.28	2,895.37	3,088.87	52.23	55.54	43.35	49.89
2050	137.30	137.31	2,234.84	2,772.11	91.67	93.68	76.11	79.55
2051	834.58	834.20	40,036.78	46,007.44	674.38	678.11	528.17	564.46
2087	1,637.21	61.84	47,626.46	8,542.13	1,017.54	38.43	859.65	20.03
2090	1,118.59	886.74	52,029.91	41,987.40	1,139.42	910.62	966.60	896.80
2093	431.45	283.48	12,467.20	9,562.36	298.92	201.87	265.68	179.40
2094	734.43	405.60	34,418.78	32,921.60	683.84	380.73	654.20	312.92
2095	916.45	82.02	7,229.07	5,157.92	162.30	27.72	121.58	54.43
2096	271.88	263.97	9,440.00	11,890.00	217.02	211.67	188.55	176.98
2099	787.63	793.40	36,266.80	39,211.00	790.86	802.33	664.82	697.68
2100	448.43	434.82	31,864.02	40,911.30	590.14	575.45	516.86	492.67
2101	110.75	111.43	8,099.94	8,479.44	158.45	161.22	155.72	144.32
2102	343.41	263.54	12,766.92	13,253.55	287.50	221.31	262.61	188.57
2103	339.80	339.47	12,931.28	14,910.40	250.92	259.18	224.88	212.70
2104	192.04	109.29	7,256.91	9,251.33	175.09	103.73	151.27	105.43

Notes:
TSS = Total suspended Solids; TP = Total Phosphorus; TN = Total Nitrogen
(1) County refers to results from the Los Angeles County WMMS Model, while City refers to results from the City of Torrance PLAT Model.

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Chapter 7

WATER QUALITY EVALUATION

7.1 METHODOLOGY

The water quality evaluation is conducted by applying pollutant loads, both point source (PS) and non-point source (NPS), to each of the delineated subbasins. Development of the different components of the water quality model is discussed in detail in Chapter 6. This chapter describes the findings of the pollutant load analysis and water quality evaluation results, and concludes with a discussion of Best Management Practice (BMP) treatment options and a recommended BMP siting plan.

Within this chapter, various terminologies is used to describe delineation and hydrologic units. For reference, these terms are defined as follows:

- Subbasin – drainage subareas were delineated from the City's 2-foot elevation contours and existing watershed boundaries. For water quality analysis, the subbasins are the highest resolution in terms of area. They used to estimate pollutant sources using PLOAD.
- Subarea – drainage areas were delineated using subbasins and existing watershed boundaries. Two or more subbasins were combined to create a subarea. The subareas were created for the purposes of detailed water quality modeling using P8.
- Subregion – drainage areas treated at a BMP location; subregions were delineated using subarea, existing watershed boundaries, and BMP locations. Two or more subareas were combined to delineate subregions, which are used for BMPs effectiveness modeling using continuous simulation.

The water quality evaluation presents the predicted pollutant loading, followed by prioritization of the subbasins and subareas and a comparison of modeling results from the various tools developed as a part of this project. The prioritization of subareas were used to locate and prioritize recommended BMPs.

BMPs were recommended separately for reducing pollutant loading during dry weather conditions (low flow diversion) and reducing pollutant loading during wet weather conditions (which would include reducing pollutant loading during dry weather conditions).

7.2 WATER QUALITY EVALUATION

As discussed in Chapter 6, tools were developed to estimate both PS and NPS pollutant loads of total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP), and zinc based on the existing land information. The tools estimated pollution loads to each subbasin from sources such as residential, commercial, industrial, and transportation.

Pollutant load, as it applies to the model, refers to the amount of pollutant exiting the subbasin. Models were calibrated using procedures described in Chapter 6. These models can also be used to demonstrate the effect of pollutant loads on potential NPS management strategies.

The predicted pollutant loading was used to develop ranking for each subbasin and subarea to locate and prioritize recommended BMPs. High priority subareas were prioritized in the CIP as BMPs which the City should implement first to maximize reductions in pollutant loading.

7.2.1 Impervious Cover Mapping

Prior to detailed water quality modeling, preliminary identification of high-pollutant sources was conducted using the impervious information extracted from WorldView-2 satellite imagery and the "Impervious Cover Model" (ICM). This is a quick and cost effective approach to spatially characterize pollutant sources prior to detailed modeling efforts. The methodology used includes the following steps:

- **Watershed delineation**. This step includes the delineation of each subbasin in the study area and development of a geographical interface system (GIS) data layer.
- **Impervious cover mapping**. This step includes the development of watershed coverages for land cover and impervious cover within a GIS data layer.
- **Impervious cover determination**. this step includes the determination of impervious cover magnitude for the for overall watershed and subbasins.
- **Classification**. This step includes the classification of watershed imperviousness based on the ICM categories, which are discussed in more detail below.

The hydrologic, physical, and ecological changes caused by development can have a dramatic impact on the natural function of waterways. Many studies are finding a direct relationship between the intensity of development in an area as indicated by the amount of impervious surfaces and the degree of degradation of its receiving waters.

The Center for Watershed Protection developed the ICM, which has been supported by over 200 studies. The model is based on the average percentages of impervious cover at which receiving stream quality declines, and classifies those impacts into three categories, making management decisions clearer. The three categories are listed as follows:

- Degraded.
- Impacted.
- Protected.

The ICM with the three ICM categories is presented on Figure 7.1.

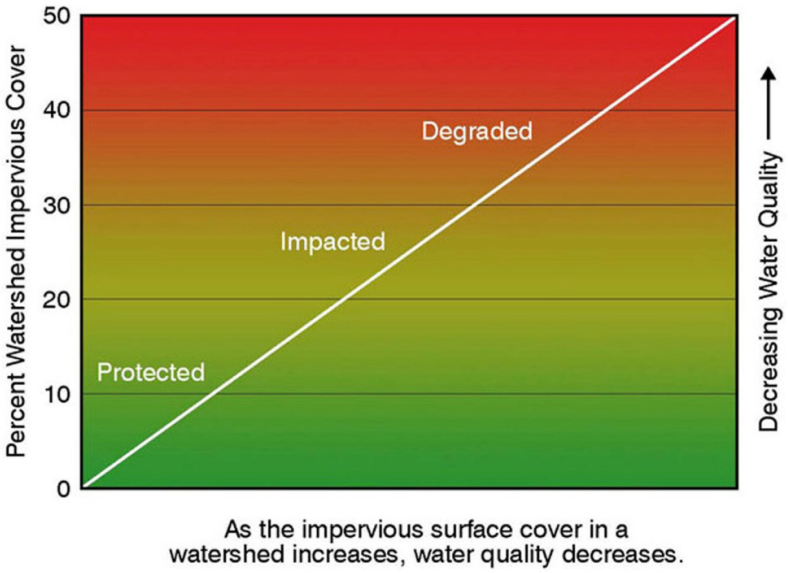


Figure 7.1 The Impervious Cover Model

The model suggests that aquatic biological systems begin to degrade at impervious levels of 10 to 15 percent, or at even lower levels for particularly sensitive streams. As the percentage of imperviousness climbs above these levels, degradation tends to increase accordingly. The end result is a system changed for the worse. These ranges are part of a continuum, and there can be variation between individual streams. The model is most reliable when impervious cover exceeds 10 percent, which makes it applicable to the study area.

The approach of extracting impervious cover from satellite imagery offers significantly improved levels of accuracy and types of end products. Extrapolating impervious cover from land use data provides a general understanding of the amount of impervious cover, but does not show where the impervious cover is located. Directly mapping impervious cover with high-resolution satellite imagery provides a more accurate assessment of impervious cover. Additionally, the high-resolution land cover map shows the location and different types of impervious cover. This level of accuracy and detail is critical for many types of planning and engineering studies. For example, watershed planners need to know where different impervious cover types are located to determine management options.

Average watershed/subbasin impervious cover was determined by digitally intersecting subbasin and impervious cover GIS data layers and then calculating an area-weighed average impervious cover percentage for each subbasin and for the overall watershed. This information is presented in tabular format in Table 7.1.

Table 7.1 Imperviousness Range by Watershed				
Watershed ID	**Description**	**Percent Imperviousness**		
		Minimum	**Mean**	**Maximum**
DA	Del Amo	75	79	83
DC	Dominguez Channel	32	67	91
HL	Habor Lakes	31	59	86
WL	Walteria Lake	26	55	83
PVE	Palos Verdes Estates & Others	1	20	54
MB	Mobil	50	65	80
MM	Madrona Marsh	39	61	73
OC	Ocean	50	65	84
PI	Pioneer	76	81	87
PO	237th Street	69	69	69
RB	Redondo Beach	59	67	84
Average			**55**	**84**

According to the ICM, all the subbasins in the study area have the potential to degrade receiving water quality. The classification also reveals that the City is “ultra-urban,” a term used to describe metropolitan areas with imperviousness greater than 50 percent, and where space for stormwater BMP implementation is limited. As shown in Table 7.1, the mean imperviousness of the entire study area is 55 percent.

7.2.2 Pollutant Load Estimation

As discussed in Chapter 6, two models were used for pollutant load modeling, PLOAD and P8. These pollutant load estimation process for each application is described in the following subsections.

7.2.2.1 PLOAD Application

After developing the PLOAD model for the study area, the model was used to calculate pollutant loads from all relevant subbasins.

Los Angeles County stormwater monitoring data was used to calibrate the PLOAD model pollutant characteristics files to more closely approximate the pollutant runoff from similar land uses. Where data was missing, the National Stormwater Quality Database values were used. The stormwater concentrations by land use were generated for the calibration and are presented in Chapter 6 along with the amount of imperviousness associated with each land use.

The annual load generated from each watershed is summarized in Table 7.2, while a breakdown by subarea is presented later in this chapter in Table 7.3 and detailed pollutant distribution maps showing pollutant loading by subbasin are presented in Figure 7.2 through Figure 7.7.

Table 7.2 Pollutant Loads by Watershed

Watershed	Area (ac)	Calculated Load (lb/yr)			Calculated Load (lb/ac/yr)			Allowable Load (lb/yr)	
		TSS	TP	TN[(2)]	TSS	TP	TN	TP	TN
Walteria Lake	2,109	287,010	1,100	5,609	136	0.52	2.66	n/a[(1)]	n/a[(1)]
Harbor Lakes	2,067	252,719	1,082	5,397	122	0.52	2.61	664[(2)]	6,631[(2)]
Dominguez Channel	4,708	707,763	2,218	11,355	150	0.47	2.41	n/a[(3)]	n/a[(3)]
Palos Verdes Estates	3,253	43,599	460	3,249	13	0.14	1.00	n/a[(4)]	n/a[(4)]
ExxonMobil	461	16,380	413	520	36	0.90	1.13	n/a[(3)]	n/a[(3)]

Notes:
1. The County is responsible for operations of Walteria Lake, which is considered a BMP that should remove all pollutants.
2. WLA shown represents Phase 2 (Final) of the Machado Lake Nutrients TMDL.
3. TMDLs for nutrients in the Dominguez Channel or Santa Monica Bay have not been developed to date. Based on the list of assessment units in the consent decree, nutrient TMDLs are not anticipated for these bodies of water.
4. Palos Verdes Estates is the responsible party for treating loads from this watershed.

The allowable loads presented in Table 7.2 correspond to the WLA of the applicable total maximum daily load (TMDL). While requirements vary depending on the specific BPA associated with each TMDL, in many cases the baseline WLA is developed based on monitoring associated with initial phases of the TMDL implementation. Thus, for TMDLs not yet implemented, the WLA is not yet necessarily assigned. The Dominguez Channel Toxics and Machado Lake Toxics TMDLs do not specify a WLA for TSS, which is used as an indicator constituent for the various pollutants that are associated with sediment.

It should be noted that the ExxonMobil Refinery, located within the ExxonMobil watershed, is treated as point source in the model but the load shown in the table was estimated based on impervious area and land use information. Similarly, the Pioneer, Madrona Marsh, and 237th watersheds were treated as point loads and are therefore included in the Dominguez Channel and Harbor Lakes watersheds, respectively.

The pollutant loading presented in in Figure 7.2 through Figure 7.7 was used to rank the subbasins and to prioritize the placement of BMPs. The ranking of the PLOAD subbasins is presented in Figure 7.8 and Figure 7.9.

7.2.2.2 P8 Application

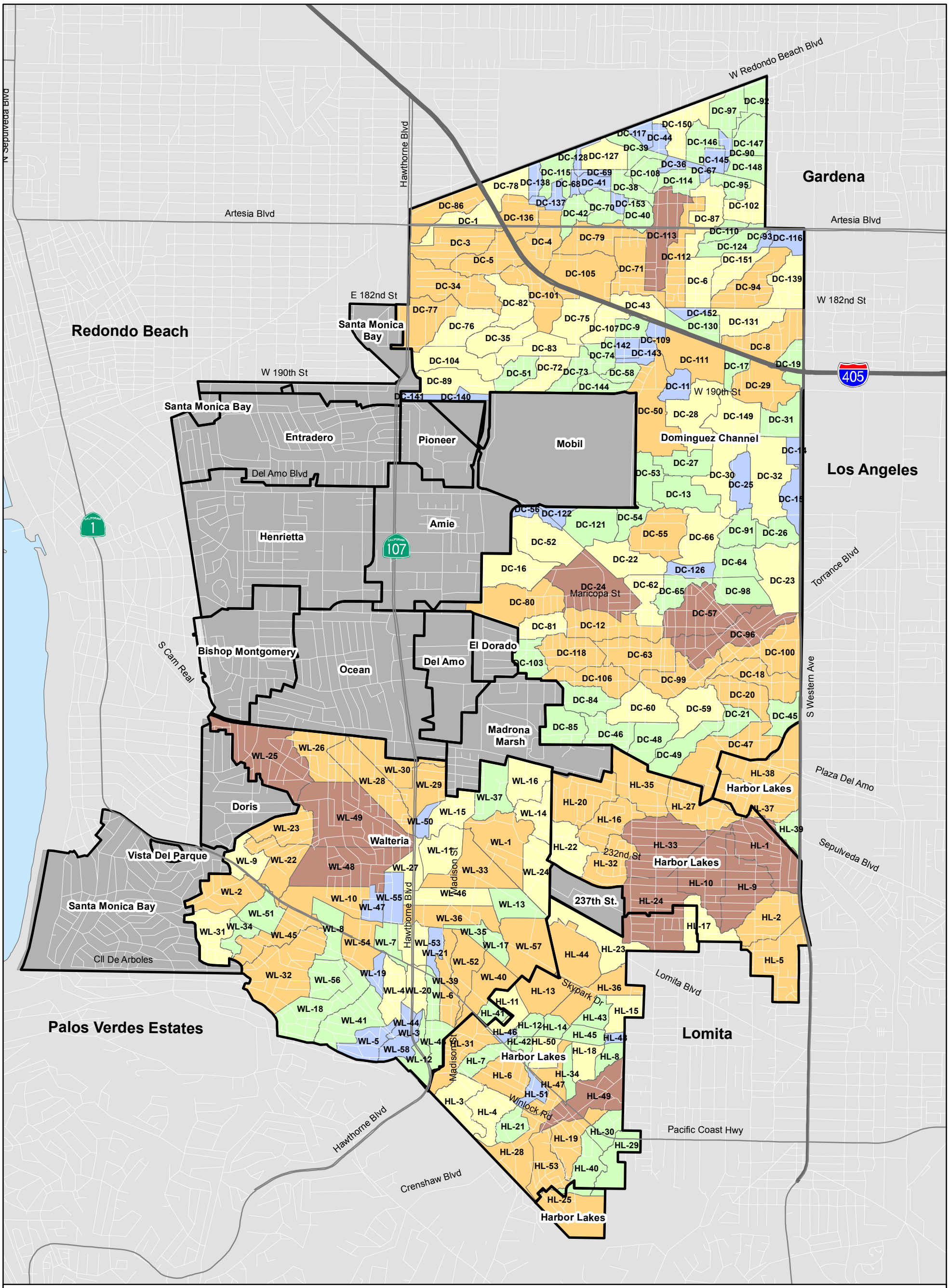
P8 is a simple model that requires moderate effort to set up, calibrate, and validate. Simulations are driven by continuous hourly rainfall and daily air temperature time series data. In order to evaluate a normal annual pollutant load, a normal year of hourly precipitation data is necessary. Most climate stations do not keep long periods or hourly records. The closest station with hourly climate data was in Long Beach. A 'normal year' of hourly data was created using the Long Beach hourly data as a basis. The Long Beach hourly rainfall data was first normalized to the Long Beach total annual rainfall. Hourly rainfall for Torrance was then derived by multiplying the normalized hourly rainfall by 12.55, which is the average annual rainfall in Torrance. Long Beach average monthly temperature was used in the evapotranspiration function in P8.

As discussed in Chapter 6, each watershed was delineated into study reaches called subareas for the P8 simulations. The subareas were delineated based on the impervious cover model and PLOAD results. The subareas were further delineated into subregions based on land use for modeling.

P8 hydrology was calibrated by performing minor adjustment to the estimated Soil Conservation Service's (SCS) curve numbers and depression storage parameters. PLOAD loads were used to calibrate P8 loads from computed pervious and impervious surfaces Table 7.3 lists the estimated annual pollutant loads from the subareas for existing conditions in the three main watersheds. The table also compares Pollutant Loading and Analysis Tool (PLAT) (PLOAD and P8) results with Nonpoint Source Pollutions and Erosion Comparison Tool (N-SPECT) results. The PLOAD data in the table was obtained by summing the loads generated by all subbasins in that subarea. As shown, there is a good agreement between the PLAT and N-SPECT results. The comparison supports the structure and calibration of the hydrologic components of the P8 model for prediction and conveyance of stormwater quality in the study area.

Table 7.3 also shows the WLA assigned to the City as discussed in Chapter 3. Only the WLA associated with the Machado Lake Nutrients TMDL is shown since the WLAs within the remaining TMDLs are not modeled explicitly. Instead, TSS is used as an indicator for the various pollutants for which a WLA is assigned. It should be noted that pollutant loading of Machado Lake from the Walteria Lake sub-watershed is not compared to the WLA. Walteria Lake should act as a BMP. The lake is predicted to include sufficient volume to adequately treat the pollutant load. If the current effectiveness of Walteria Lake as a BMP is not adequate, the City will need to work with LACDPW to address the effectiveness of the lake as the County is responsible for the operations and maintenance of the lake.

The P8 subareas were also prioritized using the two methods explained above. The subbasin priority index (SPI) maps generated for the subareas are presented in Figure 7.10 through Figure 7.12.



Legend

Predicted TSS Pollutant Load (lb/yr) by PLOAD Subbasin

- 0-1000
- 1000-2000
- 2000-3000
- 3000-5000
- >5000
- Not Calculated

- Freeway
- Major Roads
- Watershed Boundary
- HL-25 Sub Drainage Area ID
- Mobil Basin Name

0 0.25 0.5 1 Miles

Figure 7.2
Average Annual TSS Load
Stormwater Quality Master Plan
City of Torrance

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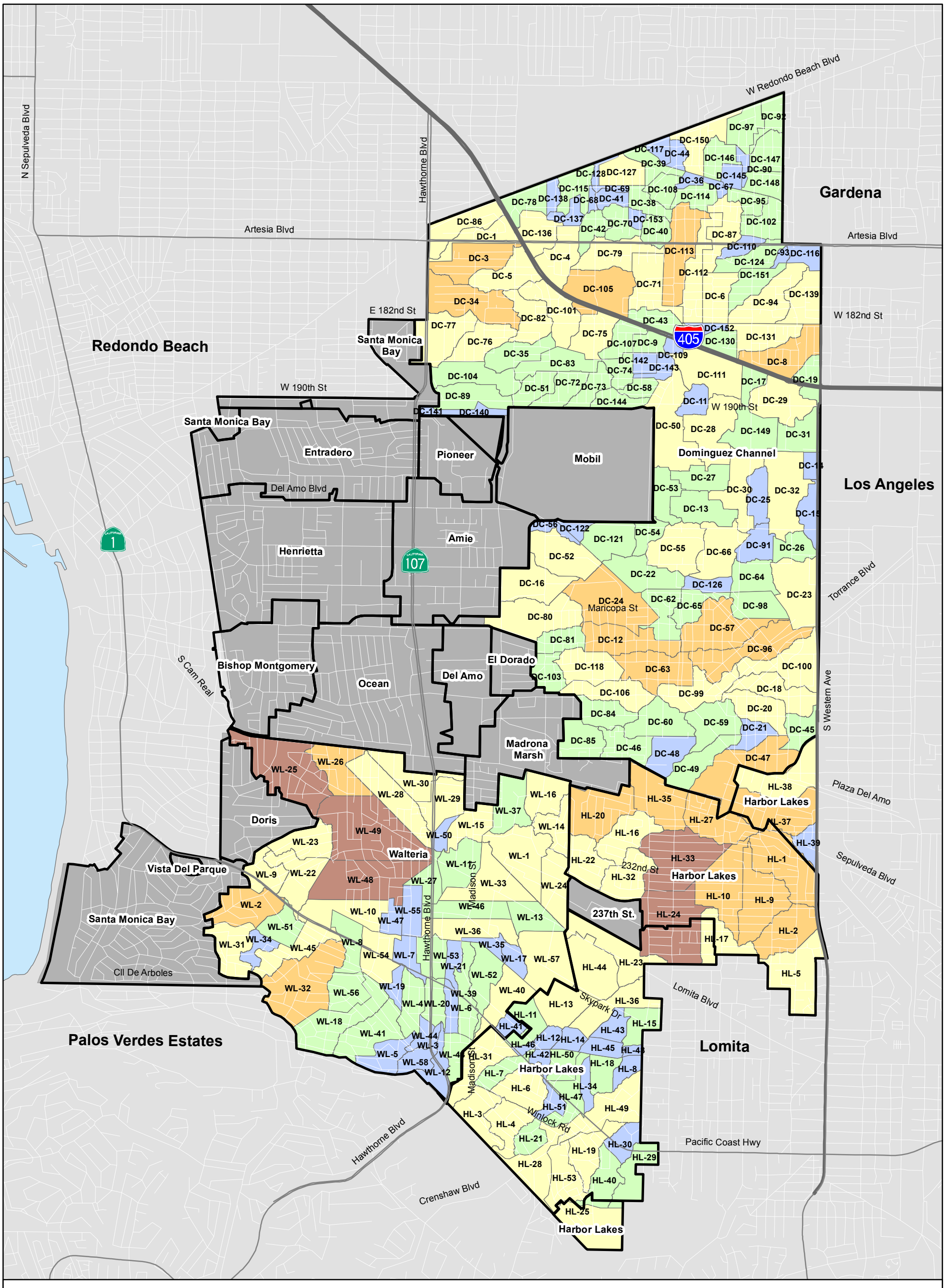

Legend

Predicted TP Pollutant Load (lb/yr) by PLOAD Subbasin

- <15
- 15-30
- 30-50
- 50-80
- >80
- Not Calculated

- Freeway
- Major Roads
- Watershed Boundary
- HL-25 Sub Drainage Area ID
- Mobil Basin Name

0 0.25 0.5 1 Miles

Figure 7.3
Average Annual TP Load
Stormwater Quality Master Plan
City of Torrance

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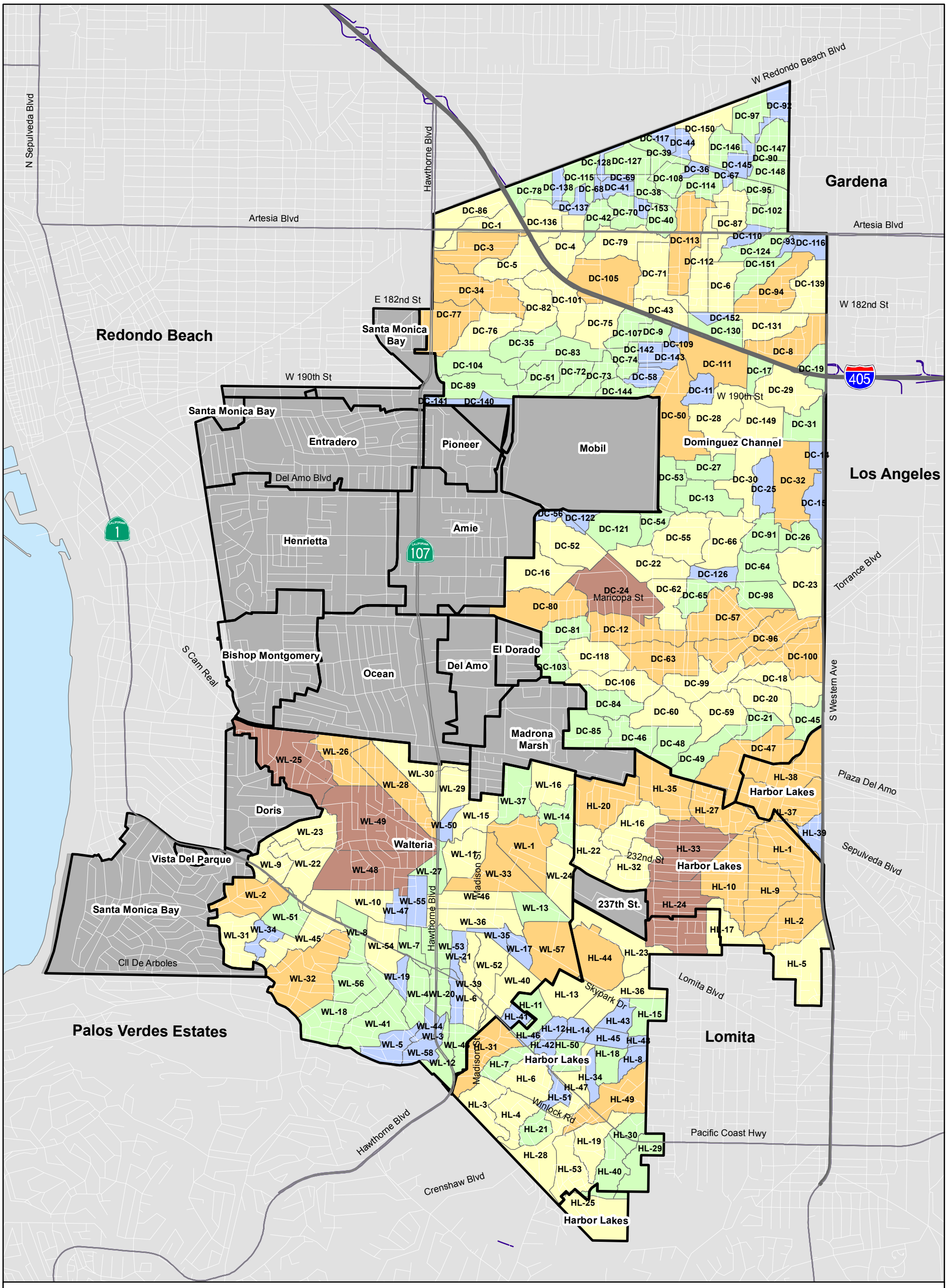

Legend

Predicted TN Pollutant Load (lb/yr) by PLOAD Subbasin

- <25
- 25-45
- 45-70
- 70-110
- >110
- Not Calculated

- Freeway
- Major Roads
- Watershed Boundary
- HL-25 Sub Drainage Area ID
- Mobil Basin Name

0 0.25 0.5 1 Miles

Figure 7.4
Average Annual TN Load
Stormwater Quality Master Plan
City of Torrance

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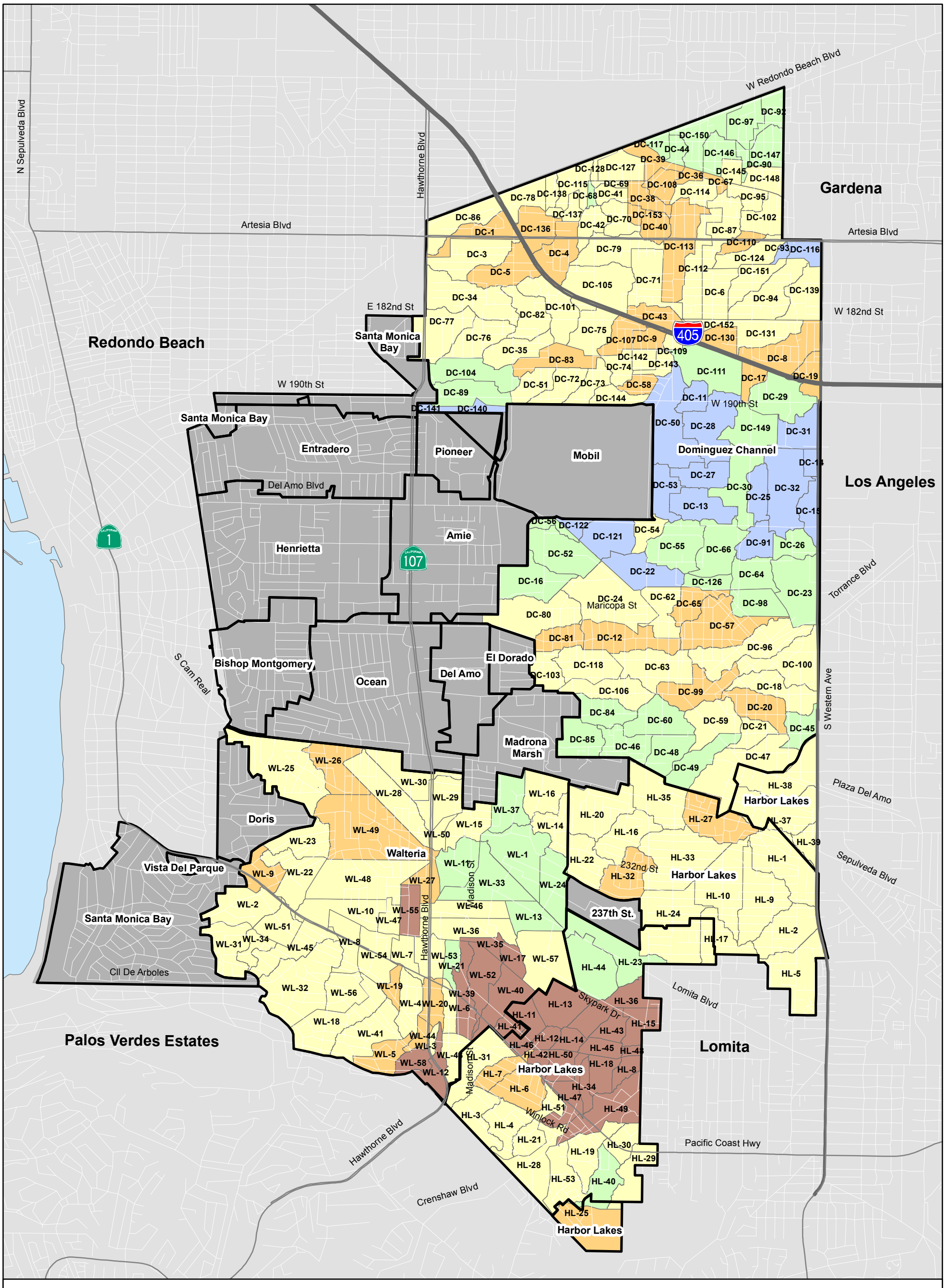

Legend

Preidcted TSS Pollutant Load (lb/yr/ac) by PLOAD Subbasin

- <35
- 35-40
- 40-45
- 45-50
- >50
- Not Calculated

- Freeway
- Major Roads
- Watershed Boundary
- HL-25 Sub Drainage Area ID
- Mobil Basin Name

0 0.25 0.5 1 Miles

Figure 7.5
Average Annual TSS Load per Acre by Subbasin
Stormwater Quality Master Plan
City of Torrance

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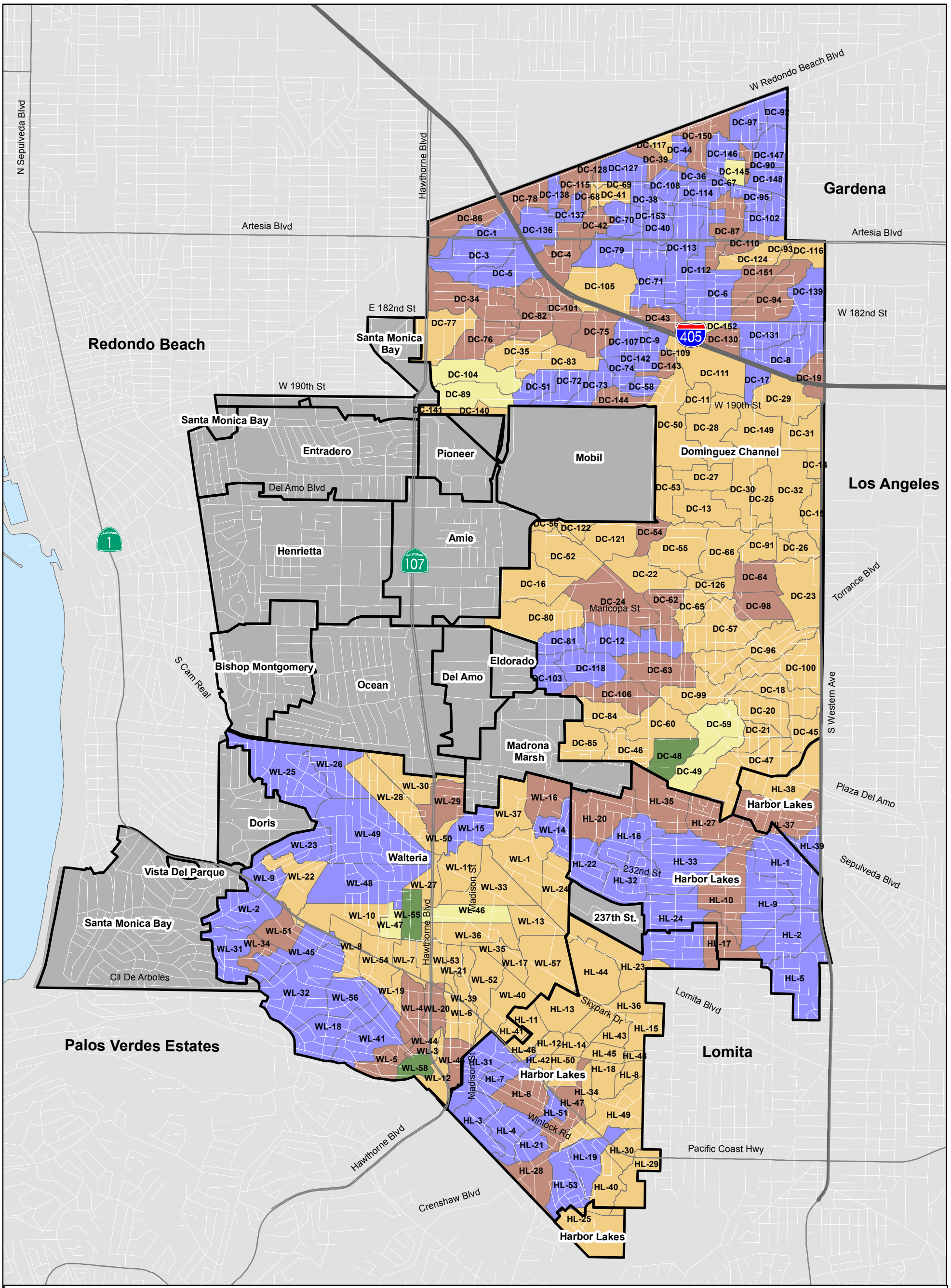

Legend

Predicted TP Pollutant Load (lb/yr/ac) by PLOAD Subbasin

- <0.3
- 0.30-0.40
- 0.40-0.45
- 0.50-0.55
- >0.55
- Not Calculated

- Freeway
- Major Roads
- Watershed Boundary
- HL-25 Sub Drainage Area ID
- Mobil Basin Name

0 0.25 0.5 1 Miles

Figure 7.6
Average Annual TP Load per Acre by Subbasin
Stormwater Quality Master Plan
City of Torrance

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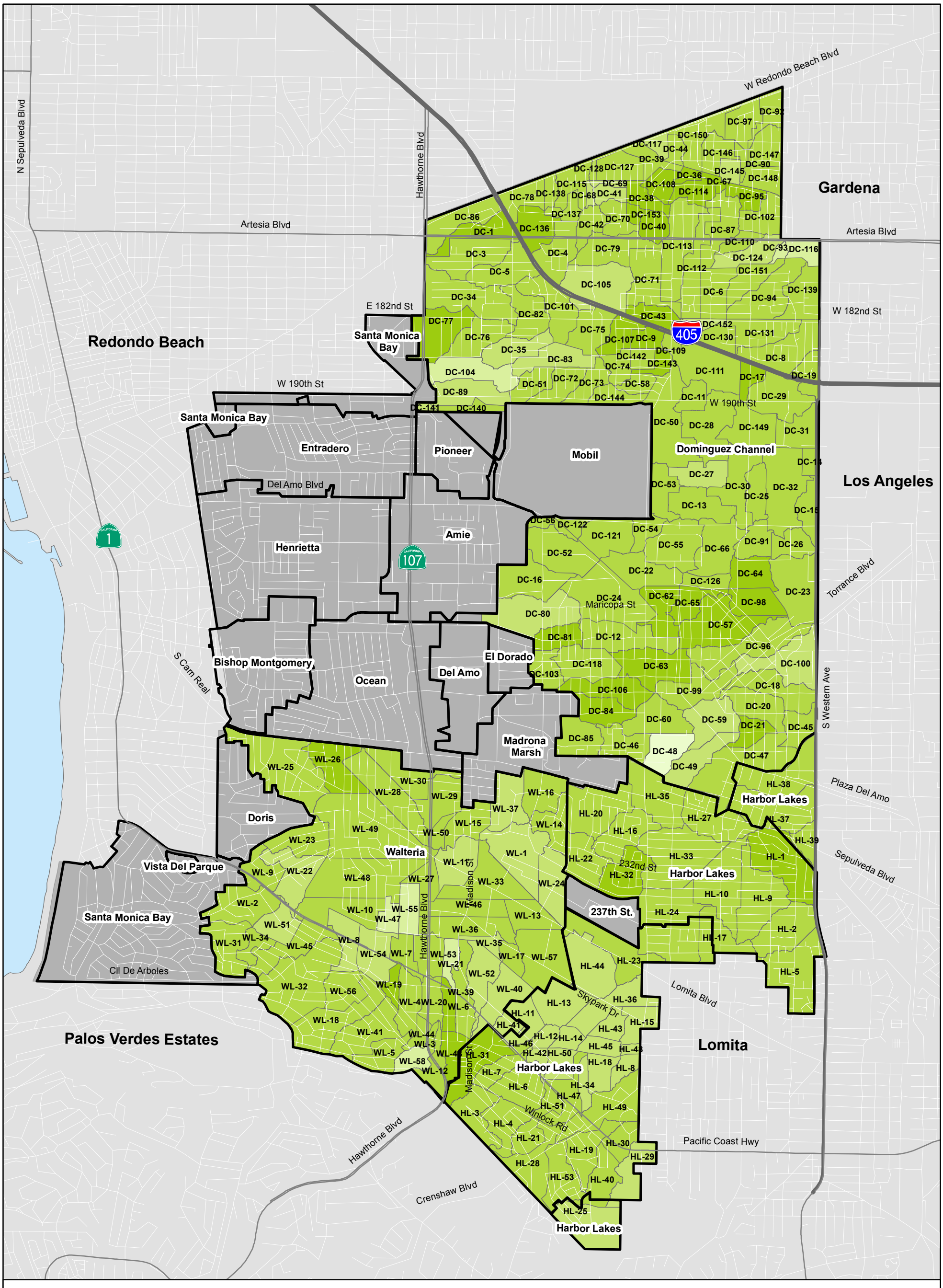

Legend

Predicted TN Pollutant Load (lb/yr/ac) by PLOAD Subbasin

- <0.70
- 0.70-0.75
- 0.75-0.80
- 0.80-0.85
- >0.85
- Not Calculated

- Freeway
- Major Roads
- Watershed Boundary
- HL-25 Sub Drainage Area ID
- Mobil Basin Name

0 0.25 0.5 1 Miles

Figure 7.7
Average Annual TN Load per Acre by Subbasin
Stormwater Quality Master Plan
City of Torrance

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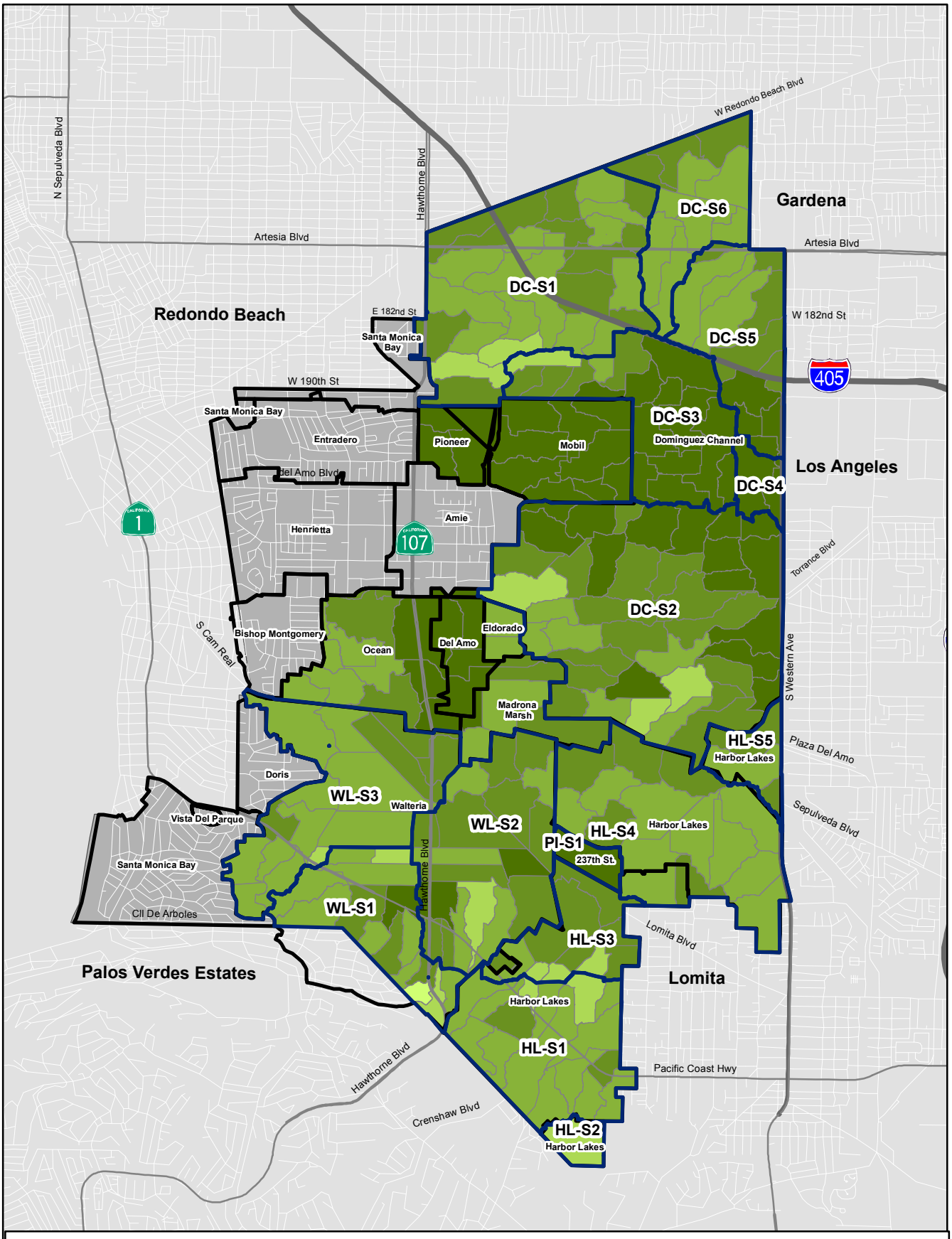
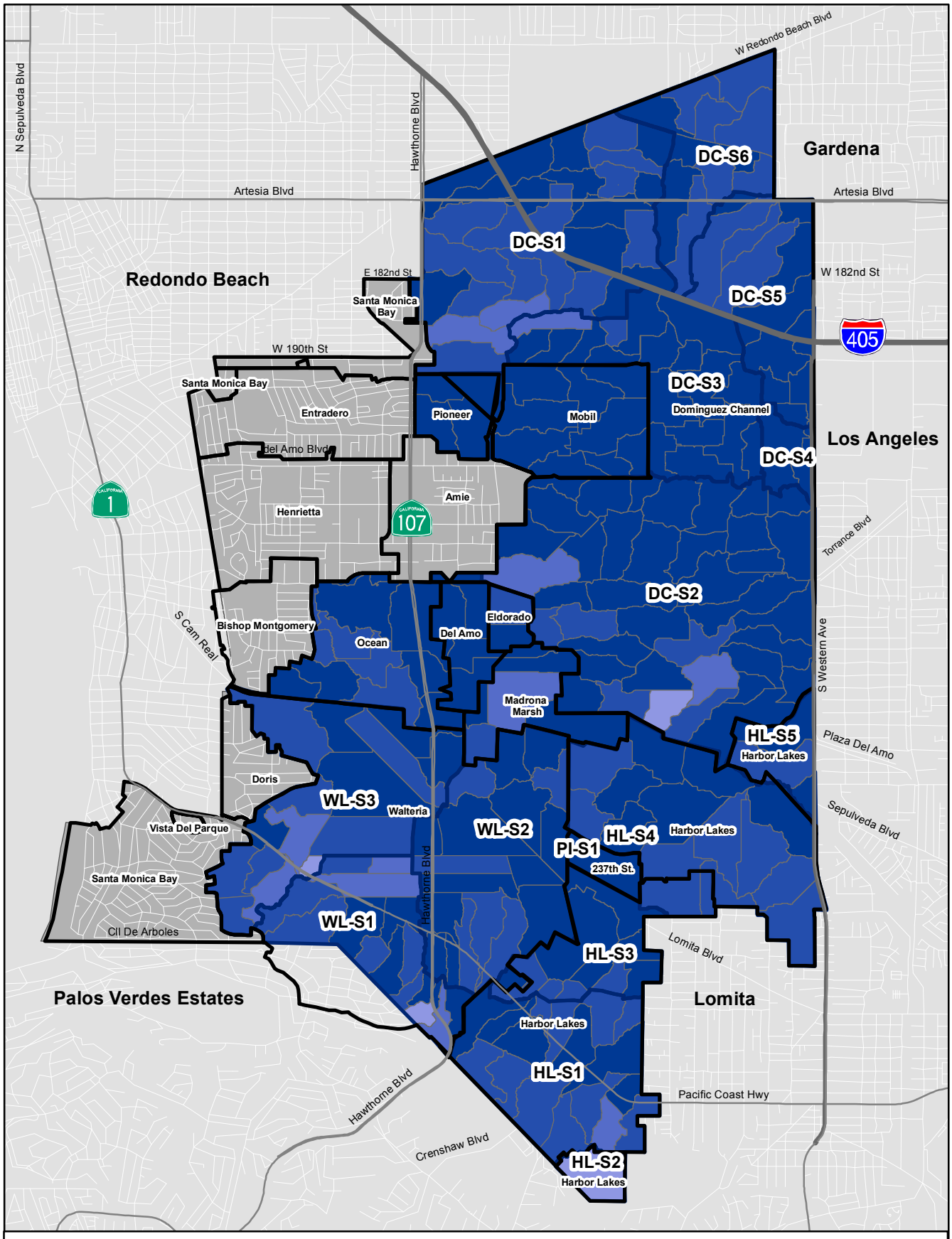


FIGURE 7.8
PLOAD Subbasin Priority Index Ranking for TP
Stormwater Quality Master Plan
City of Torrance



TKN Ranking by PLOAD Subbasin

- 1 Prioritized Low (Relatively Low Pollutant Load)
- 2
- 3
- 4
- 5 Prioritized High (Relatively High Pollutant Load)
- Not Calculated

0 0.25 0.5 1 Miles

FIGURE 7.9
PLOAD Subbasin Priority Index Ranking for TKN
Stormwater Quality Master Plan
City of Torrance

Table 7.3 Comparison of PLAT Results

Water-shed	Subarea	Predicted Pollutant Load (lb/yr)									Allowable Pollutant Load (lb/yr)	
		P8 Model			PLOAD Model			N-SPECT				
		TSS	TP	TN	TSS	TP	TN	TSS	TP	TN	TP	TN
Dominguez Channel	DC-S1	159,597	621	3,154	157,961	689	3,939	158,817	692	4,071		
	DC-S2	282,523	821	4,058	279,071	846	3,982	284,406	862	4,059		
	DC-S3	133,397	330	1,727	132,379	315	1,675	133,754	320	1,702		
	DC-S4	21,872	45	242	22,205	47	237	21,746	48	245		
	DC-S5	62,214	211	1,089	61,774	207	1,060	62,464	217	1,116		
	DC-S6	48,160	190	1,085	47,066	184	1,066	48,160	192	1,122		
	Total	**707,763**	**2,218**	**11,355**	**700,457**	**2,288**	**11,960**	**709,346**	**2,332**	**12,316**	**n/a(1)**	
Harbor Lakes	HL-S1	76,854	349	1,655	75,319	339	1,608	76,070	348	1,608		
	HL-S2	7,419	17	98	7,272	19	95	7,362	19	101		
	HL-S3	30,590	141	607	29,983	162	584	30,682	137	557		
	HL-S4	117,270	502	2,680	115,009	493	2,622	117,433	515	2,567		
	HL-S5	20,586	73	357	20,238	85	348	21,697	89	342		
	Total	**252,719**	**1,082**	**5,397**	**247,821**	**1,098**	**5,258**	**253,244**	**1,108**	**5,175**	**664**	**6,631**
Walteria Lake	WL-S1	57,821	234	1,249	56,672	241	1,298	60,103	252	1,389		
	WL-S2	121,966	430	2,059	120,158	412	2,183	122,007	386	2,235		
	WL-S3	107,223	436	2,301	105,899	425	2,277	104,677	433	2,255		
	Total	**287,010**	**1,100**	**5,609**	**282,729**	**1,078**	**5,758**	**286,787**	**1,071**	**5,879**	**n/a(2)**	

Notes:

(1) TMDLs for nutrients in the Dominguez Channel or Santa Monica Bay have not been developed to date.

(2) The County is responsible for pollutant removal from Walteria Lake.

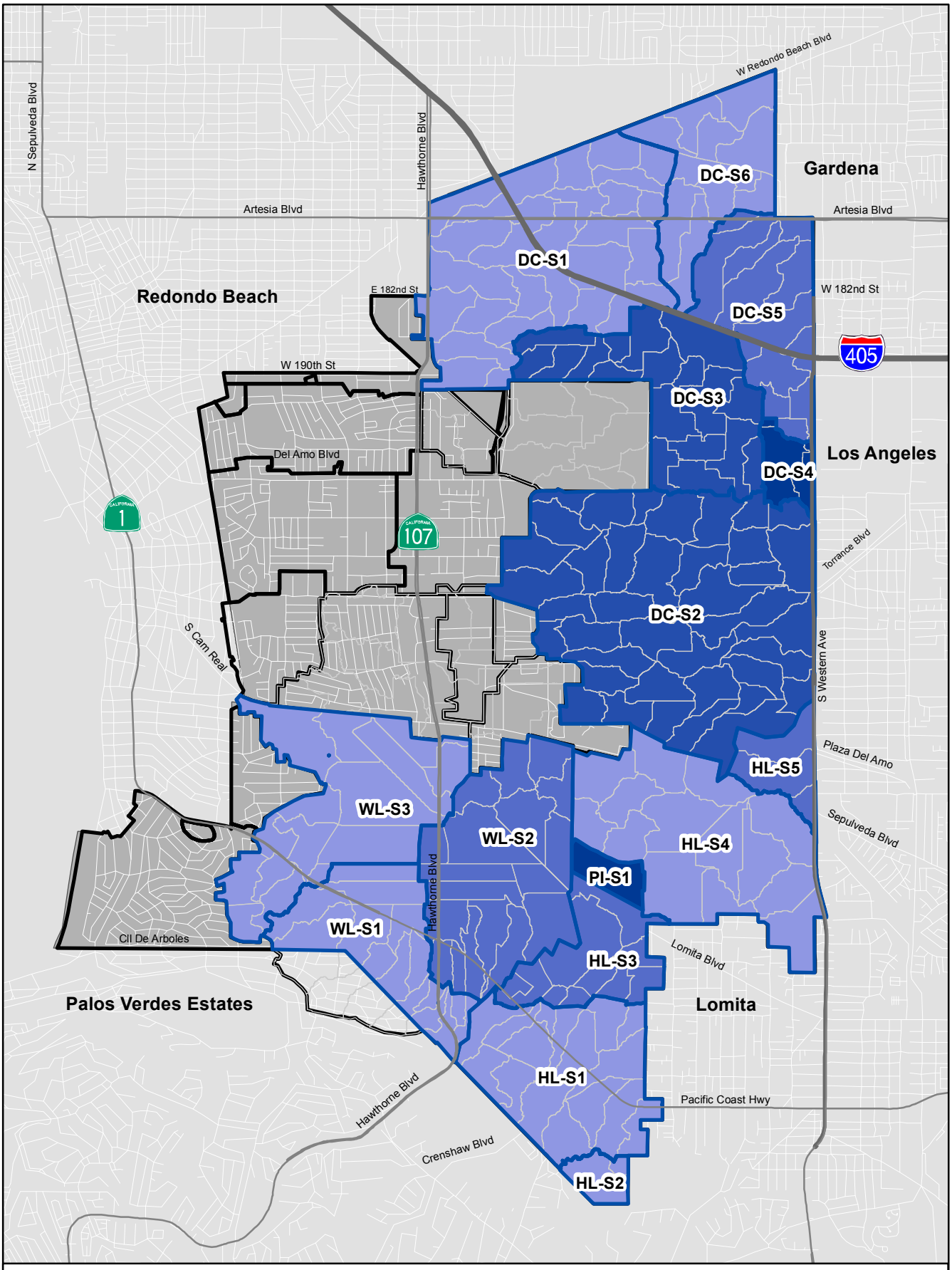
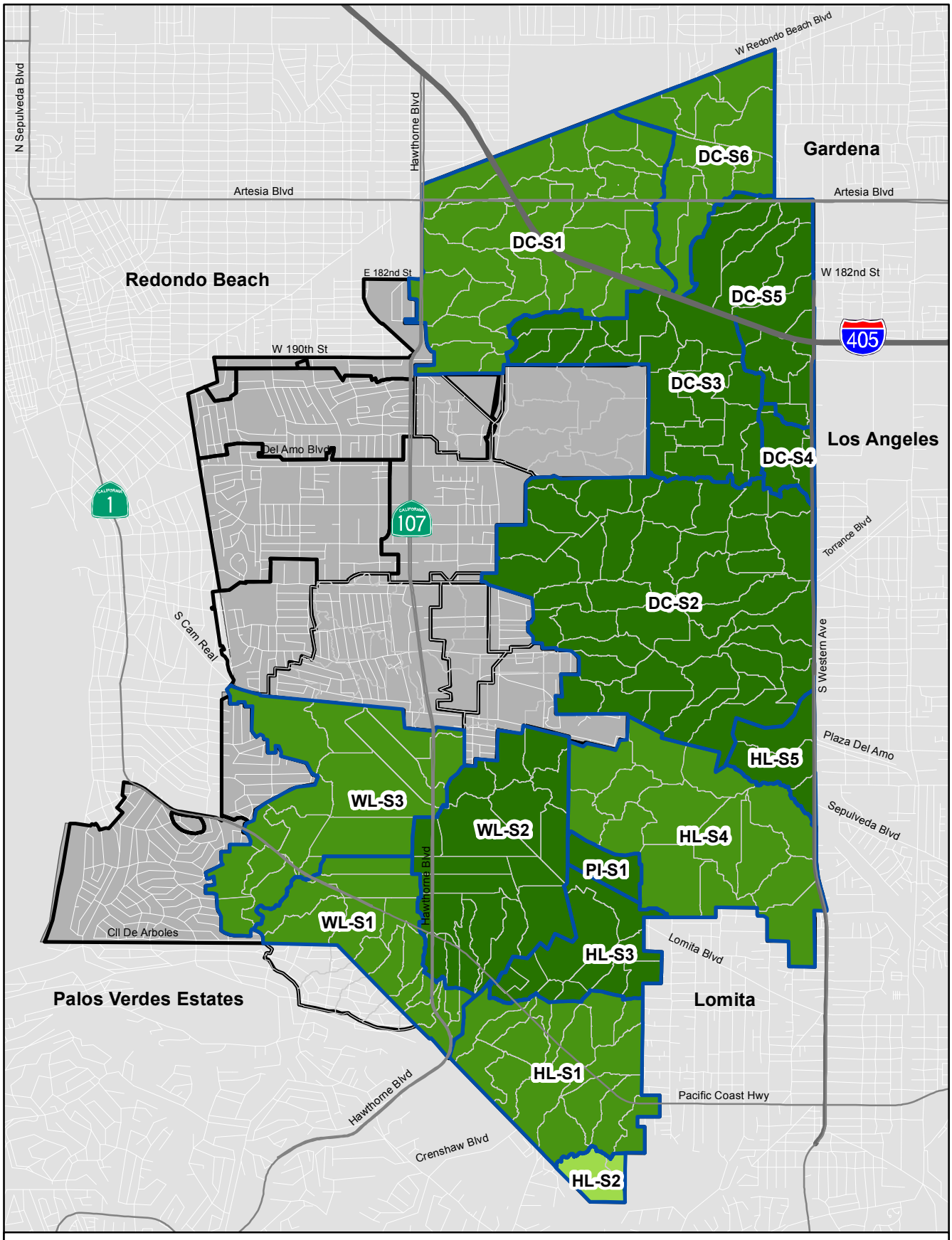


Figure 7.10
P8 Subarea Priority Index Ranking for TSS
Stormwater Quality Master Plan
City of Torrance

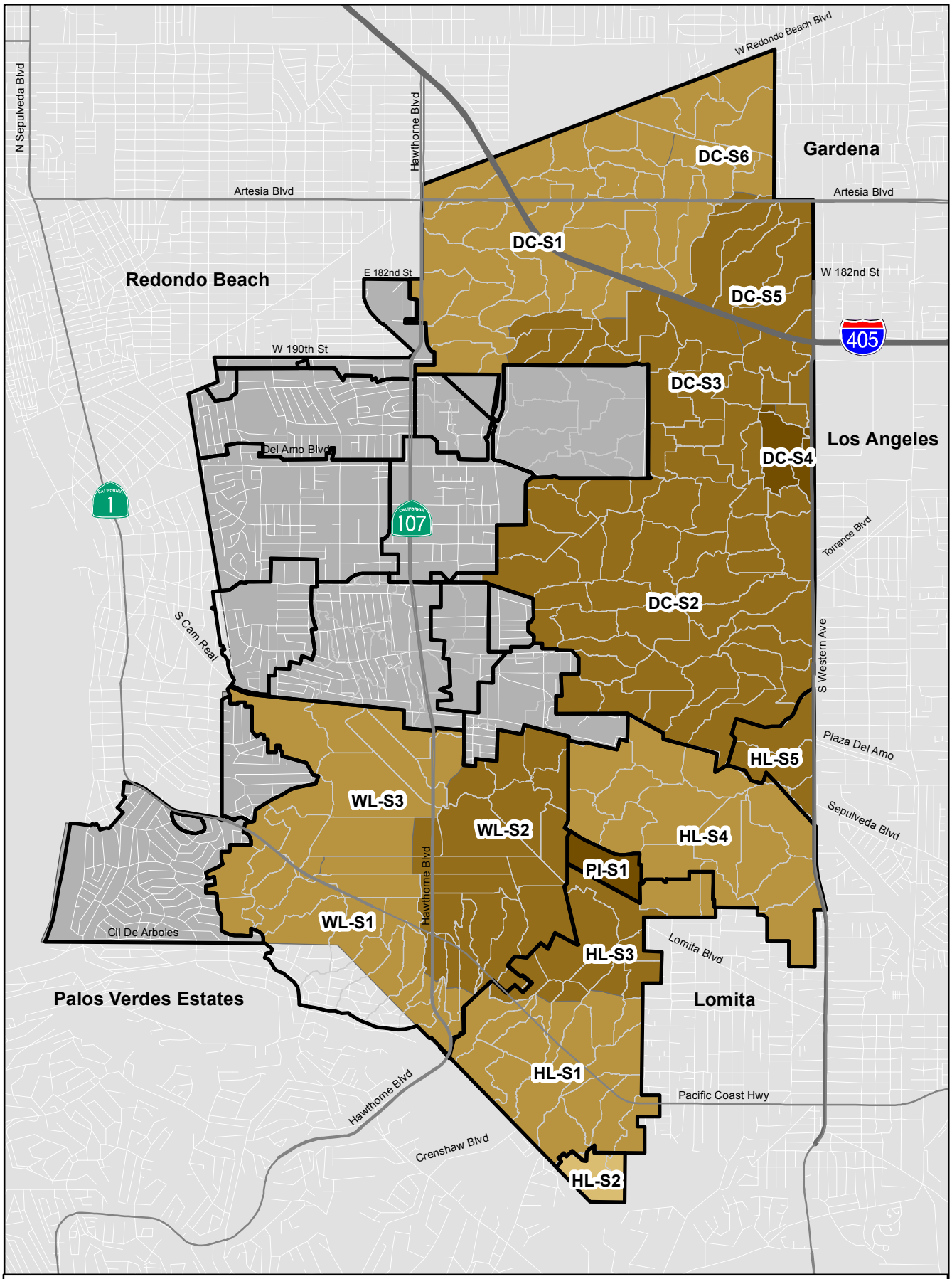


TP Ranking by P8 Subarea

- 1 Prioritized Low (Relatively Low Pollutant Load)
- 2
- 3
- 4
- 5 Prioritized High (Relatively High Pollutant Load)
- Not Calculated
- PLOAD Subbasin Boundaries

0 0.25 0.5 1 Miles

Figure 7.11
P8 Subarea Priority Index Ranking for TP
Stormwater Quality Master Plan
City of Torrance



TKN Ranking by P8 Subarea

- 1 Prioritized Low (Relatively Low Pollutant Load)
- 2
- 3
- 4
- 5 Prioritized High (Relatively High Pollutant Load)
- PLOAD Subbasin Boundaries

0 0.25 0.5 1 Miles

Figure 7.12
P8 Subarea 12 Priority Index Ranking for TKN
Stormwater Quality Master Plan
City of Torrance

7.2.3 Comparison of Pollutant Load Results

The estimated annual pollutant loads from the subareas for existing conditions in the three main watersheds are summarized in Table 7.3. This table also compares PLAT (PLOAD and P8) results with N-SPECT results. The PLOAD data in the table was obtained by summing the loads generated by all subbasins in that subarea.

A graphical presentation of the comparison of pollutant load estimates by the three tools for TSS, Total Nitrogen (TN), and TP are presented on Figure 7.13, Figure 7.14, and Figure 7.15, respectively. As shown on these figures, there is a good agreement between the PLAT and N-SPECT results. The comparison supports the structure and calibration of the hydrologic components of the P8 model for prediction and conveyance of stormwater quality in the study area.

As shown in Figure 7.13 through Figure 7.15, in general, larger subbasins generate higher average annual pollutant than smaller subbasins due to the larger area. Therefore, subbasin prioritization should not be based on average annual pollutant load. There are various methods available for ranking subbasins. In this study, a systematic method was developed and applied. This method scores subbasins, resulting in a subbasin prioritization. The ranking method is explained in Section 7.2.5.

Figure 7.2 through Figure 7.7 present detailed pollutant distribution maps showing total pollutant loading, concentration of pollutant loading, and density of pollutant loading, each by subbasin. Results for each of these is discussed below.

Total Pollutant Loads by Subbasin

The total pollutant load by subbasin is the annual load in pounds (lb/yr) generated by each subbasin. A review of the results in Figure 7.13 through Figure 7.15 illustrates that subbasins WL-49, WL-25, HL-24, HL-33, and WL-48 are the major contributors of TP to the City's surface water discharge, in descending order. For TN, subbasins WL-48, HL-24, WL-25, HL-33 and WL-48 are the major contributors in descending order. For TSS, subbasins DC-50, WL-49, DC-32, DC-23, and DC-28 are the major contributors in descending order.

Event Mean Concentration by Subbasin

The event mean concentration by subbasin is the average event mean concentration in milligrams per liter (mg/L) for each specific pollutant, weighted by the relevant land use types and associated areas. Reviewing the results presented in Figure 7.2 through Figure 7.4, it can be concluded that subbasins DC-117, DC -150, and DC -144 have the most significant average event mean concentration (EMC) values for TN, in descending order. For TP, subbasins DC -64, HL-14, and DC-52 have the largest EMC values.

Pollutant Loads per Unit Area by Subbasin

The pollutant load per unit area by subbasin is the annual load of pollutant expressed in pounds per acre per year (lbs/ac/yr) generated per unit area of a subbasin, taking into account density of pollutant loading. The annual pollutant load per unit area is particularly important in the identification of high pollutant sources and, therefore, decision making regarding BMP placement as a pollutant mitigation effort. Reviewing the results in Figure 7.5 through Figure 7.7, it can be seen that subbasins WL-54, DC-117, WL-27, DC-19 and DC-110 have the most significant TN load per unit subbasin area, in descending order. Subbasins, DC-9, DC-19, DC-43, WL-20 and WL-27 are the largest contributors in terms of generation of TP per unit of subbasin area. On load per unit acre basis, subbasins WL-54, DC-117, WL-27, DC-19, DC-43, WL-20, DC-110 and DC-9 have the highest potential of generating pollutant loads.

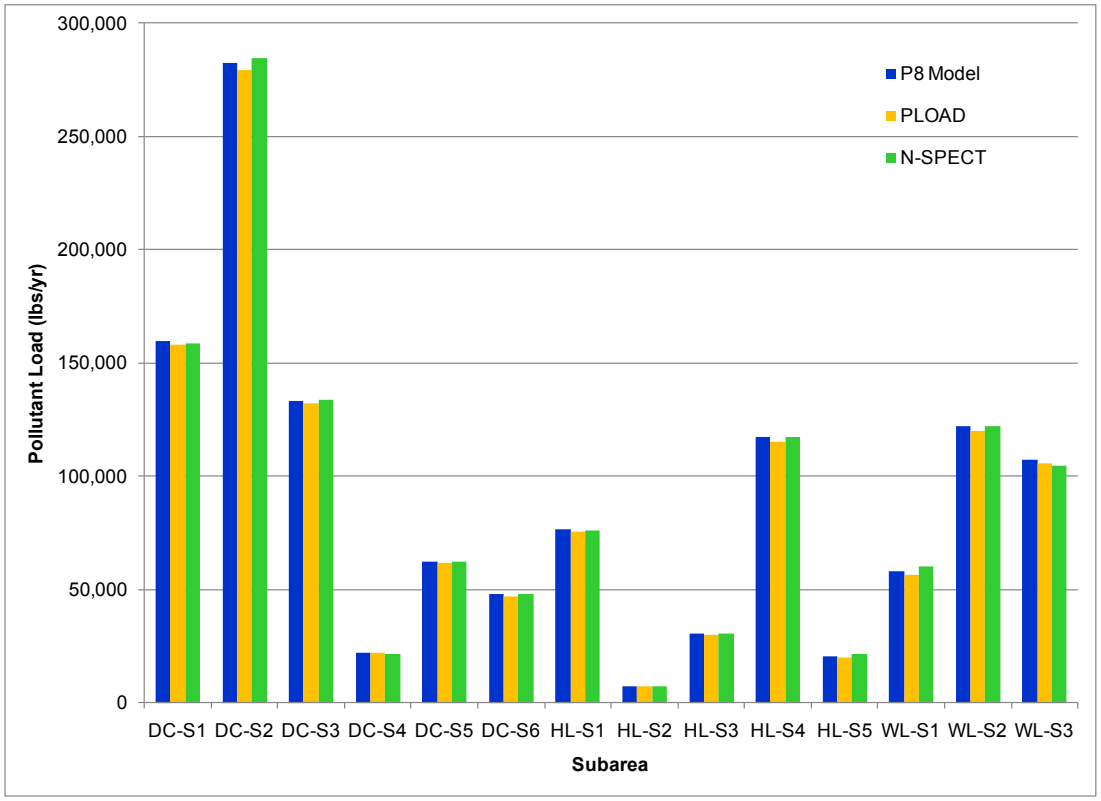


Figure 7.13 Pollutant Load Comparison for TSS by Subarea

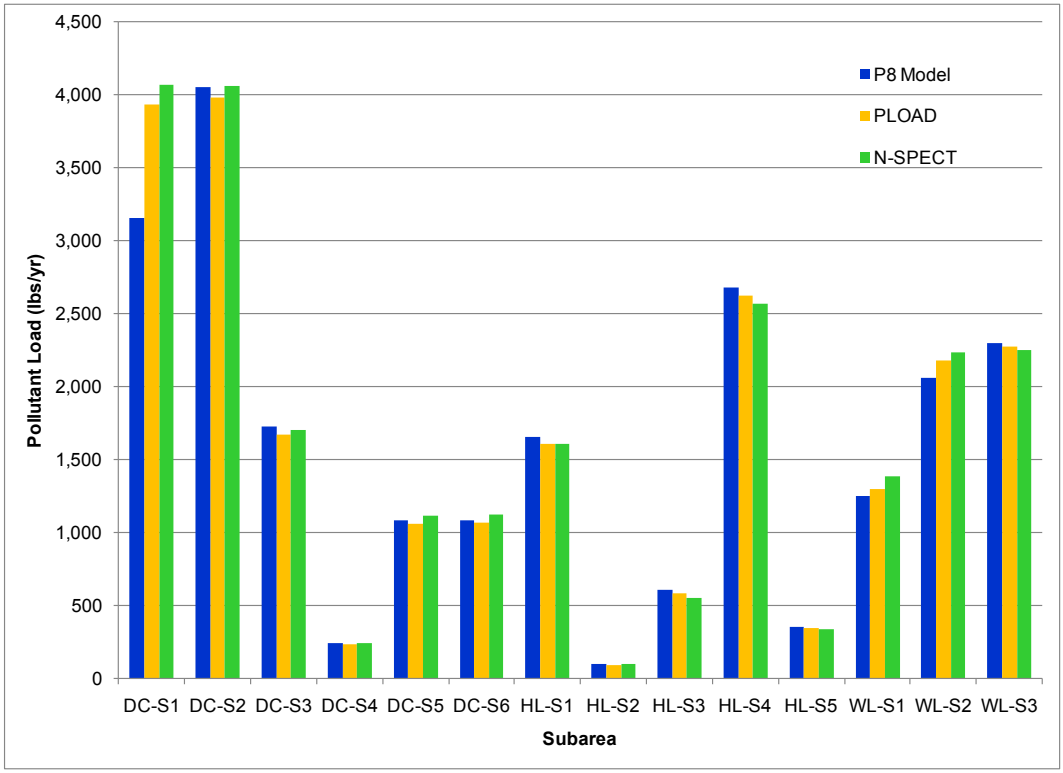


Figure 7.14 Pollutant Load Comparison for TN by Subarea

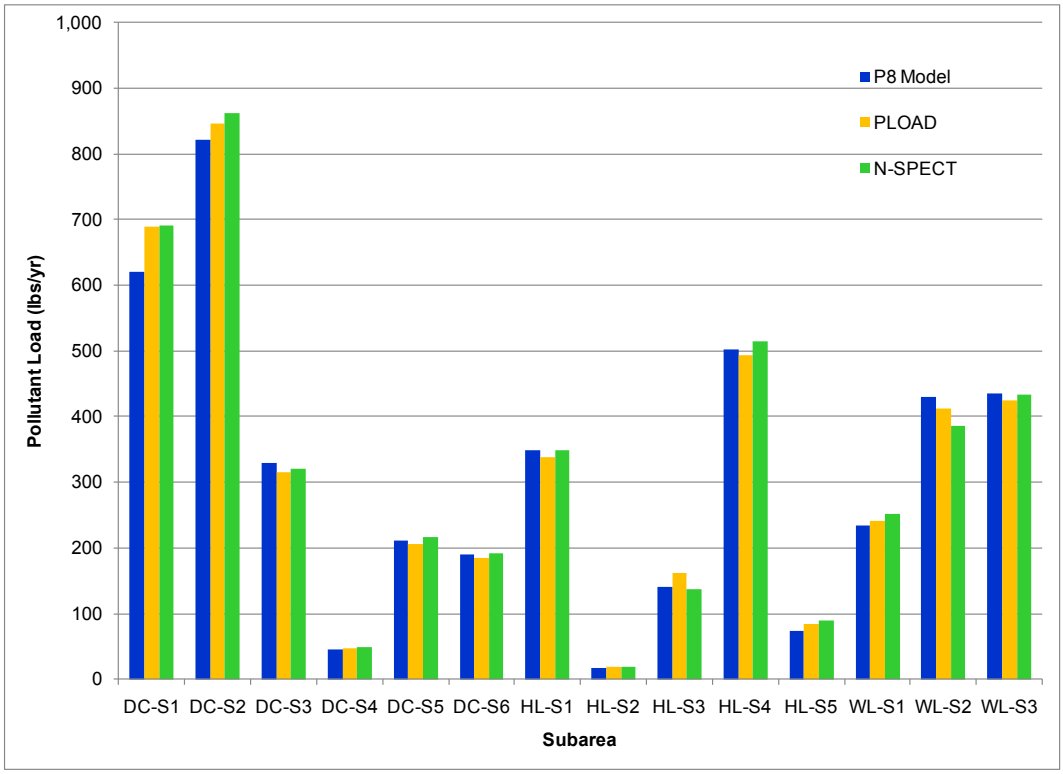


Figure 7.15 Pollutant Load Comparison for TP by Subarea

7.2.4 Water Quality Evaluation Results Summary

Based on the pollutant distribution maps presented on Figure 7.2 through Figure 7.7 two high pollutant areas can be identified in the east and south part of the study. These are:

- The highest pollutant loads found in the southeast part of the City are located near the airport and are primarily located east of Hawthorne Boulevard and north and south of Lomita Avenue. This includes subareas PI-S1, WL-S2, and HL-S3.
- The highest pollutant loads (both nutrients and sediments) found in the eastern part of the City are located between 190th Street and Maricopa Street. This includes subareas DC-S2, DC-S3, and DC-S4. The land use in this area is mainly heavy manufacturing and includes the ExxonMobil Refinery.

As shown in Table 7.2 and Table 7.3, the calculated loading for areas of the City from which stormwater is discharged to Machado Lake is anticipated to exceed the allowable pollutant load for total phosphorous while total nitrogen is anticipated to be below the allowable pollutant load. It should be noted that the discharge from Walteria Lake is not assumed to contribute to the nutrient loading of Machado Lake.

Potential TMDLs for the Dominguez Channel are not anticipated to include nutrients; thus, nutrients are not compared to an allowable load for the Dominguez Channel. For toxics, including metals and pesticides, TSS is used within the models as an indicator for the potential pollutant loading of the various constituents included in toxics TMDLs. Since TSS is used as an indicator and is itself not assigned a WLA within the TMDLs applicable to the City's stormwater points of discharge, a numerical comparison of allowable pollutant loading with the predicted pollutant loading is not possible.

Since predicted loading of trash was not evaluated with the models, a comparison of allowable pollutant loading with predicted pollutant loading for trash is not possible. Recommended BMPs will include components to capture trash and alternatives such as street sweeping, are discussed later in this chapter.

7.2.5 Ranking of Subareas

In developing the final ranking of the hydrologic units or subbasins, a numeric ranking system was developed to determine subbasin priority index, a prioritization score on a scale of 1 to 5 with 5 being the highest priority. The following steps were used to develop the subbasin priority index:

1. Calculate annual pollutant load for existing land use conditions.
2. Calculate theoretical maximum subbasin pollutant load (maxLoad). The theoretical maximum subbasin pollutant load is the land use condition in a subbasin that will generate maximum pollutant loads. In this analysis, commercial land use condition is identified to give the theoretical maximum TP and TKN loads. For TSS, the high-

density residential land use condition is used to calculate the theoretical maximum TSS load.

3. Normalize Step 1 values by Step 2 values.
4. Calculate subbasin score by multiplying Step 3 values by 5.
5. Determine SPI by rounding Step 4 values to next highest integer (e.g., report result of 1.1 as 2).
6. Generate SPI maps.

The SPI maps generated for TP and TKN were presented earlier in the chapter with the discussion on the results of the PLOAD model on Figure 7.8 through Figure 7.9. It should be noted that the predictions from PLOAD strongly depend on the accuracy of the impervious values by land use type and the EMC data. Although the PLOAD model allows for the evaluation of the effects of BMPs, it does not consider the spatial location of these BMPs, and it relies on literature values of effectiveness to determine the sum of pollutant removal by all the BMPs within a watershed. The City may continue to use PLOAD as a screening tool, but a more sophisticated modeling tools such as P8 and SUSTAIN are needed to address the land use planning and stormwater management demands placed on the City.

The P8 subareas were also prioritized using the two methods explained above. The SPI maps generated for the subareas are presented earlier in the chapter with the discussion on the results of the P8 model on Figure 7.10 through Figure 7.12.

The subarea prioritization for all three evaluated NPS pollutants resulted in the following ranking depicted in Figure 7.16:

- Subarea DC-S4.
- Subarea DC-S3.
- Subarea DC-S2.
- Subarea HL-S3.
- Subarea HL-S2.

The highest ranked subbasins predicted by PLOAD are all located in these subareas. The screening procedure included in PLAT provides a technique to support the decision making process for City staff for a variety of stormwater program objectives.

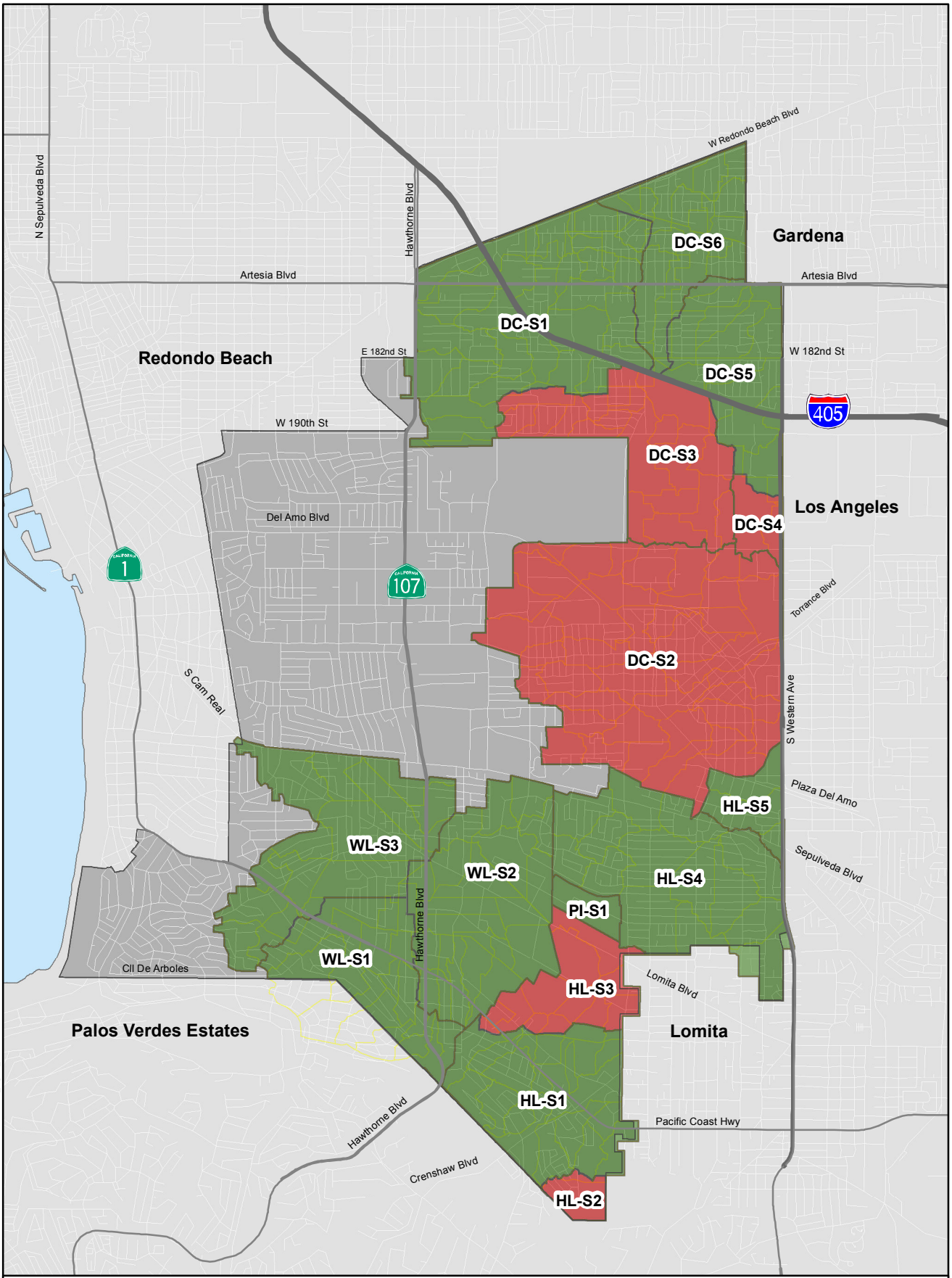


Figure 7.16
High Priority Subareas
Stormwater Quality Master Plan
City of Torrance

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7.3 BMP TREATMENT OPTIONS

TMDLs and other regulatory requirements mandate that treatment controls address the pollutants of concern. Treatment options can generally be categorizes as non-structural BMPs and structural BMPs. Each category is described briefly below.

7.3.1 Structural BMPs

The most common structural treatment BMPs along with the pollutants of concern addressed by each are listed in Table 7.4. This table provides a qualitative summary of the effectiveness of each BMP to address the various categories of pollutants of concern.

Table 7.4 Treatment Control BMP Selection Matrix

Pollutant of Concern	Treatment Control BMP Categories[(1)]					
	Catch Basin Inserts	Bioretention	Hydrodynamic Separators	Infiltration	Wet Ponds	Wetlands
Sediment	M	H	M	H	H	H
Nutrients	L	M	L	H	M	H
Trash	M	H	M	H	H	H
Trace Metals	L	H	M	H	H	H
Organics	L	H	M	H	H	H
Bacteria	L	H	M	H	H	H

Notes:
(1) Efficiency: H =65% – 100%; M = 30% – 60% and L = <30%

As currently planned, stormwater runoff from all high priority subareas within the City will be routed to structural treatment BMPs. These treatment BMPs, when combined with source control and non-structural BMPs are anticipated to address all of the pollutants of concern.

The results of this study were used as a screening tool for selecting the most efficient placement of these structural BMPs. Based on the subarea ranking described in Section 7.2.5, it can be concluded that the middle portions of the Dominguez Channel watershed area are contributing the largest total amount of TN, TP, and TSS pollution.

These high pollutant concentration areas are mainly due to the high imperviousness of these subbasins as a result of heavy manufacturing activity. In addition, there are subbasins with significant pollutant contribution per unit area in the Harbor Lakes watershed. There are several subbasins in subarea HL-S3 comprised mainly of business, commercial, and roadway land uses, which have much higher pollutant loads per unit area than the rest of the City.

Based on model results, subbasins in Walteria Lake watershed have the lowest annual pollutant load per unit area for TP, TN, and TSS. Therefore, when considering BMP placement, these subbasins would not be considered good candidates for BMPs as their annual pollutant loading rates per unit area are low. In addition, Walteria Lake provides treatment to pollutant loads generated from this watershed. It should be noted that sediment within Walteria Lake is a source of pollutants. BMPs located upstream of Walteria Lake would do little to reduce the pollutant load from sediment within Walteria Lake.

Based on the high pollutant concentration areas as well as the subbasin and subarea ranking, the following subareas appear to be the top priority areas for treatment considerations, as presented in Figure 7.16. Thus, recommendations for BMP siting and placement will carefully consider these subareas.

- Dominguez Channel Watershed:
  - Subbasin DC-S4.
  - Subbasin DC-S3.
  - Subbasin DC-S2.
- Harbor Lakes Watershed:
  - Subbasin HL-S3.
  - Subbasin HL-S2.

7.3.2 Non-Structural and Source Control BMPs

In addition to the many structural BMPs that may be used to reduce the pollutants found in stormwater, there are a large number of non-structural activities that are also effective. These are often referred to as "good housekeeping" measures. Most of these activities fall into categories such as preventing the exposure of materials to rain (covering), preventing spills from entering the conveyance system (containment), and general good housekeeping measures. Non-structural BMPs may be implemented in several ways. For example, ordinances may be used to control the application of pesticides and herbicides. Public education may teach proper use of household chemicals including fertilizers. Spill prevention planning can be used to reduce problems caused by large spills of chemicals. Most non-structural methods are not designed to decrease the rate of stormwater runoff, but to limit pollution. Their effectiveness varies widely and is difficult to quantify with any accuracy.

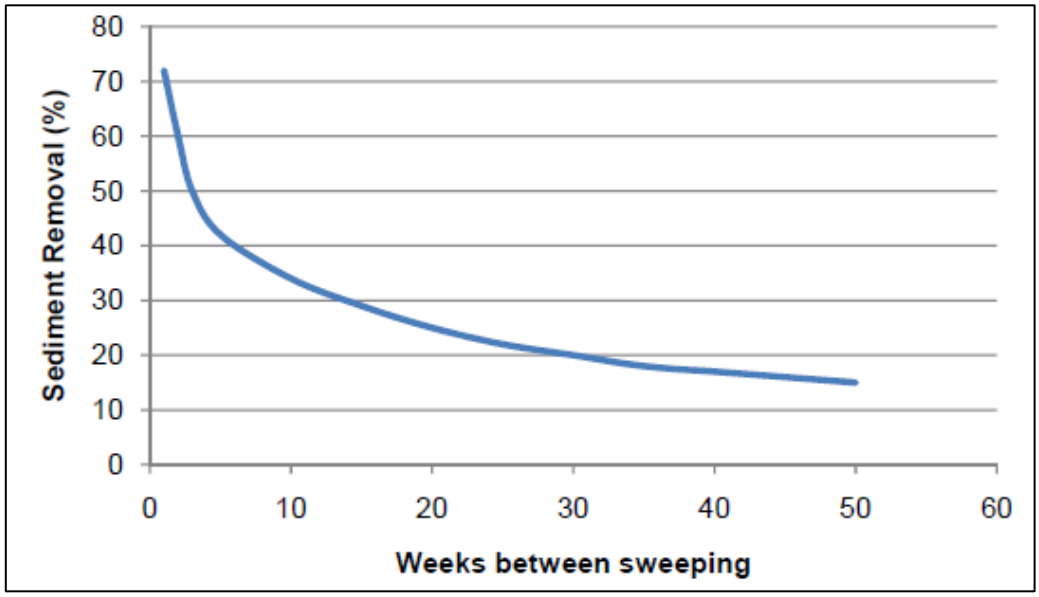
7.3.2.1 Street Sweeping

Sweeping removes debris and particulates from paved surfaces; it does not decrease the peak or volume of stormwater runoff. Pollutants targeted by street sweeping include sediment, nutrients, trash, metals, bacteria, oil and grease, and organics. The pollutant removal effectiveness is dependent on the sweeper technology and frequency of cleaning, as well as posting and enforcement of “No Parking” signs.

Street sweepers usually have a rotating brush, but may also have a vacuum or jets for washing. The City uses jets and vacuum sweepers. However, the City has not installed signage in order to clear parked vehicles during street sweeping in about 90 percent of the City. This results in only being able to clean the center of the streets in many places, missing the sides of the streets where trash and debris collects.

Sweeping is one of the best methods for removing stormwater pollutants in urban areas. This source control type of activity removes pollutants before the runoff enters the stormwater collection system or receiving waters. It is recommended that the City install signage throughout the City to maximize the pollutant reducing effectiveness of its street sweeping activities.

Restrictions on street sweeper operation are primarily due to traffic patterns, posting of "No Parking" signs, and costs. For instance, state highway departments may be restricted by the amount of time that lanes can be blocked on highways for street sweeping. On residential streets, clearing the street of parked vehicles can also be difficult. Street sweepers require a high capital investment, thus limiting the number of sweepers available to a community. Figure 7.17 shows how sediment removal efficiency is related to the frequency of sweeping. Removal efficiency continues to improve with more frequent sweeping, with the maximum efficiency point lying between weekly and monthly sweeping. Increasing the frequency beyond once per week provides limited additional benefit.



Source: (Sutherland, 1998)

Figure 7.17 Impact of Street Sweeping Frequency on Sediment Removal

7.3.2.2 Catch Basins

Catch basins may be designed with or without a bottom compartment that is designed to trap particulates. Without the trap, the catch basin does not remove any pollutants, and requires little maintenance. With the trap and regular cleaning, the catch basin will remove coarser particulates. Catch basins may also be constructed to trap oils and floatable trash. A drop inlet catch basin has a goose-necked outlet pipe that maintains a semi-permanent pool, trapping floatables, oils, and coarse solids. EPA estimates of unit costs for typical pre-cast catch basins are between $2,000 and $3,000 (EPA, 2006).

Due to the built out nature of the City's service area, it is not anticipated that many new catch basins will be built in the future. Thus, revising standard catch basin designs to incorporate a bottom compartment for trapping particulates is not anticipated to result in significant reductions in pollutant loading.

7.3.2.3 Inlet/Catch Basin Inserts

Inlet/catch basin inserts are devices that are placed within a stormwater inlet or catch basin to trap pollutants. They are designed to improve pollutant removal by inserting a series of trays, absorbent material, or filters between the catch basin inlet and the outlet pipe. A number of catch basin inserts are available on the market, including BioClean Environmental's Curb Inlet Basket, Kristar's FloGard Plus, United Storm Water, Inc.'s DrainPac, and Contec's Triton.

The most common type is a fabric liner or sock. A more complex device is an arrangement of trays that have wells for sediment removal and high-flow bypass capability. Field testing of inserts has shown varying degrees of effectiveness. In general, rigid inserts allow the washing out of particulates after a few storms. Fabric inserts are more effective at trapping particulates, but are usually temporary in nature and require more frequent maintenance. It can be used with any standard configuration of inlet. EPA estimates for effectiveness of catch basin inserts for TSS removal ranges widely. One study estimated a removal rate of about 32 percent while another study evaluating small storms estimates a removal rate from 60 to 97 percent. Estimates for metals (copper, specifically) were about 3 to 4 percent based on annual cleaning (EPA, 2006).

A related type of BMP to the catch basin insert are screen covers, which can either be installed on the outside of curb inlet openings as a fixed cover or as retractable covers inside the catch basin inlet that can be adjusted manually or automatically. Automatic retractable screen covers remain closed during dry weather and open during wet weather events based on stormwater flow levels. Manually retractable screen covers must be manually closed and opened (generally this would be done seasonally to prevent clogging during stormwater events). The primary advantage of screens is that debris and trash are effectively collected outside of the catch basin where they can be removed by street sweeping. Screen covers are intended to target trash and debris, and generally do not

capture fine sediment, metals, or oil and grease. However, screen covers can be combined with other catch basin inserts, reducing the frequency of cleaning the catch basin inserts.

The cost per catch basin can be relatively low, but each catch basin treats only a small drainage area, so the capital cost of the entire drainage system may be high. Typical costs per catch basin can range from $400 for the simplest types, up to $10,000 for the more complex inserts (EPA, 2006).

Based on the City's experience during its catch basin insert pilot testing program, preliminary cost estimates for incorporating catch basins inserts into catch basins throughout the City was estimated as $2.5 million. The operational costs are largely dependent on the frequency of cleaning, but can be fairly intensive given the number of catch basins within the City.

7.3.2.4 Modular Wetlands

Modular wetlands are a hybrid stormwater treatment system incorporating multiple treatment technologies into a single packaged system. Modular Wetlands Systems' MWS-Linear model integrates screening, hydrodynamic separation, media filtration, and bioretention along with a high flow bypass into a pre-cast concrete structure, typically 5 feet by 22 feet. The module supports landscape vegetation, typically drought tolerant plants or native vegetation.

Modular wetlands are designed to remove several pollutants, including TSS, hydrocarbons, dissolved metals, dissolved nutrients including nitrogen and phosphorous, and pathogens. Based on manufacturers bench scale testing, modular wetlands are fairly effective at removal of TSS, hydrocarbons, and turbidity, with removal rates between 93 and 100 percent. Removal of dissolved metals is also good, with removal rates between 80 and 93 percent for copper, lead, and zinc. Removal of phosphorous is estimated at 22 percent, and bacteria at about 60 percent. Modular Wetlands Systems' MWS-Linear model is sized for a peak flow rate of 0.27 cfs, with a treatment volume of 4,000 ft^3, and the modular system is sized to fit in a typical parking lot curb or street median.

Maintenance of modular wetlands can be accomplished by hand or vacuum truck. Four stages within the hybrid system have individual cleaning requirements, each consecutive stage requires less frequent cleaning. The first two stages are screening and hydrodynamic separation, for which cleaning consists of removing debris. Cleaning of the third stage consists of replacing the filtration media, and is typically completed annually. The fourth stage, the vegetated media, is typically replaced after five to twenty years.

Based on the City's required treatment volumes, it is anticipated that use of modular wetlands would not be economically feasible if implemented on a City-wide basis, especially considering the ongoing costs of replacement of filtration media. However, these systems may be a good option for small catchment areas or individual sites.

7.4 BMP SITING PLAN

Modification of existing detention basins into BMPs represents a low cost approach to developing BMPs to reduce the City's pollutant load. However, existing detention basins were designed based on water capacity considerations rather than water quality, thus the placement and potential use of existing detention basins is limited. Therefore, additional BMP sites to address water quality treatment needs were identified in this study. The existing detention basin sites are shown (in green) on Figure 7.18.

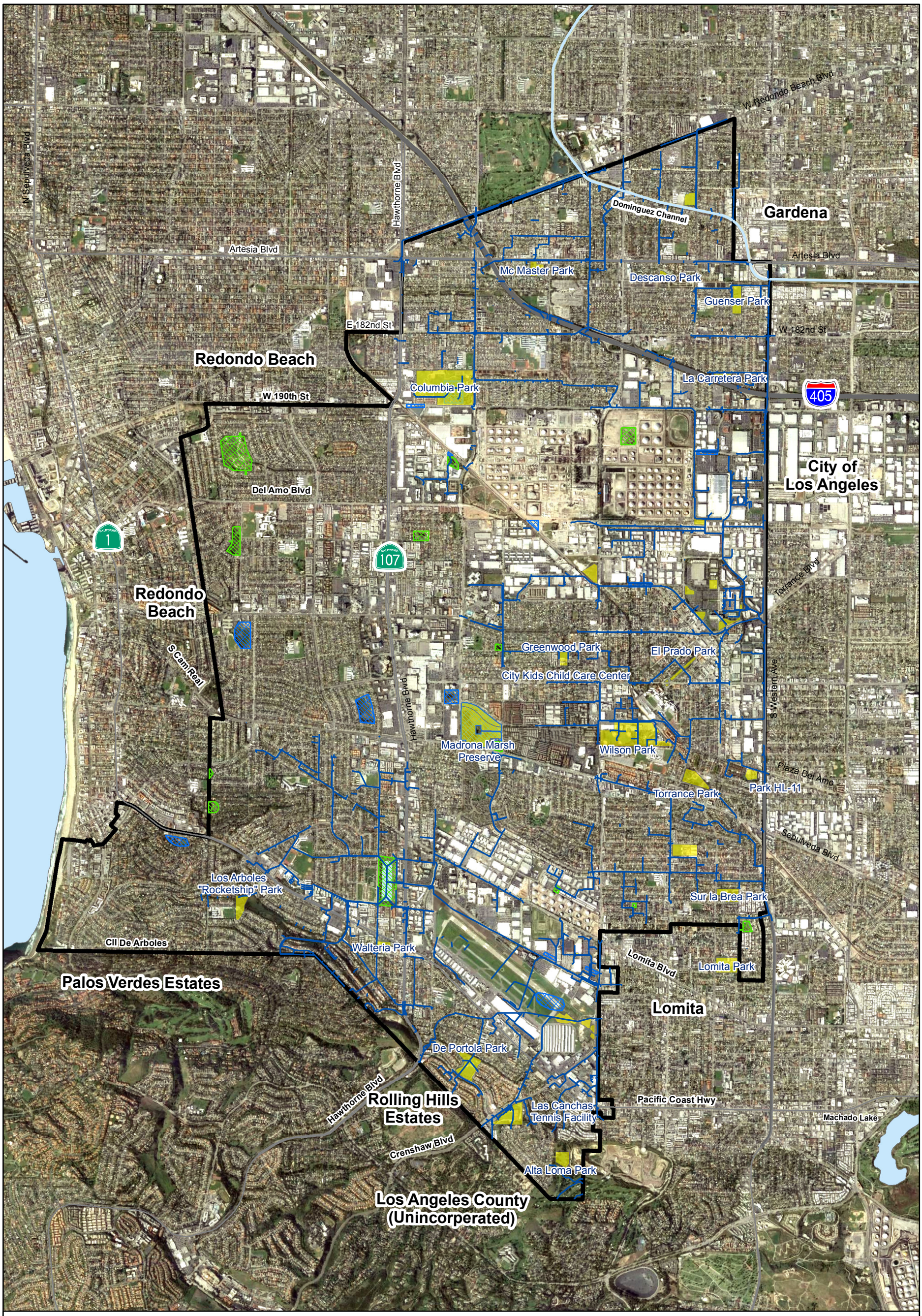
The site selection process was expanded through a reconnaissance of study area for potential new BMP sites. Site evaluations included an initial feasibility investigation, followed by a more detailed site investigation. A feasibility investigation was performed to determine the locations of surplus areas owned by City in the study area. Potential sites from this initial investigation are shown on Figure 7.18.

The feasibility investigation started by reviewing topographic maps to verify that identified sites were located at or near the low point of the associated subbasin drainage. Candidate sites from the feasibility phase were further investigated to determine available site area, estimated tributary watershed. Adequacy of the site was determined by estimating the required basin surface area (a function of tributary area, 0.5 percent was used). If these criteria were satisfied, further site investigation was completed, such as reviews of soil conditions and drainage plans.

Finally, the site information was evaluated using a weighted decision matrix. Each site was evaluated and compared with respect to several different criteria. The criteria were weighted according to their importance and relevance to the site selection process. The most important criteria were:

- Sufficient area (without substantial improvement).
- Location away from building foundations and highway pavement.
- Proximity to receiving waters.
- Ease of maintenance access.
- Availability of a perennial water source.
- Treatment or inclusion of high priority subbasins

Each site scored 1 to 10 with respect to each criterion. The site's total score was the sum of the individual scores, multiplied by the weighting factors associated with that criterion. Based on this scoring, the selected locations for wet weather BMPs and low flow diversion BMPs are depicted on Figure 7.19 and Figure 7.20, respectively.



Legend

- Potential BMP Location
- Detention Basins
- Retention Basins
- Bodies of Water
- Storm Drain
- Freeway
- Major Roads

0 0.2 0.4 0.8 Miles

Figure 7.18
Potential BMP Siting Locations
Stormwater Quality Master Plan
City of Torrance

carollo
Engineers...Working Wonders With Water™

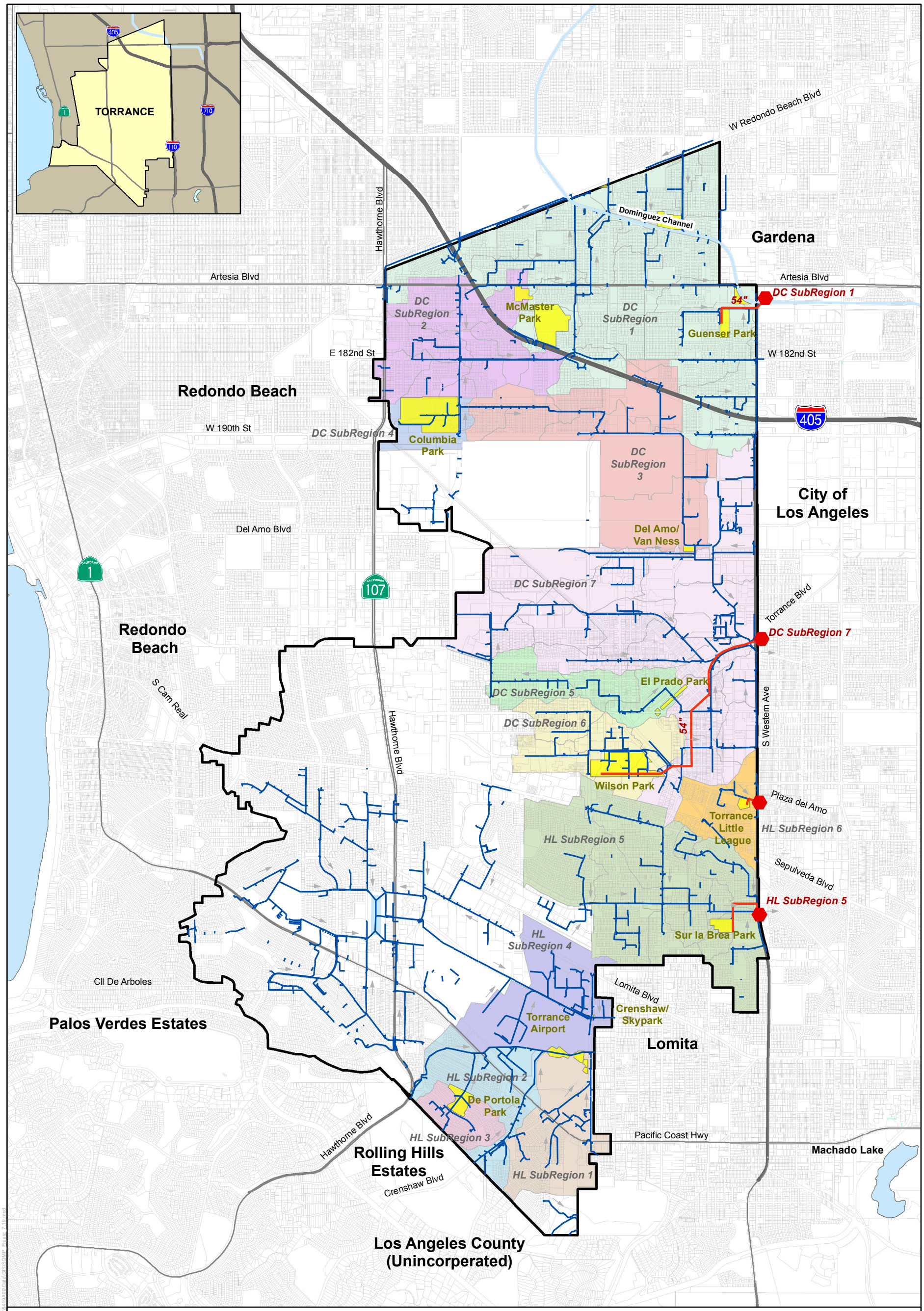


Figure 7.19
Selected Wet Weather BMP Sites
Stormwater Quality Master Plan
City of Torrance

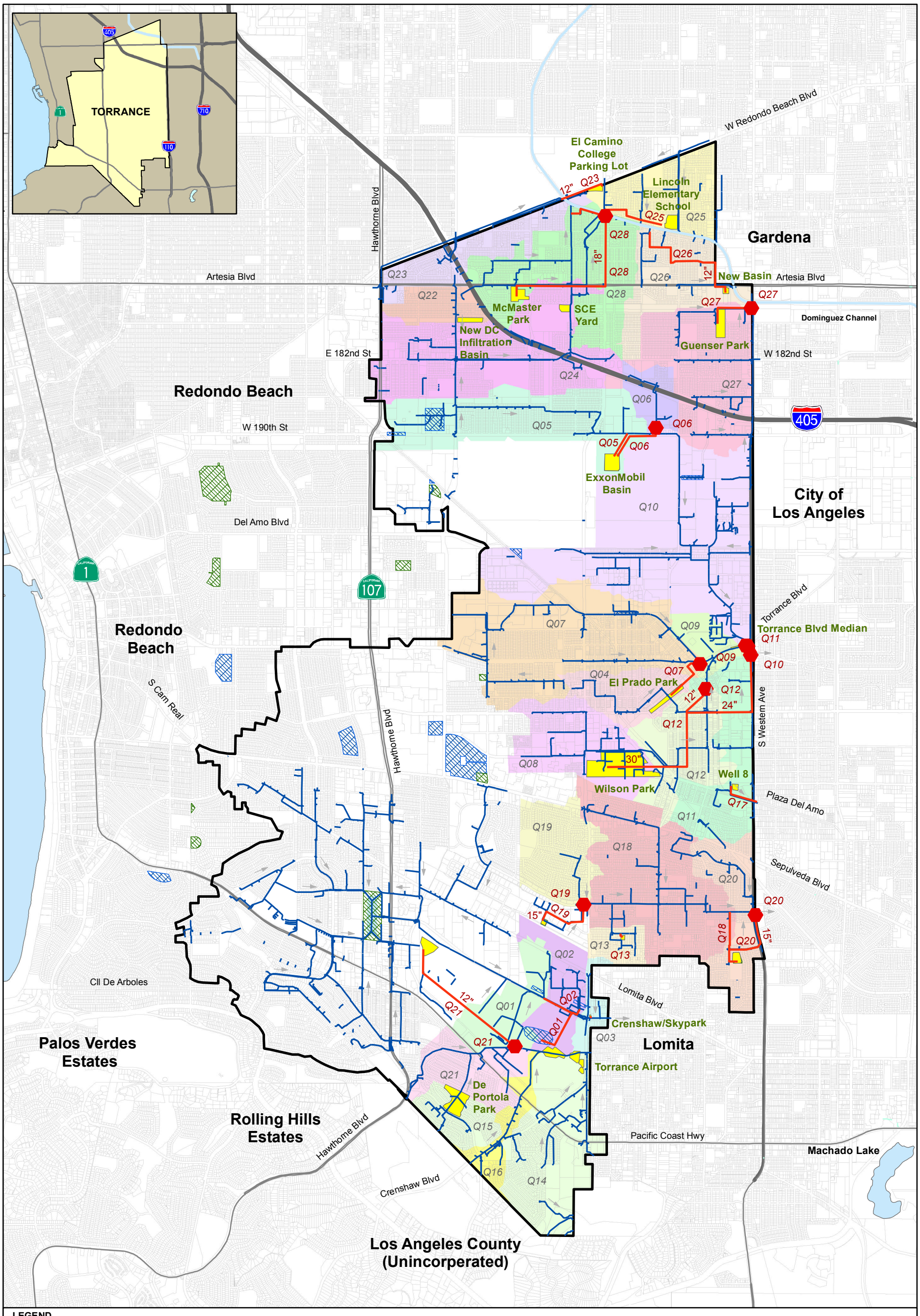


Figure 7.20
Recommended Low Flow Diversion BMP Sites
Stormwater Quality Master Plan
City of Torrance

7.4.1 Regional and Distributed BMPs

For the purposes of this analysis, BMPs have been divided into two categories:

- Regional/subregional BMPs: centralized stormwater facilities, typically placed near the outlet of a catchment (a drainage area of approximately 40 acres) or subwatershed (a group of catchments with a common outlet) and designed to treat stormwater from a relatively large drainage area (order of magnitude, approximately 100 acres).
- Distributed BMPs or source area practices: stormwater devices and landscaping practices dispersed throughout a catchment and typically serving relatively small drainage areas (order of magnitude, approximately 10 acres), such as a large single parcel, rooftop, or section of roadway

Parcel data was used to identify and prioritize opportunities for implementation of both regional and distributed BMP types. Parcel data used to distinguishing public and private ownership and, if public, owner agency. The parcel data was quarried to include all public parcels and to exclude any private parcels below a minimum size. By overlaying the parcel dataset with the land-use data, parcels were classified as open space, residential, or other developed based on land use. Residential parcels were dropped from the analysis, as it was assumed that stormwater management for these parcels was best addressed through institutional BMPs.

Maps and catchment scores for the two types of BMP opportunities were generated: Regional/sub-regional BMPs are defined here as structural treatment or volume mitigation BMPs implemented at the subwatershed or catchment scales. Distributed/onsite BMPs are defined here as structural treatment or volume mitigation BMPs implemented at the neighborhood, parcel or site scale.

The following criteria were used:

- Regional/Subregional BMP Opportunity Scoring:
  - Identify large (e.g., >1 acre) open space parcels located near storm drains or channels, assigning 0 to all areas not selected;
  - For selected parcels, assign individual regional opportunity scores: 5 for all City- or County-owned public parcels, 4 for all other-owned public parcels (schools/universities, state and federal facilities, utilities, and highway corridors), and 2 for all private commercial or industrial parcels; assign 0 for all others (e.g., residential).

- Distributed/Onsite BMP Opportunity Scoring:
  - Identify large (i.e., >1 acre area) developed parcels, including all roadway areas;
  - For these parcels, assign individual distributed opportunity scores of 5 for all large City- or County-owned public parcels or "major" roadways, 4 for all other-owned public parcels (schools/universities, state and federal facilities, utilities, and "minor" roadways), and 2 for all private commercial or industrial parcels; assign 0 for all non-highlighted distributed opportunity parcels.

Recommended Wet Weather BMP sites for the high priority areas are as follows:

- Subbasin DC-S4: Wilson Park and Torrance Blvd. Median
- Subbasin DC-S3: ExxonMobil Detention Basin (existing basin)
- Subbasin DC-S2: Wilson Park, El Prado Park, and Torrance Blvd. Median
- Subbasin HL-S3: Torrance Airport and intersection of Crenshaw/Skypark
- Subbasin HL-S2: De Portola Park

As listed above, existing detention basins (though privately owned) were found to be useable for one high priority subbasin (DC-S3). Public facilities, including Wilson Park, El Prado Park, Torrance Airport, and De Portola Park were identified for most of the remaining high-priority subbasins. One BMP was sited in the public right of way near the intersection of Crenshaw and Skypark. The remaining high priority BMP was sited on private property near Torrance Blvd.

Subregional and source area practices are discussed in Section 7.6.

7.5 BMP DESIGN

As described in the preceding chapters, storm water runoff has the potential of introducing pollutants (nutrients, pathogens, oil and grease, suspended solids, metals, gasoline and other toxics) to the storm water conveyance system and, ultimately, the receiving water body. Pollutants of concern exhibit one or more of the following characteristics:

1. Current loadings or historic deposits of the pollutant are impacting the beneficial uses of receiving water bodies.

2. Elevated levels of the pollutant are found in sediments of receiving water body and/or have the potential to bioaccumulate in organisms therein.

3. The detectable inputs of the pollutant are at a concentrations or loads considered potentially toxic to humans and habitats.

The overall objective of the SQMP is compliance with the Machado Lake Nutrients TMDL. and Dominguez Channel Toxics TMDL. The primary objective, therefore, is to remove nutrients from the existing stormdrains. Additional objectives are to remove pollutants other than nutrients, such as suspended solids, trash, metals, particulates, and bacteria. It is anticipated that pollutant loading of pesticides, petroleum hydrocarbons, and pathogens are reduced through the implementation of BMPs addressing suspended solids.

In selection of BMP types, the City has emphasized its intent to maximize reuse of stormwater, focusing BMP efforts on retention and infiltration where possible. This emphasis is underscored by the City's sustainability objectives and focus on LID within the General Plan.

These objectives may in general be met by implementing Best Management Practices (BMPs) or a combination thereof. The main elements of BMPs proposed for the City of Torrance include:

- Diversion of off-site stormwater from existing stormdrain system to the BMP project site.
- Pretreatment of diverted stormwater through hydrodynamic separators or properly designed forebays.
- Retention of pretreated stormwater in one underground detention tanks.

Return of excess treated stormwater to the stormdrain during dry-weather conditions is another potential element of BMPs. However, this was not used within the City's planned BMPs due to the City's emphasis on sustainability and maximizing reuse of stormwater.

The proposed BMPs may improve the beneficial and recreational uses of receiving water bodies, reduce potential risks for human safety and health, reduce beach closures, preserve aquatic marine and plant habitats, and benefit tourism industry. This project will also assist the City with meeting new requirements of the stormwater NPDES permit to reduce pollutant levels in the receiving waters.

7.5.1 BMP Sizing

Unlike flood control measures that are designed to handle peak flow rates, stormwater treatment control BMPs are designed to treat the more frequent, lower-flow rate storm events, or the first flush portion of runoff from larger storm events. For the City's service area, small, frequent storm events represent most of the total average annual rainfall. The flow rate and volume from such small events will need to be targeted for treatment.

The primary control strategy for designing treatment control BMPs is to treat the stormwater quality design flow or the stormwater quality design volume of the stormwater runoff.

Flow based treatment BMPs treat water on a continuous flow basis. Examples include vegetated swales, hydrodynamic separators and screened systems. Sizing of a flow based treatment BMP is based on the stormwater quality flow. The stormwater quality flow is also used to size stormwater lift stations.

Volumetric-based stormwater quality BMPs, such as infiltration systems and wetlands, are sized based on a stormwater quality design volume.

The Los Angeles County Low Impact Development Standards Manual (LAC, 2009) recommends use of an 85th percentile 24-hour runoff event as one of four options for calculation of the design storm to size LID BMPs. This SQMP has used this criterion for the sizing of the City's BMPs. The following two subsections explain how the stormwater quality design flow and the volume were calculated.

7.5.1.1 Stormwater Quality Design Flow Calculation

The stormwater quality design flow can be estimated from one of three methods listed below.

- Ten percent of the 50-year peak flow rate; or
- The flow of runoff produced by a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the applicable area, based on historical records of hourly rainfall depths;
- The flow of runoff from a rain event equal to at least 0.2 inches per hour intensity

Stormwater treatment BMPs designed using any of the three methods specified above, when properly applied, will be in compliance with the NPDES permit's requirements. In this study, the 85th percent method was used to estimate stormwater quality flow.

First, the 85th percentile hourly rainfall intensity was determined from Figure 7.21, which was developed for the City. From the figure, the 85th percentile intensity is 0.123 inches per hour. The stormwater quality flow was then calculated using the rational method:

$$Q_{wq} = C * I * A$$

Where:

C = runoff coefficient obtained from Table 7.5
I = rainfall intensity (2 x 0.123 in/hr)
A = area of the site or sub-drainage area in acres.
Q_{wq} = stormwater quality flow in cfs

Table 7.5 Runoff Coefficients Based on Impervious/Pervious Area Ratios		
Percent Impervious	**Percent Pervious**	**Runoff Coefficient "C"**
0	100	0.15
5	95	0.19
10	90	0.23
15	85	0.26
20	80	0.30
25	75	0.34
30	70	0.38
35	65	0.41
40	60	0.45
45	55	0.49
50	50	0.53
55	45	0.56
60	40	0.60
65	35	0.64
70	30	0.68
75	25	0.71
80	20	0.75
85	15	0.79
90	10	0.83
95	5	0.86
100	0	0.90

The calculation is presented in Table 7.6, with high priority subareas highlighted and listed first.

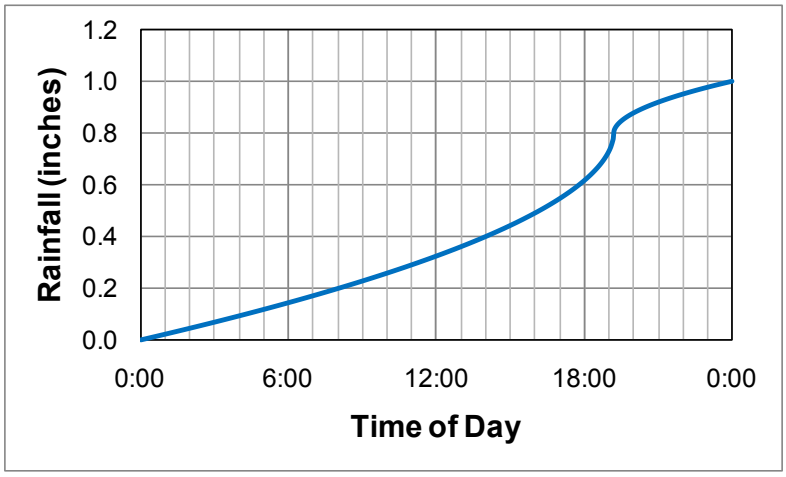


Figure 7.21 Rainfall Intensity

Table 7.6 Calculation of Stormwater Quality Design Flow

Subarea	Area (ac)	Percent Impervious	Runoff Coefficient	Stormwater Quality Design Flow (cfs)
DC-S2	492	64%	0.63	76.3
DC-S3	689	67%	0.66	111.2
DC-S4	114	44%	0.48	13.5
HL-S2	247	62%	0.62	37.6
HL-S3	99	40%	0.45	11.0
DC-S1	1,506	66%	0.65	240.1
DC-S5	233	57%	0.58	33.0
DC-S6	319	64%	0.63	49.6
DC-S7	1,399	74%	0.70	242.3
HL-S1	297	61%	0.61	44.4
HL-S4	348	58%	0.59	50.3
HL-S5	921	62%	0.62	140.2
HL-S6	155	64%	0.63	24.1

Note:
1. High priority subareas are shaded in grey.

7.5.1.2 Stormwater Quality Design Volume Calculation

Hydrologic calculation for design of volumetric-based stormwater quality BMPs was based on Los Angeles County procedures. The calculation procedure consists of the following four steps:

1. Review the area draining to the proposed BMP and determine the percentages of drainage area that is considered impervious.
2. Use Table 7.5 to determine the runoff coefficient for the drainage area.
3. Use runoff coefficient and Figure 7.22 to estimate the Unit Storage Volume required for 80% annual capture of runoff.
4. The basin volume or basic volume of the BMP is then calculated by multiplying the Unit Basin Volume by the BMP's drainage area.

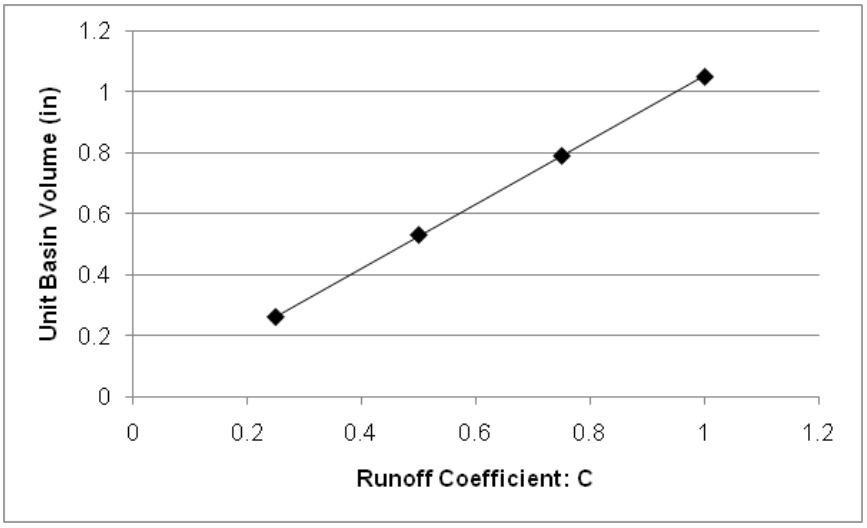


Figure 7.22 Volumetric BMP Sizing Curve

The results of the stormwater design volume calculations are summarized in Table 7.7. The high priority subareas are listed first and shaded in grey.

Table 7.7 Calculation of Stormwater Quality Design Volume

Subarea	Area (ac)	Percent Impervious	Runoff Coefficient	Unit Storage Volume (in)	Stormwater Quality Design Volume (MG)
DC-S2	492	64%	0.63	0.66	8.9
DC-S3	689	67%	0.66	0.69	12.9
DC-S4	114	44%	0.48	0.51	1.6
HL-S2	247	62%	0.62	0.65	4.4
HL-S3	99	40%	0.45	0.48	1.3
DC-S1	1,506	66%	0.65	0.68	27.9
DC-S5	233	57%	0.58	0.61	3.8
DC-S6	319	64%	0.63	0.67	5.8
DC-S7	1,399	74%	0.70	0.74	28.1
HL-S1	297	61%	0.61	0.64	5.2
HL-S4	348	58%	0.59	0.62	5.8
HL-S5	921	62%	0.62	0.65	16.3
HL-S6	155	64%	0.63	0.67	2.8

Note:
1. High priority subareas are shaded in grey.

7.6 RECOMMENDED STORMWATER TREATMENT PRACTICES

Recommendations for stormwater treatment practices are made separately for wet weather and low flow diversion approaches. For each of the recommended BMPs, tributary areas were delineated that are also referred to as Sub Regions. The Sub Regions for wet weather BMPs and low flow diversion BMPs are depicted on Figure 7.19 and Figure 7.20, respectively.

7.6.1 Selection of Wet Weather Stormwater Treatment Practices

Subregional BMPs were selected to achieve the water quality goals for this project. Several types of source area practices (distributed BMPs) cover each of the types of source areas.

A number of source area practices include both proprietary and non-proprietary practices with a range of nutrient and TSS removal. These represent a number of treatment processes, such as infiltration, bio-retention cells, retention, and hydrodynamic separators. The criteria for selecting subregional and source practices included the availability of good data to verify effectiveness of practices, preliminary cost information, and some experience with practices in Los Angeles County.

Subregional Practices

Infiltration systems were selected as the first option for subregional practices as they met all the criteria for the selection of treatment practices. Many infiltration systems have been successfully installed in Los Angeles County and infiltration systems have been used by many cities in the region, including the City of Los Angeles, as a way to meet goals for TMDL, MS4 permit requirements, and flood control. It is anticipated that infiltration systems will meet future MS4 permit requirements regarding LID.

Source Area

Source area practices selected for this project include bio-retention cells and hydrodynamic separators. The nutrient reduction capabilities of bio-retention cells have been verified by a number studies based on modeling and field data. Potential general locations generally used to implement source area practices are large parking lots, industrial parcels, and business areas. Because such properties are generally private in nature, the City would need to negotiate with the property owners in order to implement source area practices.

Because of the uncertainty associated with negotiating with private entities, and the requirements to meet TMDL and MS4 permit requirements discussed in Chapter 3, only subregional practices are discussed in the following sections. If the City is able to successfully implement source area controls, the overall capital cost needed to implement subregional practices is anticipated to decrease.

7.6.1.1 Dominguez Channel Watershed Management Plan

Based on the stormwater system layout and the prioritization of subareas discussed in Section 7.2.5, the Dominguez Channel watershed is divided into seven subregions, or tributary areas, for BMP treatment. Stormwater runoff from each of the subregions will be diverted to an offline facility for treatment. The selected BMP locations for the Dominguez Channel watershed are displayed on Figure 7.19 along with the subregion for each BMP. In all, six locations were selected for subregional BMP implementation for the seven subregions.

Table 7.8 provides a summary of the recommended BMP for each sub-region, along with the major project elements of each BMP. Subregions 3, 5, 6, and 7 fall within high priority subareas and are shaded in grey.

Table 7.8 Identified BMPs in Dominguez Channel Watershed

Project Area	Type of BMP	Project Elements
Sub Region 1	Infiltration	• Stormwater lift station. • Flow diversion facility. • Overflow piping • 54-inch diameter pipeline
Sub Region 2	Infiltration	• Flow diversion facility. • Overflow piping
Sub Region 3	None (Diverted along with Sub Region 7)	• n/a
Sub Region 4	Detention/Infiltration	• Flow diversion facility. • Overflow piping
Sub Region 5	Infiltration Trench	• Flow diversion facility. • Overflow piping
Sub Region 6	Detention/Infiltration	• Flow diversion facility. • Overflow piping
Sub Region 7	Detention/Infiltration	• Stormwater lift station. • Flow diversion facility. • Overflow piping • 54-inch diameter pipeline

Note:
1. Sub regions that fall within high priority subareas are shaded in grey.

The following sections describe the general concept of each subregional BMP. However, detailed information on the specific layout of each site will need to be developed during the preliminary design phase of each project.

Sub Region 1 – Infiltration BMP at Guenser Park

The total drainage of this sub-region is about 1,506 acres. This sub-region is highly impervious with average imperviousness of about 66 percent. The runoff coefficient is about 0.65.

Much of the stormwater from this subregion is conveyed by the Dominguez Channel. The upstream sections of Sub Region 1 drainage area discharging into Dominguez Channel prior to the proposed diversion structure and lift station location may present construction challenges. BMP placement and BMP siting analyses show that the selected location provides optimum results. However, since diversion of stormwater from the Dominguez Channel would represent a significant design and construction challenge, three alternatives have been developed to reduce pollutant loading from Sub Region 1.

Alternative 1 - Diversion from Dominguez Channel to Guenser Park

This project alternative proposes the installation of:

- Stormwater lift station.
- Flow diversion facility.
- Infiltration basin.
- Sediment forebay
- Overflow Piping
- Conveyance Piping to route water quality flow to Guenser Park.

Off-site surface runoff will be pumped from both the Dominguez Channel and the existing 54-inch diameter pipeline south of Western Avenue and Artesia intersection to the stormwater lift station. The raw stormwater will be conveyed in a 54-inch diameter pipe to Guenser Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the infiltration basin.

The total water quality flow from Sub Region 1 is about 240 cfs, which would require a a large stormwater lift station. To reduce the size of the lift station, Alternative 1 would split Sub Region 1 into two subareas to be served by two smaller lift stations. In this case, one pump station will serve only flow diverted from Dominguez Channel and the other lift station will serve diverted flow from the 54-inch diameter pipeline along Western Avenue.

Alternative 2 – Small scale Bioretention Projects

This project alternative focuses on smaller bioretention projects distributed around Sub Region 1. Stormwater would be diverted from the major stormdrains within Sub Region 1 and routed to the individual bioretention sites. Implementation of source area BMPs, especially bioretention cells, in this area is anticipated to require expensive and prolonged process of property acquisition as there is insufficient open space in the area for optimal BMP placement.

Alternative 3 – Catch Basin Inserts

This alternative consists of catch basin inserts as an alternative for components of BMPs to treat pollutants from this sub-region. While installation of catch basin inserts is anticipated to decrease the design and construction challenges significantly, the operations and maintenance costs for cleaning the catch basin inserts could be significant (based on results of the City's catch basin insert pilot program). However, these efforts may be more amenable if focused on the smaller sub region rather than the City's entire service area and may represent a more economical alternative. The pollutant reducing performance of the catch basin inserts should be compared with the various WLAs assigned to the City in the Dominguez Channel Toxics TMDL during the preparations for the implementation phase of the TMDL to verify that the catch basin inserts adequately address pollutant loading associated with the WLAs.

The wet weather capital improvement program presented in Chapter 9 is based on the implementation of Alternative 1.

Sub Region 2 – Infiltration BMP at McMaster Park

The total drainage of this sub-region is about 492 acres. This sub-region is highly impervious with an average imperviousness of about 64 percent and a runoff coefficient of about 0.63. The Sub Region 2 Stormwater BMP project proposes the installation of:

- Flow diversion facility.
- Infiltration basin.
- Sediment forebay
- Overflow Piping

Stormwater will be diverted at McMaster Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the infiltration basin.

The total water quality flow from Sub Region 2 is estimated to be 76 cfs. It is anticipated that flow diversion will be sufficient to convey flow into the infiltration basin.

Sub Region 3 – Del Amo / Van Ness

The total drainage of this sub-region is about 689 acres. This sub-region is highly impervious with an average imperviousness of about 67 percent and a runoff coefficient of about 0.66. A hydrodynamic separator is recommended to discharge to a proposed wetlands at the identified location near the intersection of Del Amo and Van Ness.

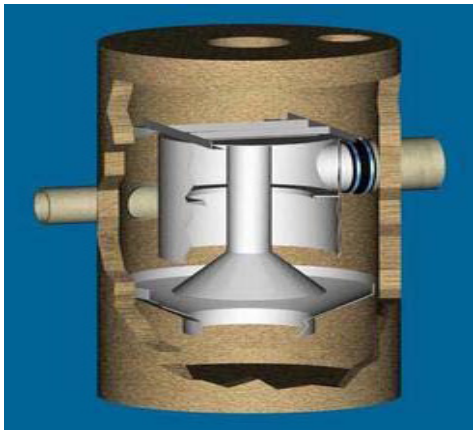


Figure 7.23

Sub Region 4 – Retention BMP at Columbia Park

The total drainage of this sub-region is about 114 acres. This sub-region is less impervious with an average imperviousness of about 44 percent and a runoff coefficient of about 0.48. The Sub Region 4 Stormwater BMP project proposes the installation of:

- Flow diversion facility.
- Retention basin.
- Sediment forebay
- Overflow Piping

Stormwater will be diverted at Columbia Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the retention basin.

The total water quality flow from Sub Region 4 is estimated to be 13 cfs. It is anticipated that flow diversion will be sufficient to convey flow into the retention basin.

Sub Region 5 – Infiltration Trench BMP at El Prado Park

The total drainage of this sub-region is about 233 acres. This sub-region is fairly impervious with an average imperviousness of about 57 percent and a runoff coefficient of about 0.58. The Sub Region 4 Stormwater BMP project proposes the installation of:

- Flow diversion facility.
- Infiltration trench.
- Sediment forebay
- Overflow Piping

Stormwater will be diverted at El Prado Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the infiltration trench.

The total water quality flow from Sub Region 5 is estimated to be 33 cfs. It is anticipated that flow diversion will be sufficient to convey flow into the infiltration trench.

Sub Region 6 – Infiltration BMP at Wilson Park

The total drainage of this sub-region is about 319 acres. This sub-region is highly impervious with an average imperviousness of about 64 percent and a runoff coefficient of about 0.63. The Sub Region 6 Stormwater BMP project proposes the installation of:

- Flow diversion facility.
- Infiltration basin.
- Sediment forebay
- Overflow Piping

Stormwater will be diverted at Wilson Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the infiltration basin. Flow from Sub Region 7 will also be diverted to this site.

The total water quality flow from Sub Region 6 is estimated to be 50 cfs. It is anticipated that flow diversion will be sufficient to convey flow into the infiltration basin.

Sub Region 7 – Infiltration BMP at Wilson Park

The total drainage of this sub-region is about 1,399 acres. This sub-region is highly impervious with average imperviousness of about 74 percent. The runoff coefficient is about 0.70. The Sub Region 7 Stormwater BMP project proposes the installation of:

- Stormwater lift station.
- Flow diversion facility.
- Infiltration basin.
- Sediment forebay
- Overflow Piping
- Conveyance Piping to route water quality flow to Wilson Park

Off-site surface runoff will be pumped from the existing 75-inch pipe in Torrance Boulevard to the stormwater lift station. The raw stormwater will be conveyed in a 54-inch pipe to Wilson Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the infiltration basin.

The total water quality flow from Sub Region 7 is about 242 cfs, requiring a large stormwater lift station.

Walteria Lake Watershed

All of Walteria Lake Watershed drains to Walteria Lake, which is about 1,005 acre-feet. The total surface area of the lake is about 25.4 acres with a total cumulative tributary area of approximately 2,533 acres. The composite runoff coefficient of the drainage area is about 0.6 with the corresponding water quality capture volume of about 0.61 inches. Therefore, the water quality volume required for all the tributary area of Walteria Lake is about 129 acre-feet. This demonstrates that there is adequate capacity in the Lake to treat runoff from all the tributary areas, and therefore no new BMPs are needed in this watershed.

7.6.1.2 Harbor Lakes Watershed

The selected BMP locations for the Harbor Lakes watershed are displayed on Figure 7.19 along with tributary areas for each BMP. Table 7.8 provides a summary of the recommended BMP for each sub-region, along with the major project elements of each BMP. Subregion 4 falls within high priority subareas and is shaded in grey. In all, five locations were selected for subregional BMP implementation.

Table 7.9 Identified BMPs in Harbor Lakes Watershed

Project Area	Type of BMP	Project Elements
Sub Region 1	Underground Infiltration	• Flow diversion facility. • Overflow piping • Hydrodynamic separator
Sub Region 2	Underground Infiltration	• Flow diversion facility. • Overflow piping
Sub Region 3	Wetland	• Flow diversion facility. • Overflow piping
Sub Region 4	Retention	• Flow diversion facility. • Overflow piping
Sub Region 5	Infiltration	• Stormwater lift station. • Flow diversion facility. • Overflow piping • 54-inch diameter pipeline
Sub Region 6	Hydrodynamic Separator	• Stormwater lift station. • Flow diversion facility. • Hydrodynamic separator. • Overflow piping • 24-inch diameter pipeline

Note:
1. Sub regions that fall within high priority subareas are shaded in grey.

The following sections describe the general concept of each subregional BMP. However, detailed information on the specific layout of each site will need to be developed during the preliminary design phase of each project.

Sub Regions 1 and 2 – Infiltration BMP at Torrance Airport

The total drainage of these sub-regions is about 544 acres. These sub-regions are highly impervious with an average imperviousness of around 62 percent. The Sub Region 1 and 2 Stormwater BMP projects propose the installation of:

- Two flow diversion facilities.
- Underground infiltration basin.
- Hydrodynamic separator (for pretreatment)
- Overflow Piping

Stormwater will be diverted to the Torrance Airport for underground infiltration. Heavy sediments, oil, grease and floatable wastes will be removed in the by a hydrodynamic separator before discharging into the infiltration basin.

Figure 7.24 Torrance Airport

Figure 7.25
Plastic Infill Underground Detention System

Figure 7.26
Underground Infiltration System

Figure 7.27
Diversion in Crenshaw Boulevard

Underground infiltration is required at the airport to minimize the congregation of birds, which would be a danger to the aircraft. Underground detention and infiltration systems come in many configurations. Plastic infill underground detention systems include a free-form structure encased in a plastic liner. Major vendors of these systems include Rainstore, StormCell®, ADS (StormTech), and Infiltrator.

The flow diversion structure for Sub Region 1 will need to be constructed underneath Crenshaw Boulevard. The flow diversion structure for Sub Region 2 can be constructed within Torrance Airport, as the existing storm drain crosses the airport.

The total water quality flow from Sub Regions 1 and 2 is estimated to be 82 cfs. It is anticipated that flow diversion will be sufficient to convey flow into the infiltration basin.

Sub Region 3 – Wetland BMP at De Portola Park

The total drainage of this sub-region is about 99 acres. This sub-region is less impervious with an average imperviousness of about 40 percent and a runoff coefficient of about 0.45. The Sub Region 3 Stormwater BMP project proposes the installation of:

- Flow diversion facility.
- Infiltration basin.
- Sediment forebay
- Overflow Piping

Stormwater will be diverted at De Portola Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the infiltration basin.

The total water quality flow from Sub Region 3 is estimated to be 11 cfs. It is anticipated that flow diversion will be sufficient to convey flow into the infiltration basin.

Sub Region 4 – Hydrodynamic Separator BMP at Crenshaw and Skypark

The total drainage of this sub-region is about 348 acres. This sub-region is highly impervious with an average imperviousness of about 58 percent and a runoff coefficient of about 0.59. The Sub Region 4 Stormwater BMP project proposes the installation of:

- Flow diversion facility.
- Hydrodynamic separator
- Compact treatment
- Overflow Piping

Stormwater will be diverted by the hydrodynamic separator and treated at the location, within the sidewalk median.

The total water quality flow from Sub Region 4 is estimated to be 50 cfs. Two 30 cfs hydrodynamic separators are recommended for this BMP.

Sub Region 5 – Infiltration BMP at Sur la Brea Park

The total drainage of this sub-region is about 921 acres. This sub-region is highly impervious with average imperviousness of about 62 percent. The runoff coefficient is about 0.62. The Sub Region 5 Stormwater BMP project proposes the installation of:

Figure 7.28
Sur la Brea Park

- Stormwater lift station.
- Flow diversion facility.
- Infiltration basin.
- Sediment forebay
- Overflow Piping
- Conveyance Piping to route water quality flow to Sur la Brea Park.

Off-site surface runoff will be pumped from the existing pipeline in Western Avenue to the stormwater lift station. The raw stormwater will be conveyed in a 54-inch pipe to Sur la Brea Park for pretreatment in the forebay. Heavy sediments, oil, grease and floatable wastes will be removed in the forebay before discharging into the infiltration basin.

Figure 7.29
Diversion in Western Avenue

The total water quality flow from Sub Region 5 is about 140 cfs.

Sub Region 6 – Hydrodynamic Separator BMP at Torrance Little League Fields

The total drainage of this sub-region is about 155 acres. This sub-region is highly impervious with an average imperviousness of about 64 percent and a runoff coefficient of about 0.63. The Sub Region 6 Stormwater BMP project proposes the installation of:

- Flow diversion facility.
- Hydrodynamic separator
- Compact treatment
- Overflow Piping

Stormwater will be diverted by the hydrodynamic separator and treated at the location, within the sidewalk median.

The total water quality flow from Sub Region 6 is estimated to be 24 cfs. One 30 cfs hydrodynamic separator is recommended for this BMP.

7.6.1.3 BMP Performance

For the selected BMPs, P8 and SUSTAIN models were able to predict TSS, nutrient and other pollutant reduction of street sweeping, bio-retention and infiltration systems. Iterations of the models were used to optimize the size of the treatment systems. Reported removal values of hydrodynamic separators were inserted directly into the model.

The model evaluated each BMP alone and in series, targeting volume, TSS, nutrients and other pollutants. Effectiveness was based on load reduction, event mean concentrations, and frequency of exceedances of relevant water quality standards. Model predictions of annual average pollutant loading before and after treatment is shown in Table 7.10.

Table 7.10 Predicted Wet Weather BMP Efficiency Table

Watershed	Sub Region	Pollutant Load (lb/yr)					
		Upstream or Pre-treatment			Post-treatment		
		TSS	TN	TP	TSS	TN	TP
Dominguez Channel	1	166,178	3,462	653	8,309	35	10
	2	86,449	1,978	700	4,322	20	11
	3	135,908	1,755	335	27,182	351	67
	4	16,835	191	36	3,367	57	9
	5	17,095	353	72	855	4	1
	6	45,736	596	120	2,287	6	2
	7	230,324	3,076	616	11,516	31	9
	Total	**698,525**	**11,411**	**2,532**	**57,838**	**503**	**109**
Harbor Lakes	1	31,822	673	145	1,591	7	2
	2	29,734	657	138	1,487	7	2
	3	13,310	286	54	2,662	57	8
	4	30,590	607	141	10,707	212	42
	5	117,270	2,681	502	5,864	27	8
	6	20,586	357	72	4,117	71	15
	Total	**243,312**	**5,261**	**1,052**	**26,427**	**381**	**77**

As shown in Table 7.10, the model predicted over 95% reduction in the load discharged to surface waters for most conditions simulated; however, effectiveness was reduced slightly, to about 92%, during large storms and wet years. Although performance was similar based on load reduction and water quality standard exceedances, the latter was most sensitive to storm size.

The model shows a reduction of about 70 percent in the nutrient load discharged to groundwater. The removal efficiency is predicted to increase to about 85 percent when vegetation is incorporated into the BMP design.

PLAT includes all potential field sampling locations and therefore the model parameters can be easily refined or calibrated with field data. PLAT can be used by the city to understand expected BMP performance over a range of storms, time periods, and design parameters, and, perhaps more significantly, evaluate BMPs in series.

7.6.2 Selection of Low Flow Stormwater Treatment Practices

Based on the significant capital cost and large capital projects associated with wet weather stormwater treatment practices discussed in Section 7.6.1, subregional BMPs were downsized to achieve the water quality goals under low flow conditions. Several types of source area practices cover each of the types of source areas.

A number of source area practices include both proprietary and non-proprietary practices with a range of nutrient and TSS removal. These represent a number of treatment processes, such as infiltration, bio-retention cells, retention, and hydrodynamic separators. The criteria for selecting subregional and source practices included the availability of good data to verify effectiveness of practices, preliminary cost information, and some experience with practices in Los Angeles County.

Subregional Practices

Infiltration systems were selected as the first option for subregional practices as they met all the criteria for the selection of treatment practices. Many infiltration systems have been successfully installed in Los Angeles County and infiltration systems have been used by many cities in the region, including the City of Los Angeles, as a way to meet goals for TMDL, MS4 permit requirements, and flood control. It is anticipated that infiltration systems will meet future MS4 permit requirements regarding LID.

Source Area

Source area practices selected for this project include bio-retention cells and hydrodynamic separators. The nutrient reduction capabilities of bio-retention cells have been verified by a number studies based on modeling and field data. Potential general locations generally used to implement source area practices are large parking lots, industrial parcels, and

business areas. Because such properties are generally private in nature, the City would need to negotiate with the property owners in order to implement source area practices.

Because of the uncertainty associated with negotiating with private entities, and the requirements to meet TMDL and MS4 permit requirements discussed in Chapter 3, only subregional practices are discussed in the following sections. If the City is able to successfully implement source area controls, the overall capital cost needed to implement subregional practices is anticipated to decrease.

7.6.2.1 Dominguez Channel Watershed Management Plan

Based on the stormwater system layout and the prioritization of subareas discussed in Section 7.2.5, the Dominguez Channel watershed is divided into sixteen subregions, or tributary areas, for BMP treatment. Stormwater runoff from each of the subregions will be diverted to an offline facility for treatment. The selected BMP locations for the Dominguez Channel watershed are displayed on Figure 7.30 along with the subregion (tributary area) for each BMP. In all, twelve locations were selected for subregional BMP implementation for the sixteen subregions.

Table 7.11 provides a summary of the recommended BMP for each sub-region, along with the major project elements of each BMP. Projects are identified by Map ID. Recommended BMPs Q04, Q05, Q06, Q08, Q09, Q10, Q11, and Q12, highlighted in grey, fall within high priority subareas identified earlier in this chapter.

Table 7.11 Identified BMPs in Dominguez Channel Watershed

Map ID	Type of BMP	BMP Site	Project Elements
Q04	Infiltration	El Prado Park	Diversion Structure Infiltration
Q05	Detention	ExxonMobil Detention Basin	Diversion Structure Pipeline
Q06	Detention	ExxonMobil Detention Basin	Diversion Structure Low Flow Diversion Pump Station Pipeline
Q07	Infiltration	El Prado Park	Diversion Structure Low Flow Diversion Pump Station Pipeline Infiltration
Q08	Infiltration	Wilson Park	Diversion Structure Infiltration
Q09	Infiltration	Torrance Blvd. Median	Diversion Structure Low Flow Diversion Pump Station Infiltration

Table 7.11 Identified BMPs in Dominguez Channel Watershed

Map ID	Type of BMP	BMP Site	Project Elements
Q10	Infiltration	Wilson Park	Diversion Structure Low Flow Diversion Pump Station Pipeline Infiltration
Q11	Infiltration	Wilson Park	Diversion Structure Low Flow Diversion Pump Station Infiltration
Q12	Infiltration	Wilson Park	Diversion Structure Low Flow Diversion Pump Station Pipeline Infiltration
Q22	Infiltration	New Infiltration Basin	Diversion Structure Infiltration Basin
Q23	Infiltration	El Camino College	Diversion Structure Pipeline Infiltration
Q24	Infiltration	SCE Yard	Diversion Structure Infiltration Basin
Q25	Infiltration	Lincoln School	Diversion Structure Pipeline Underground Infiltration
Q26	Detention	Artesia and Dominguez Channel	Diversion Structure Pipeline Retention Basin
Q27	Infiltration	Guenser Park	Diversion Structure Low Flow Diversion Pump Station Pipeline Infiltration
Q28	Infiltration	McMaster Park	Diversion Structure Low Flow Diversion Pump Station Pipeline Infiltration

Note:
1. BMPs that fall within high priority subareas are shaded in grey.

As shown in Table 7.11, 16 BMPs are recommended based on low flow diversion. Specific sizing of each component is included in Chapter 9. Detailed information on the specific layout of each site will need to be developed during the preliminary design phase of each project.

7.6.2.2 Harbor Lakes Watershed

The selected BMP locations for the Harbor Lakes watershed are displayed on Figure 7.20 along with tributary areas for each BMP. Table 7.12 provides a summary of the recommended BMP for each sub-region, along with the major project elements of each BMP. In all, eight locations were selected for subregional BMP implementation for the twelve subregions. Recommended BMPs Q01, Q02, and Q03, highlighted in grey, fall within high priority subareas identified earlier in this chapter.

Table 7.12 Identified BMPs in Harbor Lakes Watershed

Map ID	Type of BMP	BMP Site	Project Elements
Q21	Detention / Infiltration	Airport Pond	Diversion Structure Low Flow Diversion PS Pipeline Infiltration Site Piping and Valves
Q15	Wetlands	De Portola Park	Diversion Structure Wetlands
Q14	Infiltration	Torrance Airport	Diversion Structure
Q16	Wetlands	Torrance Airport	Diversion Structure Wetlands
Q01	Infiltration	Torrance Airport	Diversion Structure Pipeline
Q02	Infiltration	Torrance Airport	Diversion Structure Pipeline
Q03	CDS / HDS	Sidewalk at Crenshaw and Skypark	Diversion Structure Hydrodynamic Separator
Q19	Detention	237th Street Detention Basin	Diversion Structure Low Flow Diversion PS Pipeline
Q18	Detention	Sur la Brea Detention Basin	Diversion Structure Low Flow Diversion PS Pipeline Infiltration
Q13	Infiltration	Vine Avenue Detention Basin	Diversion Structure Infiltration
Q20	Detention	Walnut Street Detention Basin	Diversion Structure Low Flow Diversion PS Pipeline
Q17	Detention	Well 8	Diversion Structure Pipeline

Note:
1. BMPs that fall within high priority subareas are shaded in grey.

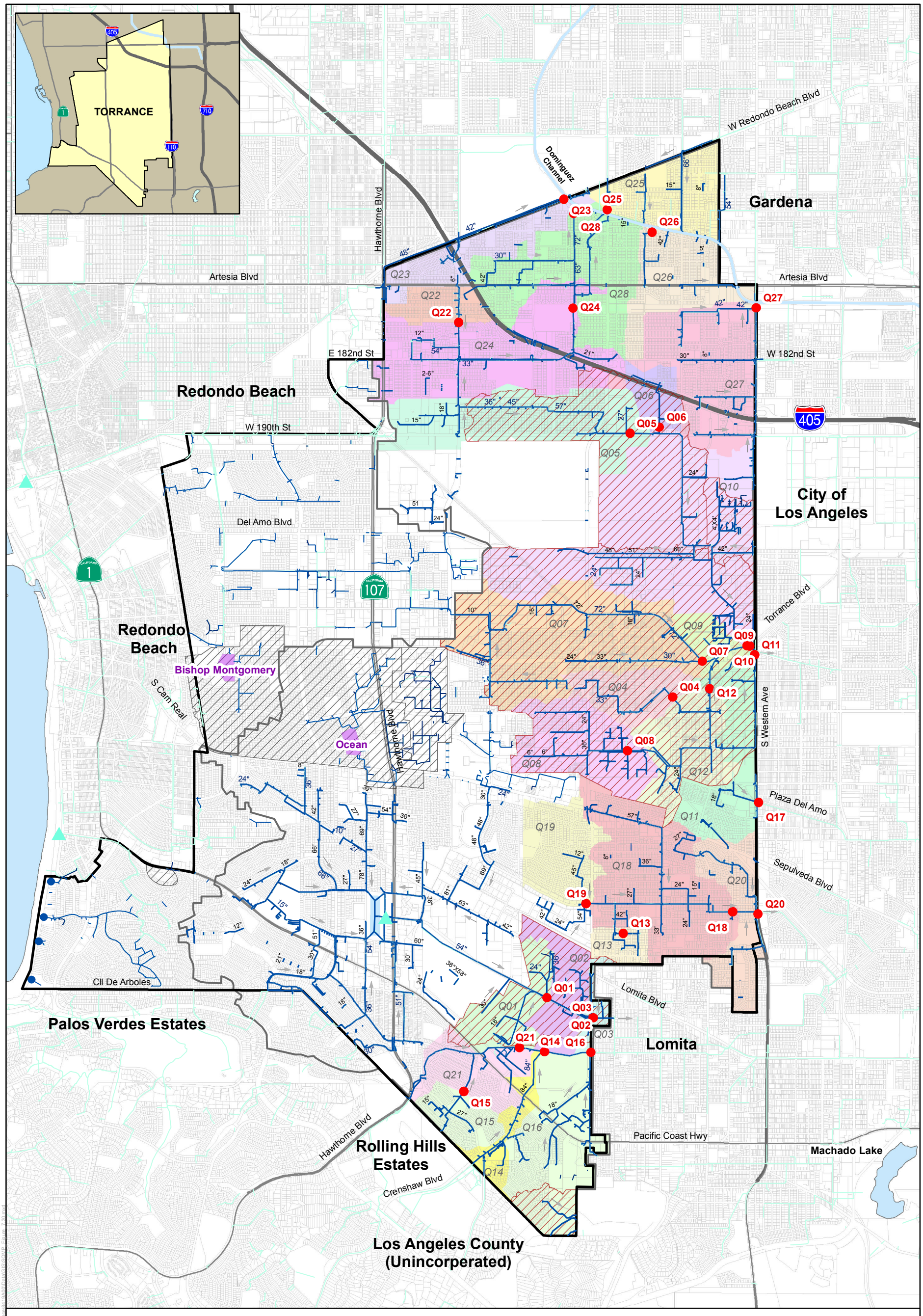


Figure 7.30
Prioritization of Recommended Low Flow Diversion BMP Projects
Stormwater Quality Master Plan
City of Torrance

As shown in Table 7.12, 12 BMPs are recommended at eight BMP sites based on low flow diversion. Specific sizing of each component is included in Chapter 9. Detailed information on the specific layout of each site will need to be developed during the preliminary design phase of each project.

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Chapter 8

WATER CAPACITY EVALUATION

8.1 METHODOLOGY

The water capacity evaluation is conducted using a combined hydrologic and hydraulic model, which is discussed in more detail in Chapter 6. The hydrologic component of the model addresses stormwater runoff generated from the rainfall events outlined in Chapter 4. For each of the delineated subbasins, the hydrologic component of the model identified a peak runoff rate and the volume of runoff from a storm event; this data was then used to drive the hydraulic model. The hydraulic model estimates water surface elevations along the storm drain network, which is used to identify portions of the network that are predicted to experience flooding under each design storm.

8.2 HYDRAULIC CAPACITY EVALUATION

Detailed hydrologic and hydraulic model components were constructed to evaluate existing flooding problems for a majority of the drainage systems in the study area. The problems were compared with historical flooding problems identified by local residents to help validate the modeling results. The results of these analyses are summarized in this section.

Flooding problems are typically evaluated in terms of how often a particular problem is likely to occur. For example, flooding problems that occur an average of once every 2 years are defined as having a 2-year return period while problems that only occur an average of once every 100 years are defined as having a 100-year return period. In this analysis, flooding problems were evaluated along drainage conveyance systems for a variety of return periods, including 2-year, 5-year, 10-year, 25-year, and 100-year return periods.

For pipe segments and roadway crossings, surcharging was considered acceptable and flooding problems were identified only if the model showed water getting out of the system and into streets. For open waterways, deficiencies were identified when the depth of the design flow exceeded the top of the channel banks.

The hydraulic capacity evaluation consisted of the following steps:

1. A hydrologic analysis of the storm sewer system was performed to estimate flows through each pipe segment for the 5-, 10-, 25-, 50- and 100-year storms under existing land use conditions. The 10-year storm was used as the design storm for storm drains.
2. A hydraulic analysis of the storm sewer system was performed to determine the flow capacity of each pipe segment.
3. Simulation runs were performed for storm sewers with insufficient capacity to meet the design storm flows to determine the pipe size required to accommodate the design flow.
4. Culverts in the study area were analyzed separately.

8.2.1 Criteria for Identifying Hydraulic Bottlenecks

The Los Angeles County (County) Department of Public Works Hydrology and Sedimentation Manual (LACDPW, 2006) provides agency policy on levels of flood protection. The manual advises that all facilities in developed areas be designed to protect against the Urban Flood, which is referred as runoff from a 25-year return interval design storm falling on a saturated watershed (fourth day storm). Under these criteria, street flows are not allowed above the private property line. In addition, the County recommends that any conduit be designed to convey the runoff from at least the 10-year frequency design storm. The County criteria also require that natural watercourses, floodways, depressions, sumps, and culverts under primary and secondary roadways, be designed to withstand the 50-year design storm. Finally, the manual notes that drain size may be increased to reduce street surface flows that could impede vehicular traffic.

In this deficiency analysis, the allowed upstream node or junction runoff flow for street conveyance systems was selected to be zero cubic feet per second for the 10-year design storm. Thus, whenever a drainage system consisted of street and conduit conveyances, the system was identified as deficient unless it could convey the entire runoff from the 10-year storm; thus, no street overtopping is allowed. The street conveyance capacity for the 25-year return interval design storm was calculated assuming flow depth of 8 inches on curbs using the typical street cross-section criteria.

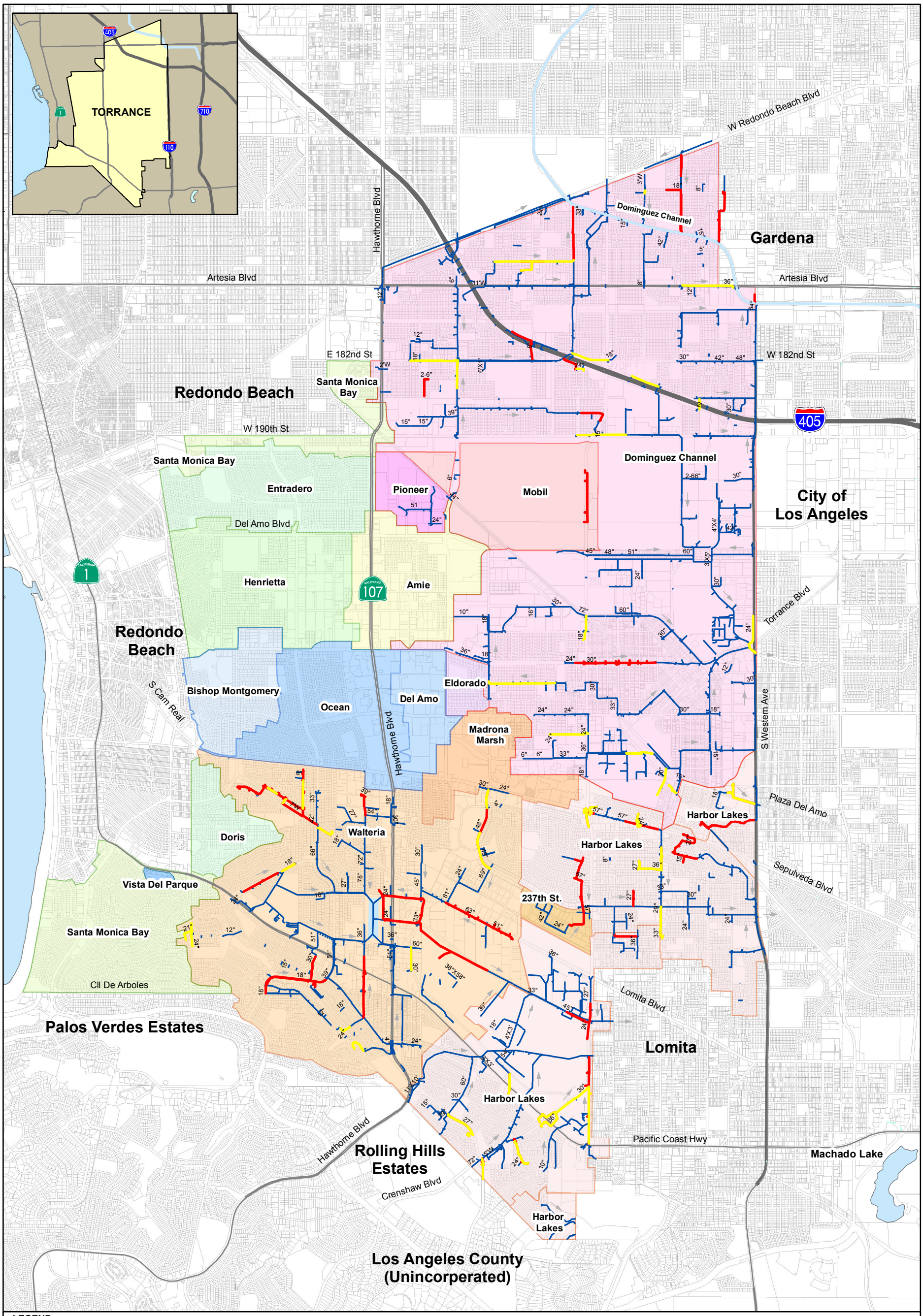
The street conveyance for the 50-year design storm was modeled to allow flows to the property line (right of way or back of walk) based on an additional depth of 2.4 inches (0.2 feet) between the curb top and property line.

The deficiency criteria used in this analysis is based on Los Angeles County's criteria, which is consistent with American Public Works Association (APWA) standards, and can be summarized as:

1. Conveyance systems unable to convey the 10-year storm are characterized as deficient. For piped segments and roadway crossings, surcharging was considered acceptable and flooding problems were identified only if the model showed water getting out of the system and into streets during the 10-year storm.
2. Flows from the 25-year storm only allowed to top of curb rather than property line.
3. Maximum street overtopping for the 50-year storm is 10.4 inches.

8.2.2 Analysis Results

The ability of the existing system to meet the above criteria was evaluated through computer modeling and the identified deficiencies are presented on Figure 8.1. Within this analysis, the simulated flooding problems are grouped into two main categories of flooding events.



LEGEND

Watersheds

Groundwater Replenishment
- Bishop Montgomery
- Del Amo
- Ocean
- Vista Del Parque

Dominguez Channel
- Surface Drainage
- Eldorado
- Mobil
- Pioneer

Santa Monica Bay
- Surface Drainage
- Amie
- Doris
- Entradero
- Henrietta

Harbor Lakes
- Surface Drainage
- 237th St.
- Madrona Marsh
- Walteria

Capacity Deficiencies
- Deficiency During Minor Event (<10 yr)
- Deficiency During Major Event (>50yr)

Storm Drains
- City's Stormwater System
- LACDPW System
- Flow Direction
- Freeway
- Major Roads
- Bodies of Water

0 0.2 0.4 0.8 Miles

Figure 8.1
Water Capacity Hydraulic Deficiencies
Stormwater Quality Master Plan
City of Torrance

carollo
Engineers...Working Wonders With Water™

As shown on Figure 8.1, these two categories are:

- Frequent flooding problems, which are deficiencies that occur during minor storm events (< every 10 yrs). Frequent flooding is typically characterized by localized ponding and street flooding of less than or equal to 8 inches of flood depth. These problems are due to under-capacity or unmet maintenance requirements of the existing system. Backwater and surcharging of storm sewers are also commonly observed due to low outfall elevations. Storm drains with these deficiencies are shown in yellow.

- Major flooding problems, which are deficiencies that occur during major storm events (> 50 yrs). Since major storm events are greater in intensity than minor storm events, the major flooding problems include all frequent flooding problems. Under a major storm event, deficiencies related to frequent flooding problems will increase in magnitude and portions of the drainage system that have sufficient capacity under a minor storm event may be incapable of meeting the capacity requirements of larger design storms. Storm drains with these deficiencies are shown in red.

8.3 IMPROVEMENT OPTIONS

Evaluating flood hazard management alternatives requires an understanding of the flooding issues, and a clear community vision for basin development. This section focuses on the task of developing cost-effective solutions for the identified flooding problems. The recommended solutions are developed into capital improvement projects.

The development of cost-effective solutions entails various steps for evaluating the appropriateness and effectiveness of solution alternatives. The process is broken down into four general steps:

- Inventorying Solution Types: Documenting the range of available solution types and their general levels of effectiveness, cost and other implementation considerations.
- Identifying Preferred Solutions: Procedures for identifying the "preferred" solution type for a given problem area. Also includes planning level estimates of the general benefits and costs for site-specific preliminary solutions for each of the identified problems.
- Estimating Goal Attainment: Comparing the benefits provided by proposed solutions to drainage management goals and objectives.
- Planning Implementation Activities: Describing the steps to implement capital projects, programs, and regulations.

Selecting the most appropriate capital solution alternative(s) for a specific problem area is heavily influenced by the development conditions of the watershed in which the target problem area is located. There are four basic approaches to stormwater management applicable to the City: no action; upgrades to the existing system; runoff detention; and infiltration ponds. These basic approaches may be implemented singly within a basin or in combination to manage present and expected future stormwater problems. The drainage systems recommended for improvements are shown on Figure 8.2.

8.3.1 No Action

The no action approach implies that no improvements whatsoever will be made to the existing drain system. For comparison purposes, it will be included in the analyses for all eight basins. It is always possible not to improve the system, at the cost of continued damage and inconveniences where drainage facilities are inadequate or non-existent. To ensure that system improvements are justified, it is necessary to compare the costs and advantages of those improvements to the no action alternative.

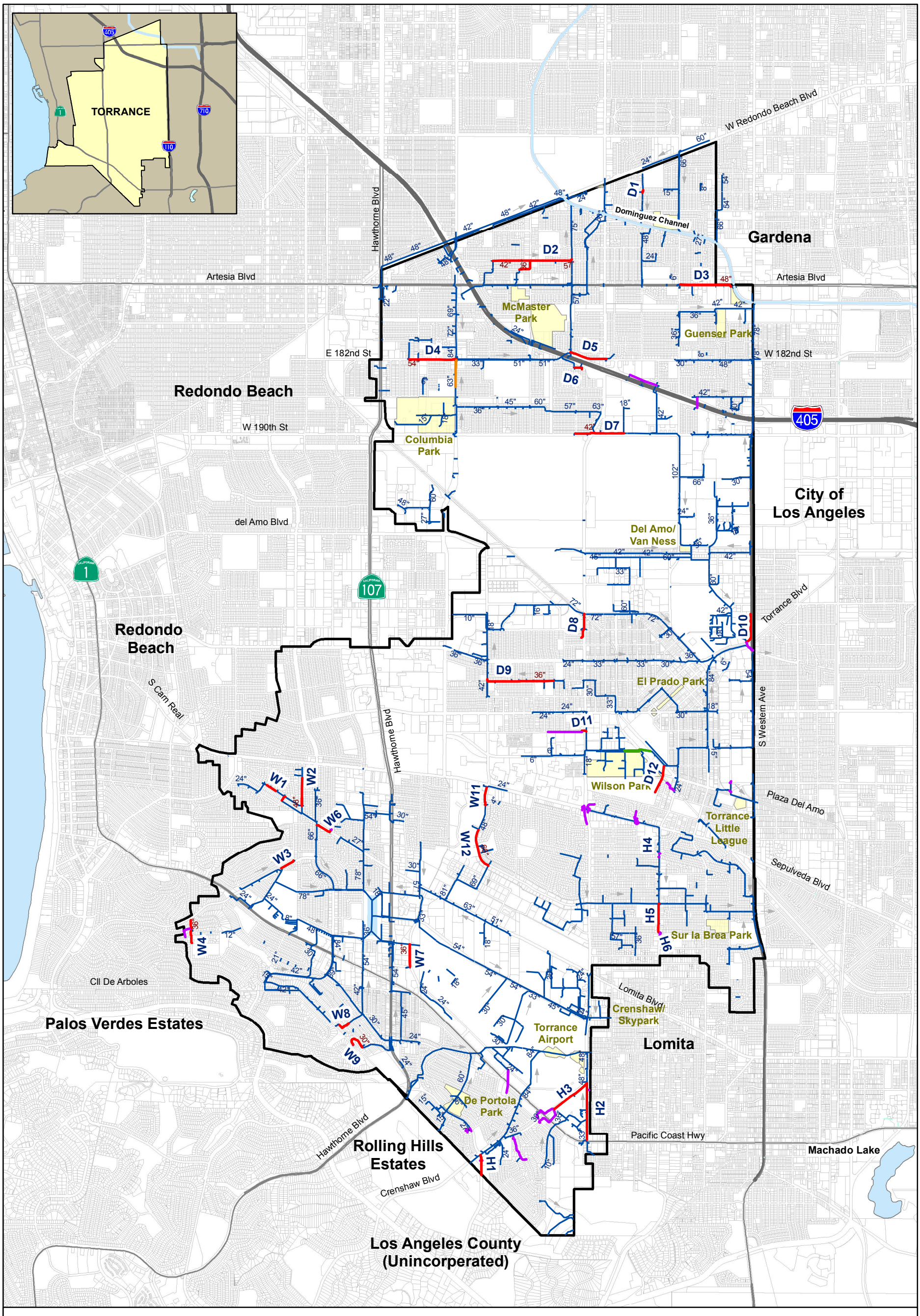
8.3.2 Upgrading the Existing System

This approach would involve constructing replacement or parallel pipes and upgrading or piping existing ditches to provide adequate capacity for the design flow. Upgrading of existing ditches may consist of vegetation and debris removal, regrading, shaping, and channel enlargement. This is often the most obvious alternative since it involves the existing drainage system and easements.

8.3.3 Low Impact Development

Low impact development (LID) is an alternative approach to managing stormwater runoff. LID design practices focus on reducing quantities of stormwater runoff by recharging and infiltrating runoff near the site of development. LID focuses on distributing facilities to manage stormwater rather than concentrating stormwater runoff and discharging it to other water bodies. LID can consist of many different technologies and design practices, including porous pavement, routing of downspouts to infiltration or vegetation, or incorporation of dry wells to infiltrate rainwater. General principles guiding LID include minimizing disturbance to natural drainage, minimizing soil compaction, maintaining natural vegetation and soils, and minimizing impervious surfaces.

Los Angeles County requires LID design practices for development in unincorporated areas of Los Angeles County. The City may consider adopting a similar ordinance requiring LID development. The Los Angeles County MS4 permit reissuance is planning to incorporate LID planning to “complement” local LID efforts. Due to the built out nature of the City’s service area and lack of vacant areas for future development, it is not anticipated that requiring new development to incorporate LID practices will significantly reduce the quantity of water entering the City’s stormwater system unless significant redevelopment were to occur.



LEGEND

Minor Event
Water Quantity Deficiencies

Recommendation
- Divert to BMP
- Upstream Diversion Resolves Deficiency
- No Action
- Replace, Parallel, or New Construction
- Recommended BMP Locations
- Study Area

Storm Drains
- City's Stormwater System
- LACDPW System
- Flow Direction
- Freeway
- Major Roads

Others
- Retention Basin
- Detention Basin
- Bodies of Water

0 0.2 0.4 0.8 Miles

Figure 8.2
Recommended Capacity Deficiencies Improvements
Stormwater Quality Master Plan
City of Torrance

8.3.4 Runoff Detention

The concept of runoff detention is simple: hold back the excess upstream runoff that would cause flooding problems downstream. This excess water is released later at a rate the downstream drainage structures are capable of handling. The rate of release from the detention site may be based on the capacity of existing downstream drainage structures. Alternatively, the rate of flow release may be a reduction to a lesser design storm flow (e.g., the system design storm may have a 10-year recurrence interval, and the detention facility outlet may be sized to release only 5-year storm flows). Runoff detention facilities can be on-site or regional. On-site detention is defined as runoff detention installed with each development to reduce peak runoff to a certain mandated value. On-site detention may be accomplished using small detention ponds, underground pipe storage, or rooftop and parking lot detention. Regional detention basins are defined as basins that receive runoff from a large drainage area, usually tens to hundreds of acres, and are large enough to attenuate the peak in that runoff. A policy requiring on-site detention in residential areas results in several small detention facilities throughout the community. These are difficult to maintain and often do not function properly. For this reason, on-site detention in residential areas was not considered. On-site detention in commercial and industrial areas generally consists of parking lot and rooftop detention. This can be a feasible option where large parking lots or structures are available and will be well maintained. Regional detention basins are small enough in number that they can be maintained properly. Often, regional detention basins can have multiple uses (e.g., parks). When these other uses also require regular maintenance, the basin is more likely to be maintained and function properly when needed.

8.3.5 Infiltration Ponds (Retention Basins)

A concept similar to detention ponds is infiltration ponds. Flow is routed into a pond, as with detention; however, the runoff is not released, rather, the stormwater infiltrates into the soil. This option would only be feasible in a location that has soils with high infiltration rates (hydrologic soil types A and B), and an overflow route should be included in design of infiltration facilities. Such a facility would dispose of stormwater without taxing existing storm drains with runoff from existing or new development areas.

8.4 IMPROVEMENT PROJECTS

As discussed in the earlier sections of this chapter, stormwater infrastructure deficiencies were identified within each watershed. A series of project alternatives were developed to address these inadequacies. The selected projects for each watershed are discussed below.

8.4.1 Dominguez Channel Watershed

Within the Dominguez Channel Watershed, a total of 41,792 feet of pipelines, culverts, and open channels were predicted as deficient, representing about 49 percent of the storm drain system. Of the deficient segments, approximately 44 percent is identified as frequent flooding. Table 8.1 summarizes the deficiencies identified by the model in the Dominguez Channel Watershed.

Table 8.1 Frequent and Major Floodings in Dominguez Watershed

Flooding Type	Pipe/Culvert Size (in)	Number of Segments[1]	Total Length (ft)	Storm Event Threshold
Frequent[2]	84	1	66	10-year event
	63	6	873	
	51 - 54	13	1,566	
	30 - 48	27	7,548	
	< 30	42	7,101	
	Culvert	10	1,039	
	Open Channel	15	3,188	
Major[3]	81	5	2,228	> 10-year event
	72 - 75	4	1,939	
	60 - 66	14	3,998	
	54	3	599	
	30 - 42	26	4,119	
	< 30	53	7,528	

Notes:
1. The model contains 4,338 segments in total.
2. Frequent flooding problems are those deficiencies predicted under storms less than or equal to the 10-year storm event.
3. Major flooding problems are those deficiencies predicted under storms greater than the 10-year storm event.

As shown in Table 8.1, the frequent flooding pipe segments include one segment of double 84-inch diameter pipe culvert of about 66 feet in length, six segments of 60-inch diameter pipes totaling 873 feet in length, and 82 segments of pipeline less than 54-inches in diameter totaling 16,215 feet in length. In addition, 1,039 feet of culvert and 3,188 feet of open channel is also predicted to be deficient during minor storm events.

Under a major storm event, the major flooding pipe segments are predicted to also include five segments of 81-inch diameter pipes totaling 2,228 feet in length, 18 segments between 60 and 75-inches in diameter totaling about 6,000 feet in length, and 82 segments of pipeline 54-inches in diameter or less in diameter totaling 12,246 feet in length.

Improvements were not evaluated for double 84-inch diameter pipe and the box culverts. The double 84-inch pipe is an offline storage facility. The inlet conditions of these structures need to be carefully evaluated to consider field conditions before any improvements are recommended. The box culverts deficiencies are due low outfall elevations. In addition, in some cases where flow is diverted to water quality BMP, improvements were not recommended for deficient pipes downstream of BMPs.

Most of the improvements identified in this watershed are recommended for pipe replacement. However, parallel pipelines should be evaluated during preliminary design for these improvements.

8.4.2 Walteria Lake Watershed

Within the Walteria Lake Watershed, a total of 25,303 feet of pipelines were predicted as deficient, representing about 63 percent (by length) of the storm drain system. Of the deficient segments, approximately 34 percent is identified as frequent flooding. Table 8.2 summarizes the deficiencies identified by the model in this watershed. The recommended pipe improvement projects included all the 48 pipe segments totaling 8,592 feet. The improvements, which are mainly pipe replacements, are detailed in Chapter 9 of this report.

No improvements are recommended for the major flooding areas. Flooding in these areas is anticipated to reduce significantly with the improvements to the 10-year deficient pipes.

Table 8.2 Frequent and Major Floodings in Walteria Lake Watershed

Flooding Type	Pipe/Culvert Size (in)	No. of Segments	Total Length (ft)	Storm Event Threshold
Frequent	30 - 48	22	5,347	10-year event
	< 30	26	3,245	
Major	63	8	1.258	> 10-year event
	51 - 57	10	3,736	
	30 - 48	43	9,237	
	< 30	49	3,737	

8.4.3 Harbor Lakes Watershed

Within the Harbor Lakes Watershed, a total of 20,310 feet of pipelines were predicted as deficient, representing about 50 percent (by length) of the storm drain system. Of the deficient segments, approximately 80 percent is identified as frequent flooding. Table 8.3 summarizes the deficiencies identified by the model in this watershed. The improvements, which are mainly pipe replacements, are detailed in Chapter 9 of this report.

It should be noted that the Harbor Lakes Watershed includes significant portions of several Palos Verdes Peninsula communities and the drainage systems from these communities were not evaluated.

Table 8.3 Frequent and Major Floodings in Harbor Lakes Watershed

Flooding Type	Pipe/Culvert Size (in)	No. of Segments	Total Length (ft)	Storm Event Threshold
Frequent	60 - 63	8	1,024	10-year event
	57	2	23	
	30 - 42	32	7,739	
	< 30	58	5,245	
	Culverts	8	882	
	Open Channel	2	1,289	
Major	57	18	1,037	> 10-year event
	30 - 48	24	1,850	
	< 30	17	1,221	

About 48 percent of the 10-year deficient pipes are between 30- and 42-inch in diameter. Of these, improvements were not evaluated for 10 segments because these segments are located downstream of proposed water quality flow diversion structures. The diverted flow will help to reduce the HGL in these areas.

Nine out of the 58 pipe segments with diameters less than 30 inches are also located downstream of proposed water quality diversion structures. The diverted flow is anticipated to reduce the HGL in these segments and therefore no improvements are recommended.

CAPITAL IMPROVEMENT PROGRAM

The purpose of this chapter is to provide the City of Torrance (City) with a capital improvement program (CIP) that will guide the City with implementing the recommendations made in Chapters 7 and 8 in order to resolve hydraulic deficiencies in the stormwater system, treat stormwater pollutants, meet regulatory compliance requirements opportunities, and express the City's renewed commitment to the use of environmentally responsible, cost-effective, and sustainable solutions.

The previous two chapters proposed recommended improvements to the stormwater system. In this chapter, cost assumptions are presented, followed by planning level cost estimates for the proposed improvements, and the proposed project phasing. This chapter is concluded with an estimate of the recommended CIP costs and a discussion on funding for implementing the CIP.

9.1 COST ASSUMPTIONS

The cost for each recommended improvement is a combination of construction costs and project costs. Construction costs account for the budget required for a contractor to install the proposed infrastructure. Project costs account for project contingencies, construction management, engineering, planning, and legal fees. The cost assumptions used in this report are discussed in the following sections.

9.1.1 Level of Accuracy

The level of accuracy for cost estimates varies depending on the level of detail to which the project has been defined. Feasibility studies and master plans represent the lowest level of accuracy, while pre-bid estimates represent a much higher level of accuracy. The American Association of Cost Engineers has developed guidelines, which are shown in Table 9.1, for developing project cost estimates:

Table 9.1 Project Estimate Guidelines[(1)]

Type of Estimate	Anticipated Accuracy
Order-of-Magnitude (Master Plans)	+50% to -30%
Budget Estimate (Pre-design Report)	+30% to -15%
Budget Estimate (Design Report)	+15% to -5%

Note:
1. Developed by the American Association of Cost Engineers.

The cost opinions in this report should be considered order-of-magnitude estimates, with an anticipated accuracy level of +50 to -30 percent. Cost opinions herein represent July 2011 dollars consistent with the Los Angeles metropolitan area Engineering News Record (ENR) value of 10,063. Future cost estimate adjustments can be calculated by increasing the estimated capital cost by the ratio of the future ENR to 10,063.

9.1.2 Construction Costs

The construction costs can include a combination of the following cost items:

- Storm Drains.
- Force Mains.
- Pump Stations.
- Detention Basins.
- Jack and Bore Crossings.
- Structural best management practices (BMPs):
  - Infiltration Systems.
  - Wetlands.
  - Retention Basins.

Each element is discussed below and unit costs for each element are summarized in Table 9.2. Unit costs for each element are based on previous project experience and the values presented in Table 9.2 include the equipment supply cost, installation, and general contractor overhead and markup costs. Construction contingency and markups for engineering, construction management, administration, and legal consultation are discussed in Section 9.1.3. Where unit costs were adapted from national averages, location was adjusted using the RS Means City Cost Index of 1.08 for the Los Angeles area. Pipeline installation costs assume open cut excavation in typical coarse-grained soil with minimal rock.

9.1.2.1 Storm Drains

Storm drain construction costs are estimated based on the length of the recommended improvement (rounded to the nearest 100 feet). Storm drain improvements recommended in this master plan range from 24 to 60 inches in diameter. Water quantity improvements less than 24 inches in diameter are not included.

9.1.2.2 Force Mains

Force main construction costs are estimated based on the length of the recommended improvement (rounded to the nearest 100 feet). Recommended force main improvements for the City's stormwater system range in diameter from 12 to 30 inches.

Table 9.2 Construction Cost Assumptions	
Category	**Unit Cost**
Storm Drains	**$/linear ft**
24-inch diameter	$567
30-inch diameter	$709
36-inch diameter	$851
39-inch diameter	$922
42-inch diameter	$992
48-inch diameter	$1,135
54-inch diameter	$1,276
57-inch diameter	$1,347
66-inch diameter	$1,560
Force Mains	**$/linear ft**
12-inch diameter	$205
16-inch diameter	$273
20-inch diameter	$409
24-inch diameter	$512
30-inch diameter	$614
Pump Stations	**$**
20 to 30 feet TDH	$(13{,}143 \times Q_{\text{mgd}}) + 65{,}573$
Diversion Structures	**$/site**
Diversion Structure	$50,000
Retention/Detention Basins	**$/ft^3**
Basins	$1.70
Jack and Bore Crossings	**$/linear ft**
Railroad/Highway Crossings	$250
BMPs	**-**
Infiltration Systems	$3.12 per ft^3 treated
Hydrodynamic Separator – Two 60 cfs Units	$1,025,000 per site
Hydrodynamic Separator – Single 30 cfs Unit	$270,000 per site
Wetlands	$1.91 per ft^3 treated

9.1.2.3 Pump Stations

Pump station construction costs are estimated based on capacity according to the following equation:

$$\text{Cost} = (13{,}143 \times Q_{\text{mgd}}) + 65{,}573$$

This equation is considered applicable for pump stations with a total dynamic head (TDH) between 20 and 30 feet. This cost estimate includes spare pumps and associated equipment, but does not specify the number of pumps or configuration. Note that this

equation is adapted to the City's location using the RS Means City Cost Index of 1.08 for the Los Angeles area.

9.1.2.4 Detention/Retention Basins

Construction costs for detention and retention basins are estimated based on the volume of the proposed detention or retention basin. As shown in Table 9.2, the estimated unit cost is $1.70 per cubic foot. While it is assumed that unit costs for significantly larger detention and retention basins would be less, this unit cost is assumed to be applicable for basins of the size recommended in this CIP. Note that land acquisition costs are not included in the estimated construction costs. This unit cost is adapted to the City's location using the RS Means City Cost Index of 1.08 for the Los Angeles area.

9.1.2.5 Jack and Bore Crossings

An additional cost of $250 per linear foot will be required for the length of any proposed pipeline crossing a highway or railroad.

9.1.2.6 BMPs

Construction costs for structural BMPs recommended in Chapter 7 are based on unit costs of capacity of treated volume. It should be noted that the estimates are made without consideration of area and land acquisition costs, which are not included. Structural BMPs recommended in Chapter 7 include Infiltration Systems and Wetlands; thus, estimated unit construction costs are included for these two BMPs. This unit cost is adapted to the City's location using the RS Means City Cost Index of 1.08 for the Los Angeles area.

Based on information provided by the City, the cost for installation of street sweeping signs was estimated to be $1,000,000 for the remaining areas in the City that do not currently have any street sweeping signs. The cost for implementation in each subregion was calculated based on the proportional street length in each subregion compared to the total length of City streets.

9.1.3 Project Costs

Once construction costs were estimated for each segment, the following project costs were added to the estimate to develop the total project cost, which is also referred to as the capital cost:

- Contingency Cost.
- Construction Management Cost.
- Engineering, Administration, Planning, and Legal Cost.

The assumptions used in this Stormwater Quality Master Plan (SQMP) to estimate capital cost are listed in Table 9.3.

Table 9.3 Capital Project Cost Assumptions	
Description	**Value**
Contingency	30% of the CC[(1)]
Engineering, Construction Management, Administration, and Legal	30% of the CC[(1)] plus contingency[(2)]
Capital Cost[(3)]	**169% of the CC[(1)]**

Notes:
1. CC=construction cost; it is the cost of materials, installation, and general contractor overhead and markup only.
2. Includes direct construction cost and contingency cost.
3. Capital Cost includes the construction cost, contingency, engineering, administration, legal, and construction management cost.

9.1.4 Operations and Maintenance Costs

For each BMP, operations and maintenance (O&M) costs were also developed. The following items were considered:

- Storm Drain System Cleaning.
- General Administration.
- Full-Time Employee (FTE) Costs.

These O&M costs are used in the financial feasibility analysis discussed in Section 0. A brief description of each O&M cost is given in the following sections.

9.1.4.1 Assumed Costs

Operations and maintenance costs for future BMPs is estimated based on the BMPs drainage area according to the following equation:

$$\text{Cost} = \$9{,}938 \times (A_{\text{acres}})^{0.269}$$

Cost in this equation is the present worth of 20 years of annual operations and maintenance costs. This equation is based on a national database of BMP operations and maintenance costs and is adapted to the City's location using the RS Means City Cost Index of 1.08 for the Los Angeles area.

City staff projected capital costs to comply with the Machado Lake Trash Total Maximum Daily Load (TMDL) at $1,400,000.

City staff provided projected costs for monitoring of the Machado Lake Nutrients TMDL at $100,000 annually. The monitoring requirements to comply with future TMDLs will not be known until the monitoring reporting plans associated with each TMDL are prepared. Some

of these future monitoring plans include the Machado Lake Toxics TMDL, Domingez Channel Toxics TMDL, or the Santa Monica Bay Debris TMDL.

These monitoring reporting plans will define the number of monitoring sites, frequency, and sampling and testing details. For the purpose of this CIP, its is estimated that the monitoring cost for future TMDLs is the same as the estimated cost of the Machado Lake Nutrients TMDL at $100,000 per year. This is most likely a conservative estimates as some economies of scale are anticipated when conduction monitoring for multiple TMDLs.

9.2 PROJECT CAPITAL COST ESTIMATES

Based on the water quality recommendations from Chapter 7, capital costs are estimated separately for wet weather flows and low flow diversion. As discussed in Chapters 6 and 7, implementing water quality projects associated with wet weather flow would incorporate the pollutant load reductions resulting from the water quality projects associated with low flow diversion. Thus, the capital costs for the two are not additive. Capital costs for stormwater capacity related improvements are therefore summarized separately.

Based on discussions with City staff, the recommended CIP is limited to the low flow diversion stormwater quality project (see 9.2.1), capacity improvement projects (see 9.2.3), and miscellaneous stormwater improvement projects (see 9.2.4). Hence, the wet weather stormwater quality projects (see 9.2.2) are included for information purposes only.

9.2.1 Low Flow Diversion Stormwater Quality Projects

Table 9.4 presents the phasing and detailed capital cost estimates for each component of the recommended wet weather flow stormwater quality projects as discussed in Chapter 7 and the unit costs presented in Table 9.2.

As shown in Table 9.4, the total estimated construction cost of all identified projects is $28,060,000, and the corresponding capital cost with the additional markups and contingencies from Table 9.2 is $47,100,000.

9.2.2 Wet Weather Flow Stormwater Quality Projects

Table 9.5 presents the phasing and detailed capital cost estimate for each component of the recommended wet weather flow stormwater quality projects as discussed in Chapter 7 and the unit costs presented in Table 9.2.

As shown in Table 9.5, the total estimated construction cost of all identified projects is $71,105,000, and the corresponding capital cost with the additional markups and contingencies from Table 9.2 is $120,235,000.

9.2.3 Stormwater Capacity Projects

Table 9.6 presents the phasing and detailed capital cost estimate for each component of the recommended wet weather flow stormwater quantity projects recommended in Chapter 8 and the unit costs presented in Table 9.2.

As shown in Table 9.6, the total estimated construction cost of all identified projects is $32,140,000, and the corresponding capital cost with the additional markups and contingencies from Table 9.2 is $54,420,000.

9.2.4 Miscellaneous Stormwater Quality Improvement Projects

Table 9.7 presents the detailed capital cost estimate for stormwater quality recommendations from previous studies for the Santa Monica Basin (Carollo, 2011). In addition, installation of street sweeping signs for the areas of the City falling within the Santa Monica Bay watershed are included here.

As shown in Table 9.7, the total estimated construction cost of all identified projects is $6,269,019, and the corresponding capital cost is $10,385,000.

9.3 PROJECT PHASING METHOD

As the City has indicated it plans to implement low flow diversion stormwater quality recommendations, the phasing of projects in the CIP was focused on implementation of the low flow diversion stormwater quality recommendations. Implementation of BMPs will depend largely on timing of required regulatory compliance. Since the City's TMDLs are assigned by watershed, timing of BMPs within specific watersheds may need to be prioritized to meet compliance deadlines. The phasing of the recommended improvements presented in this CIP is based on the anticipated timeline of TMDL requirements.

As discussed in Chapter 3, compliance with the Machado Lake Trash TMDL and Nutrients TMDL are the first anticipated regulatory deadlines. The Santa Monica Bay Bacteria TMDLs includes compliance targets which have already occurred; however, the City has initiated projects to comply with these TMDLs. Compliance with the Machado Lake Toxics TMDL and the potential future TMDLs related to the Dominguez Channel are anticipated to become effective later. Phasing has been coordinated to these assumptions regarding the regulatory timeline.

9.3.1 Phase 1

Improvements included in Phase 1 are recommended to implement critical water quality related improvements for watersheds discharging to Machado Lake. Phase 1 focuses on the high priority Harbor Lakes subareas HL-S2 (Torrance Airport) and HL-S3 (De Portala Park). The prioritization of subareas is described in detail in Chapter 7.

As discussed in Chapter 3, compliance is phased with two targets in March 2014 and September 2018. Model predictions for one of the two constituents associated with this TMDL indicate that the City will not meet the five year target without reductions in pollutant loading. Thus, implementation of this phase will need to be implemented prior to 2014. Compliance deadlines for the Machado Lake Trash TMDL begin in 2012, with annual targets and full compliance in 2016. Note that trash was not modeled as a part of this study, but the recommended BMPs are anticipated to reduce the quantity of trash conveyed by the stormwater system. Based on discussions with City staff, the City has decided to maximize its implementation of street sweeping in order to comply with the Trash TMDL. Installation of street sweeping signs for all areas of the City draining to Harbor Lakes is therefore also included in Phase 1.

Phase 1 also includes two projects for the Santa Monica Bay watershed that were recommended from previous studies. These projects include a trash interceptor for Ocean Basin and the Bishop Montgomery Athletic Field project.

9.3.2 Phase 2

Improvements included in Phase 2 are recommended to implement water quality related improvements for watersheds discharging to Dominguez Channel. Phase 2 focuses on the high priority Dominguez Channel subareas DC-S2 (Wilson Park), DC-S3 (ExxonMobil Detention Basin), and DC-S4 (Wilson Park). The prioritization of subareas is described in detail in Chapter 7.

The first compliance deadline for the Dominguez Channel Toxics TMDL is in 2017, thus Phase 2 should be implemented prior to 2017. Prediction of the pollutant levels for each constituent in the Toxics TMDL was not evaluated within the model, as TSS was used as an indicator for the various toxic constituents.

While timelines for potential regulatory deadlines are difficult to estimate, previous TMDLs required about a year for approval after being adopted by the regional board, and include a timeline of 10 years for compliance. Thus, it is anticipated that development of a nutrient TMDL for the Dominguez Channel would be implemented between 2015 and 2025.

9.3.3 Phase 3

Improvements included in Phase 3 are recommended to implement the remaining Harbor Lakes water quality related improvements. Phase 3 focuses on the remaining Harbor Lakes subareas (non-high priority areas) described in Chapter 7. Phase 3 also includes the street sweeping signs for the Santa Monica Bay watershed, as this is anticipated to be required as a part of implementation of the Santa Monica Bay Debris TMDL.

The final compliance deadline for the Machado Lakes Nutrients TMDL is 2018. However, the final compliance deadline for the Machado Lake Trash TMDL is 2016, thus BMPs will

need to be implemented prior to this date if the BMPs are to be relied upon for the required reduction in pollutant loading for trash.

Compliance with the Santa Monica Bay Debris TMDL is phased between 2016 and 2020. However, the City has already implemented some BMPs in the Santa Monica Bay watershed; timing on when the increased street sweeping efforts will be necessary for compliance will be need to be defined in the trash monitoring report for the Santa Monica Bay Debris TMDL, anticipated to be developed in 2012.

9.3.4 Phase 4

Improvements included in Phase 4 include the remaining Dominguez Channel water quality related improvements. Phase 4 focuses on the remaining Dominguez Channel subareas (non-high priority areas) described in Chapter 7.

The last two compliance deadlines for the Dominguez Channel Toxics TMDL is 2027 and 2032. It is anticipated that development of a nutrient TMDL for the Dominguez Channel would be implemented between 2015 and 2025.

9.3.5 Phase 5

Improvements included in Phase 5 are recommended to implement remaining water capacity related improvements.

While water capacity recommendations are significant in nature, it is anticipated that funding of stormwater related improvements will be limited. And since water quality related improvements are tied to regulatory deadlines, water quality improvements will need to take priority in the CIP.

Table 9.4 Low Flow Diversion Stormwater Quality Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
Q01	D	Diversion Structure to Divert Flow	HL	1	1 structure		50,000 $/site	$50,000	$85,000
Q01	P	Pipeline to Divert Flow to Divert to Airport pond	HL	1	1,200 ft	12 inch diam.	205 $/ft	$250,000	$425,000
Q01	P	Pipeline to Divert Flow to Divert to Airport pond	HL	1	1,900 ft	15 inch diam.	273 $/ft	$520,000	$880,000
Q02	D	Diversion Structure to Divert Flow	HL	1	1 structure		50,000 $/site	$50,000	$85,000
Q02	P	Pipeline to Divert Flow to Divert to Airport pond	HL	1	400 ft	12 inch diam.	205 $/ft	$85,000	$145,000
Q03	B	Hydrodynamic Separator	HL	1	1 HDS		270,000 $/site	$270,000	$460,000
Q03	D	Diversion Structure to Divert Flow	HL	1	1 structure		50,000 $/site	$50,000	$85,000
SS1	S	Installation of Street Sweeping Signs in High Priority Subarea HL-S3	HL	1	2 mi		3,187 $/mi	$10,000	$10,000
SS2	S	Installation of Street Sweeping Signs in High Priority Subarea DC-S2	DC	2	45 mi		3,187 $/mi	$145,000	$145,000
SS3	S	Installation of Street Sweeping Signs in High Priority Subarea DC-S3	DC	2	9 mi		3,187 $/mi	$30,000	$30,000
SS4	S	Installation of Street Sweeping Signs in High Priority Subarea DC-S4	DC	2	mi		3,187 $/mi	$5,000	$5,000
Q04	B	El Prado Park for Infiltration	DC	2	77,000 ft^3	Infiltration	3 $/ft^3$	$240,000	$410,000
Q04	D	Diversion Structure to Divert Flow	DC	2	1 structure		50,000 $/site	$50,000	$85,000
Q05	D	Diversion Structure to Divert Flow to ExxonMobil	DC	2	1 structure		50,000 $/site	$50,000	$85,000
Q05	P	Pipeline to Divert Flow to ExxonMobil	DC	2	1,000 ft	18 inch diam.	341 $/ft	$345,000	$585,000
Q06	D	Diversion Structure to Divert Flow	DC	2	1 structure		50,000 $/site	$50,000	$85,000
Q06	P	Pipeline to Divert Flow	DC	2	2,100 ft	12 inch diam.	205 $/ft	$435,000	$740,000
Q06	U	Pump Station to Divert Flow	DC	2	2 mgd	25 hp		$95,000	$165,000
Q07	B	El Prado Park for Infiltration	DC	2	310,000 ft^3	Infiltration	3 $/ft^3$	$970,000	$1,640,000
Q07	D	Diversion Structure to Divert Flow	DC	2	1 structure		50,000 $/site	$50,000	$85,000
Q07	P	Pipeline to Divert Flow	DC	2	2,100 ft	18 inch diam.	341 $/ft	$720,000	$1,220,000
Q07	U	Pump Station to Divert Flow	DC	2	13 mgd	75 hp		$240,000	$410,000
Q08	B	Divert to Wilson Park for Infiltration	DC	2	144,000 ft^3	Infiltration	3 $/ft^3$	$450,000	$765,000
Q08	D	Diversion Structure to Divert Flow	DC	2	1 structure		50,000 $/site	$50,000	$85,000
Q09	B	Divert to Median for Infiltration	DC	2	45,000 ft^3	Infiltration	3 $/ft^3$	$145,000	$250,000
Q09	D	Diversion Structure to Divert Flow	DC	2	1 structure		50,000 $/site	$50,000	$85,000

Table 9.4 Low Flow Diversion Stormwater Quality Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
Q09	U	Pump Station to Divert Flow	DC	2	2 mgd	25 hp		$95,000	$165,000
Q10	B	Divert to Wilson Park for Infiltration	DC	2	440,000 ft^3	Infiltration	3 $/ft^3	$1,375,000	$2,325,000
Q10	D	Diversion Structure to Divert Flow	DC	2	1 structure		50,000 $/site	$50,000	$85,000
Q10	P	Pipeline to Divert Flow	DC	2	4,800 ft	24 inch diam.	512 $/ft	$2,460,000	$4,160,000
Q10	U	Pump Station to Divert Flow	DC	2	19 mgd	125 hp		$320,000	$545,000
Q11	B	Divert to Wilson Park for Infiltration	DC	2	60,000 ft^3	Infiltration	3 $/ft^3	$190,000	$325,000
Q11	D	Diversion Structure to Divert Flow	DC	2	1 structure		50,000 $/site	$50,000	$85,000
Q11	U	Pump Station to Divert Flow	DC	2	2 mgd	25 hp		$95,000	$165,000
Q12	B	Divert to Wilson Park for Infiltration	DC	4	120,000 ft^3	Infiltration	3 $/ft^3	$375,000	$635,000
Q12	D	Diversion Structure to Divert Flow	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q12	P	Pipeline to Divert Flow	DC	4	1,200 ft	12 inch diam.	205 $/ft	$250,000	$425,000
Q12	P	Pipeline to Divert Flow	DC	4	4,800 ft	30 inch diam.	614 $/ft	$2,950,000	$4,990,000
Q12	U	Pump Station to Divert Flow	DC	4	5 mgd	25 hp		$135,000	$230,000
SS5	S	Installation of Street Sweeping Signs in Remaining Subareas of HL	HL	3	51 mi		3,187 $/mi	$165,000	$165,000
SS6	S	Installation of Street Sweeping Signs in Remaining Subareas of DC	DC	4	107 mi		3,187 $/mi	$330,000	$330,000
Q13	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q14	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q15	B	Retention and Storage at Wetlands	HL	3	52,200 ft^3	Wetlands	2 $/ft^3	$100,000	$170,000
Q15	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q16	B	Treat and Storage at Wetlands	HL	3	156,600 ft^3	Wetlands	2 $/ft^3	$300,000	$510,000
Q16	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q17	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q17	P	Pipeline to Divert Flow to Divert to Well 8	HL	3	1,300 ft	15 inch diam.	273 $/ft	$355,000	$600,000
Q18	B	Divert flow to Sur la Brea Sump	HL	3	427,091 ft^3	Retention	2 $/ft^3	$730,000	$1,235,000
Q18	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q19	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q19	P	Pipeline to Divert Flow to Divert to Sump	HL	3	2,400 ft	15 inch diam.	273 $/ft	$660,000	$1,120,000
Q19	U	Pump Station to Divert Flow	HL	3	7 mgd	50 hp		$160,000	$275,000
Q20	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q20	P	Pipeline to Divert Flow to Divert to Sur la Brea Sump	HL	3	3,000 ft	15 inch diam.	273 $/ft	$820,000	$1,390,000

Table 9.4 Low Flow Diversion Stormwater Quality Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
Q20	U	Pump Station to Divert Flow	HL	3	7 mgd	50 hp		$160,000	$275,000
Q21	B	Detention/infiltration	HL	3	87,000 ft^3	Infiltration	3 $/ft^3	$275,000	$465,000
Q21	D	Diversion Structure to Divert Flow	HL	3	1 structure		50,000 $/site	$50,000	$85,000
Q21	P	Pipeline to Divert Flow to Detention/infiltration	HL	3	5,100 ft	12 inch diam.	205 $/ft	$1,050,000	$1,775,000
Q21	U	Pump Station to Divert Flow	HL	3	4 mgd	25 hp		$120,000	$205,000
Q21	V	Site Piping and Valves	HL	3				$50,000	$85,000
Q22	B	New Infiltration Basin near DC	DC	4	55,000 ft^3	Infiltration	3 $/ft^3	$175,000	$300,000
Q22	D	Diversion Structure to Divert Flow to SCE	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q23	B	New Infiltration BMP	DC	4	105,000 ft^3	Infiltration	3 $/ft^3	$330,000	$560,000
Q23	D	Diversion Structure to Divert Flow	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q23	P	Pipeline to Divert Flow	DC	4	1,700 ft	12 inch diam.	205 $/ft	$350,000	$595,000
Q24	B	New Infiltration Basin at SCE	DC	4	250,000 ft^3	Infiltration	3 $/ft^3	$780,000	$1,320,000
Q24	D	Diversion Structure to Divert Flow to SCE	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q25	B	Underground Infiltration BMP at Lincoln School	DC	4	120,000 ft^3	Infiltration	3 $/ft^3	$375,000	$635,000
Q25	D	Diversion Structure to Divert Flow to Lincoln School	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q25	P	Pipeline to Divert Flow to Lincoln School	DC	4	2,000 ft	12 inch diam.	205 $/ft	$410,000	$695,000
Q26	B	Divert to New Retention Basin	DC	4	125,000 ft^3	Retention	2 $/ft^3	$215,000	$365,000
Q26	D	Diversion Structure to Divert Flow	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q26	P	Pipeline to Divert Flow	DC	4	4,100 ft	12 inch diam.	205 $/ft	$845,000	$1,430,000
Q27	B	Infiltration BMP at Guenser Park	DC	4	190,000 ft^3	Infiltration	3 $/ft^3	$595,000	$1,010,000
Q27	D	Diversion Structure to Divert Flow	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q27	P	Pipeline to Divert Flow	DC	4	1,900 ft	18 inch diam.	341 $/ft	$650,000	$1,100,000
Q27	U	Pump Station to Divert Flow	DC	4	8 mgd	50 hp		$175,000	$300,000
Q28	B	Infiltration BMP	DC	4	220,000 ft^3	Infiltration	3 $/ft^3	$690,000	$1,170,000
Q28	D	Diversion Structure to Divert Flow	DC	4	1 structure		50,000 $/site	$50,000	$85,000
Q28	P	Pipeline to Divert Flow	DC	4	1,500 ft	12 inch diam.	205 $/ft	$310,000	$525,000
Q28	P	Pipeline to Divert Flow	DC	4	6,100 ft	18 inch diam.	341 $/ft	$2,085,000	$3,525,000
Q28	U	Pump Station to Divert Flow	DC	4	10 mgd	75 hp		$200,000	$340,000
							Total	**$28,060,000**	**$47,100,000**

Table 9.5 Wet Weather Stormwater Quality Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
DC1-1	BMP	Infiltration BMP at Guenser Park	DC	2	3,730,000 ft^3	Infiltration	3 $/ft^3$	$11,625,000	$19,650,000
DC1-2	PS	Pump Station for DC1-1 BMP	DC	2	156 mgd	975 hp		$2,120,000	$3,585,000
DC1-3	FM	Force Main from DC1-2 Pump Station to DC1-1 BMP	DC	2	2,100 ft	54 inch diam.	1,080 $/ft	$2,270,000	$3,840,000
DC1-4	BMP	Diversion Structure	DC	2	1 structure		50,000 $/site	$50,000	$85,000
DC2-1	BMP	Infiltration BMP at McMaster Park	DC	2	1,185,000 ft^3	Infiltration	3 $/ft^3$	$3,695,000	$6,245,000
DC2-2	BMP	Diversion Structure	DC	2	1 structure		50,000 $/site	$50,000	$85,000
DC3-1	BMP	Wetland BMP at Del Amo / Van Ness	DC	2	1,730,000 ft^3	Wetlands	2 $/ft^3$	$3,315,000	$5,605,000
DC3-2	BMP	HDS BMP at Del Amo / Van Ness	DC	2	1 site	HDS	1,030,000 $/site	$1,030,000	$1,745,000
DC4-1	BMP	Retention BMP at Columbia Park	DC	2	210,000 ft^3	Retention	2 $/ft^3$	$360,000	$610,000
DC4-2	BMP	Diversion Structure	DC	2	1 structure		50,000 $/site	$50,000	$85,000
DC4-3	BMP	Diversion Structure	DC	2	1 structure		50,000 $/site	$50,000	$85,000
DC5-1	BMP	Infiltration Trench BMP at El Prado Park	DC	2	515,000 ft^3	Infiltration	3 $/ft^3$	$1,605,000	$2,715,000
DC5-2	BMP	Diversion Structure	DC	2	1 structure		50,000 $/site	$50,000	$85,000
DC6-1	BMP	Infiltration BMP at Wilson Park	DC	2	775,000 ft^3	Infiltration	3 $/ft^3$	$2,415,000	$4,085,000
DC6-2	BMP	Diversion Structure	DC	2	1 structure		50,000 $/site	$50,000	$85,000
DC7-1	BMP	Infiltration BMP at Wilson Park	DC	2	3,765,000 ft^3	Infiltration	3 $/ft^3$	$11,735,000	$19,835,000
DC7-2	PS	Pump Station for DC7-1 BMP	DC	2	158 mgd	1,000 hp		$2,145,000	$3,630,000
DC7-3	FM	Force Main from DC7-2 Pump Station to DC7-1 BMP	DC	2	9,200 ft	54 inch diam.	1,080 $/ft	$9,940,000	$16,800,000
DC7-4	BMP	Diversion Structure	DC	2	1 structure		50,000 $/site	$50,000	$85,000
HL2-1	BMP	Infiltration BMP at Torrance Airport	HL	1	1,275,000 ft^3	Infiltration	3 $/ft^3$	$3,975,000	$6,720,000
HL2-2	BMP	Diversion Structure	HL	1	1 structure		50,000 $/site	$50,000	$85,000
HL2-3	BMP	HDS BMP at Torrance Airport (for pretreatment)	HL	1	1 site	HDS	270,000 $/site	$270,000	$460,000
HL3-1	BMP	Wetland BMP at De Portola Park	HL	1	175,000 ft^3	Wetlands	2 $/ft^3$	$340,000	$575,000
HL3-2	BMP	Diversion Structure	HL	1	1 structure		50,000 $/site	$50,000	$85,000
HL4-1	BMP	Retention BMP at Crenshaw Blvd. and Skypark Dr.	HL	1	785,000 ft^3	Retention	2 $/ft^3$	$1,335,000	$2,260,000
HL4-2	BMP	Diversion Structure	HL	1	1 structure		50,000 $/site	$50,000	$85,000
HL4-3	BMP	HDS BMP at Crenshaw Blvd. and Skypark Dr.	HL	1	1 site	HDS	1,030,000 $/site	$1,030,000	$1,745,000

Table 9.5 Wet Weather Stormwater Quality Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
HL5-1	BMP	Infiltration BMP at Sur La Brea Park	HL	1	2,180,000 ft^3	Infiltration	3 $/ft^3$	$6,795,000	$11,485,000
HL5-2	BMP	Diversion Structure	HL	1	1 structure		50,000 $/site	$50,000	$85,000
HL5-3	PS	Pump Station for HL5-1 BMP	HL	1	91 mgd	575 hp		$1,265,000	$2,140,000
HL5-4	FM	Force Main from HL5-3 Pump Station to HL5-1 BMP	HL	1	2,200 ft	54 inch diam.	1,080 $/ft	$2,380,000	$4,025,000
HL6-1	BMP	HDS BMP at Torrance Little League Fields	HL	1	1 site	HDS	270,000 $/site	$270,000	$460,000
HL6-2	PS	Pump Station for HL6-1 BMP	HL	1	16 mgd	100 hp		$280,000	$475,000
HL6-3	FM	Force Main from HL6-2 Pump Station to HL6-1 BMP	HL	1	600 ft	24 inch diam.	512 $/ft	$310,000	$525,000
HL6-4	BMP	Diversion Structure	HL	1	1 structure		50,000 $/site	$50,000	$85,000
							Total	**$71,105,000**	**$120,235,000**

Table 9.6 Stormwater Capacity Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
C01	P	Replace 24" to 30" existing pipeline with 36" pipeline	WL	5	600 ft	36 inch diam.	851 $/ft	$515,000	$875,000
C02	P	Replace 36" existing pipeline with 48" pipeline	WL	5	1,600 ft	48 inch diam.	1,135 $/ft	$1,820,000	$3,080,000
C03	P	Replace 18" existing pipeline with 30" pipeline	WL	5	600 ft	30 inch diam.	709 $/ft	$430,000	$730,000
C04	P	Replace 24" to 30" existing pipeline with 36" pipeline	WL	5	900 ft	36 inch diam.	851 $/ft	$770,000	$1,305,000
C05	P	Replace 24" to 30" existing pipeline with 36" pipeline	WL	5	600 ft	36 inch diam.	851 $/ft	$515,000	$875,000
C06	P	Construct new 36" pipeline	WL	5	900 ft	36 inch diam.	851 $/ft	$770,000	$1,305,000
C07	P	Replace 24" existing pipeline with 30" pipeline	WL	5	500 ft	30 inch diam.	709 $/ft	$355,000	$600,000
C08	P	Replace 24" existing pipeline with 30" pipeline	WL	5	800 ft	30 inch diam.	709 $/ft	$570,000	$965,000
C09	P	Construct new 42" pipeline	WL	5	700 ft	42 inch diam.	992 $/ft	$695,000	$1,175,000
C10	P	Construct new 66" pipeline	WL	5	1,500 ft	66 inch diam.	1,560 $/ft	$2,340,000	$3,955,000
C11	P	Replace 36" existing pipeline with 51" pipeline	HL	5	800 ft	51 inch diam.	1,206 $/ft	$965,000	$1,635,000
C12	P	Replace 39" to 42" existing pipeline with 54" pipeline	HL	5	1,100 ft	54 inch diam.	1,276 $/ft	$1,405,000	$2,375,000
C13	P	Replace 30" to 36" existing pipeline with 48" pipeline	HL	5	2,500 ft	48 inch diam.	1,135 $/ft	$2,840,000	$4,800,000
C14	P	Parallel 63" existing pipeline with 24" pipeline	HL	5	900 ft	24 inch diam.	567 $/ft	$515,000	$875,000
C15	P	Construct new 42" pipeline	HL	5	400 ft	42 inch diam.	992 $/ft	$400,000	$680,000
C16	P	Replace 33" existing pipeline with 42" pipeline	HL	5	700 ft	42 inch diam.	992 $/ft	$695,000	$1,175,000
C17	P	Replace 45" existing pipeline with 54" pipeline	DC	5	200 ft	54 inch diam.	1,276 $/ft	$260,000	$440,000
C18	P	Construct new 36" pipeline	DC	5	700 ft	36 inch diam.	851 $/ft	$600,000	$1,015,000
C19	P	Construct new 42" pipeline	DC	5	1,400 ft	42 inch diam.	992 $/ft	$1,390,000	$2,350,000
C20	P	Construct new 57" pipeline	DC	5	1,500 ft	57 inch diam.	1,347 $/ft	$2,025,000	$3,425,000
C21	P	Replace 30" to 36" existing pipeline with 48" pipeline	DC	5	1,900 ft	48 inch diam.	1,135 $/ft	$2,160,000	$3,655,000
C22	P	Construct new 54" pipeline	DC	5	1,700 ft	54 inch diam.	1,276 $/ft	$2,170,000	$3,670,000
C23	P	Construct new 36" pipeline	DC	5	1,400 ft	36 inch diam.	851 $/ft	$1,195,000	$2,020,000
C24	P	Replace 24" existing pipeline with 30" pipeline	DC	5	400 ft	30 inch diam.	709 $/ft	$285,000	$485,000
C25	P	Construct new 24" pipeline	DC	5	1,100 ft	24 inch diam.	567 $/ft	$625,000	$1,060,000
C26	P	Replace 39" existing pipeline with 42" pipeline	DC	5	700 ft	42 inch diam.	992 $/ft	$695,000	$1,175,000
C27	P	Replace 15" to 18" existing pipeline with 27" pipeline	DC	5	400 ft	27 inch diam.	638 $/ft	$260,000	$440,000
C28	P	Replace 24" existing pipeline with 36" pipeline	DC	5	400 ft	36 inch diam.	851 $/ft	$345,000	$585,000
C29	P	Construct new 36" pipeline	DC	5	200 ft	36 inch diam.	851 $/ft	$175,000	$300,000

Table 9.6 Stormwater Capacity Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
C30	P	Replace 24" existing pipeline with 36" pipeline	DC	5	1,200 ft	36 inch diam.	851 $/ft	$1,025,000	$1,735,000
C31	P	Construct new 36" pipeline	DC	5	600 ft	36 inch diam.	851 $/ft	$515,000	$875,000
C32	P	Replace 30" existing pipeline with 51" pipeline	DC	5	600 ft	51 inch diam.	1,206 $/ft	$725,000	$1,230,000
C33	P	Construct new 51" pipeline	DC	5	100 ft	51 inch diam.	1,206 $/ft	$125,000	$215,000
C34	P	Replace 24" existing pipeline with 30" pipeline	DC	5	1,100 ft	30 inch diam.	709 $/ft	$780,000	$1,320,000
C35	P	Replace 18" to 24" existing pipeline with 36" pipeline	DC	5	200 ft	36 inch diam.	851 $/ft	$175,000	$300,000
C36	P	Construct new 36" pipeline	DC	5	100 ft	36 inch diam.	851 $/ft	$90,000	$155,000
C37	P	Replace 15" existing pipeline with 24" pipeline	DC	5	400 ft	24 inch diam.	567 $/ft	$230,000	$390,000
C38	P	Replace 24" to 30" existing pipeline with 36" pipeline	DC	5	600 ft	36 inch diam.	851 $/ft	$515,000	$875,000
C39	P	Construct new 36" pipeline	DC	5	200 ft	36 inch diam.	851 $/ft	$175,000	$300,000
							Total	**$32,140,000**	**$54,420,000**

Table 9.7 Miscellaneous Stormwater Quality Improvement Projects

Project ID	Category	Description	Watershed	Phase	Size	Capacity or Type	Unit Cost	Construction Cost	Capital Cost
OC	B	Ocean Basin Enhancements (Trash Interceptor)	SMB	1				$1,506,436	$2,550,000
BM	B	Bishop Montgomery Multi-Use Althletic Field (Below Grade Chamber System and NetPave Parking System)	SMB	1				$4,447,583	$7,520,000
	S	Installation of Street Sweeping Signs in Remainder of City (Outside Study Area)	SMB	3	99 mi		3,187 $/mi	$315,000	$315,000
							Total	**$6,269,019**	**$10,385,000**

9.4 CAPITAL IMPROVEMENT PROGRAM

As described above, the recommended CIP is based on low flow diversion stormwater quality improvements, capacity improvements, and miscellaneous improvements. The cost of wet weather stormwater quality improvements is presented herein for information purposes. As shown in Table 9.8, but not included in the total cost of the recommended CIP.

Table 9.8 Recommended CIP Summary

Improvement Type	Capital Cost ($ million)	Source
Low Flow Diversion Water Quality Projects	$47.1	Table 9.4
Capacity Improvement Projects	$54.4	Table 9.6
Miscellaneous Improvement Projects	$10.4	Table 9.7
Total Cost of Recommended Dry Weather CIP	**$111.9**	n/a
Wet Weather Water Quality Projects	$120.2	Table 9.5
Total Cost of Wet Weather CIP(1)	**$185.0**	**n/a**

Notes:
(1) Does not include Low Flow Diversion Improvement Projects to avoid double counting.

9.4.1 CIP by Planning Phase

As previously discussed, the CIP is divided into five phases. Table 9.9 summarizes the breakdown of costs for each of the phases (shown in million dollars).

Table 9.9 Capital Cost by Planning Phase and Project Type

Category	Phase 1 ($M)	Phase 2 ($M)	Phase 3 ($M)	Phase 4 ($M)	Phase 5 ($M)	Total ($M)
BMPs	$10.5	$5.7	$2.4	$6.0	$0.0	$24.6
Diversion Structures	$0.3	$0.7	$0.8	$0.7	$0.0	$2.4
Storm Drains and Force Mains	$1.5	$6.7	$4.9	$13.3	$54.4	$80.7
Street Sweeping	$0.2	$0.2	$0.3	$0.3	$0.0	$1.0
Pump Stations	$0.0	$1.5	$0.8	$0.9	$0.0	$3.1
Valves and Site Piping	$0.0	$0.0	$0.1	$0.0	$0.0	$0.1
Total	**$12.4**	**$14.7**	**$9.2**	**$21.2**	**$54.4**	**$111.9**

Notes:
1. Capital Costs are based on the cost assumptions discussed in Section 9.1. Detailed information for each project can be found in Table 9.5.

As shown in Table 9.9, total capital cost is estimated at $112 million, which is divided into five phases. Figure 9.1 presents the capital costs for each identified phase.

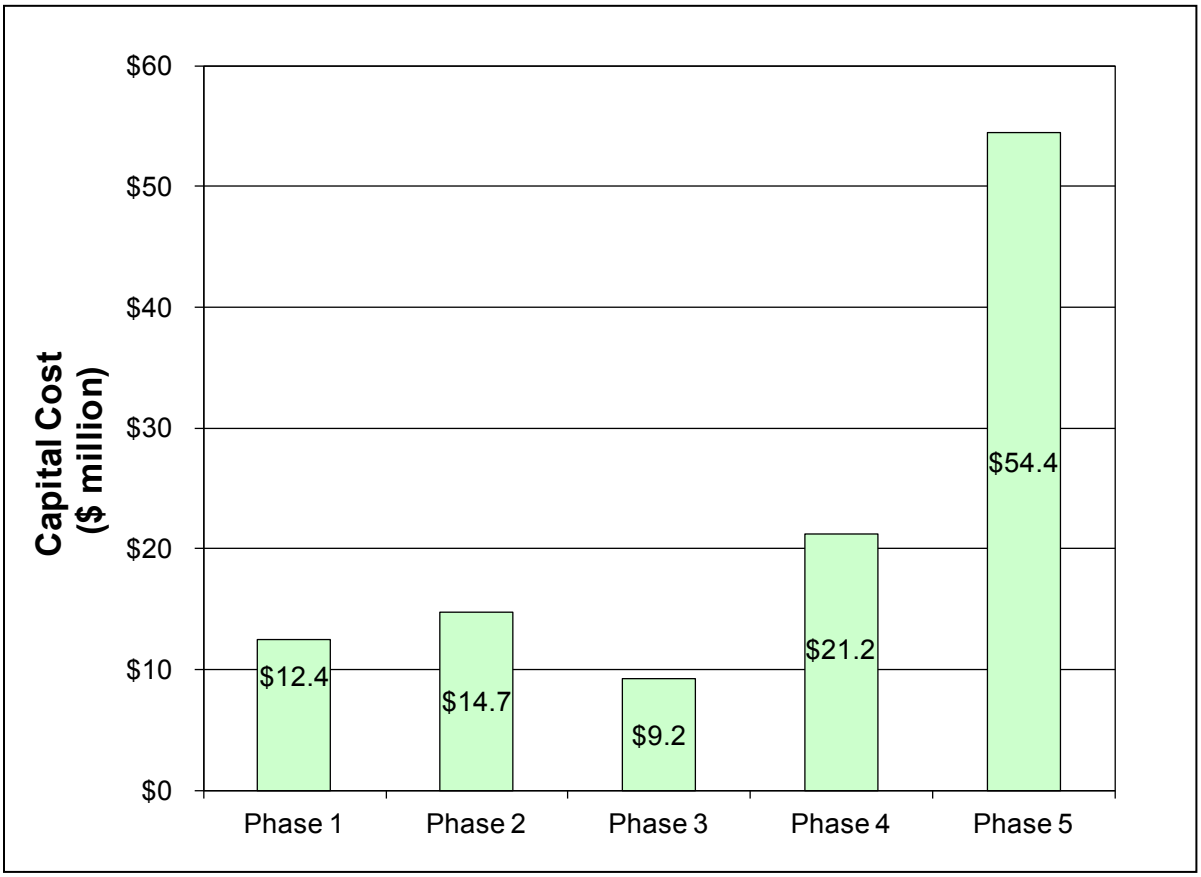
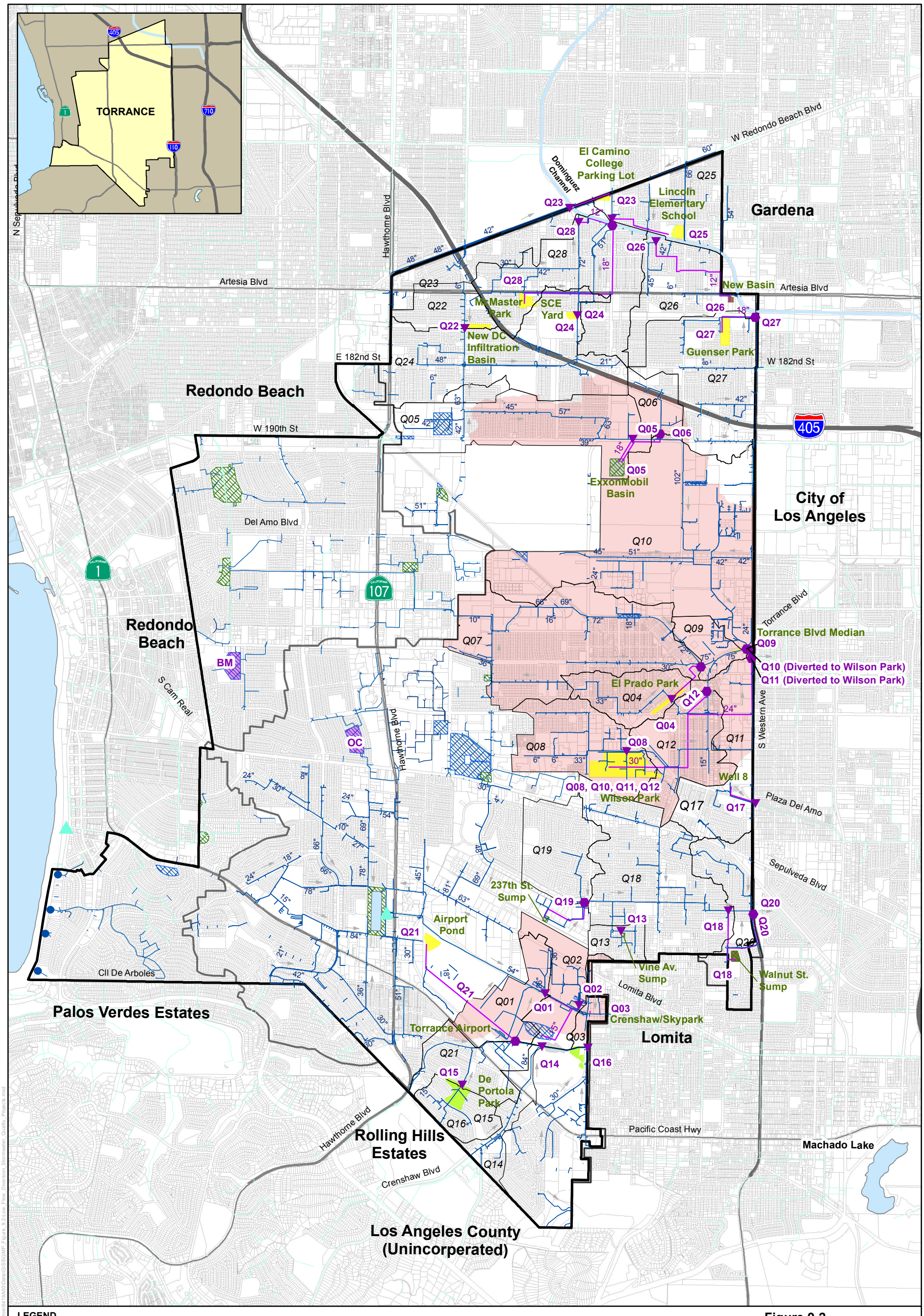


Figure 9.1 Capital Cost by Phase

Locations for improvements included in the CIP are shown on Figure 9.2.



LEGEND

CIP Projects

- Diversion Structure
- Low Flow Diversion Pump Station
- BMP Tributary Area (ID in Italics)
- Diversion Pipelines
- City Boundary
- Additional BMP Locations

Retention and Detention Basins

Type

- Detention Basin
- Retention Basin

Recommended BMP Locations

by Type

- Infiltration
- Wetlands
- Retention
- HDS
- None (Use Existing Facility)
- High Priority Subareas
- Study Area

Existing Pump Stations

by Owner

- LACDPW

Existing BMPs

by Type

- Continuous Deflective Separator
- Bodies of Water

Storm Drains

- City's Stormwater System
- LACDPW System
- Flow Direction
- Freeway
- Major Roads

Note:
Not all proposed diversion structures and site piping shown due to scale of map.

0 0.2 0.4 0.8 Miles

Figure 9.2
Low Flow Diversion
Stormwater Quality
CIP Projects
Stormwater Quality Master Plan
City of Torrance

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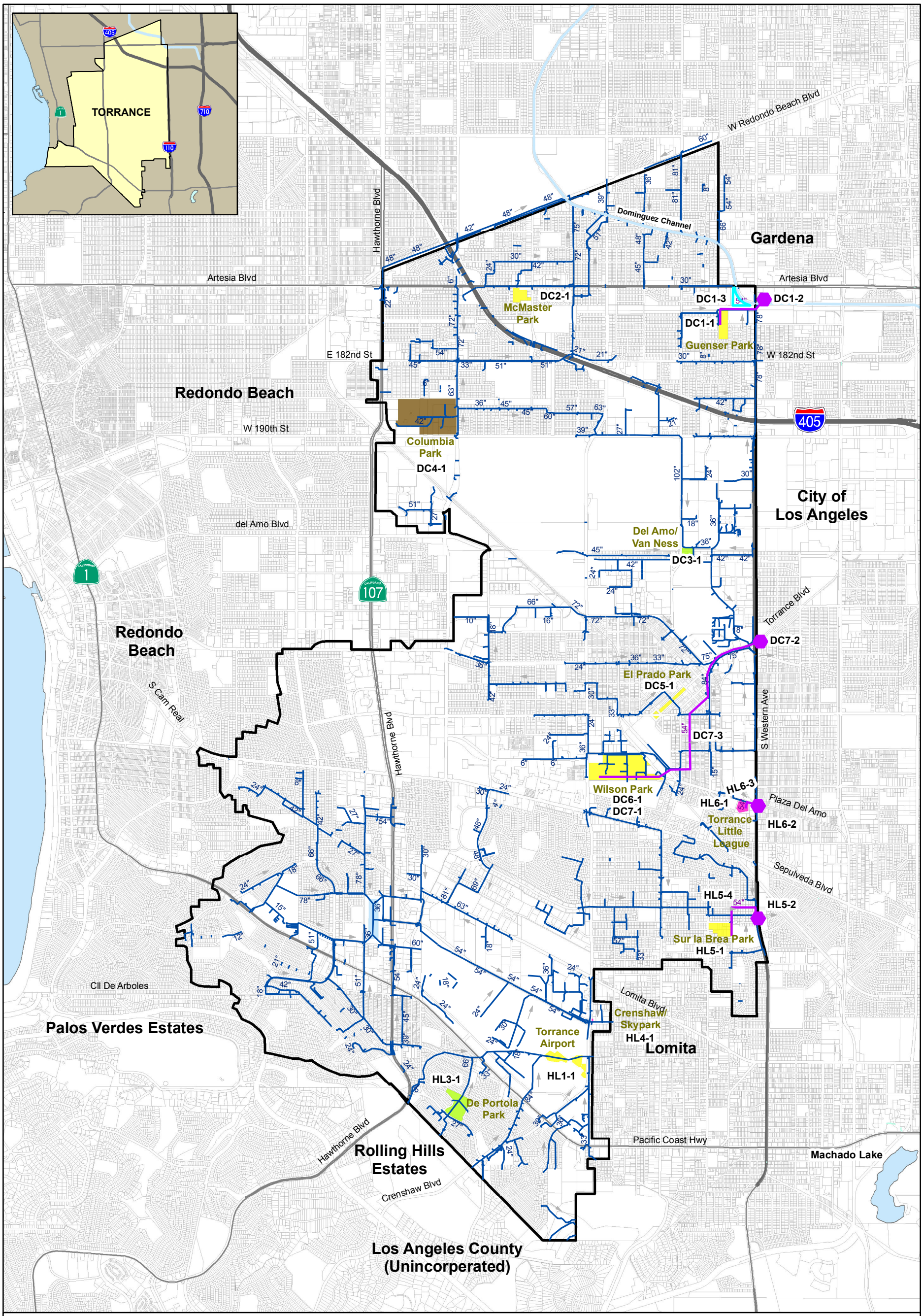


LEGEND

- Pump Station
- Force Main

Recommended BMP Locations by Type

- Infiltration
- Wetlands
- Retention
- HDS
- None (Use Existing Facility)

- Study Area

Storm Drains

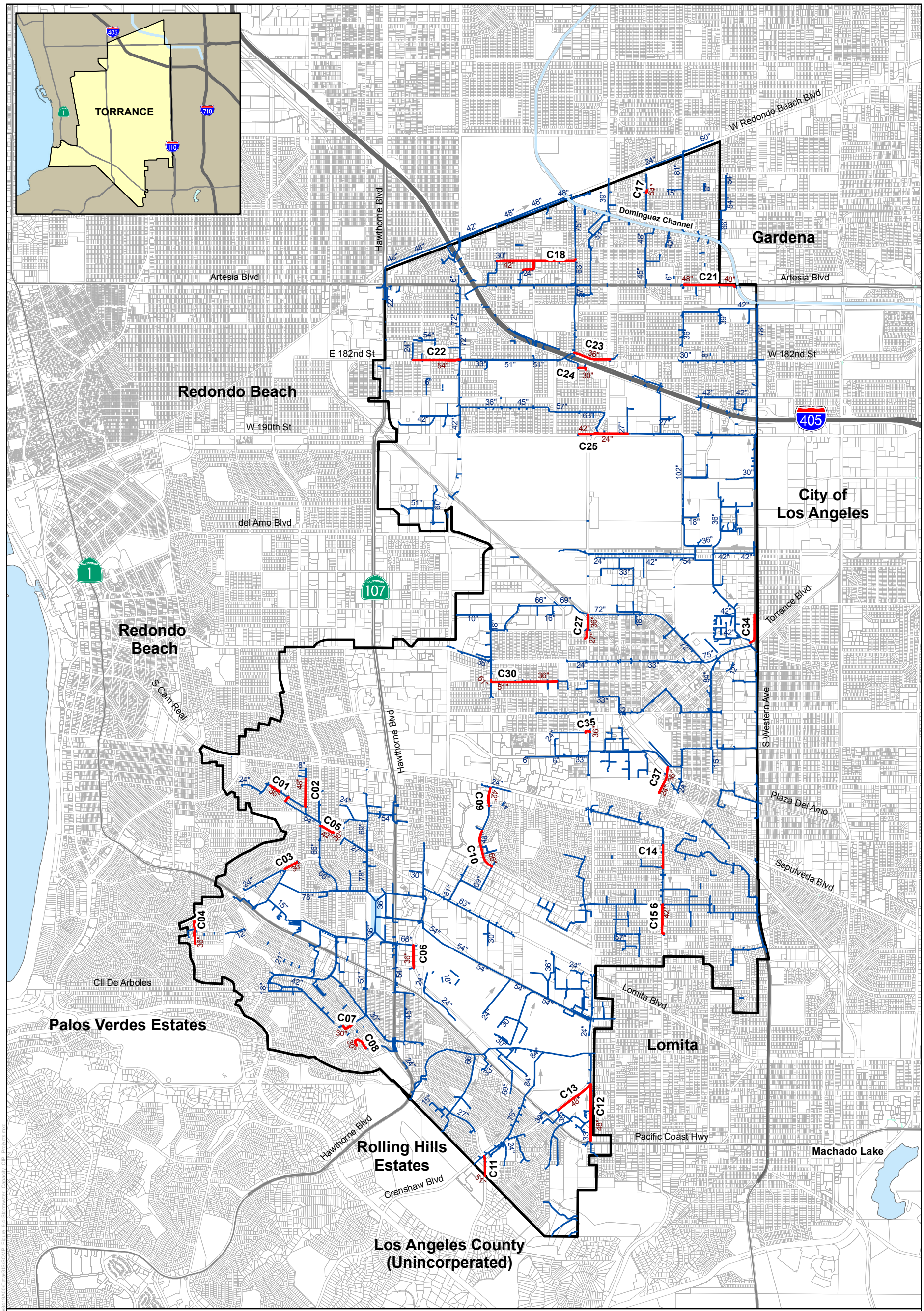
- City's Stormwater System
- LACDPW System
- Flow Direction
- Freeway
- Major Roads

Others

- Retention Basin
- Detention Basin
- Bodies of Water

0 0.2 0.4 0.8 Miles

Figure 9.3
Wet Weather Stormwater Quality CIP Projects
Stormwater Quality Management Plan
City of Torrance



LEGEND

Minor Event
Water Quantity Deficiencies

- Replace, Parallel, or New Construction
- Study Area

Storm Drains

- City's Stormwater System
- LACDPW System
- Flow Direction
- Freeway
- Major Roads

Others

- Retention Basin
- Detention Basin
- Bodies of Water

0 0.2 0.4 0.8 Miles

Figure 9.4
Stormwater Capacity
CIP Projects
Stormwater Quality Master Plan
City of Torrance

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9.4.2 CIP by Watershed

The breakdown of capital costs for the improvements included in the CIP by watershed are included in Table 9.10.

Table 9.10 Capital Cost by Planning Phase and Watershed

Watershed	Phase 1 ($M)	Phase 2 ($M)	Phase 3 ($M)	Phase 4 ($M)	Phase 5 ($M)	Total ($M)
Dominguez Channel	$0.0	$14.7	$0.0	$21.2	$28.0	$63.9
Harbor Lakes	$2.3	$0.0	$8.9	$0.0	$11.5	$22.8
Walteria Lake	$0.0	$0.0	$0.0	$0.0	$14.9	$14.9
Santa Monica Bay	$10.1	$0.0	$0.3	$0.0	$0.0	$10.4
Total	**$12.4**	**$14.7**	**$9.2**	**$21.2**	**$54.4**	**$111.9**

Note:
1. Capital Costs are based on the cost assumptions discussed in Section 9.1. Detailed information for each project can be found in Table 9.5.

As shown in Table 9.10, the Dominguez Channel watershed includes the majority of the recommended improvements at $63.9 million, with the Harbor Lakes and Walteria Lake watersheds including $22.8 million and $14.9 million, respectively. The Santa Monica Bay watershed includes about $10.4 million. However, the City has already invested in BMPs within Santa Monica Bay since some applicable TMDLs are already in place.

Improvements included in the CIP are shown by improvement type on Figure 9.2.

As shown on Figure 9.5, pipelines represent the most significant component of the CIP, accounting for about 72 percent of the total CIP cost. BMPs account for about 22 percent. Pump stations, street sweeping, diversion structures, and valves and site piping are the smallest categories, representing a total of 6 percent.

Figure 9.6 shows the cost breakdown between improvements recommended for water quality and water capacity. As shown, water capacity improvements represent the bulk of the CIP, with about 68 percent of the total CIP cost. Water quantity improvements represent the remaining 32 percent of the CIP.

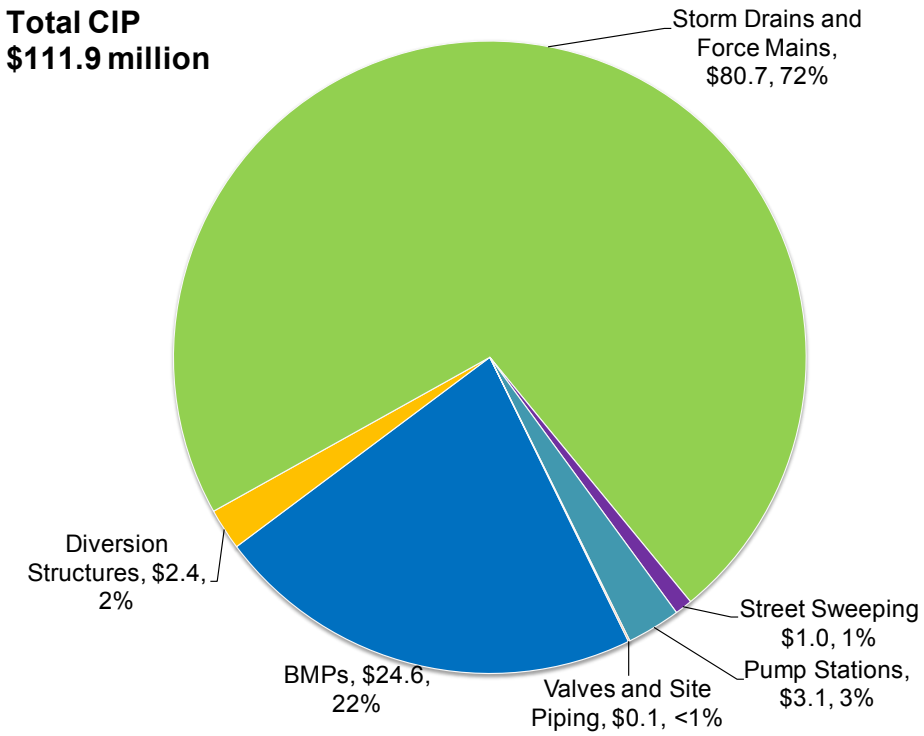

Figure 9.5 Capital Cost by Phase

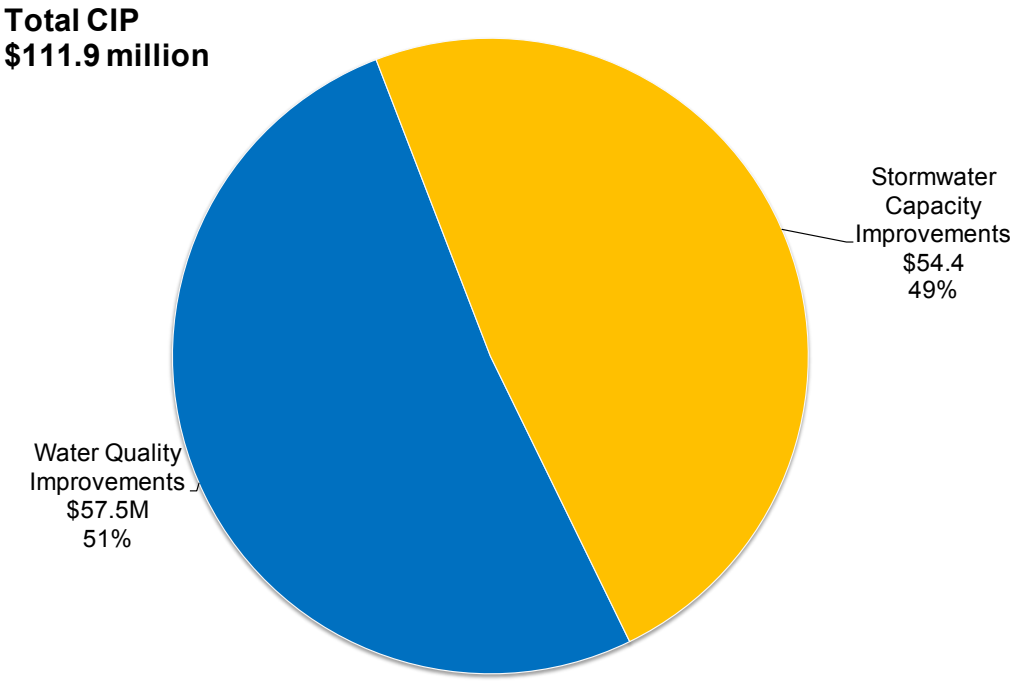

Figure 9.6 Capital Cost by Category

9.5 MONITORING COSTS

As discussed in Chapter 3, the monitoring is a component for most of the TMDLs applicable to the City's discharges. Table 9.11 summarizes the TMDLs discussed in Chapter 3, and shows when baseline monitoring is scheduled and when compliance monitoring would initiate.

Table 9.11 Monitoring Components of TMDLs

Body of Water	Name	Status	Baseline Monitoring	Initiate Compliance Monitoring
Santa Monica Bay	Bacteria	Effective	-	2004[4]
	PCBs + DDT	In Development[1]	*2013*	*2016*
	Debris (Trash + Plastic Pellets)	Adopted	2013 (Trash) 2014 (Plastic)	2016
Dominguez Channel[2]	Bacteria	In Development[2]	*2013 - 2015*	*2016*
	Toxics	Adopted	2013 - 2014	2015
	Nutrients	Anticipated	*2013 - 2015*	*2016*
Machado Lake	Nutrients	Effective	2012	2013
	Toxics	Effective	2011 - 2013	2014
	Trash[3]	Effective	2009 - 2010	-

Notes:
Dates in italics are assumed since the actual dates are not yet established. It was assumed that potential TMDLs would take at least 2 years for development and 1 year for approval, with 2 years for baseline monitoring followed by compliance monitoring.
1. The EPA released a draft TMDL for this pollutant on December, 9, 2011 (EPA, 2011).
2. Dominguez Channel discharges into the Los Angeles Harbor; thus TMDLs may apply to dischargers to the Dominguez Channel even though the Body of Water is listed as Los Angeles Harbor (Los Angeles River and Machado Lake also discharge into the Los Angeles Harbor).
3. The Machado Lake Trash TMDL did not include an explicit compliance monitoring program. However, it is assumed that compliance monitoring will be required through the approval of the monitoring reporting plan.
4. It is not believed this is conducted by the City.

As shown in Table 9.11, approximately seven baseline monitoring programs are anticipated to be required in 2013. For some TMDLs, less effort is associated with compliance monitoring when compared to baseline monitoring. After 2016, nine compliance monitoring programs are anticipated to be simultaneously required. While details such as sampling frequency, sample types, and number of samples will be developed in the various monitoring reports established early in the monitoring process, effort associated with

monitoring was approximated using the City's estimate of $100,000 annually for monitoring of the Machado Lake Nutrients TMDL.

While sampling costs for some TMDLs, such as the Dominguez Channel Toxics TMDL are anticipated to be significantly higher than the efforts associated with the Machado Lake Nutrients TMDL, sampling costs for others are anticipated to be significantly lower, such as the trash TMDLs without costs for chemical testing or the Machado Lake Toxics TMDL, which only requires sampling every two years. At this level of planning, insufficient detail on the monitoring programs has been developed in order to predict monitoring costs to any level of detail. Thus, Table 9.12 presents approximate potential costs for monitoring assuming the monitoring efforts associated with the Machado Lake Nutrients TMDL is assumed to be representative of the average level of effort for all of the monitoring plans. Since the monitoring efforts primarily consist of staff costs, an annual increase of 5 percent is incorporated into the potential annual cost.

Table 9.12 Projected Monitoring Costs

Year	Number of Monitoring Programs	Annual Cost ($M)	Escalated Annual Cost ($M)
2009 – 2010	1	$0.1	$0.1
2011 – 2012	2	$0.2	$0.2
2013	7	$0.8	$0.8
2014	8	$0.8	$0.9
2015	8	$0.8	$1.0
2016	8	$0.8	$1.0
2017	8	$0.8	$1.1
2018	8	$0.8	$1.1
2019	8	$0.8	$1.2
2020	8	$0.8	$1.2
2021	8	$0.8	$1.3

As shown in Table 9.12, the City's costs associated with monitoring are anticipated to increase dramatically after 2013.

9.6 FINANCIAL PLAN

9.6.1 Water Quality Fee Initiative

The Los Angeles County Flood Control District (LACFCD) is planning to implement a program to clean up polluted water in Los Angeles County. This water quality fee initiative (WQFI), also called the Clean Water, Clean Beaches Initiative, is in the planning stages of implementing a clean water fee. The purpose of the fee is to clean waterways within Los Angeles County. The fee could also provide the City with funding to implement some of the projects within the recommended CIP.

The fee will be parcel based, and requires the approval of landowners within the LACFCD. It should be noted that it is currently planned for fee to apply to all property, government as well as private.

The proceeds from the fee will be split into three categories:

- 40 percent will be provided directly to the cities within which the parcels fall
- 50 percent will be provided to Watershed Authority Groups to create regional projects
- 10 percent will be provided to Los Angeles County Department of Public Works to administer the program

As a part of the WQFI, Watershed Authority Groups (WAGs) are formed regionally by watershed. According to preliminary maps, the City's service area will fall within two WAGs, the Santa Monica Bay, and Dominguez Channel WAGs.

While the details of the fee are not yet available, based on a preliminary estimate from the County of about $54 per single-family residential lot and 30,000 single family residences within the City, the total collected fee from residences would be approximately $1.6M per year. In addition, the City would collect fees from other land uses. Based on the City's land use distribution, it is assumed that non-residential parcels would add another 35 percent of the residential fee, or about $0.56 million per year. The estimated water quality fee from the City is therefore $2.2 million per year. This would equate to $875,000 annually for City projects (40%) and $1,100,000 annually available for regional projects (50%).

9.6.2 Annual Costs

Based on a useful life of 75 years for storm drains and force mains and 30 years for BMPs and force mains, annual costs were developed for each of the recommended phases.

Operations and maintenance costs were estimated based on national averages for operations and maintenance of BMPs.

Table 9.13 Annual Cost by Planning Phase						
Category	**Phase 1 ($M)**	**Phase 2 ($M)**	**Phase 3 ($M)**	**Phase 4 ($M)**	**Phase 5 ($M)**	**Total ($M)**
Annual Capital Cost[(1)]	$0.89	$0.99	$0.61	$1.38	$3.31	$7.16
Annual O&M	$0.03	$0.27	$0.17	$0.36	$0.00	$0.82
Total	**$0.91**	**$1.25**	**$0.78**	**$1.73**	**$3.31**	**$7.98**

Note:
1. Annual costs estimated based on 6 percent interest and useful life of 75 years for storm drains and force mains and 30 years for BMPs and force mains..

As shown, estimated annual costs for implementation of the complete CIP are about $8 million. Excluding water capacity improvements, the estimated annual costs for implementation of the water quality related recommendations is $4.7 million. Note that operations and maintenance costs are predicted only for the BMPs, not for the storm drain system.

9.6.3 Potential Funding

When comparing the available funding associated with the WQFI to the annual capital costs, the City's anticipated costs to implement the CIP anticipated revenue from the WQFI, even if the City is able to fund some of the BMPs as regional projects. Assuming the City is able to fully utilize its share of the fee associated with regional projects, the City will still need to fund about $0.5 million annually for the water quality improvements associated with Machado Lake, and $6.8 million to implement the remaining water quality related improvements.

If the City were to implement a fee on parcels within its service area in addition to the WQFI, the resulting annual fee associated with implementation of the remaining water quality improvements would be $168, or about $14 per month. This estimation is based on 30,000 single-family parcels and 135 percent of the single-family cost applied to other land uses. If such a fee were implemented, it is recommended that the fee incorporate considerations of land use and parcel size.

Appendix A

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References: GIS Layers			
Layer Name (Reference, if applicable)	**Description**	**Date Modified (or Received)**	**Source**

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REGULATIONS AND MONITORING PLANS

This appendix contains the following regulations:

- Machado Lake Nutrient TMDL Basin Plan Amendment
- Machado Lake Nutrient TMDL Resolution
- Machado Lake Trash TMDL Basin Plan Amendment
- Machado Lake Trash TMDL Resolution
- Machado Lake PCBs and Toxics TMDL Basin Plan Amendment
- Machado Lake PCBs and Toxics TMDL Resolution
- Los Angeles and Long Beach Harbors Toxics TMDL Modeling Study
- Los Angeles and Long Beach Harbors Toxics TMDL Resolution (referred to in the text of this report as the Dominguez Channel Toxics TMDL)
- Los Angeles and Long Beach Harbors Toxics TMDL Basin Plan Amendment (referred to in the text of this report as the Dominguez Channel Toxics TMDL)
- Ventura County MS4 Permit
- Los Angeles County MS4 Permit
- Santa Monica Bay Bacteria TMDL Resolution (3)
- Santa Monica Bay Bacteria TMDL Basin Plan Amendment (2)
- Santa Monica Bay Debris TMDL Resolution
- Santa Monica Bay Debris TMDL Basin Plan Amendment

In addition, this appendix contains the following monitoring plans:

- Machado Lake Nutrient TMDL Monitoring Study
- Machado Lake PCBs and Toxics Monitoring Study

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Amendment to the Water Quality Control Plan – Los Angeles Region

to Incorporate the

Total Maximum Daily Load for Eutrophic, Algae, Ammonia, and Odors (Nutrient) in Machado Lake

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on May 1, 2008

Amendments

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Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)

7- 29 Machado Lake Nutrient TMDL

List of Figures, Tables, and Inserts
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables

7-29 Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL
7-29.1. Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL - Elements
7-29.2. Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL - Implementation Schedule

Chapter 7. Total Maximum Daily Loads (TMDLs)
Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL

This TMDL was adopted by:

The Regional Water Quality Control Board on May 1, 2008.

This TMDL was approved by:

The State Water Resources Control Board on **[Insert date].**
The Office of Administrative Law on **[Insert date].**
The U.S. Environmental Protection Agency on **[Insert date].**

This TMDL is effective on **[Insert Date]**

The elements of the TMDL are presented in Table 7-29.1 and the Implementation Plan in Table 7-29.2

Table 7-29.1. Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL: Elements

TMDL Element	Regulatory Provisions
Problem Statement	Excessive loadings of nutrients, in particular nitrogen (including ammonia) and phosphorus, cause eutrophic effects, including algae and odors, which impair the beneficial uses of Machado Lake. The nutrient enrichment results in high algal productivity; algal blooms have been observed in the lake during summer months. In addition, high nutrient concentrations contribute to excessive and nuisance macrophyte growth. Algae respiration and decay depletes oxygen from the water column creating an adverse aquatic environment. Machado Lake was placed on the Clean Water Act 303(d) list of impaired waterbodies in 1998, 2002, and 2006 for ammonia, algae, odors, and eutrophic. Applicable Water Quality Objectives for this TMDL are narrative objectives for Biostimulatory Substances and Taste and Odor; and numeric objectives for Dissolved Oxygen and Ammonia. The beneficial uses of Machado Lake include beneficial uses associated with recreation (REC 1 and REC 2), aquatic life (WARM, WILD, RARE, and WET) and water supply (MUN). This TMDL addresses the eutrophic, algae, ammonia, and odor listings which impair these uses.
Numeric Targets	The total phosphorus target for Machado Lake is 0.1 mg/L as a monthly average concentration in the water column, which is based upon US EPA Nutrient Criteria Technical Guidance Manual for Lakes and Reservoirs. A ratio of total nitrogen to total phosphorus of 10 is the basis for the total nitrogen (TKN + NO_3-N + NO_2 –N) numeric target of 1.0 mg/L as a monthly average concentration in the water column. The total nitrogen target incorporates all forms of nitrogen including TKN, which is the sum of organic nitrogen and ammonia nitrogen, nitrate nitrogen (NO_3-N), and nitrite nitrogen (NO_2-N). The total nitrogen target expressed as a monthly average is protective of chronic aquatic life exposure for ammonia. There is a separate numeric target for ammonia of 5.95 mg/L as an hourly average to be protective of acute aquatic life exposure. The chlorophyll *a* target is 20 ug/L based on EPA guidance and the Carlson Trophic Status Index. The dissolved oxygen target is a single sample concentration of no less than 5 mg/L measured at 0.3 meter above the sediments based on the Basin Plan objective. The following table provides the numeric targets for the Machado Lake TMDL.

<table>
<tr><th>TMDL Element</th><th>Regulatory Provisions</th></tr>
<tr><td></td><td>
<table>
<tr><th>Indicator</th><th>Numeric Target</th></tr>
<tr><td>Total Phosphorus</td><td>0.1 mg/L monthly average</td></tr>
<tr><td>Total Nitrogen (TKN + NO_3-N + NO_2 –N)</td><td>1.0 mg/L monthly average</td></tr>
<tr><td>Ammonia - N</td><td>5.95 mg/L one-hour average</td></tr>
<tr><td>Ammonia - N</td><td>2.15 mg/L 30 day average</td></tr>
<tr><td>Dissolved Oxygen</td><td>5 mg/L single sample minimum measured 0.3 meter above the sediments.</td></tr>
<tr><td>Chlorophyll a</td><td>20 µg/L monthly average</td></tr>
</table>
</td></tr>
<tr><td>Source Analysis</td><td>The point sources of nutrients into Machado Lake are stormwater discharges from the municipal separate storm sewer system (MS4), California Department of Transportation (Caltrans), and general construction and industrial discharges. Stormwater discharges to Machado Lake occur through the following subdrainage systems: Drain 553, Wilmington Drain, Project 77/510, and Walteria Lake. Discharges from Walteria Lake and Drain 553 are tributary to the Wilmington Drain, which then directly discharges in the northern portion of Machado Lake. Approximately, 88 % of the discharge into the lake enters through the Wilmington Drain.

The major nonpoint source of nutrients to Machado Lake is internal nutrient loading (nutrient flux from sediments). Atmospheric deposition is also a nonpoint source of total nitrogen. Nutrient loads from wind resuspension, bioturbation, birds, and general surface runoff are minor sources. Special studies may be conducted to further evaluate sources.</td></tr>
<tr><td>Linkage Analysis</td><td>The linkage analysis focuses on the relationship between the nutrient loading to the lake and the numeric targets established to measure attainment of beneficial uses. The Nutrient Numeric Endpoints BATHTUB Spreadsheet Model, which was developed by Tetra Tech for US EPA, was used to establish the linkage between nutrient loading to Machado Lake and the predicted water quality response. The model performs water and nutrient balance calculations under steady-state conditions. Eutrophication related water quality conditions are expressed in terms of total phosphorus, ortho-phosphourus, total nitrogen, inorganic nitrogen, chlorophyll a, transparency (Secchi depth), and hypolimnetic oxygen depletion rates. The linkage analysis demonstrates that assigning waste load and load allocations for total nitrogen and total phosphorus will address eutrophication related water quality conditions.</td></tr>
<tr><td>Waste Load Allocations</td><td>Waste load allocations are assigned to urban stormwater dischargers (MS4, Caltrans, general construction and general industrial) in both wet and dry weather. The final waste load allocations are assigned as concentration based allocations of 0.1 mg/L and 1.0 mg/L as monthly averages for total phosphorus and total nitrogen (TKN + NO_3-N + NO_2 –N), respectively.</td></tr>
</table>

TMDL Element	Regulatory Provisions

Interim WLAs are based on current in-lake concentrations. The effective date interim total nitrogen and total phosphorus waste load allocations are set as the 95th percentile of current concentrations in the lake. The 5 year interim total nitrogen WLAs are established as a 30 percent reduction from current in-lake concentrations. Concentration-based interim and final WLAs will be included in stormwater permits in accordance with NPDES guidance and requirements. The tables below present the interim and final waste load allocations for the stormwater discharges.

Waste Load Allocations	Total Phosphorus	Total Nitrogen ($TKN + NO_3\text{-}N + NO_2\text{-}N$)
	Final WLA (mg/L)	Final WLA (mg/L)
MS4 Permittees[1] Caltrans, General Construction and Industrial stormwater permits	0.1	1.0

1. Municipal Separate Storm Sewer System (MS4) Permittees that are responsible for discharges to Machado Lake include: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance.

Waste Load Allocations	Years After Effective Date	Interim Total Phosphorus WLAs (mg/L)	Interim Total Nitrogen (TKN + NO3-N + NO2-N) WLAs (mg/L)
MS4 Permittees, Caltrans, General Construction and Industrial Stormwater permits	At Effective Date[1]	1.25	3.50
	5[2]	1.25	2.45
	9.5 (Final WLAs[3])	0.10	1.00

[1] The compliance point for all effective date interim WLAs is measured in the lake.
[2] The compliance point for all year 5 interim WLAs is measured as specified in Implementation Plan Section II of Table 7-29.1
[3] The compliance point for all final WLAs is measured as specified in Implementation Plan Section II of Table 7-29-.1

<table>
<tr><th>TMDL Element</th><th>Regulatory Provisions</th></tr>
<tr><td>Load Allocations</td><td>
Load allocations are assigned for nonpoint source discharges to the lake, primarily internal loading from the lake. The final load allocations for internal loading are concentration based allocations of 0.1 mg/L and 1.0 mg/L as monthly averages for total phosphorus and total nitrogen (TKN + NO_3-N + NO_2 –N), respectively. Concentration based load allocations are appropriate and can be evaluated by monitoring the nutrient concentrations in the water column.

Interim LAs are based on current in-lake concentrations. The effective date interim total nitrogen and phosphorus load allocations are set at the 95th percentile of current concentrations in the lake. The 5 year interim total nitrogen LAs are established as a 30 percent reduction from current in-lake concentrations. The tables below present the final and interim load allocations for the nonpoint sources.

<table>
<tr><th rowspan="2">Load Allocations</th><th>Total Phosphorus</th><th>Total Nitrogen (TKN + NO_3-N + NO_2-N)</th></tr>
<tr><th>Final LA (mg/L)</th><th>Final LA (mg/L)</th></tr>
<tr><td>Internal Nutrient Load (City of Los Angeles Department of Recreation and Parks)</td><td>0.1</td><td>1.0</td></tr>
</table>

<table>
<tr><th>Load Allocations</th><th>Years After Effective Date</th><th>Interim Total Phosphorus LAs (mg/L)</th><th>Interim Total Nitrogen (TKN + NO3-N + NO2-N) LAs (mg/L)</th></tr>
<tr><td rowspan="3">Internal Nutrient Load (City of Los Angeles Department of Recreation and Parks)</td><td>At Effective Date</td><td>1.25</td><td>3.50</td></tr>
<tr><td>5</td><td>1.25</td><td>2.45</td></tr>
<tr><td>9.5 (Final LAs)</td><td>0.10</td><td>1.00</td></tr>
</table>
</td></tr>
<tr><td>Margin of Safety</td><td>The uncertainties associated with this TMDL are due to limited data from the stormdrains entering the lake and the inherent seasonal and annual variability in delivery of phosphorus and nitrogen for external sources and nutrient cycling within the lake. To address these uncertainties, conservative numeric targets were selected by establishing the targets under a critical lake volume. Likewise, the waste load and load allocations are based on a constant value for internal loading. Moreover, the lake conditions under which the load capacity was developed were based on dry weather critical conditions when the lake level is</td></tr>
</table>

TMDL Element	Regulatory Provisions
	reduced and therefore loading capacity is reduced. These conservative approaches provide an implicit margin of safety.
Seasonal Variations and Critical Conditions	The external nutrient loading to Machado Lake generally occurs during winter and spring months, in conjunction with storm events. During the dry season the lake receives minimal external loading. In the summer there is the release of nutrients from the sediments. At the same time there is very little water inflow and a decreased lake level due to evaporation. These seasonal variations cause increased nutrient concentrations. Moreover, the reduced lake volume during the summer months provides less assimilative capacity. The critical condition for the attainment of beneficial uses at Machado Lake occurs during the summer months. Also, the critical conditions for dissolved oxygen impairments related to algae growth are during the warm dry summer months when algal respiration is highest. The Machado Lake nutrient TMDL accounts for seasonal and critical conditions of the summer months by assigning a load allocation to the lake sediments and requiring a reduction in this source of nutrients to the lake, and by assigning WLAs to urban stormwater dischargers year-round.
Special Studies and Monitoring Plan	**Special Studies** Additional monitoring and special studies may be undertaken by dischargers and responsible agencies to evaluate the uncertainties and assumptions made in the development of this TMDL. (The results of special studies may be used to reevaluate waste load allocations and load allocations when the Machado Lake Nutrient TMDL is reconsidered.) ***Optional Study #1:*** Core flux study to estimate the nutrient flux from sediments under equilibrium conditions. Results from this study would be beneficial to gauge the success of implementation measures such as aeration. ***Optional Study #2:*** A study to understand factors such as nitrogen and phosphorus sedimentation rates (particulate settling velocities), the overall lake sedimentation rate, and sediment resuspension rate. These factors would be important for a Machado Lake nutrient budget and gauging the potential need for periodic hydraulic dredging. ***Optional Study #3***: A work plan for permittees to assess compliance with TMDL WLAs on a mass basis for total nitrogen and total phosphorous. The work plan should detail testing methodologies, BMPs, and treatments to be implemented to attain and demonstrate a reduction of total nitrogen and phosphorous loading on a mass basis. A final report including the results shall be submitted to the Regional Board for Executive Officer approval. Additional special studies proposed by stakeholders are optional and will be considered at the 7.5 year TMDL reconsideration. All proposed special study work plans and documents shall be submitted to the Regional Board for Executive Officer approval prior to special studies being initiated.

TMDL Element	Regulatory Provisions
	Monitoring Plan A Monitoring and Reporting Program (MRP) plan to assess compliance with LAs and WLAs measured in lake must be submitted to the Executive Officer for approval within one year of the effective date. Monitoring will begin 60 days after the Executive Officer has approved the monitoring plan. This MRP plan will be required as part of the Lake Water Quality Management Plan as discussed in the Implementation Section. The MRP plan will be designed to monitor and implement this TMDL. The monitoring plan is required to measure the progress of pollutant load reductions and improvements in water quality. The monitoring plan shall ▪ Determine attainment of total phosphorus, total nitrogen, ammonia, dissolved oxygen, and chlorophyll *a* numeric targets. ▪ Determine compliance with the waste load and load allocations for total phosphorus, and total nitrogen. ▪ Monitor the effect of implementation actions on lake water quality Responsible jurisdictions shall be required to begin monitoring sixty days after the Executive Officer approves the MRP. Field samples and water samples shall be collected bi-weekly on a year-round basis. The lake sampling sites will be located in the open water portion of the lake with one in the northern portion and one in the southern portion of the lake. *In situ* measurements of water quality shall be made. The water quality probes will be calibrated immediately prior to departure to the field against known pH, EC, and DO solutions. Secchi depth, a measurement of transparency, will also be measured with a standard Secchi disk or other approved method. Additionally, a staff gauge shall be placed in an appropriate location at the lake to measure changes in lake elevation. The monitoring plan shall consider stratification for the collection of water samples. Water samples shall be analyzed for constituents including but not limited to the following. ▪ Total nitrogen ▪ Total phosphorus ▪ Nitrate (NO_3-N) ▪ Total ammonia (NH_3-N) ▪ Ortho-phosphorus (PO_4) ▪ Total Dissolved Solids ▪ Total Suspended Solids ▪ Chlorophyll a ▪ Turbidity

TMDL Element	Regulatory Provisions
	Detection limits shall be less than the numeric targets in this TMDL. A monitoring report shall be prepared and submitted to the Regional Board annually within six months after the completion of the final sampling event of the year. If an alternative WLA compliance option is selected, an appropriate separate TMDL compliance MRP Plan and TMDL Implementation Plan must be submitted for Executive Officer approval. Annual monitoring reports demonstrating compliance or non-compliance with WLAs shall be submitted for Executive Officer approval. All compliance monitoring must be conducted in conjunction with a Regional Board approved Quality Assurance Project Plan (QAPP). The QAPP shall include protocols for sample collection, standard analytical procedures, and laboratory certification.

TMDL Element	Regulatory Provisions
Implementation Plan	Compliance with the TMDL is based on the assigned WLAs and LAs. Compliance with this TMDL will require the implementation of NPDES stormwater permit limits and lake management activities to reduce nutrient loading to the lake, reduce nutrient concentrations in the lake, prevent excessive algal biomass growth, and maintain an adequate dissolved oxygen concentration. Table 7-29.2 contains a schedule for responsible jurisdictions to implement BMPs and a Lake Water Quality Management Plan to comply with the TMDL. I. Implementation and Determination of Compliance with LAs Compliance with the LAs will be measured in the lake and will be achieved through a combination of implementation of lake management projects and BMPs to reduce external and internal nutrient loading to the lake and to reduce and manage internal nutrient sources. Load allocations will be implemented through the following: (1) Memorandum of Agreement (MOA), or (2) Clean Up and Abatement Order or Other Regulatory Order The responsible jurisdictions for the load allocations shall be allowed one year from the effective date of this TMDL to enter into a Memorandum of Agreement (MOA) with the Executive Officer, detailing the voluntary efforts that will be undertaken to attain the load allocations. The MOA shall comply with the Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options ("Policy"), including part II, section 2 c ii and related provisions, and shall be consistent the requirements of this TMDL. If the MOA is timely adopted, and so long as it is implemented, the program described in the MOA shall be deemed "certified", pursuant to the Policy, subject to the conditions of Policy section 2 e. The MOA shall include development of a Lake Water Quality Management Plan (LWQMP), must be approved by the Executive Officer, and may be amended with Executive Officer approval, as necessary. If a MOA is not established with responsible jurisdictions within one year or if responsible jurisdictions do not comply with the terms of the MOA, a cleanup and abatement order pursuant to Water Code section 13304, or another appropriate regulatory order, shall be issued to implement the load allocations. Furthermore, the implementation of the MOA must result in attainment of the TMDL load allocations. If the MOA and LWQMP are not implemented or otherwise do not result in attainment of load allocations, the certification shall be revoked, the MOA rescinded, and the load allocations shall be implemented through a cleanup and abatement order, or other order, as described above. Implementation of the MOA shall be reviewed annually by the Executive Officer as part of the Monitoring and Reporting Program (MRP) annual reports. To the satisfaction of the Executive Officer the LWQMP shall meet the following criteria:

TMDL Element	Regulatory Provisions
	■ One and one half years from the effective date of the TMDL responsible jurisdictions shall submit a LWQMP, MRP Plan and QAPP for approval by the Executive Officer. ■ The LWQMP shall include a list of cooperating parties. ■ The LWQMP shall address appropriate water quality monitoring and a timeline for the implementation of management practices to reduce and manage nutrient loading to the lake. The timeline shall ensure that the implementation actions are underway prior to Regional Board reconsideration of the TMDL. The LWQMP shall present a comprehensive management plan and strategy for achieving the LAs at Machado Lake and attaining numeric targets and beneficial uses. The LWQMP shall include a schedule for implementation actions. ■ The LWQMP shall achieve compliance with the load allocations through the implementation of lake management strategies to reduce and manage internal nutrient sources. The lake management implementation actions may include, but are not limited to the following: ■ Wetland restoration ■ Aeration system ■ Hydraulic Lake dredging ■ Hydroponic Islands ■ Alum treatment ■ Fisheries Management ■ Macrophyte Management and Harvesting ■ Maintain Lake Level – Supplemental Water ■ The LWQMP shall include a MRP Plan. The MRP shall include a requirement that the responsible jurisdictions report compliance and non-compliance with load allocations as part of annual reports submitted to the Regional Board. Compliance with the load allocations shall be measured in the lake at two locations, one in the north portion and one in the south. The average of these two sampling locations shall determine compliance with the load allocations. MRP protocols may be based on Surface Water Ambient Monitoring Program (SWAMP) protocols for water quality monitoring or alternative protocols proposed by dischargers and approved by the Executive Officer. ■ A QAPP shall also be submitted to the Regional Board for approval by the Executive Officer to ensure data quality. The QAPP shall include protocols for sample collection, standard analytical procedures, and laboratory certification. The QAPP may be based on SWAMP protocols for water quality monitoring and quality assurance or alternative protocols proposed by dischargers and approved by the Executive Officer.

TMDL Element	Regulatory Provisions
	■ The MOA and LWQMP program shall include assurances that it will be implemented by the responsible jurisdiction. ■ Implementation of the LWQMP program should include a Health and Safety Plan to protect personnel. The Executive Officer may require a revised assessment under the MOA and LWQMP: (a) To prevent nutrients from accumulating or recycling in the lake in deleterious amounts that impair water quality, contribute to negative eutrophic conditions or adversely affect beneficial uses; (b) To reflect the results of nutrient assessment or special studies Cleanup and Abatement Order or Other Regulatory Order: Alternatively, responsible jurisdictions may propose, or the Regional Board may impose, an alternative program which would be implemented through a cleanup and abatement order, or any other appropriate order or orders, provided the program is consistent with the allocations, reductions, and schedule described in Table 7-29.2. ❖ Determination of Compliance with Interim LAs Responsible parties shall comply with numeric interim LAs or may be deemed in compliance with the interim LAs through implementation of lake sediment removal and/or lake management implementation actions in accordance with the LWQMP schedule as approved by the Regional Board Executive Officer. II. Implementation and Determination of Compliance with WLAs WLAs will be incorporated into NPDES stormwater permits. Stormwater permittees may be deemed in compliance with waste load allocations by actively participating in a LWQMP and attaining the waste load allocations for Machado Lake. Stormwater permittees and the responsible party for the lake may work together to implement the LWQMP and reduce external nutrient loading to attain the TMDL waste load allocations measured in the lake. Alternatively, MS4 Permittees may be deemed in compliance with waste load allocations by demonstrating reduction of total nitrogen and total phosphorous on an annual mass basis measured at the stormdrain outfall of the permittee's drainage area. The annual mass based allocation shall be equal to a monthly average concentration of 0.1 mg/L TP and 1.0 mg/L TN based on approved flow conditions. Permittees must demonstrate total nitrogen and total phosphorous load reductions to be achieved in accordance with a special study workplan approved by the Executive Officer. Compliance may also be demonstrated as concentration based monthly averages

TMDL Element	Regulatory Provisions
	for TP and TN measured at the stormdrain outfall of the permittee's drainage area. MS4 Permittees shall be required to develop and implement a MRP plan and TMDL Implementation Plan. The MRP plan shall include a requirement that the responsible jurisdictions report compliance and non-compliance with waste load allocations as part of annual reports submitted to the Regional Board. ❖ Determination of Compliance with Interim WLAs Responsible parties may comply with the numeric interim WLAs or may be deemed in compliance with the interim WLAs through implementation of external nutrient source reduction projects in accordance with the TMDL Implementation Plan schedule as approved by the Regional Board Executive Officer. The Regional Board may revise these WLAs and the compliance point based on the collection of additional information developed through special studies or monitoring conducted as part of this TMDL. The Regional Board will reconsider the TMDL at 7.5 years from the effective date based on water quality monitoring and special studies.

TMDL Element	Regulatory Provisions
	III. APPLICATION OF ALLOCATIONS TO RESPONSIBLE JURISDICTIONS Responsible jurisdictions to attain WLAs for this TMDL include but are not limited to: • Caltrans • General Stormwater Permit Enrollees • MS4 Permittees including: ➢ Los Angeles County ➢ Los Angeles County Flood Control District ➢ Cities of Carson, ➢ City of Lomita, ➢ City of Los Angeles, ➢ City of Palos Verdes Estates, ➢ City of Rancho Palos Verdes, ➢ City of Redondo Beach, ➢ City of Rolling Hills, ➢ City of Rolling Hills Estates, ➢ City of Torrance. The City of Los Angeles, Department of Recreation and Parks is responsible jurisdiction to implement the assigned Load Allocations for this TMDL.

Table 7-29.2 Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL: Implementation Schedule

Task Number	Task	Responsible Jurisdiction	Date
1	Effective date interim waste load (WLA) and load allocations (LA) for total nitrogen and total phosphorus apply.	California Department of Transportation (Caltrans), Municipal Separate Storm Sewer System Permittees[4] (MS4 Permittees), City of Los Angeles – Department of Recreation and Parks	Effective Date of TMDL
2	Responsible jurisdictions shall enter into a Memorandum of Agreement (MOA) with the Regional Board to implement the load allocations.	City of Los Angeles – Department of Recreation and Parks	1 year from effective date of TMDL
3	Regional Board staff shall begin development of a Clean Up and Abatement Order or other regulatory order to implement the load allocations if an MOA is not established with responsible jurisdictions.	Regional Board Staff	1 year from effective date of TMDL
4	Clean Up and Abatement Order or other regulatory order adopted by the Regional Board if an MOA is not established with responsible jurisdictions. The Clean Up and Abatement Order or other regulatory order shall reflect the TMDL Implementation Schedule.	Regional Board Staff	1.5 years from effective date of TMDL
5	Responsible jurisdictions whose compliance is determined as concentration based WLAs measured at end of pipe shall submit a Monitoring and Reporting Program (MRP) Plan to the Executive Officer for approval.	Caltrans, MS4 Permittees	One year from effective date of TMDL
6	Responsible jurisdictions shall submit a Lake Water Quality Management Plan, MRP Plan and Quality Assurance Project Plan for approval by the Executive Officer to comply with MOA.	City of Los Angeles – Department of Recreation and Parks	1.5 years from effective date of TMDL
7	Responsible jurisdictions shall submit a work plan for optional special study #3 (if responsible jurisdictions choose to conduct this special study) for approval by the Executive Officer.	Caltrans, MS4 Permittees	One year from effective date of TMDL

[4] Municipal Separate Storm Sewer System (MS4) Permittees that are responsible for discharges to Machado Lake include: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance.

Task Number	Task	Responsible Jurisdiction	Date
8	Responsible jurisdictions shall submit work plans for optional special studies #1 and #2 (if responsible jurisdictions choose to conduct special studies) for approval by the Executive Officer.	Caltrans, MS4 Permittees, City of Los Angeles – Department of Recreation and Parks	1.5 years from effective date of TMDL
9	Responsible jurisdictions shall begin monitoring as outlined in the approved MRP plan.	Caltrans, MS4 Permittees, City of Los Angeles – Department of Recreation and Parks	Sixty days from date of MRP Plan approval
10	Responsible jurisdictions shall begin implementation of Lake Water Quality Management Plan.	City of Los Angeles – Department of Recreation and Parks	Sixty days from date of Lake Water Quality Management Plan approval
11	Responsible jurisdictions whose compliance is determined as concentration based WLAs measured at end of pipe shall submit a TMDL Implementation Plan including BMPs to address discharges from storm drains.	Caltrans, MS4 Permittees	Two years from effective date of TMDL
12	Responsible jurisdictions whose compliance is determined as concentration based WLAs measured at end of pipe shall begin implementation of BMPs to address discharges from stormdrains	Caltrans, MS4 Permittees	Sixty days from date of Implementation Plan approval
13	Responsible jurisdictions shall submit annual monitoring reports. The monitoring reports shall include a requirement that the responsible jurisdictions demonstrate compliance with the MOA. If the MOA and Lake Water Quality Management Plan are not implemented or otherwise do not result in attainment of load allocations, the Regional Board shall revoke the MOA and the load allocations shall be implemented through a Clean Up and Abatement Order or other regulatory order.	City of Los Angeles – Department of Recreation and Parks	Annually – from date of Lake Water Quality Management Plan approval
14	Responsible jurisdictions whose compliance is determined as concentration based WLAs measured at end of pipe shall submit annual monitoring reports.	Caltrans, MS4 Permittees	Annually – from date of MPR Plan approval
15	Optional Special Study #3 completed and final report submitted for Executive Officer approval.	Caltrans, MS4 Permittees	Within 2.5 years of effective date of TMDL

Task Number	Task	Responsible Jurisdiction	Date
16	Responsible jurisdictions shall submit a MRP Plan and TMDL Implementation Plan for the alternative mass based WLA compliance option (if selected), to the Executive Officer for approval.	Caltrans, MS4 Permittees	Within 2.5 years of effective date of TMDL
17	Responsible jurisdictions shall begin monitoring and implementing projects/programs as outlined in the approved MRP and TMDL Implementation Plan for the alternative mass based WLA compliance option.	Caltrans, MS4 Permittees	Sixty days from date of MRP/ Implementation Plan approval
18	Responsible jurisdictions whose compliance is determined as mass based WLAs measured at end of pipe shall submit annual monitoring reports.	Caltrans, MS4 Permittees	Annually – from date of MPR/ Implementation Plan approval
19	Optional Special Studies completed and Special Study final reports submitted for Executive Officer approval.	Caltrans, MS4 Permittees, City of Los Angeles – Department of Recreation and Parks	Within 6 years of effective date of TMDL
20	Regional Board staff and responsible jurisdictions will present an Information Item to the Regional Board on the progress of TMDL implementation efforts and compliance with implementation schedules.	Regional Board staff and responsible jurisdictions	4 years from effective date of TMDL
21	5 Year interim total nitrogen WLA and LA apply.	Caltrans, MS4 permittees, City of Los Angeles – Department Recreation and Parks	Within 5 years of effective date of TMDL
22	Regional Board will reconsider the TMDL to include results of optional special studies and water quality monitoring data completed by the responsible jurisdictions and revise numeric targets, WLAs, LAs, and the implementation schedule as needed.	Regional Board	7.5 years from effective date of TMDL
23	Responsible jurisdictions shall achieve Final WLAs and LAs for total nitrogen (including ammonia) and total phosphorus and demonstrate attainment of numeric targets for total nitrogen, ammonia, total phosphorus, dissolved oxygen, and chlorophyll a. Responsible parties shall demonstrate attainment of water quality standards for total nitrogen, ammonia, total phosphorus, dissolved oxygen, and biostimulatory substances in accordance with federal regulations and state policy on water quality control.	Caltrans, MS4 Permittees, City of Los Angeles – Department of Recreation and Parks	Within 9.5 years of effective date of TMDL

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. R08-006
May 1, 2008

Amendment to the *Water Quality Control Plan for the Los Angeles Region* to Incorporate a Total Maximum Daily Load for Eutrophic, Algae, Ammonia, and Odors (Nutrient) for Machado Lake

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The Federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angles Region (Regional Board) to establish water quality standards for each water body within its region. Water quality standards include beneficial uses, water quality objectives that are established at levels sufficient to protect those beneficial uses, and an antidegradation policy to prevent degrading waters. Water bodies that do not meet water quality standards are considered impaired.

2. CWA section 303(d)(1) requires each state to identify the waters within its boundaries that do not meet water quality standards. Those waters are placed on the state's "303(d) List" or "Impaired Waters List". For each listed water, the state is required to establish the Total Maximum Daily Load (TMDL) of each pollutant impairing the water quality standards in that waterbody. Both the identification of impaired waters and TMDLs established for those water must be submitted to the United States Environmental Protection Agency (U.S. EPA) for approval pursuant to CWA section 303(d)(2). For all waters that are not identified as impaired, the states are nevertheless required to create TMDLs pursuant to CWA section 303(d)(3).

3. A consent decree between U.S. EPA, Heal the Bay, Inc. and BayKeeper, Inc. was approved on March 22, 1999, which resolved litigation between those parties relating to the pace of TMDL development. The court order directs the U.S. EPA to ensure that TMDLs for all 1998-listed impaired waters be established within 13 years of the consent decree. The consent decree combined water body pollutant combinations in the Los Angeles Region into 92 TMDL analytical units. In accordance with the consent decree, the Machado Lake Eutrophic, Alage, Ammonia, and Odors (Nutrient) TMDL addresses the waterbody with eutrophic, algae, ammonia, and odor listings in analytical unit 76. Based on the consent decree schedule, TMDLs must be approved or established by U.S.EPA by March 2012.

4. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d)(1)(C) and (D) of the CWA, as well as in U.S. EPA guidance documents (Report No. EPA/440/4-91/001). A TMDL is defined as the sum of the individual waste load allocations for point sources, load allocations for nonpoint sources and natural background (40 CFR 130.2). TMDLs must be set at levels necessary to attain and maintain the applicable narrative and numeric water quality

standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.7(c)(1)). 40 CFR 130.7 also dictates that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters. TMDLs typically include one or more numeric "targets", i.e., numerical translations of the existing water quality standards, which represent attainment of those standards, contemplating the TMDL elements described above. Since a TMDL must represent the "total" load, TMDLs must account for all sources of the relevant pollutants, irrespective of whether the pollutant is discharged to impaired or unimpaired upstream reaches.

5. Neither TMDLs nor their targets or other components are water quality objectives, and thus their establishment does not implicate California Water Code section 13241. Rather, under California Law, TMDLs are programs to implement existing standards (including objectives), and are thus established pursuant to Water Code section 13242. Moreover, they do not create new bases for direct enforcement against dischargers apart from the existing water quality standards they translate. The targets merely establish the bases through which load allocations (LAs) and waste load allocations (WLAs) are calculated. WLAs are only enforced for a discharger's own discharges, and then only in the context of the discharger's National Pollutant Discharge Elimination System (NPDES) permit (or other permit, waiver, or prohibition), which must contain effluent limits consistent with the assumptions and requirements of the WLAs (40 C.F.R. 122.44(d)(vii)(B)). The Regional Board will develop permit requirements through subsequent permit actions that will allow all interested persons, including but not limited to municipal storm water dischargers, to provide comments on how the WLAs should be translated into permit requirements.

6. As envisioned by Water Code section 13242, the TMDL contains a "description of surveillance to be undertaken to determine compliance with objectives." The Compliance Monitoring and Special Studies elements of the TMDL recognize that monitoring will be necessary to assess the on-going condition of Machado Lake and to assess the on-going effectiveness of efforts by dischargers to reduce nutrient loading to Machado Lake. Special studies may also be appropriate to provide further information about new data, new or alternative sources, and revised scientific assumptions. The TMDL does not establish the requirements for these monitoring programs or reports, although it does recognize the type of information that will be necessary to secure. The Regional Board's Executive Officer will issue orders to appropriate entities to develop and to submit monitoring programs and technical reports. The Executive Officer will determine the scope of these programs and reports, taking into account any legal requirements, and issue the orders to the appropriate entities.

7. Upon establishment of TMDLs by the State or U.S. EPA, the State is required to incorporate the TMDLs into the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). This Water Quality Control Plan for the Los Angeles Region (Basin Plan) and applicable statewide plans serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Regional Board. Attachment A to this resolution contains the Basin Planning language for this TMDL.

8. Machado Lake is located in the Ken Malloy Harbor Regional Park (KMHRP), which is a 231 acre Los Angeles City Park serving the Wilmington and Harbor City areas. The Park is located west of the Harbor freeway (110) and east of Vermont Street between the Tosco Refinery on the south and the Pacific Coast Highway on the North. The Machado Lake area is approximately 103.5 acres in total size. The upper portion, which includes the open water area, is approximately 40 acres and the lower wetland portion is about 63.5 acres. This TMDL will address the 40 acre open water lake. Machado Lake is located within the Machado Lake Sub-watershed which is approximately 20 square miles and positioned within the larger 110 square mile Dominguez Channel Watershed. The dominant land use in the Machado Lake Watershed is high density single family residential accounting for approximately 45 % of the land use. Industrial, vacant, retail/commercial, multi-family residential, transportation, and educational institutions each account for 5-7 % of the land use while "all other" accounts for the remaining 23 %. Machado Lake is a receiving body of urban and stormwater runoff from a network of storm drains throughout the watershed. Machado Lake is identified on the 1998, 2002, and 2006 Clean Water Act 303(d) list of impaired water bodies as impaired due to eutrophic conditions, algae, ammonia, and odors. The proposed TMDL addresses impairments of water quality caused by these constituents and the Implementation Plan is developed to achieve water quality objectives for biostimulatory substances in Machado Lake.

9. Eutrophication is increased nutrient loading to a waterbody and the resulting increased growth of biota, phytoplankton and other aquatic plants. Phosphorus and nitrogen are key nutrients for phytoplankton growth in lakes and are often responsible for the eutrophication of surface waters. The increased nutrient loading is generally from two sources, external loading (discharges into the lake) and internal loading (recycling of nutrients within the lake). There are many biological responses to nutrients (nitrogen and phosphorus) in lakes. The biologically available nutrients and light will stimulate phytoplankton and or macrophyte growth. As these plants grow they provide food and habitat for other organisms such as zooplankton and fish. When the aquatic plants die they will release nutrients (ammonia and phosphorus) back into the water through decomposition. The decomposing of plant material consumes oxygen from the water column; in addition the recycled nutrients are available to stimulate additional plant growth. Physical properties such as light, temperature and wind mixing also play integral roles throughout the pathways described.

10. Excessive nutrient loading, from either external or internal process, will lead to excessive phytoplankton and macrophyte growth, which are often considered the primary problems associated with increased nutrient concentrations in lakes. This excessive plant biomass may cause increased turbidity, altered planktonic food chains, algal blooms, reduced dissolved oxygen concentrations, and increased nutrient recycling. These changes can lead to a cascade of biological responses culminating in impaired beneficial uses. Plant growth can lead to increased pH in the lake due to rapid consumption of carbon dioxide. The elevated pH creates a harmful environment for organisms and can increase the concentration of ammonia potentially leading to direct toxicity of fish and other organisms. As these large phytoplankton populations and macrophytes die or break apart the decomposition process will consume oxygen and reduce the

oxygen levels found in the lake. Low dissolved oxygen levels can be stressful for fish and other organisms and may in fact lead to fish kills.

11. Numeric targets for the TMDL are based on the specific narrative and numeric water quality objectives (WQOs) provided in the Basin Plan.

12. The Regional Board's goal in establishing the TMDL for eutrophic, algae, ammonia, and odors in Machado Lake is to protect the REC 1, REC 2, aquatic life (WARM, WILD, RARE, WET) and water supply (MUN) beneficial uses of Machado Lake and to achieve the numeric and narrative water quality objectives set to protect those uses.

13. Regional Board Staff have prepared a detailed technical document that analyzes and describes the specific necessity and rationale for the development of this TMDL. The technical document entitled "Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL" is an integral part of this Regional Board action and was reviewed, considered, and accepted by the Regional Board before acting. Further, the technical document provides the detailed factual basis and analysis supporting the problem statement, numeric targets (interpretation of the narrative and numeric water quality objectives, used to calculate the load allocations), source analysis, linkage analysis, waste load allocations (for point sources), load allocations (for nonpoint sources), margin of safety, and seasonal variations and critical conditions of this TMDL.

14. On November 2, 2004, City of Los Angeles voters approved Proposition O, a ballot initiative to implement water quality improvement projects within the City of Los Angeles. As part of Proposition O, concept reports have been developed for the Machado Lake Ecosystem Rehabilitation Project and the Wilmington Drain Multi-use project. Many of the proposed actions under these Proposition O projects, such as sediment removal and storm drain inlet upgrades, will improve water quality in Machado Lake. Therefore, the Implementation Plan for the Machado Lake TMDL was designed to coordinate with these Proposition O projects in order to realize the best use of public funds. However, the Proposition O projects, currently in the concept stage, may need to be augmented to achieve TMDL numeric targets and eliminate negative eutrophic conditions in Machado Lake. In recognition of the potential need to expand on Proposition O projects, the TMDL Implementation Schedule provides adequate time for design and implementation of projects so that they attain TMDL requirements and achieve water quality standards.

15. On May 1, 2008, prior to the Board's action on this resolution, public hearings were conducted on the Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutirent) TMDL. Notice of the hearing for the Machado Lake Nutrient TMDL was published in accordance with the requirements of Water Code Section 13244. This notice was published in the Los Angeles Times on February 7, 2008.

16. The public has had a reasonable opportunity to participate in the review of the amendment to the Basin Plan. Public Stakeholder meetings were held on March 14, 2006, February 21, 2007, July 16, 2007, September 12, 2007, and November 26, 2007. A draft of the TMDL was released for public comment on February 7,

2008; a Notice of Hearing and Notice of Filing were published and circulated 45 days preceding Board action; Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on May 1, 2008 to consider adoption of the TMDL.

17. In amending the Basin Plan to establish this TMDL, the Regional Board considered the requirements set forth in Sections 13240 and 13242 of the California Water Code.

18. Because the TMDL implements existing narrative and numeric water quality objectives (i.e., numeric water quality objectives in the Basin Plan), the Regional Board (along with the State Water Resources Control Board) have determined that adopting a TMDL does not require the water boards to consider the factors of Water Code section 13241. The consideration of the Water Code section 13241 factors, by section 13241's express terms, only applies "in establishing water quality objectives." Here the Regional Board is not establishing water quality objectives, but as required by section 303(d)(1)(C) of the Clean Water Act is adopting a TMDL that will implement the previously established objectives that have not been achieved. In making this determination, the Regional Board has considered and relied upon a legal memorandum from the Office of Chief Counsel to the State Water Board's basin planning staff detailing why TMDLs cannot be considered water quality objectives. (See Memorandum from the Staff Counsel Michael J. Levy, Office of Chief Counsel, to Ken Harris and Paul Lillebo, Division of Water Quality: *The Distinction Between A TMDL's Numeric Targets and Water Quality Standards*, dated June 12, 2002.)

19. While the Regional Board is not required to consider the factors of Water Code section 13241, it nonetheless has developed and received significant information pertaining to the Water Code section 13241 factors and has considered that information in developing and adopting this TMDL. The past, present, and probable future beneficial uses of water have been considered in that Machado Lakeis designated for a multitude of beneficial uses in the Basin Plan. The beneficial uses for Machado Lake include aquatic life habitat uses, water contact and non-contact water recreation, and water supply. The environmental characteristics of Machado Lake are spelled out at length in the Basin Plan and in the technical documents supporting this Basin Plan amendment, and have been considered in developing this TMDL. Water quality conditions that reasonably could be achieved through the coordinated control of all factors which affect water quality in the area have been considered. This TMDL provides several compliance options, including lake management strategies/lake treatment options that could be implemented directly at the lake and watershed strategies for stormwater runoff throughout the watershed to treat and reduce nutrient loading to the lake. These options provide flexibility for responsible jurisdictions to reduce internal and external nutrient loading to Machado Lake. Establishing a plan that will ensure Machado Lake attains and continues to maintain water quality standards is a reasonable water quality condition. However, to the extent that there would be any conflict between the consideration of the factor in Water Code section 13241, subdivision (c), if the consideration were required, and the Clean Water Act, the Clean Water Act would prevail. Economic considerations were considered throughout the development of the TMDL. Some of these economic considerations arise in the

context of Public Resources Code section 21159 and are equally applicable here. The implementation program for this TMDL recognizes the economic limitations on achieving immediate compliance and allows a flexible implementation schedule of 8.5 years. The need for housing within the region has been considered, but this TMDL is unlikely to affect housing needs. Whatever housing impacts could materialize are ameliorated by the flexible nature of this TMDL and the 8.5 year implementation schedule.

20. The amendment is consistent with the State Antidegradation Policy (State Board Resolution No. 68-16), in that the changes to water quality objectives (i) consider maximum benefits to the people of the state, (ii) will not unreasonably affect present and anticipated beneficial use of waters, and (iii) will not result in water quality less than that prescribed in policies. Likewise, the amendment is consistent with the federal Antidegradation Policy (40 CFR 131.12).

21. Pursuant to Public Resources Code section 21080.5, the Resources Agency has approved the Regional Water Boards' basin planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) (Public Resources Code, § 21000 et seq.) requirements for preparing environmental documents (14 Cal. Code Regs. § 15251(g); 23 Cal. Code Regs. § 3782.) The Regional Water Board staff has prepared "substitute environmental documents" for this project that contains the required environmental documentation under the State Water Board's CEQA regulations. (23 Cal. Code Regs. § 3777.) The substitute environmental documents include the TMDL staff report entitled "Machado Lake Eutrophic Algae, Ammonia, and Odors (Nutrient) TMDL", the environmental checklist, the comments and responses to comments, the basin plan amendment language, and this resolution. The project itself is the establishment of a TMDL for eutrophic, algae, ammonia, and odors in Machado Lake. While the Regional Board has no discretion to not establish a TMDL (the TMDL is required by federal law), the Board does exercise discretion in assigning waste load allocations and load allocations, determining the program of implementation, and setting various milestones in achieving the water quality standards. The CEQA checklist and other portions of the substitute environmental documents contain significant analysis and numerous findings related to impacts and mitigation measures.

22. A CEQA Scoping hearing was conducted on September 12, 2007 at the Regional Board's office – 320 West 4th Street, Suite 200, Los Angeles, California. A notice of the CEQA Scoping hearing was sent to interested parties including cities and/or counties with jurisdiction in or bordering the watershed. The notice of CEQA Scoping hearing was also published in the Los Angeles Daily News on August 1, 2007.

23. In preparing the substitute environmental documents, the Regional Board has considered the requirements of Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and intends those documents to serve as a tier 1 environmental review. This analysis is not intended to be an exhaustive analysis of every conceivable impact, but an analysis of the reasonably foreseeable consequences of the adoption of this regulation, from a programmatic perspective. Many compliance obligations will be undertaken directly by public agencies that will have their own obligations

under CEQA. In addition, public agencies including but not limited to County of Los Angeles, Los Angeles County Flood Control District, Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance are foreseeably expected to facilitate compliance obligations. The "Lead" agencies for such tier 2 projects, will assure compliance with project-level CEQA analysis of this programmatic project. Project level impacts will need to be considered in any subsequent environmental analysis performed by other public agencies, pursuant to Public Resources Code section 21159.2.

24. The foreseeable methods of compliance for this TMDL entail construction and operation of stormwater management practices such as filter systems, alum injection system, swales, and bioretention areas. Foreseeable methods of compliance also include lake management practices, such as hydraulic dredging, aeration systems, alum treatment, and fisheries management.

25. Consistent with the Regional Board's substantive obligations under CEQA, the substitute environmental documents do not engage in speculation or conjecture, and only consider the reasonably foreseeable environmental impacts, including those relating to the methods of compliance, reasonably foreseeable feasible mitigation measures to reduce those impacts, and the reasonably foreseeable alternative means of compliance, which would avoid or reduce the identified impacts.

26. The proposed amendment could have a potentially significant adverse effect on the environment. However, there are feasible alternatives, feasible mitigation measures, or both, that if employed, would substantially lessen the potentially significant adverse impacts identified in the substitute environmental documents; however such alternatives or mitigation measures are within the responsibility and jurisdiction of other public agencies, and not the Regional Board. Water Code section 13360 precludes the Regional Board from dictating the manner in which responsible agencies comply with any of the Regional Board's regulations or orders. When the agencies responsible for implementing this TMDL determine how they will proceed, the agencies responsible for those parts of the project can and should incorporate such alternatives and mitigation into any subsequent projects or project approvals. These feasible alternatives and mitigation measures are described in more detail in the substitute environmental documents. (14 Cal. Code Regs. § 15091(a)(2).)

27. From a program-level perspective, incorporation of the alternatives and mitigation measures outlined in the substitute environmental documents may not forseeably reduce impacts to less than significant levels.

28. The substitute documents for this TMDL, and in particular the Environmental Checklist and staff's responses to comments, identify broad mitigation approaches that should be considered at the project level.

29. To the extent significant adverse environmental effects could occur, the Regional Board has balanced the economic, legal, social, technological, and other benefits of the TMDL against the unavoidable environmental risks and finds that specific economic, legal, social, technological, and other benefits of the TMDL outweigh

the unavoidable adverse environmental effects, such that those effects are considered acceptable. The basis for this finding is more fully set forth in the substitute environmental documents. (14 Cal. Code Regs. § 15093.)

30. Health and Safety Code section 57004 requires external scientific peer review for certain water quality control policies. Prior to public notice of the draft TMDL, the Regional Board submitted the scientific basis and scientific portions of the Machado Lake Nutrient TMDL to Dr. Rakesh Gelda and Dr. Paul McGinley for external scientific peer review. The peer review comment reports were received by the Regional Board on January 7, 2008 and January 15, 2008. The peer review found that the proposed TMDL data, modeling analyses, and pollutant allocations were presented in a scientifically credible manner. Minor modifications were made to the scientific portions of the TMDL to address comments identified during the peer review process.

31. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subdivision (b). As specified above, Federal law and regulations require that TMDLs be incorporated into the water quality management plan. The Regional Board's Basin Plan is the Regional Board's component of the water quality management plan, and the Basin Plan is how the Regional Board takes quasi-legislative, planning actions. Moreover, the TMDL is a program of implementation for existing water quality objectives, and is, therefore, appropriately a component of the Basin Plan under Water Code section 13242. The necessity of developing a TMDL is established in the TMDL staff report, the section 303(d) list, and the data contained in the administrative record documenting the eutrophic, algae, ammonia, and odors impairments of Machado Lake.

32. The Basin Plan amendment incorporating a TMDL for eutrophic, algae, ammonia, and odors for Machado Lake must be submitted for review and approval by the State Water Resources Control Board (State Board), the State Office of Administrative Law (OAL), and the U.S. EPA. The Basin Plan amendment will become effective upon approval by OAL and U.S. EPA. A Notice of Decision will be filed with the Resources Agency.

33. If during the State Board's approval process Regional Board staff, the SWRCB or State Board staff, or OAL determines that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer should make such changes consistent with the Regional Board's intent in adopting this TMDL, and should inform the Board of any such changes.

34. Considering the record as a whole, this Basin Plan amendment will result in no effect, either individually or cumulatively, on wildlife resources.

THEREFORE, be it resolved that pursuant to sections 13240 and 13242 of the Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. The Regional Board hereby approves and adopts the CEQA substitute environmental documentation, which was prepared in accordance with Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and directs the Executive Officer to sign the environmental checklist.

2. Pursuant to Sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapter 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment A hereto, to incorporate the elements of the Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL.

3. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

4. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it to OAL and the U.S. EPA.

5. If during the State Board's approval process, Regional Board staff, the State Board or OAL determines that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

6. The Executive Officer is authorized to request a "No Effect Determination" from the Department of Fish and Game, or transmit payment of the applicable fee as may be required to the Department of Fish and Game.

I, Tracy J. Egoscue, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on May 1, 2008.

Tracy J. Egoscue
Executive Officer

5/29/08
Date

Attachment A to Resolution No. R4-2007-006

Proposed Amendments

to the

Water Quality Control Plan – Los Angeles Region

for the

Machado Lake Trash TMDL

Amendments:

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Chapter 7. Total Maximum Daily Loads (TMDLs)

7-26 Machado Lake Trash TMDL

List of Figures, Tables and Inserts
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Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables
7-26 Machado Lake Trash TMDL
7-26.1. Machado Lake Trash TMDL, Elements

7-26.2a. Machado Lake Trash TMDL, Implementation Schedule – Full Capture Implementation Schedule

7-26.2b. Machado Lake Trash TMDL, Implementation Schedule – Minimum Frequency Assessment and Collection Schedule

Chapter 7. Total Maximum Daily Loads (TMDLs)
Machado Lake Trash TMDL

This TMDL was adopted by:

The Regional Water Quality Control Board on June 7, 2007.
The State Water Resources Control Board on [Insert Date].
The Office of Administrative Law on [Insert Date].
The U.S. Environmental Protection Agency on [Insert Date].

The elements of the TMDL are presented in Table 7-26.1 and the

Implementation Plan in Tables 7-26.2a and 7-26.2b.

Table 7-26.1 Machado Lake Trash TMDL: Elements

Element	Machado Lake Trash TMDL
Problem Statement	Current levels of trash discharges into Machado Lake violate water quality objectives and are impairing beneficial uses. Relevant water quality objectives include Floating Material and Solid, Suspended, or Settleable Materials. The following designated beneficial uses are impacted by trash: municipal and domestic supply (MUN); contact water recreation (REC-1); non-contact water recreation (REC-2); warm freshwater habitat (WARM); wildlife habitat (WILD), rare, threatened, or endangered species (RARE), and wetland habitat (WET).
Numeric Target *(interpretation of the narrative water quality objective, used to calculate the load allocations)*	Zero trash in Machado Lake, and on the shoreline. Zero is defined as (1) no trash immediately following each assessment and collection event consistent with an established Minimum Frequency of Assessment and Collection Program (MFAC Program) or (2) installing full capture systems on conveyances that discharge to Machado Lake through a progressive implementation schedule. The MFAC Program is established at an interval that prevents trash from accumulating in deleterious amounts that cause nuisance or adversely affect beneficial uses between collections.
Source Analysis	Litter from adjacent land areas, roadways and direct dumping and deposition are sources of trash to Machado Lake. Point sources such as storm drains are also sources of trash discharged to Machado Lake.
Loading Capacity	Zero, as defined in the Numeric Target.
Waste Load Allocations (for point sources)	Waste Load Allocations (WLAs) are assigned to the California Department of Transportation (Caltrans) and permittees under the Los Angeles County Municipal Separate Storm Sewer System (MS4) NPDES permit, including Los Angeles County, Los Angeles Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance. WLAs are zero trash. WLAs may be issued to additional responsible jurisdictions in the future under Phase 2 of the US EPA Stormwater Permitting Program, or other applicable regulatory programs.
Load Allocations (for nonpoint sources)	Load Allocations (LAs) are assigned to the City of Los Angeles. LAs are zero trash. LAs may be issued to additional responsible jurisdictions in the future under applicable regulatory programs.
Implementation	Implementation of the trash TMDL for Machado Lake includes structural and non-structural best management practices (BMPs) and a program of minimum frequency of assessment and collection (MFAC) to address point and nonpoint trash sources. **Point Sources**

	WLAs shall be implemented through storm water permits and via the authority vested in the Executive Officer by section 13267 of the Porter-Cologne Water Quality Control Act (Water Code section 13000 et seq.). If point source dischargers comply with WLAs by implementing an Executive Officer certified full capture system on conveyances that discharge to Machado Lake through a progressive implementation schedule of full capture devices, they will be deemed in compliance with the WLA. In certain circumstances, (if approved by the Executive Officer), point source dischargers may also comply with WLAs by implementing a program for minimum frequency of assessment and collection in conjunction with best management practices (MFAC/BMPs). 1. Compliance with the final WLA may be achieved through an adequately sized and maintained full capture system that has been certified by the Executive Officer. A full capture system is any device or series of devices that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate (Q) resulting from a one-year, one-hour, storm in the sub-drainage area. The rational equation is used to compute the peak flow rate: $Q = C \times I \times A$, where Q = design flow rate (cubic feet per second, cfs); C = runoff coefficient (dimensionless); I = design rainfall intensity (inches per hour); and A= subdrainage area (acres). Point sources that choose to comply via a full capture system, must demonstrate a phased implementation of full capture devices over an 8-year period until the final WLA of zero is attained. Zero will be deemed to have been met if full capture systems have been installed on all conveyances discharging to Machado Lake. Irrespective of whether point sources employ a full capture system, they may comply with the WLA in any lawful manner. 2. Compliance through an MFAC program in conjunction with BMPs may be proposed to the Regional Board for incorporation into the relevant NPDES permit. The MFAC program must include requirements equivalent to those described in the Conditional Waiver set forth below. Agencies that are listed as both point and nonpoint sources will be deemed in compliance with both the WLAs and LAs if a MFAC/BMP program, approved by the Executive Officer, is implemented.

	Nonpoint Sources LAs shall be implemented through either (1) a conditional waiver from waste discharge requirements, or (2) an alternative program implemented through waste discharge requirements or an individual waiver or another appropriate order of the Regional Board. Non-point source dischargers may achieve compliance with the LAs by implementing a MFAC/BMP program approved by the Executive Officer. Responsible jurisdictions that are listed as both point and nonpoint sources will be deemed in compliance with both the WLAs and LAs if an MFAC/BMP program, approved by the Executive Officer, is implemented. 1) Conditional Waiver: Pursuant to Water Code section 13269, waste discharge requirements are waived for any responsible jurisdiction that implements a MFAC/BMP Program which, to the satisfaction of the Executive Officer, meets the following criteria: a) The MFAC/BMP Program includes an initial minimum frequency of trash assessment and collection and suite of structural and/or nonstructural BMPs. The MFAC/BMP program shall include collection and disposal of all trash found in the water and on the shoreline. Responsible jurisdictions shall implement an initial suite of BMPs based on current trash management practices in land areas that are found to be sources of trash to Machado Lake. For Machado Lake, the initial minimum frequency shall be set as follows: 1. Five days per week on the shoreline and in the Ken Malloy Harbor Regional Park. 2. Twice per week on waters of Machado Lake. b) The MFAC/BMP Program includes reasonable assurances that it will be implemented by the responsible jurisdiction. c) The MFAC/BMP Program includes a Trash Monitoring and Reporting Plan, as described below, and a requirement that the responsible jurisdictions will self-report any non-compliance with its provisions. The results and report of the Trash Monitoring and Reporting Plan must be submitted to Regional Board on an annual basis. d) MFAC protocols may be based on SWAMP protocols for rapid trash assessment, or alternative protocols proposed by dischargers and approved by the Executive Officer. e) Implementation of the MFAC/BMP program should include a Health and Safety Plan to protect personnel. The MFAC/BMP shall not require responsible jurisdictions to access and collect trash from areas where personnel are prohibited.

	The Executive Officer may approve or require a revised assessment and collection frequency and definition of the critical conditions under the waiver: (a) To prevent trash from accumulating in deleterious amounts that cause nuisance or adversely affect beneficial uses between collections; (b) To reflect the results of trash assessment and collection; (c) If the amount of trash collected does not show a decreasing trend, where necessary, such that a shorter interval between collections is warranted; or (d) If the amount of trash collected is decreasing such that a longer interval between collections is warranted. At the end of the implementation period, a revised MFAC/BMP program may be required if the Executive Officer determines that the amount of trash accumulating between collections is causing nuisance or otherwise adversely affecting beneficial uses. With regard to (a), (b) or (c), above, the Executive Officer is authorized to allow responsible jurisdictions to implement additional structural or non-structural BMPs in lieu of modifying the monitoring frequency. Any waivers implementing the TMDL shall expire pursuant to Water Code section 13269 five years after the effective date of this TMDL, unless reissued. The Regional Board may reissue this waiver through an order consistent herewith, instead of readopting these regulatory provisions. (2) Alternatively, responsible jurisdictions may propose, or the Regional Board may impose, an alternative program which would be implemented through waste discharge requirements an individual waiver, a cleanup and abatement order, or any other appropriate order or orders, provided the program is consistent with the assumptions and requirements of the reductions described in Table 7-26.2b, below. Within six months of the effective date of this TMDL, the Executive Officer shall require responsible jurisdictions to submit either a notice of intent to be regulated under the conditional waiver with their proposed MFAC/BMP Program and Trash Monitoring and Reporting Plan (TMRP), or a report of waste discharge.
Monitoring and Reporting Plan	Responsible jurisdictions will develop a TMRP for Executive Officer approval that describes the methodologies that will be used to assess and monitor trash in Machado Lake and/or within responsible

	jurisdiction land areas. The TMRP shall include a plan to establish the trash Baseline WLAs for non-Caltrans entities, or an alternative to the default trash baseline for Caltrans to prioritize installation of full capture devices. The default trash baseline WLA for Caltrans is 6677.4 gallons per square mile per year. Requirements for the TMRP shall include, but are not limited to, assessment and quantification of trash collected from the surfaces and shoreline of Machado Lake or from responsible jurisdiction land areas. The monitoring plan shall provide details of the frequency, location, and reporting of trash monitoring. Responsible jurisdictions shall propose a metric (e.g., weight, volume, pieces of trash) to measure the amount of trash in Machado Lake and on the land area surrounding Machado Lake. The TMRP shall include a prioritization of areas that have the highest trash generation rates. The TMRP shall give preference to this prioritization when scheduling the installation of full capture devices, BMPs, or trash collection programs. The TMRP shall also include an evaluation of effectiveness of the MFAC/BMP program to prevent trash from accumulating in deleterious amounts that cause nuisance or adversely affect beneficial uses between collections, proposals to enhance BMPs, and a revised MFAC for Executive Officer review. Responsible Jurisdictions may coordinate their TMRP activities for Machado Lake.
Margin of Safety	Zero is a conservative numeric target which contains an implicit margin of safety.
Seasonal Variations and Critical Conditions	Discharge of trash from the conveyances occurs primarily during or shortly after a major rain event. Discharge of trash from nonpoint sources occurs during all seasons, but can be increased during or shortly after high wind events, which are defined as periods of wind advisories issued by the National Weather Service, and the period from May 15 to October 15.

Table 7-26.2a Machado Lake Trash TMDL: Implementation Schedule Full Capture System

Task No.	Task	Responsible Jurisdiction	Date
1	Submit Trash Monitoring and Reporting Plan, including a plan for defining the trash baseline WLA and a proposed definition of "major rain event".	California Department of Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	6 months from effective date of TMDL. If a plan is not approved by the Executive Officer within 9 months, the Executive Officer will establish an appropriate monitoring plan.
2	Implement Trash Monitoring and Reporting Plan.	California Department of Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	6 months from receipt of letter of approval from Regional Board Executive Officer, or the date a plan is established by the Executive Officer.
3	Submit results of Trash Monitoring and Reporting Plan, recommend trash baseline WLA, and propose Full Capture System prioritization.	California Department of Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	2 years from receipt of letter of approval for the Trash Monitoring and Reporting Plan from Regional Board Executive Officer.
4	Installation of Full Capture Systems to achieve 20% reduction of trash from Baseline WLA*.	California Department of Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	Four years from effective date of TMDL.
5	Installation of Full	California Department of	Five years

	Capture Systems to achieve 40% reduction of trash from Baseline WLA*.	Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	from effective date of TMDL.
6	Evaluate the effectiveness of Full Capture Systems, and reconsider the WLA.	Regional Board.	Five years from effective date of TMDL.
7	Installation of Full Capture Systems to achieve 60% reduction of trash from Baseline WLA*.	California Department of Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	Six years from effective date of TMDL.
8	Installation of Full Capture Systems to achieve 80% reduction of trash from Baseline WLA*.	California Department of Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	Seven years from effective date of TMDL.
9	Installation of Full Capture Systems to achieve 100% reduction of trash from Baseline WLA*.	California Department of Transportation (Caltrans) and Municipal Separate Storm Sewer System (MS4) Permittees including: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance	Eight years from effective date of TMDL.

Compliance with percent reductions from the Baseline WLA will be assumed wherever full capture systems are installed in corresponding percentages of the conveyance discharging to Machado Lake. Installation will be prioritized based on the greatest point source loadings.

Table 7-26.2b Machado Lake Trash TMDL:
Implementation Schedule
Minimum Frequency of Assessment and Collection Program *

Task No.	Task	Responsible Jurisdiction	Date
1	Conditional Waiver in effect.	City of Los Angeles	Regional Board adoption of TMDL.
2	Submit Notice of Intent to Comply with Conditional Waiver of Discharge Requirements, including MFAC/BMP Program and Trash Monitoring and Reporting Plan.	City of Los Angeles	Six months from TMDL effective date.
3	Implement MFAC/BMP Program.	City of Los Angeles	Six months from receipt of Notice of Acceptance from Regional Board Executive Officer.
4	Submit annual TMRP reports including proposal for revising MFAC/BMP for Executive Officer approval.	City of Los Angeles	Two years from effective date of TMDL, and annually thereafter.
5	Reconsideration of Trash TMDL based on evaluation of effectiveness of MFAC/BMP program.	Regional Board.	Five years from effective date of TMDL.

* At Task 3, all Responsible Jurisdictions must be attaining the zero trash target after each required trash assessment and collection event. At Task 4, all Responsible Jurisdictions must demonstrate full compliance and attainment of the zero trash target between the required trash assessment and collection events. Based on Responsible Jurisdiction monitoring reports, the Executive Officer may adjust the minimum frequency of assessment and collection as necessary to ensure compliance between the required trash assessment and collection events.

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. R4-2007-006

June 7, 2007

Amendment to the *Water Quality Control Plan for the Los Angeles Region* to Incorporate a Total Maximum Daily Load for Trash in Machado Lake

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The Federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angles Region (Regional Board) to establish water quality standards for each water body within its region. Water quality standards include beneficial uses, water quality objectives that are established at levels sufficient to protect those beneficial uses, and an antidegradation policy to prevent degrading waters. Water bodies that do not meet water quality standards are considered impaired.

2. CWA section 303(d)(1) requires each state to identify the waters within its boundaries that do not meet water quality standards. Those waters are placed on the state's "303(d) List" or "Impaired Waters List". For each listed water, the state is required to establish the Total Maximum Daily Load (TMDL) of each pollutant impairing the water quality standards in that waterbody. Both the identification of impaired waters and TMDLs established for those water must be submitted to U.S. EPA for approval pursuant to CWA section 303(d)(2). For all waters that are not identified as impaired, the states are nevertheless required to create TMDLs pursuant to CWA section 303(d)(3).

3. A consent decree between the United States Environmental Protection Agency, Heal the Bay, Inc. and BayKeeper, Inc. was approved on March 22, 1999, which resolved litigation between those parties relating the the pace of TMDL development. Thecourt order directs the U.S. EPA to ensure that TMDLs for all 1998-listed impaired waters be established within 13 years of the decree. A schedule was established in the consent decree for the completion of Trash TMDLs, including completion of a TMDL to reduce trash in Machado Lake.

4. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d) of the CWA, as well as in U.S. EPA guidance documents (Report No. EPA/440/4-91/001). A TMDL is defined as the sum of the individual waste load allocations for point sources, load allocations for nonpoint sources and natural background (40 CFR 130.2). TMDLs must be set at levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.7(c)(1)). 40 CFR 130.7 also dictates that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters. TMDLs typically include one or more numeric "targets", i.e., numerical

translations of the existing water quality standards, which represent attainment of those standards, contemplating the TMDL elements described above.

5. Neither TMDLs nor their targets or other components are water quality objectives, and thus their establishment does not implicate Water Code section 13241. Rather, under California Law, TMDLs are programs to implement existing standards (including objectives), and are thus established pursuant to Water Code section 13242. Moreover, they do not create new bases for direct enforcement against dischargers apart from the existing water quality standards they translate. The targets merely establish the bases through which load allocations (LAs) and waste load allocations (WLAs) are calculated. LAs and WLAs are only enforced for a discharger's own discharges, and then only in the context of the discharger's relevant National Pollutant Discharge Elimination System (NPDES) permit (or other permit, waiver, or prohibition). NPDES permits must contain effluent limits consistent with the assumptions and requirements of the WLAs (40 C.F.R. 122.44(d)(vii)(B)). The Regional Board will develop NPDES permit requirements through subsequent permit actions that will allow all interested persons, including but not limited to Municipal Separate Stormwater Sewer System permittees, to provide comments on how the WLAs should be translated into permit requirements. LAs will be implemented either through a conditional waiver included in the basin plan amendment or in a subsequent permitting or waiver action.

6. As envisioned by Water Code section 13242, the TMDL contains a "description of surveillance to be undertaken to determine compliance with objectives." The Monitoring elements of the TMDL recognize that monitoring will be necessary to assess the on-going condition of Machado Lake and to assess the on-going effectiveness of efforts by dischargers to reduce trash loading to Machado Lake.

7. Upon establishment of TMDLs by the State or U.S. EPA, the State is required to incorporate the TMDLs into the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). The Water Quality Control Plan for the Los Angeles Region (Basin Plan) and applicable statewide plans serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Regional Board. Attachment A to this resolution contains the Basin Planning language for this TMDL.

8. Machado Lake is located within the Dominguez Channel watershed bordered by Rosecrans and Dominguez Hills at the north and east, by Palos Verdes Hills at the southwest, and by Port of Los Angeles and Port of Long Beach to the south. Machado Lake is a receiving body of urban and storm water runoff from storm drain system covering an approximately 20 square mile watershed. Wilmington Drain discharges over 50 percent of the water to Machado Lake at northeast corner. The rest of the water enters the lake through other storm drains including Project No. 77 channel, Harbor City Relief Drain located at the west end of the lake, City of Los Angeles drains for runoff from streets and Harbor Park Municipal Golf Course. Current land use includes high density residential, and open space and recreational uses. The 1998 Clean Water Act 303(d) list identified Machado Lake as impaired for trash. This listing was approved by the United States Environmental Protection Agency on May 12, 1999. The proposed TMDL addresses impairments of water quality caused by trash in Machado Lake, and establishes the loading capacity of trash and requires ongoing periodic monitoring to ensure that it continues to attain standards.

9. The Water Quality Control Plan for the Los Angeles Region prescribes narrative water quality objectives that are applicable to trash. These water quality objectives include floating material:

> *"Waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses."*

and solid, suspended, or settleable materials:

> *"Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses."*

10. The Regional Board's goal in establishing the TMDL for trash in Machado Lake is to protect the Water Contact Recreation, Navigation, Non-contact Water Recreation, Commercial and Sport Fishing, Marine Habitat, and Rare, Threatened, or Endangered Species beneficial uses, and to achieve the narrative water quality objectives set to protect those uses.

11. Information regarding the technical document that was generated by Regional Board staff in meetings with stakeholders is contained in a staff report. The staff report, "Trash Total Maximum Daily Load for Machado Lake in the Dominguez Channel Watershed," dated March 20, 2007, includes information regarding the environmental setting of Machado Lake, description of the trash impairments and/or current attainment status as appropriate, and descriptions of best management practices to comply with the trash TMDL.

12. The public has had a reasonable opportunity to participate in the review of the amendment to the Basin Plan. A draft of the TMDL was released for public comment on March 20, 2007; a Notice of Hearing and Notice of Filing were published and circulated on March 20, 2007; Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on June 7, 2007 to consider adoption of the TMDL.

13. In amending the Basin Plan to establish this TMDL, the Regional Board considered the requirements set forth in Sections 13240 and 13242, and section 13269 of the California Water Code.

14. Because the TMDL implements existing narrative water quality objectives (i.e., narrative objectives for floating materials and solid, suspended or settleable materials), the Regional Board (along with the State Water Resources Control Board) have determined that adopting a TMDL does not require the water boards to consider the factors of Water Code section 13241. The consideration of the Water Code section 13241 factors, by section 13241's express terms, only applies "in establishing water quality objectives." Here the Regional Board is not establishing water quality objectives, but as required by section 303(d)(1)(C) of the Clean Water Act is adopting a TMDL that will implement the previously established objectives that have not been achieved. In making this determination, the Regional Board has considered and relied upon a legal memorandum from the Office of Chief Counsel to the State Water Board's basin planning staff detailing why TMDLs cannot be considered water quality objectives. (See Memorandum from the Staff Counsel Michael J. Levy, Office of Chief Counsel, to Ken Harris and Paul Lillebo, Division of Water Quality: *The Distinction Between A TMDL's Numeric Targets and Water Quality Standards*, dated June 12, 2002.)

15. While the Regional Board is not required to consider the factors of Water Code section 13241, it, nonetheless, has developed and received significant information pertaining to the Water Code section 13241 factors and has considered that information in developing and adopting this TMDL. The past, present, and probable future beneficial uses of water have been considered in that Machado Lake are designated for a multitude of beneficial uses in the Basin Plan. The key beneficial uses for Machado Lake include aquatic life habitat uses and water contact and non-contact water recreation. Nonpoint source discharges of trash improperly deposited in the vicinity of Machado Lake are the predominant sources of trash loading to Machado Lake. The environmental characteristics of Machado Lake are spelled out at length in the Basin Plan and in the technical documents supporting this Basin Plan amendment, and have been considered in developing this TMDL. Water quality conditions that reasonably could be achieved through the coordinated control of all factors which affect water quality in the area have been considered. This TMDL provides several compliance options, including implementation of full capture devices for stormdrain conveyances and a minimum frequency of trash assessment and collection. These options provide flexibility for responsible jurisdictions to select the most effective BMPs that reduce trash loading to Machado Lake. Establishing a plan that will ensure Machado Lake attain and continue to attain water quality standards is a reasonable water quality condition. However, to the extent that there would be any conflict between the consideration of the factor in Water Code section 13241 subdivision (c), if the consideration were required, and the Clean Water Act, the Clean Water Act would prevail. Economic considerations were considered throughout the development of the TMDL. Some of these economic considerations arise in the context of Public Resources Code section 21159 and are equally applicable here. The implementation program for this TMDL recognizes the economic limitations on achieving immediate compliance if structural BMPs are selected to abate point source discharges and allows a flexible implementation schedule of 8 years in that event. A program requiring a minimum frequency of trash assessment and collection is not forseeably a cost-prohibitive BMP. The need for housing within the region has been considered, but this TMDL is unlikely to affect housing needs because new housing will need to comply with existing county ordinances regarding proper disposal of trash. Whatever housing impacts could materialize are ameliorated by the flexible nature of this TMDL and the implementation schedule.

16. The amendment is consistent with the State Antidegradation Policy (State Board Resolution No. 68-16), in that the changes to water quality objectives (i) consider maximum benefits to the people of the state, (ii) will not unreasonably affect present and anticipated beneficial use of waters, and (iii) will not result in water quality less than that prescribed in policies. Likewise, the amendment is consistent with the federal Antidegradation Policy (40 CFR 131.12). This policy is further promoted by requiring that the amount of trash collected in between collection events cannot increase and is required to decrease by 50% over eight years.

17. Pursuant to Public Resources Code section 21080.5, the Resources Agency has approved the Regional Water Boards' basin planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) (Public Resources Code, Section 21000 et seq.) requirements for preparing environmental documents. (14 Cal. Code Regs. § 15251(g); 23 Cal. Code Regs. § 3782.) The Regional Water Board staff has prepared "substitute environmental documents" for this project that contains the required environmental documentation under the State Water Board's CEQA

regulations. (23 Cal. Code Regs. § 3777.) The substitute environmental documents include the TMDL staff report entitled "Trash Total Maximum Daily Load for Machado Lake", the environmental checklist, the comments and responses to comments, the basin plan amendment language, and this resolution. The project itself is the establishment of a TMDL for trash in Machado Lake. While the Regional Board has no discretion to not establish a TMDL (the TMDL is required by federal law), the Board does exercise discretion in assigning waste load allocations and load allocations, determining the program of implementation, and setting various milestones in achieving the water quality standards. The CEQA checklist and other portions of the substitute environmental documents contain significant analysis and numerous findings related to impacts and mitigation measures.

18. A CEQA Scoping hearing was conducted on December 6, 2006 at the Los Angeles Regional Water Quality Control Board. A notice of the CEQA Scoping hearing was sent to interested parties including cities and/or counties with jurisdiction in or near Machado Lake on November 7, 2006. This notice was also published in the Los Angeles Times on November 3, 2006.

19. In preparing the substitute environmental documents, the Regional Board has considered the requirements of Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and intends those documents to serve as a tier 1 environmental review. This analysis is not intended to be an exhaustive analysis of every conceivable impact, but an analysis of the reasonably foreseeable consequences of the adoption of this regulation, from a programmatic perspective. Compliance obligations will be undertaken directly by public agencies that may have their own obligations under CEQA. Project level impacts may need to be considered in any subsequent environmental analysis performed by other public agencies, pursuant to Public Resources Code section 21159.2. To the extent applicable, this Tier 1 substitute environmental document may be used to satisfy subsequent CEQA obligations of those agencies.

20. Consistent with the Regional Board's substantive obligations under CEQA, the substitute environmental documents do not engage in speculation or conjecture, and only consider the reasonably foreseeable environmental impacts, including those relating to the methods of compliance, reasonably foreseeable feasible mitigation measures to reduce those impacts, and the reasonably foreseeable alternative means of compliance, which would avoid or reduce the identified impacts.

21. The proposed amendment could have a potentially significant adverse effect on the environment. However, there are feasible alternatives, feasible mitigation measures, or both, that if employed, would substantially lessen the potentially significant adverse impacts identified in the substitute environmental documents, however such alternatives or mitigation measures are within the responsibility and jurisdiction of other public agencies, and not the Regional Board. Water Code section 13360 precludes the Regional Board from dictating the manner in which responsible agencies comply with any of the Regional Board's regulations or orders. When the agencies responsible for implementing this TMDL determine how they will proceed, the agencies responsible for those parts of the project can and should incorporate such alternatives and mitigation into any subsequent projects or project approvals. These feasible alternatives and mitigation measures are described in more detail in the substitute environmental documents. (14 Cal. Code Regs. § 15091(a)(2).)

22. From a program-level perspective, incorporation of the alternatives and mitigation measures outlined in the substitute environmental documents will forseeably reduce impacts to less than significant levels.

23. The substitute documents for this TMDL, and in particular the Environmental Checklist, identify broad mitigation approaches that should be considered at the project level.

24. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, Section 11353, Subdivision (b). As specified above, Federal law and regulations require that TMDLs be incorporated into the water quality management plan. The Regional Board's Basin Plan is the Regional Board's component of the water quality management plan, and the Basin Plan is how the Regional Board takes quasi-legislative, planning actions. Moreover, the TMDL is a program of implementation for existing water quality objectives, and is, therefore, appropriately a component of the Basin Plan under Water Code section 13242. The necessity of developing a TMDL is established in the TMDL staff report, the section 303(d) list, and the data contained in the administrative record documenting the conditions related to trash in Machado Lake.

25. The Basin Plan amendment incorporating a TMDL for trash for Machado Lake must be submitted for review and approval by the State Water Resources Control Board (State Board), the State Office of Administrative Law (OAL), and the U.S. EPA. The Basin Plan amendment will become effective upon approval by OAL and U.S. EPA. Notice of Decision will be filed with the Resources Agency.

26. If during the State Board's approval process Regional Board staff, the SWRCB or OAL determines that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer should make such changes consistent with the Regional Board's intent in adopting this TMDL, and should inform the Board of any such changes.

THEREFORE, be it resolved that pursuant to sections 13240 and 13242, and section 13269 of the Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. Pursuant to Sections 13240 and 13242, and section 13269 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapter 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment A hereto, to incorporate the elements of the Trash TMDL for Machado Lake.

2. Regional Board staff is directed to develop a monitoring plan to assess accumulation of settleable trash on the bottom of Machado Lake and, if necessary, make recommendations for remediation.

3. The Regional Board hereby approves and adopts the CEQA substitute environmental documentation, including all findings contained therein, which was prepared in accordance with Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and directs the Executive Officer to sign the environmental checklist.

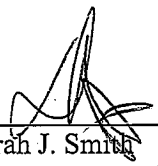
4. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

5. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it to OAL and the U.S. EPA.

6. If during the State Board's approval process, Regional Board staff, the State Board or OAL determines that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

7. The Executive Officer is authorized to sign a Certificate of Fee Exemption.

I, Deborah J. Smith, Interim Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on June 7, 2007.



Deborah J. Smith
Interim Executive Officer

7-17-07
Date

Table 7-38.1. Machado Lake Pesticides and PCBs TMDL: Elements

TMDL Element	Regulatory Provisions
Problem Statement	Machado Lake is identified on the 1998, 2002, 2006, and 2008 Federal Clean Water Act Section 303(d) lists of impaired waterbodies due to chlordane, DDT, dieldrin, Chem A, and PCBs in fish tissue. Chem A (the abbreviation for 'chemical group A') is a suite of bio-accumulative pesticides that includes chlordane and dieldrin. The 1998 303(d) listing (and subsequent listings) for Chem A was predominately based on fish tissue concentrations of chlordane and dieldrin; there was only minimal detection of other Chem A pollutants in 1983 and 1984. Chlordane and dieldrin have been recently detected in fish tissue, while other Chem A pollutants have not been detected in 25 years. Therefore, this TMDL only addresses the Chem A pollutants (chlordane and dieldrin) that are causing impairment. Because of potential harm to human health and the environment, the use of these pollutants has been banned for many years; however, the physio-chemical properties of the pollutants cause them to persist in the environment. These pollutants, bound to soil particles, are easily transported with surface runoff to waterbodies. Contaminated sediments accumulate in the receiving waterbodies and aquatic organisms are exposed to the toxic pollutants. Sediment toxicity has been documented at Machado Lake, and it is likely that pesticides and PCBs contribute to the toxic condition of the sediments. Moreover, all of these pollutants biomagnify as they move up the food chain, thereby increasing concentrations in higher trophic-level aquatic organisms and wildlife. The exposure of the Machado Lake ecosystem to chlordane, DDT, dieldrin, and PCBs has impaired the aquatic life (WARM, WILD, RARE, WET) and recreation (REC-1, REC-2), including fishing, designated beneficial uses of the lake. This TMDL addresses these impairments. Applicable water quality objectives for this TMDL are narrative objectives for Chemical Constituents, Bioaccumulation, Pesticides, and Toxicity in the Basin Plan and the numeric water quality criteria promulgated in 40 CFR section 131.38 (the California Toxics Rule (CTR)).
Numeric Targets	Numeric targets are for pesticides and PCBs in water, sediment, and fish tissue to protect aquatic life, fishing, and other recreational uses in the lake. The CTR criteria for human health (including protection for consumption of organisms) are the numeric targets for the water column. These targets will protect both aquatic life and human health because the CTR human health criteria are more stringent than the aquatic life criteria.

TMDL Element	Regulatory Provisions

Pollutant	Water Column Target (µg/L)
Total PCBs	0.00017
4,4' DDT	0.00059
4,4' DDE	0.00059
4,4' DDD	0.00084
Chlordane	0.00059
Dieldrin	0.00014

The sediment numeric targets are based on the freshwater Threshold Effect Concentration (TEC) guidelines compiled by the National Oceanic and Atmospheric Administration (NOAA). The fish tissue numeric targets are based on the Office of Environmental Health Hazard Assessment (OEHHA) Fish Contaminant Goals (FCGs).

Pollutant	Sediment Target (µg/kg dry weight)	Fish Tissue Target (ng/g wet weight)
Total PCBs	59.8	3.6
DDT (all congeners)	4.16	No target
DDE (all congeners)	3.16	No target
DDD (all congeners)	4.88	No target
Total DDT	5.28	21.0
Chlordane	3.24	5.6
Dieldrin	1.9	0.46

Source Analysis

The point sources of pesticides and PCBs into Machado Lake are stormwater and urban runoff discharges from the municipal separate storm sewer system (MS4), California Department of Transportation (Caltrans), and general construction and industrial dischargers. Stormwater and urban runoff discharges to Machado Lake occur through the following subdrainage systems: Wilmington Drain, Project 77 and Project 510.

PCBs, DDT, dieldrin, and chlordane are no longer legally sold or used, yet, they remain ubiquitous in the environment, bound to fine-grained particles. When these particles become waterborne, the chemicals are ferried to new locations. The more recent small discharges of pesticides and PCBs to Machado Lake most likely come from the erosion of pollutant-laden sediment further up in the watershed. Urban runoff and rainfall higher in the watershed mobilize the particles, which are then washed into storm drains and channels that discharge to the lake.

<table>
<tr><th>TMDL Element</th><th>Regulatory Provisions</th></tr>
<tr><td></td><td>The major nonpoint source of pesticides and PCBs to Machado Lake is the internal lake sediments. The contaminated lake sediments are a reservoir of historically deposited pollutants. The resuspension of these sediments contributes to the fish tissue impairment in the lake. Additionally, the feeding behaviors of fish expose them to contaminated sediments. Therefore, a load allocation is assigned to the existing reservoir of contaminated sediment.

The estimated contribution of pesticides and PCBs from point sources is much smaller than the estimated contribution from internal lake sediments. However, a waste load allocation is assigned to ongoing point source discharges to the lake.</td></tr>
<tr><td>Linkage Analysis</td><td>A conceptual model links the source loading information to the numeric targets.

The chemical properties of pesticides and PCBs result in strong binding to particulate matter; therefore, most of the incoming contaminants from the watershed are bound to suspended sediment particles. When the contaminated suspended sediment settles to the lake bottom, pesticides and PCBs accumulate in the lake sediments. These pollutants are available to migrate to the water column and ultimately to the food web. Through bioturbation and feeding processes the contaminants may be taken up by benthic organisms. Once the sediment-bound PCBs and pesticides contaminate benthic organisms, the contaminants may move out of the lake sediments through each trophic level. Thus, the contaminated lake sediments are an important source. It is expected that if sediments within the lake and those loaded to the lake meet sediment numeric targets, then the fish tissue targets will be met as well. The monitoring program will consist of water, sediment, and fish tissue monitoring to assess this assumption.</td></tr>
<tr><td>Loading Capacity</td><td>The loading capacity is calculated as the volume of the active layer of sediment in the lake multiplied by the sediment numeric target.

Pollutant Loading Capacity = Volume Active Sediment x Target Concentration

However, in the case that the existing load is less than the loading capacity (dieldrin and PCBs); the loading capacity is set at the existing load. The existing load is calculated as the volume of the active layer of sediment in the lake multiplied by the observed pollutant concentration.

Existing Pollutant Load = Volume Active Sediment x Pollutant Concentration.
The loading capacity for each pollutant is presented as follows.
<table>
<tr><th>Pollutant</th><th>Loading Capacity (g)</th></tr>
<tr><td>Chlordane</td><td>1,275</td></tr>
<tr><td>Total DDT</td><td>2,078</td></tr>
<tr><td>Dieldrin</td><td>519</td></tr>
<tr><td>PCBs</td><td>14,049</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>TMDL Element</th><th>Regulatory Provisions</th></tr>
<tr><td>Waste Load Allocations</td><td>Waste load allocations (WLAs) for contaminants associated with suspended sediment are assigned to stormwater dischargers (MS4, Caltrans, general construction and general industrial dischargers) in both wet and dry weather.
<table>
<tr><th>Responsible Party</th><th>Pollutant</th><th>WLA for Suspended Sediment-Associated Contaminants[1] (µg/kg dry weight)</th></tr>
<tr><td rowspan="7">MS4 Permittees[1], Caltrans, General Construction and Industrial Stormwater Permittees, Other Non-stormwater NPDES Permittees</td><td>Total PCBs</td><td>59.8</td></tr>
<tr><td>DDT (all congeners)</td><td>4.16</td></tr>
<tr><td>DDE (all congeners)</td><td>3.16</td></tr>
<tr><td>DDD (all congeners)</td><td>4.88</td></tr>
<tr><td>Total DDT</td><td>5.28</td></tr>
<tr><td>Chlordane</td><td>3.24</td></tr>
<tr><td>Dieldrin</td><td>1.9</td></tr>
<tr><td colspan="3">[1] WLAs are applied with a 3-year averaging period.</td></tr>
</table></td></tr>
<tr><td>Load Allocations</td><td>Load allocations (LAs) addressing nonpoint sources of pesticides and PCBs are assigned to the existing lake sediments. The LAs are set to attain the lake loading capacity, including a 10% margin of safety.
<table>
<tr><th>Responsible Party</th><th>Pollutant</th><th>LA (grams)</th></tr>
<tr><td rowspan="4">City of Los Angeles, Department of Recreation and Parks</td><td>Chlordane</td><td>1,147</td></tr>
<tr><td>Total DDT</td><td>1,870</td></tr>
<tr><td>Dieldrin</td><td>467</td></tr>
<tr><td>PCBs</td><td>12,644</td></tr>
</table></td></tr>
</table>

[1] Municipal Separate Storm Sewer System (MS4) Permittees include: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance.

<table>
<tr><th>TMDL Element</th><th>Regulatory Provisions</th></tr>
<tr><td>Margin of Safety</td><td>The uncertainties associated with this TMDL are due to:
Limited data on the amount of pesticides and PCBs residing within the lake sediments
Limited data on the amount of pesticides and PCBs entering the lake
Estimated information on the volume of the active layer of sediment in Machado Lake
Estimated information on the watershed sediment deposition rate
Constant bulk density, sediment density, and sediment porosity values used to calculate the load associated with deposited sediment
To address these uncertainties, an implicit margin of safety is included by employing conservative assumptions in the TMDL analysis. Additionally, an explicit 10 % margin of safety is applied to the loading capacity for this TMDL.<table><tr><th>Pollutant</th><th>Loading Capacity (g)</th><th>Loading Capacity with 10 % Margin of Safety</th></tr><tr><td>Chlordane</td><td>1,275</td><td>1,147</td></tr><tr><td>Total DDT</td><td>2,078</td><td>1,870</td></tr><tr><td>Dieldrin</td><td>519</td><td>467</td></tr><tr><td>PCBs</td><td>14,049</td><td>12,644</td></tr></table></td></tr>
<tr><td>Seasonal Variations and Critical Conditions</td><td>Pesticides and PCBs in fish tissue are a concern in Machado Lake due to long-term loading and bioaccumulation and biomagnification. Wet-weather events may produce extensive sediment redistribution and transport sediments to the lake. This would be considered the critical condition for loading and the CTR-based water column targets are protective of this condition. However, the effects of pesticides and PCBs in sediment and fish tissue are manifested over long time periods. The TMDL is established in a manner that accounts for the longer time periods in which ecological effects may occur.</td></tr>
<tr><td>Monitoring Plan</td><td>Responsible parties assigned both WLAs and LAs may submit one document that addresses the monitoring requirements (as described below) and implementation activities for both WLAs and LAs.

<u>Waste Load Allocation Compliance Monitoring</u>

Responsible parties assigned WLAs shall conduct monitoring to determine compliance with the WLAs. Samples will be analyzed for total suspended solids. Sampling shall be designed to collect sufficient volumes of suspended solids to allow for analysis of the following pollutants in the bulk sediment:</td></tr>
</table>

TMDL Element	Regulatory Provisions
	▪ Total Organic Carbon ▪ Total PCBs ▪ DDT and Derivatives ▪ Dieldrin ▪ Total Chlordane In addition to TMDL constituents, general water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) and a flow measurement will be required at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection, if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements. The monitoring shall be conducted in two phases at appropriate locations in the subwatershed. <u>Phase 1</u> Phase 1 monitoring will be conducted for a two-year period. Samples will be collected during three wet weather events each year. The first large storm event of the season shall be included as one of the monitoring events. <u>Phase 2</u> Phase 2 monitoring will commence once Phase 1 monitoring has been completed. Samples will be collected during one wet weather event every other year. Monitoring shall be conducted under a technically appropriate Monitoring and Reporting Plan (MRP) and Quality Assurance Project Plan (QAPP). The MRP shall include a requirement that the responsible parties report compliance and non-compliance with waste load allocations as part of annual (or biennial during Phase 2 monitoring) reports submitted to the Regional Board. The QAPP shall include protocols for sample collection, standard analytical procedures, and laboratory certification. All samples shall be collected in accordance with SWAMP protocols. Phase 1 sampling shall begin within 60 days of Executive Officer approval of the MRP and QAPP. Stormwater dischargers that fully divert a stormwater discharge to the sanitary sewer may document the diversion as a wet-weather monitoring event and report both the flow and pollutant concentration as zero. Unless all stormwater discharges are fully diverted to the sanitary sewer, at least one wet-weather event must be sampled according to the monitoring requirements above. Stormwater discharges that are not fully diverted are subject to the WLA compliance monitoring described above. The reported pollutant concentration of zero may be combined with other measured sample concentrations (from stormwater discharges that are not fully diverted) when demonstrating compliance with the WLA over the 3-year averaging period.

TMDL Element	Regulatory Provisions
	The Regional Board's Executive Officer may reduce, increase, or modify Phase 2 monitoring and reporting requirements, as necessary, based on the results of Phase 1 monitoring. Currently, several of the constituents of concern have numeric targets that are lower than the readily available detection limits. As analytical methods and detection limits continue to improve (i.e., development of lower detection limits) and become more environmentally relevant, responsible parties shall incorporate new method detection limits in the MRP and QAPP. The Regional Board may reconsider the TMDL WLAs based on the results of Phase 1 and 2 monitoring, if necessary. <u>Load Allocation Compliance and Numeric Target Assessment Monitoring</u> Monitoring to determine compliance with the TMDL load allocations and attainment of numeric targets shall be conducted as part of the Lake Water Quality Management Plan (LWQMP). This monitoring shall commence following the remediation of lake sediments as presented in the LWQMP. Lake sediment samples will be collected from three locations in the lake (northern end, mid point, southern end). Immediately following remediation of lake sediments, samples will be collected at a frequency appropriate to assess post remediation conditions and demonstrate compliance with LAs. Thereafter, samples will be collected every three years to assess attainment of numeric targets. All samples shall be collected in accordance with SWAMP protocols. Sediment samples will be analyzed for: ▪ Total Organic Carbon ▪ Total PCBs ▪ DDT and Derivatives ▪ Dieldrin ▪ Total Chlordane A water sample will be collected every three years from the mid point of the lake. Sample collection shall be associated with wet-weather conditions. Samples will be collected as a depth integrated water column sample and/or a bottom sample (collected near the sediments) as appropriate based on lake depth. All samples shall be collected in accordance with SWAMP protocols. Samples (unfiltered) will be analyzed for: ▪ Total PCBs ▪ DDT and Derivatives ▪ Dieldrin ▪ Total Chlordane Fish shall be collected for tissue analysis every 3 years. Fish tissue samples will be analyzed for:

TMDL Element	Regulatory Provisions
	▪ Total PCBs ▪ DDT and Derivatives ▪ Total Chlordane ▪ Dieldrin The fish collection and analysis shall be conducted in accordance with the U.S. EPA *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1 Fish Sampling and Analysis* (EPA 823-B-00-0007) or updates. In addition to TMDL constituents, general water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) will be required at each sampling event. The Executive Officer may require additional monitoring depending on which implementation alternatives are pursued by the responsible parties. Currently, several of the constituents of concern have numeric targets that are lower than the readily available detection limits. As analytical methods and detection limits continue to improve (i.e., development of lower detection limits) and become more environmentally relevant, responsible parties shall incorporate new method detection limits in the MRP and QAPP. <u>Wilmington Drain Monitoring</u> The Los Angeles County Flood Control District shall monitor Wilmington Drain to demonstrate that Wilmington Drain is not re-contaminating Machado Lake. Monitoring shall include bed sediment sampling and visual inspection of channel maintenance and operation of best management practices (BMPs). Monitoring shall be required by Regional Board order or a conditional Water Quality Certification under section 401 of the Clean Water Act. This monitoring shall be initiated at the same time as all other required WLA monitoring.

TMDL Element	Regulatory Provisions
Implementation Plan	Compliance with the TMDL is based on the assigned WLAs and LAs. Compliance with this TMDL will require the implementation of NPDES permit limitations for urban runoff and stormwater discharges and cleanup of contaminated lake sediments. Table 7-38.2 contains a schedule for responsible parties to implement BMPs and a LWQMP to comply with the TMDL. I. Implementation of WLAs The TMDL WLAs shall be incorporated into the MS4, Caltrans, and general construction and industrial stormwater NPDES permits and any other non-stormwater NPDES permits. Permitted stormwater dischargers can implement a variety of implementation strategies to meet the required WLAs, such as non-structural and structural BMPs, and/or diversion and treatment to reduce sediment transport from the watershed to the lake. II. Implementation of LAs Load allocations shall be implemented through the following: (1) Memorandum of Agreement (MOA), or (2) Cleanup and Abatement Order or Other Regulatory Order. The responsible parties for the load allocations shall be allowed one year from the effective date of this TMDL to enter into a Memorandum of Agreement (MOA) with the Regional Board, detailing the voluntary efforts that will be undertaken to attain the load allocations. The MOA shall include development of a LWQMP. The MOA shall comply with the Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options ("Policy"), including part II, section 2.c.ii. and related provisions, and shall be consistent with the requirements of this TMDL. If the MOA is timely adopted, and so long as it is implemented, the program described in the MOA shall be deemed "certified", pursuant to the Policy, subject to the conditions of section 2.e. of the Policy. The MOA must be approved by the Executive Officer, and may be amended with Executive Officer approval, as necessary. If an MOA is not established with responsible parties within one year or if responsible parties do not comply with the terms of the MOA, a cleanup and abatement order pursuant to California Water Code section 13304 or another appropriate regulatory order shall be issued to implement the load allocations. Furthermore, the implementation of the MOA must result in attainment of the TMDL load allocations. If the MOA and LWQMP are not implemented or otherwise do not result in attainment of load allocations, the certification shall be revoked, the MOA rescinded, and the load allocations shall be implemented through a cleanup and abatement order or other order as described above. Implementation of the MOA shall be reviewed annually by the Executive Officer

TMDL Element	Regulatory Provisions
	as part of the MRP annual reports. Responsible parties entering into an MOA with the Regional Board shall submit and implement a LWQMP. The LWQMP must be approved by the Executive Officer and may be amended by Executive Officer approval, as necessary. The LWQMP shall include an MRP to address appropriate monitoring and a clear timeline for the implementation of measures that will achieve the lake sediment LAs. The LWQMP shall include annual reporting requirements. In addition to the LWQMP and MRP, a QAPP shall also be submitted to the Regional Board for approval by the Executive Officer to ensure data quality. One and one half years from the effective date of the TMDL, the responsible parties entering into the MOA shall submit a letter of intent, LWQMP, MRP, and QAPP for approval by the Executive Officer in order to be in compliance with the MOA adopted as part of this TMDL. If there is already an MOA, LWQMP, MRP, and QAPP in place to implement the Machado Lake Nutrient TMDL, these documents may be amended to implement and attain the load allocations of this TMDL. The Executive Officer may require a revised assessment under the MOA and LWQMP: (a) To prevent pesticides and PCBs from accumulating or recycling in the lake in deleterious amounts that impair water quality and/or adversely affect beneficial uses; (b) To reflect the results of special studies. Cleanup and Abatement Order or Other Regulatory Order: Alternatively, responsible parties may propose or the Regional Board may impose an alternative program that would be implemented through a cleanup and abatement order, or any other appropriate order or orders, provided the program is consistent with the allocations and schedule described in Table 7-38.2. III. Compliance with Allocations and Attainment of Numeric Targets TMDL effectiveness will be determined through water, sediment, and fish tissue monitoring and comparison with the TMDL waste load and load allocations and numeric targets. The compliance point for the stormwater WLA is at the storm drain outfall of the permittee's drainage area. Alternatively, if stormwater dischargers select a coordinated compliance option, the compliance point for the stormwater WLA may be at storm drain outfalls which suitably represent the combined discharge of cooperating parties discharging to Machado Lake. Depending on potential BMPs implemented, alternative stormwater compliance points may be proposed by responsible parties subject to approval by the Regional Board Executive Officer. The compliance point for responsible parties receiving a load allocation is in Machado Lake.

TMDL Element	Regulatory Provisions
	Stormwater dischargers may coordinate compliance with the TMDL. Compliance with the TMDL may be based on a coordinated MRP and implementation plan. Dischargers interested in coordinated compliance shall submit a coordinated MRP and implementation plan that identifies stormwater BMPs and monitoring to be implemented by the responsible parties. After lake remediation activities, to address existing sediment contamination, are complete and LAs are attained, if Machado Lake is recontaminated as a result of continued polluted discharge from the surrounding watershed, the WLA compliance monitoring data will be used, along with other available information, to assess the relative contribution of watershed dischargers and determine their responsibility for secondary lake remediation activities. If a significant amount of contaminated sediment is transported to Machado Lake from the surrounding watershed after lake remediation actives are completed, but before monitoring is conducted to confirm attainment of LAs, Regional Board staff shall consider all information related to watershed discharges and lake conditions when assessing responsibility for secondary lake remediation activities. IV. Application of Allocations to Responsible Parties Responsible parties to attain WLAs for this TMDL include but are not limited to: • Caltrans • General Stormwater Permit Enrollees • MS4 Permittees including: ➢ Los Angeles County ➢ Los Angeles County Flood Control District ➢ City of Carson ➢ City of Lomita ➢ City of Los Angeles ➢ City of Palos Verdes Estates ➢ City of Rancho Palos Verdes ➢ City of Redondo Beach ➢ City of Rolling Hills ➢ City of Rolling Hills Estates ➢ City of Torrance • Other Non-stormwater Permittees The City of Los Angeles is the responsible jurisdiction to implement the assigned Load Allocations for this TMDL.

Table 7-38.2. Machado Lake Pesticides and PCBs TMDL: Implementation Schedule

Task Number	Task	Responsible Party	Deadline
Load Allocation Requirements			
1	Enter into a Memorandum of Agreement (MOA) with the Regional Board to implement the load allocations. If there is already an MOA in place to implement the Machado Lake Nutrient TMDL, the current MOA may be amended to address the requirements of this TMDL.	City of Los Angeles, Department of Recreation and Parks	1 year from effective date of TMDL
2	Begin development of a Cleanup and Abatement Order or other regulatory order to implement the load allocations if an MOA is not established with responsible parties.	Regional Board	1 year from effective date of TMDL
3	Issue a Cleanup and Abatement Order or other regulatory order if an MOA is not established with responsible parties. The Cleanup and Abatement Order or other regulatory order shall reflect the TMDL Implementation Schedule.	Regional Board	1.5 years from effective date of TMDL
4	Submit a LWQMP[2], MRP[3] Plan, and QAPP[4] for approval by the Executive Officer to comply with the MOA. If there is already a LWQMP, MRP Plan, and QAPP in place to implement the Machado Lake Nutrient TMDL, these documents may be amended to address the requirements of this TMDL.	City of Los Angeles, Department of Recreation and Parks	1.5 years from the effective date of the TMDL
5	Begin implementation of the LWQMP.	City of Los Angeles, Department of Recreation and Parks	60 days from date of LWQMP approval
6	Achieve LAs for Pesticides and PCBs and assess attainment of numeric targets.	City of Los Angeles, Department of Recreation and Parks	September 30, 2019
Waste Load Allocation Requirements			
7	Submit a MRP and QAPP for Executive Officer approval[6].	Caltrans, MS4 Permittees[5], General Construction and	6 months from effective date of TMDL or

[2] Lake Water Quality Management Plan
[3] Monitoring Reporting Program
[4] Quality Assurance Project Plan
[5] Municipal Separate Storm Sewer System (MS4) Permittees include: Los Angeles County, Los Angeles County Flood Control District, and the Cities of Carson, Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance.

Task Number	Task	Responsible Party	Deadline
		Industrial Stormwater Permittees	September 11, 2011 whichever date is later
8	Begin monitoring as outlined in the approved MRP and QAPP.	Caltrans, MS4 Permittees, General Construction and Industrial Stormwater Permittees	60 days from date of approval
9	Conduct Phase 1 Monitoring	Caltrans, MS4 Permittees, General Construction and Industrial Stormwater Permittees	2 year monitoring period
10	Based on the results of Phase 1 Monitoring, submit an implementation plan to attain WLAs or document that WLAs are attained.	Caltrans, MS4 Permittees, General Construction and Industrial Stormwater Permittees	6 months from completion of Phase 1 Monitoring (Submit Draft Plan) 1 year from completion of Phase 1 Monitoring (Submit Final Plan)
11	Begin implementation actions to attain WLAs, as necessary.	Caltrans, MS4 Permittees, General Construction and Industrial Stormwater Permittees	60 days from date of plan approval
12	Achieve WLAs for Pesticides and PCBs	Caltrans, MS4 Permittees, General Construction and Industrial Stormwater Permittees	September 30, 2019

[6]The deadline for Responsible Parties assigned both WLAs and LAs to submit one document to address both WLA and LA monitoring requirements and implementation activities shall be 1.5 years from the effective date.

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. R10-008
September 2, 2010

Amendment to the *Water Quality Control Plan for the Los Angeles Region* to Incorporate a Total Maximum Daily Load for Pesticides and PCBs for Machado Lake

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The Federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angles Region (Regional Board) to establish water quality standards for each waterbody within its region. Water quality standards include beneficial uses, water quality objectives that are established at levels sufficient to protect those beneficial uses, and an antidegradation policy to prevent degrading waters. Waterbodies that do not meet water quality standards are considered impaired.

2. CWA section 303(d)(1) requires each state to identify the waters within its boundaries that do not meet water quality standards. Those waters are placed on the state's "303(d) List" or "Impaired Waters List". For each listed water, the state is required to establish the Total Maximum Daily Load (TMDL) of each pollutant impairing the water quality standards in that waterbody. Both the identification of impaired waters and TMDLs established for those waters must be submitted to the United States Environmental Protection Agency (U.S. EPA) for approval pursuant to CWA section 303(d)(2). For all waters that are not identified as impaired, the states are nevertheless required to create TMDLs pursuant to CWA section 303(d)(3).

3. A consent decree between U.S. EPA, Heal the Bay, Inc. and Santa Monica BayKeeper, Inc. was approved on March 22, 1999, which resolved litigation between those parties relating to the pace of TMDL development in the Los Angeles Region. The court order directs the U.S. EPA to ensure that TMDLs for all 1998-listed impaired waters in the Los Angeles Region be established within 13 years of the consent decree. The consent decree combined waterbody pollutant combinations in the Los Angeles Region into 92 TMDL analytical units. In accordance with the consent decree, the Machado Lake Pesticides and PCBs TMDL addresses the listings for chlordane, dieldrin, Chem A, DDT and PCBs in tissue for analytical unit 73. Based on the consent decree schedule, TMDLs must be approved or established by U.S. EPA by March 2012.

4. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d)(1)(C) and (D) of the CWA, as well as in U.S. EPA guidance documents (Report No. EPA/440/4-91/001). A TMDL is defined as the sum of the individual waste load allocations for point sources, load allocations for non-point sources and natural background (40 CFR 130.2). TMDLs must be set at levels necessary to attain and maintain the applicable narrative and numeric water quality

standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.7(c)(1)). 40 CFR 130.7 also dictates that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters. TMDLs typically include one or more numeric "targets", i.e., numerical translations of the existing water quality standards, which represent attainment of those standards, contemplating the TMDL elements described above. Since a TMDL must represent the "total" load, TMDLs must account for all sources of the relevant pollutants, irrespective of whether the pollutant is discharged to impaired or unimpaired upstream reaches.

5. Neither TMDLs nor their targets or other components are water quality objectives, and thus their establishment does not implicate California Water Code section 13241. Rather, under California Law, TMDLs are programs to implement existing standards (including objectives), and are thus established pursuant to Cal. Water Code section 13242. Moreover, they do not create new bases for direct enforcement against dischargers apart from the existing water quality standards they translate. Like most other parts of the Water Quality Control Plan for the Los Angeles Region (Basin Plan), TMDLs are not generally self-implementing. The targets merely establish the bases through which load allocations (LAs) and waste load allocations (WLAs) are calculated. The LAs and WLAs may be implemented in any manner consistent with the Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options, adopted by the State Water Resources Control Board (State Board) on June 16, 2005 (Resolution 2005-0050). Federal regulations also require that National Pollutant Discharge Elimination System (NPDES) permits be consistent with the assumptions and requirements of available WLAs (40 C.F.R. 122.44(d)(vii)(B)).

6. As envisioned by Cal. Water Code section 13242, the TMDL contains a "description of surveillance to be undertaken to determine compliance with objectives." The Compliance Monitoring element of the TMDL recognizes that monitoring will be necessary to assess the progress of pollutant load reductions and improvements in water quality in Machado Lake. The TMDL establishes the types of information that will be necessary to secure. The Regional Board's Executive Officer will ensure that appropriate entities develop and submit monitoring programs and technical reports necessary to achieve the purposes of the TMDL. The Executive Officer will determine the scope of these programs and reports, taking into account any legal requirements, including this TMDL, and if necessary issue appropriate orders to appropriate entities.

7. Upon establishment of TMDLs by the State or U.S. EPA, the State is required to incorporate, or reference, TMDLs in the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). The Basin Plan and applicable statewide plans serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Los Angeles Regional Board. Attachment A to this resolution contains the language to be incorporated into the Basin Plan for this TMDL.

8. Machado Lake is located in the Ken Malloy Harbor Regional Park (KMHRP), which is a 231-acre Los Angeles City Park serving the Wilmington and Harbor

City areas. The Park is located west of the Harbor Freeway (110) and east of Vermont Street between the Conoco Phillips Refinery on the south and the Pacific Coast Highway on the north. The Machado Lake area is approximately 103.5 acres in total size. The upper portion, which includes the open water area, is approximately 40 acres and the lower wetland portion is about 63.5 acres. This TMDL will address the 40-acre open water lake. Machado Lake is located within the Machado Lake subwatershed, which is approximately 20 square miles and positioned within the larger 110-square mile Dominguez Channel Watershed. The dominant land use in the Machado Lake Watershed is high-density single-family residential, accounting for approximately 45 % of the land use. Industrial, vacant, retail/commercial, multi-family residential, transportation, and educational institutions each account for 5-7 % of the land use, while "all other" accounts for the remaining 23 %. Machado Lake receives urban and stormwater runoff from a network of storm drains throughout the watershed.

9. Numeric targets for the TMDL are based on narrative and numeric water quality objectives (WQOs) provided in the Basin Plan and 40 CFR 131.38 (California Toxics Rule or CTR).

10. The Regional Board's goal in establishing the TMDL for Pesticides and PCBs in Machado Lake is to protect the recreation (REC 1 and REC 2) and aquatic life (WARM, WILD, RARE, WET) beneficial uses of Machado Lake by achieving the numeric and narrative water quality objectives set to protect those uses.

11. Regional Board Staff have prepared a detailed technical document that analyzes and describes the specific necessity and rationale for the development of this TMDL. The technical document entitled "Machado Lake Pesticides and PCBs TMDL" is an integral part of this Regional Board action and was reviewed, considered, and accepted by the Regional Board before acting. Further, the technical document provides the detailed factual basis and analysis supporting the problem statement, numeric targets (interpretation of the narrative and numeric water quality objectives, used to calculate the waste load and load allocations), source analysis, linkage analysis, waste load allocations (for point sources), load allocations (for non-point sources), margin of safety, and seasonal variations and critical conditions of this TMDL.

12. On September 2, 2010, prior to the Board's action on this resolution, a public hearing was conducted on the Machado Lake Pesticides and PCBs TMDL. Notice of the hearing was published in accordance with the requirements of Cal. Water Code Section 13244. This notice was published in the Los Angeles Times on April 15, 2010.

13. The public has had a reasonable opportunity to participate in the review of the amendment to the Basin Plan. A public stakeholder meeting was held on March 18, 2010; a draft of the TMDL was released for public comment on April 14, 2010; a Notice of Hearing and Notice of Filing were published and circulated 45 days preceding Board action; Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on September 2, 2010 to consider adoption of the TMDL.

14. In amending the Basin Plan to establish this TMDL, the Regional Board considered the requirements set forth in Sections 13240 and 13242 of the California Water Code.

15. Because the TMDL implements existing narrative and numeric water quality objectives (i.e., water quality objectives in the Basin Plan), the Regional Board (along with the State Board) has determined that adopting a TMDL does not require the Regional Board to consider the factors of Cal. Water Code section 13241. The consideration of the Water Code section 13241 factors, by section 13241's express terms, only applies "in establishing water quality objectives." Here the Regional Board is not establishing water quality objectives, but as required by section 303(d)(1)(C) of the Clean Water Act is adopting a TMDL that will implement the previously established objectives that have not been achieved. In making this determination, the Regional Board has considered and relied upon a legal memorandum from the Office of Chief Counsel to the State Board's basin planning staff detailing why TMDLs cannot be considered water quality objectives. (See Memorandum from Staff Counsel Michael J. Levy, Office of Chief Counsel, to Ken Harris and Paul Lillebo, Division of Water Quality: *The Distinction Between a TMDL's Numeric Targets and Water Quality Standards*, dated June 12, 2002.)

16. While the Regional Board is not required to consider the factors of Cal. Water Code section 13241, it nonetheless has developed and received significant information pertaining to the Cal. Water Code section 13241 factors and has considered that information in developing and adopting this TMDL. Section 13241 at a minimum requires that water quality objectives ensure reasonable protection of beneficial uses. The designated beneficial uses for Machado Lake include aquatic life habitat uses, water contact recreation, and non-water contact recreation. The past, present and probable future beneficial uses of water have been considered in that Machado Lake is designated for a number of beneficial uses in the Basin Plan. The environmental characteristics of Machado Lake are spelled out at length in the Basin Plan and in the technical documents supporting this Basin Plan amendment, and have been considered in developing this TMDL. Water quality conditions that reasonably could be achieved through the coordinated control of all factors which affect water quality in the area have been considered. This TMDL provides several compliance options, including lake management strategies/lake treatment options that could be implemented directly in the lake and watershed strategies for urban and stormwater runoff throughout the watershed to treat and reduce PCBs and pesticide loading to the lake. These options provide flexibility for responsible parties to reduce external loading and remediate contaminated sediments in Machado Lake. The implementation of the in-lake and watershed compliance options should ensure that Machado Lake attains and continues to maintain water quality standards. Attainment of the water quality standards through the in-lake and watershed compliance options is a reasonably achievable water quality condition for Machado Lake. However, to the extent that there would be any conflict between the consideration of the factor in Water Code section 13241, subdivision (c), if the consideration were required, and the Clean Water Act, the Clean Water Act would prevail. Economic considerations were considered throughout the development of the TMDL. Some of these economic considerations arise in the context of Public Resources Code section 21159 and are equally applicable

here. The implementation program for this TMDL recognizes the economic limitations on achieving immediate compliance and allows a flexible implementation schedule of 7 years. The need for housing within the region has been considered, but this TMDL is unlikely to affect housing needs. Whatever housing impacts could materialize are ameliorated by the flexible nature of this TMDL and the 7-year implementation schedule.

17. The amendment is consistent with the State Antidegradation Policy (State Board Resolution No. 68-16), and the federal Antidegradation Policy (40 CFR 131.12), in that it does not allow degradation of water quality, but requires restoration of water quality and attainment of water quality standards.

18. Pursuant to Public Resources Code section 21080.5, the Resources Agency has approved the Regional Boards' basin planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) (Public Resources Code, § 21000 et seq.) requirements for preparing environmental documents (14 Cal. Code Regs. § 15251(g); 23 Cal. Code Regs. § 3782). The Regional Board staff has prepared "substitute environmental documents" for this project that contain the required environmental documentation under the State Board's CEQA regulations. (23 Cal. Code Regs. § 3777.) The substitute environmental documents include the TMDL staff report entitled "Machado Lake Pesticides and PCBs TMDL", the environmental checklist, the comments and responses to comments, the basin plan amendment language, and this resolution. The project itself is the establishment of a TMDL for pesticides and PCBs in fish tissue and sediment of Machado Lake. While the Regional Board has no discretion to not establish a TMDL (the TMDL is required by federal law), the Board does exercise discretion in assigning waste load allocations and load allocations, determining the program of implementation, and setting various milestones in achieving the water quality standards. The CEQA checklist and other portions of the substitute environmental documents contain significant analysis and numerous findings related to impacts and mitigation measures.

19. A CEQA Scoping meeting was conducted on March 18, 2010 at the Los Angeles Regional Water Quality Control Board Office, 320 West 4th Street, Los Angeles, California 90013. A notice of the CEQA Scoping meeting was sent to interested parties within the subwatershed.

20. In preparing the substitute environmental documents, the Regional Board has considered the requirements of Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and intends those documents to serve as a tier 1 environmental review. This analysis is not intended to be an exhaustive analysis of every conceivable impact, but an analysis of the reasonably foreseeable consequences of the adoption of this regulation, from a programmatic perspective. The "Lead" agencies for tier 2 projects will assure compliance with project-level CEQA analysis of this programmatic project. Project level impacts will need to be considered in any subsequent environmental analysis performed by other public agencies, pursuant to Public Resources Code section 21159.2.

21. The foreseeable methods of compliance for this TMDL entail construction and operation of stormwater management practices such as filter systems and grass swales. Foreseeable methods of compliance also include lake management practices, such as hydraulic dredging, in-situ capping, and monitored natural attenuation.

22. Consistent with the Regional Board's substantive obligations under CEQA, the substitute environmental documents do not engage in speculation or conjecture, and only consider the reasonably foreseeable environmental impacts, including those relating to the methods of compliance, reasonably foreseeable feasible mitigation measures to reduce those impacts, and the reasonably foreseeable alternative means of compliance, which would avoid or reduce the identified impacts.

23. The proposed amendment could have a potentially significant adverse effect on the environment. However, there are feasible alternatives, feasible mitigation measures, or both, that if employed, would substantially lessen the potentially significant adverse impacts identified in the substitute environmental documents; however such alternatives or mitigation measures are within the responsibility and jurisdiction of other public agencies, and not the Regional Board. Cal. Water Code section 13360 precludes the Regional Board from dictating the manner in which responsible parties comply with any of the Regional Board's regulations or orders. When the parties responsible for implementing this TMDL determine how they will proceed, the parties responsible for those parts of the project can and should incorporate such alternatives and mitigation into any subsequent projects or project approvals. These feasible alternatives and mitigation measures are described in more detail elsewhere in the substitute environmental documents. (14 Cal. Code Regs. § 15091(a)(2).)

24. The substitute documents for this TMDL, and in particular the Environmental Checklist and staff's responses to comments, identify broad mitigation approaches that should be considered at the project level.

25. To the extent significant adverse environmental effects could occur, the Regional Board has balanced the economic, legal, social, technological, and other benefits of the TMDL against the unavoidable environmental risks and finds that specific economic, legal, social, technological, and other benefits of the TMDL outweigh the unavoidable adverse environmental effects, such that those effects are considered acceptable. The basis for this finding is set forth in the substitute environmental documents. (14 Cal. Code Regs. § 15093.)

26. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subdivision (b). As specified above, federal law and regulations require that TMDLs be incorporated into the state's water quality management plan. The Regional Board's Basin Plan is the Regional Board's component of the water quality management plan, and the Basin Plan is how the Regional Board takes quasi-legislative, planning actions. Moreover, the TMDL is a program of implementation for existing water quality objectives, and is, therefore, appropriately a component of the Basin Plan under Water Code section 13242. The necessity of developing a TMDL is established in the TMDL staff report, the section 303(d) list, and the data contained in the

administrative record documenting the sediment and fish tissue impairments of Machado Lake.

27. The Basin Plan amendment incorporating a TMDL for Pesticides and PCBs in Machado Lake must be submitted for review and approval by the State Board, the State Office of Administrative Law (OAL), and the U.S. EPA. The Basin Plan amendment will become effective upon approval by OAL and U.S. EPA. A Notice of Decision will be filed with the Resources Agency.

28. If during the State Board's approval process Regional Board staff, the State Board or State Board staff, or OAL determine that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer should make such changes consistent with the Regional Board's intent in adopting this TMDL, and should inform the Board of any such changes.

29. Considering the record as a whole, this Basin Plan amendment is expected to result in an effect, either individually or cumulatively, on wildlife resources.

THEREFORE, be it resolved that pursuant to sections 13240 and 13242 of the Cal. Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. The Regional Board hereby approves and adopts the CEQA substitute environmental documentation, which was prepared in accordance with Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and directs the Executive Officer to sign the environmental checklist.

2. Pursuant to Sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapter 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment A hereto, to incorporate the elements and implementation schedule of the Machado Lake Pesticides and PCBs TMDL.

3. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

4. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it to OAL and the U.S. EPA.

5. If during the State Board's approval process, Regional Board staff, the State Board or State Board staff, or OAL determine that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

6. The Executive Officer is authorized to request a "No Effect Determination" from the Department of Fish and Game, or transmit payment of the applicable fee as may be required to the Department of Fish and Game.

I, Samuel Unger, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on September 2, 2010.

Samuel Unger
Samuel Unger, PE
Executive Officer

Nov. 22, 2016
Date

Los Angeles-Long Beach Harbors and San Pedro Bay Hydrodynamic and Sediment-Contaminant Transport Model Calibration

DRAFT

February 2009

Prepared for:
USEPA Region 9
Los Angeles Regional Water Quality Control Board

Prepared by:
Tetra Tech, Inc.

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1. Introduction

This report summarizes the development and calibration of the hydrodynamic and sediment transport model components of a coupled hydrodynamic and water quality modeling system under development to support TMDLs in the greater Los Angeles and Long Beach Harbors, including the Los Angeles River estuary and San Pedro Bay. The report presents the overall modeling framework to support TMDL development, observational data to support the hydrodynamic and sediment transport model configuration and calibration, and calibration results.

Areas of the Los Angeles and Long Beach Harbors and San Pedro Bay, including their tributaries, the Los Angeles and San Gabriel Rivers and Dominguez Channel, are currently on the State of California's 303(d) list of impaired waters. A variety of toxic inorganic and organic contaminants contribute to benthic effects and sediment toxicity impairments. Specific inorganic metal contaminants on the list include cadmium, chromium, copper, lead, mercury, nickel, and zinc. Organic contaminants listed include chlordane, DDT, dieldrin, PAHs, PCBs, and toxaphene. The fate and transport of metals and organic contaminants in surface water systems is strongly coupled with the fate and transport of organic and inorganic sediments and dissolved organic material due to their affinity to adsorb to sediment particles and bond with dissolved organic carbon to form complexes.

Hydrodynamic and water quality models provide an important tool to evaluate existing conditions, including identifying non-point source load contributions, source controls, and TMDL allocation alternatives. A modeling system that includes hydrodynamic, sediment transport, and contaminant transport and fate is necessary to assess current conditions and potential load reduction scenarios for the listed waterbodies. This report provides an update on the status of the development of the hydrodynamic component of this modeling system, including calibration results (Section 5, Section 6, and Appendix A), and describes the sediment transport and contaminant transport and fate components. The report is organized as follows:

- *Modeling Framework*. Summarizes the overall modeling framework including model selection and the sequence of steps leading to the decision support modeling system for TMDL development.
- *Observational Data for Model Configuration and Calibration*. Summarizes available observational data for configuration and calibration of the hydrodynamic model component.
- *Hydrodynamic Model Configuration*. Describes general and hydrodynamic configuration of the model for the greater Los Angeles and Long Beach Harbors system.
- *Hydrodynamic Calibration*. Outlines the approach used and presents results for the hydrodynamic and transport calibration.

- *Sediment and Contaminant Transport Configuration.* Describes the configuration of the sediment and contaminant transport and fate components of the modeling including analysis of field observations.
- *Sediment and Contaminant Transport Calibration*. Outlines the approach used and presents calibration results.
- *Summary and Recommendations*. Summarizes the status of the calibration and makes recommendations for use of the model for TMDL development.
- *Appendix A*. Provides time series plots of the salinity calibration.
- *Appendix B*. Describes the model performance measures used to compare model output and observed data during model calibration.
- *Appendix C.* Presents dry season model sensitivity analyses.
- *Appendix D*. Presents model sensitivity to long-term load reductions.
- *Appendix E.* Provides analyses of additional water column data.

2. Modeling Framework

A modeling system to support TMDL development for metals and hydrophobic organic compounds in the greater Los Angeles and Long Beach Harbors system requires three primary components: hydrodynamic, sediment transport, and contaminant transport and fate. The U. S. Army Corps of Engineers (ACOE) has conducted numerous hydrodynamic and eutrophication modeling studies in the greater harbors area (Seabergh and Outlaw, 1984; Seabergh, 1985; CERC, 1990; Hall, 1990; Hall, 1995; Wang et al., 1995; Miller et al., 1998; Bunch, et al., 2000, 2002, 2003) using the proprietary CH3D hydrodynamic and CE-QAUL-IC water quality models. No previous modeling efforts have addressed the fate and transport of sediment adsorbed toxic metals and organic compounds in the greater harbor waters.

The Environmental Fluid Dynamics Code (EFDC) (Hamrick, 1992; Hamrick and Wu; 1997; Park et al., 1995) was selected for this study for a number of reasons. The EFDC model includes all required model components (hydrodynamic, sediment transport, and contaminant transport and fate) and is in the public domain, as well as being supported by the U. S. Environmental Protection Agency (EPA). The EFDC model has been used for more than 100 surface water modeling applications including nutrient TMDL development (Wool et al., 2003; Zou et al., 2006) and metals and organic contaminant fate and transport at conventional (Ji et al., 2002; King County, 1999) and superfund sites (U. S. EPA, Region 1, 2006; U. S. EPA Region 10, 2006). An EFDC model was developed by the Port of Los Angeles for the Dominguez Channel estuary and the Consolidated Slips.

The EFDC modeling framework to support TMDL development in the greater harbors systems was undertaken in a sequence of steps. The first step was configuration and calibration of the model hydrodynamic component, including

salinity and temperature transport. This step was followed by the configuration and calibration of the sediment transport and contaminant fate and transport components. Both of these steps utilized results from two complimentary studies. Fresh water inflow and associated sediment and contaminant loads were provided by LSPC models of the near shore watersheds and the three larger watersheds (Dominguez Channel, Los Angeles River, and San Gabriel River watersheds) (Tetra Tech, 2006). The EFDC model had previously been applied to simulate sediment and metals transport in the tidal region of Dominguez Channel (Everest, 2006). The model grid used in the Dominguez study was adopted for this study. Field observations collected during that study were also used for model calibration and validation in this current effort. This report summarizes the configuration and calibration of the hydrodynamic, sediment transport, and contaminant transport and fate components of this modeling system.

3. Observational Data for Model Configuration and Calibration

Observational data for the hydrodynamic model falls within two general classes: data used for model configuration and data used for model calibration. Model configuration data includes the water body shoreline, bathymetry, data used for specifying hydrodynamic and salinity and temperature boundary conditions, atmospheric wind and thermal forcing, and inflows. Calibration data includes observations of hydrodynamic variables predicted by the modeling including water surface elevation, horizontal currents, salinity, temperature, and dye tracer concentration.

Table 1 summarizes the observational data currently used for hydrodynamic model configuration and calibration. Data listed in Table 1 and used for the hydrodynamic model configuration and calibration are discussed later in this report. It is useful to summarize that the available observational data for hydrodynamic model configuration are very adequate, while the data for model calibration could be judged as less adequate. The available data being used for calibration are limited to two tide gauges, four current meters within the breakwater, six current meters outside the breakwater in San Pedro Bay, and approximately 120 salinity and temperature monitoring stations.

The adequacy of the data for calibration relates strongly to the hydrodynamic characteristics of the greater harbors system. Previous modeling studies by the ACOE indicated that water surface elevation amplitude and phase vary insignificantly in the system and that the long-term NOAA tide gauge record is representative of the entire system. Recent current meter observations within the breakwater (POLA Prop 13, Table 1) have been confined to the inner regions of Los Angeles Harbor. Current meter observations outside the breakwater (LSCSD Palos Verde Shelf, Table 1) were useful in developing boundary conditions, but are far removed from the primary area of interest.

Table 1. Data Used for Hydrodynamic Model Configuration and Calibration

Data Type	Use	Source
Shoreline, Breakwaters and Fairways	Model Grid Generation	NOAA Electronic Navigation Charts
Bathymetry	Primary Model Bathymetry Configuration	NOAA High Resolution Coastal Relief Bathymetric Data Set
Bathymetry	Local Model Bathymetry Configuration	NOAA Electronic Navigation Charts
Bathymetry	Local Model Bathymetry Configuration	Port of Los Angeles
Tide Gauge Record at Port of Los Angeles	Development of Tidal Boundary Conditions and Tidal Elevation Calibration	NOAA Center for Operational Oceanographic Products and Services
Port of Los Angeles Prop 13 Current Meter Record	Tidal Elevation Calibration	Electronic Data Provided to US EPA by Study Contractor
LSCSD Palo Verde Shelf Study Current Meter and CTD Records	Development of Tidal and Temperature Boundary Conditions and Tidal Current Calibration	Electronic Data Provided to US EPA by Study Contractor (SAIC, 2004)
Port of Los Angeles Prop 13 Current Meter Record	Tidal Current Calibration	Electronic Data Provided to US EPA by Study Contractor
Stream Flow Records	Dominguez Channel Los Angeles and San Gabriel River Inflows	County of Los Angeles, Department of Public Works
WWTP Discharge Record	Terminal Island Treatment Plant Discharge	City of Los Angeles
Wind Speed and Direction Records	Wind Forcing	NOAA National Climate Data Center LAX Airport Station
Wind Speed and Direction Records	Wind Forcing	California Irrigation Management System, Long Beach and Santa Monica Station
Wind Speed and Direction Records	Wind Forcing	NOAA National Data Buoy Center Stations 46025, 46086
Atmospheric Temperature, Relative Humidity, Solar Radiation and Cloud Cover Records	Atmospheric Thermal Forcing	NOAA National Climate Data Center LAX Airport Station
Atmospheric Temperature, Relative Humidity, Solar Radiation and Cloud Cover Records	Atmospheric Thermal Forcing	California Irrigation Management System, Long Beach and Santa Monica Stations
Salinity and Temperature Monitoring Data	Transport Calibration and Temperature Calibration	City of Los Angeles
Salinity and Temperature Monitoring Data	Transport Calibration and Temperature Calibration	Harbor Generating Station
Salinity and Temperature Monitoring Data	Transport Calibration and Temperature Calibration	Port of Los Angeles
Salinity and Temperature Monitoring Data	Transport Calibration and Temperature Calibration	Port of Los Angeles & Port of Long Beach Biological Baseline Study
Port of Los Angeles Prop 13 Salinity, Temperature and Dye Data	Transport Calibration	Electronic Data Provided to US EPA by Study Contractor
Port of Long Beach Tide Gauge and Current Meter Data	Tidal Elevation	Horizontal ADCP Monitoring Pier J Basin Winter Monitoring Report (Moffatt & Nichol, 2004)
Salinity and Temperature Monitoring Data (Bight 03 data on stormwater runoff and dispersion)	Transport Calibration and Temperature Calibration	SCCWRP and others

Table 1 lists a number of discrete salinity and temperature monitoring studies, representing approximately 120 stations. With respect to temperature, these data are very adequate. However because temperature variability is primarily temporal, model temperature prediction is more of a measure of correctness of atmospheric thermal forcing rather than hydrodynamic transport. The adequacy of the salinity observations in these monitoring data sets is very limited. This is due to the climate and hydrology of the area that results in significant salinity variability being associated with episodic freshwater inflow events. Of the 120 monitoring stations, only 20 have observations corresponding to times when the salinity is significantly less than the 32 to 33 ppt level characteristic of the greater harbors system. Further, at these 20 stations, there are only three observations per station showing depressed salinity.

Table 2 summarizes data used for sediment transport and contaminant fate and transport configuration and calibration. These data are described in detail throughout sections 7 and 8 and their associated appendices.

Table 2. Data Used for Sediment and Contaminant Model Configuration and Calibration

Data Description	Use	Source
POLA/POLB – Sediment bed physical data (2006)	Sediment Bed Physical Model Initialization	Electronic Data Provided to US EPA by Study Contractor
Bight 03 – Sediment bed physical data (2003)	Sediment Bed Physical Model Initialization	Electronic Data Provided by SCCWRP
Bight 94 – Sediment bed physical data (1994)	Sediment Bed Physical Model Initialization	Contaminated Sediments Task Force Database
Bight 98 – Sediment bed physical data (1998)	Sediment Bed Physical Model Initialization	Contaminated Sediments Task Force Database
POLA/POLB Biological Baseline Study – Sediment bed physical data (2000)	Sediment Bed Physical Model Initialization	Electronic Reports Provided to US EPA
Bay Protection and Toxic Cleanup – Sediment bed physical data (1997)	Sediment Bed Physical Model Initialization	Contaminated Sediments Task Force Database
Western EMAP – Sediment bed physical data (1999)	Sediment Bed Physical Model Initialization	Contaminated Sediments Task Force Database
POLA/POLB Special Studies (1998-2001) POLA Berth 100 Final Report POLA Berth 121, 122-124 Final Rprt 2/2 POLA Berth 240B Final Report POLA Berths 148-151 Sed Test POLA Berths 167-169 Sed Tests POLA Berths 212-215 Sed Tests POLA Berths 263-264 Sed Tests POLA Slip 5 Sed Tests POLA West Ch B40-44 Sed Testing POLB Contract HD5951 POLB Pier J, East Channel Dredge POLB Pier S Dredging, Final Report POLB West Basin, 8/98 Sed Testing	Sediment Bed Physical Model Initialization	Contaminated Sediments Task Force Database

Data Description	Use	Source
Harbor Generating Station - Sediment chemistry data (2001-2003)	Sediment Bed Chemistry Model Initialization	Electronic Data Provided to US EPA by Contractor during 303(d) data compilation efforts
Terminal Island Treatment Plant - Sediment chemistry data (2001-2003)	Sediment Bed Chemistry Model Initialization	Electronic Data Provided to US EPA by City of Los Angeles, Environmental Monitoring Division
EPA/POLA/AMEC - Sediment chemistry data (2002)	Sediment Bed Chemistry Model Initialization	Electronic Data Provided to US EPA by Study Contractor
Bight 03 – Sediment chemistry data (2003)	Sediment Bed Chemistry Model Initialization	Electronic Data Provided by SCCWRP
POLA/POLB – Sediment chemistry data (2006)	Sediment Bed Chemistry Model Initialization	Electronic Data Provided to US EPA by Study Contractor
POLA/POLB – Overlying water chemistry data (2006)	Water Column Chemistry Calibration	Electronic Data Provided to US EPA by Study Contractor
POLA/POLB – Mid-column water chemistry data at POLB stations (2006)	Water Column Chemistry Calibration	Electronic Data Provided to US EPA by Study Contractor
POLA - Mid-column water chemistry data at POLA stations (2005)	Water Column Chemistry Calibration	Electronic Data Provided to US EPA by Port of Los Angeles

4. Model Configuration

The following subsections outline the steps conducted to configure the EFDC hydrodynamic model.

4.1. Model Grid System

A multi-resolution, curvilinear spatial grid of the greater harbors and San Pedro Bay was constructed using the using the Visual Orthogonal Grid Generation (VOGG) grid generation system (Tetra Tech, 2002). Shoreline boundaries for the grid were based on the NOAA/NOS electronic navigation charts in GIS format. The grid and shoreline, with the exception of the Dominguez Channel area, are shown in Figure 1. The Dominguez Channel grid from a previous study was incorporated into the model (Everest, 2006). The grid system uses a multi-domain mapping, unique to the EFDC model, which allow a course resolution outside the breakwater in San Pedro Bay and a finer resolution in the harbors system. The grid has 2,568 horizontal cells. In the vertical, the number of sigma layers is readily changed to allow for use of an optimum number of layers to represent hydrodynamic and transport processes. For this study four vertical layers were used.

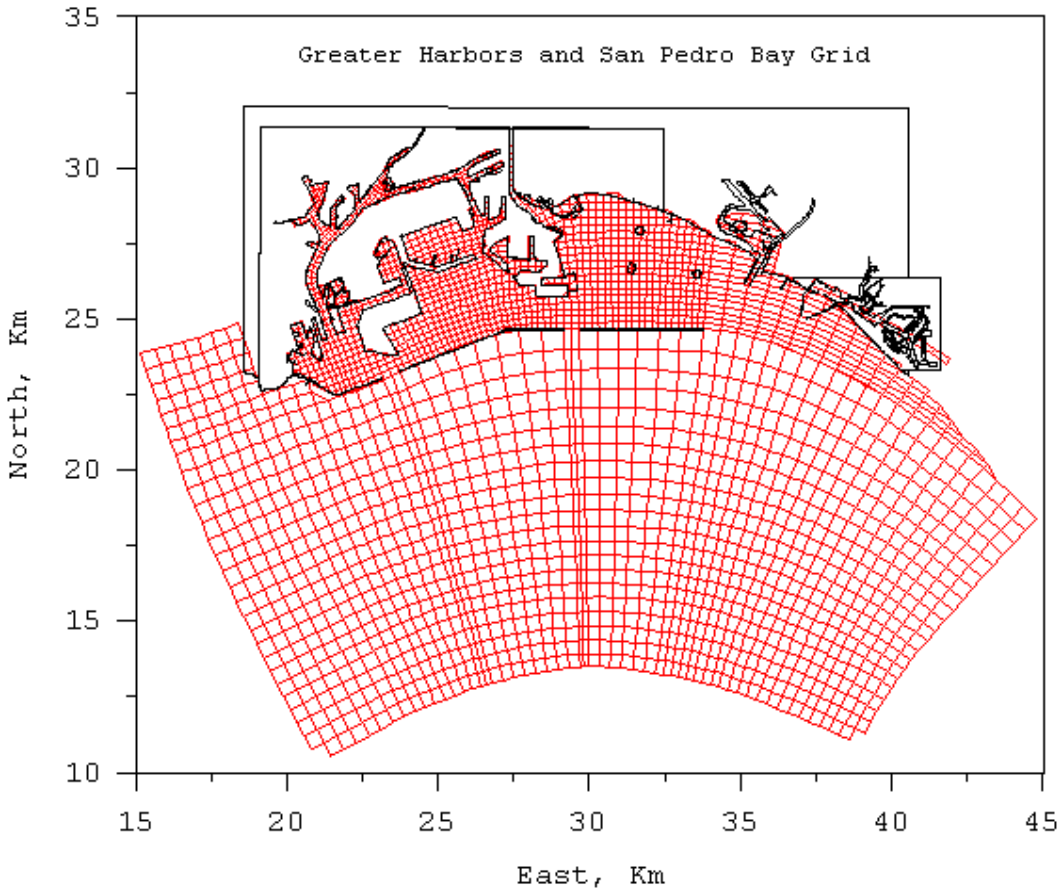
4.2. Bathymetry and Topography

Bathymetric data were interpolated on to the model grid using an average of the bathymetric data points falling within a cell. The primary bathymetric data set

used was the NOAA High Resolution Coastal Relief Data, which has a horizontal resolution of approximately 90 meters. This data set was supplemented by recent bathymetric survey data provided by the Port of Los Angeles. Additional bathymetry adjustments were made by visual comparison of gridded bathymetry with NOAA/NOS electronic navigation charts. Model bathymetry is shown in Figure 2.

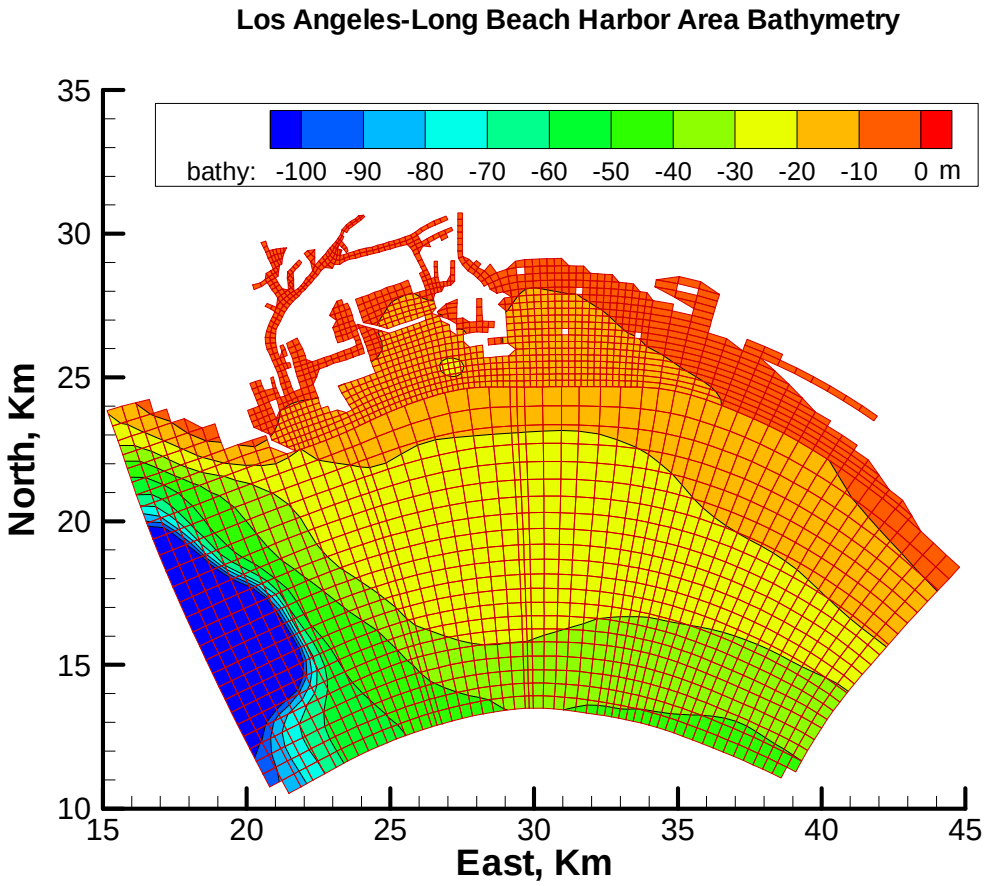
4.3. Selection of Temporal Simulation Period

The hydrodynamic and transport model was configured for a four-year historical simulation period spanning January 2002 through December 2005, since this period encompasses the greatest density of observational data for model calibration.



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

Figure 1. Greater harbors and San Pedro Bay grid



Note: Elevation in meters relative to local mean sea level.

Figure 2. Los Angeles-Long Beach Harbor area bathymetry

4.4. Open Boundary Hydrodynamic Forcing

Circulation in the greater harbor system is forced by water surface elevation and transport along the grid boundaries in San Pedro Bay. The hydrodynamic boundary condition used along the three open boundaries is a radiation separation condition of the form

$$\zeta - \frac{\mathbf{n}\cdot\mathbf{u}H}{\sqrt{gH}} = 2\zeta_R \qquad (1)$$

where ζ is the water surface elevation relative to a sea-level data, **n** is the outward normal vector to the boundary, **u** is the horizontal barotropic velocity vector, H is the water depth, and ζ_R is the equivalent progressive wave amplitude.

Along the open boundaries, the water surface elevation is composed of periodic tidal components and a transient or low frequency component in the sub-tidal frequency spectrum. The equivalent incoming wave boundary condition (1) was specified as the sum of a low frequency component and harmonic components, described by equation (2):

$$\zeta_R = \zeta_{LF} + \sum_{m=1}^{M} \left(\zeta_{RCm} \cos(\omega_m t) + \zeta_{RSm} \sin(\omega_m t) \right) \quad (2)$$

where *M* is the number of tidal constituents, ζ_{RCm} and ζ_{RSm} are cosine and sine amplitudes at frequency ω_m. Six harmonics constituents (M2, S2, N2, K1, O1, and P1) were used. Since observational data were not available along the open boundaries, the tidal frequency components of the incoming wave open boundary condition were estimated by an optimization based inverse procedure to obtain a best fit prediction of water surface elevation and current meter observations within the model domain shown in Figure 3.

4.5. Salinity and Temperature Open Boundary Conditions

Salinity and temperature open boundary conditions were specified as spatially constant and temporally varying along the open boundary. The salinity boundary condition was based on fitting monitoring data to a seasonally varying function with an adjustment factor to account for higher salinities in San Pedro Bay. The adjustment factor was calibrated. The temperature boundary condition was based on fitting the Palos Verde Shelf station A8 CTD record (SAIC, 2004) to a seasonally varying function.

4.6. Wind and Atmospheric Forcing

Wind speed and direction and atmospheric thermal conditions including air temperature, relative humidity, rainfall, solar short wave radiation, and cloud cover data were obtained from the NOAA National Climate Data Center for Los Angeles International Airport (LAX). These data were supplemented by California Irrigation Management Information System observational data for Long Beach and Santa Monica and NOAA National Data Buoy Center observational data for off shore stations 46025 and 46086. The resulting model wind forcing is a spatially variable weighted average taking into account regional topographic conditions, while the atmospheric thermal forcing is spatially uniform and based on a composite of the various data sets. The NOAA Ports observational system for Los Angeles and Long Beach Harbors began providing wind speed and direction data for seven stations in May 2005. Since these data spanned only 25 percent of the 2003-2005 simulation and did not cover the high freshwater inflow events of January 2003 and December 2004 to February 2005, they were not used in the current model configuration. In addition, during the period of May

2005 to December 2005, there were no salinity data to evaluate whether these data would improve model performance. However they should be considered for use in potential update model configurations if the simulation intervals are expanded into 2006 and beyond (when additional observational data may be available to further evaluate model performance).

4.7. Fresh Water Inflow

Fresh water inflow along the boundaries of the model domain is introduced for Dominguez Channel, the Los Angeles River, and the San Gabriel River. For these three sources, inflow data provided by the Los Angeles County Department of Public Works or from LSPC models (Tetra Tech, 2006) can be used. Terminal Island Treatment Plant Discharges, provided by the City of Los Angeles, were introduced into the interior model grid cell at the corresponding diffuser location. Non-point source freshwater inflows corresponding to 67 local near shore watersheds were provided by the LSPC watershed model (Tetra Tech, 2006).

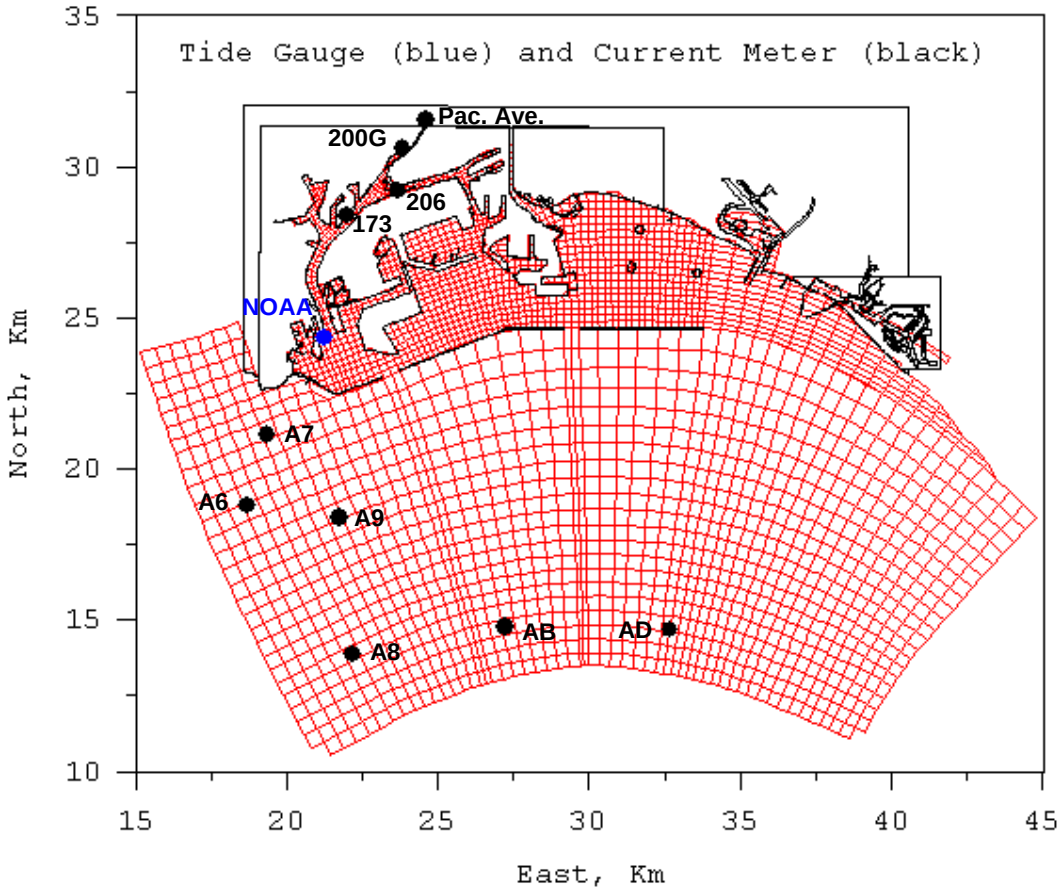


Figure 3. Location of Tide Gauge (blue) and Current Meters (black)

5. Hydrodynamic Calibration

Hydrodynamic model calibration involved the adjustment of open boundary forcing, bottom roughness, and bottom elevations to obtain a general best agreement between model predictions and observations of water surface elevation and horizontal currents. Quantitative evaluation of the hydrodynamic calibration is based on comparison of observed and model predicted harmonic amplitudes and phases of tidal water surface elevation and currents and time series error analysis of observed and low frequency water surface elevation. The following subsections summarize the steps followed in the calibration process.

5.1. Tidal Frequency Water Surface Elevation

Tidal frequency water surface elevation calibration is based on comparison of observed and model predicted tidal constituent amplitudes and phases at the NOAA Los Angeles Harbor tide gauge shown in Figure 3 and water surface elevation records at four Los Angeles inner harbor current meter stations also shown in Figure 3. Tables 3 through 7 summarize the comparisons for these five locations. For the NOAA gauge (Table 3) four of the six constituents have normalized amplitude errors less than 1 percent (0.01). The normalized amplitude error for the N2 constituent is approximately 10 percent, but is acceptable because the N2 constituent is of secondary importance. Absolute phase error for the dominant M2 constituent is just over 1 minute. Agreement between observed and predicted constituent amplitudes and phases is reasonably good for inner harbor stations 206B (Table 4) and 173 (Table 5), which also indicate that there is little change in amplitude and phase throughout the system consistent with previous model study findings. For station 200G (Table 6), the harmonic analysis of the data essentially failed and model predictions are tabulated to support the conclusion of marginal amplitude and phase variability. For the Pacific Avenue station in Dominguez Channel (Table 7), the amplitude and phase errors are large for all constituents. The failure of harmonic analysis to resolve the data at station 200G (Table 6) and the disagreement at Pacific Avenue (Table 7) is likely due to a large number of default entries in the data records. As will be shown in section 5.3, model comparison with current meter data at these two stations is more reasonable.

5.2. Low Frequency Water Surface Elevation

Low frequency or sub-tidal water surface elevation in the greater harbors responds to low-frequency sea level variability in San Pedro Bay with negligible amplitude and phase variation. Figure 4 shows a comparison of model predicted and observed low frequency sea level at the Los Angeles Harbor NOAA Tide Gauge. Time series error analyses for the observed and predicted low frequency

sea level are summarized in Table 8. These, and other, model performance measures are described in Appendix B.

Table 3. Water Surface Elevation Tidal Constituents Comparison at NOAA Gauge

Tidal Constituent	Observed Amplitude (meters)	Modeled Amplitude (meters)	Amplitude Error (|Observed-Modeled|/Observed)	Observed Phase (seconds)	Modeled Phase (seconds)	Phase Error (Seconds)
M2	0.503	0.505	0.004	27434	27498	64
S2	0.203	0.202	0.005	31335	31149	186
N2	0.119	0.119	0.000	31824	31657	167
K1	0.371	0.364	0.019	19854	19095	759
O1	0.246	0.240	0.024	7829	7082	747
P1	0.107	0.102	0.047	22894	26560	3666

Table 4. Water Surface Elevation Tidal Constituents Comparison at 206B Gauge

Tidal Constituent	Observed Amplitude (meters)	Modeled Amplitude (meters)	Amplitude Error (|Observed-Modeled|/Observed)	Observed Phase (seconds)	Modeled Phase (seconds)	Phase Error (Seconds)
M2	0.500	0.508	0.016	27273	27489	216
S2	0.219	0.204	0.068	31102	31123	21
N2	0.120	0.119	0.008	31436	31664	228
K1	0.380	0.366	0.037	18958	19214	256
O1	0.254	0.241	0.051	8891	7136	1755
P1	0.102	0.103	0.010	22507	26241	3734

Table 5. Water Surface Elevation Tidal Constituents Comparison at 173 (Data File Borx) Gauge

Tidal Constituent	Observed Amplitude (meters)	Modeled Amplitude (meters)	Amplitude Error (|Observed-Modeled|/Observed)	Observed Phase (seconds)	Modeled Phase (seconds)	Phase Error (Seconds)
M2	0.575	0.508	0.116	27065	27502	437
S2	0.250	0.203	0.188	31921	31127	794
N2	0.135	0.119	0.118	32390	31667	723
K1	0.400	0.366	0.085	18089	19217	1128
O1	0.303	0.241	0.204	9299	7136	2163
P1	0.086	0.103	0.197	23452	26229	2777

Table 6. Water Surface Elevation Tidal Constituents Comparison at 200G (Data file Barg) Gauge

Tidal Constituent	Observed Amplitude (meters)	Modeled Amplitude (meters)	Amplitude Error (|Observed-Modeled|/Observed)	Observed Phase (seconds)	Modeled Phase (seconds)	Phase Error (Seconds)
M2	0.163	0.508		21967	27503	
S2	0.614	0.204		19966	31129	
N2	0.070	0.119		33352	31670	
K1	0.664	0.366		30625	19217	
O1	0.160	0.241		12668	7138	
P1	0.809	0.103		25720	26251	

Table 7. Water Surface Elevation Tidal Constituents Comparison at DC Pacific Avenue Gauge

Tidal Constituent	Observed Amplitude (meters)	Modeled Amplitude (meters)	Amplitude Error (|Observed-Modeled|/Observed)	Observed Phase (seconds)	Modeled Phase (seconds)	Phase Error (Seconds)
M2	0.897	0.510	0.431	39765	27705	12060
S2	0.378	0.204	0.460	18710	31333	12623
N2	0.245	0.119	0.510	44224	31909	12315
K1	0.361	0.370	0.025	39878	19428	20450
O1	0.225	0.242	0.076	30302	7349	22953
P1	0.148	0.102	0.310	45411	26159	19252

Table 8. Instantaneous and Low Frequency Water Surface Elevation Statistical Comparison at NOAA Gauge

Statistical Measure	Instantaneous	Low Frequency
Mean Error (meters)	0.001	0.001
Absolute Mean Error (meters)	0.122	0.003
Maximum Absolute Error (meters)	0.670	0.047
RMS Error (meters)	0.168	0.004
RMS Error/RMS Observed	0.324	0.058
Linear Regression Intercept (meters)	0.001	0.001
Linear Regression Slope	0.959	0.993
Correlation Coefficient	0.986	0.997
Skill (0 to 1, 1 being perfect)	0.973	0.999

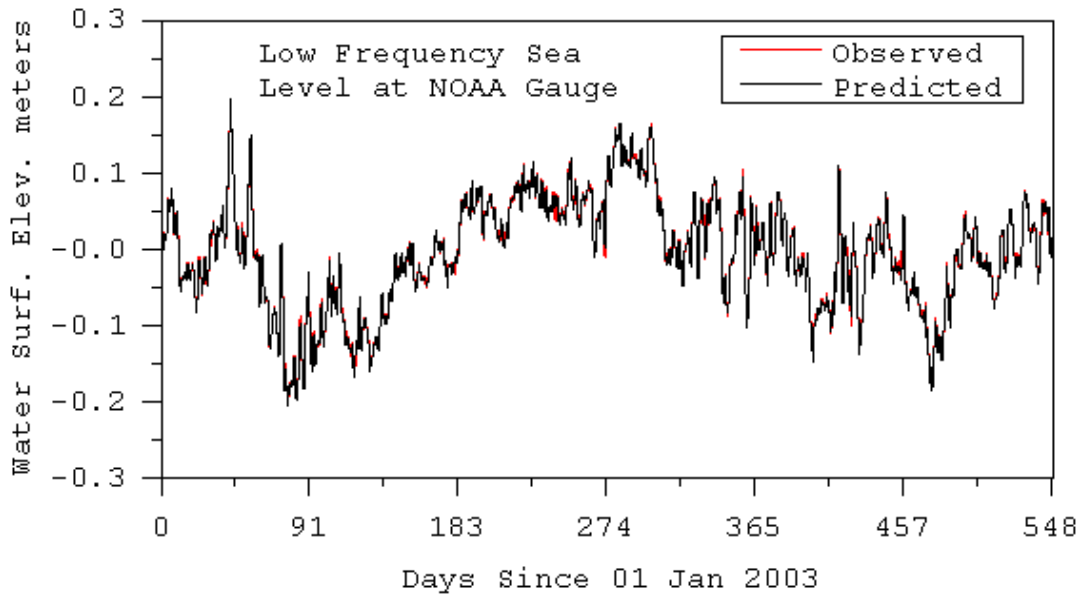


Figure 4. Low frequency sea level comparison at NOAA tide gauge in Los Angels Harbor

5.3. Tidal Frequency Currents

Table 9 through Table 14 summarize the comparison of horizontal tidal current major axis amplitudes, phases, and orientation angles at six Palos Verde Shelf current meter locations for the six primary tidal constituents. The locations correspond to the six current meter locations outside the breakwater shown in Figure 3. Although absolute quantitative agreement between the observations and model predictions is poor, the qualitative agreement is reasonable in that current magnitudes are similar and phases are consistent. Predicted major axis orientations are generally good having angular errors of less than 20 degrees.

Tables 15 through 20 summarize the comparison of horizontal tidal current major axis amplitudes, phases, and orientation angles at the four Los Angeles Inner Harbor current meter locations shown in Figure 3. Tidal currents are weak at the 173, 200G, and 206B stations and on the order of 2 cm/sec or less for all constituents. However, the model predicted major axis amplitudes and phases compare reasonably well at these three stations and directions. The Pacific Avenue station in Dominguez Channel has much stronger currents and the model predicted major axis amplitudes, phase, and directions compare well with the observations. The strong agreement between model predicted currents at the Pacific Avenue station tends to support the conclusion that water surface elevation observations at this station are compromised.

Table 9. Horizontal Current M2 Major Axis Amplitude, Orientation and Phase Comparison at Palo Verde Shelf Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
PV A6	0.053	0.023	9126	8091	160	170
PV A7	0.096	0.047	10840	9709	179	180
PV A8	0.047	0.060	5084	4326	145	152
PV A9	0.069	0.059	7843	9190	171	15 (195)
PV AB	0.053	0.077	2731	5080	141	161
PV AD	0.052	0.050	21788	3125	126	117

Table 10. Horizontal Current S2 Major Axis Amplitude, Orientation and Phase Comparison at Palo Verde Shelf Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
PV A6	0.027	0.014	17329	17372	175	178
PV A7	0.050	0.028	18703	17986	2	0
PV A8	0.024	0.031	13561	14130	131	155
PV A9	0.032	0.033	16132	17200	174	15 (195)
PV AB	0.028	0.043	10211	14209	151	169
PV AD	0.021	0.022	7372	12358	136	127

Table 11. Horizontal Current N2 Major Axis Amplitude, Orientation and Phase Comparison at Palo Verde Shelf Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
PV A6	0.012	0.007	14608	12120	166	166
PV A7	0.025	0.013	14521	13794	0 (180)	179
PV A8	0.009	0.017	8373	8419	121	155
PV A9	0.016	0.015	12077	13427	152	15
PV AB	0.012	0.021	6201	9430	145	162
PV AD	0.012	0.013	827	8026	105	112

Table 12. Horizontal Current K1 Major Axis Amplitude, Orientation and Phase Comparison at Palo Verde Shelf Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
PV A6	0.034	0.024	4924	7573	129	82
PV A7	0.048	0.031	42864	32391	162	4 (184)
PV A8	0.032	0.056	2027	11750	104	152
PV A9	0.046	0.056	2086	29650	131	17
PV AB	0.036	0.058	39852	19312	125	154
PV AD	0.031	0.043	42692	42053	141	21

Table 13. Horizontal Current O1 Major Axis Amplitude, Orientation and Phase Comparison at Palo Verde Shelf Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
PV A6	0.026	0.019	37240	40430	143	74
PV A7	0.034	0.022	38133	22097	170	3 (183)
PV A8	0.014	0.036	39197	91780	110	154
PV A9	0.025	0.040	36670	17039	149	16
PV AB	0.018	0.039	34854	6872	138	152
PV AD	0.017	0.027	33163	26160	140	0 (180)

Table 14. Horizontal Current P1 Major Axis Amplitude, Orientation and Phase Comparison at Palo Verde Shelf Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
PV A6	0.006	0.007	6472	15643	116	77
PV A7	0.005	0.009	3839	39296	112	0 (180)
PV A8	0.008	0.015	42175	19610	134	153
PV A9	0.007	0.015	41014	36314	39	16
PV AB	0.010	0.017	39484	26896	51	153
PV AD	0.010	0.012	1007	3990	99	13

Table 15. Horizontal Current M2 Major Axis Amplitude, Orientation and Phase Comparison at Los Angeles Inner Harbor Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
206 B	0.021	0.017	19382	21780	1	14
200G	0.023	0.019	15881	14407	57	29
173	0.020	0.026	10989	12645	59	53
DC PA	0.365	0.317	17542	17306	64	60

Table 16. Horizontal Current S2 Major Axis Amplitude, Orientation and Phase Comparison at Los Angeles Inner Harbor Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
206 B	0.005	0.007	2543	6861	4	14
200G	0.010	0.008	20890	17170	54	26
173	0.008	0.014	19476	16920	60	53
DC PA	0.156	0.119	21958	21340	64	60

Table 17. Horizontal Current N2 Major Axis Amplitude, Orientation and Phase Comparison at Los Angeles Inner Harbor Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
206 B	0.005	0.004	21792	25047	7	14
200G	0.004	0.004	22337	18580	54	26
173	0.005	0.006	15018	16930	62	53
DC PA	0.082	0.072	22027	21350	64	60

Table 18. Horizontal Current K1 Major Axis Amplitude, Orientation and Phase Comparison at Los Angeles Inner Harbor Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
206B	0.008	0.004	42848	27923	1	14
200G	0.008	0.005	468	24060	61	29
173	0.002	0.014	1353	38330	62	52
DC PA	0.138	0.125	41512	40890	64	60

Table 19. Horizontal Current O1 Major Axis Amplitude, Orientation and Phase Comparison at Los Angeles Inner Harbor Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
206B	0.007	0.004	27528	39638	-2	14
200G	0.004	0.006	32331	9203	66	26
173	0.002	0.006	38429	20710	60	53
DC PA	0.086	0.075	32783	31020	63	60

Table 20. Horizontal Current P1 Major Axis Amplitude, Orientation and Phase Comparison at Los Angeles Inner Harbor Current Meter Stations

Station	Observed Major Amplitude (m/s)	Modeled Major Amplitude (m/s)	Observed Phase (seconds)	Modeled Phase (seconds)	Observed Angle (degrees CCW from East)	Modeled Angle (degrees CCW from East)
206B	0.005	0.005	15789	24410	-4	14
200G	0.003	0.001	3300	8369	54	26
173	0.003	0.007	28868	37500	65	53
DC PA	0.004	0.025	2950	3126	61	60

6. Transport Calibration

Transport calibration involves the quantitative comparison of model predicted and observed concentrations of dissolved and suspended material in the water column. For freshwater influenced estuarine and coastal waterbodies, salinity transport calibration provides an additional level of confidence in model predictive

ability, particularly in the absence of extensive current meter observations. Model prediction of temperature is generally more sensitivity to wind and atmospheric thermal forcing rather than hydrodynamic transport, the exception being situations that have large thermal loads from power plants. In the absence of significant salinity variability, simulation of other tracers, including dye, is also an important means of transport calibration. This section presents the results of model calibration for salinity. Temperature simulation is typically not conducted for modeling applications directed at simulating sediment and contaminant transport and fate, unless temperature stratification and thermal buoyancy induced current contribute significantly to transport processes. Evaluation of temperature observations in the greater harbors systems indicates that this is not the case and temperature is not simulated. Model configuration and calibration for sediment and adsorptive contaminant transport calibration are presented in sections 7 and 8, respectively.

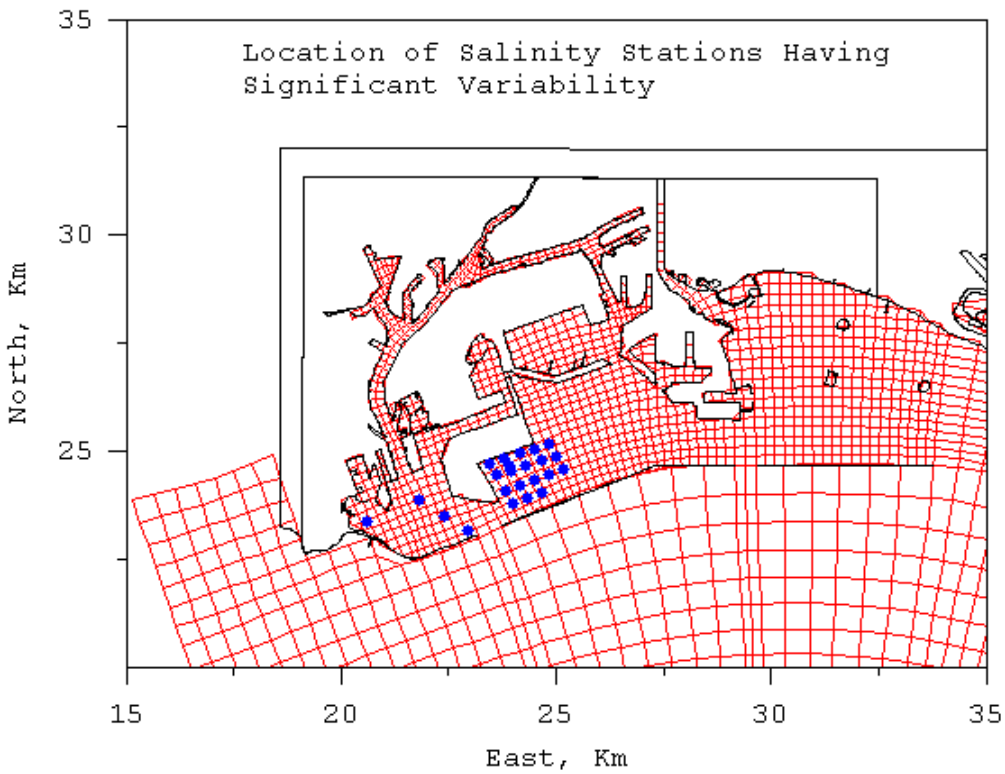
6.1. Salinity Calibration

Salinity calibration involves the adjustment of salinity open boundary conditions and possibly freshwater inflows if there is significant uncertainty associated with the inflows. Although there are approximately120 salinity monitoring stations, only 20 of those stations, whose locations are shown in Figure 5, have significant salinity variability (when the salinity is significantly less than the 32 to 33 ppt level characteristic of the greater harbors system). Bight 03 event stations in San Pedro Bay (Figure 6) did not show salinity variations significant enough for comparison with model predictions. Figure 7 shows a scatter plot comparing predicted and observed data for the 20 station locations shown in Figure 5. The surface and bottom notation corresponds to averages over the upper and lower halves of the water column. The data comparison points correspond to seven sampling times (Julian Days 16, 44, and 72 of 2003, Julian Day 351 of 2004, and Julian Days 13, 55, and 68 of 2005), three of which (44 of 2003 and 13 and 55 of 2005) correspond to depressed observed salinity. Predicted salinities over the lower half of the water column agree reasonably well with observations although there are a number of stations where the model under predicts salinity. Predicted salinities for the upper half of the water column agree reasonably well at many stations (Figure 7) although the model under predicts surface salinity at the same locations where it under predicts bottom salinity, as illustrated by the close proximity of similar station numbers in Figure 8.

Due to the extreme scatter of the data, lumped error statistics are not particularly meaningful. The salinity response of the model is better represented by time series plots of continuous model simulations of salinity observations at the twenty stations. These plots are presented in Figures A-1 through A-20 of Appendix A. Although point wise agreement is not always good, the model does represent the general response to the high freshwater inflow events represented by the observations. The model tends to under predict observed stratification. There

are a number of possible causes for the salinity under prediction and the under prediction of stratification. Under prediction of stratification might result from too much vertical mixing, which can influence the dynamics of the freshwater plume from the Los Angeles River during storm events. During significant storm events, the freshwater inflows should exit through the gate opening in the breakwater. However, if the dynamics of the freshwater plume are impacted by excessive vertical mixing in the model, the low salinity water could enter into the sampling area (rather than taking the intended path through the gate in the breakwater).

Vertical mixing in the model is predicted by a robust and widely accepted turbulence model having universal parameters. Adjustment of these parameters to force a fit to a spatially and temporally limited observational data, set such as that being discussed here is not considered acceptable. As previously noted, these are the only observations of salinity response to freshwater inflow events in the other regions of the harbor. A more extensive set of observations having a wider spatial coverage over multiple events would be necessary to quantify the dynamics of the freshwater transport and diagnose the cause of the present under prediction. The settling dynamics of particulate matter carrying contaminates can result in contaminant transport patterns different from fresh water making model performance extrapolations speculative.



Note: Stations illustrated are where the salinity during the simulation period is significantly less than the 32 to 33 ppt level characteristic of the greater harbors system.

Figure 5. Location of salinity stations having significant variability

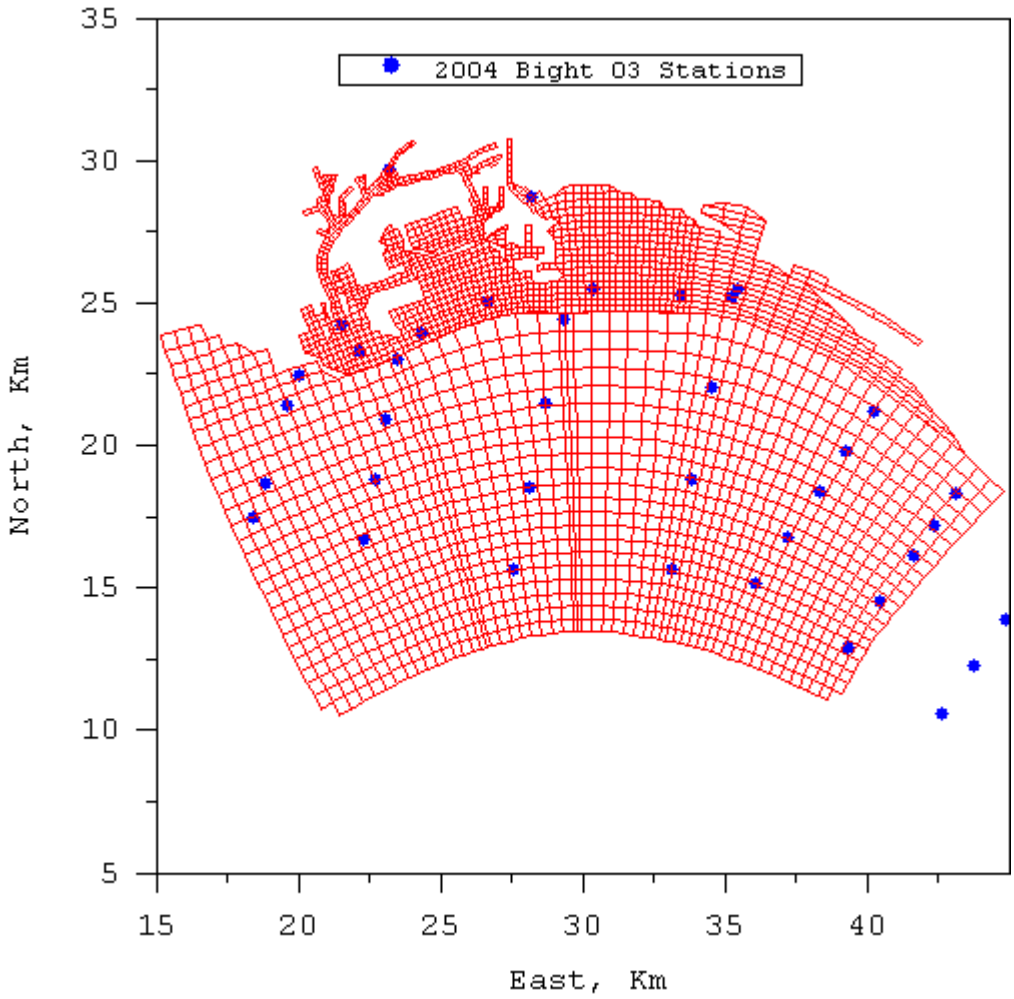


Figure 6. Location of Bight 03 salinity sampling stations

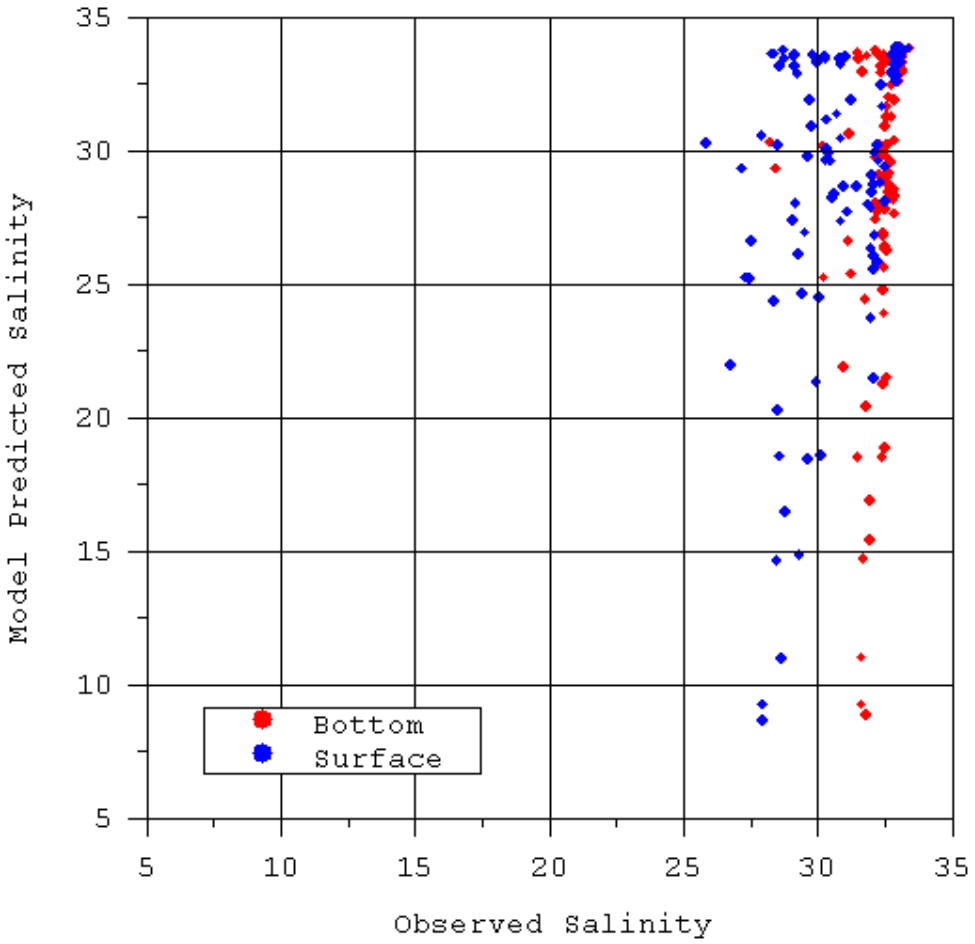


Figure 7. Comparison of predicted and observed salinity at 20 stations during seven monitoring times over upper (surface) and lower (bottom) fractions of the water column

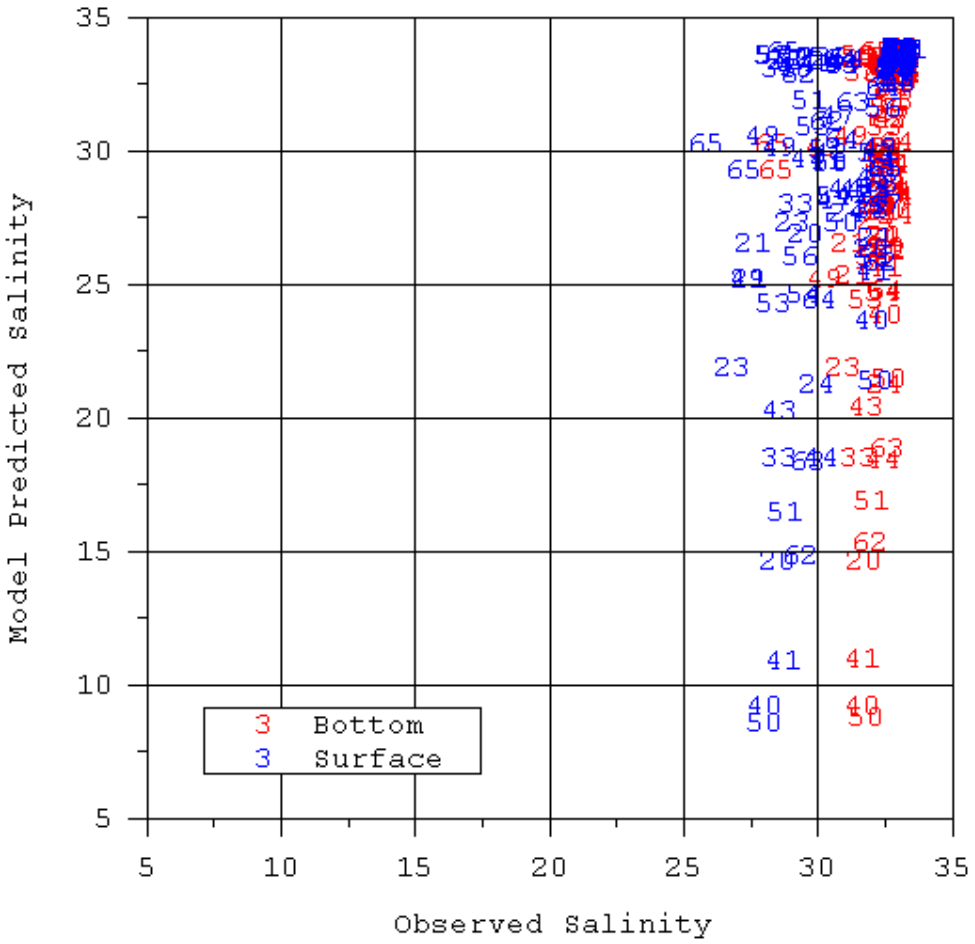


Figure 8. Station numbers associated with the comparison of predicted and observed salinity at 20 stations during seven monitoring times over upper (surface) and lower (bottom) fractions of the water column

7. Sediment and Contaminant Transport Model Configuration

This section describes the configuration of the EFDC based greater harbors model for the simulation of sediment and adsorptive contaminant transport simulation. Sediment and contaminant transport formulations in the EFDC model are documented by Tetra Tech (2007). Both fine, cohesive behaving sediment and noncohesive sand are simulated. Particulate organic material is assumed to be associated with the fine sediment class. Contaminants modeled include three metals; copper, lead, and zinc and three organics; DDT, PAH, and PCB. Two-phase equilibrium partitioning is used to represent adsorption of the metals and organics to the fine sediment class. The EFDC model simulates transport and fate in both the water column and sediment bed. Water column transport includes advection, diffusion, and settling for sediment and sediment adsorbed contaminates. The sediment bed is represented by multiple layers with internal

transport of contaminants by pore water advection and diffusion. Sediment and water is exchanged between the water column and bed by deposition and erosion, with corresponding exchange of adsorbed and dissolved contaminants. Dissolved phase contaminants are also exchanged by diffusion between bed pore water and the overlying water column. The following subsections describe specific aspects of model configuration including: establishment of spatially varying initial conditions in the sediment bed, specification of sediment erosion potential, specification of contaminant partition coefficients, and external loadings and boundary conditions.

7.1. Sediment Bed Initial Conditions

Inter-annual scale simulation of sediment adsorbed contaminants requires establishment of sediment bed initial conditions to the highest possible level of accuracy because the bed can be a significant source and/or sink of contaminants with respect to the water column as well as a reservoir for exposure and subsequent transport up the aquatic food chain. In contrast to water column initial conditions that wash out or rapidly respond to external sources and open boundary conditions, bed initial conditions are persistent with changes in bed sediment composition and contamination levels occurring slowly at annual scales and longer. Initial conditions are required for both sediments and contaminants. Sediment initial conditions influence both sediment transport dynamics and the phase distribution and mobility of contaminants in the bed. Required model initial conditions include sediment size class fractional distribution and a measure of water content such as porosity or void ratio. Organic material composition as specified by particulate or total organic carbon (POC or TOC) is also desirable.

Numerous studies in the greater harbors system have collected sediment bed physical data. However the data sets are quite heterogeneous in that they include near surface samples, composite cores, and depth varying sub-cores having data ranging from fraction of fine sediment to detailed grain size distributions. To achieve the widest spatial coverage, approximately 200 data points were selected, which are distributed among the datasets described in Table 2. Data inside the breakwaters prior to 1998 were excluded while all data outside the break water were used. Grain size information was reduced to two classes, fines composed of silt and clay, and sand and coarser particles, using 0.063 mm as the class size boundary. Water content measures were all converted to porosity. Figure 9 shows the location of 200 data sites having bed sediment size information, while Figure 10 shows a zoom of the most recent sub-set of these data.

Since many of the sites had no information on water content as defined by porosity, correlations between porosity and fine sediment fractions were developed using sites having data for both (Figure 11). The average of these two correlations was used to estimate porosity at sites having no data. Due to

lack of quantitative data in San Pedro Bay, sediment composition near the open boundaries was assumed to be 25 percent fine with a porosity of 0.5. The fine sediment fraction and porosity data including assumed values along the open boundaries in San Pedro Bay were interpolated to the model grid (Figure 1) using a Laplacian scheme which is equivalent to bi-linear interpolation with the exception that interpolation over land is prohibited. Figures 12 and 13 show the bed initial conditions for fine sediment fraction and porosity. The sediment bed was also configured to initially have 4 layers, each 20 cm thick. Sediment size class fractions, porosity, and contaminant concentrations are assumed uniform over the depth of the sediment bed at each horizontal location.

The procedure for establishing initial conditions for contaminants in the sediment bed follows that for sediment physical properties. To again achieve the widest spatial coverage, approximately 250 to 300 data points were selected for each contaminant, which are distributed among the datasets shown in Table 2. Data inside the breakwaters prior to 2000 were excluded while all data outside the breakwater were used. Figure 14 shows the location of all contaminant bed concentration data sites, while Figure 15 shows the location of sites recently sampled in fall 2006. The bed data for sites shown in Figure 15 were used to initialize metals and organics concentrations, while the overlying water data at these stations were used for calibration of sediment and contaminant transport. Since data in San Pedro Bay were extremely limited, bed solid phase concentrations near the open boundaries were estimated to be 10, 10, and 50 mg/kg for copper, lead, and zinc, and 0.01, 0.1, and 0.01 mg/kg for DDT, PAH, and PCB. Figures 16 through 21 show the spatial distribution of total sediment-normalized bed initial conditions for six contaminants using logarithmic concentration scales. For clarification of the logarithmic concentration scales, the log of the pollutant-specific sediment quality guidelines are identified in the figure captions as well as on the concentration legends.

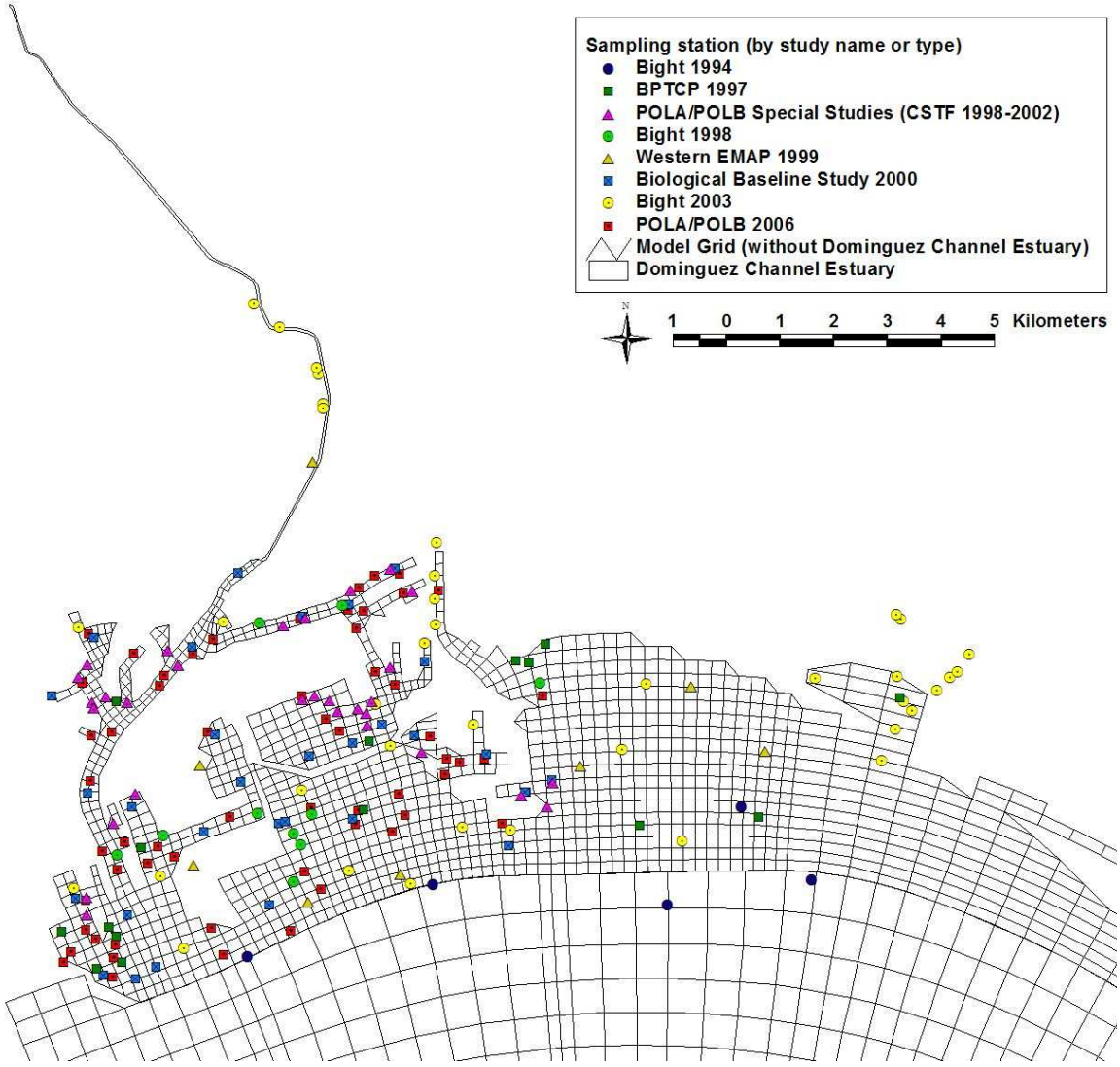
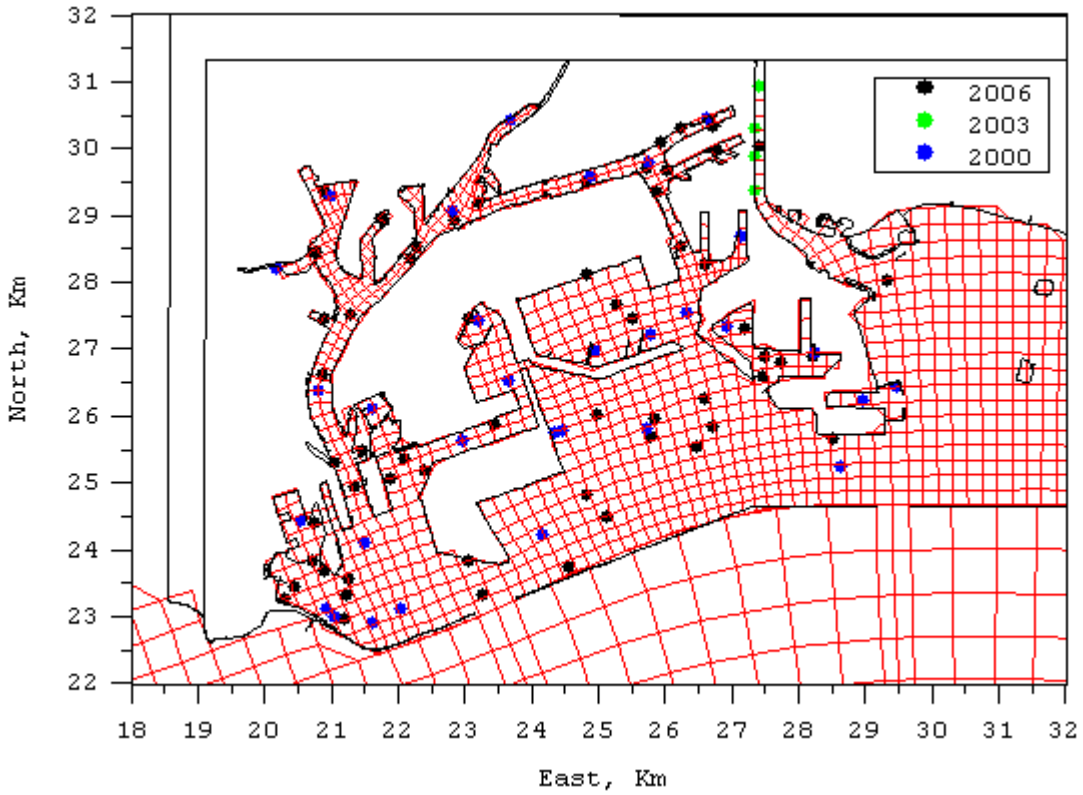


Figure 9. Location of 200 data sites used to initialize sediment bed physical properties



Note: 2006 data points refer to the POLA/POLB fall 2006 sampling; Bight 03 samples are represented by the 2003 points; 2000 data points refer to the POLA/POLB Biological Baseline Study conducted in 2000.

Figure 10. Most recent sediment bed physical data sites inside the breakwater

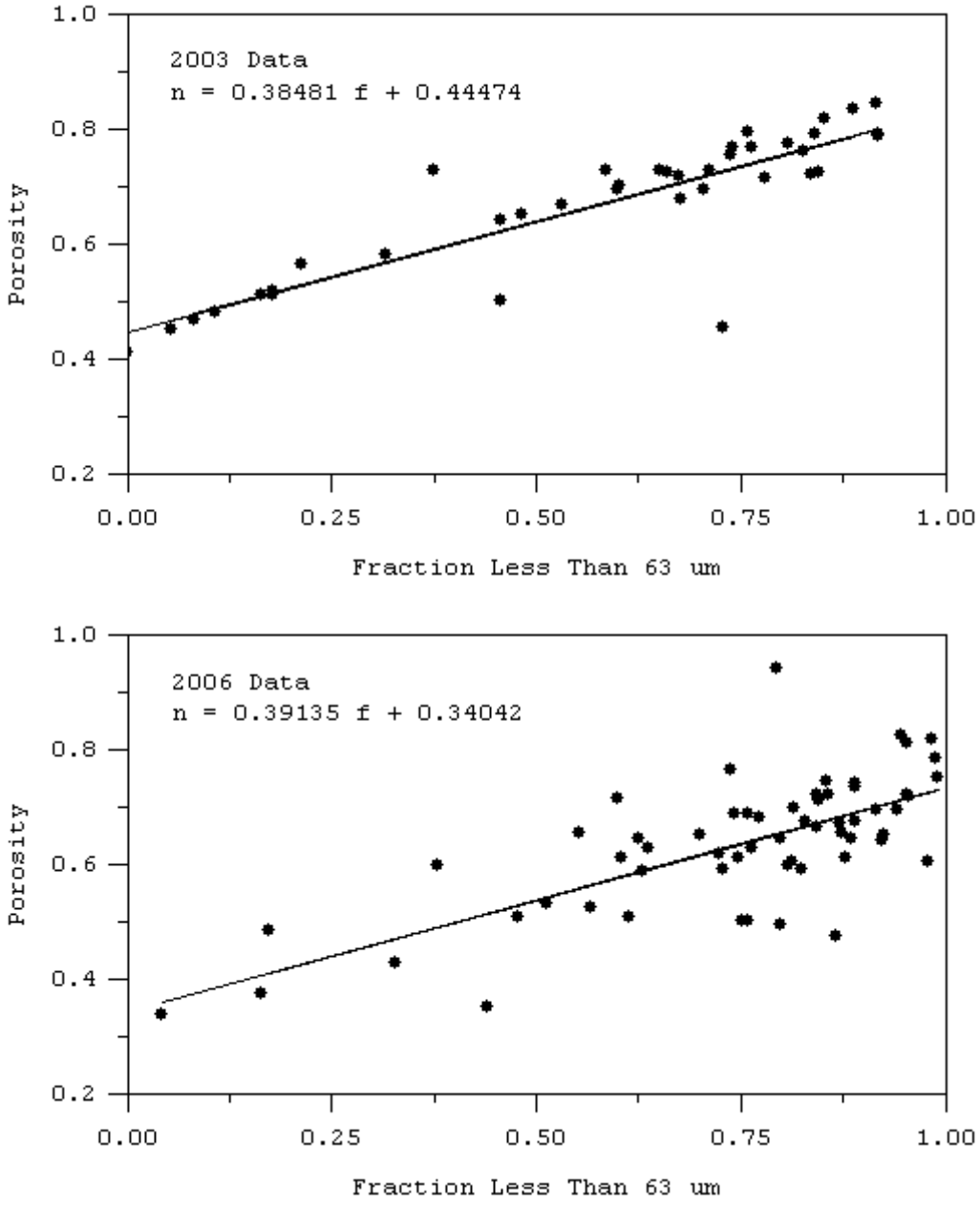


Figure 11. Porosity as a function of fine sediment fraction

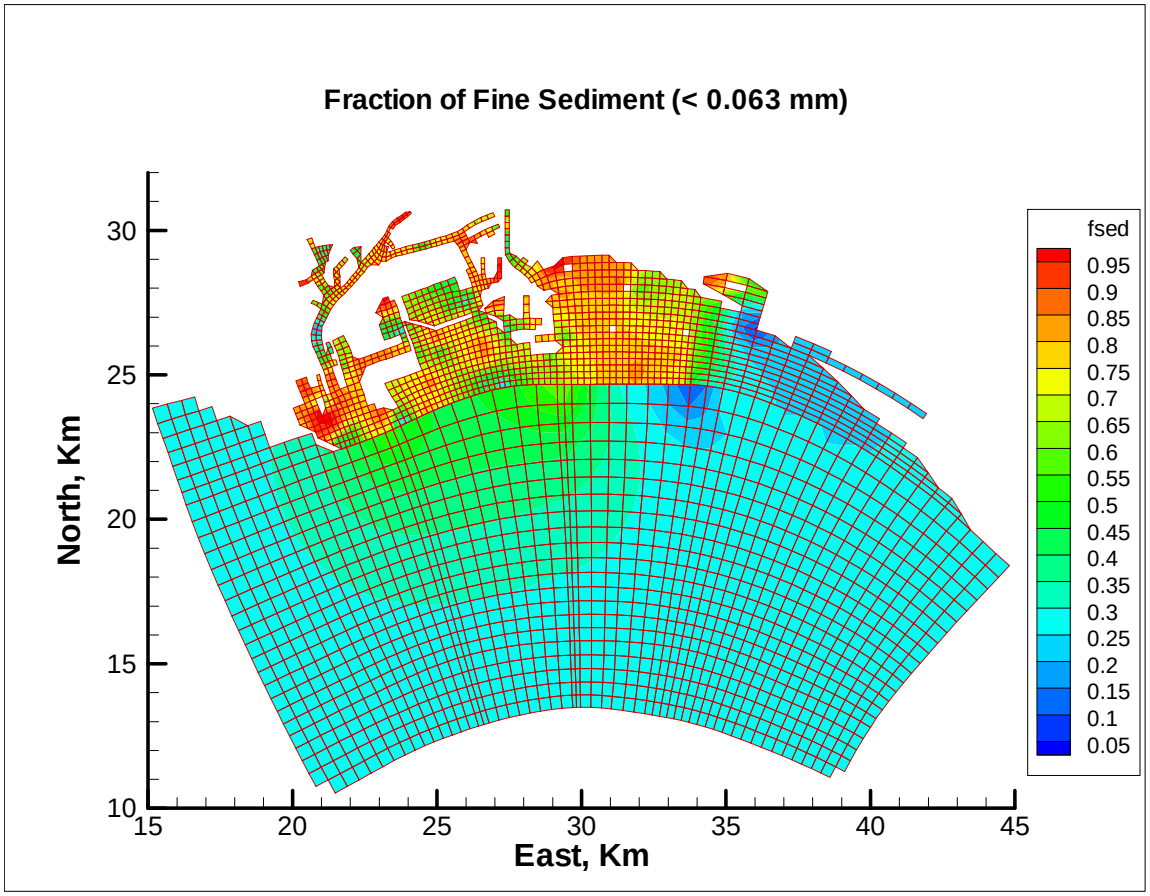


Figure 12. Fraction of fine sediment (< 0.063 mm) in the sediment bed used for model initialization

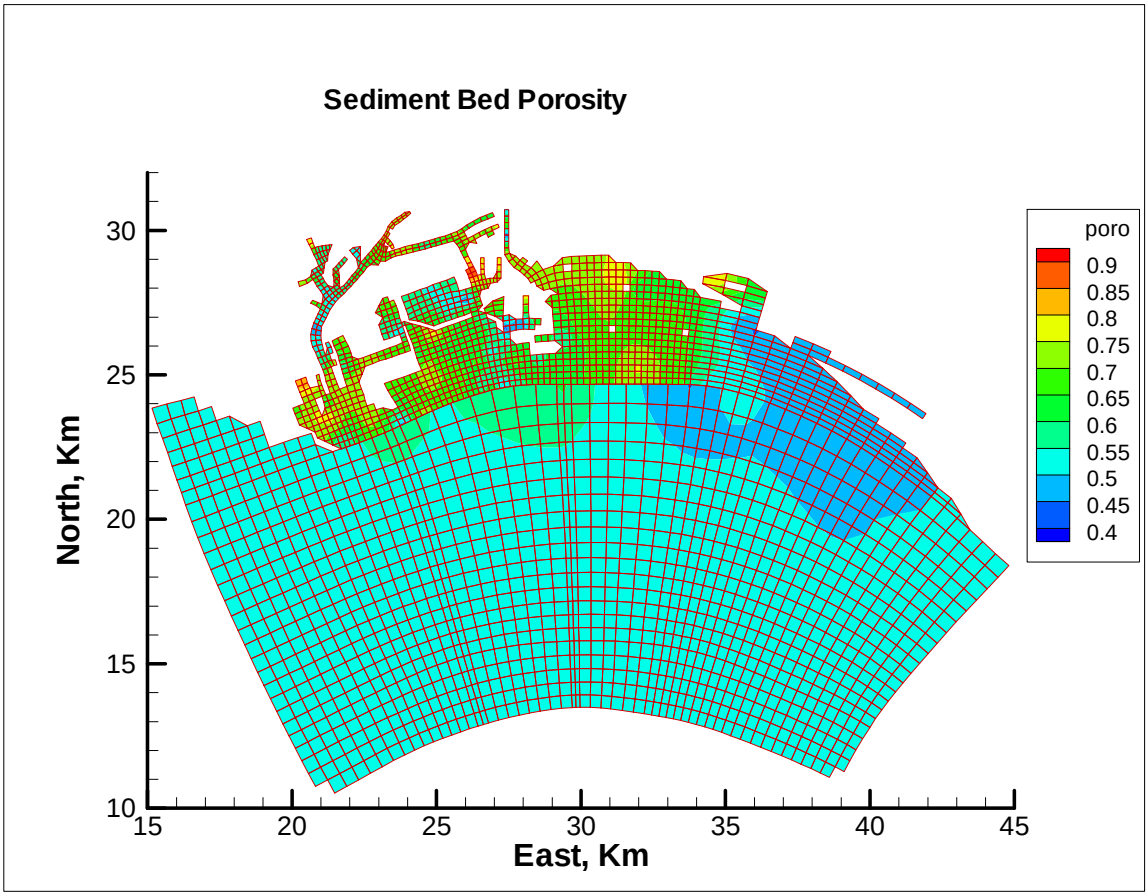


Figure 13. Sediment bed porosity used for model initialization

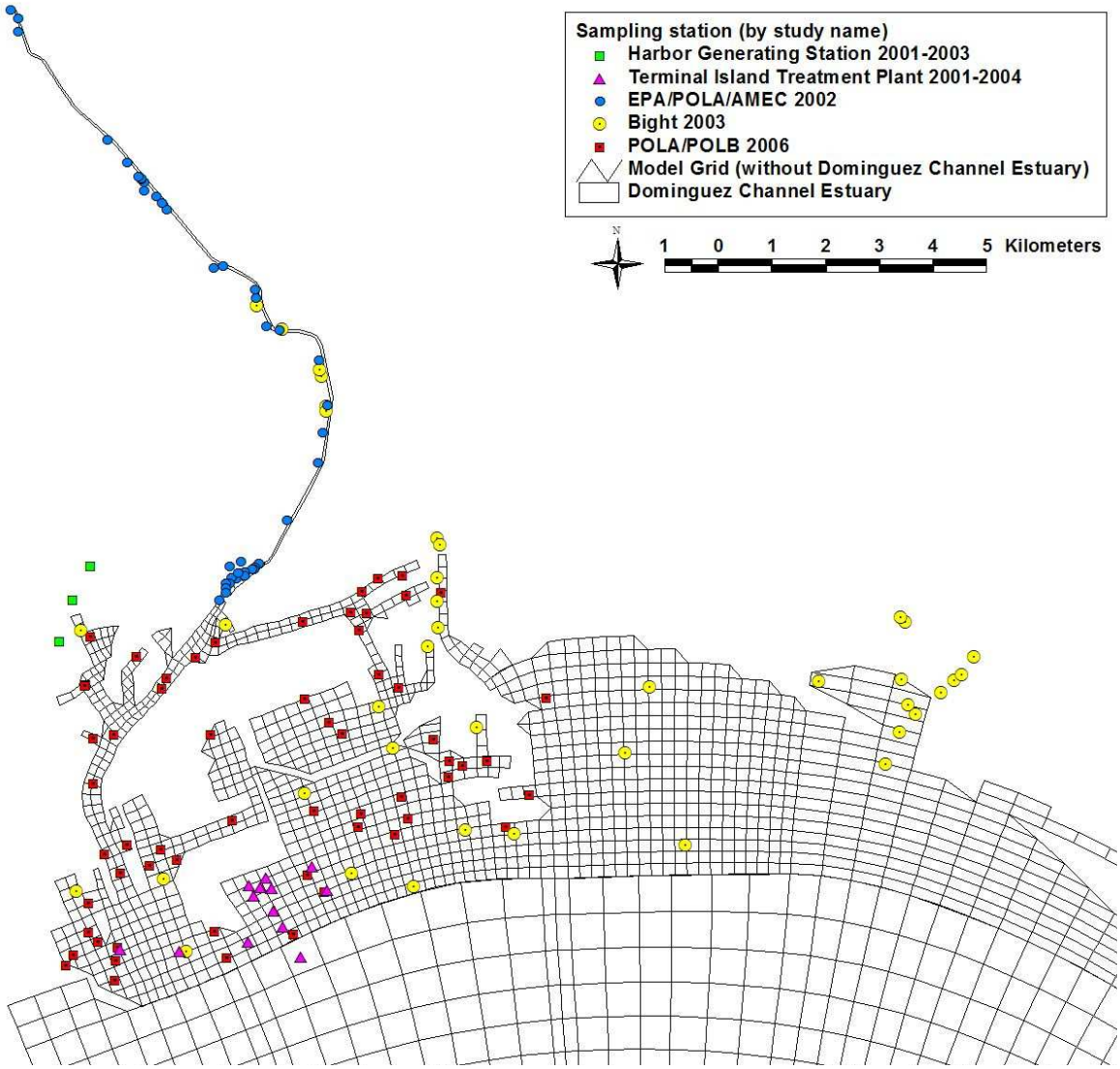
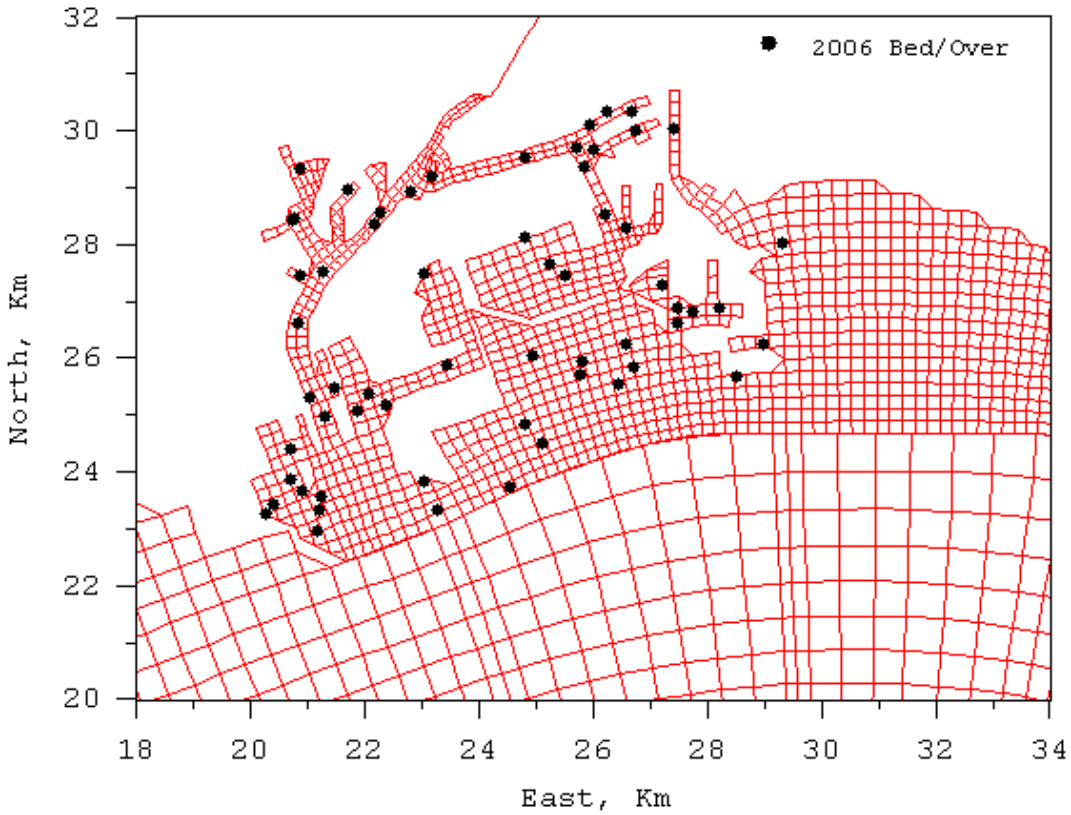
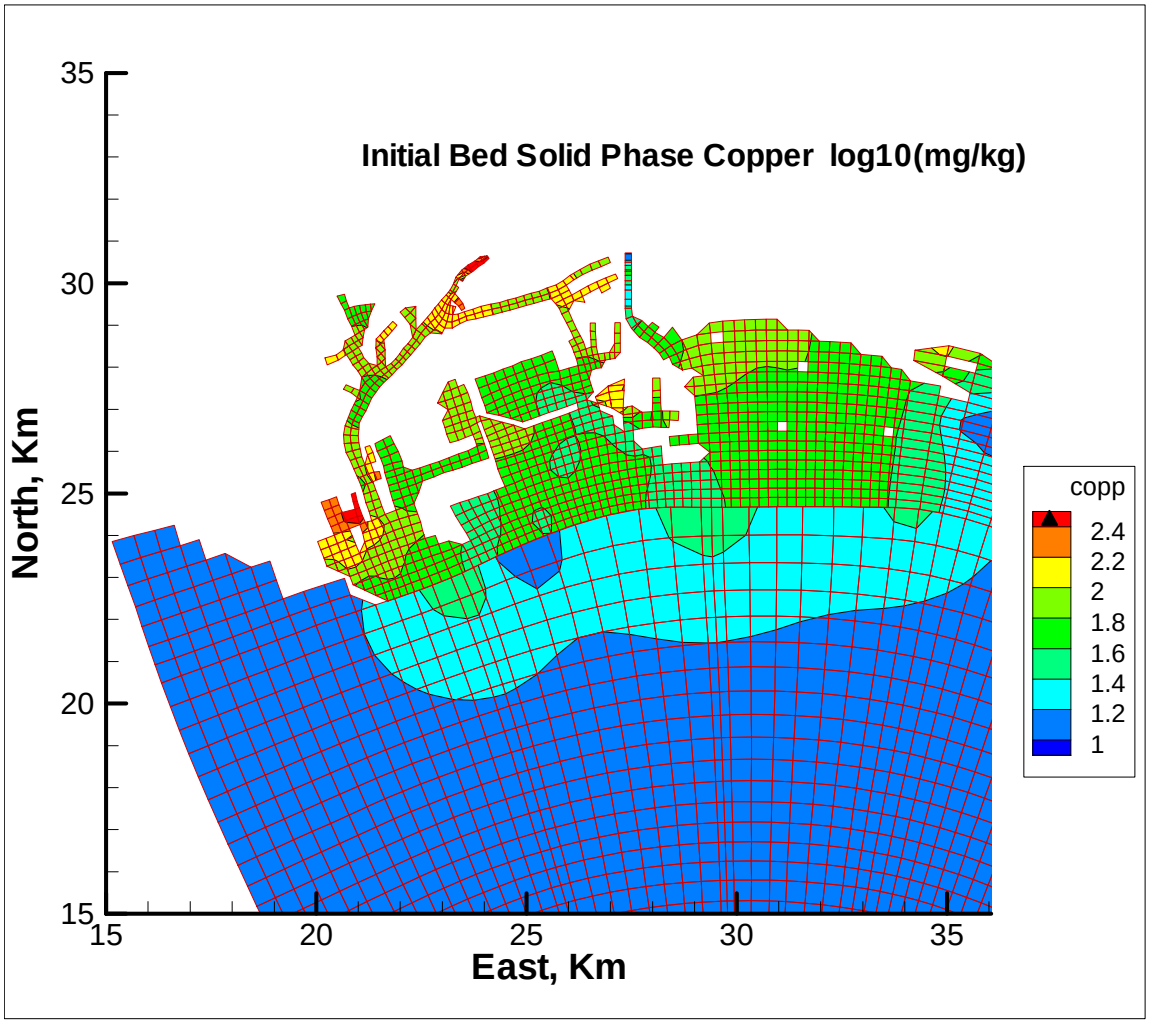


Figure 14. All sites used to initialize sediment bed metals, and organics concentrations



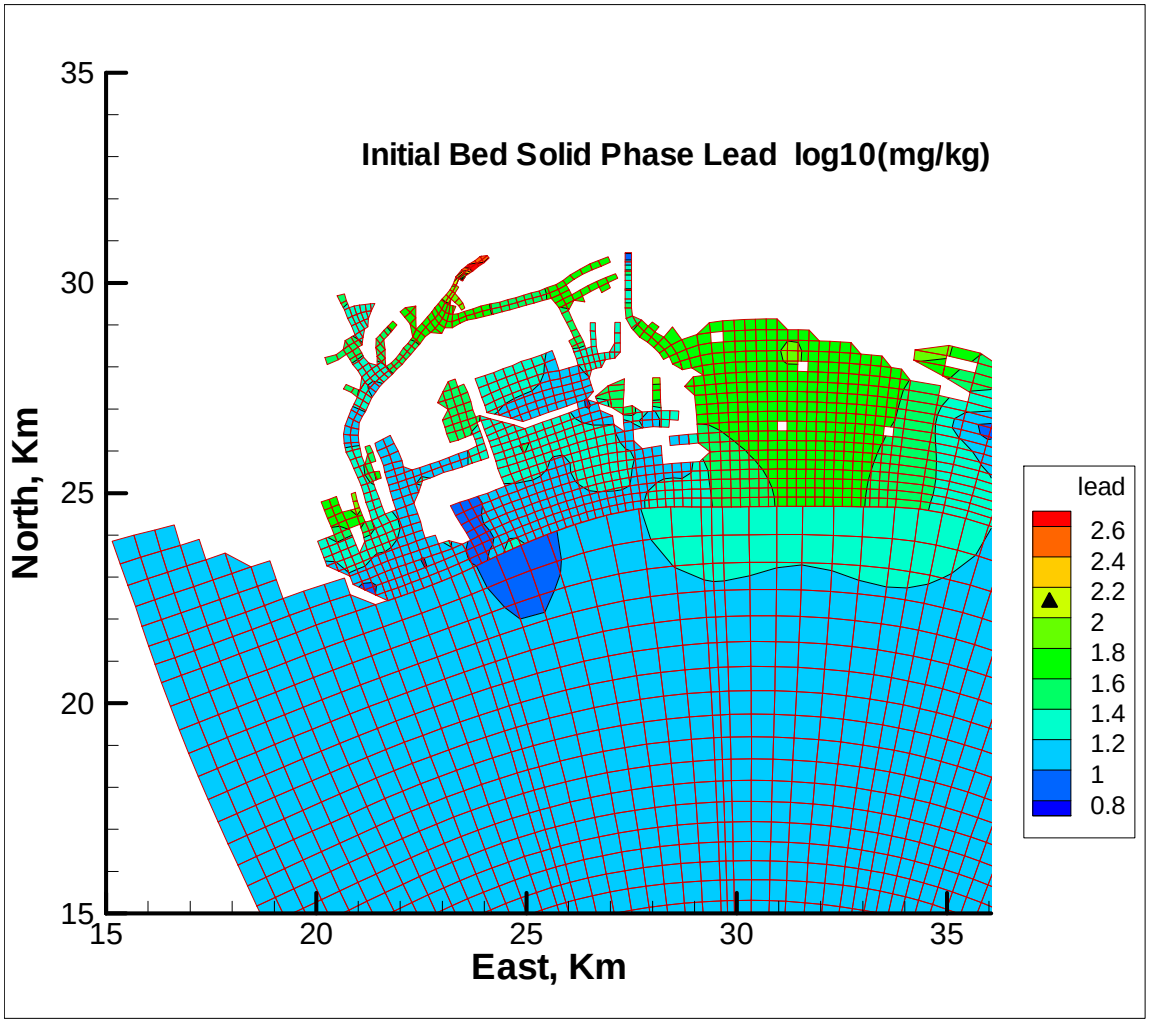
Note: These stations are the recently sampled locations in the greater harbors used for model configuration and calibration (POLA/POLB 2006). They are a subset of the stations presented in Figure 14. Bed data used to initialize sediment, metals, and organics concentrations. Overlying water data used for sediment and contaminant transport calibration.

Figure 15. Fall 2006 bed and overlying water column sample sites



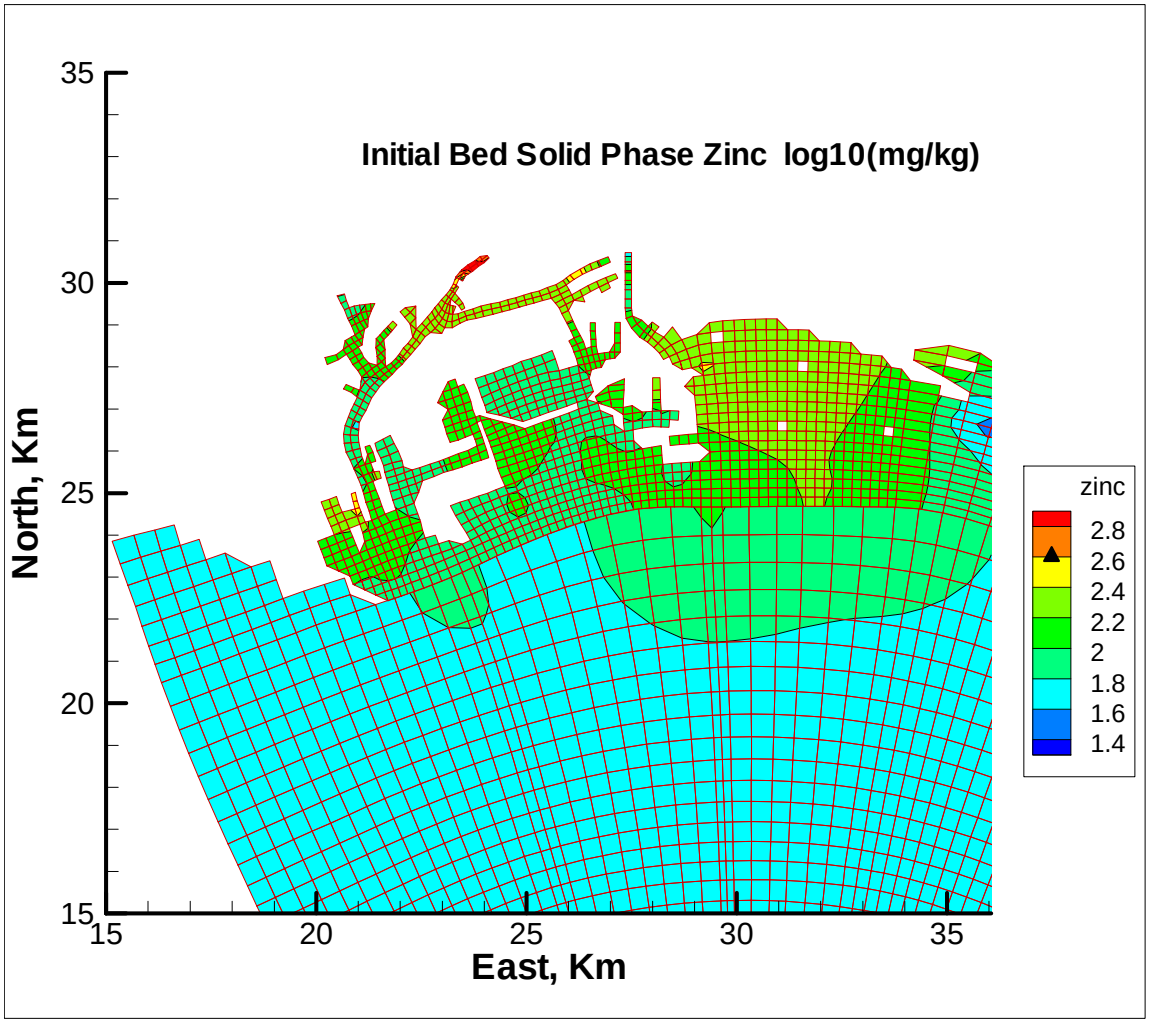
Note: Copper sediment quality guideline is 270 ppm (or mg/kg dry weight). Log(270) = 2.4 (represented by a black triangle in the concentration legend).

Figure 16. Initial bed solid phase copper concentration



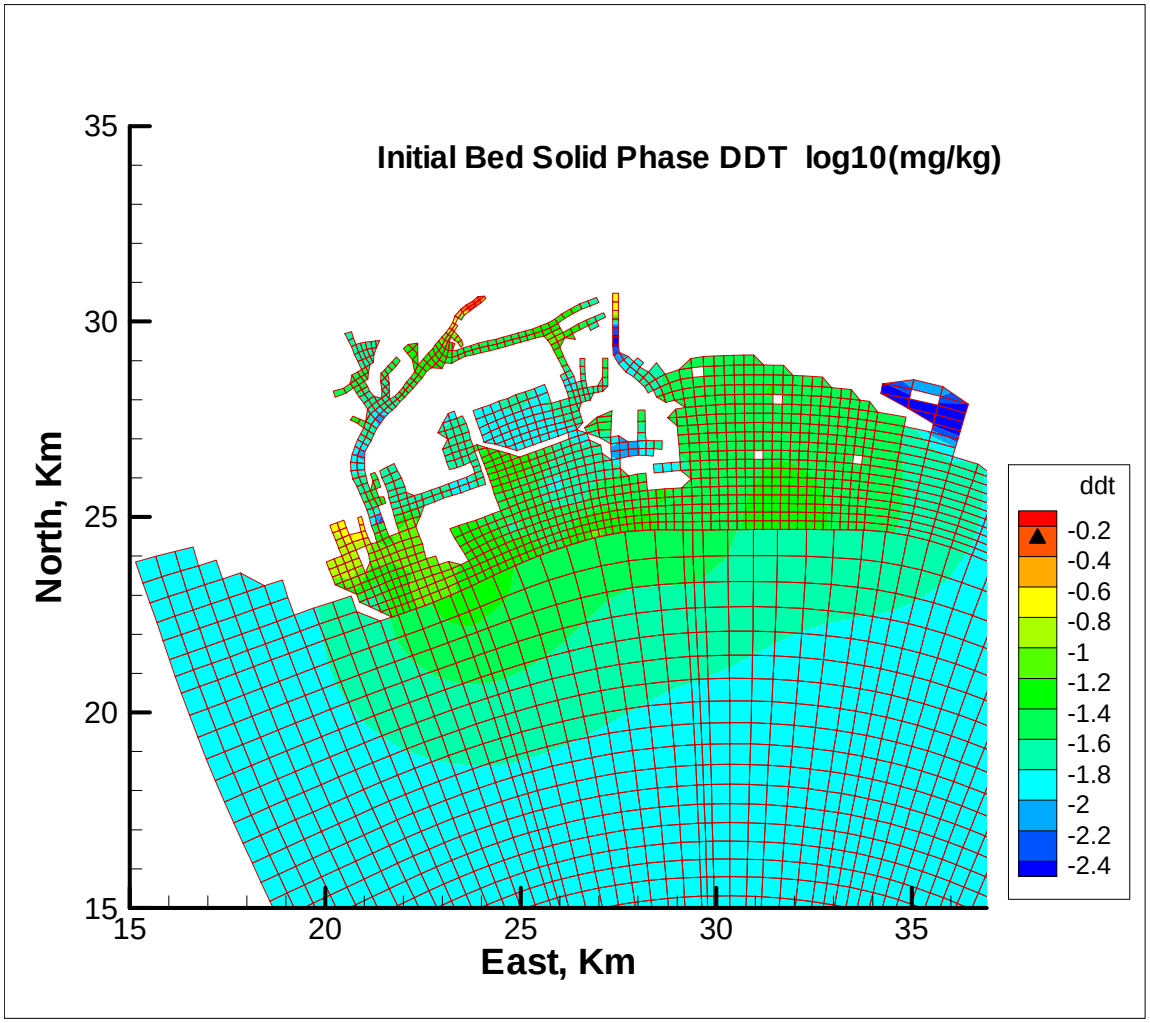
Note: Lead sediment quality guideline is 112 ppm (or mg/kg dry weight). Log(112) = 2.1 (represented by a black triangle in the concentration legend).

Figure 17. Initial bed solid phase lead concentration



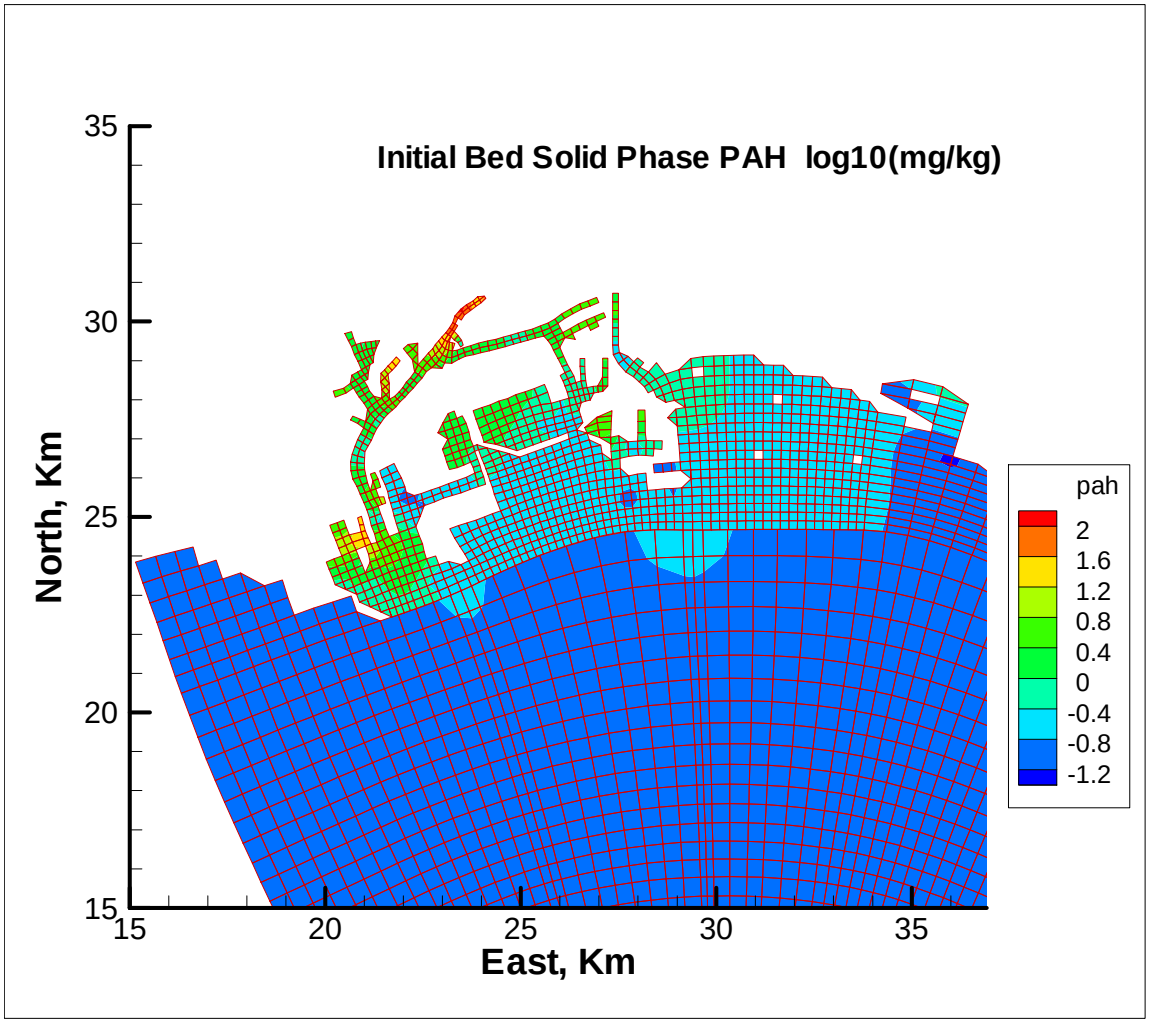
Note: Zinc sediment quality guideline is 410 ppm (or mg/kg dry weight). Log(410) = 2.6 (represented by a black triangle in the concentration legend).

Figure 18. Initial bed phase zinc concentration



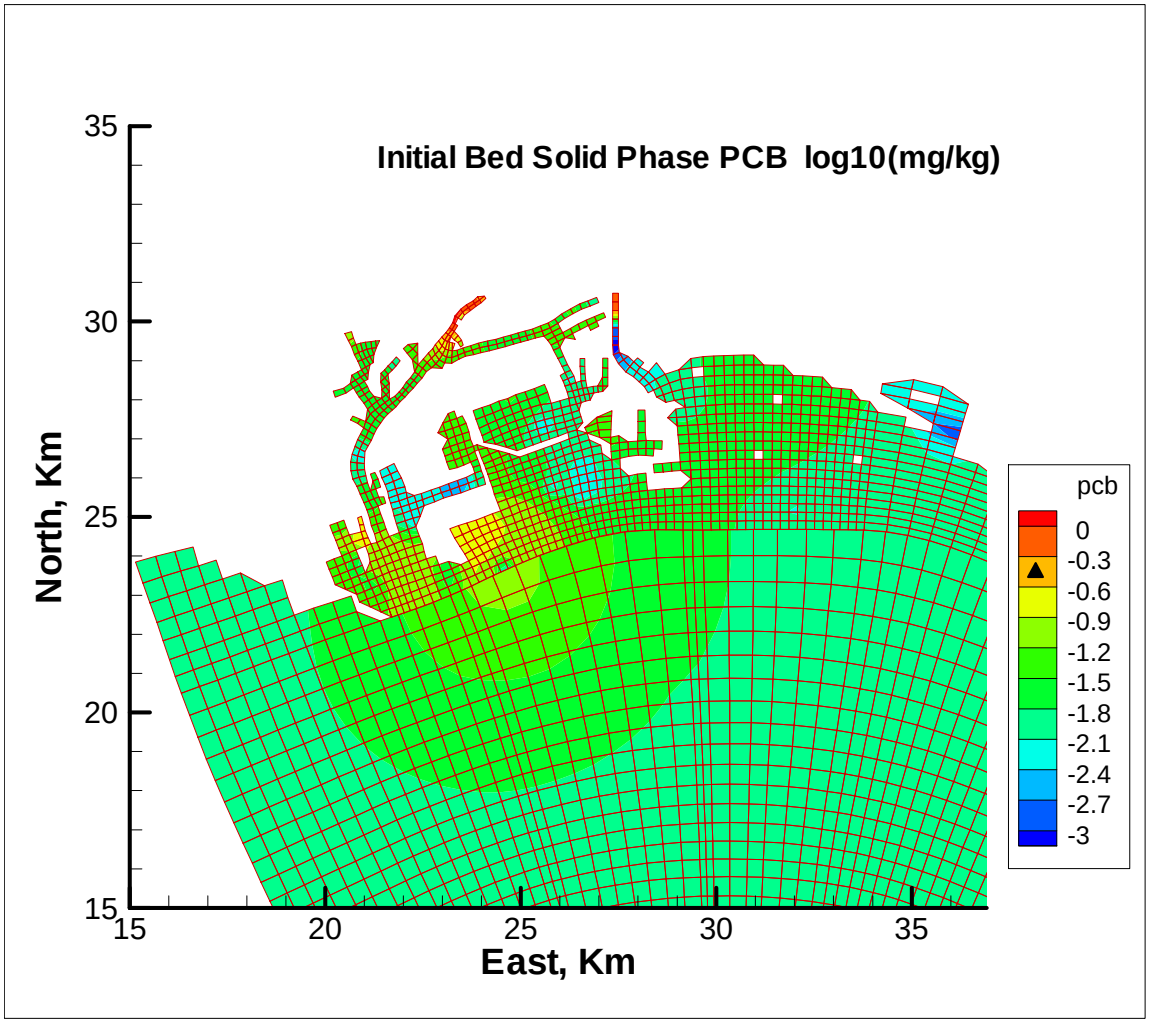
Note: DDT sediment quality guideline is 0.59 ppm (or mg/kg dry weight). Log(0.59) = -0.23 (represented by a black triangle in the concentration legend).

Figure 19. Initial bed solid phase DDT concentration



Note: Data presented are normalized to total solids.

Figure 20. Initial bed solid phase PAH concentration



Note: PCB sediment quality guideline is 0.4 ppm (or mg/kg dry weight). Log(0.4) = -0.4 (represented by a black triangle in the concentration legend).

Figure 21. Initial bed solid phase PCB concentration

7.2. Sediment Settling, Deposition and Erosion Parameters

The sediment transport model requires specification of various sediment settling, deposition and erosion parameters. For the noncohesive sand sediment class, settling velocity is determined internally in the model based on input mean sand size. Erosion and deposition of sand associated with suspended and bed load transport is also internally parameterized in the model based on size class diameter and user choices of a number of widely accepted suspended and bed transport formulas (Tetra Tech, 2007). Available sediment bed grain size data suggest that a mean sand diameter between 0.125 and 0.250 mm would be appropriate and could be further refined during calibration.

The settling, deposition and erosion of fine cohesive-behaving silt and clay tends to be highly site specific and influenced by water ionic chemistry, organic content, sediment mineralogy and the state of bed consolidation. Site specific information requires settling column analyses and either in-situ or laboratory sediment erosion potential analyses. For environments having relatively low suspended sediment concentration, settling column analyses are not feasible and the fine sediment settling velocity is generally assigned an appropriate fresh or salt water value, in this case 0.0001 m/s, which can be adjusted during calibration as necessary.

A laboratory study of sediment erosion was conducted by Jepson et al. (1997) using intact field cores and cores reconstituted from field samples taken near Queen's Way and Queen's Gate in Long Beach Harbor. Grain size analysis of the material sampled near Queen's Gate and used to form four reconstituted cores indicated approximately 30 percent of the material to be cohesive silt and clay and the remaining 70 percent to be fine sand with a mean diameter of approximately 0.120 mm. The four reconstituted cores were allowed to consolidate for 2, 6, 20, and 60 days before their erosion potential was measured with the sedflume devise, described in Jepson et al. (1997). Consolidation of the cores allowed the degree of consolidation, represented by the void ratio, to be considered as a factor in determining erosion potential. The resulting sedflume measurements provided data to parameterize erosion as a function of applied shear stress and sediment bulk density using

$$\frac{E}{V} = \alpha \left(\frac{\tau}{V^2} \right)^{\beta} \exp\left(\frac{\gamma}{1+\varepsilon} \right) \qquad (3)$$

$$\alpha = 0.237 \quad \beta = 2.18$$

$$\gamma = -32.05$$

$$V = (\nu g)^{1/3} = 0.02\ m/s$$

for the erosion velocity, E, and

$$\frac{M}{\rho_s V} = \alpha\left(\frac{f}{1+\varepsilon}\right)\left(\frac{\tau}{V^2}\right)^{\beta} \exp\left(\frac{\gamma}{1+\varepsilon}\right) \qquad (4)$$

for the mass erosion rate M. In equations (3) and (4), ρ_s is the sediment particle density, V is a velocity scale, f is the fine fraction, τ is the kinematic shear stress, and ε is the void ratio. The coefficients α, β, and γ are based on a log-linear least squares fit of equation (3). Figure 22 compares observed erosion velocities with those predicted by equation (3).

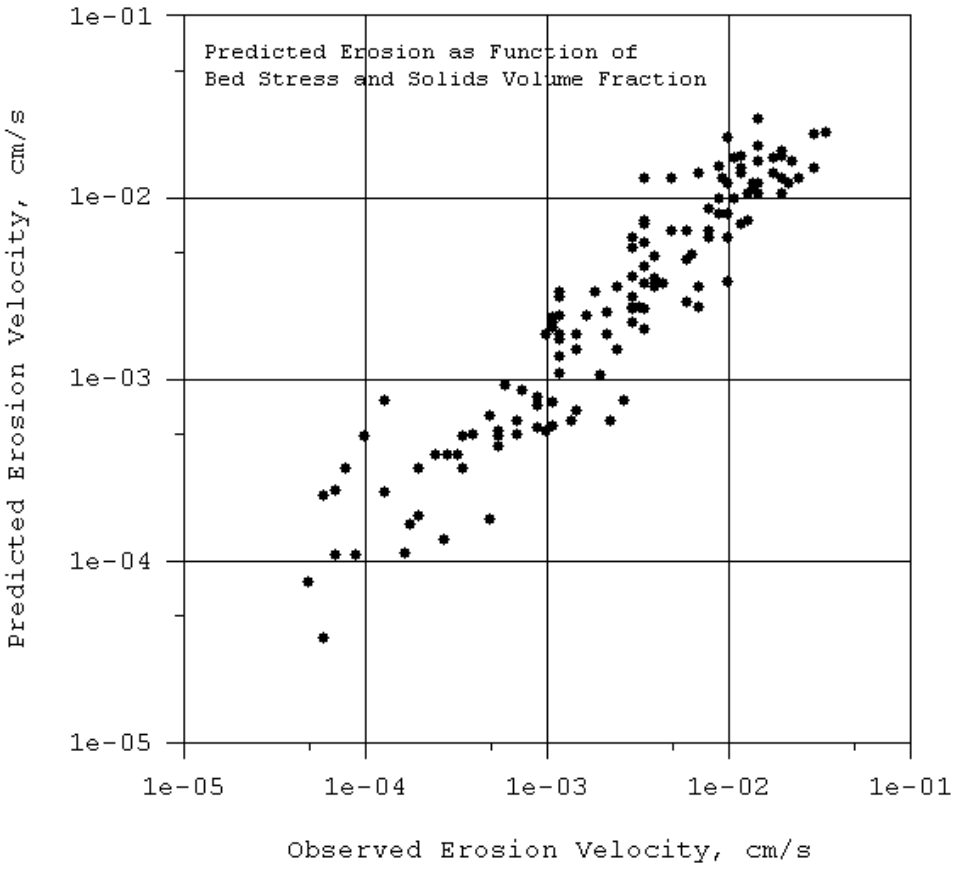


Figure 22. Erosion velocity predicted by equation (3) versus erosion velocity observed during sedflume erosion potential measurements

7.3. Equilibrium Partition Coefficients

The phase distribution of adsorptive contaminants, including metals and hydrophobic organic compounds, is an important determinant in their transport

and fate. Although arguments and evidence can be presented to question the utility of equilibrium partitioning to represent phase distribution, the equilibrium approach is accepted by US EPA for regulatory modeling studies associated with TMDL development and Remedial Investigation/Feasibility studies (RI/FS) at Superfund sites. Literature values are available for use when site specific information is not available. Site specific information, when available, is preferred to estimate equilibrium partition coefficients, in conjunction with comparison to literature values to identify unreasonable estimates. The EFDC model supports three phase equilibrium partitioning into free dissolved, complexeated or adsorbed to dissolved organic carbon, and particulate adsorbed, with further particulate phase options based on sediment size class, fraction of organic carbon and particulate organic carbon. Data available in the greater harbors system do not support three phase partitioning; therefore, the following two phase formulation was used:

$$C_d = \left(\frac{n}{n + K_p \bullet P} \right) C = dissolved \ \ per \ total \ volume \qquad (5a)$$

$$C_p = \left(\frac{P \bullet K_p}{n + K_p \bullet P} \right) C = particulate \ \ per \ total \ volume \qquad (5b)$$

$$C = contaminant \ concentration \ \ per \ total \ volume$$

$$n = porosity$$

$$P = particulate \ adsorption \ site \ concentration \ \ per \ total \ volume$$

$$K_p = \frac{C_p}{P} \bullet \frac{n}{C_d} = partition \ coefficient \qquad (5c)$$

The particulate adsorption site can be defined as the concentration of the fine sediment size class or as the concentration of particulate organic carbon (POC). The concentration of particulate organic carbon can in turn be defined as the product of a POC fraction and fine sediment concentration.

A field study in fall 2006 collected both sediment and contaminant data at approximately 60 sediment bed and overlying water sites (Figure 15). Bed data were sufficient to estimate partition coefficients using equation (5c) since both the particulate and dissolved phase contaminants were measured as total solids and organic carbon concentrations. The overlying water was sampled only for total concentration and total suspended solids. For the three metals, partition coefficients were defined in terms of fine sediment concentration. For the three organic compounds, partition coefficients were defined in terms of both the fine sediment and particulate organic carbon concentrations. Since organic carbon data were not complete for the entire sample set, a relationship between total bed solids concentration and total bed organic carbon was developed and shown in Figure 23.

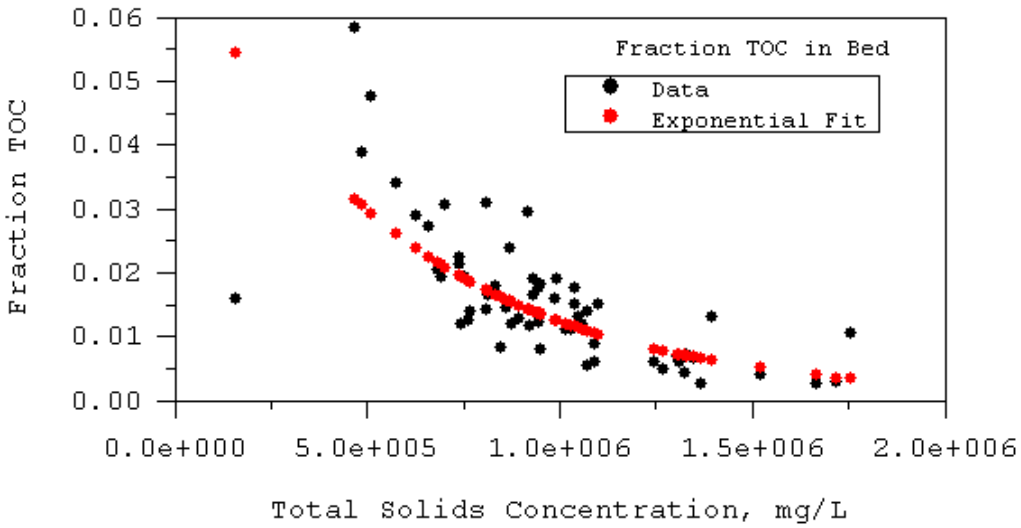


Figure 23. Total organic carbon fraction as a function of total solids concentration, based on 2006 sediment bed data

Equilibrium partition coefficients as a function of bed sediment concentration for the three metals are shown in Figure 24. Corresponding average and visual best estimates based on the 2006 sediment bed and overlying water data (Figure 15) are listed in Table 21. The visual best estimates are based on clustering and are lower than the averages by a factor of approximately two since the averages are influenced by a few large values. Both sets for values are within the literature range summarized by USEPA (2005). Water column partition coefficients for metal adsorption to dilute sediment (concentrations on the order of 1 to 100's mg/L) are typically larger than bed values. For water column sediment concentrations in the range of a few mg/L, the water column partition coefficients would be five to ten times larger than those for the bed values (USEPA, 2005). For initial metals configuration, the visual best fit bed partition coefficients (column three) were used and water column values were set to five times the bed values (column five).

Table 21. Sediment Bed and Water Column Equilibrium Partition Coefficients and Particulate to Dissolved Concentration Ratios for Metals

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

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

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

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

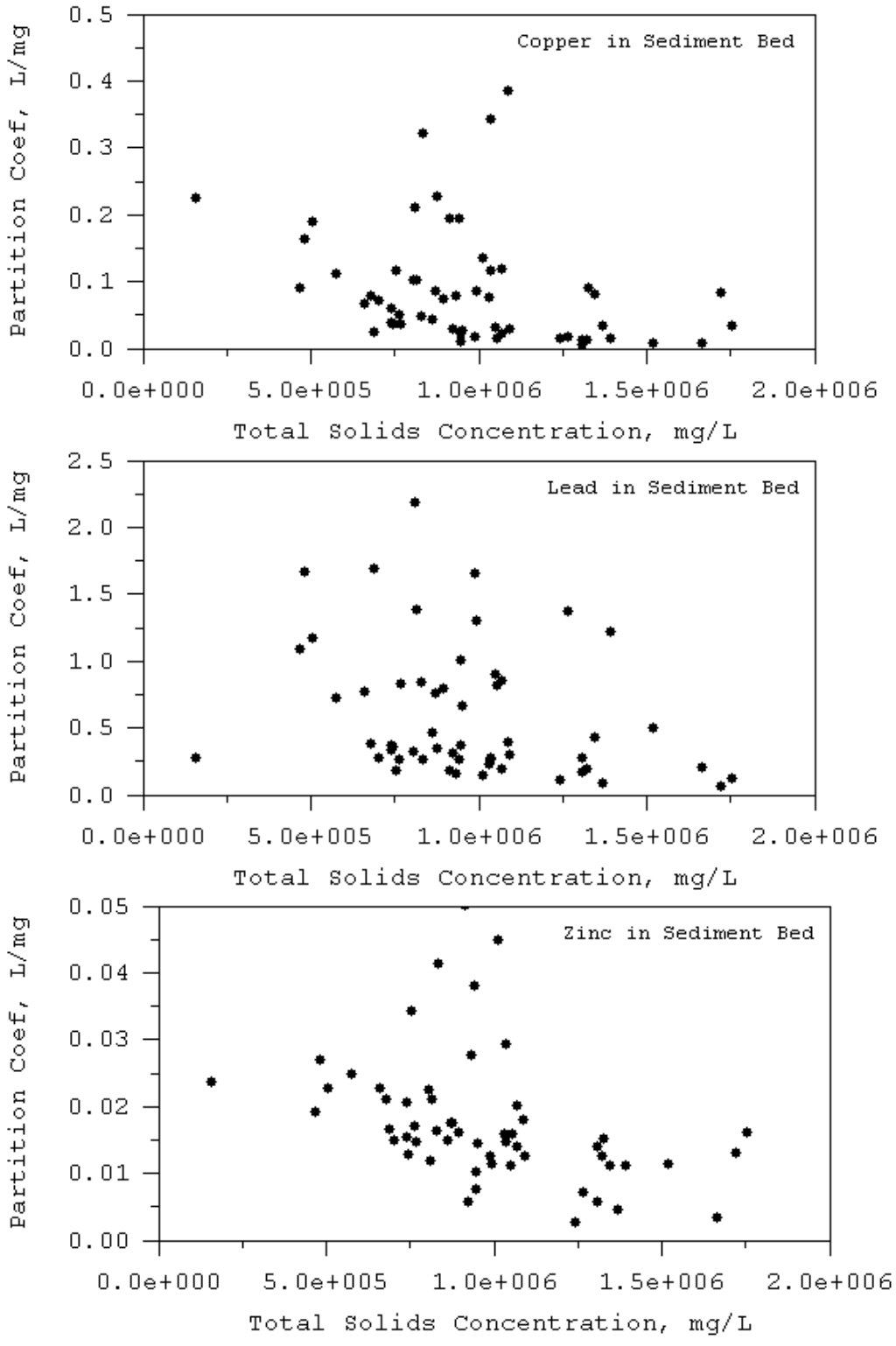
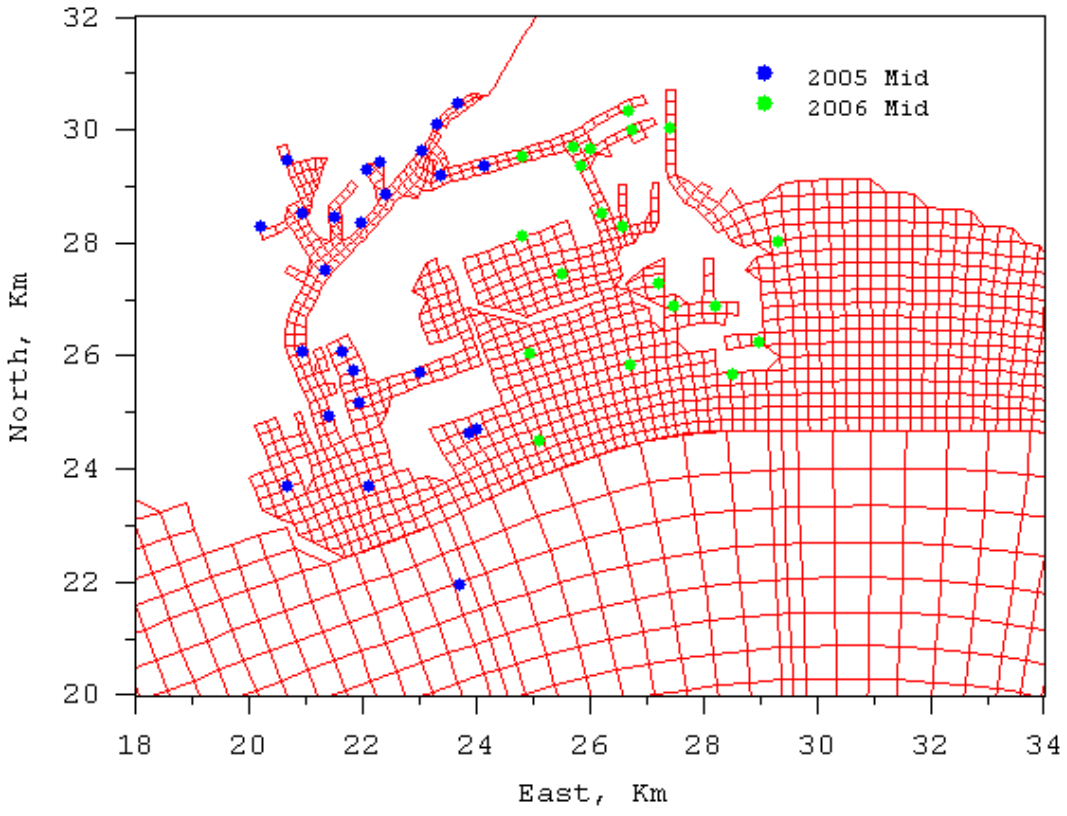


Figure 24. Equilibrium partition coefficients for copper, lead, and zinc based on bed total solids concentration.

Thomann and Mueller (1987) suggest that the product of the partition coefficient and sediment concentration, given by,

$$K_p \bullet P = \frac{C_p}{C_d} \qquad (6)$$

is approximately constant. Mid-water column metals samples collected during 2005 and 2006 (Figure 25) provide dissolved and particulate concentrations allowing the quantity defined in equation (6) to be determined. Sediment concentrations were erroneously not recorded. Figure 26 shows this product for the 2005-2006 mid-water data (Figure 25) for copper, lead, and zinc with average values tabulated in Table 21. The range of average ratios for the copper and zinc data is consistent with the value of 0.25 suggested by Thomann and Mueller (1987) while the lead value is an order of magnitude higher.



Note: 2005 data collected by POLA; 2006 data collected at POLB stations as part of 2006 POLA/POLB study.

Figure 25. Mid-water column sample sites used for metals calibration

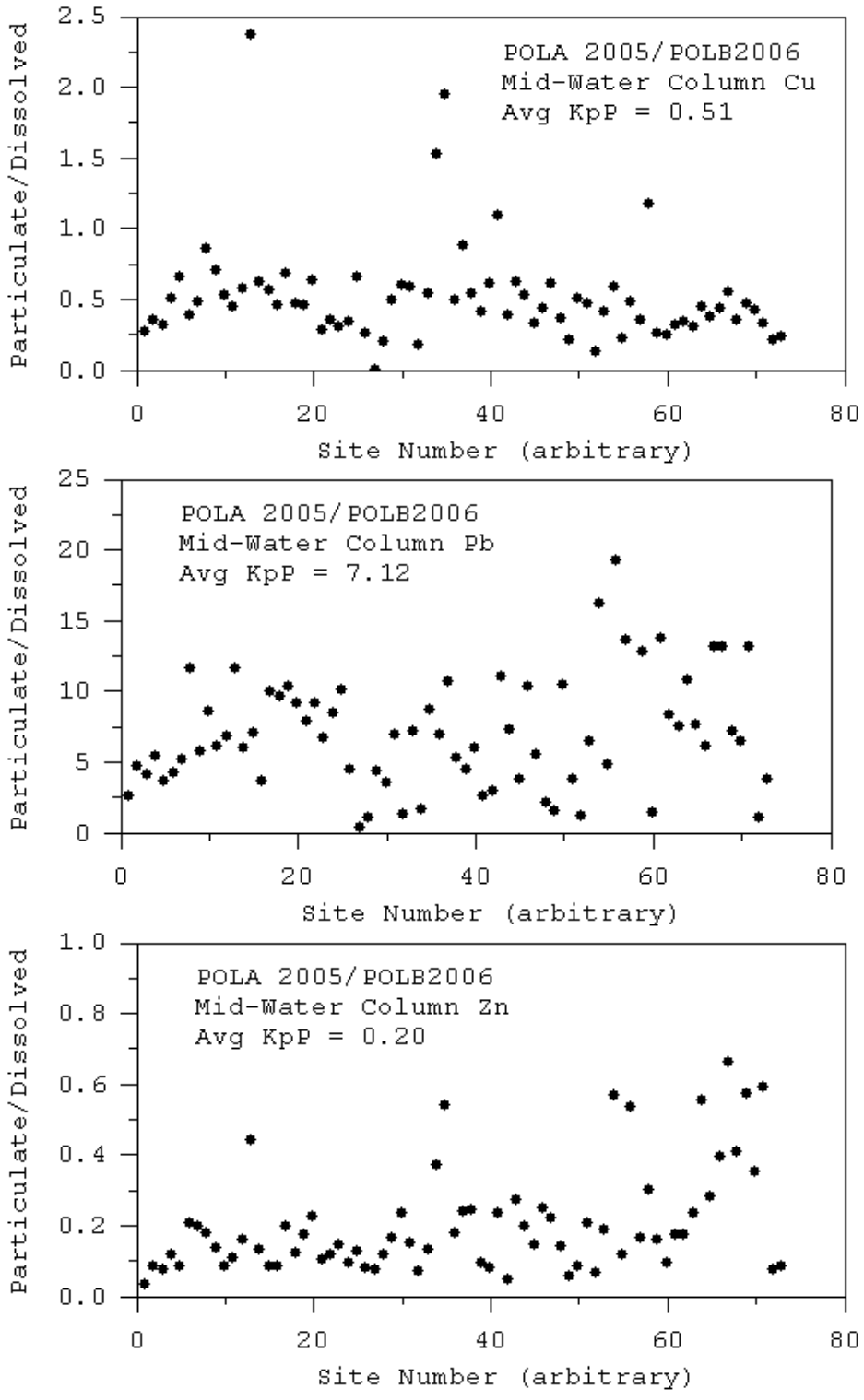


Figure 26. Particulate to dissolved concentration ratio (equal to product of partition coefficient and adsorption site particle concentration) for mid-water column metals concentrations

Subsequent to conducting the calibration and sensitivity simulations for metals, described in Chapter 8 and Appendix C, using water column partition coefficients in column 5 of Table 21, additional water column metals and sediment concentration data sets became available. These data sets include dissolved and total metals data collected during January and March 2006, and dissolved and total metals and suspended solids during January 2008 by POLA. The locations of these data sets correspond to the 2005 locations shown in Figure 25. An analysis and discussion of the significance of these additional data sets is provided in Appendix E.

Equilibrium partition coefficients based on the 2006 POLA-POLB data (Figure 15) for DDT, PAH, and PCB, as a function of bed sediment concentration and bed total organic carbon concentration, are shown in Figures 27 through 29. Table 22 summarizes approximate constant values of these equilibrium partition coefficients for the three organic contaminants based on the data shown in Figures 27 through 29. Bed solids and bed TOC based values are consistent with the ranges reported in the literature (Chapra, 1997; Chiou, 2002). Low and high range values in Table 22 are based on the range of octanol-water partition coefficients for pesticides, PAHs, and PCBs reported in Chapra (1997). For these three contaminants, organic carbon-referenced bed values should be readily utilized in the water column and can be referenced to water column solids by dividing by the ratio of TOC to total solids. A limited number of the fall 2006 overlying water sites (Figure 15) had organic carbon samples, which are shown in Figure 30. At higher sediment concentrations, the ratio is approximately 0.01, which is approximately the ratio represented by the difference in solids and TOC normalized bed values (Table 22). This suggests that the bed solids referenced partition coefficients for the three organics can also be used in the water column.

Table 22. Sediment Bed Equilibrium Partition Coefficients for Organics

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

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

[2] Based on Chapra, 1997.

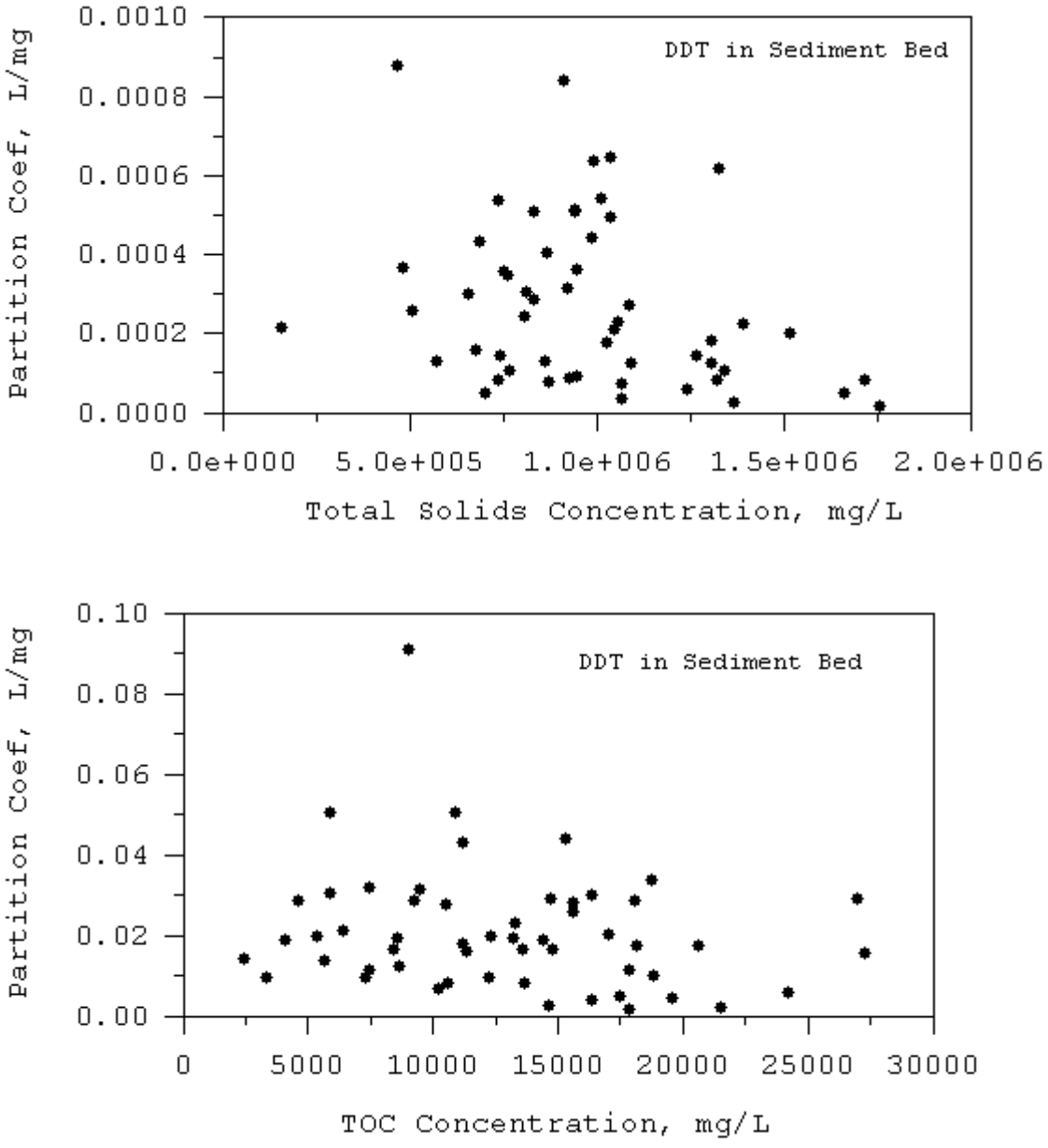


Figure 27. Equilibrium partition coefficient for DDT based on total solids (top panel) and total organic carbon (bottom panel) based on data collected in 2006

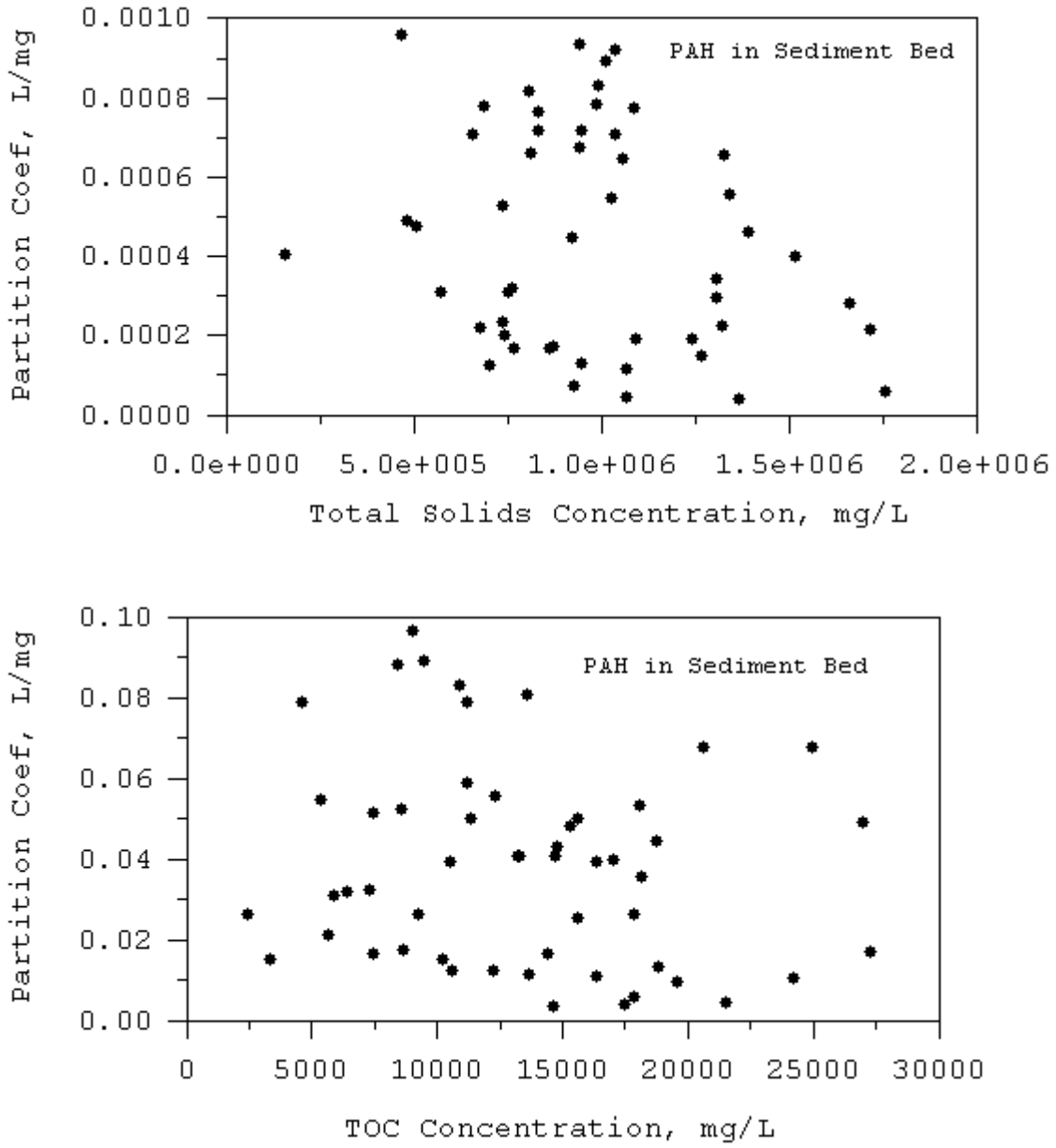


Figure 28. Equilibrium partition coefficient for PAH based on total solids (top panel) and total organic carbon (bottom panel) based on data collected in 2006

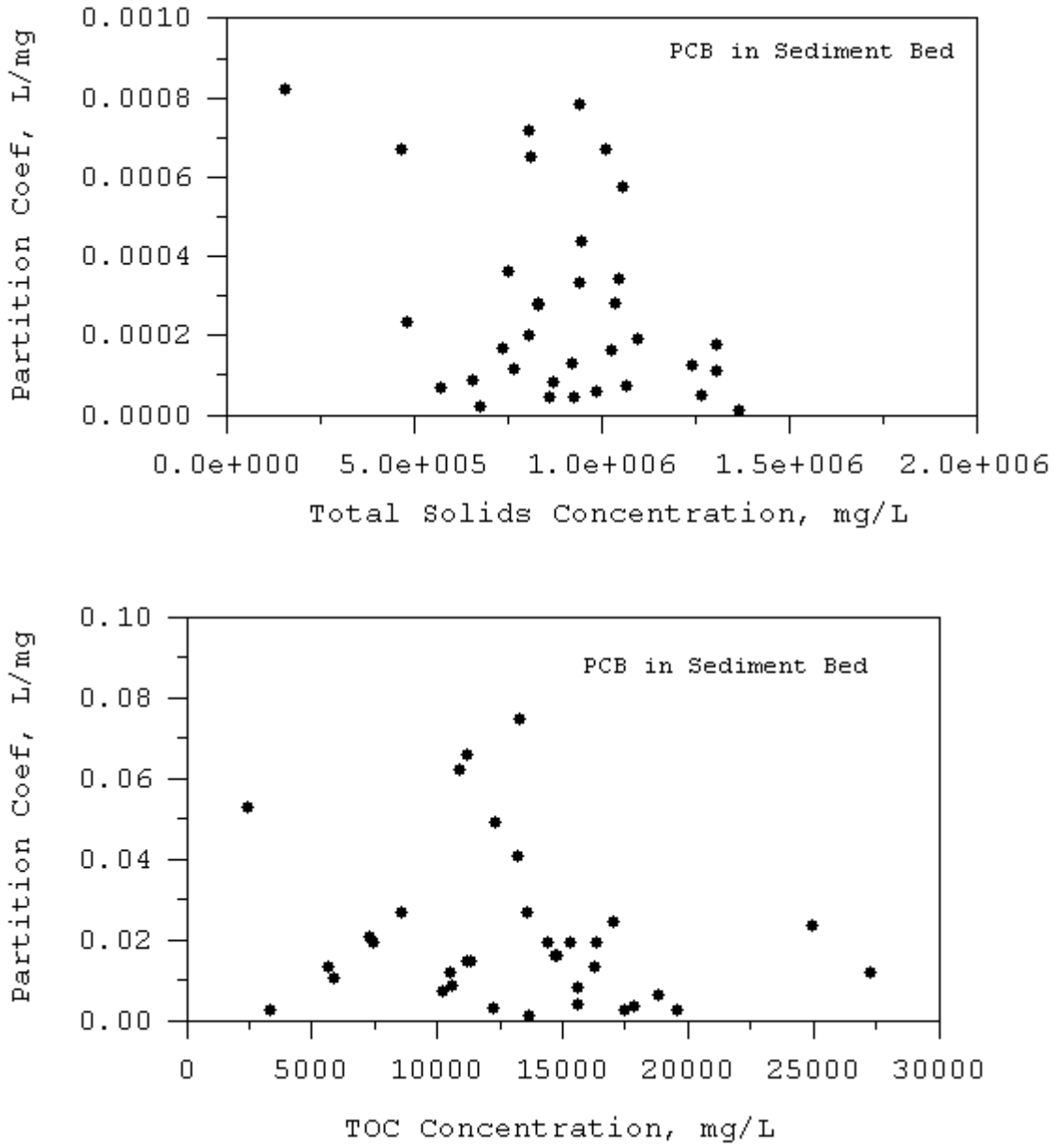


Figure 29. Equilibrium partition coefficient for PCB based on total solids (top panel) and total organic carbon (bottom panel) based on data collected in 2006

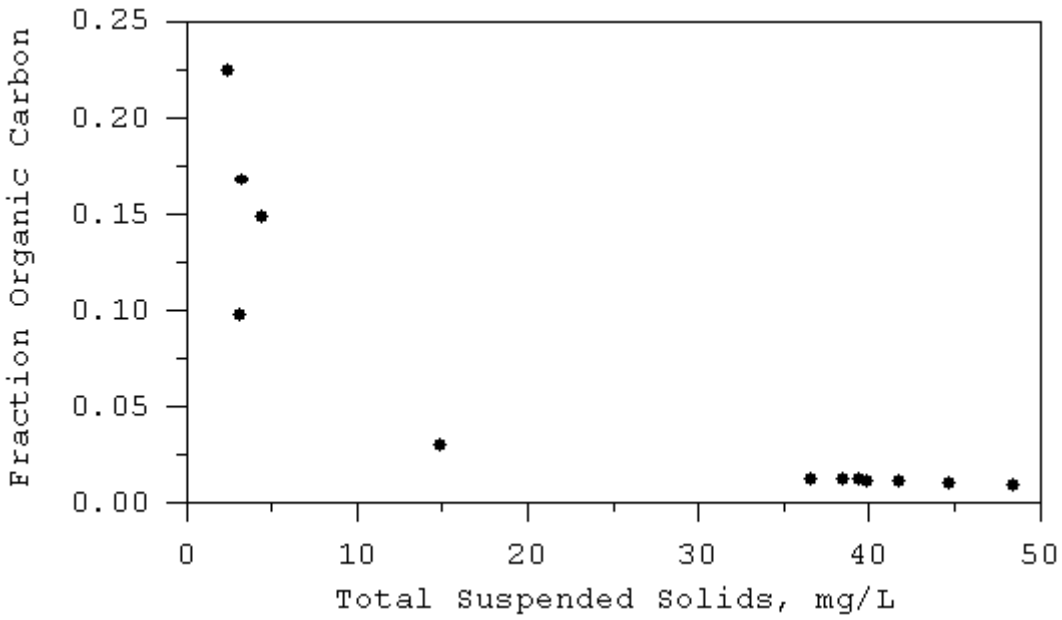


Figure 30. Fraction of organic carbon as function of total suspended solids concentration based on fall 2006 overlying water site data

7.4. External Loads and Open Boundary Conditions

External loads of sediment and contaminants are provided by the watershed model (Tetra Tech, 2006), which was used to provide point and nonpoint source inflows to the greater harbors system. Each inflow time series is assigned a corresponding time series of contaminant concentrations. Figure 31 shows an example of inflow and inflowing sediment and copper concentrations for the Los Angeles River. Loads for metals also included atmospheric dry deposition rates of 22, 14, and 160 μg/m^2-day, for copper, lead, and zinc, respectively.

Sediment and contaminant concentration must be specified on the model open boundaries in San Pedro Bay (Figure 1). Sediment concentrations on all three open boundaries were set to a value of 2.0 mg/L based on limited measurements during the Bight 03 study. Concentrations of copper, lead, and zinc were set to 0.10, 0.03, and 0.30 μg/L based on greater harbors observations during 2005 and 2006 taken near and immediately outside of the breakwater (Figure 25). Concentrations of DDT, PAH, and PCB were set to 0.25, 100.0, and 0.015 ng/L. Values for DDT and PCB were based on those reported by Zeng and Tran (2002) and Zeng, et al. (2005). Values for PAH were based on greater harbors observations during 2006 take near and immediately outside of the breakwater (Figure 25; 2006 sample locations only).

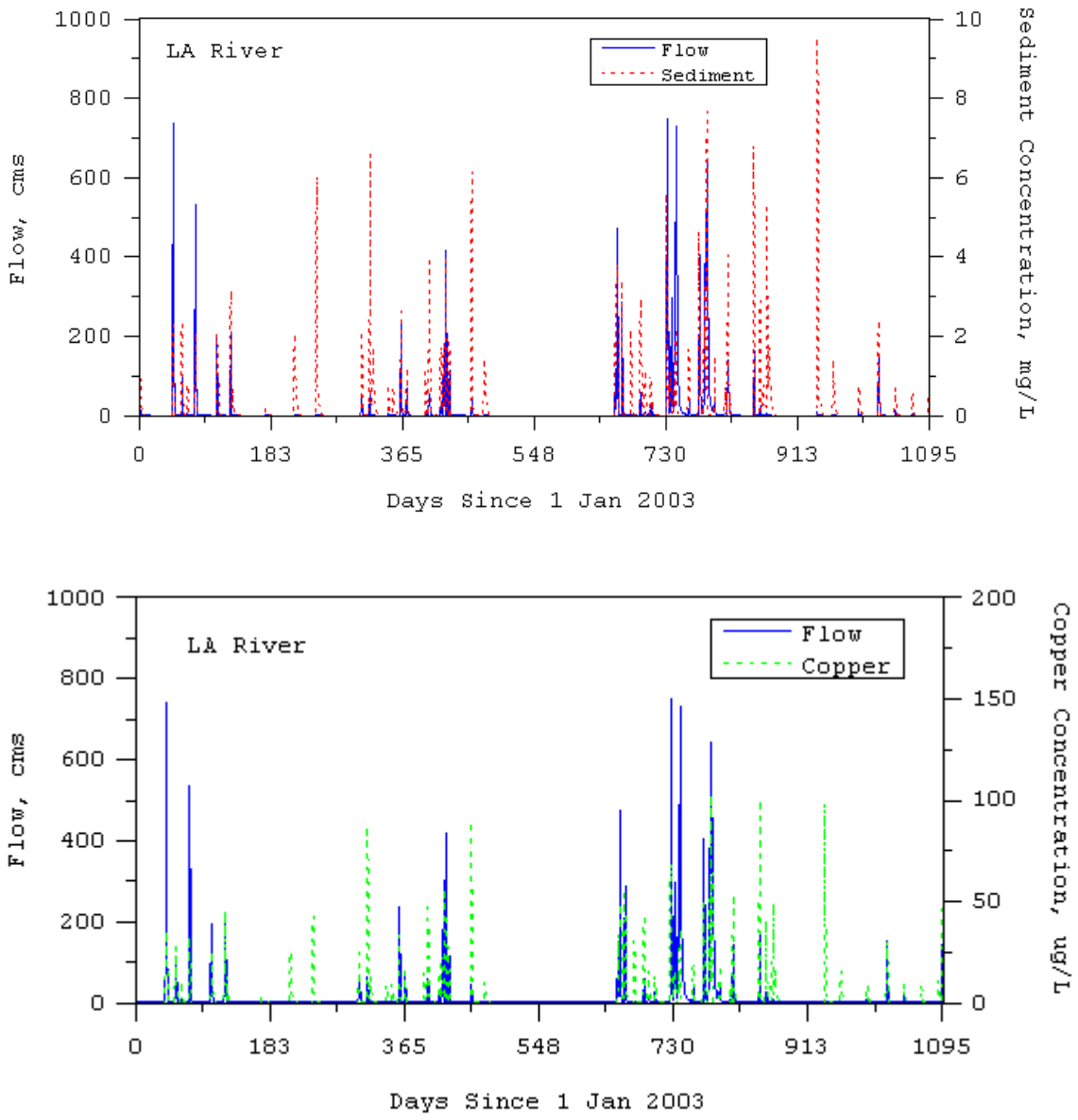


Figure 31. Examples of flow and inflowing sediment and copper concentration for the Los Angeles River

8. Sediment and Contaminant Transport Calibration

Model calibration involves the adjustment of selected model input parameters to achieve a best or targeted level of agreement between model predictions and observations. The level of agreement can be judged by combinations of qualitative methods, usually visual comparison, or quantitative methods, such as those discussed in Appendix B of this document. Subsequent validation of a calibrated model involves using the same procedures to judge the level of agreement between model predictions and a different set of observations not used for calibration. Preferably the observations used for validation should represent hydrodynamic and transport conditions different from those under which the calibration observations were obtained. In many situations, particularly when the cost of obtaining multiple observation data sets is prohibitive, calibration and validation cannot be unique activities and validation is often foregone or replaced by sensitivity analysis. Since the availability of water column sediment and contaminant data in the greater harbors precludes formal validation, sensitivity analysis was conducted (see Appendix C and Appendix D). Specifically, the dry weather sensitivity of water column sediment and contaminant concentration prediction to changes in river and watershed loads, open boundary conditions, and sediment erosion rates were analyzed (Appendix C). Long-term sensitivity was also evaluated by comparing water column and sediment bed concentration results from simulations using baseline conditions and a 50 percent reduction in river and watershed loading (Appendix D).

The observational data available for sediment and contaminant transport model calibration and validation is sparse to the extent that only a calibration effort can be undertaken. As discussed in the preceding section, observational data defining conditions in the sediment bed were used for model initialization and are not appropriate for use in calibration. Instead, the calibration approach taken in this study is to use observational data in the water column for model calibration. Observational data in the water column includes sediment and contaminant concentrations measured near the bottom of the water column during fall 2006. This data set is referred to as the overlying water observations since they were taken at the same locations as the in bed observations (Figure 15). Specifically, the data set includes total suspended sediment concentration and total concentration of the six contaminants sampled at one instance in time. Two additional water column data sets taken at mid-depth in the water column during 2005 and 2006 (Figure 25) provide observations of total and particulate concentrations of the three metals. Total suspended solids information, which would allow definition of phase distribution in these metal data sets, was not recorded. Subsequently, six of the sites sampled in 2005, were sampled for mid-water column total suspended solids in 2007. The following two sections further discuss the calibration approach and present results for sediment and contaminants.

8.1. Sediment Transport Calibration

The degree of calibration of the sediment transport model is evaluated using sediment concentrations at the 60, fall 2006 overlying water sites (Figure 15) and six of the 2005 mid-water column sites (Figure 25) which were sampled for suspended sediment concentration in fall 2007. For comparison with the instantaneous observations, taken under dry fall conditions, model predictions were averaged over a six month dry season period. Figure 32 shows the continuous model predictions at a representative site with the instantaneous observation value shown as a dashed line. Model predicted and observed sediment concentration at the 2006 overlying water sites and the 2007 mid-water column sites are shown in Figure 33. Model predicted concentrations are reasonable, however a quantitative measure of agreement would be extremely low. The average predicted values show less variation than observations, although Figure 32 shows that instantaneous predictions can vary significantly about the mean.

Calibration parameters for suspended sediment traditionally include effective diameters for noncohesive size classes, settling velocity and erosion rate for the fine cohesive size class, loading relationships, and open boundary conditions. Best estimates for all of these parameters were used for model configuration. The primary adjustment made during calibration was setting the noncohesive sediment class diameter to 0.125 mm so that excess erosion did not occur in San Pedro Bay and override the observational based boundary conditions. For the fine cohesive sediment, which represented more than 90 percent of the model predicted water column sediment, sensitivity of predictions with respect to settling velocity were conducted. Lower and higher settling velocities increased disagreement between predictions and observations at most stations. Increasing and decreasing the base cohesive sediment erosion rate coefficient (α in equation 5) resulted in similar responses using lower and higher settling velocities.

8.2. Contaminant Transport Calibration

The degree of calibration of the contaminant transport model is evaluated using contaminant concentrations at the 60, fall 2006 overlying water sites (Figure 15) and the 2005 and fall 2006 mid-water column sites (Figure 25). As previously noted, the mid-water column sites only have data for the three metals. Overlying water sites failed to provide detectable concentrations of PCB, resulting in no calibration results being presented for PCB other than confirmation that the model predicted water column PCB levels were below detection limits. As was done for the sediment comparison, contaminant concentrations were averaged over a six month dry season period for comparison with instantaneous observations taken during dry fall conditions.

Figures 34 through 36 show comparisons of model predictions and observations for total copper, lead, and zinc. The comparisons show extensive scatter, but model predicted levels are within the range of observations. For copper, the model predictions tend to be flat, on the order of 0.25 μg/L, while observations show more variability. For lead, the model predicts a larger range of concentrations than the observational data. Zinc predictions show a greater range as well as a region of flat predictions on the order of 1 μg/L. The flat prediction regions for copper and zinc have concentrations approximately three times larger than the open boundary values suggesting that they are not boundary condition driven. Predicted lead concentrations are also significantly larger than boundary conditions values. Figures 37 and 38 show comparisons of predicted and observed total concentrations of DDT and PAH. Predictions for DDT are almost constant and equal to the boundary condition value of 0.25 ng/L. Predictions for PAH show slightly more variability but are also close to the boundary condition value of 100 ng/L. Model predictions for PCB also were close to the boundary condition value of 0.015 ng/L, but are not shown since PCB levels in the samples were not detectable.

8.3. Dry Season Sensitivity Analysis

A dry season sensitivity analysis was conducted to determine the influence of open boundary concentrations, watershed loads, and sediment bed erosion rates on model predictions. These results are presented in Appendix C. Open boundary conditions, representing ambient or background concentrations in San Pedro Bay, result from much larger scale distributed sources than the greater harbors watersheds, and cannot be readily controlled with respect to a localized watershed-scale TMDL. In this respect, demonstration of low sensitivity to open boundary conditions is desirable A moderate to high sensitivity with respect to river and watershed loads indicates that these sources are primarily responsible for observed levels of contamination. In water bodies having significant existing or legacy contaminant of the sediment bed, net flux of sediment, metals, and organics from the bed to the water column due to erosion and slower diffusive flux can represent a significant source to the water column.

For the organics and, to a certain extent, zinc, the sensitivity analyses suggest that a reduction of land-derived loads may result in lower levels of water column contamination. In addition, sediment bed erosion was found to be a significant source of contamination. Pollutant load reductions may be achieved by implementation measures either individually or in combination. Such implementation measures may include, but are not limited to, reducing watershed and river inflows of contaminated sediments (but not necessarily clean sediment), localized capping or sediment removal, and gradual replacement of incoming contaminated sediment with clean sediment (to reduce contaminant

flux from the sediment bed since the new deposited cleaner sediment would lower contamination levels).

8.4. Sensitivity to Long-Term Load Reductions

To compliment the dry season sensitivity analysis and demonstrate the application of the model to investigate load allocations, two long-term simulations were conducted (Appendix D). Both simulations examined several pollutants (copper, zinc, DDT, and PAHs) and spanned a four year period from 2002 through 2005. The first (or baseline) simulation used watershed model estimated sediment and contaminant loads (i.e., the baseline conditions from the calibrated model). The second (or load reduction) simulation used sediment and contaminant loads which were reduced by 50 percent for inputs from both the rivers and near shore watersheds. The sensitivity analysis results are presented in both time series graphs and maps illustrating changes in contaminant level over the four year period.

Results for both copper and zinc indicate decreases in water column concentrations during periods of high flow, when comparing the baseline conditions with the 50 percent load reduction scenario. In addition, after the four-year period, the copper and zinc sediment bed concentrations associated with the 50 percent load reduction scenario were lower than baseline. The spatial maps of copper and zinc indicate that a 50 percent reduction of incoming loads results in a system-wide reduction in sediment bed concentrations.

Similar to the metals, DDT and PAH concentrations in the water column decrease during periods of high flow when comparing the baseline conditions with the 50 percent load reduction scenario. Sediment bed contaminant concentration behavior was more spatially varied after the four-year period for DDT; one station increased in concentration while another decreased. PAH in the sediment bed followed a pattern more similar to metals (concentrations associated with the 50 percent load reduction scenario were lower than baseline conditions). As illustrated by the maps, the spatial pattern is somewhat similar for the two organics, with the most significant changes occurring in the inner harbors and near the Los Angeles River inflow. Similar to the metals, these maps indicate that a 50 percent reduction of incoming loads results in a system-wide reduction in sediment bed DDT and PAH concentrations.

Overall, the simulations showed that water column contaminant concentrations were lower for the reduced load simulation during wet period events and that sediment bed contaminant levels were lower after the four year period for the reduced load simulation. These results suggest that the model could be used to evaluate spatially distributed and wet weather magnitude-based load reduction scenarios. Detailed discussion of the simulations are presented in Appendix D.

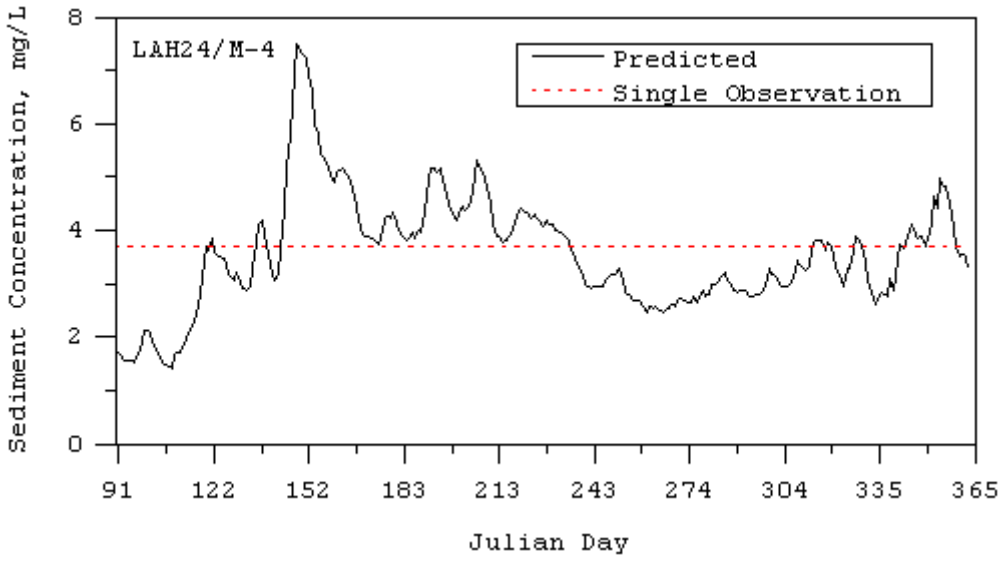


Figure 32. Comparison of model predicted and single observed sediment.

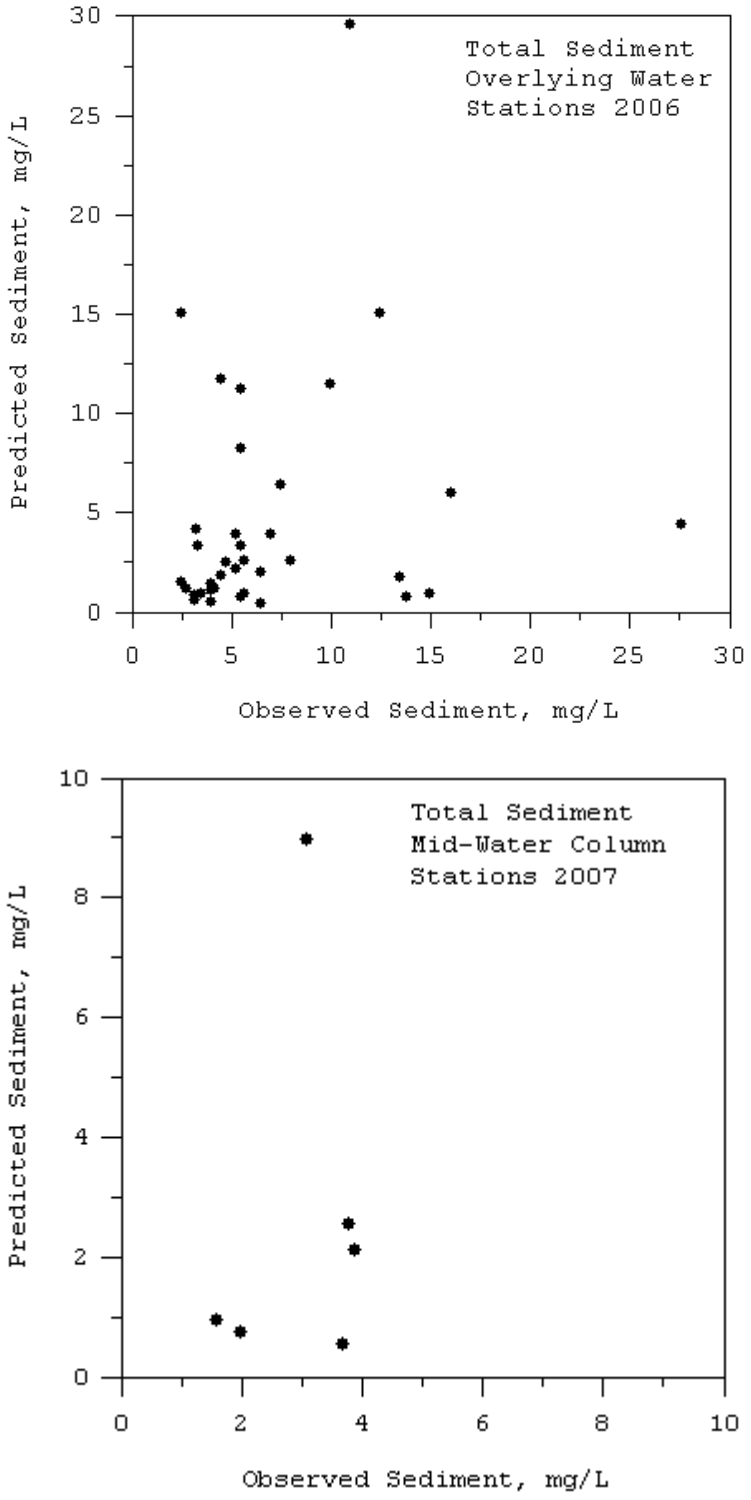
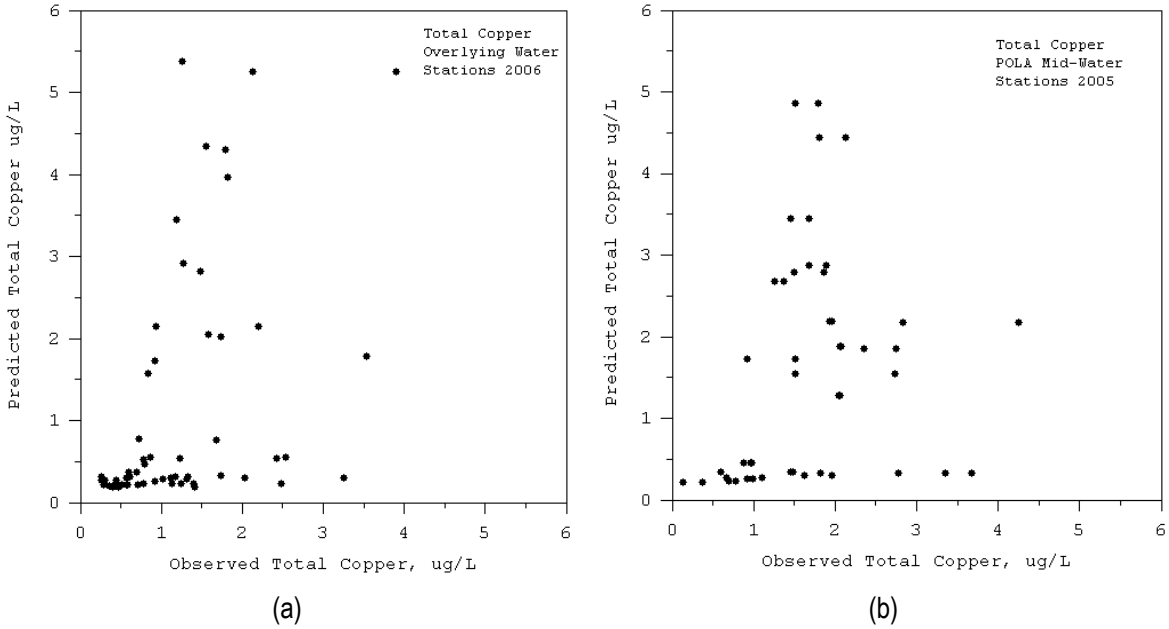
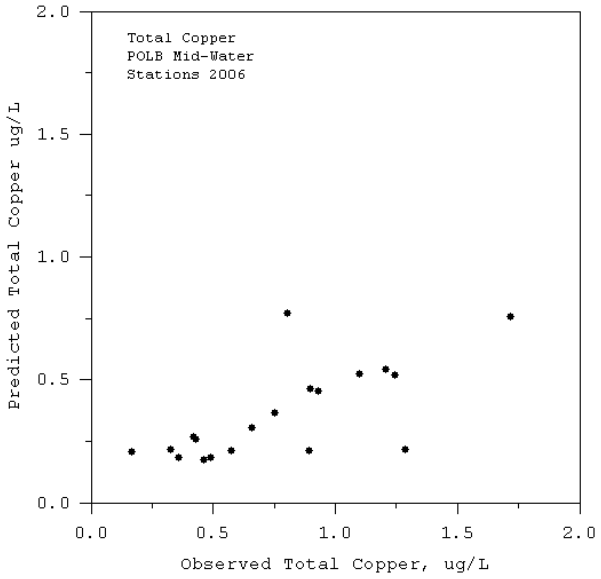


Figure 33. Comparison of model predicted and observed sediment concentration at the 2006 overlying water sites and 2007 mid-water column sites



(a)

(b)



(c)

Figure 34. Comparison of model predicted and observed copper concentration at the overlying water and mid-water column sites

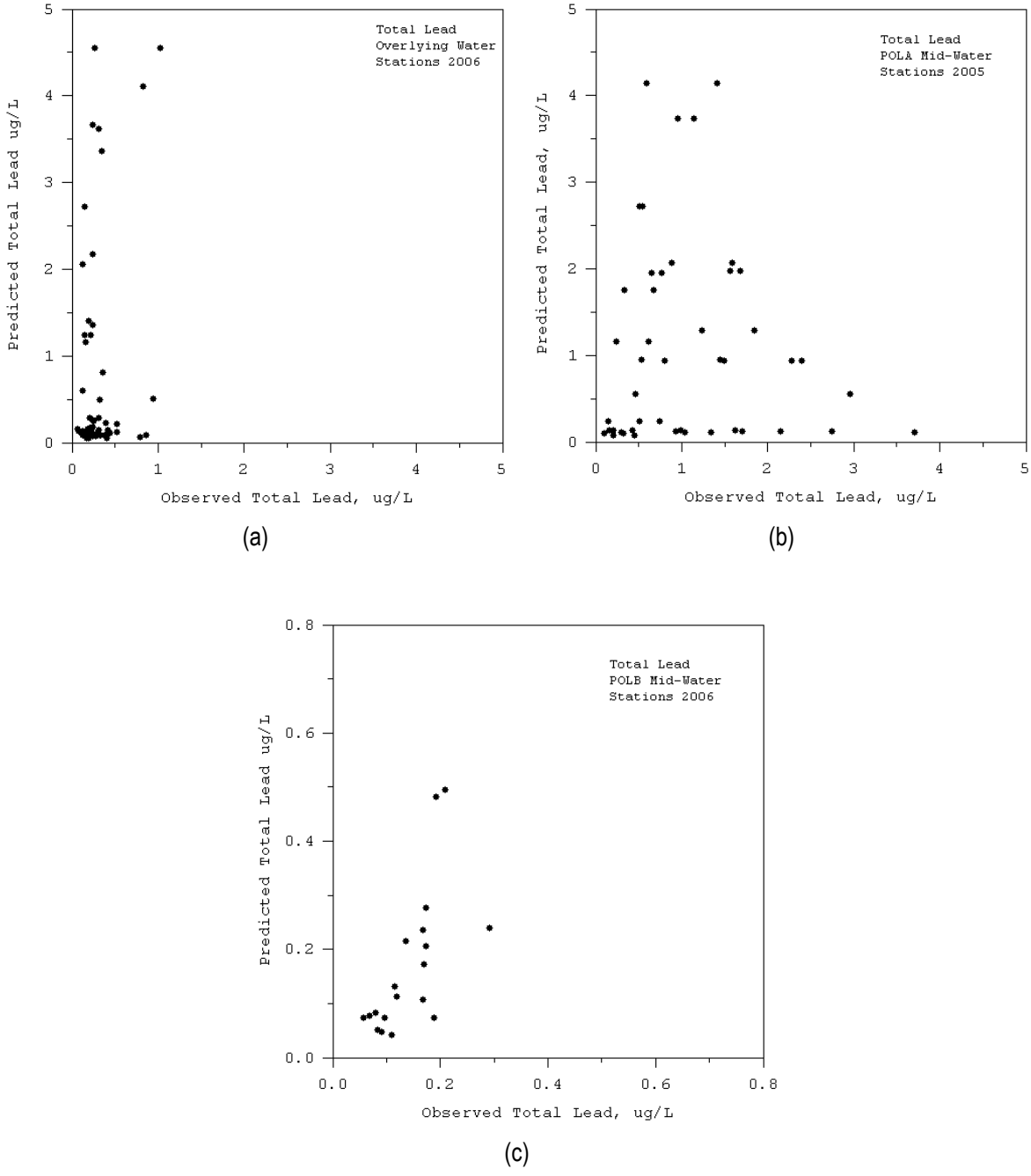


Figure 35. Comparison of model predicted and observed lead concentrations at the overlying water and mid-water column sites

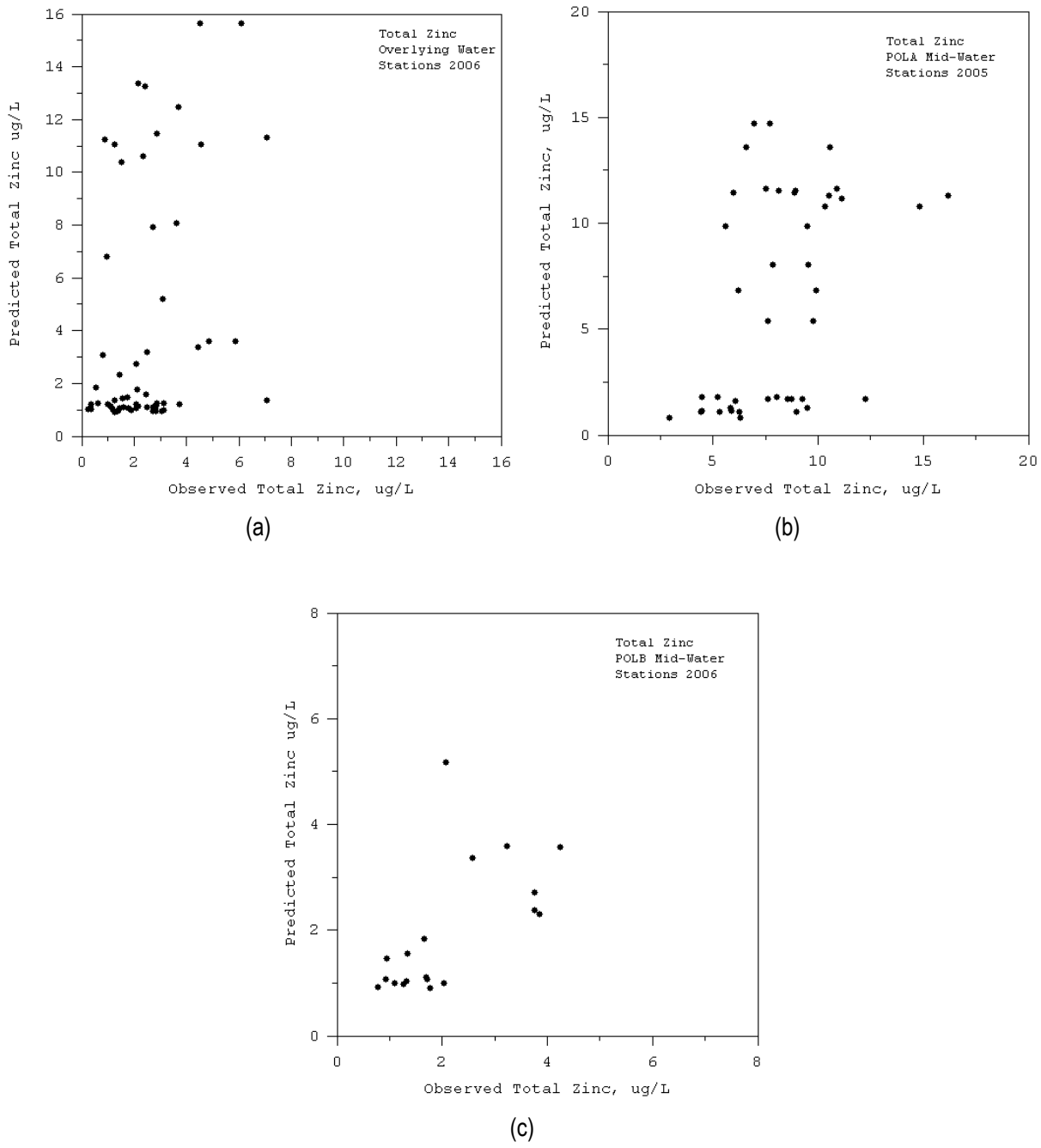


Figure 36. Comparison of model predicted and observed zinc concentration at the 2006 overlying water and mid-water column sites

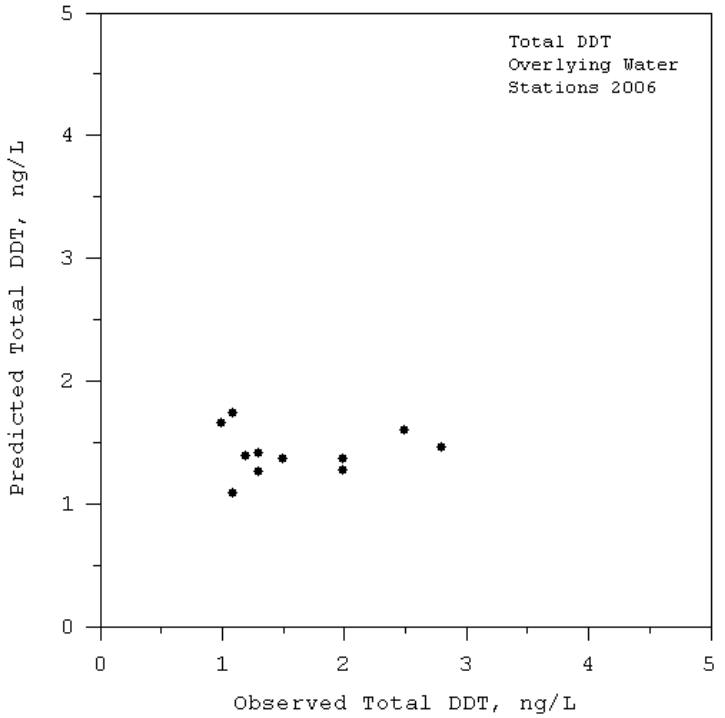


Figure 37. Comparison of model predicted and observed DDT concentration at the 2006 overlying water column sites

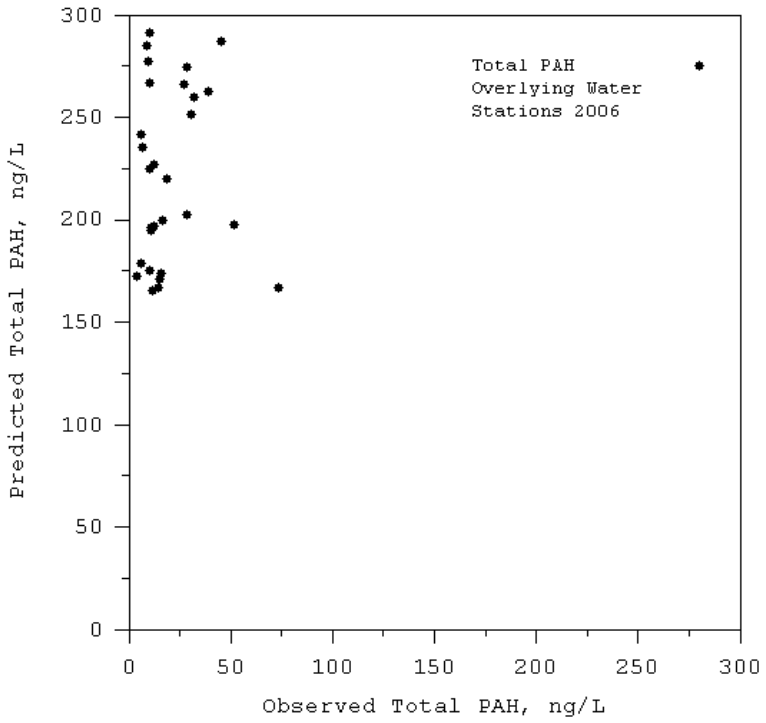


Figure 38. Comparison of model predicted and observed PAH concentration at the 2006 overlying water sites

9. Summary and Recommendations

This report summarizes the calibration of a fully coupled EFDC based hydrodynamic, sediment transport, and contaminant transport and fate model for the greater Los Angeles/Long Beach Harbors and adjacent region of San Pedro Bay. Observational data to support model configuration and calibration were reviewed and judged adequate to very adequate for model configuration. Tide gauge and current meter data were very adequate for hydrodynamic calibration and the level of calibration is consistent with other hydrodynamic modeling studies of similar scope. Due to the event-driven character of fresh water inflow into the greater harbors, salinity data sets lacked significant variability to fully evaluate salinity transport calibration as compared to studies in other estuaries and coastal harbors having continuous freshwater inflow.

Sediment and contaminant data were adequate for model configuration, which focused on establishing sediment bed initial conditions. Water column data for suspended sediment concentration are very limited and tend to constrain the level of calibration which can be achieved, although field observations during fall 2006 significantly enhanced the base of data. Water column data for metals concentration are more extensive, but metal calibration is still limited by the water column sediment transport calibration. Water column data for DDT and PAH are also limited and data for PCB indicate that levels are below detection limits. Dry weather sensitivity analyses were conducted to determine the influence of open boundary concentrations, watershed loads, and sediment bed erosion rates on water column, sediment, and contaminant concentration levels (Appendix C). Long-term sensitivity was also evaluated by comparing water column and sediment bed concentrations associated with baseline conditions and a 50 percent reduction in river and watershed loading (Appendix D). In contrast to hydrodynamic and eutrophication modeling studies in estuarine and coastal regions, extensive literature is not available for establishing what constitutes an acceptable level of calibration for sediment and contaminant transport modeling. However the calibration results presented herein demonstrate that use of available data combined with best estimates of required model parameters do yield model predictions well within the range of observations.

The EFDC based hydrodynamic, sediment transport, and contaminant transport and fate model for the greater Los Angeles/Long Beach Harbors and adjacent region of San Pedro Bay is judged suitable for use in TMDL development. The model provides a rigorous framework for contaminant response surface development with respect to the major sources including land-based loadings, net flux of legacy contaminants for the sediment bed, and open boundary driven loads. The attention given to the development of initial conditions for the sediment bed makes the modeling framework particularly useful in determining difficult to control source contributions from the sediment bed. Likewise the ease in model reconfiguration to adjust incoming contaminant levels on a sub-watershed scale will allow focused allocations to be developed.

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Appendix A: Salinity Time Series Calibration Plots

DRAFT

November 2008

Prepared for:
USEPA Region 9
Los Angeles Regional Water Quality Control Board

Prepared by:
Tetra Tech, Inc.

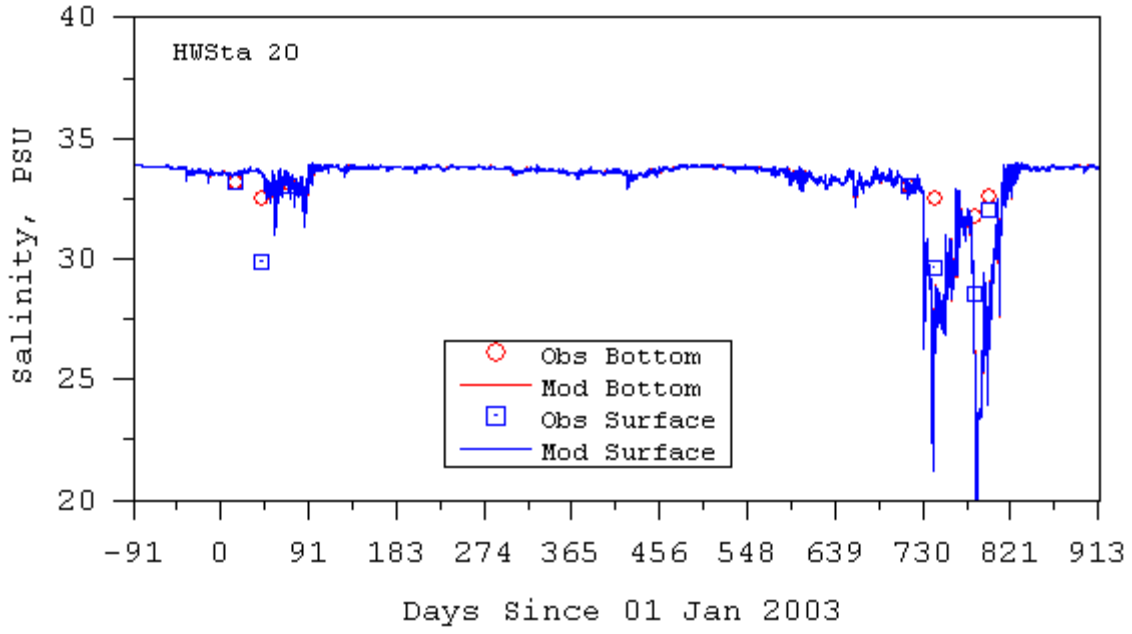
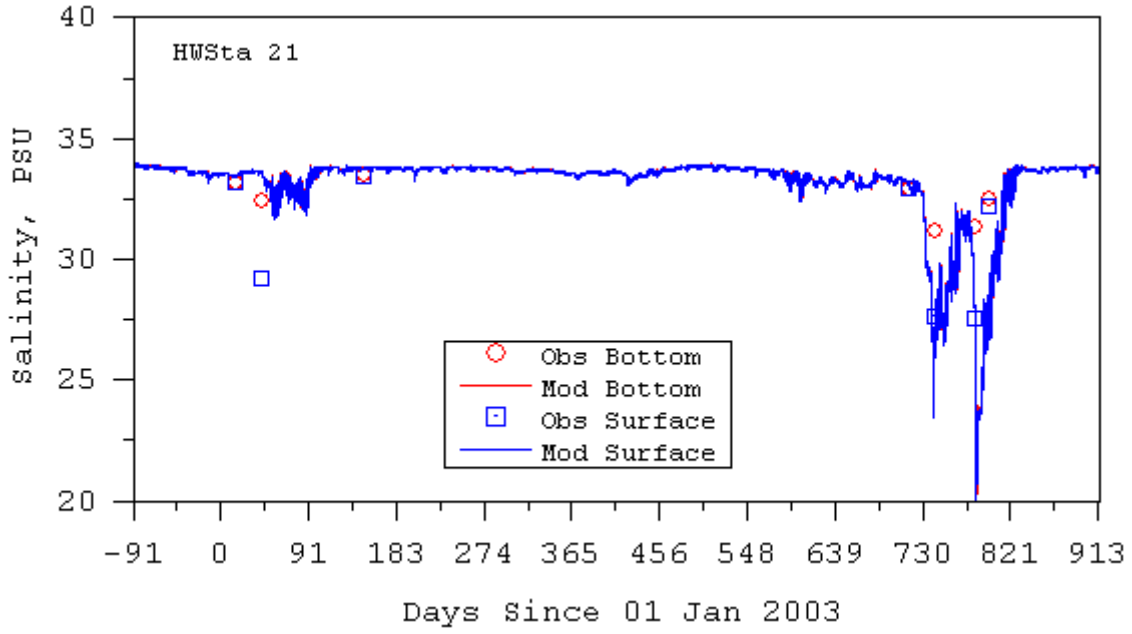


Figure A-1. Model Predicted and Observed Salinity at LAH Station 20



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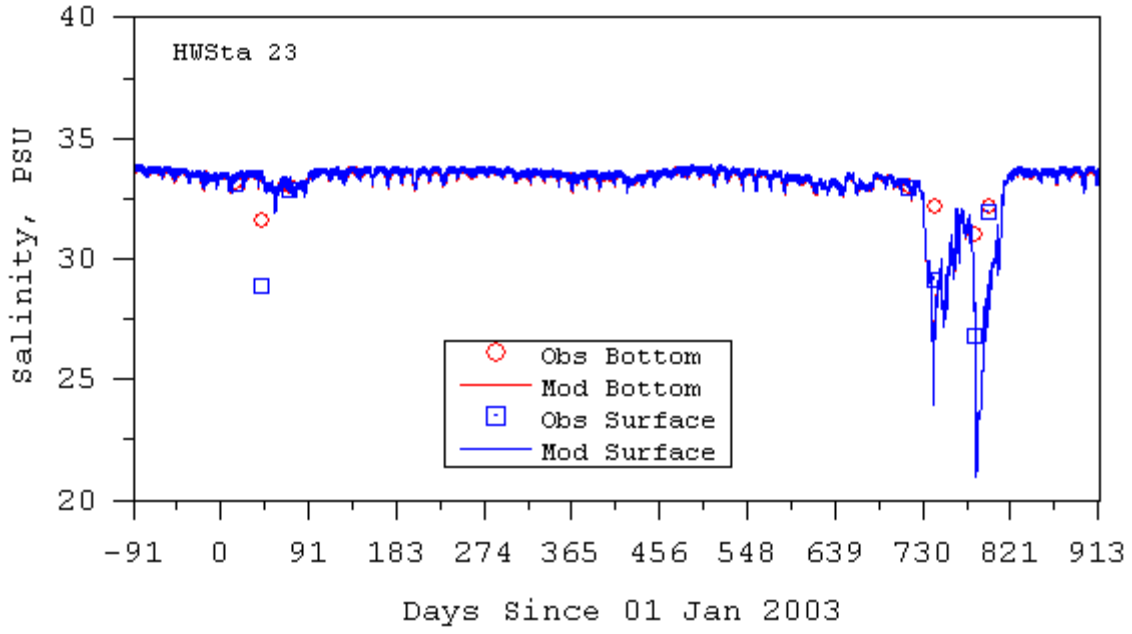

Figure A-3. Model Predicted and Observed Salinity at LAH Station 23

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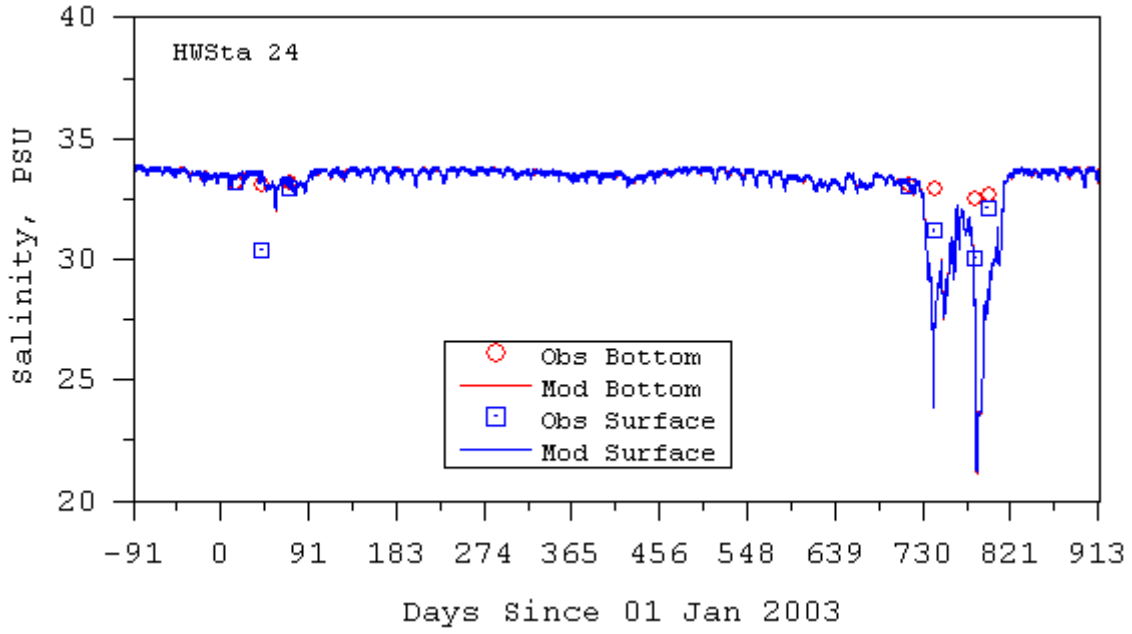

Figure A-4. Model Predicted and Observed Salinity at LAH Station 24

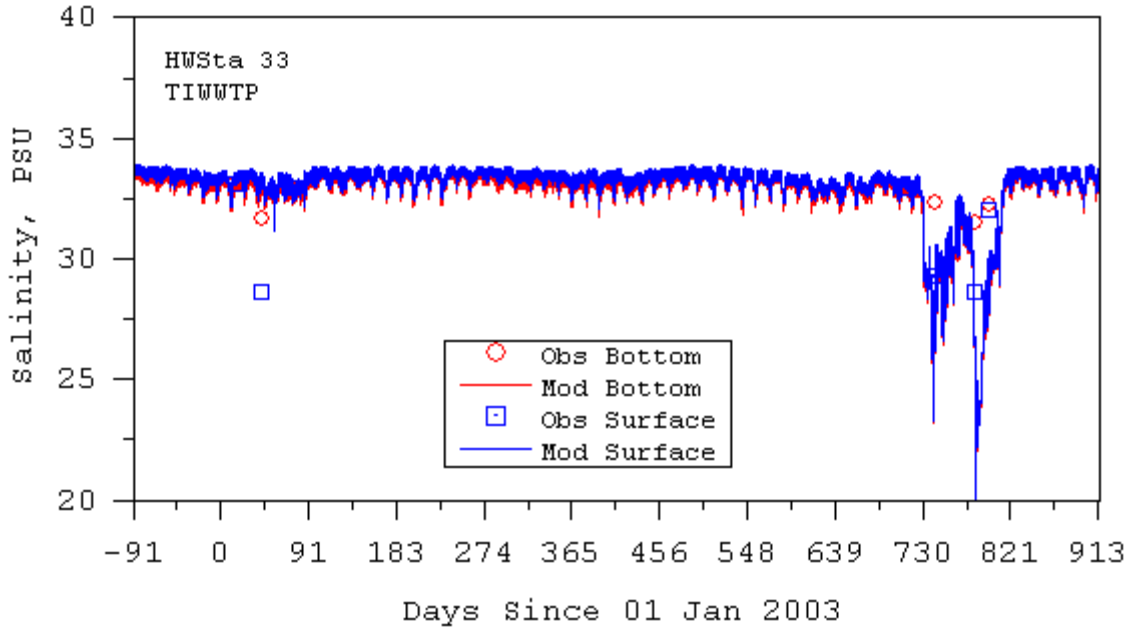

Figure A-5. Model Predicted and Observed Salinity at LAH Station 33

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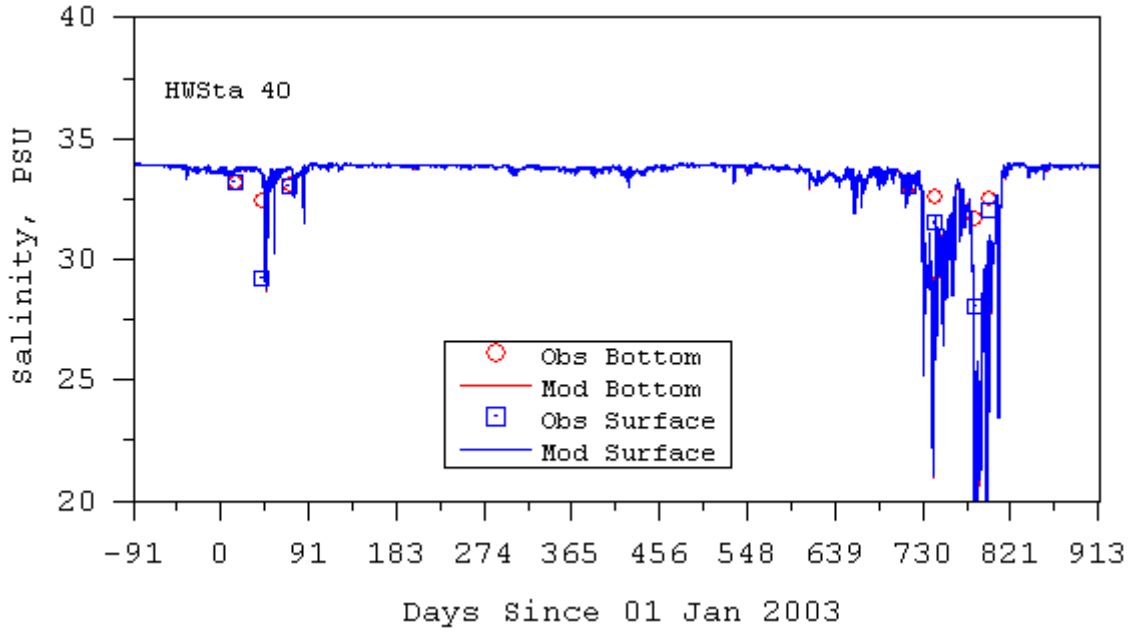


Figure A-6. Model Predicted and Observed Salinity at LAH Station 40

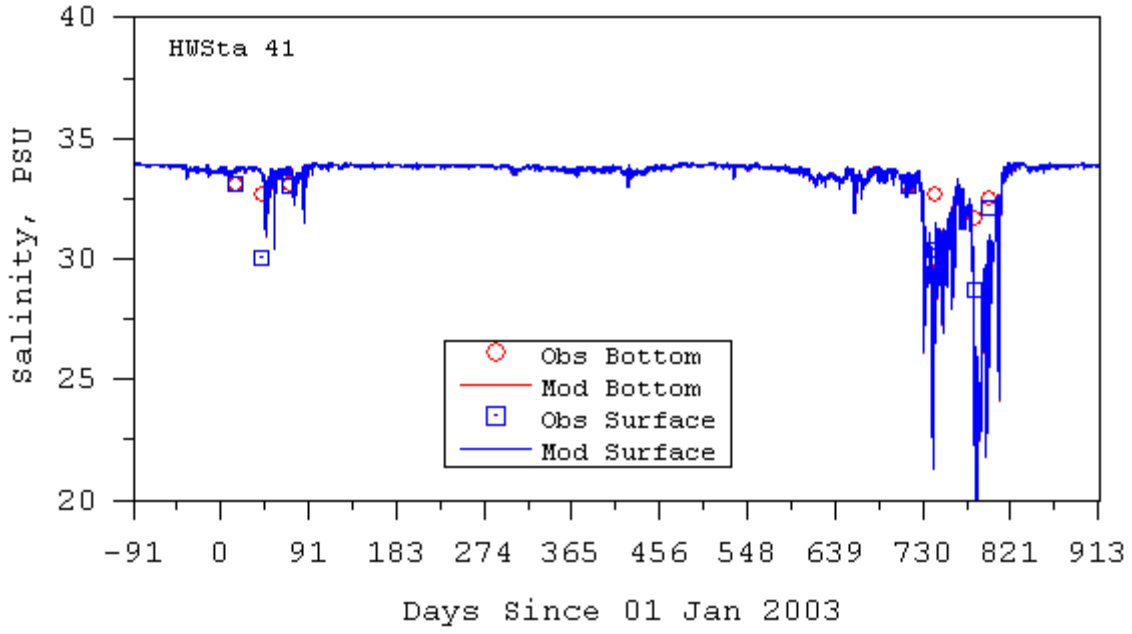


Figure A-7. Model Predicted and Observed Salinity at LAH Station 41

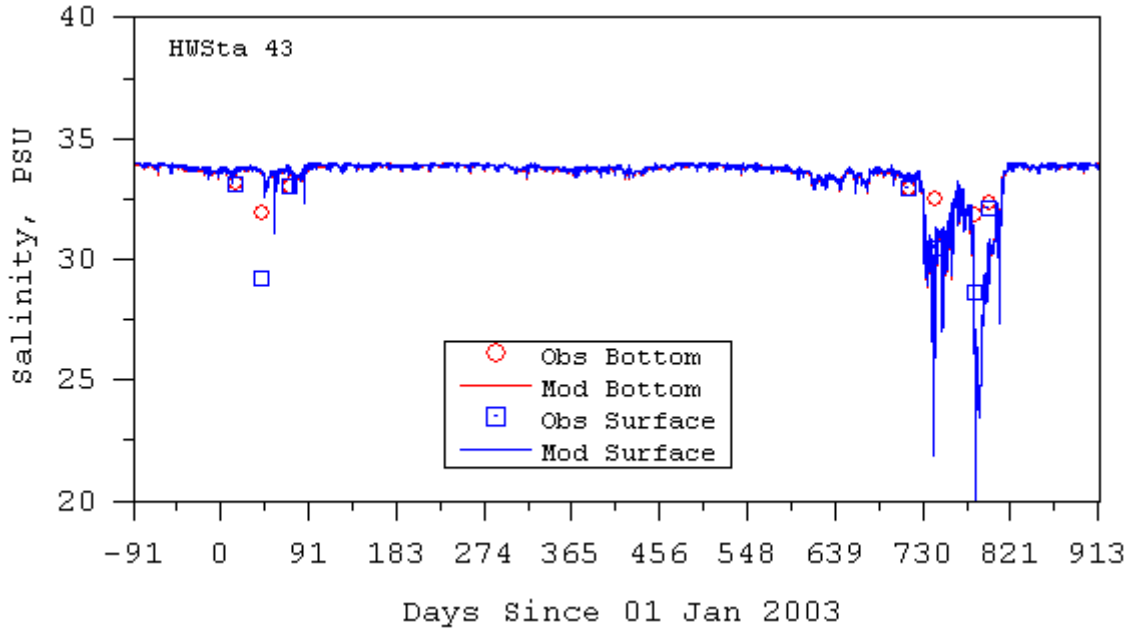
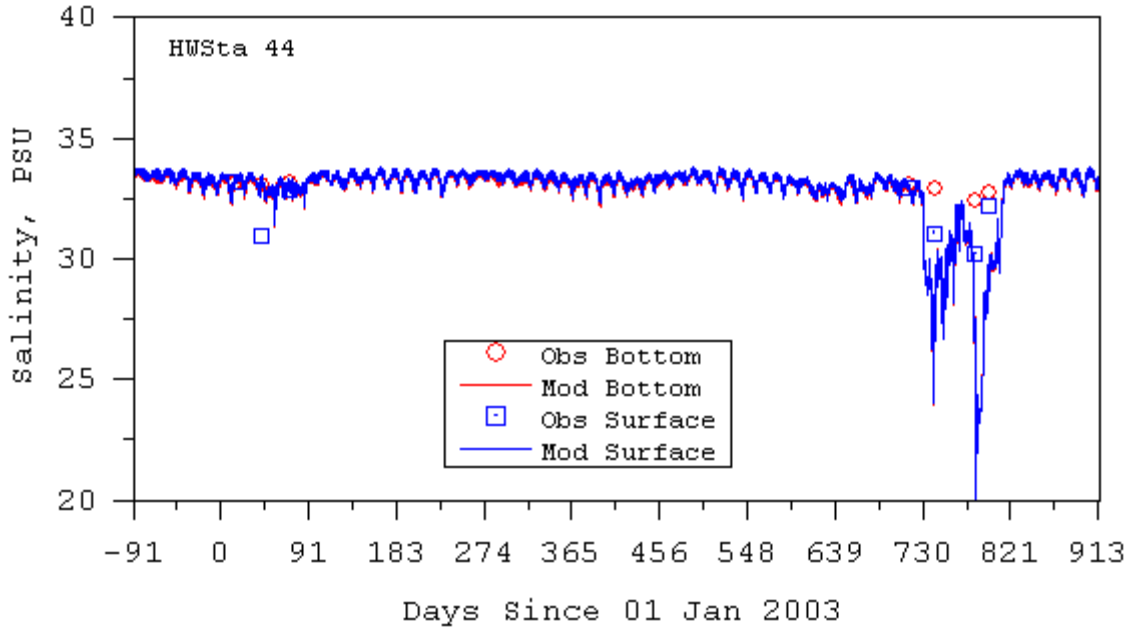


Figure A-8. Model Predicted and Observed Salinity at LAH Station 43



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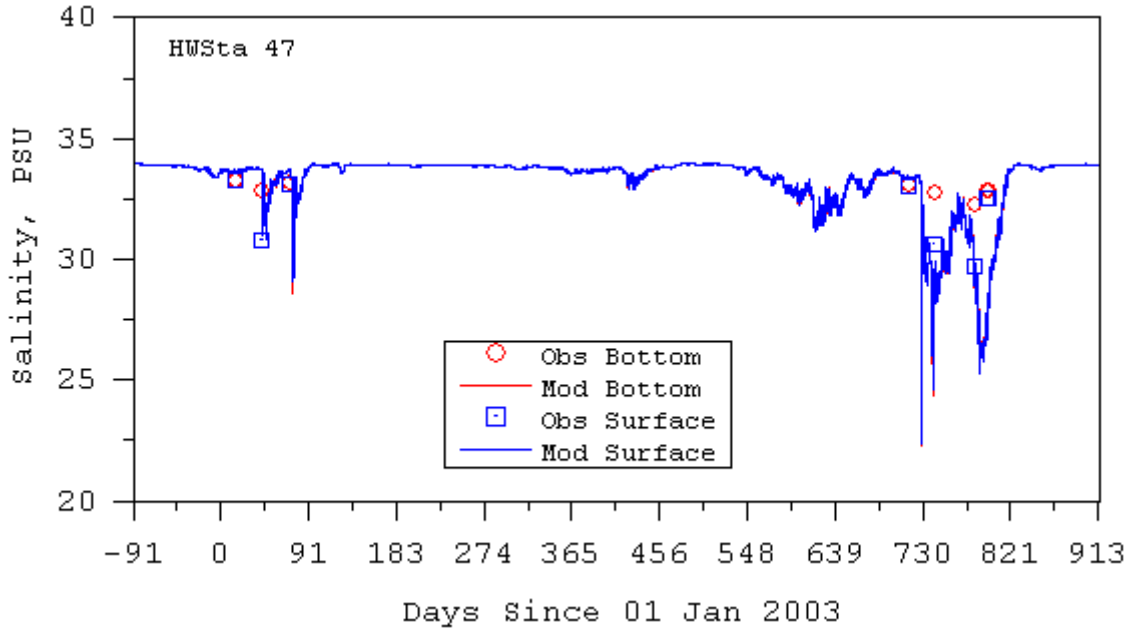

Figure A-10. Model Predicted and Observed Salinity at LAH Station 47

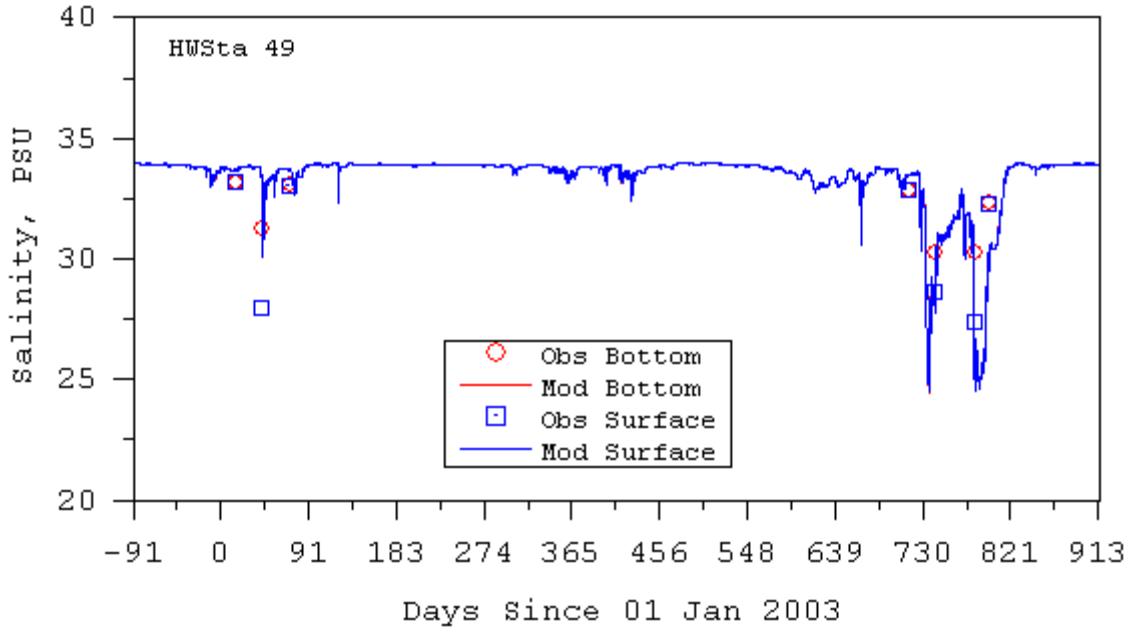

Figure A-11. Model Predicted and Observed Salinity at LAH Station 49

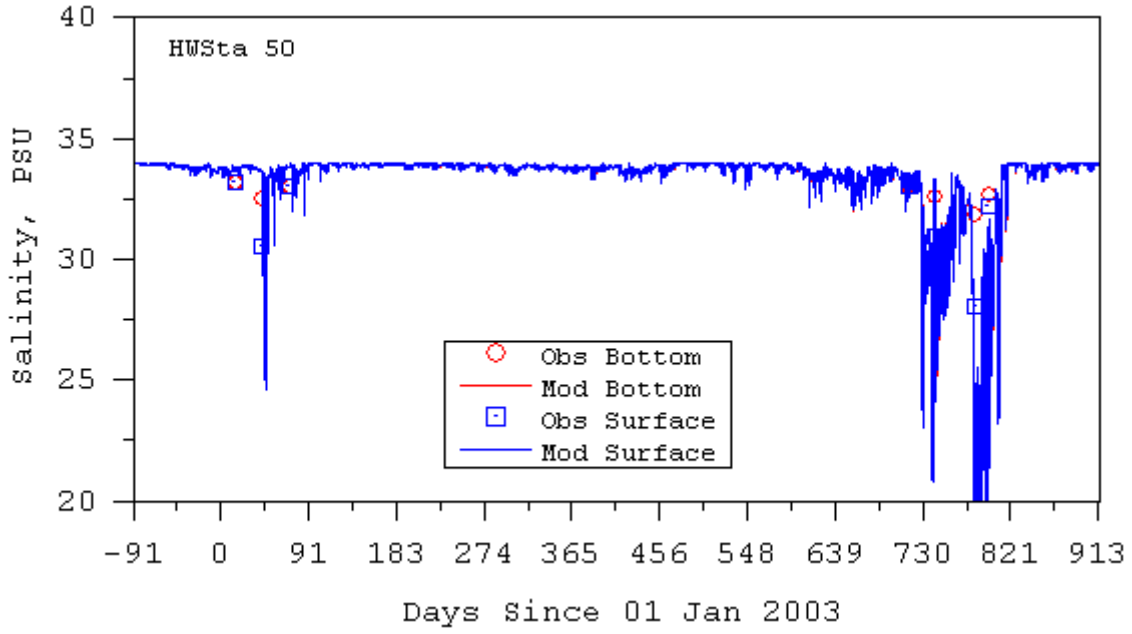

Figure A-12. Model Predicted and Observed Salinity at LAH Station 50

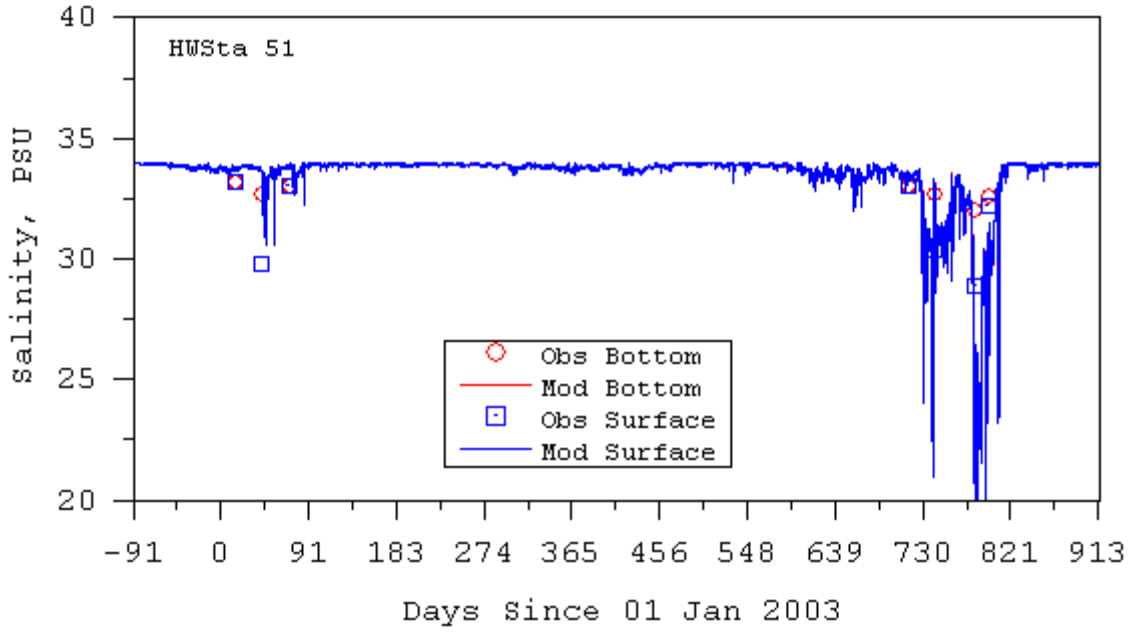

Figure A-13. Model Predicted and Observed Salinity at LAH Station 51

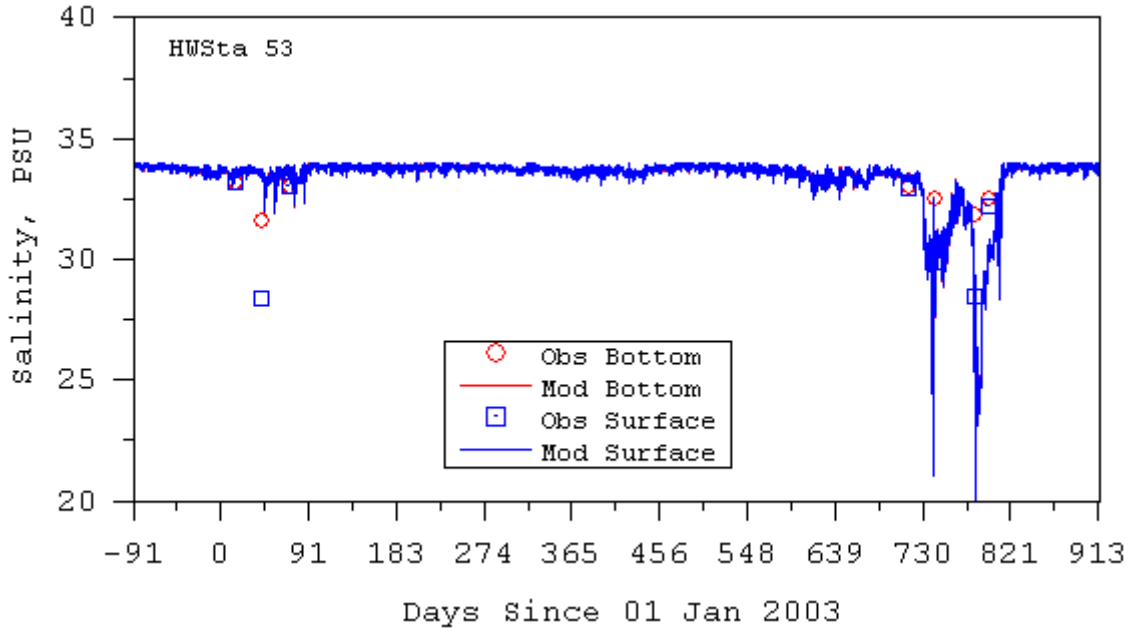

Figure A-14. Model Predicted and Observed Salinity at LAH Station 53

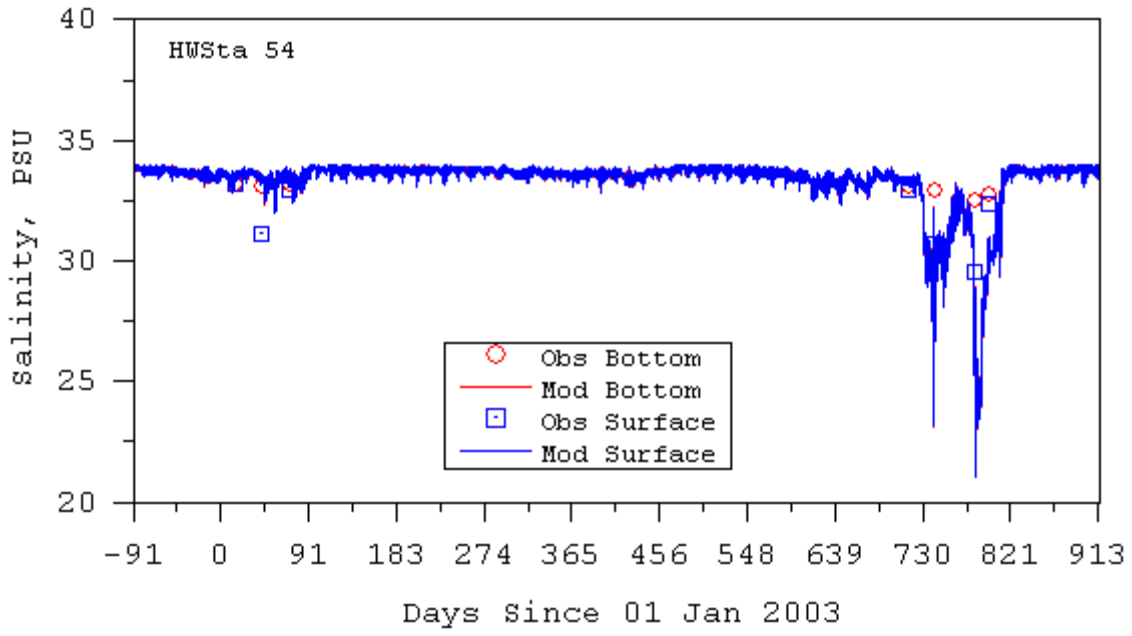

Figure A-15. Model Predicted and Observed Salinity at LAH Station 54

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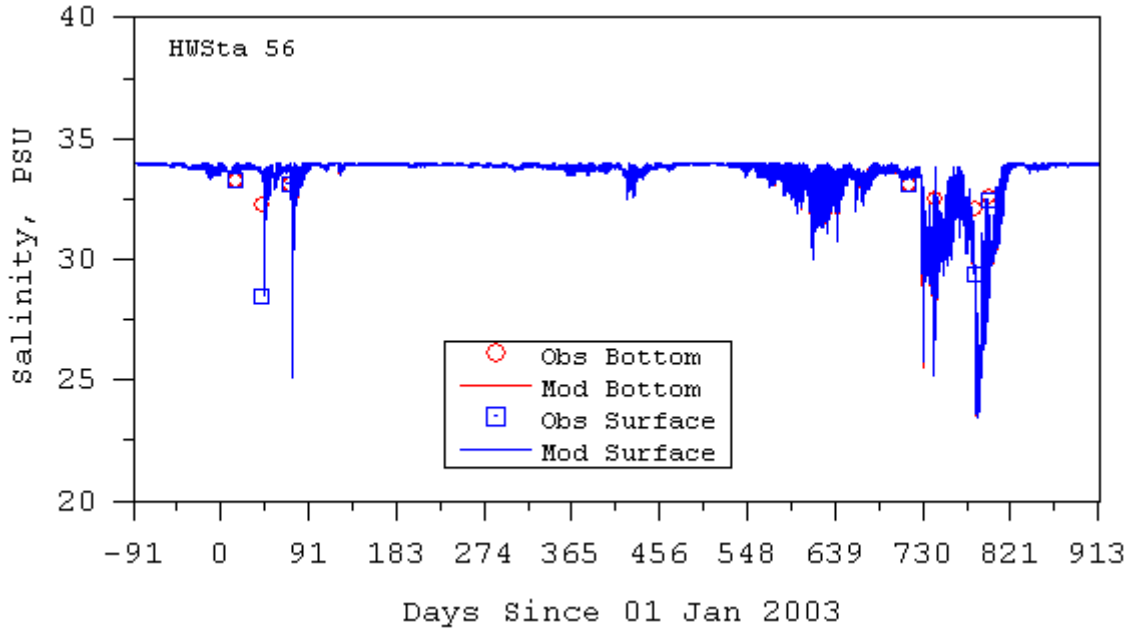


Figure A-16. Model Predicted and Observed Salinity at LAH Station 56

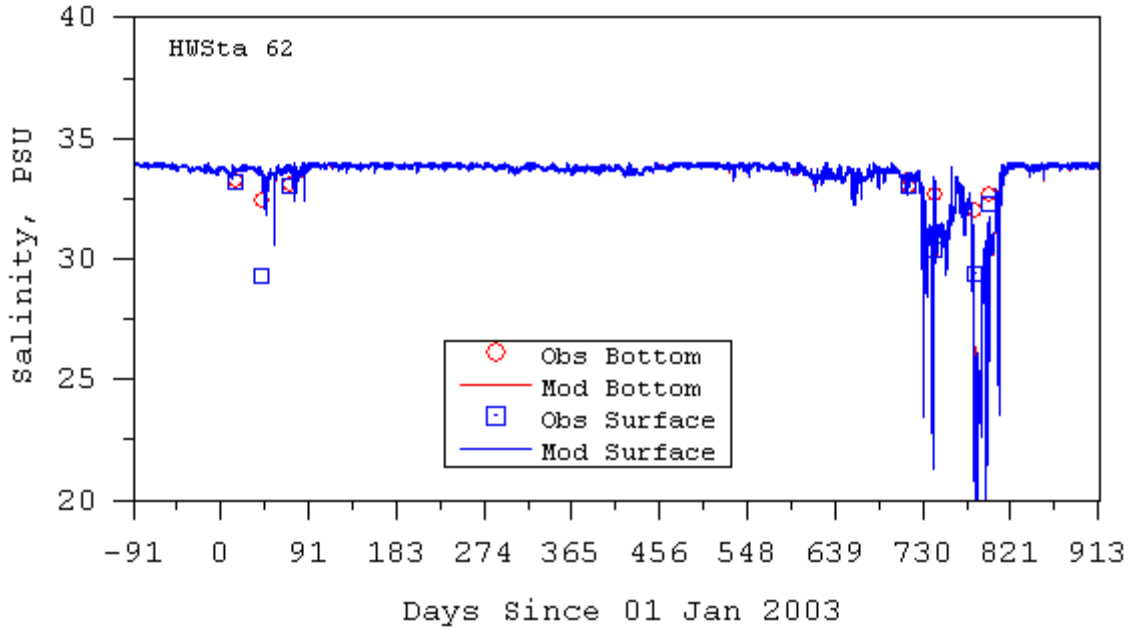


Figure A-17. Model Predicted and Observed Salinity at LAH Station 62

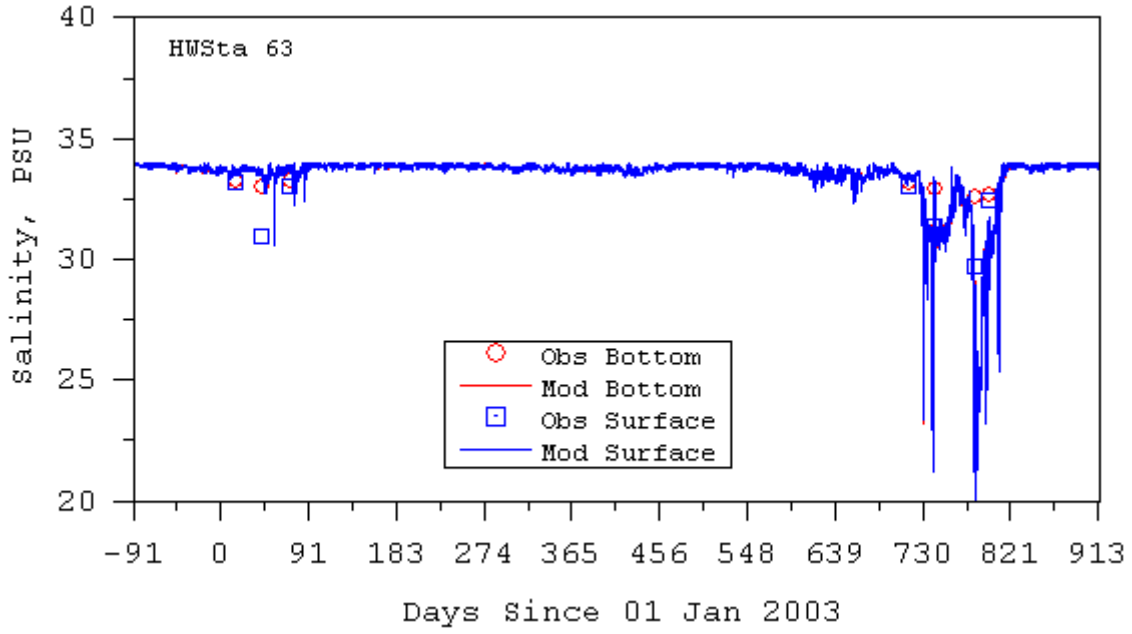


Figure A-18. Model Predicted and Observed Salinity at LAH Station 63

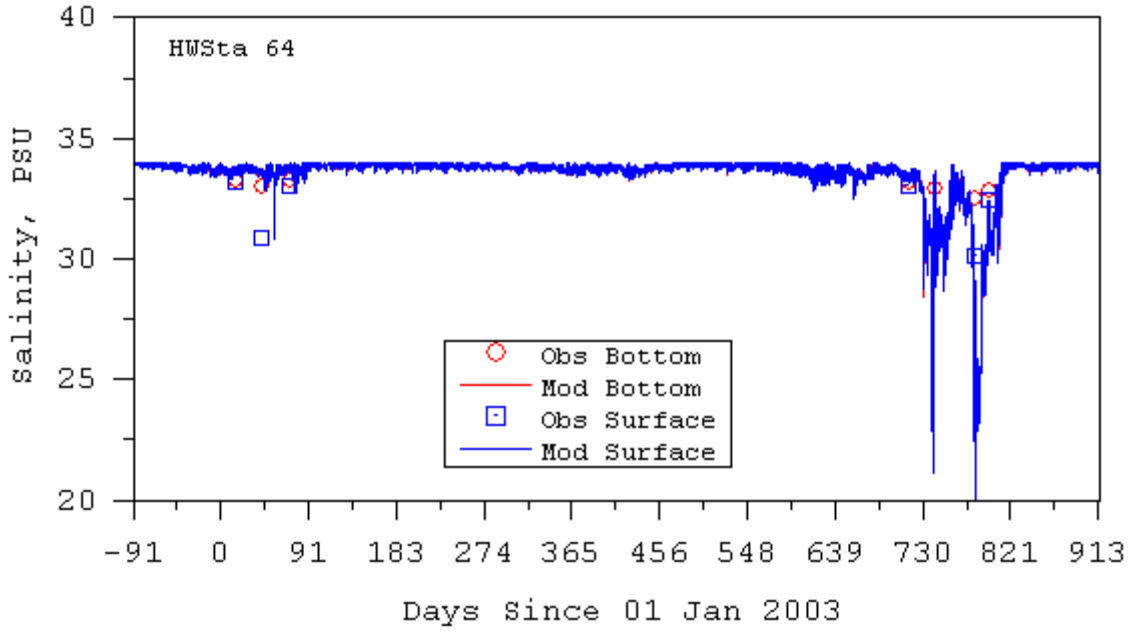


Figure A-19. Model Predicted and Observed Salinity at LAH Station 64

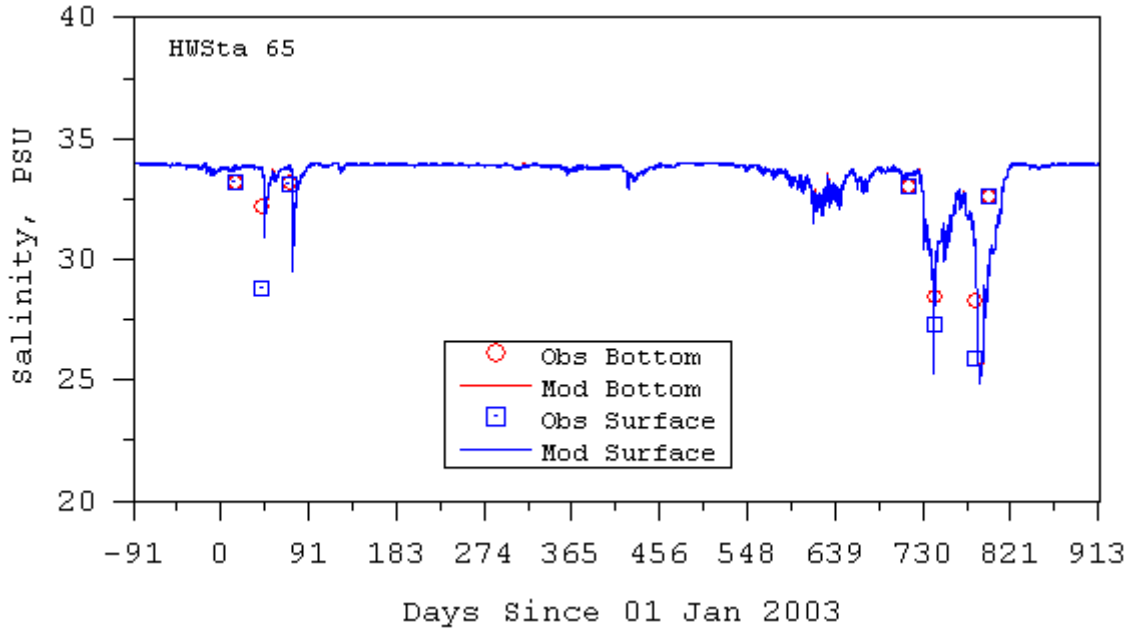


Figure A-20. Model Predicted and Observed Salinity at LAH Station 65

Appendix B: Model Performance Measures

DRAFT

November 2008

Prepared for:
USEPA Region 9
Los Angeles Regional Water Quality Control Board

Prepared by:
Tetra Tech, Inc.

To quantify the EFDC model's prediction of water surface elevation, velocity, and concentration of suspended and dissolved water scalar state variables, a number of statistical tests and time series analyses are used. This section summarizes general test and analysis procedures.

The statistical test that can be used for evaluating model predictions includes the mean error, mean absolute error, root mean square error, maximum absolute error, relative mean error and relative absolute mean error (Thomann, 1982). Letting *O* and *P* denote observed and predicted values of a quantity at *N* observation times, the mean error is defined by

$$ME = \frac{1}{N}\sum_{n=1}^{N}\left(O_n - P_n\right) \tag{B.1}$$

Positive values of the mean error indicate that the model tends to under predict the observations whereas negative values indicate that the model tends to over predict observations. The mean absolute error is defined by

$$MAE = \frac{1}{N}\sum_{n=1}^{N}\left|O_n - P_n\right| \tag{B.2}$$

Although the mean absolute error provides no indication of over prediction or under prediction, it eliminates the canceling effects of positive and negative errors and can be viewed as a more extreme measure of observation-prediction agreement. The root mean square error is defined by

$$RMSE = \sqrt{\frac{1}{N}\sum_{n=1}^{N}\left(O_n - P_n\right)^2} \tag{B.3}$$

The root mean square error can be interpreted as a weighted equivalent to the mean absolute error with larger observation-prediction differences given larger weightings. The square root operation recovers the units of the data quantities. The rms error is generally viewed as the most rigorous absolute error test. The maximum absolute error is defined by

$$MAXE = \max\left|O_n - P_n\right| \quad : n = 1, N \tag{B.4}$$

and provides information on the largest discrepancy between corresponding values of observed and predicted quantities over an interval of *N* measurements.

Relative error measures can be used to eliminate data units and to provide a measure of error relative to the magnitude of the observational data. The relative mean error and the relative mean absolute error are defined by

$$RME = \frac{\frac{1}{N}\sum_{n=1}^{N}(O_n - P_n)}{\frac{1}{N}\sum_{n=1}^{N}O_n} \tag{B.5}$$

$$MAE = \frac{\frac{1}{N}\sum_{n=1}^{N}|O_n - P_n|}{\frac{1}{N}\sum_{n=1}^{N}O_n} \tag{B.6}$$

Caution should be employed in the use of these two relative error measures, particularly when observed and predicted quantities can have small values or values that have both positive and negative signs. An alternative relative error, hereafter referred to as the relative mean square error, is

$$RSE = \frac{\sum_{n=1}^{N}\left(O^{(n)} - P^{(n)}\right)^2}{\sum_{n=1}^{N}\left(\left(O^{(n)} - \overline{O}\right)^2 + \left(P^{(n)} - \overline{O}\right)^2\right)} \tag{B.7}$$

This error measure was proposed by Willmott (1982) and Willmont *et al.* (1982) and used by Blumberg and Goodrich (1990) to analyze the prediction skill of an estuarine model. The value of *RSE* always falls between zero and unity, with an increasing value corresponding to decreasing skill of the model.

Thomann (1982) suggested the use of linear regression for comparing model predictions with observations in the context of model calibration. Following Thomann, the linear equation relating observed and predicted values of the quantity is written as

$$O = \alpha + \beta P \tag{B.8}$$

where alpha and beta are determined by

$$\alpha = \frac{1}{N}\left(\sum_{n=1}^{N}O^{(n)} - \beta\sum_{n=1}^{N}P^{(n)}\right) \tag{B.9}$$

$$\beta = \frac{\sum_{n=1}^{N}\left(O^{(n)} - O^{(avg)}\right)\left(P^{(n)} - P^{(avg)}\right)}{\sum_{n=1}^{N}\left(P^{(n)} - P^{(avg)}\right)^2} \tag{B.10}$$

(Devore, 1982). The null hypothesis for the linear regression is alpha, the intercept, equal to zero, and beta, the slope, equal to one. Also useful in the regression analysis is the correlation coefficient

$$r = \frac{N\sum_{n=1}^{N} P^{(n)}O^{(n)} - \left(\sum_{n=1}^{N} P^{(n)}\right)\left(\sum_{n=1}^{N} O^{(n)}\right)}{\sqrt{N\sum_{n=1}^{N} P^{(n)}P^{(n)} - \left(\sum_{n=1}^{N} P^{(n)}\right)^2}\sqrt{N\sum_{n=1}^{N} O^{(n)}O^{(n)} - \left(\sum_{n=1}^{N} O^{(n)}\right)^2}} \tag{B.11}$$

For a good a fit or correlation between observations and predictions, the correlation coefficient should be near one. The square of the correlation coefficient equals the fractional proportion of variation of observations explained by the regression relationship between the observations and predictions (Devore, 1982).

Time series having deterministic periodic structure can be analyzed using least squares harmonic analysis. Consider a time series of the form

$$\phi(t) = a_0 + b_0 t + \sum_{m=1}^{M} a_n \cos\left(\frac{2\pi t}{T_m}\right) + \sum_{m=1}^{M} b_n \sin\left(\frac{2\pi t}{T_m}\right) \tag{B.12}$$

composed of a constant, a_0, a linear in time term $b_0 t$, and M periodic or harmonic components having periods T_m. Note that equation B.12 can also be written in the form

$$\phi(t) = a_0 + b_0 t + \sum_{m=1}^{M} A_m \cos\left(\frac{2\pi}{T_m}(t - \tau_m)\right) \tag{B.13}$$

$$A_m^2 = a_m^2 + b_m^2$$

$$\tau_m = \frac{T_m}{2\pi}\arctan\left(\frac{b_m}{a_m}\right)$$

where A_m and τ_m are the amplitude and phase of the mth periodic or harmonic component of the time series. The *a* and *b* coefficients representing the time series can be determined form discrete values of ϕ at N times by minimization of the least squares functional

$$E = \sum_{n=1}^{N}\left(\phi(t_n) - a_0 - b_0 t - \sum_{m=1}^{M} a_m \cos\left(\frac{2\pi t_n}{T_m}\right) - \sum_{m=1}^{M} b_m \sin\left(\frac{2\pi t_n}{T_m}\right)\right)^2 \tag{B.14}$$

with respect to the *a* and *b* coefficients. The minimization results in a system of *2N+1* equations for the *a* and *b* coefficients. For comparison of model

predictions with observations, harmonic coefficients are determined for both model-predicted and observed time series, and the amplitudes and phases appropriately compared for each harmonic component.

For two-dimensional vector time series, the vector components, *u* and *v*, are separately analyzed to determine the coefficients in the expansions

$$u(t) = u_0 + \sum_{m=1}^{M} uc_n \cos\left(\frac{2\pi t}{T_m}\right) + \sum_{m=1}^{M} us_n \sin\left(\frac{2\pi t}{T_m}\right) \quad \text{(B.15a)}$$

$$v(t) = v_0 + \sum_{m=1}^{M} vc_n \cos\left(\frac{2\pi t}{T_m}\right) + \sum_{m=1}^{M} vs_n \sin\left(\frac{2\pi t}{T_m}\right) \quad \text{(B.15b)}$$

The combined results can be cast in tidal velocity ellipse form with the major and minor axis amplitudes, the ellipse orientation, and the phase at which the velocity vector aligns with the major axis replacing the *uc*, *us*, *vc*, and *vs* coefficients for each constituent. The half-lengths, *ma* and *mi*, of the major and minor axes are given by

$$\begin{aligned} ma &= rp + rm \\ mi &= |rp - rm| \\ rp &= \sqrt{(uc + vs)^2 + (vc - us)^2} \\ rm &= \sqrt{(uc - vs)^2 + (vc + us)^2} \end{aligned} \quad \text{(B.16)}$$

for each constituent. The major axis orientation angle *ang*, in degrees counterclockwise from east, and the time phase *phe*, at which the velocity vector aligns with the major axis, are given by

$$\begin{aligned} ang &= \frac{90}{\pi}(ap + am) \\ phe &= \frac{T}{4\pi}(am - ap) \\ ap &= \tan^{-1}\left(\frac{vc - us}{uc + vs}\right) \\ am &= \tan^{-1}\left(\frac{vc + us}{uc - vs}\right) \end{aligned} \quad \text{(B.17)}$$

for each constituent.

An alternative method for comparing time series of observed and model predicted quantities is the use of spectral analysis techniques. Spectral analysis is particularly useful for comparing the frequency domain structure of observed and predicted responses to random external model forcings such as wind.

Spectral analysis can also be used for the analysis of time series composed of the sums of discrete harmonics and a random component. For a quantity s_k, observed or predicted at N discrete times $k\Delta t$ ($k = 0, N-1$) relative to a local time original, the discrete Fourier transform S_n is given by

$$S_n = \sum_{k=0}^{N-1} s_k \exp\left(\frac{2\pi i k n}{N}\right) \tag{B.18}$$

where i is the unit imaginary number. Note that the standard Fourier transform convention of defining N data points from indices 0 to $N-1$ is employed here (Press et al., 1992). The discrete transform is defined at discrete frequencies:

$$f_n = \frac{n}{N\Delta t} \quad ; \quad n = -\frac{N}{2}, \ldots 0 \ldots, \frac{N}{2} \tag{B.19}$$

with S_0 corresponding to the discrete 0 frequency, S_n ($n = 1, N/2-1$) corresponding to the first $N/2-1$ positive frequencies, and S_n ($n = N/2+1, N-1$) corresponding to the first $N/2-1$ negative frequencies in reverse order. At n equals $N/2$, S_n defines the value at both the positive and negative Nyquist critical frequencies,

$$f_c = f_{N/2} = \frac{1}{2\Delta t} \tag{B.20}$$

The inverse discrete transform is given by:

$$s_k = \frac{1}{N} \sum_{n=0}^{N-1} S_n \exp\left(\frac{2\pi i k n}{N}\right) \tag{B.21}$$

The power spectral density function, P_{ss}, of the quantity is defined, following Press et al. (1992), as

$$\begin{aligned} P_{ss}(0) &= P_{ss}(f_0) = \frac{1}{N^2}|S_0|^2 \\ P_{ss}(f_k) &= \frac{1}{N^2}\left(|S_k|^2 + |S_{N-k}|^2\right) \quad , \quad k = 1, \frac{N}{2} - 1 \\ P_{ss}(f_k) &= P_{ss}(f_{N/2}) = \frac{1}{N^2}|S_{N/2}|^2 \end{aligned} \tag{B.22}$$

for positive frequencies only and has the normalization property that its sum is equal to the mean square value of s.

$$\sum_{k=0}^{N/2} P_{ss}(f_k) = \frac{1}{N} \sum_{j=0}^{N-1} |s_j|^2 \tag{B.23}$$

When *s* is the water surface elevation, the summed spectral density function is readily identified as twice the mean potential energy divided by the acceleration for gravity:

$$\frac{2PE}{g} = \sum_{k=0}^{N/2} P_{\zeta\zeta}(f_k) \tag{B.24}$$

When *s* corresponds to velocity, the summed spectral density function is twice the component kinetic energy with the total kinetic energy defined by

$$2KE = \sum_{k=0}^{N/2} \left(P_{uu}(f_k) + P_{vv}(f_k)\right) \tag{B.25}$$

A useful measure of model performance is provided by the difference of observed and predicted power spectral density function of a particular quantity:

$$P_{dd}(f_k) = P_{oo}(f_k) - P_{pp}(f_k) \tag{B.26}$$

with *d*, *o*, and *p* denoting the difference, observed, and predict, quantities respectively.

Principal current direction

$$\theta_{PCD} = \frac{1}{2}\arctan\left(\frac{2\sum_{n=1}^{N}(u_n-\bar{u})(v_n-\bar{v})}{\sum_{n=1}^{N}(u_n-\bar{u})^2 - \sum_{n=1}^{N}(v_n-\bar{v})^2}\right) + m\frac{\pi}{2} \tag{B.27}$$

Where m is chosen to be 0 or 1, whichever maximizes

$$s^2 = \cos^2\theta_{PCD}\sum_{n=1}^{N}(u_n-\bar{u})^2 + \sin^2\theta_{PCD}\sum_{n=1}^{N}(v_n-\bar{v})^2 + \cos\theta_{PCD}\sin\theta_{PCD}\sum_{n=1}^{N}(u_n-\bar{u})(v_n-\bar{v}) \tag{B.28}$$

Appendix C: Sediment and Contaminant Transport Model Dry Season Sensitivity Analysis

DRAFT

November 2008

Prepared for:
USEPA Region 9
Los Angeles Regional Water Quality Control Board

Prepared by:
Tetra Tech, Inc.

Introduction

A preliminary, dry season sensitivity analysis for the sediment and contaminant transport model predictions was conducted with respect to three types of model forcing functions and process parameterizations representing sediment and contaminant sources and sinks. The three types of conditions included: open boundary concentration levels, river and watershed loads, and sediment erosion rates. These three sensitivity options represent the range of controllability. For example, it is not practicable or feasible to control the open boundary concentration levels, representing ambient or background concentrations in San Pedro Bay. In this respect, demonstration of low sensitivity to open boundary concentration levels is desirable. In contrast, river and watershed loads are the primary controllable sediment and contaminant sources. A moderate to high sensitivity with respect to loads indicates that these sources are primarily responsible for observed levels of contamination. Another sensitivity analysis was performed to explore controlling sediment bed sources via sediment erosion rates. That is, lower erosion rates would reduce diffusive flux rates and overall net flux of sediment, metals, and organics from the bed to the water column. This could be achieved via controlling sediment bed sources by either covering contaminated sediment with clean sediment from land source controlled inflow or active capping or removal at hot spots.

The approach utilized in the sensitivity analysis involved simple system wide perturbations in the three types of forcing functions. Since a primary objective of TMDL development is reduction in contamination levels, the perturbations were based on 50 percent reductions or halving of the forcing functions. The model calibration simulation was repeated for each of the three sensitivity cases. Sensitivity was evaluated by comparison of dry season average model calibration predictions with sensitivity simulation predictions at the sixty 2006 sediment and overlying water sites (Figure 15). These sites were chosen for comparison since their locations represent a random sampling within the greater harbors area of interest.

Sensitivity to Open Boundary Conditions

The open boundary of the model domain can be either a source or sink with net transport of material into or out of the model domain. To investigate sensitivity with respect to open boundary concentrations, the calibration open boundary concentrations were reduced by a factor of one-half (0.5). Dry season average concentration predictions corresponding to the full and half calibration boundary values were compared at the sixty 2006 sediment and overlying water sites and are shown in Figures C-1 through C-7. A diagonal or unit slope plot, Figure C-1 for example, of black dots indicates low sensitivity in that model predictions are not affected by halving the boundary condition. A slope of less than unity, Figure C-6 for example, indicates sensitivity. The red dots indicate the difference

between the full boundary concentration and the half boundary concentration and are measured on the y-axis.

With respect to halving boundary conditions values, PAH was the only variable showing sensitivity as noted in Table C-1. With reference to Figure C-6, sites with low concentrations tend to be highly sensitive with concentrations approximately halved. Higher concentration sites are moderately sensitive.

Sensitivity to River and Watershed Loads

In the absence of significant point source loads, river and watershed loads are the primary controllable sediment and contaminant sources. A simple global loading sensitivity analysis was conducted by halving the inflowing concentration of sediment and contaminants, which corresponds to a 50 percent load reduction. Dry season average concentration predictions corresponding to the full and half calibration sediment and contaminant loads are compared at the sixty 2006 sediment and overlying water sites and are shown in Figures C-8 through C-14. The results indicate that sediment, copper, lead, DDT, and PAH predictions are relatively insensitive to halving loads. Zinc exhibits moderate or medium level sensitivity in Figure C-11. Figure C-14 shows model predicted PCB concentrations to exhibit a medium to high sensitivity with a halving of loads yielding a corresponding reduction in PCB concentrations.

Sensitivity to Sediment Erosion Rates

Existing contamination of bed sediment can be a significant source of water column contamination due to sediment erosion and diffusion of contaminants dissolved in pore water. To gain insight into the relative importance of the sediment bed as a source of water column contamination, the base sediment erosion rate was halved. Although halving the erosion rate does not represent a feasible harbor wide control approach, it does directly reveal the relative importance of the sediment bed as a source. Alternatively, halving of the erosion rate could be viewed as analogous to wide scale capping of coarse material making the sediment more resistant to hydrodynamic forces responsible for erosion, or mixing clean sediment from the inflows such that net erosion flux of contaminants is reduced. As might be expected, the water column sediment concentrations were significantly reduced as shown in Figure C-15. The concentrations of the three metals in the water column were also reduced, Figures C-16 through C-18. Copper and lead, which have higher partition coefficients than zinc, showed corresponding higher sensitivities to erosion, as expected, due to their strong affinity for the particulate phase. The three organic contaminants showed a range of sensitivities to sediment erosion (Figures C-19 through C-21).

Summary

With respect to contaminated sediment TMDL development for the greater harbors, the sensitivity analysis suggests that a reduction of watershed and river inflows of contaminated sediments, but not necessarily clean sediment, provides a feasible pollution control strategy in combination with localized capping or sediment removal. For the organics and, to a certain extent, zinc, reduction of land-derived loads was shown to result in lower levels of water column contamination. Gradual replacement of incoming contaminated sediment with clean sediment would yield lower contaminant exposure levels to living organisms in either water column or bed sediments, since the new deposited cleaner sediment would ultimately reduce contaminant flux from the sediment bed.

Table C-1. Summary of Sensitivity Analysis

Contaminant	Sensitivity to Halving Open Boundary Conditions	Sensitivity to Halving River and Watershed Loads	Sensitivity to Halving Sediment Erosion Rate
Sediment	Low	Low	High
Copper	Low	Low	High
Lead	Low	Low	High
Zinc	Low	Medium	Medium
DDT	Low	Low	Medium
PAH	Low to Medium	Low	Medium to High
PCB	Low	Medium to High	Low to Medium

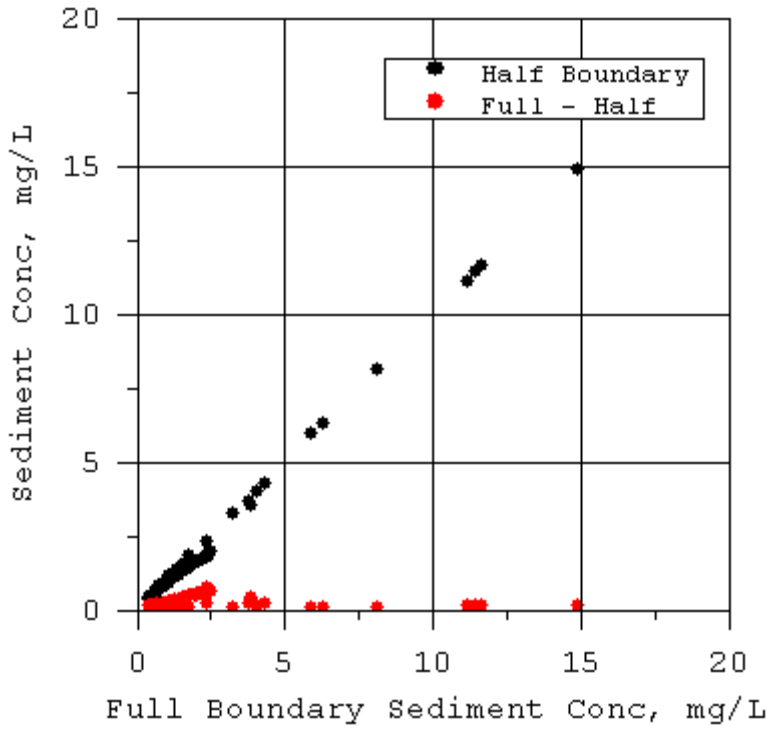


Figure C-1. Sensitivity of sediment concentration to halving sediment and contaminant open boundary conditions

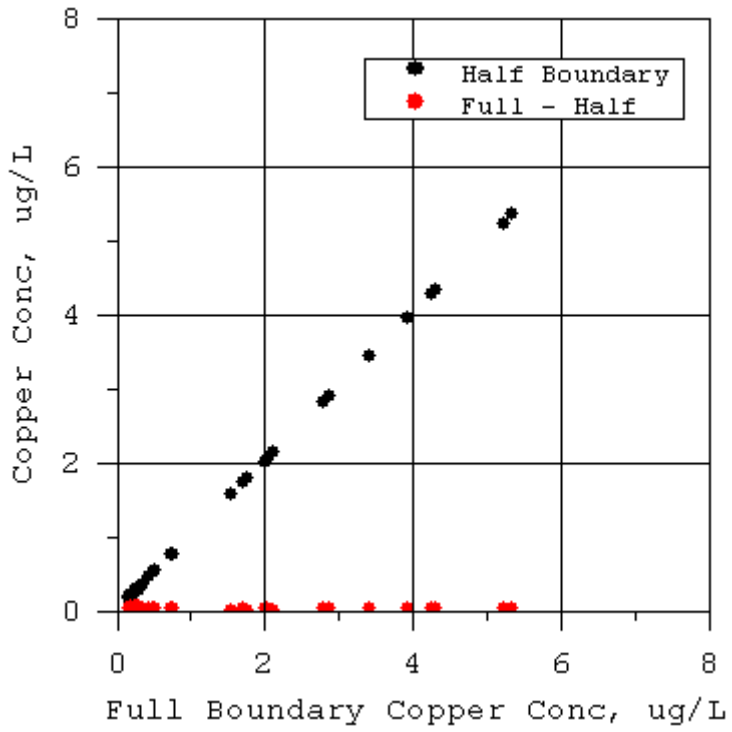


Figure C-2. Sensitivity of copper concentration to halving sediment and contaminant open boundary conditions

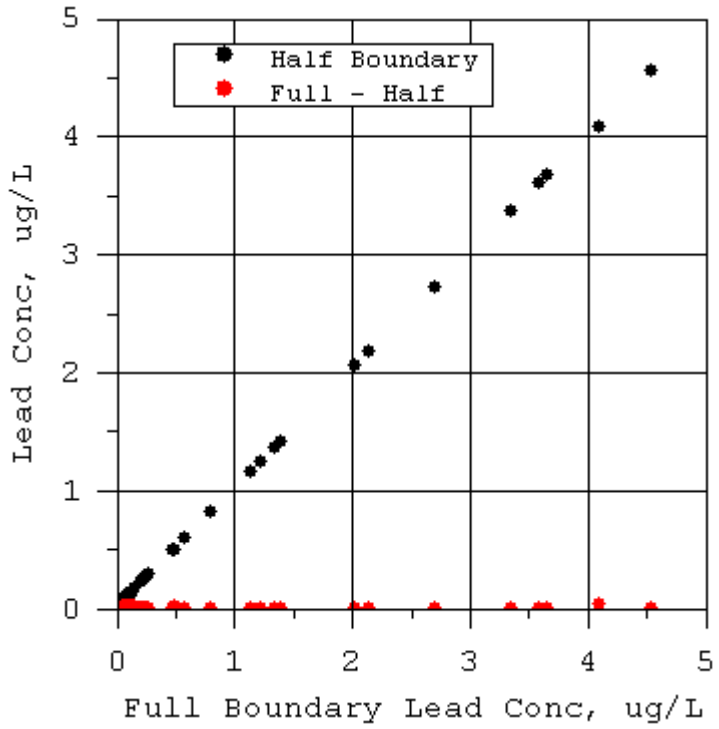


Figure C-3. Sensitivity of lead concentration to halving sediment and contaminant open boundary conditions

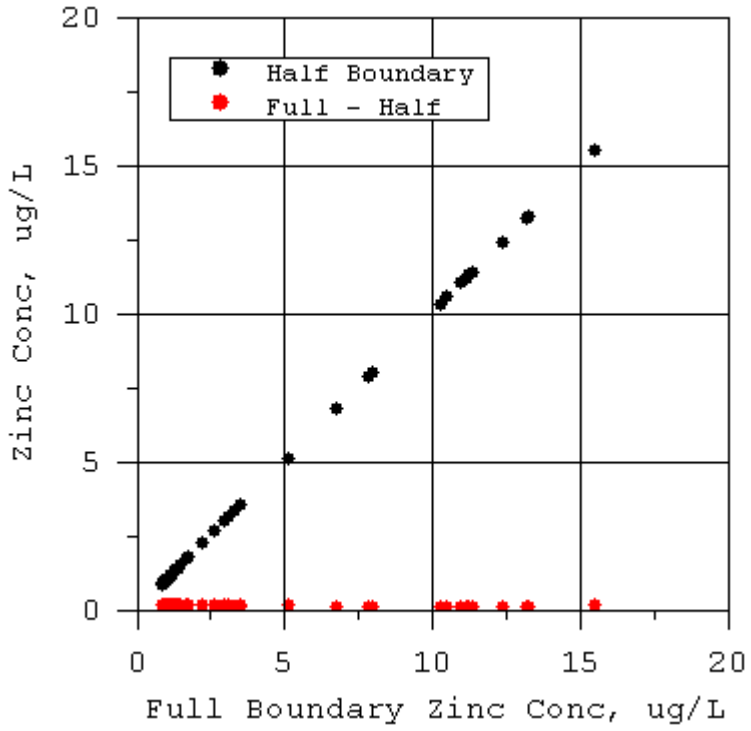


Figure C-4. Sensitivity of zinc concentration to halving sediment and contaminant open boundary conditions

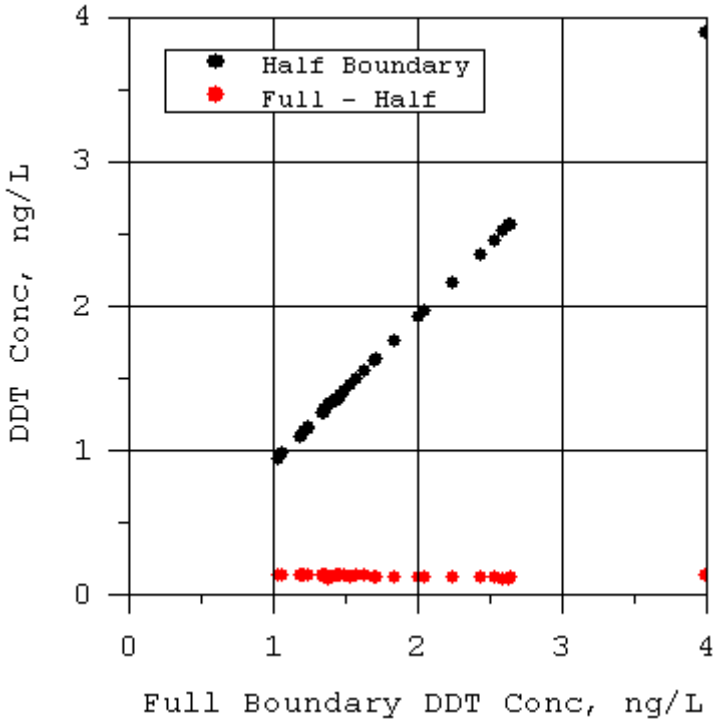


Figure C-5. Sensitivity of DDT concentration to halving sediment and contaminant open boundary conditions

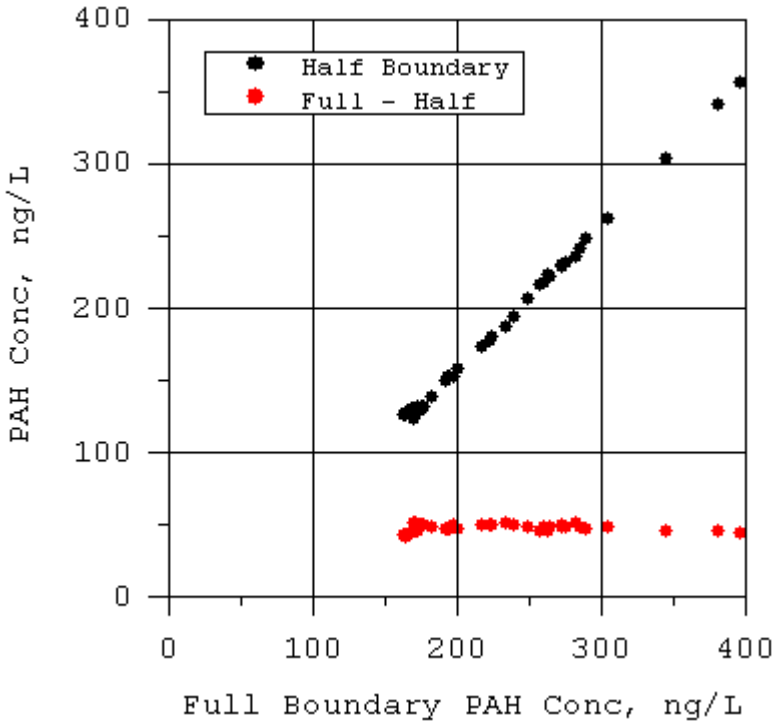


Figure C-6. Sensitivity of PAH concentration to halving sediment and contaminant open boundary conditions

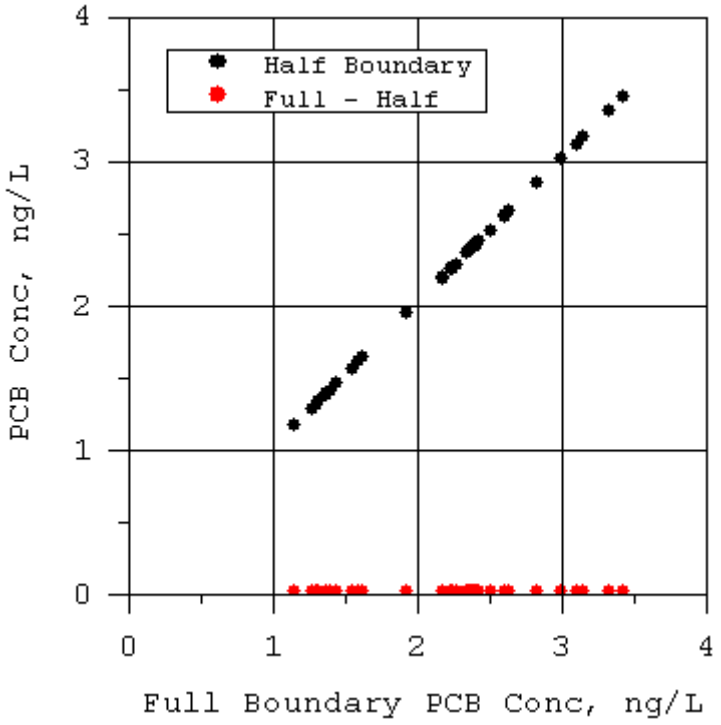


Figure C-7. Sensitivity of PCB concentration to halving sediment and contaminant open boundary conditions

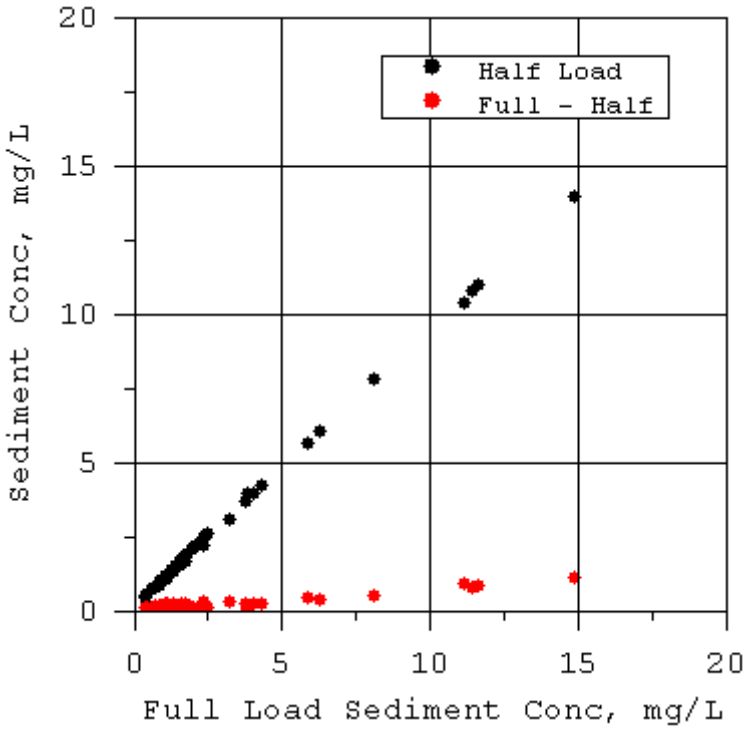


Figure C-8. Sensitivity of sediment concentration to halving sediment and contaminant loads

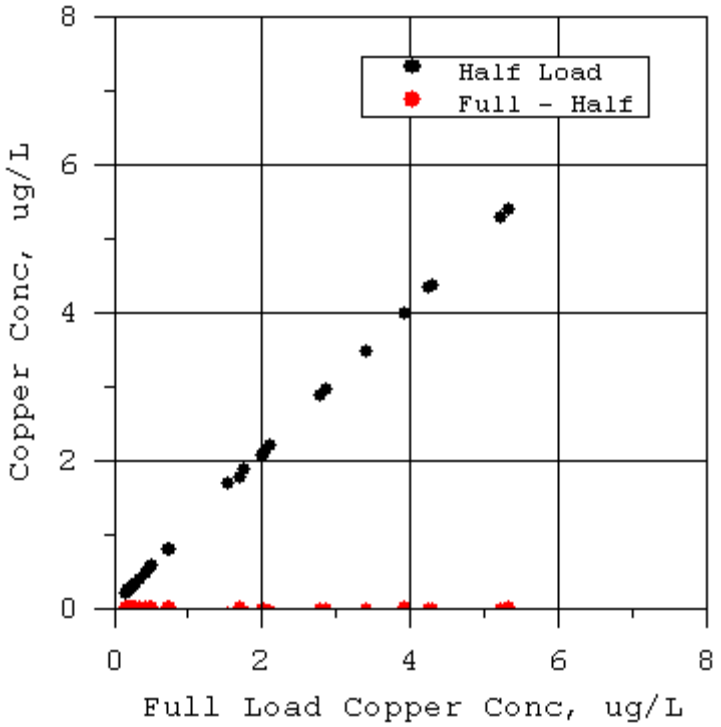


Figure C-9. Sensitivity of copper concentration to halving sediment and contaminant loads

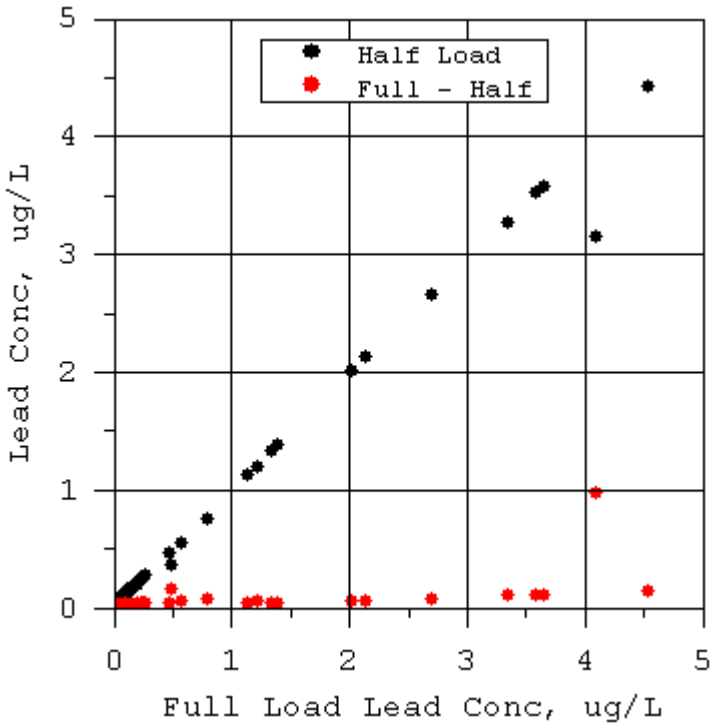


Figure C-10. Sensitivity of lead concentration to halving sediment and contaminant loads

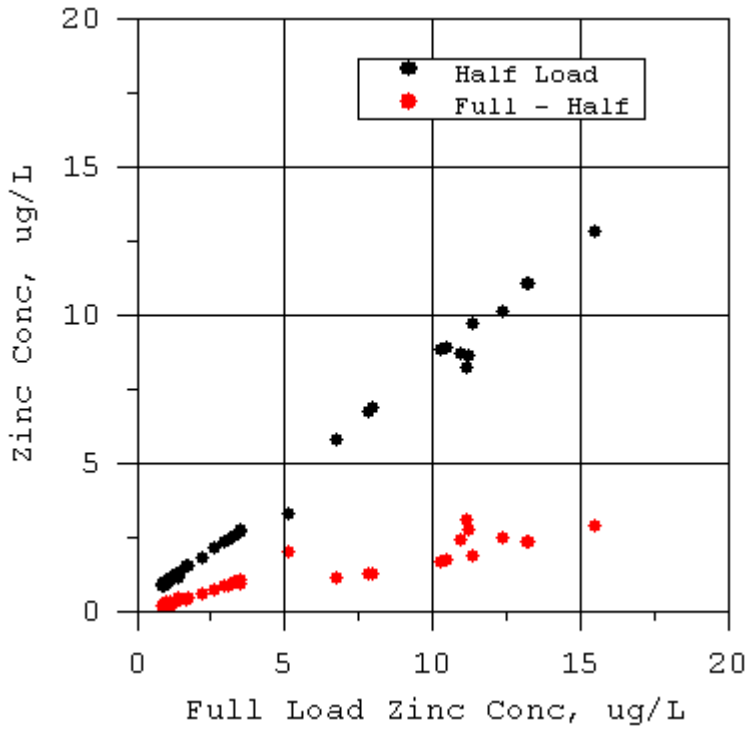


Figure C-11. Sensitivity of zinc concentration to halving sediment and contaminant loads

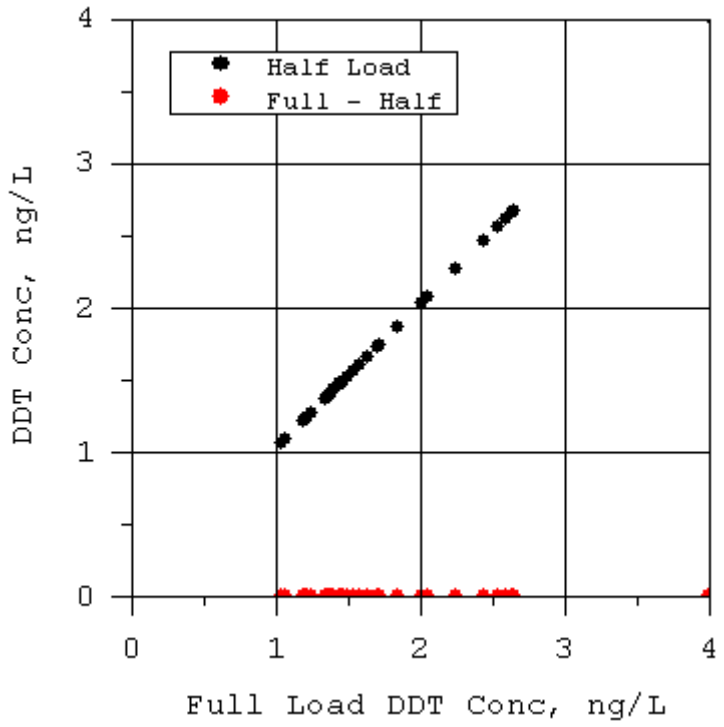


Figure C-12. Sensitivity of DDT concentration to halving sediment and contaminant loads

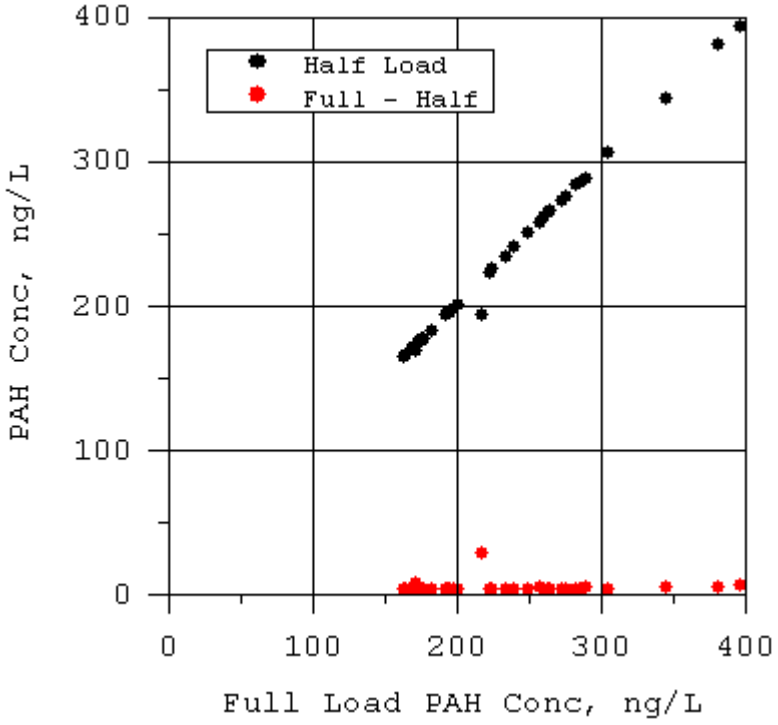


Figure C-13. Sensitivity of PAH concentration to halving sediment and contaminant loads

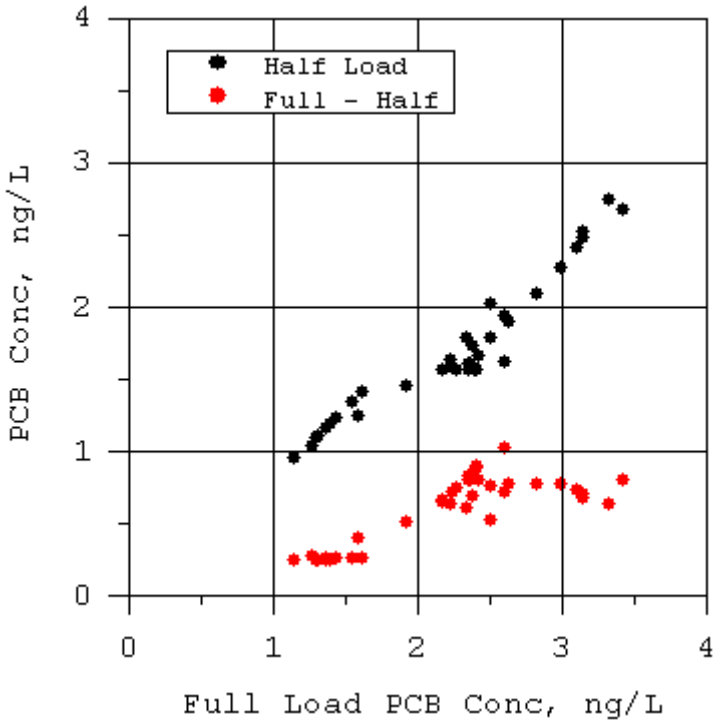


Figure C-14. Sensitivity of PCB concentration to halving sediment and contaminant loads

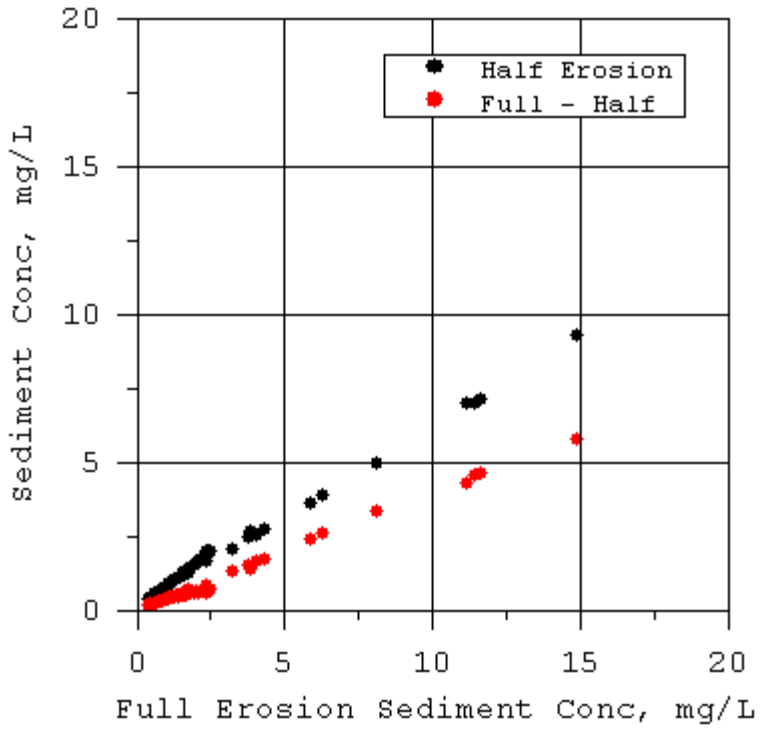


Figure C-15. Sensitivity of sediment concentration to halving sediment erosion rate

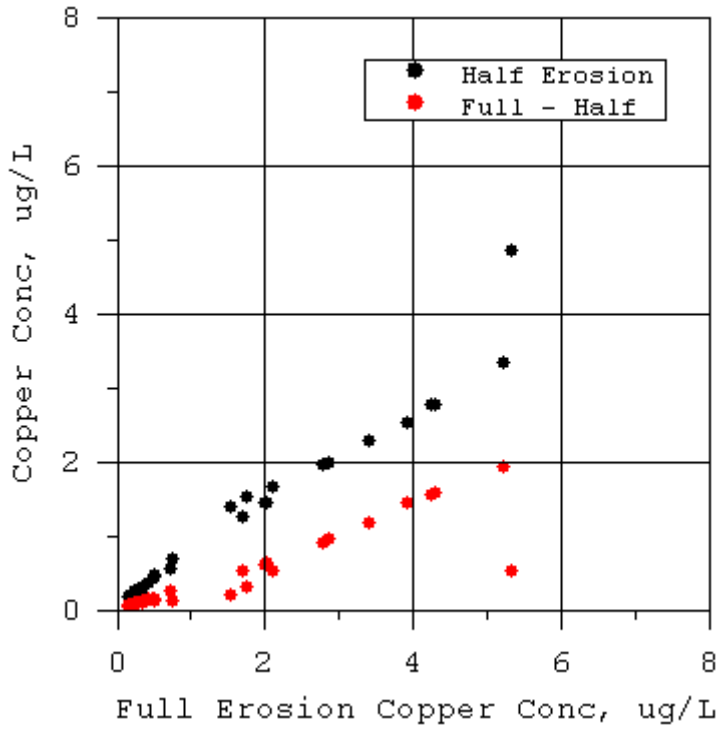


Figure C-16. Sensitivity of copper concentration to halving sediment erosion rate

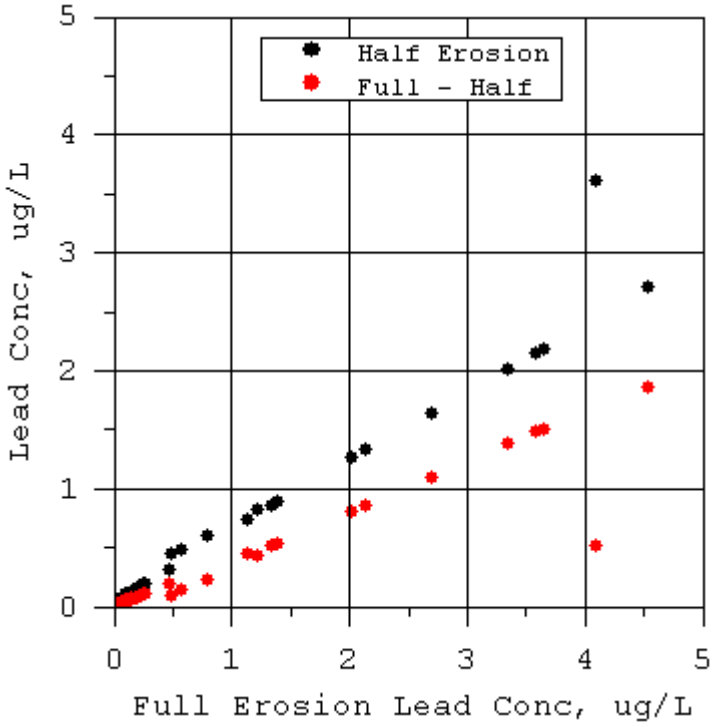


Figure C-17. Sensitivity of lead concentration to halving sediment erosion rate

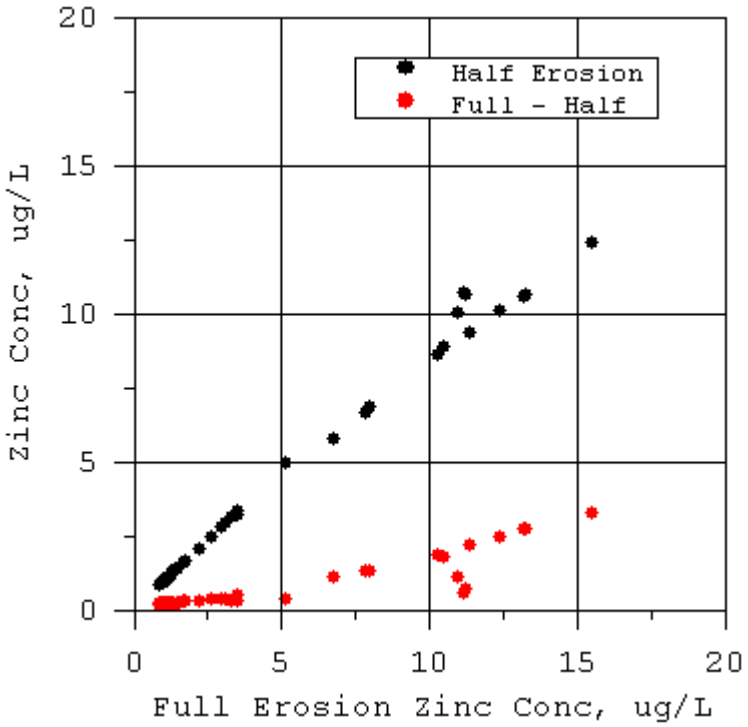


Figure C-18. Sensitivity of zinc concentration to halving sediment erosion rate

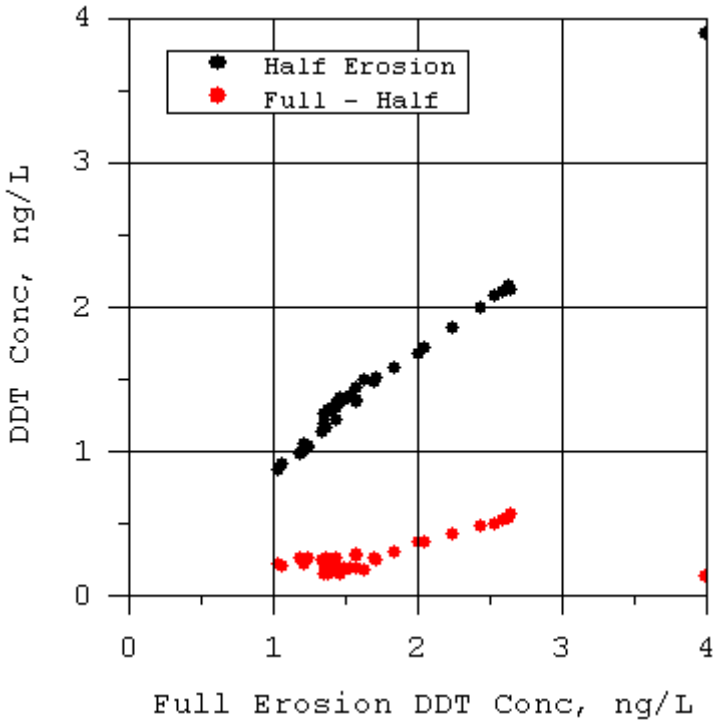


Figure C-19. Sensitivity of DDT concentration to halving sediment erosion rate

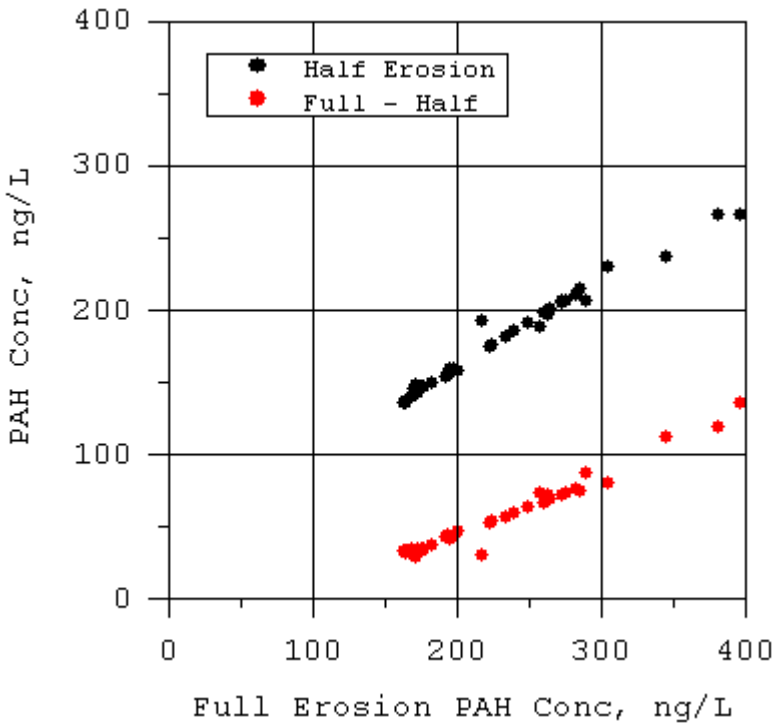


Figure C-20. Sensitivity of PAH concentration to halving sediment erosion rate

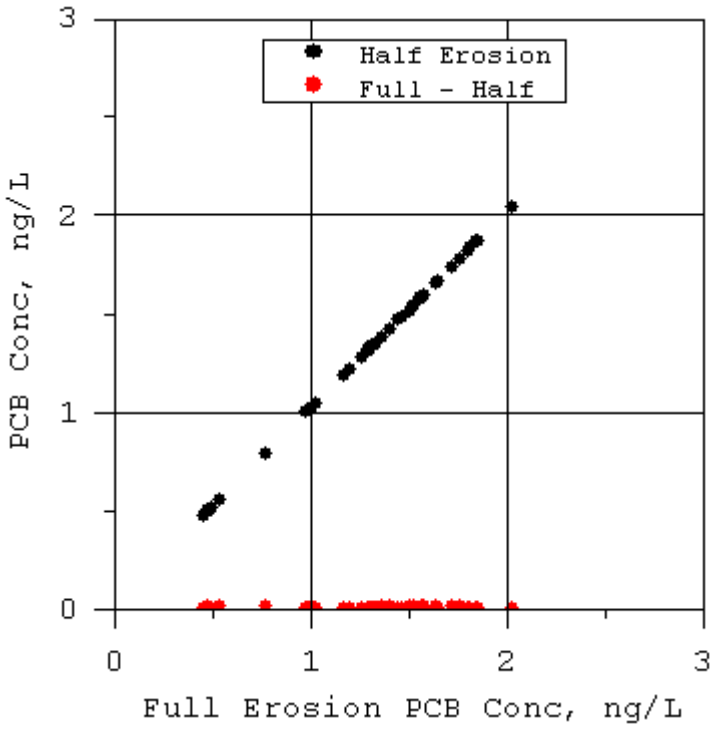


Figure C-21. Sensitivity of PCB concentration to halving sediment erosion rate

Appendix D: Sediment and Contaminant Transport Model Sensitivity to Long-Term Load Reductions

DRAFT

November 2008

Prepared for:
USEPA Region 9
Los Angeles Regional Water Quality Control Board

Prepared by:
Tetra Tech, Inc.

Introduction

Two simulations were conducted to investigate the sensitivity of the sediment and contaminant model predictions to long-term load reductions. Both simulations spanned a four year period from 2002 through 2005. This period includes significant wet season inflow events as illustrated by the Los Angeles River flow shown in Figure D-1. The first (or baseline) simulation used watershed model estimated sediment and contaminant loads. The second (or load reduction) simulation used sediment and contaminant loads which were reduced by 50 percent for both rivers and near shore watersheds. The sensitivity analysis results are presented in both time series graphs and maps illustrating changes in contaminant level over the four year period, as described below.

Time series of water column and sediment bed concentrations provide qualitative insight into the long-term response at three spatially diverse stations selected from the 60 sites visited in the Ports' 2006 study (Figure 15 and Figure D-2). Water column and sediment bed concentration time series for copper, zinc, DDT, and PAHs are shown for three stations: LA Inner Harbor (8); LB Inner Harbor (42) and Outer Harbor (54) (circled in blue on Figure D-2). These results also provide insight into water column and sediment bed concentration responses during wet weather inflow events. Concentrations in these graphs are defined as mass per unit volume (ug/L or ng/L) for both the water column and sediment bed surface. This provides a true measure of mass associated with the sediment bed and therefore illustrates the changes in total concentration.

Analysis of the simulation results focuses on the change in sediment bed surface contaminant levels over the four-year period. Three sets of spatial maps were generated to illustrate (1) the changes at the end of the four year simulations for the base and load reduction simulations and (2) the relative change for the load reduction simulation. The three maps presented for each contaminant are defined as:

Areal Concentration Change in Baseline Simulation Over Time = Final Areal Concentration using Baseline Conditions in 2005 (after 4 years) – Initial Areal Concentration using Baseline Conditions in 2002 (beginning of simulation period)

Areal Concentration Change from Load Reduction Simulation = Final Areal Base Simulation Concentration in 2005 – Final Areal Load Reduction Concentration in 2005 (based on 50 percent load reduction from the rivers and nearshore watersheds)

Relative Change in Load Reduction Simulation = Relative Change in Load Reduction Change (normalized by initial top bed layer concentration)

Note: Areal concentration is the mass per unit area in top layer of sediment bed

The “Areal Concentration Change in Baseline Simulation” is presented for comparative purposes only. Specifically, the “Areal Concentration Change from Load Reduction Simulation” results can be compared with the “Areal Concentration Change in Baseline Simulation” to evaluate the impacts of reducing the watershed and river loads by 50 percent after a four year period.

Copper and Zinc Results

Water column and sediment bed concentration time series for total copper are shown in Figures D-3 through D-5 for Stations 8, 42, and 54 (these stations are circled in blue on Figure D-2). Corresponding results for zinc are shown in Figures D-6 through D-8. The top panel of the time series figures shows the results for the Baseline Simulation (i.e., using baseline loads from the watersheds), while the lower panel illustrates the concentrations associated with the Load Reduction Simulation (i.e., river and near shore watershed loads were reduced by 50 percent). Results for both copper and zinc indicate decreases in water column concentrations during periods of high flow, when comparing the baseline conditions with the 50 percent load reduction scenario. Although the load reductions were 50 percent, there is not a corresponding 50 percent reduction in water column concentrations.

In general, sediment bed contaminant concentrations tend to increase in response to high freshwater flows, which is expected since more sediments are transported by inflows from the watershed under high flow conditions. Over a four-year period, additional sediment is added to the system due to freshwater inputs and other transport factors; therefore, there is an expected net increase in sediment bed contaminant concentrations (assuming no dredging or other pollutant-reduction activities have occurred). The net increases in sediment bed contaminant concentrations were compared between the Baseline Simulation and the Load Reduction Simulation. Overall, the net increase in copper and zinc concentrations over the four year period are substantially lower for the Load Reduction Simulation. Specifically, for stations 8 and 54 (Figures D-3 and D-5), the copper reductions observed at the end of the four-year period were approximately 1,000 ug/L (station 42 [Figure D-4] showed minimal change in copper concentrations). Sediment bed zinc concentrations at station 8 (Figure D-6) decreased by approximately 15,000 ug/L after four years in the Load Reduction Simulation, while stations 42 (Figure D-7) and 54 (Figure D-8) had smaller zinc reductions at the end of the four-year period (approximately 1,000 ug/L and 3,500 ug/L, respectively).

Figures D-9 through D-11 present the three maps associated with sediment bed copper results, while Figures D-12 through D-14 present sediment bed zinc results. For comparative purposes, the Areal Concentration Change in Baseline Simulation results are shown first and exhibit a similar spatial pattern for the two metals (Figures D-9 and D-12). These results are followed by the maps of the

Areal Concentration Change from Load Reduction Simulation. Overall, reduction of incoming loads by 50 percent results in a system-wide reduction in sediment bed copper and zinc concentrations (Figures D-10 and D-13, respectively). Recall that these figures represent the difference between the end of the simulation period under baseline conditions and the end of the simulation period for the load reduction scenario (not the change over time between the beginning and end of the load reduction simulation period). Therefore, all positive values indicate a reduction in copper and zinc sediment bed concentrations. Reductions in sediment bed copper concentrations due to the load reduction simulation ranged from over 1,000 mg/m^2 near the Consolidated Slip to less than 100 mg/m^2 by the breakwater. Similarly, zinc reductions ranged from over 10,000 mg/m^2 near the Consolidated Slip to less than 800 mg/m^2 by the breakwater. These correspond to relative copper reductions of approximately 10 percent (a factor of 0.10) in the Consolidated Slip region to nearly 1 percent (a factor of 0.01) in many of the other harbor areas (Figure D-11). Relative reductions associated with the load reduction simulations for zinc were even higher (Figure D-14), ranging from 40 percent (a factor of 0.4) to 2 percent (a factor of 0.02) throughout most of the area inside the breakwater.

DDT and PAH Results

Water column and sediment bed concentration time series for total DDT are shown for Stations 8, 42, and 54 (circled in blue on Figure D-2) in Figures D-15 through D-17. Corresponding results for PAH are shown in Figures D-18 through D-20. As described above for the metals, the top panel of the time series figures shows the results for the Baseline Simulation (i.e., using baseline loads from the watersheds), while the lower panel illustrates the concentrations associated with the Load Reduction Simulation (i.e., river and near shore watershed loads were reduced by 50 percent). The results indicate that DDT and PAH concentrations in the water column decrease during periods of high flow when comparing the baseline conditions with the 50 percent load reduction scenario, as was the case for the two metals.

Sediment bed contaminant concentration behavior is more spatially varied with DDT concentrations decreasing at Station 8 (Figure D-15) at approximately the same rate and similar magnitude for both scenarios. At the other two stations, DDT concentrations in the sediment bed do not change significantly. Specifically, almost no change in concentration is observed at Station 42 (Figure D-16) when comparing the two simulations. Station 54 shows a slight increasing trend in sediment concentrations over time in both simulations; however, the load reduction simulation has a lower concentration after four years by about 500 ng/L (Figure D-17). Bed concentration tendencies for PAH are somewhat more consistent with those for metals, but do not exhibit large relative changes. Station 8 (Figure D-18) shows a 10,000 ng/L decrease in sediment bed concentrations when comparing the base simulation results with the 50 percent load reduction simulation. Station 42 does not present a change in concentration

(Figure D-19), while there is an approximately 700 ng/L decrease in sediment concentration at Station 54 when comparing the two simulations (Figure D-20).

Spatial maps associated with sediment bed DDT results are presented in Figures D-21 through D-23, while maps for PAH levels are illustrated in Figures D-24 through D-26. Similar to the metals, for comparative purposes, the Areal Concentration Change in Baseline Simulation results are shown first (Figures D-21 and D-24) and these results are followed by the maps of the Areal Concentration Change from Load Reduction Simulation (Figures D-22 and D-25). The Areal Concentration Change in Baseline Simulation maps illustrate the change in sediment bed concentrations over a four-year period using the baseline conditions. The spatial pattern is somewhat similar for the two pollutants, with the most significant changes occurring in the inner harbors and near the Los Angeles River inflow (Figures D-21 and D-24). Review of the Load Reduction Simulation maps for DDT and PAH (i.e., the areal concentration change between the end of the simulation period under baseline conditions and the end of the simulation period for the load reduction scenario) indicates that the reduction of incoming loads by 50 percent results in a system-wide reduction in sediment bed DDT and PAH levels (Figures D-22 and D-25, respectively). These reductions are illustrated by the positive values in sediment bed concentrations. Reductions in areal sediment bed DDT concentrations due to the load reduction simulation ranged from over 1,000 $\mu g/m^2$ near the Los Angeles River to less than 100 $\mu g/m^2$ by the breakwater. Similarly, PAH reductions ranged from approximately 20,000 $\mu g/m^2$ near the Consolidated Slip to less than 200 $\mu g/m^2$ by the breakwater. These correspond to relative DDT reductions of approximately 40 percent (a factor of 0.40) in the Los Angeles River and San Gabriel River regions to 2 percent (a factor of 0.02) throughout most of the area inside the breakwater (Figure D-23). Relative reductions associated with the load reduction simulations for PAH were low (Figure D-26), ranging from 6 percent (a factor of 0.06) in Alamitos Bay, 4 percent (a factor of 0.04) near the Los Angeles River, and approximately 0.5 percent (a factor of 0.005) throughout most of the area inside the breakwater.

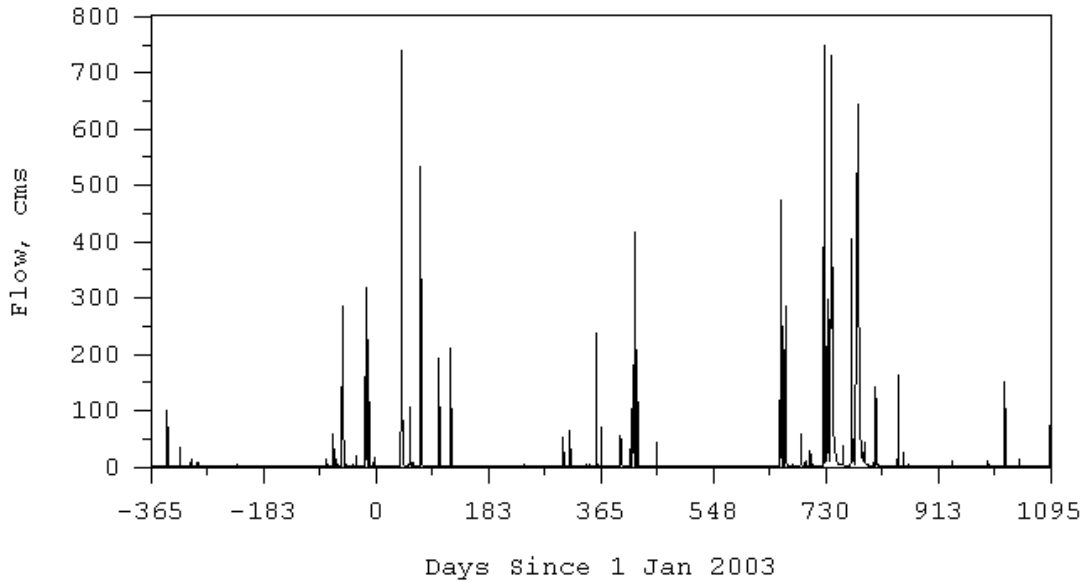
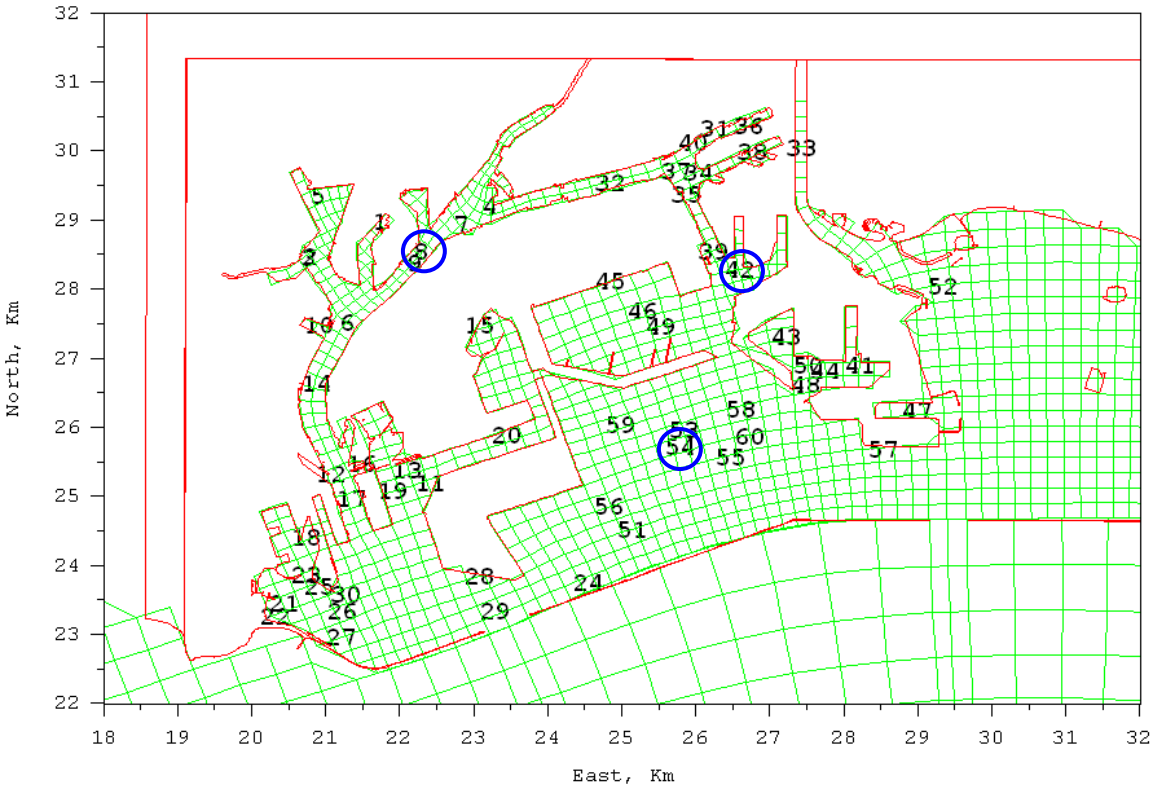


Figure D-1. Los Angeles River flow during long-term simulation period



Note: Long-term sensitivity results are presented for the three stations circled in blue.

Figure D-2. Location of 2006 sediment and overlying water sampling locations

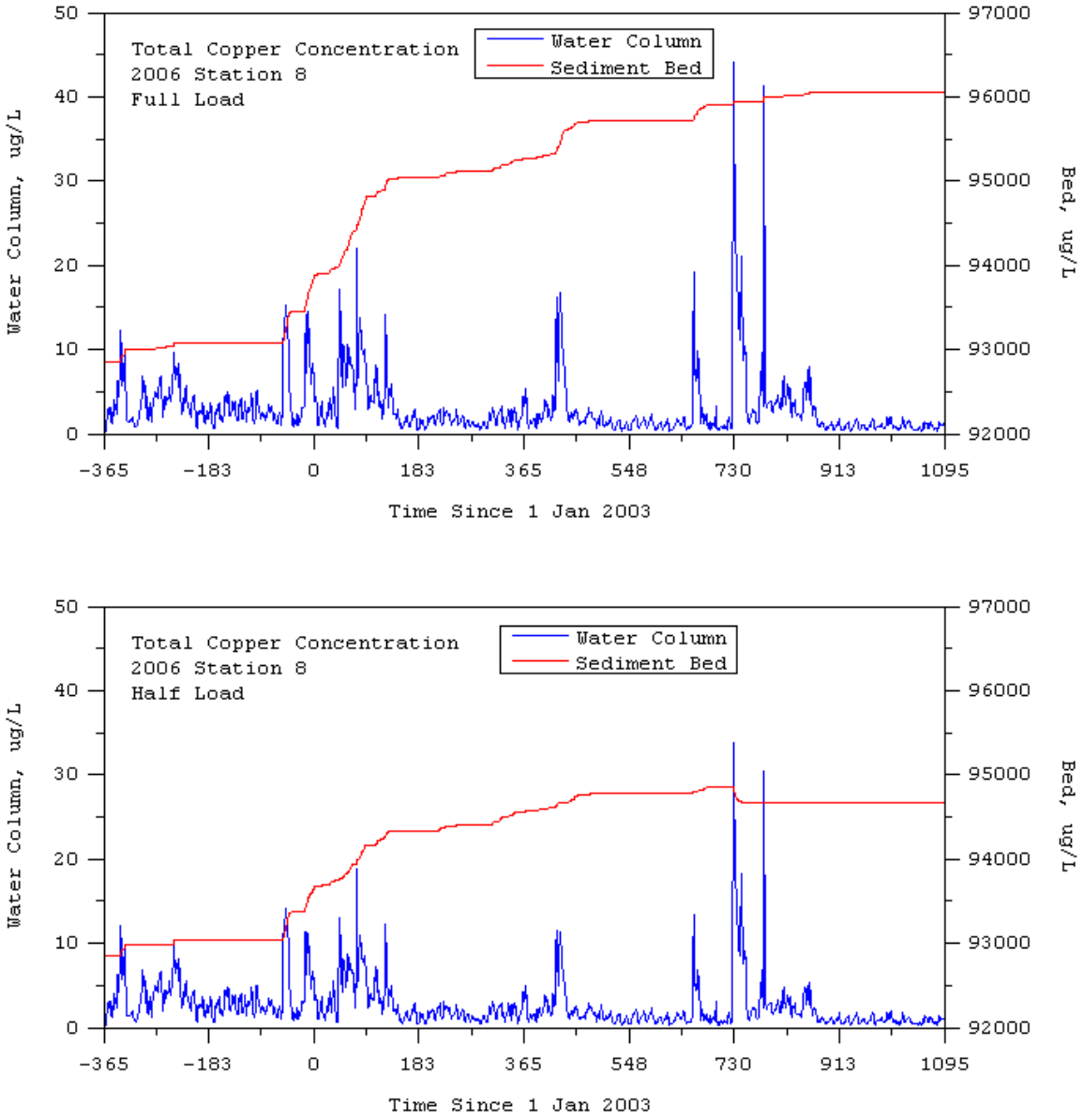


Figure D-3. Total copper concentration in water column and at sediment bed surface for Station 8 (see Figure D-2 for location)

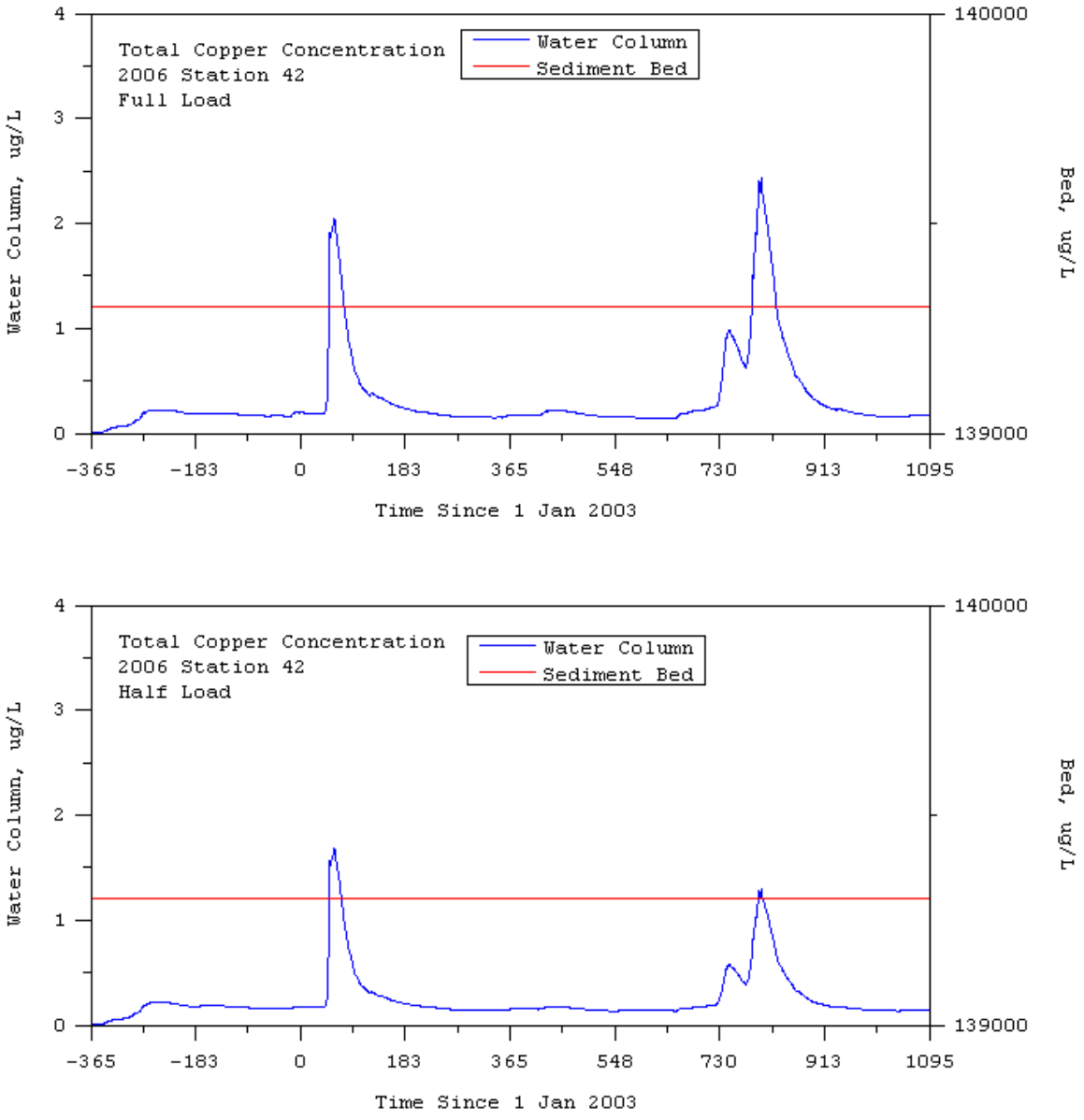


Figure D-4. Total copper concentration in water column and at sediment bed surface for Station 42 (see Figure D-2 for location)

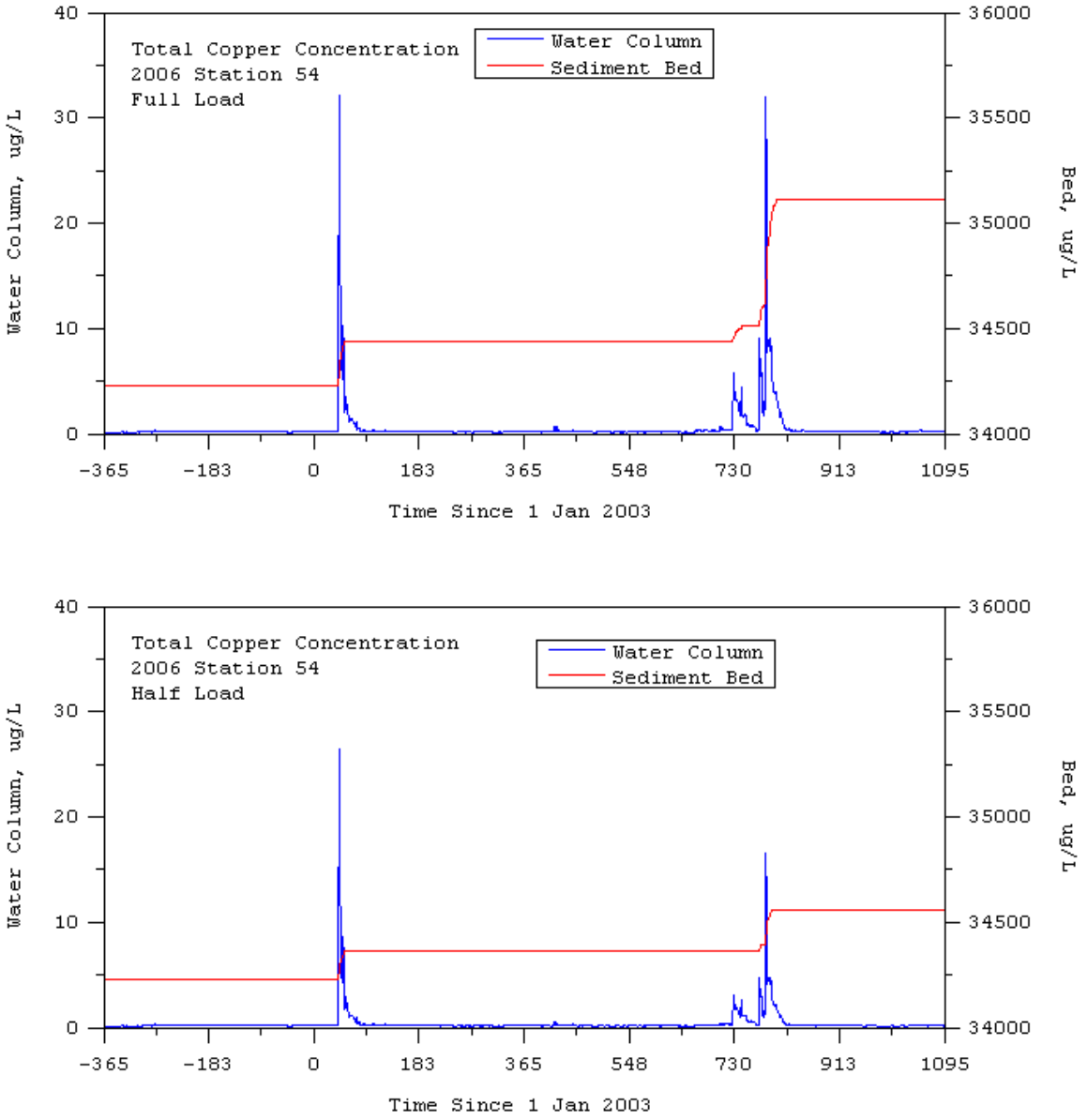


Figure D-5. Total copper concentration in water column and at sediment bed surface for Station 54 (see Figure D-2 for location)

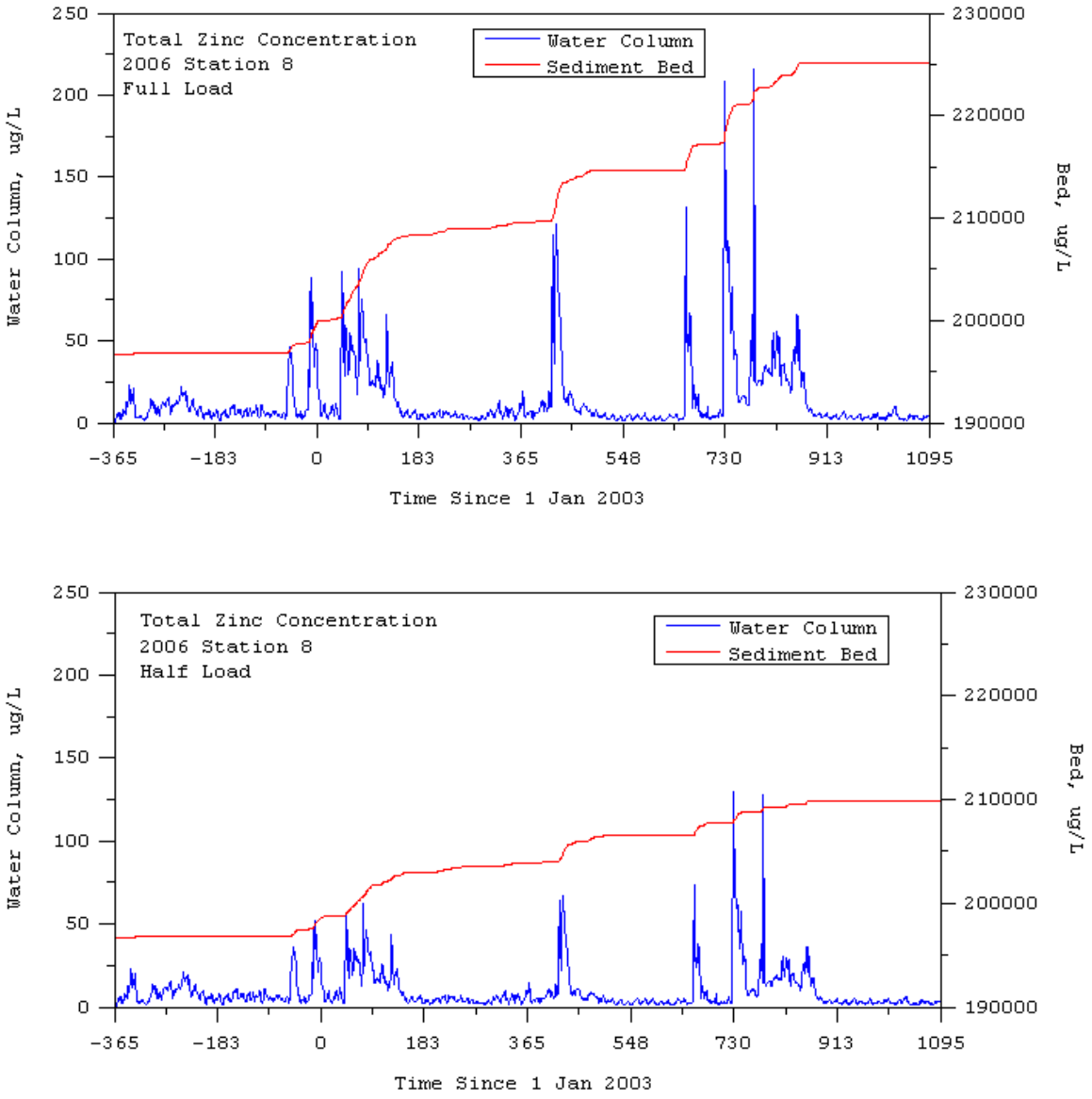


Figure D-6. Total zinc concentration in water column and at sediment bed surface for Station 8 (see Figure D-2 for location)

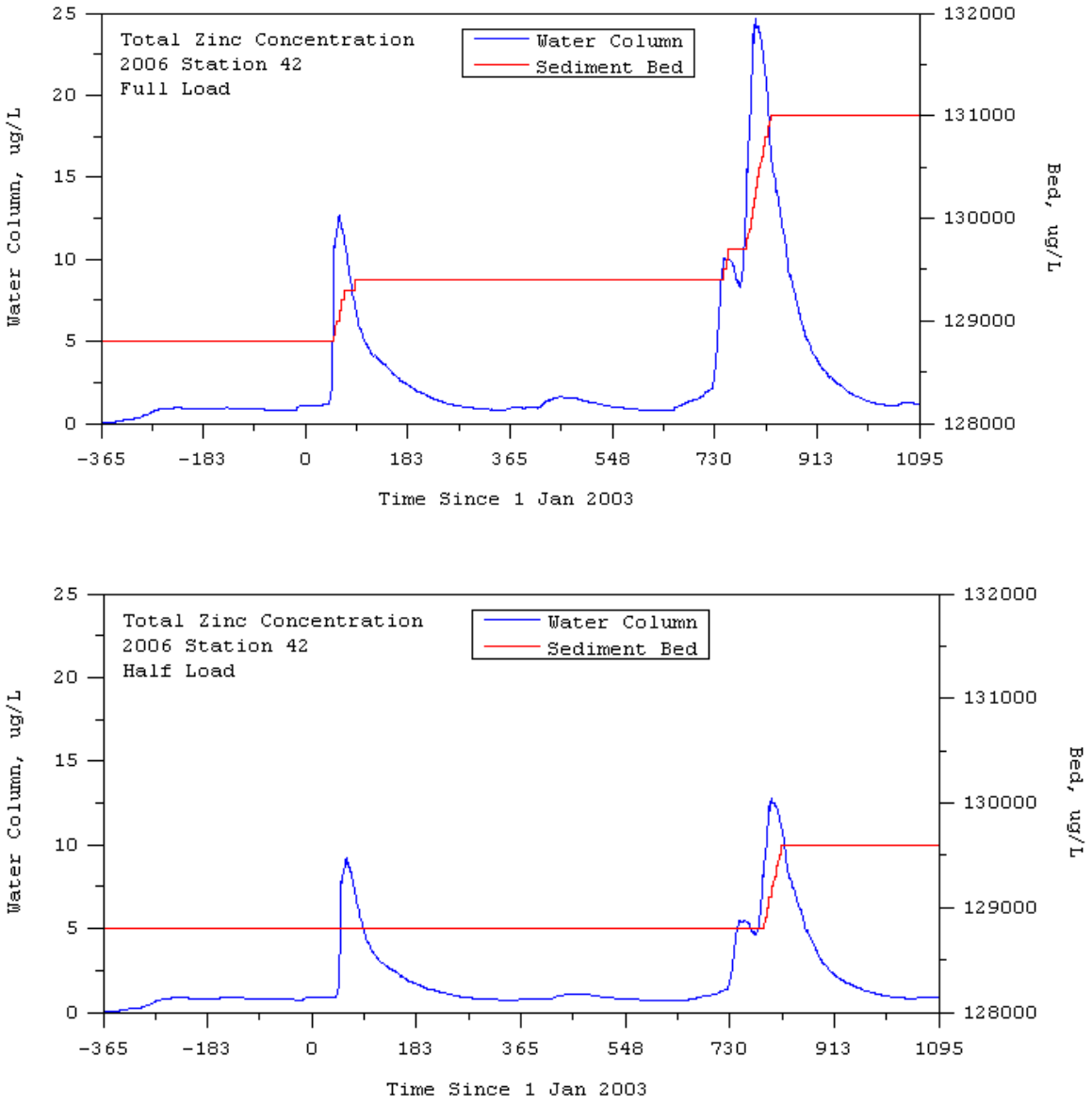


Figure D-7. Total zinc concentration in water column and at sediment bed surface for Station 42 (see Figure D-2 for location)

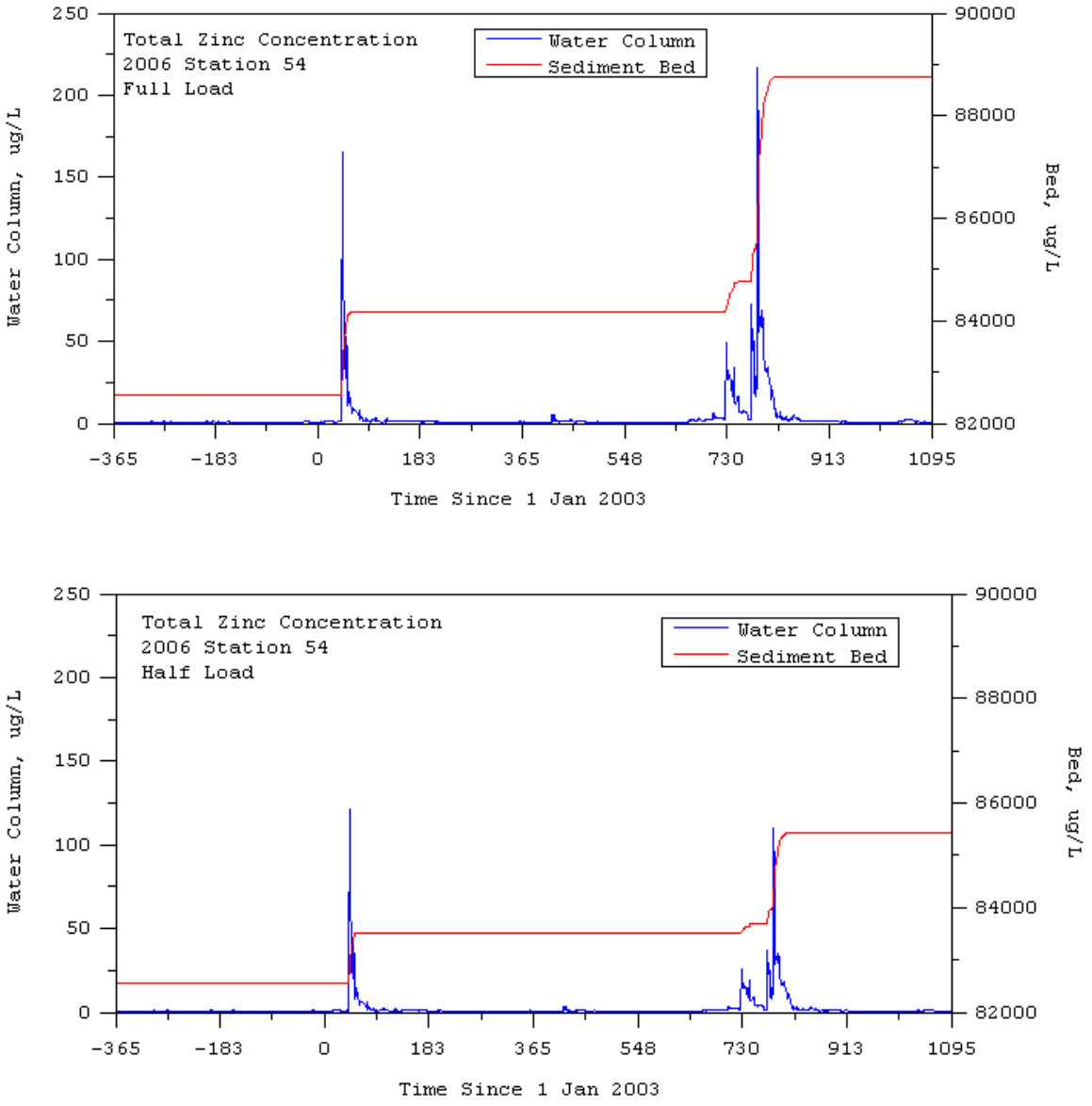
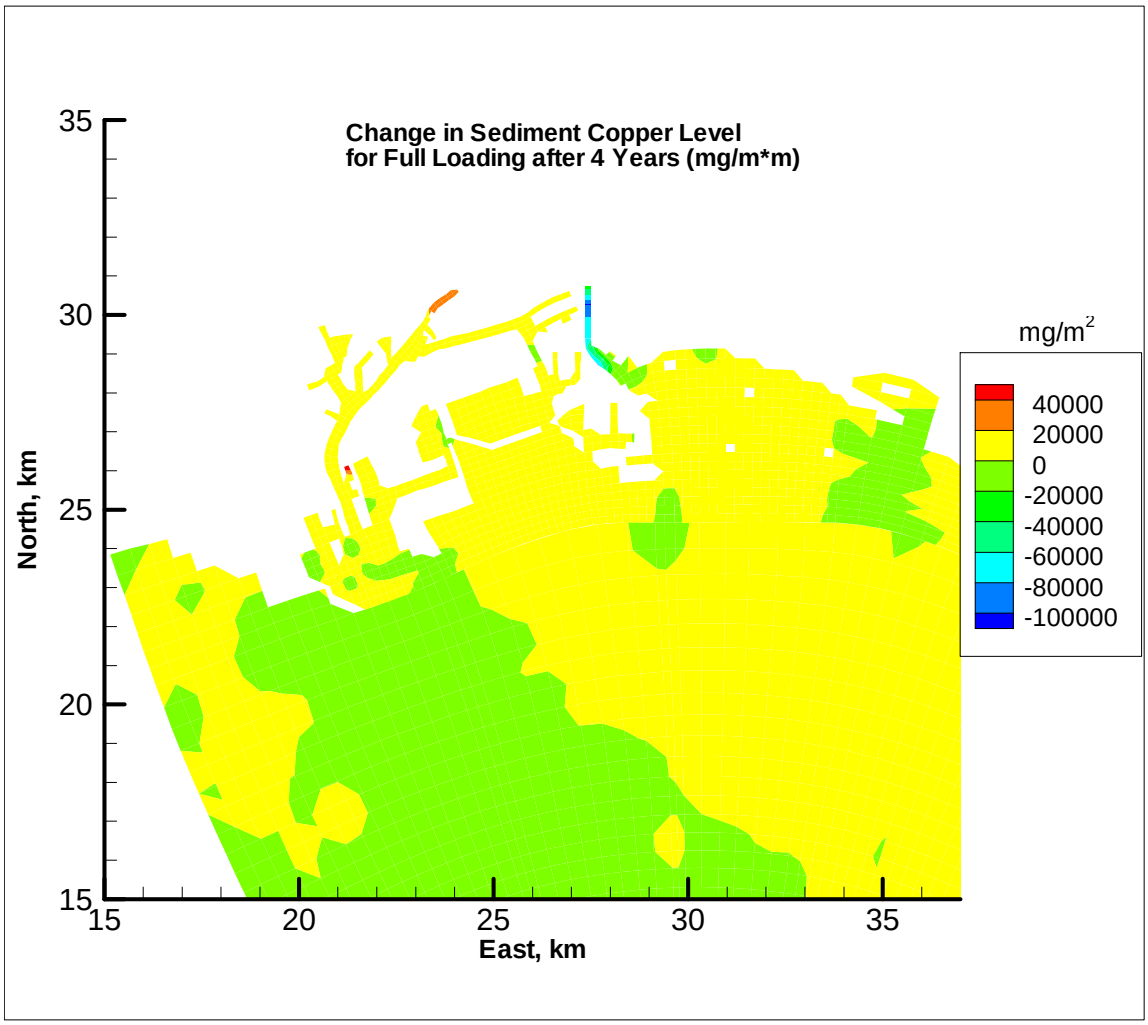
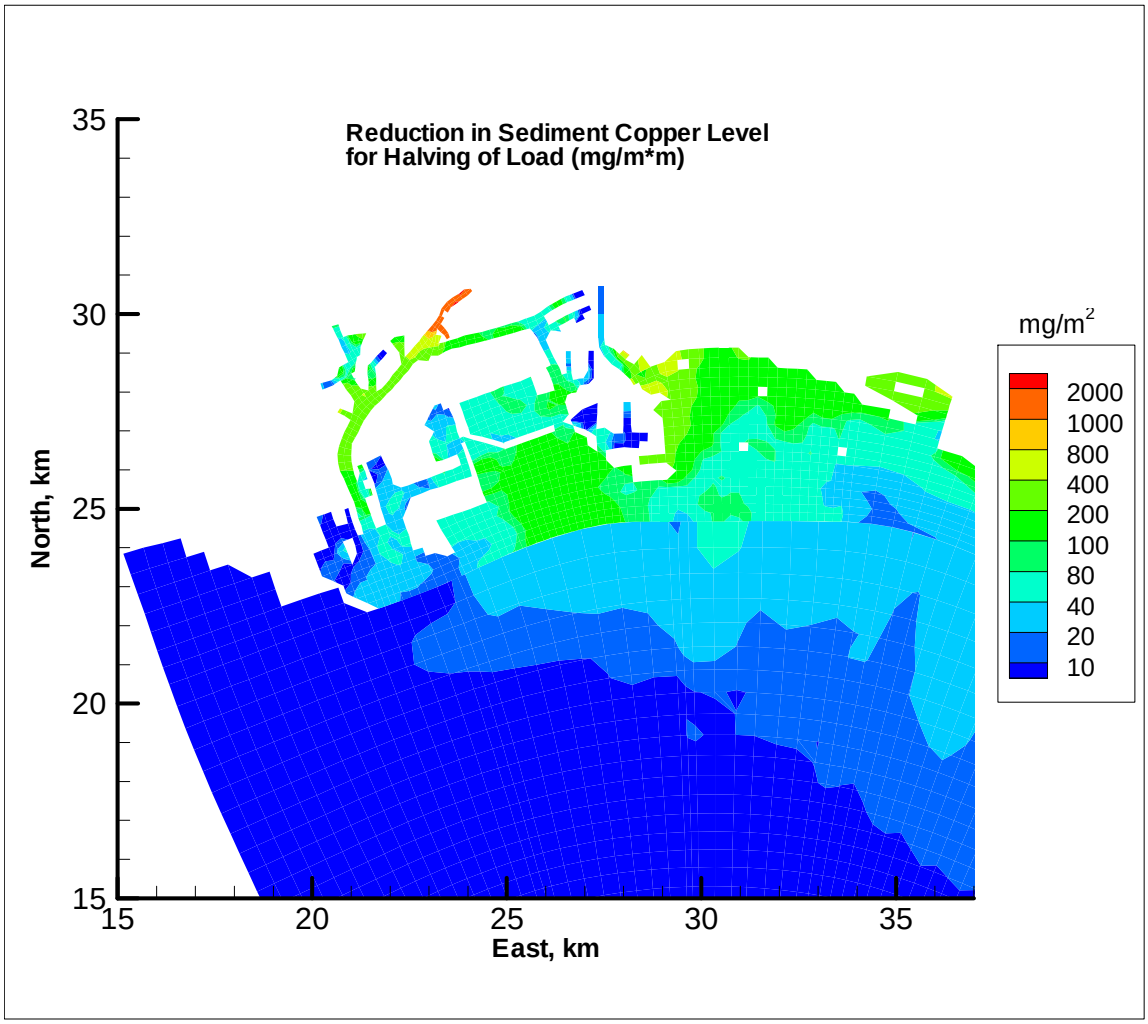


Figure D-8. Total zinc concentration in water column and at sediment bed surface for Station 54 (see Figure D-2 for location)



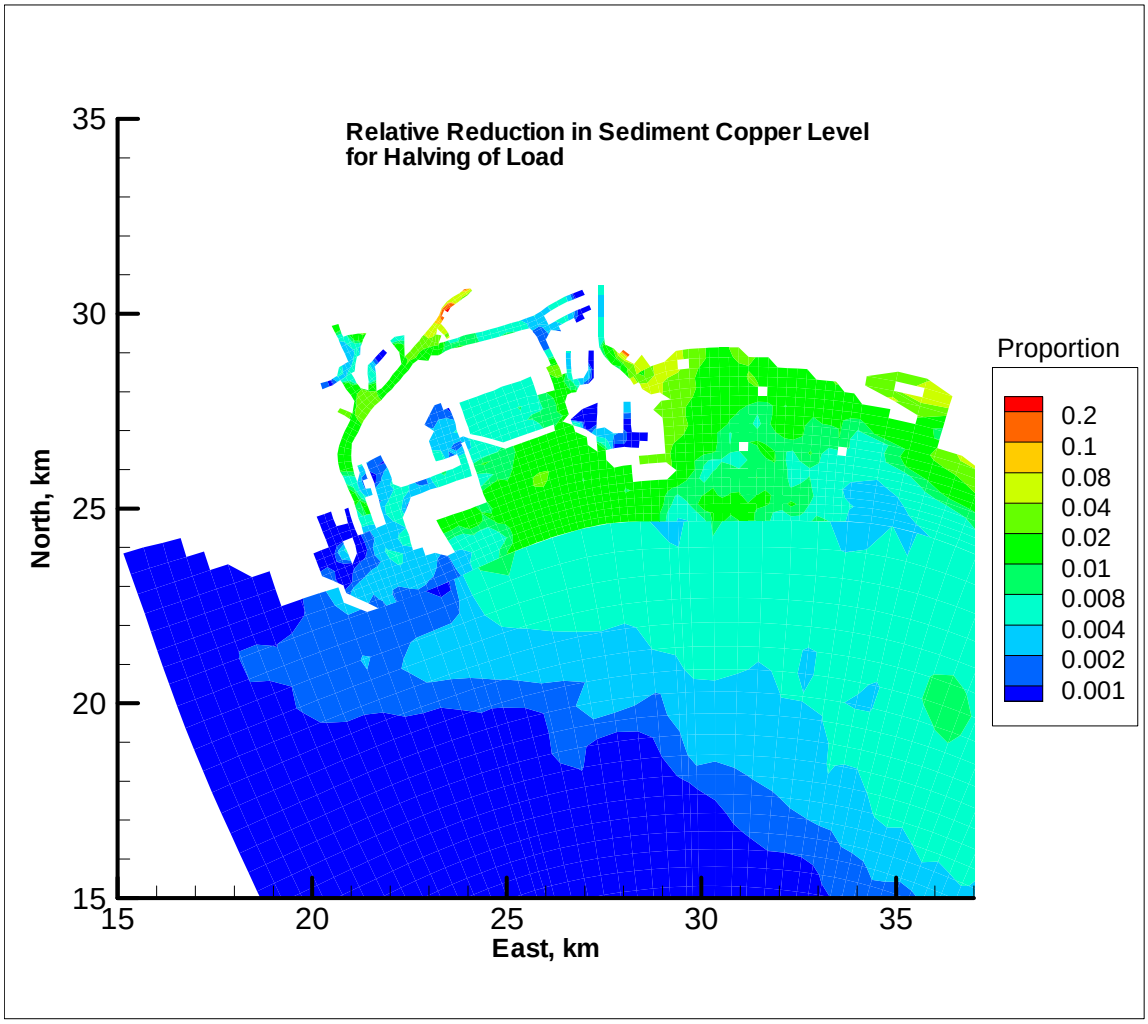
Note: Areal Concentration Change in Baseline Simulation Over Time = Final Areal Concentration using Baseline Conditions in 2005 (after 4 years) – Initial Areal Concentration using Baseline Conditions in 2002 (beginning of simulation period). Results are presented in mg/m^2.

Figure D-9. Areal concentration change in baseline simulation over time (after four years) – copper



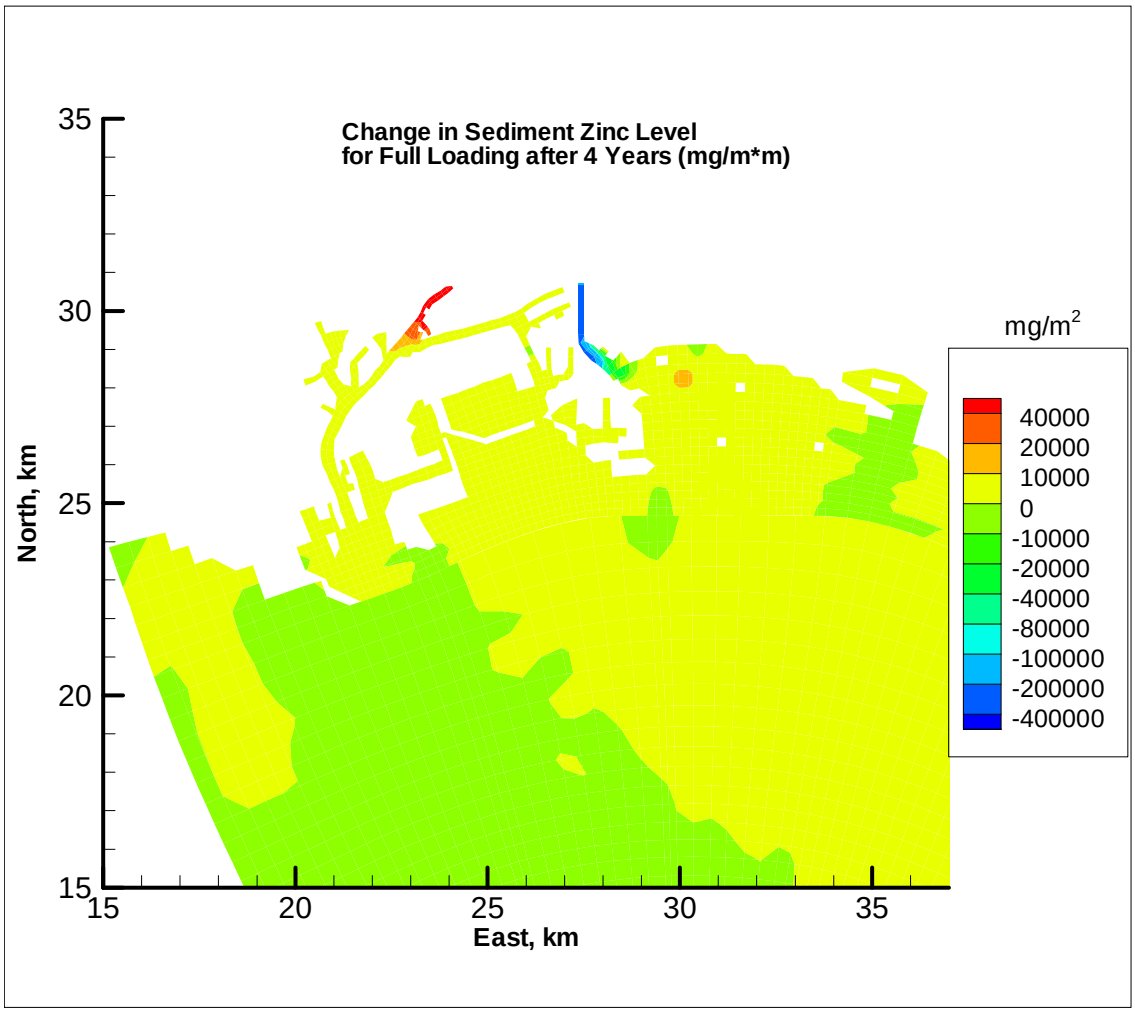
Note: Areal Concentration Change from Load Reduction Simulation = Final Areal Baseline Simulation Concentration in 2005 – Final Areal Load Reduction Concentration in 2005 (based on 50 percent load reduction from the rivers and nearshore watersheds). Results are presented in mg/m^2.

Figure D-10. Areal concentration change from load reduction simulation – copper



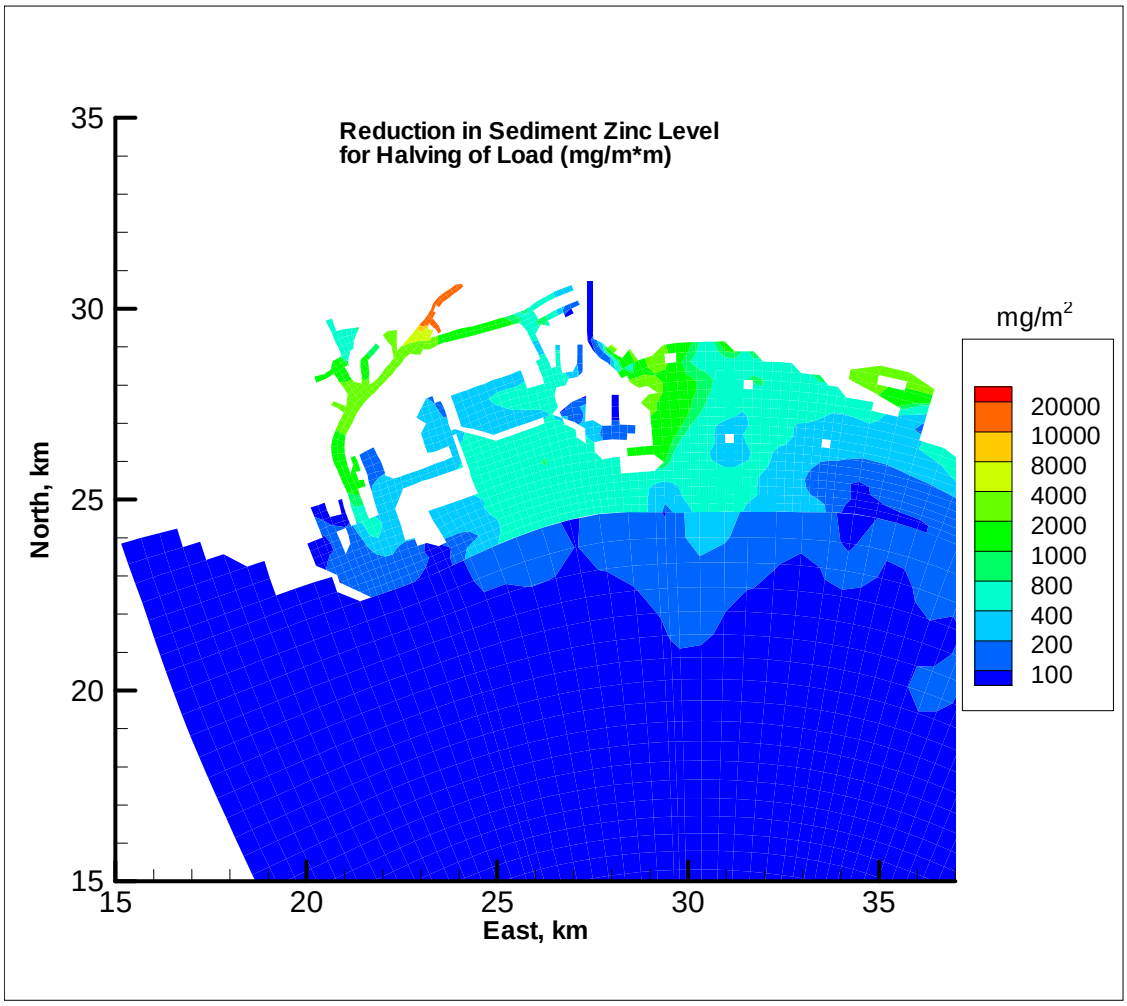
Note: Relative Change in Load Reduction Simulation = Relative Change in Load Reduction Change (normalized by initial top bed layer concentration). Results are proportions and can be multiplied by 100 to obtain percent.

Figure D-11. Relative change in load reduction simulation – copper



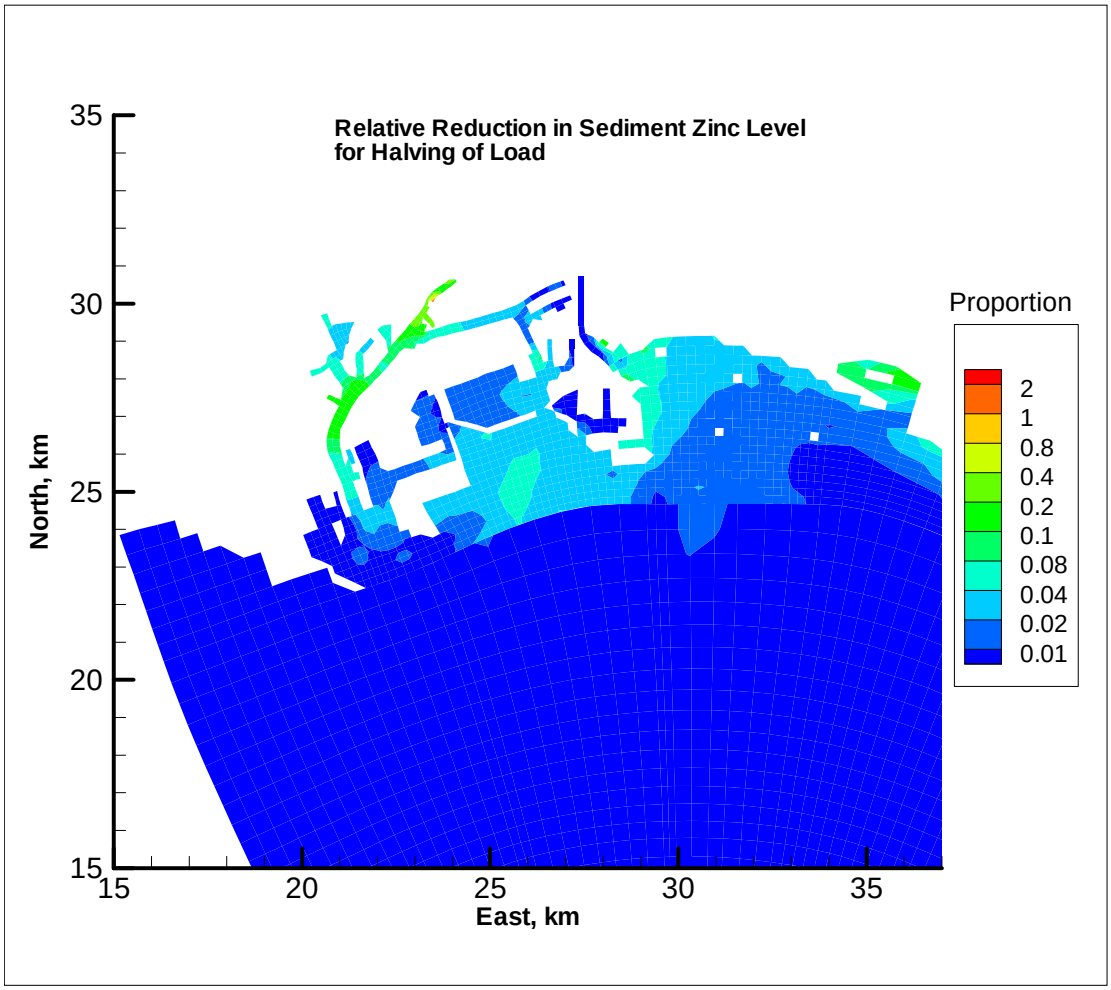
Note: Areal Concentration Change in Baseline Simulation Over Time = Final Areal Concentration using Baseline Conditions in 2005 (after 4 years) – Initial Areal Concentration using Baseline Conditions in 2002 (beginning of simulation period). Results are presented in mg/m^2.

Figure D-12. Areal concentration change in baseline simulation over time (after four years) – zinc



Note: Areal Concentration Change from Load Reduction Simulation = Final Areal Baseline Simulation Concentration in 2005 – Final Areal Load Reduction Concentration in 2005 (based on 50 percent load reduction from the rivers and nearshore watersheds). Results are presented in mg/m^2.

Figure D-13. Areal concentration change from load reduction simulation – zinc



Note: Relative Change in Load Reduction Simulation = Relative Change in Load Reduction Change (normalized by initial top bed layer concentration). Results are proportions and can be multiplied by 100 to obtain percent.

Figure D-14. Relative change in load reduction simulation – zinc

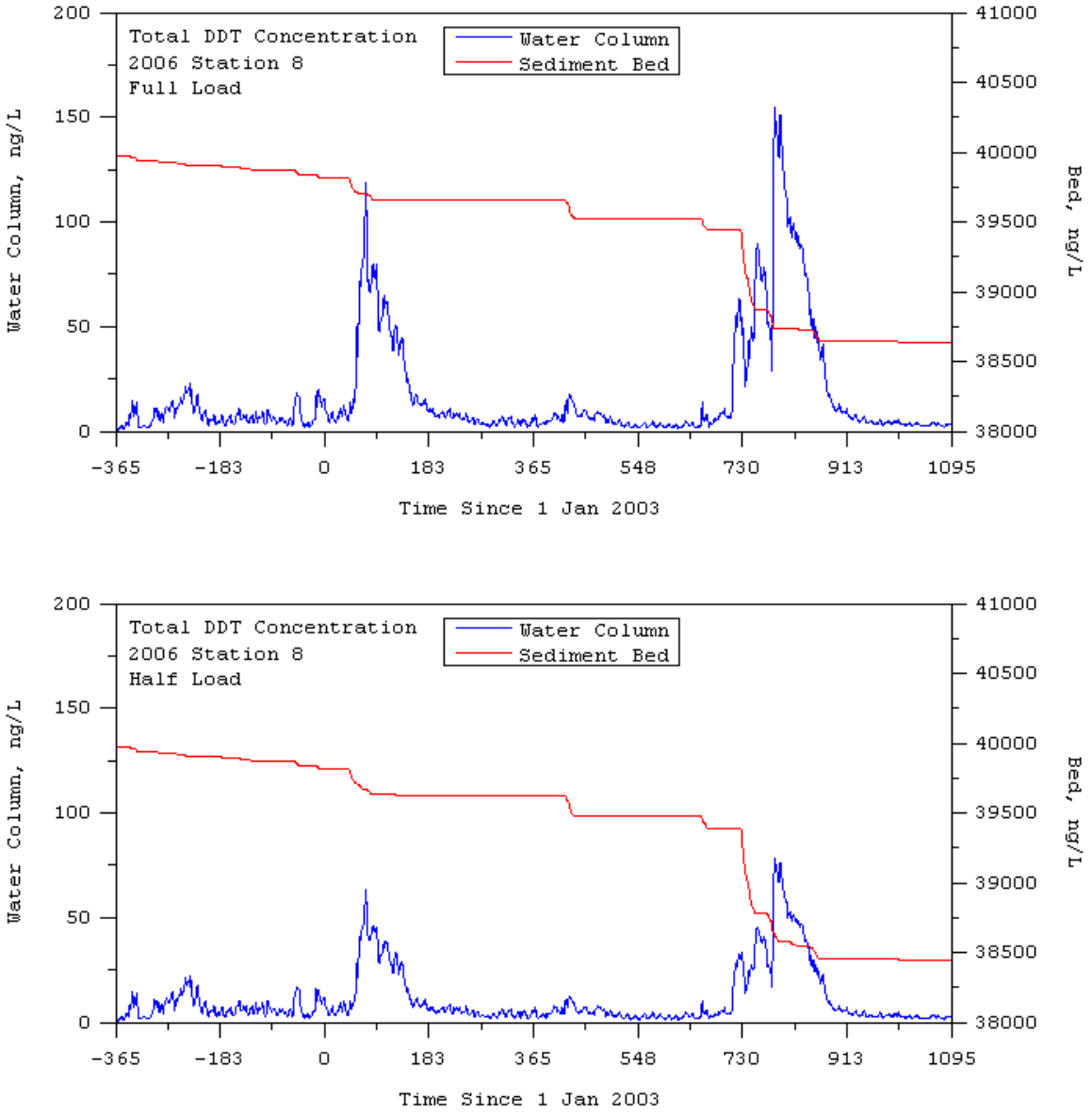


Figure D-15. Total DDT concentration in water column and at sediment bed surface for Station 8 (see Figure D-2 for location)

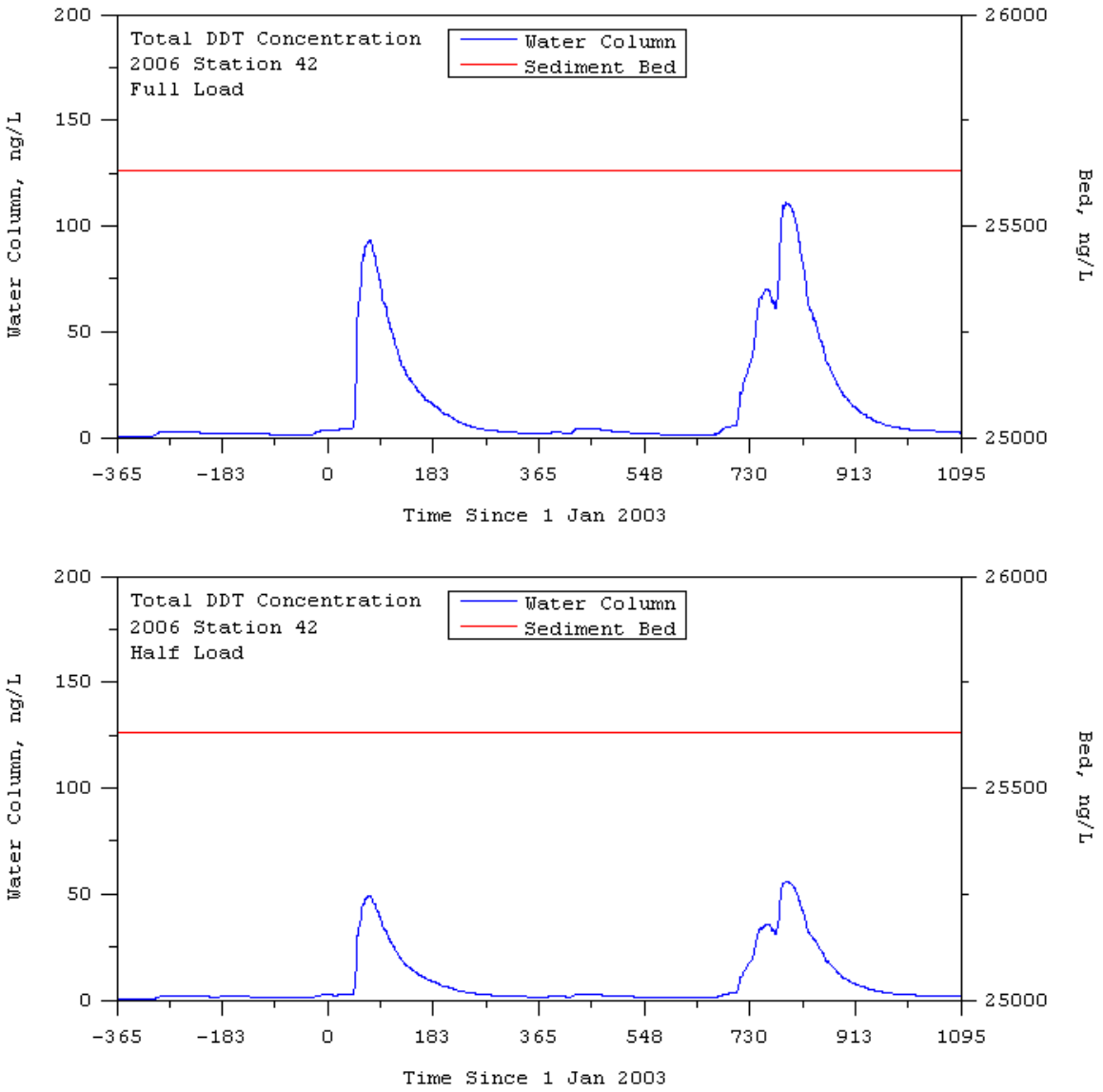


Figure D-16. Total DDT concentration in water column and at sediment bed surface for Station 42 (see Figure D-2 for location)

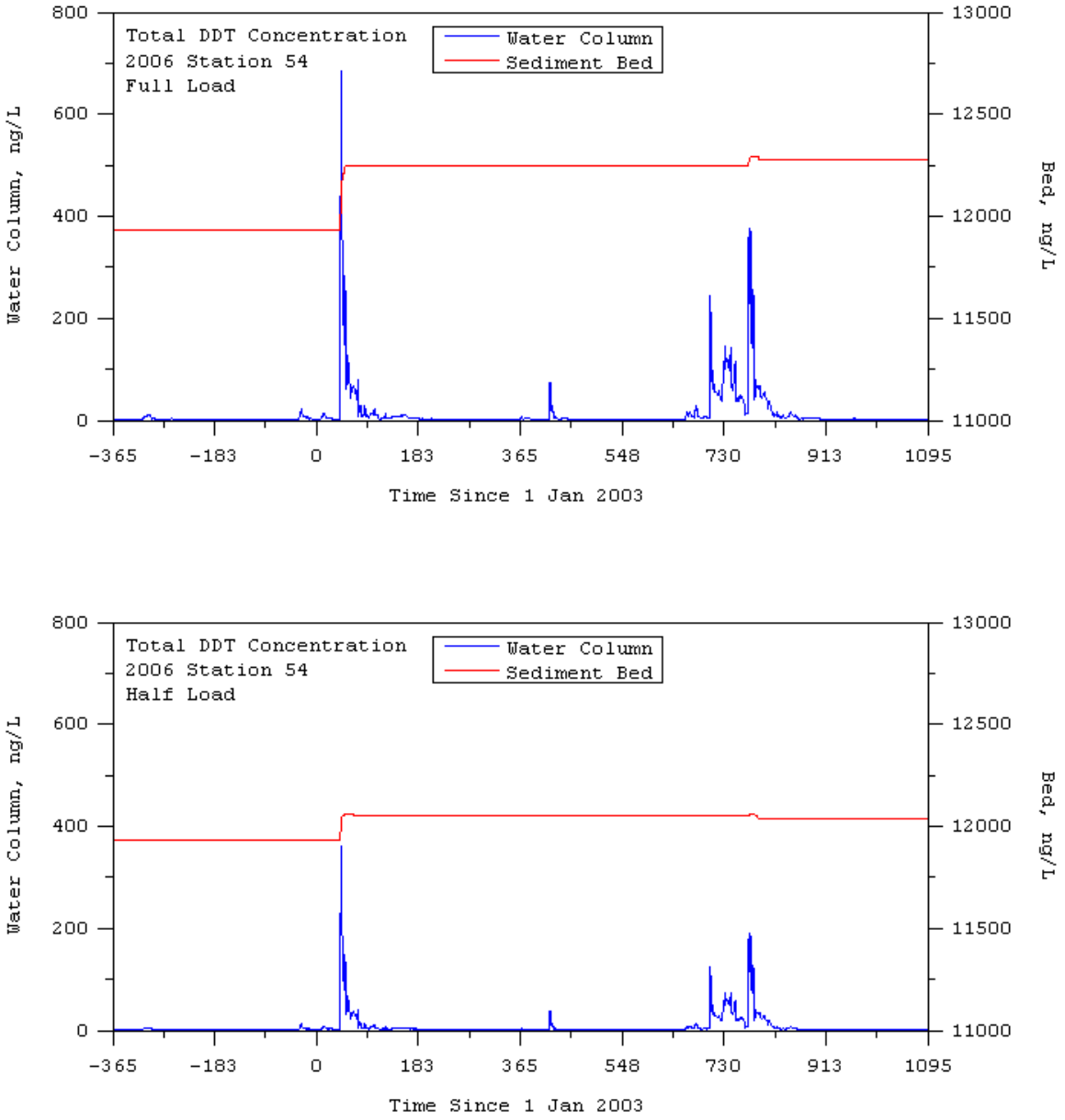


Figure D-17. Total DDT concentration in water column and at sediment bed surface for Station 54 (see Figure D-2 for location)

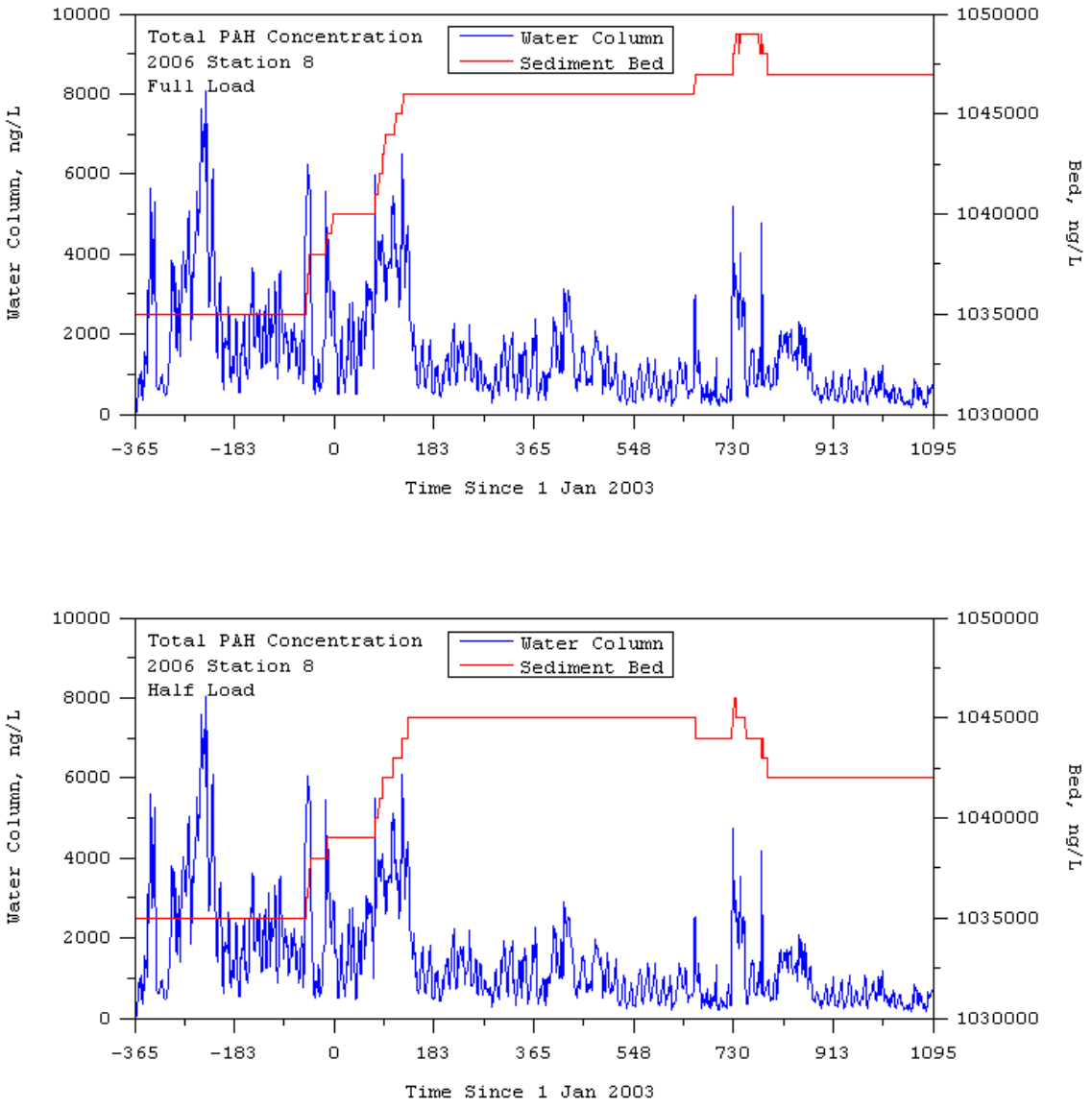


Figure D-18. Total PAH concentration in water column and at sediment bed surface for Station 8 (see Figure D-2 for location)

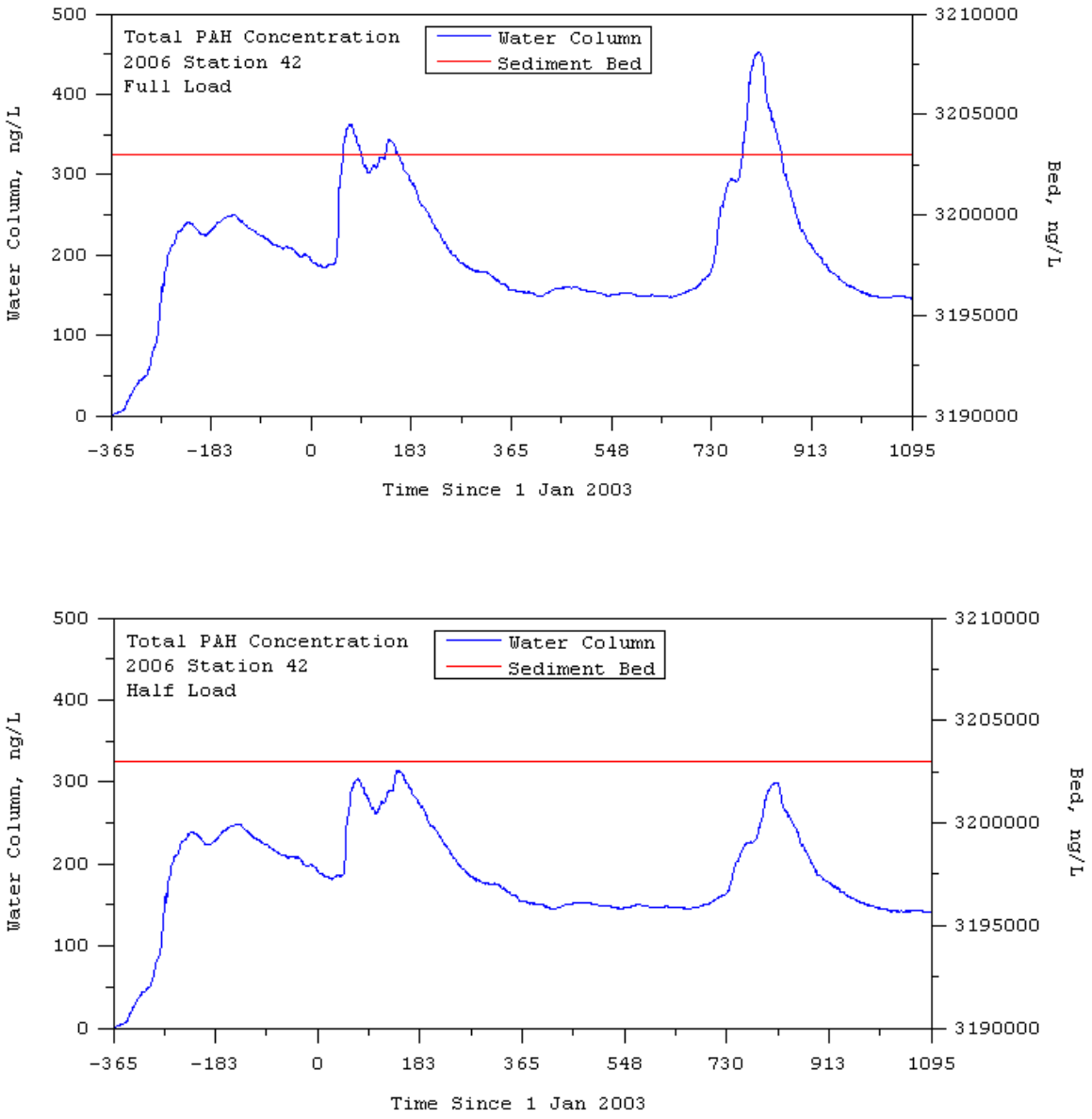


Figure D-19. Total PAH concentration in water column and at sediment bed surface for Station 42 (see Figure D-2 for location)

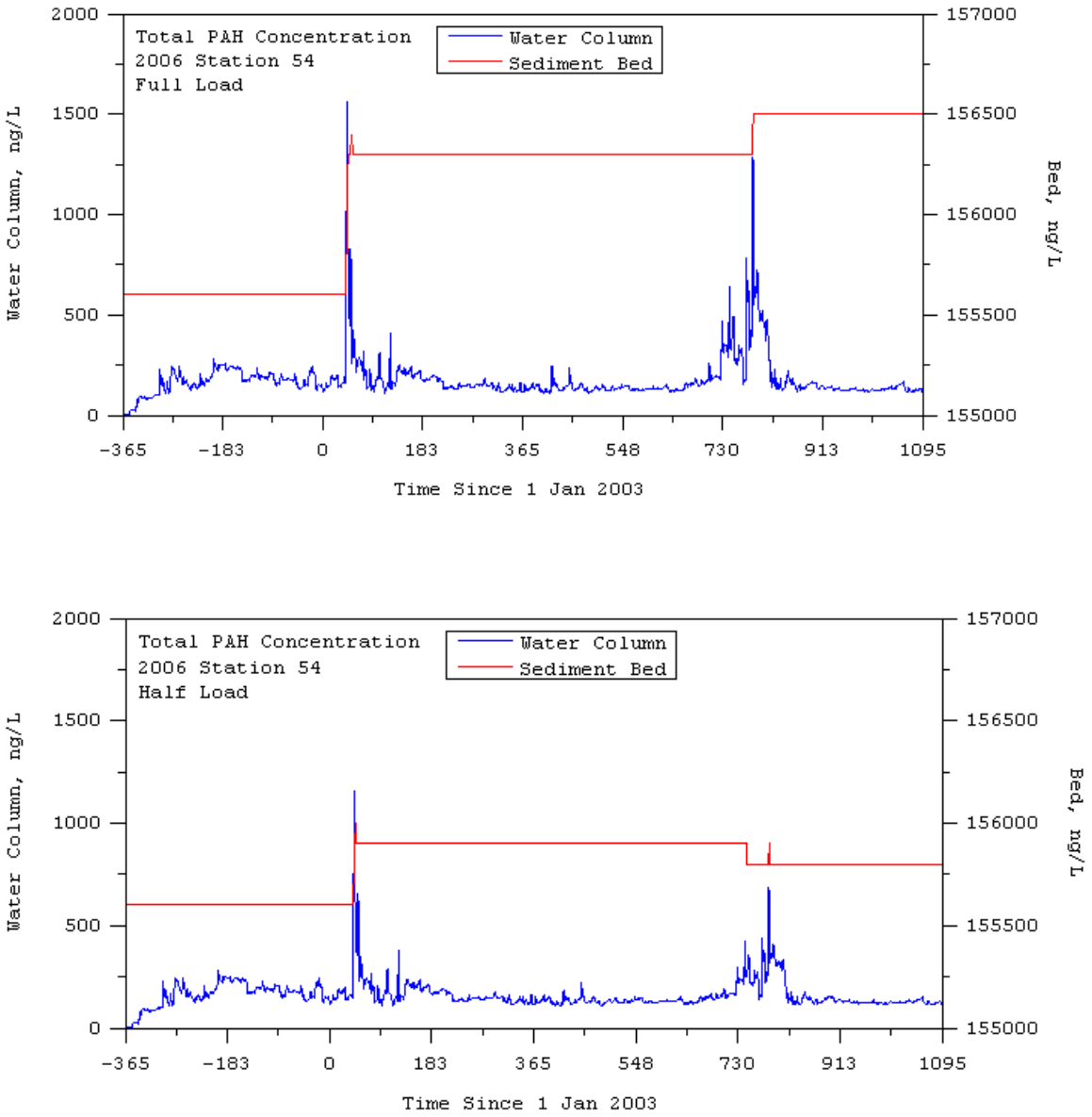
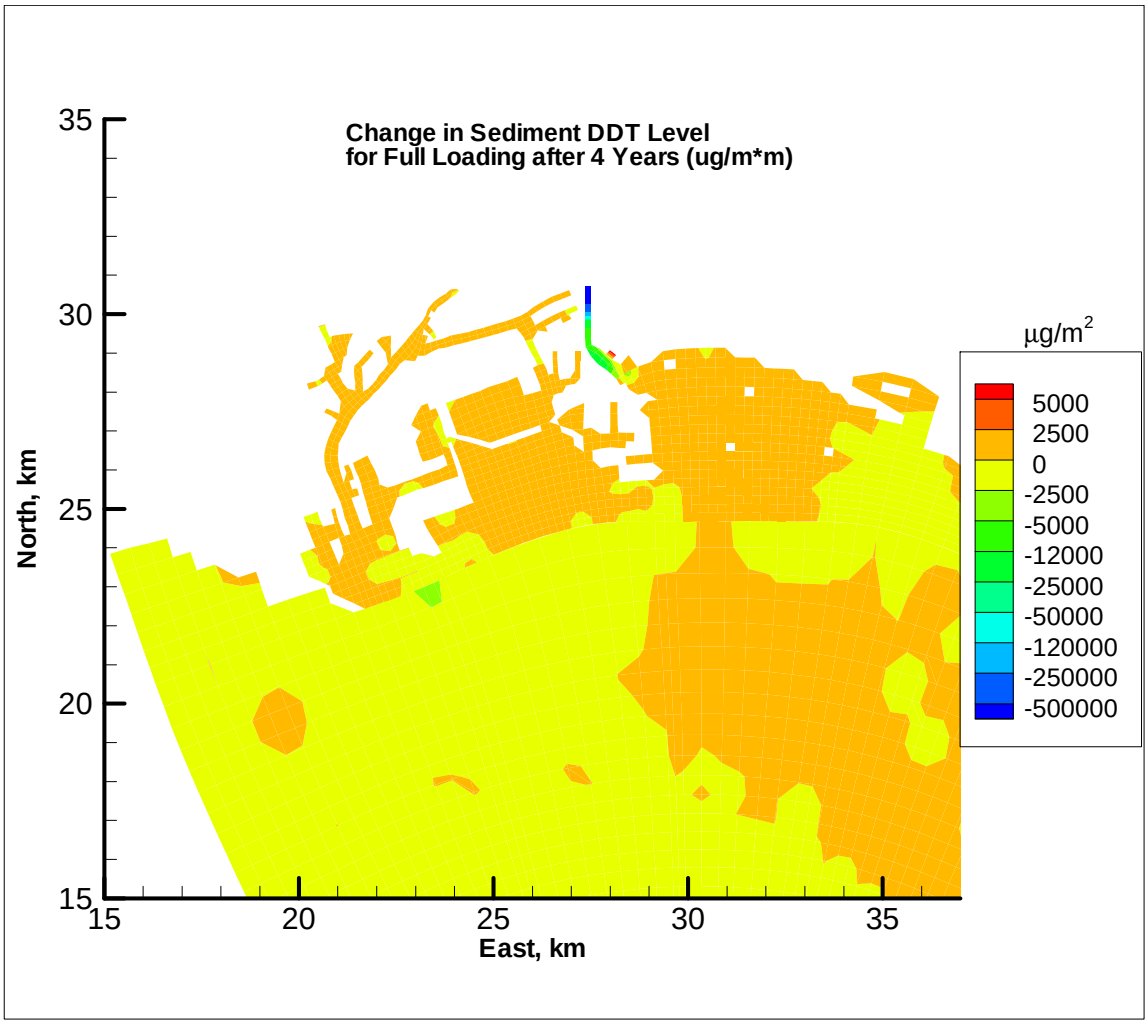
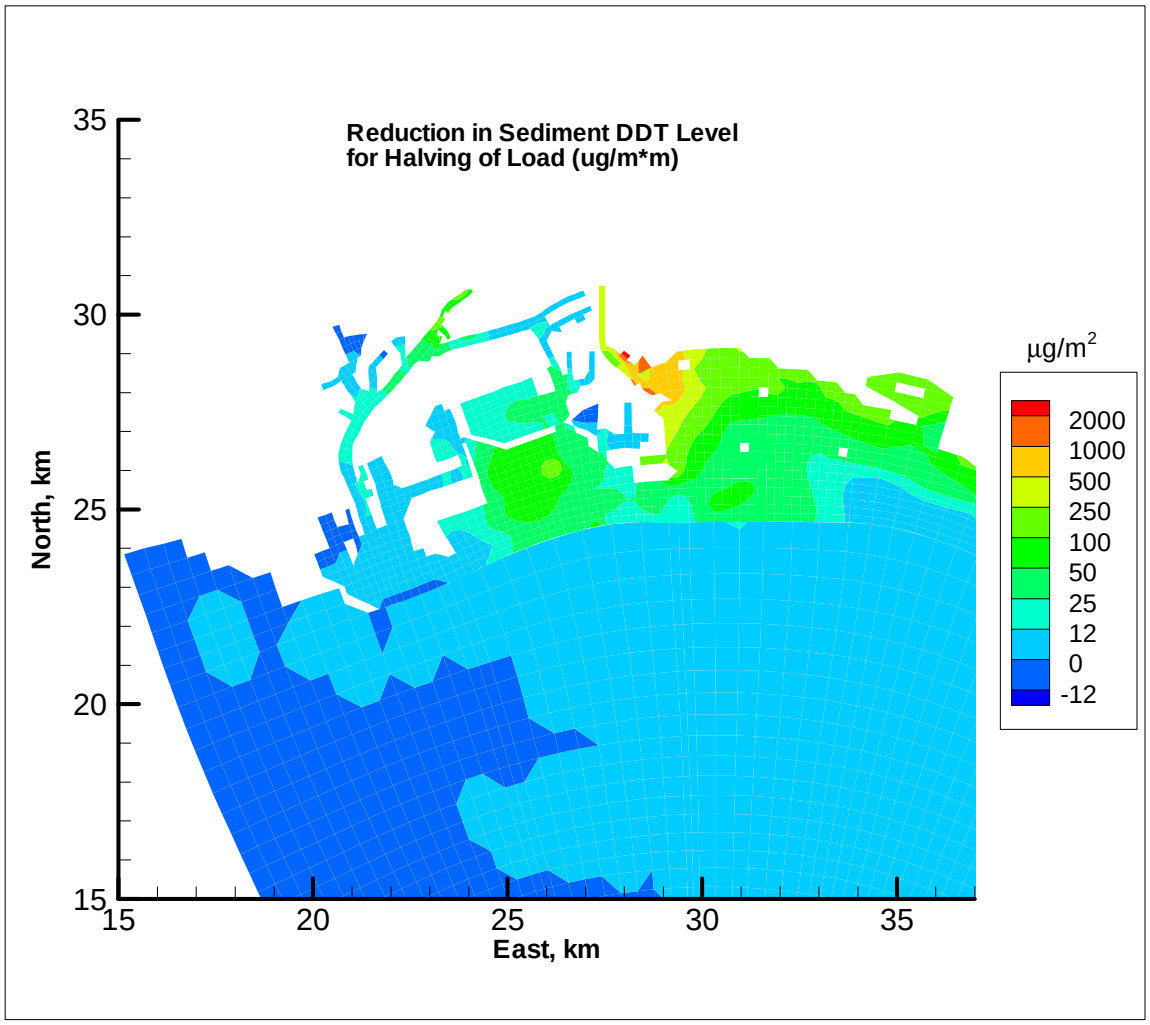


Figure D-20. Total PAH concentration in water column and at sediment bed surface for Station 54 (see Figure D-2 for location)



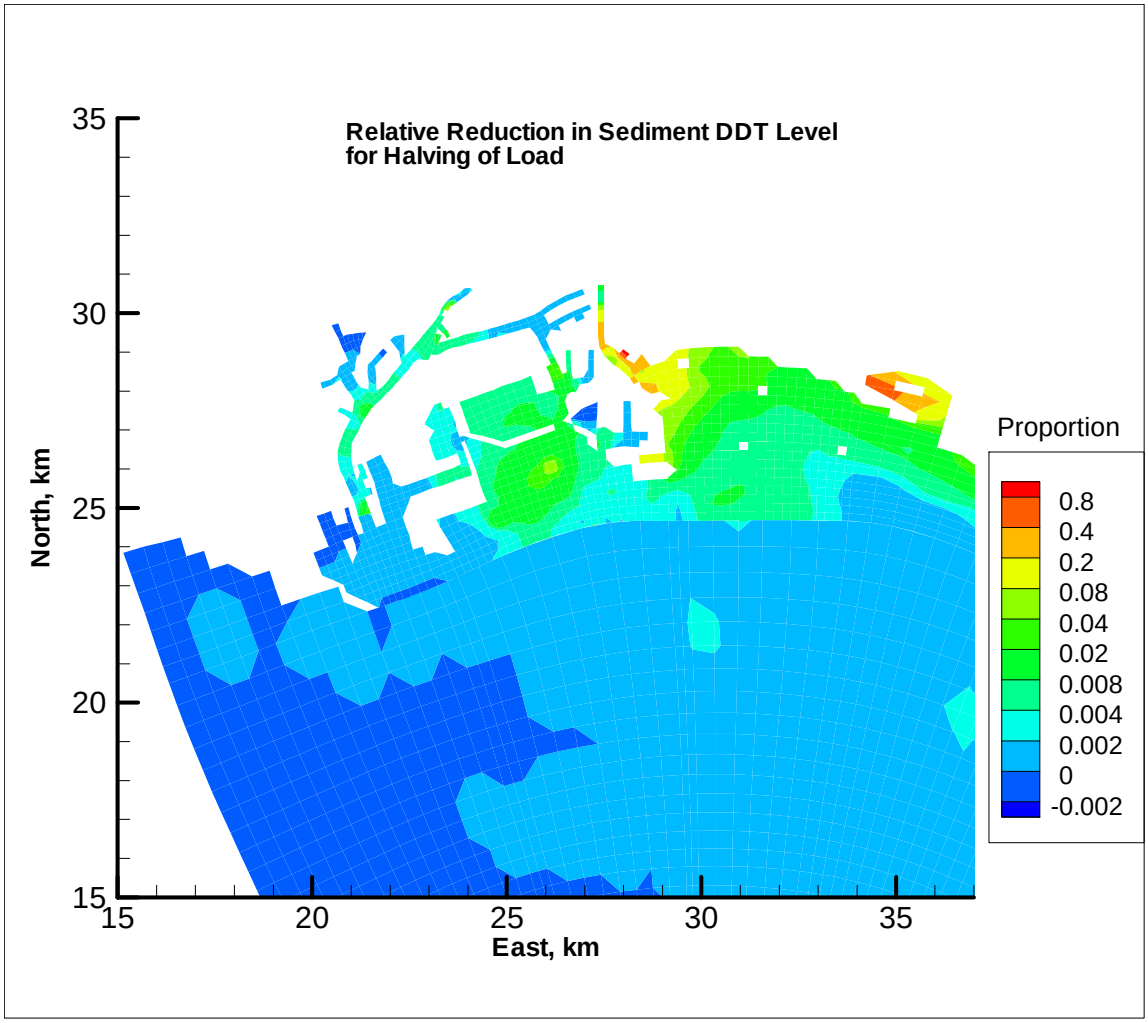
Note: Areal Concentration Change in Baseline Simulation Over Time = Final Areal Concentration using Baseline Conditions in 2005 (after 4 years) – Initial Areal Concentration using Baseline Conditions in 2002 (beginning of simulation period). Results are presented in µg/m^2.

Figure D-21. Areal concentration change in baseline simulation over time (after four years) – DDT



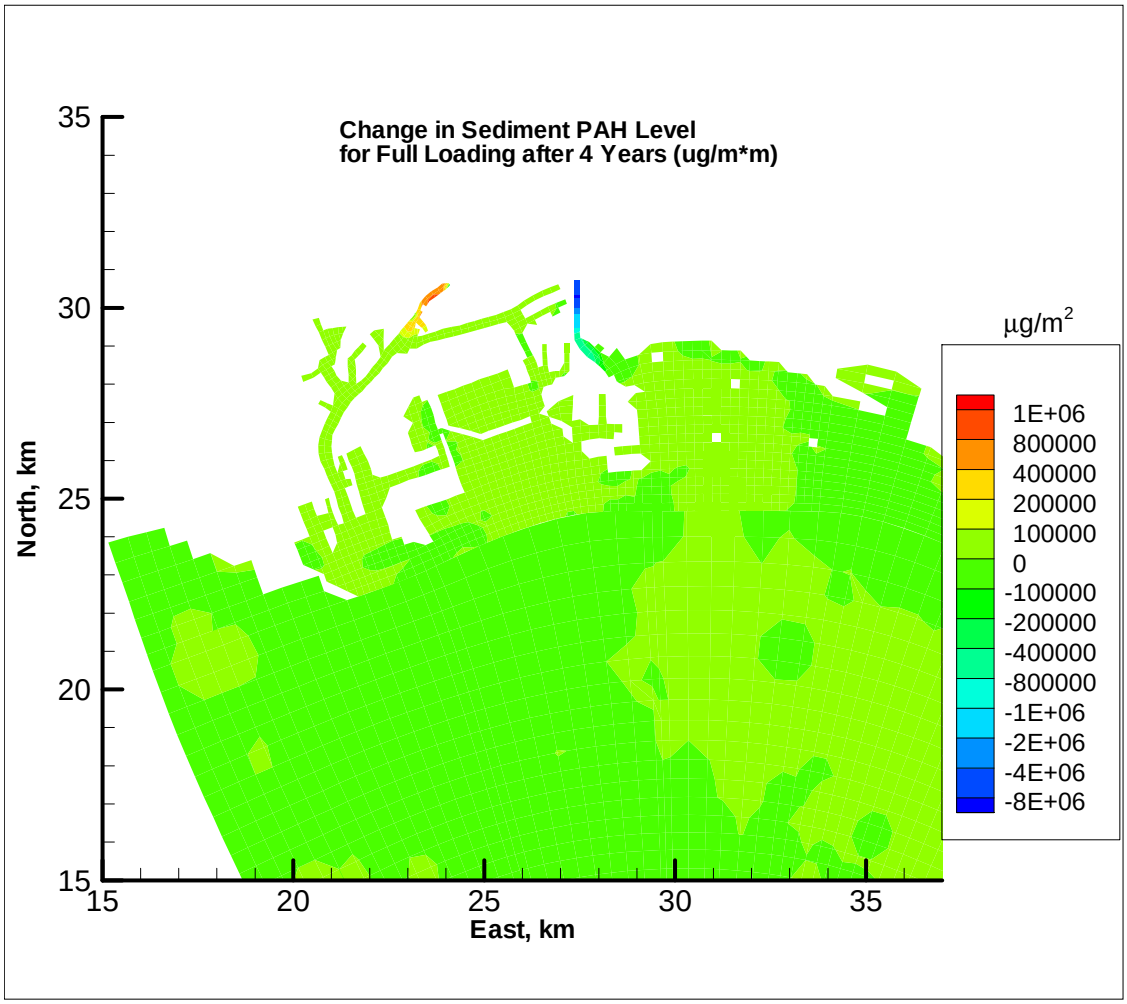
Note: Areal Concentration Change from Load Reduction Simulation = Final Areal Baseline Simulation Concentration in 2005 – Final Areal Load Reduction Concentration in 2005 (based on 50 percent load reduction from the rivers and nearshore watersheds). Results are presented in µg/m^2.

Figure D-22. Areal concentration change from load reduction simulation – DDT



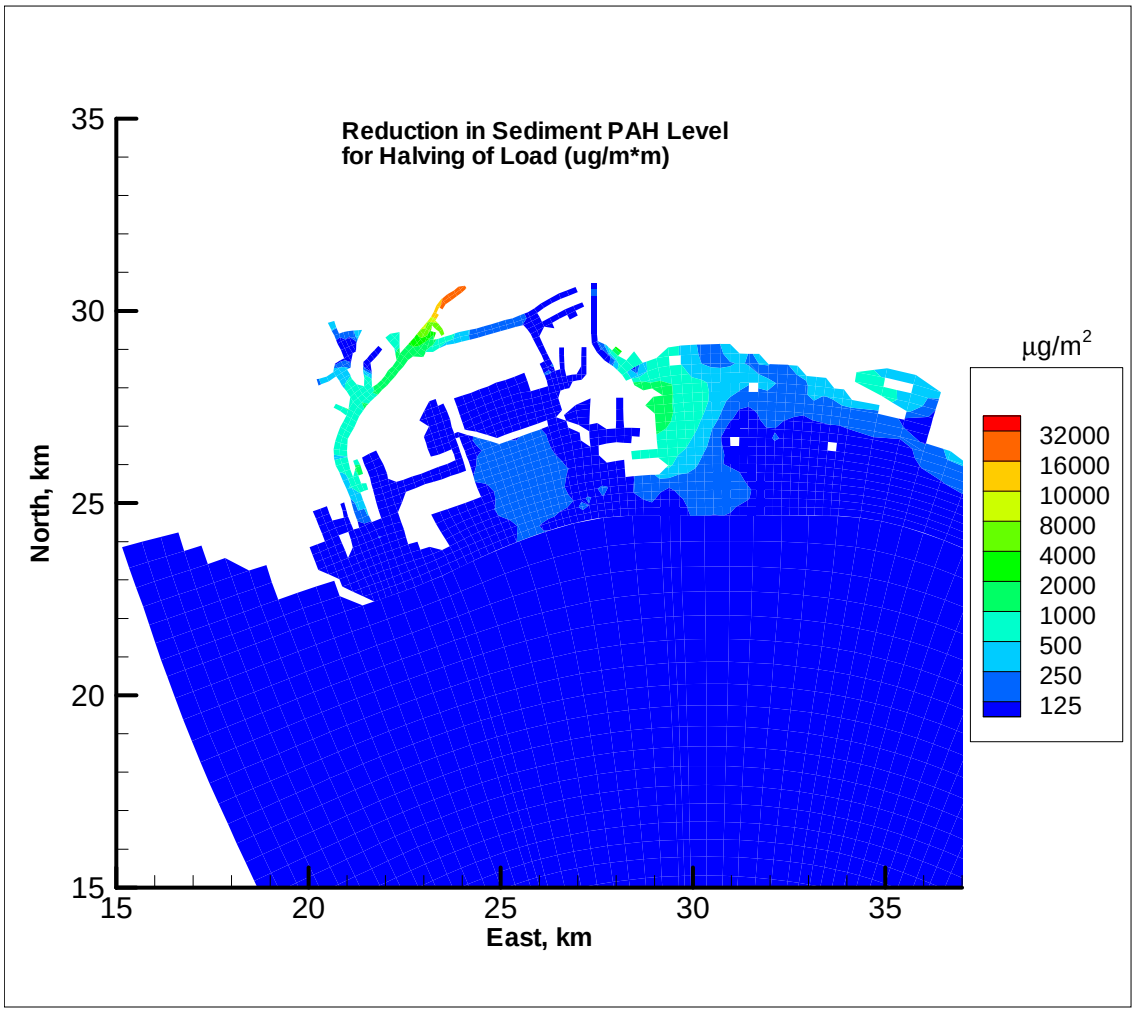
Note: Relative Change in Load Reduction Simulation = Relative Change in Load Reduction Change (normalized by initial top bed layer concentration). Results are proportions and can be multiplied by 100 to obtain percent.

Figure D-23. Relative change in load reduction simulation – DDT



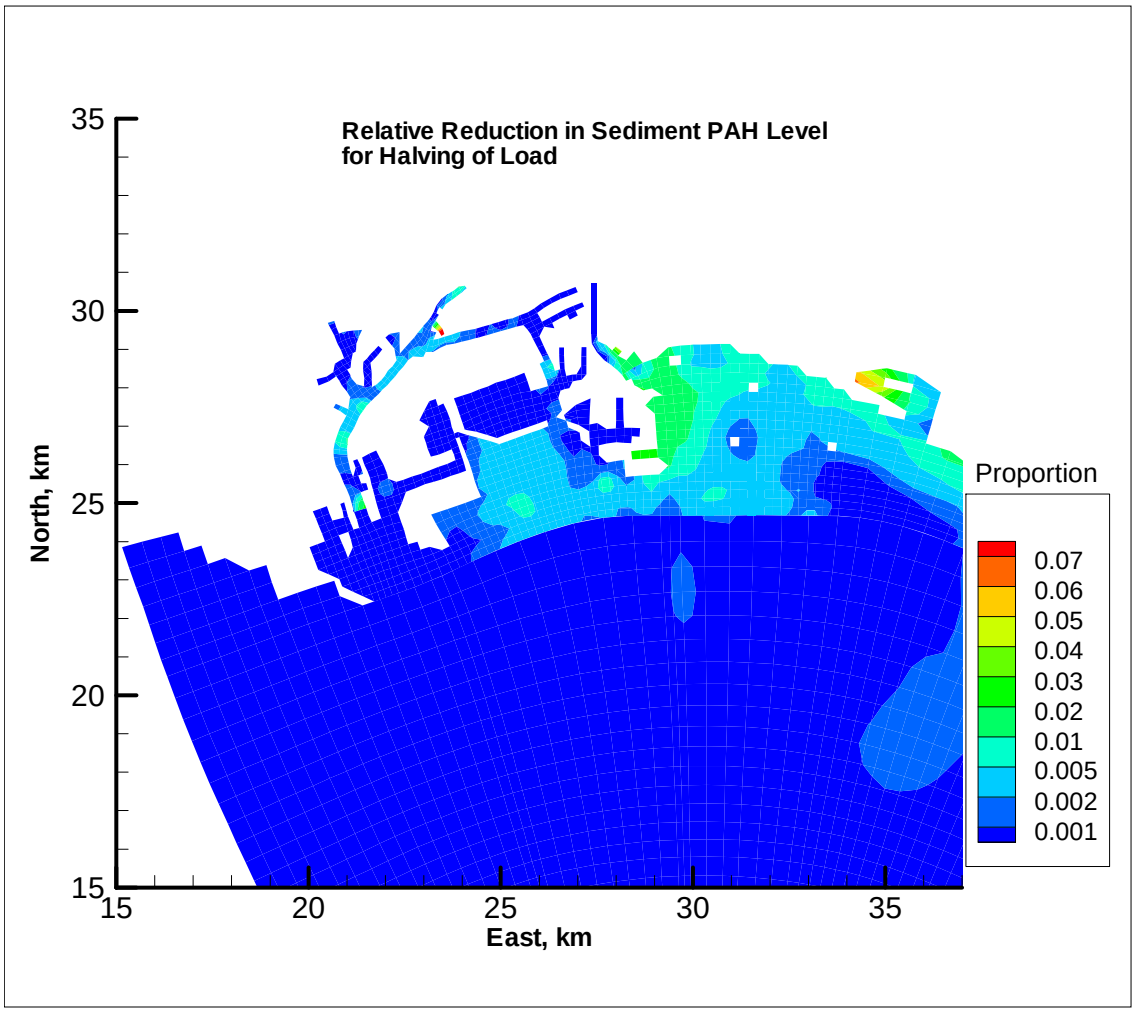
Note: Areal Concentration Change in Baseline Simulation Over Time = Final Areal Concentration using Baseline Conditions in 2005 (after 4 years) – Initial Areal Concentration using Baseline Conditions in 2002 (beginning of simulation period). Results are presented in $\mu g/m^2$.

Figure D-24. Areal concentration change in baseline simulation over time (after four years) – PAH



Note: Areal Concentration Change from Load Reduction Simulation = Final Areal Baseline Simulation Concentration in 2005 – Final Areal Load Reduction Concentration in 2005 (based on 50 percent load reduction from the rivers and nearshore watersheds). Results are presented in µg/m^2.

Figure D-25. Areal concentration change from load reduction simulation – PAH



Note: Relative Change in Load Reduction Simulation = Relative Change in Load Reduction Change (normalized by initial top bed layer concentration). Results are proportions and can be multiplied by 100 to obtain percent.

Figure D-26. Relative change in load reduction simulation – PAH

Appendix E: Analysis of Additional Water Column Metals and Suspended Solids Data

DRAFT

November 2008

Prepared for:
USEPA Region 9
Los Angeles Regional Water Quality Control Board

Prepared by:
Tetra Tech, Inc.

Introduction

Subsequent to conducting the calibration and sensitivity simulations for metals, described in Chapter 8 and Appendix C, using water column partition coefficients in column 5 of Table 21, additional water column metals and sediment concentration data sets became available. These data sets include dissolved and total metals data collected during January and March 2006 and dissolved and total metals and suspended solids data collected in January 2008. The locations of these data sets correspond to the 2005 locations shown in Figure 25. The following sections present, analyze, and discuss these data sets.

Water Column Metals Data: 2006

Dissolved and total metals concentrations were reported for 66 mid-water column sampling locations in January and March of 2006 in waters of the Port of Los Angeles. For comparison with the 2005 POLA and 2006 POLB data, these data were used to determine the ratio of the particulate to dissolved fraction, which also corresponds to the product of the equilibrium partition coefficient and suspended solids concentration according to

$$K_p \bullet P = \frac{C_p}{C_d} \qquad (6)$$

where P is the suspended sediment concentration. Figure E-1 shows scatter plots of the ratio for copper, lead, and zinc. Table E-1 summarizes the average values of the ratios and compares them with results for 2005 POLA and 2006 POLB stations (Figure 26 and Table 21, fourth column). The concentration ratios for the three metals, copper, lead, and zinc, are very consistent between the two data sets. The range of average partition coefficients corresponding to an assumed range of sediment concentrations is shown in the fourth column of Table E-1.

Water Column Metals and Suspended Solids Data: 2008

Dissolved and total metals concentrations and total suspended solids were reported for 43 mid-water column sampling locations in January 2008 in waters of the Port of Los Angeles. For comparison with the 2005 POLA and 2006 POLB data, these data were used to determine the partition coefficient with the following equation:

$$K_p = \frac{1}{P}\frac{C_p}{C_d} \qquad (5C)$$

where P is the suspended sediment concentration. Figure E-2 shows the partition coefficients for copper, lead, and zinc as function of the suspended sediment concentration. The fifth column of Table E-1 summarizes the average values of the partition coefficients. These can be compared to the range estimated using the POLA 2006 particulate to dissolved concentration ratio.

For comparison, the model calibration and sensitivity simulations (Chapter 8 and Appendix C) conducted before these data became available used partition coefficients of 0.25, 1.25, and 0.05 L/mg for copper, lead, and zinc, respectively. The model simulation values used for copper and lead, 0.25 and 1.25, are very consistent with the observation-based values of 0.17 and 1.5. The model simulation value for zinc (0.05 L/mg) is significantly less than the average observation-based value, but still within the range of shown for zinc in Figure E-1 and Table E-1.

Table E-1. Equilibrium Partition Coefficients and Particulate to Dissolved Concentration Ratios for Metals

Contaminant	**Water Column Particulate to Dissolved Concentration Ratio *POLA2005 POLB2006***	**Water Column Particulate to Dissolved Concentration Ratio *POLA2006***	**Range of Partition Coefficients, L/mg Corresponding to TSS range of 1 to 10 mg/L (based on *POLA2006*)**	**Average Partition Coefficients, L/mg for *POLA2008***
Copper	0.51	0.72	0.05 to 0.7	0.17
Lead	7.12	6.28	0.6 to 7	1.5
Zinc	0.20	0.19	0.02 to 0.2	0.20

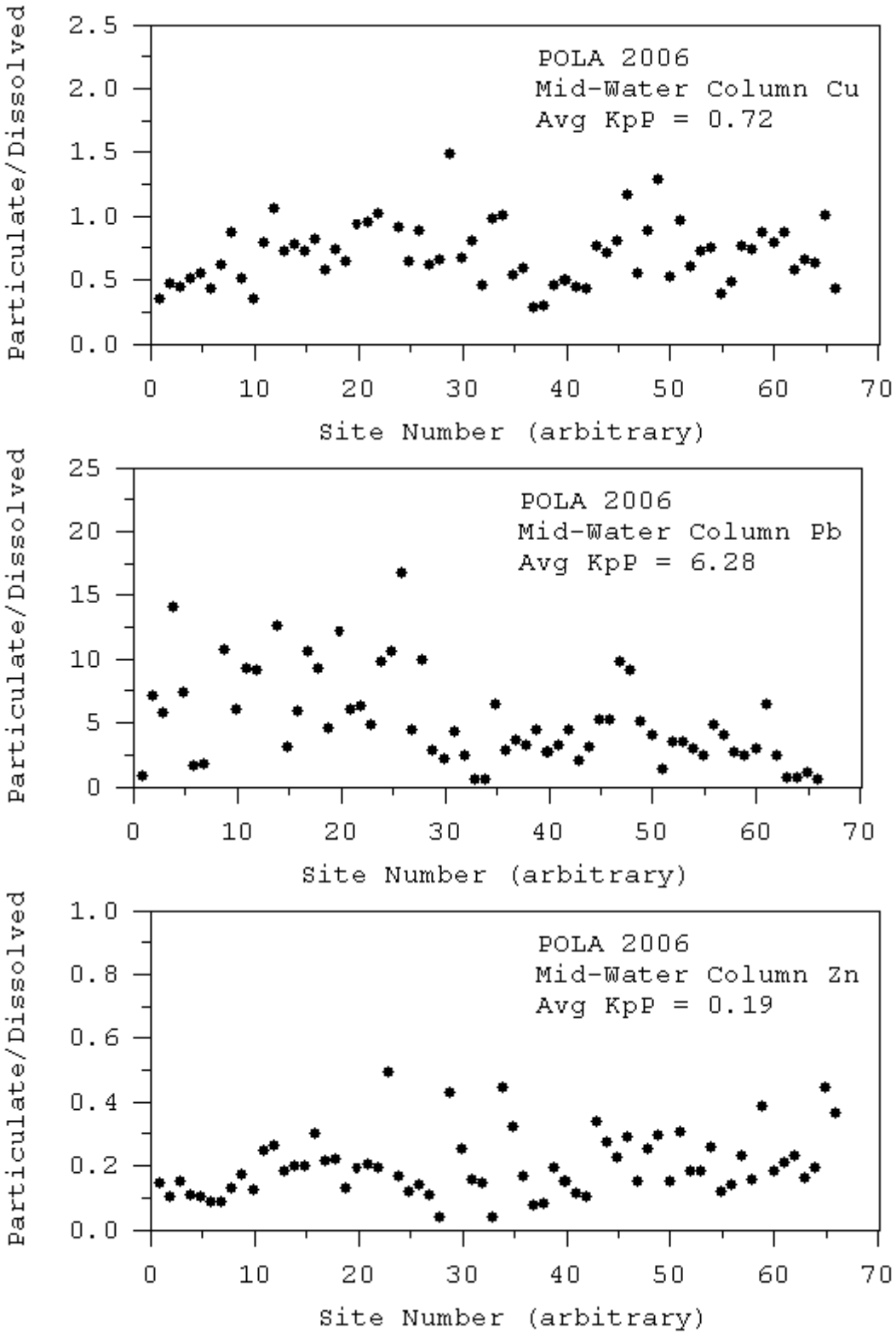


Figure E-1. Particulate to dissolved concentration ratio (equal to product of partition coefficient and adsorption site particle concentration) for 2006 POLA mid-water column metals samples

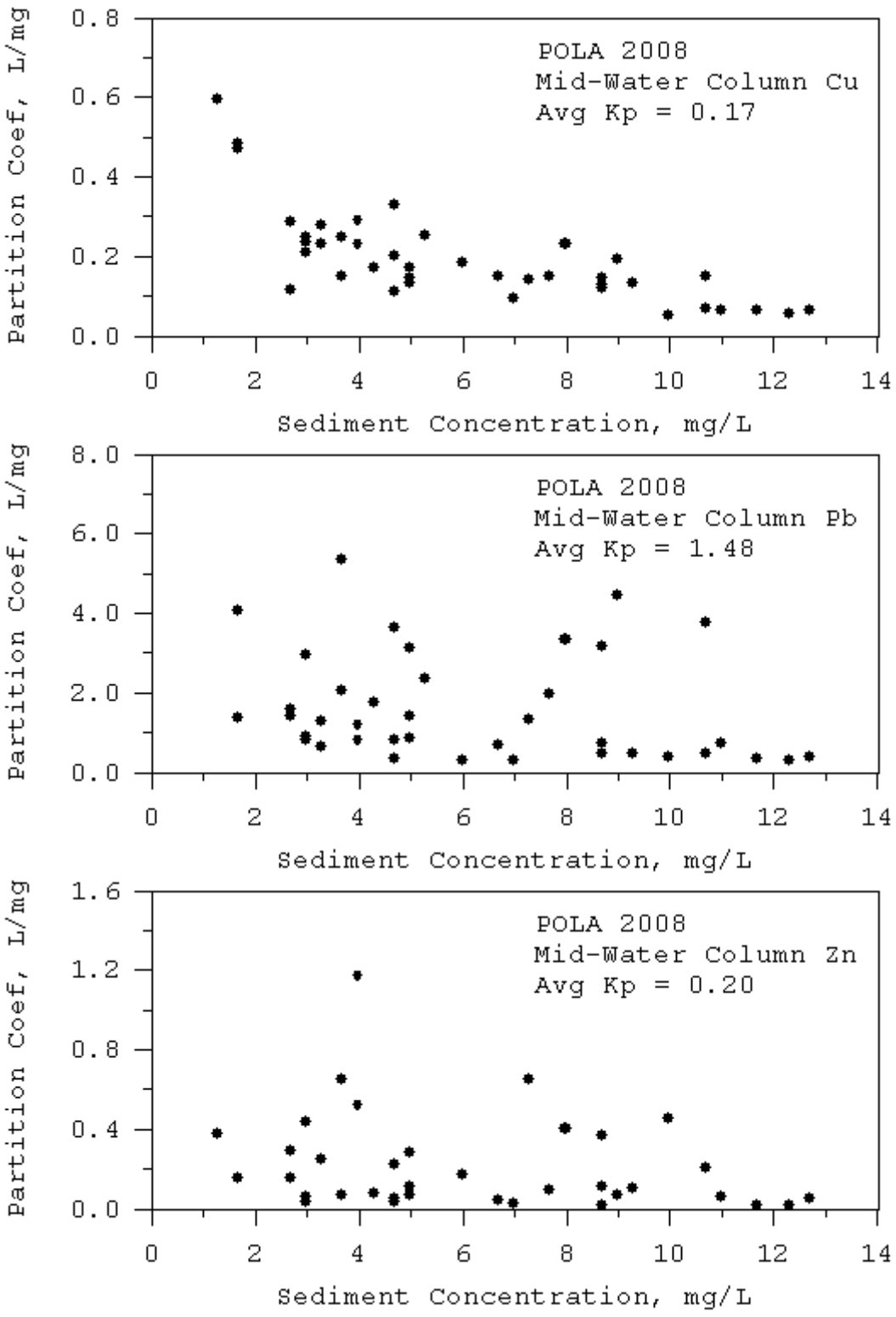


Figure E-2. Partition coefficients for copper, lead, and zinc as a function of suspended sediment concentration for 2008 POLA mid-water column samples

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. R11-008
May 5, 2011

Amendment to the *Water Quality Control Plan for the Los Angeles Region* to Incorporate a Total Maximum Daily Load for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The Federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angeles Region (Regional Board) to establish water quality standards for each waterbody within its region. Water quality standards include beneficial uses, water quality objectives that are established at levels sufficient to protect those beneficial uses, and an antidegradation policy to prevent degrading waters. Waterbodies that do not meet water quality standards are considered impaired.

2. CWA section 303(d)(1) requires each state to identify the waters within its boundaries that do not meet water quality standards. Those waters are placed on the state's "303(d) List" or "Impaired Waters List". For each listed water, the state is required to establish the Total Maximum Daily Load (TMDL) of each pollutant impairing the water quality standards in that waterbody. Both the identification of impaired waters and TMDLs established for those waters must be submitted to the United States Environmental Protection Agency (U.S. EPA) for approval pursuant to CWA section 303(d)(2).

3. A consent decree between U.S. EPA, Heal the Bay, Inc. and Santa Monica BayKeeper, Inc. was approved on March 22, 1999, and amended in September 2010, which resolved litigation between those parties relating to the pace of TMDL development in the Los Angeles Region. The court order directs the U.S. EPA to ensure that TMDLs for all 1998-listed impaired waters in the Los Angeles Region be established within 13 years of the consent decree. The consent decree combined waterbody pollutant combinations in the Los Angeles Region into 92 TMDL analytical units. In accordance with the consent decree, the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters[1] Toxic Pollutants TMDL addresses the listings for cadmium, chromium, copper, mercury, lead, zinc, chlordane, dieldrin, toxaphene, DDT, PCBs, certain PAH compounds, benthic community effects and toxicity for analytical units 73, 74, 75, and 78. These impairments exist in one or more environmental media—water, sediment, or tissue. Based on the consent decree schedule, TMDLs for these analytical units must be approved or established by U.S. EPA by March 24, 2012.

4. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d)(1)(C) and (D) of the CWA, as well as in U.S. EPA guidance documents (Report No. EPA/440/4-91/001). A TMDL is defined as the sum of the individual waste load

[1] Greater Los Angeles and Long Beach Harbor waters include Inner and Outer Harbors, Consolidated Slip, Fish Harbor, Cabrillo Marina, Inner Cabrillo Beach, Los Angeles River Estuary, and San Pedro Bay.

allocations for point sources, load allocations for non-point sources and natural background (40 CFR 130.2). TMDLs must be set at levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.7(c)(1)). 40 CFR 130.7 also dictates that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters. TMDLs typically include one or more numeric "targets", i.e., numerical translations of the existing water quality standards, which represent attainment of those standards, contemplating the TMDL elements described above. Since a TMDL must represent the "total" load, TMDLs must account for all sources of the relevant pollutants, irrespective of whether the pollutant is discharged to impaired or unimpaired upstream reaches.

5. Neither TMDLs nor their targets or other components are water quality objectives, and thus their establishment does not implicate California Water Code section 13241. Rather, under California Law, TMDLs are programs to implement existing standards (including objectives), and are thus established pursuant to California Water Code section 13242. Moreover, they do not create new bases for direct enforcement against dischargers apart from the existing water quality standards they translate. Like most other parts of the Water Quality Control Plan for the Los Angeles Region (Basin Plan), TMDLs are not generally self-implementing. The targets merely establish the bases through which load allocations (LAs) and waste load allocations (WLAs) are calculated. The LAs and WLAs may be implemented in any manner consistent with the Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options, adopted by the State Water Resources Control Board (State Board) on June 16, 2005 (Resolution 2005-0050). Federal regulations also require that National Pollutant Discharge Elimination System (NPDES) permits be consistent with the assumptions and requirements of available WLAs (40 C.F.R. 122.44(d)(vii)(B)). US EPA has provided guidance on its expectations regarding how WLAs should be incorporated into permits, including Municipal Separate Storm Sewer System (MS4) Permits (US EPA Memorandum dated November 8, 2010).

6. As envisioned by California Water Code section 13242, the TMDL contains a "description of surveillance to be undertaken to determine compliance with objectives." The Compliance Monitoring element of the TMDL recognizes that monitoring will be necessary to assess the progress of pollutant load reductions and improvements in water, fish tissue, and sediment quality in Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters. The TMDL establishes the types of information that will be necessary to secure. The Regional Board's Executive Officer will ensure that appropriate entities develop and submit monitoring programs and technical reports necessary to achieve the purposes of the TMDL. The Executive Officer will determine the scope of these programs and reports, taking into account any legal requirements, including this TMDL, and if necessary issue appropriate orders to appropriate entities.

7. Upon establishment of TMDLs by the State or U.S. EPA, the State is required to incorporate, or reference, TMDLs in the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). The Basin Plan and applicable statewide plans serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Los Angeles Regional Board. Attachment A to this resolution contains the language to be incorporated into the Basin Plan for this TMDL.

8. The watershed of the Dominguez Channel and the Los Angeles and Long Beach Harbors is an important industrial, commercial and residential area with unique and important historical and environmental resources. The area includes 18 municipalities within and including Los Angeles County and roughly 1 million residents. Prior to its development, the area was largely marshland and now almost no wetland nor original coastline exists. Water quality decreased with increased development in the 1970s. Since then, the water quality has improved but there are still significant water quality and sediment quality challenges.

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

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

   San Pedro Bay receive the discharges of the Dominguez Channel and Los Angeles and San Gabriel Rivers, although the latter two watersheds are not focus of this TMDL. The Los Angeles River is largely wastewater flow and the watershed is 834 square miles, with 66% of its land area developed. The San Gabriel River is 689 square miles (including the Los Cerritos Channel and Alamitos Bay) and is largely developed in the downstream end.

   The Dominguez Channel watershed is dominated by urban land uses such as residential, industrial, commercial, and transportation, which comprise as much as 85% of the land area. Very little vacant and open space areas are present in the watershed. The watershed is approximately 60% impervious based on assumptions of impervious areas in each land use type. The highest population density in the watershed appears to be in the communities of Inglewood and Hawthorne.

9. Applicable water quality objectives for this TMDL are narrative objectives for Chemical Constituents, Bioaccumulation, Pesticides, and Toxicity in the Basin Plan and the numeric water quality criteria promulgated in 40 CFR section 131.38 (the California Toxics Rule (CTR)). In addition, sediment condition objectives were determined by the State Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SQO Part 1) and the sediment quality guidelines of Long and Arch ET&C.

10. The Regional Board's goal in establishing the TMDL for toxic pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters is to protect aquatic life beneficial uses designated in these waters, including the marine habitat use (MAR) and rare, threatened or endangered species habitat use (RARE). In addition, the estuaries (EST) are recognized as areas for spawning, reproduction and/or early development (SPWN), migration of aquatic organisms (MIGR), and wildlife habitat (WILD).

Dominguez Channel also has an existing designated use of warm freshwater habitat (WARM) and the Los Angeles River Estuary has the designated use of wetland habitat (WET). Beneficial uses associated with human use of these waters include recreational use for water contact (REC1), non-contact water recreation (REC2), industrial service supply (IND), navigation (NAV), commercial and sport fishing (COMM), and shellfish harvesting (SHELL).

11. Given the scope and complexity of this TMDL, the Regional Board has been working closely and collaboratively with EPA Region 9 on the development of this TMDL. EPA Region 9 provided substantial resources and expertise to the development of this TMDL.

12. U.S. EPA and Regional Board staff have also worked with stakeholders during the development of a detailed technical document that analyzes and describes the specific necessity and rationale for the development of this TMDL. The technical document entitled "Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL" is an integral part of this Regional Board action and has been reviewed by the Regional Board before acting. The technical document provides the detailed factual basis and analysis supporting the problem statement, numeric targets, source analysis, linkage analysis, waste load allocations (for point sources), load allocations (for nonpoint sources), margin of safety, and seasonal variations and critical conditions of this TMDL.

13. On May 5, 2011, prior to the Board's action on this resolution, a public hearing was conducted on the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Water Toxic Pollutants TMDL. Notice of the hearing was published in accordance with the requirements of California Water Code Section 13244. This notice was published in the Los Angeles Times on December 17, 2010 and the Long Beach Press Telegram on December 17, 2010.

14. The public has had a reasonable opportunity to participate in the review of the amendment to the Basin Plan. A draft of the TMDL was released for public comment on December 17, 2010; a Notice of Hearing and Notice of Filing were published and circulated 45 days preceding Board action. The draft of the TMDL was made available on both the Regional Board and EPA Region 9 websites. Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on May 5, 2011 to consider adoption of the TMDL.

15. In amending the Basin Plan to establish this TMDL, the Regional Board considered the requirements set forth in Sections 13240 and 13242 of the California Water Code.

16. Because the TMDL implements existing narrative and numeric water quality objectives (i.e., water quality objectives in the Basin Plan), the Regional Board (along with the State Board) has determined that adopting a TMDL does not require the Regional Board to consider the factors of California Water Code section 13241. The consideration of the Water Code section 13241 factors, by section 13241's express terms, only applies "in establishing water quality objectives." Here the Regional Board is not establishing water quality objectives, but as required by section 303(d)(1)(C) of the Clean Water Act is adopting a TMDL that will implement the previously established objectives that have not been achieved. In making this determination, the Regional Board has considered and relied upon a legal memorandum from the Office of Chief Counsel to the State Board's basin planning staff detailing why TMDLs cannot be considered water quality objectives.

(See Memorandum from Staff Counsel Michael J. Levy, Office of Chief Counsel, to Ken Harris and Paul Lillebo, Division of Water Quality: *The Distinction Between a TMDL's Numeric Targets and Water Quality Standards*, dated June 12, 2002.)

17. While the Regional Board is not required to consider the factors of California Water Code section 13241, it nonetheless has developed and received significant information pertaining to the California Water Code section 13241 factors and has considered that information in developing and adopting the technical documents supporting this Basin Plan amendment.. Section 13241, at a minimum, requires that water quality objectives ensure reasonable protection of beneficial uses. The designated beneficial uses for Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters include aquatic life habitat uses, water contact recreation, and non-water contact recreation, navigation, commercial and sport fishing, and shellfish harvesting. The estuaries are recognized as areas for spawning, reproduction and/or early development, migration of aquatic organisms, and wildlife habitat. Dominguez Channel also has an existing designated use of warm freshwater habitat and the Los Angeles River Estuary has the designated use of wetland habitat. The past, present and probable future beneficial uses of water have been considered in that Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters are designated for a number of beneficial uses in the Basin Plan.

The environmental characteristics of Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters are spelled out at length in the Basin Plan and in the technical documents supporting this Basin Plan amendment, and have been considered in developing this TMDL.

The Regional Board has considered sediment, fish tissue, and water quality conditions that could be reasonably achieved through the coordinated control of implementation actions including non-structural and structural BMPs, diversion and treatment to reduce sediment transport from the watershed to Dominguez Channel and Greater Harbor waters, and sediment removal activities. TMDL implementation will be carried out by responsible parties including, but not limited to, NPDES-permitted dischargers to the Dominguez Channel and Greater Harbor waters identified in Attachment A of this resolution. Implementation will likely focus on removal of highly contaminated sediment, reduction of stormwater loadings by placement of stormwater treatment devices such as infiltration trenches, vegetated swales, and/or filter strips at critical points in the watershed to reduce sediment loading, diversion of low flows during the dry season to the sanitary sewer or capture and storage of runoff and then diversion to a location for treatment. Responsible agencies also have several options for implementing structural and nonstructural BMPs to attain fish tissue, sediment, and water quality objectives. Attainment of the water quality standards through removal of contaminated sediment, redirection of flows, and BMPs is a reasonably achievable water quality condition for Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters. To the extent that there would be any conflict between the consideration of the factors in Water Code section 13241, subdivision (c), if the consideration were required, and the Clean Water Act, the Clean Water Act would prevail.

Economic considerations were considered throughout the development of the TMDL. Some of these economic considerations arise in the context of Public Resources Code section 21159 and are equally applicable here. The implementation program for this

TMDL recognizes the economic limitations on achieving immediate compliance and allows a flexible implementation schedule of 20 years.

The need for housing within the region has been considered, but this TMDL is unlikely to affect housing needs. Whatever housing impacts could materialize are ameliorated by the flexible nature of this TMDL and the 20-year implementation schedule.

This TMDL is consistent with the goals of the Recycled Water Policy, State Water Resources Control Board Resolution No. 2009-0011.

18. The amendment is consistent with the State Antidegradation Policy (State Board Resolution No. 68-16), and the federal Antidegradation Policy (40 CFR 131.12), in that it does not allow degradation of water quality, but requires restoration of water quality and attainment of water quality standards.

19. Pursuant to Public Resources Code section 21080.5, the Resources Agency has approved the Regional Boards' basin planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) (Public Resources Code, § 21000 et seq.) requirements for preparing environmental documents (14 California Code Regs. § 15251(g); 23 California Code Regs. § 3782). The Regional Board staff has prepared "substitute environmental documents" for this project that contain the required environmental documentation under the State Board's CEQA regulations. (23 California Code Regs. § 3777.) The substitute environmental documents include the TMDL staff report entitled "Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL", the environmental checklist, the comments and responses to comments, the basin plan amendment language, and this resolution. The project itself is the establishment of TMDLs for metals, pesticides, PCBs, DDT, and PAHs in water, fish tissue and sediment in Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters. While the Regional Board has no discretion to not establish a TMDL (the TMDL is required by federal law), the Board does exercise discretion in assigning waste load allocations and load allocations, determining the program of implementation, and setting various milestones in achieving the water quality standards. The CEQA checklist and other portions of the substitute environmental documents contain significant analysis and numerous findings related to impacts and mitigation measures.

20. A CEQA Scoping meeting was conducted on September 21, 2006 at the Los Angeles Regional Water Quality Control Board Office, 320 West 4th Street, Los Angeles, California 90013. A notice of the CEQA Scoping meeting was sent to interested parties within the watersheds.

21. In preparing the substitute environmental documents, the Regional Board has considered the requirements of Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and intends those documents to serve as a tier 1 environmental review. This analysis is not intended to be an exhaustive analysis of every conceivable impact, but an analysis of the reasonably foreseeable consequences of the adoption of this regulation, from a programmatic perspective. The "Lead" agencies for tier 2 projects will assure compliance with project-level CEQA analysis of this programmatic project. Project level impacts will need to be considered in any subsequent environmental analysis performed by other public agencies, pursuant to Public Resources Code section 21159.2.

22. The foreseeable methods of compliance for this TMDL in Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters entail construction and operation of stormwater management practices such as placement of stormwater treatment devices designed to reduce sediment loading, such as infiltration trenches, vegetated swales, and/or filter strips. Structural BMPs may also include removal of contaminated sediment, diversion and treatment facilities to divert runoff directly, or capture and storage of runoff and then diversion to a location for treatment.

Foreseeable methods of compliance at the ports specifically are identified in the *Water Resources Action Plan* (WRAP), including improvement of existing non-structural BMPs to reduce stormwater pollution including more frequent/extensive sweeping; more rigorous spill prevention procedures for mobile fueling operations; more frequent trash collection; and enhanced dust and runoff control at recyclable metal terminals. New BMPs detailed in the WRAP to be instituted where appropriate may also include: requiring periodic zero-discharge pavement cleaning in key areas; providing covered storage of materials and idle equipment where necessary and feasible; instituting operational controls such as modified cargo storage, cargo loading/unloading, and materials handling and storage protocols; employing dust and runoff controls at auto dismantling and boat yards where they are not already employed; employing sustainable landscaping materials and practices to reduce water, fertilizer, and pesticide use; and introducing sustainable materials and practices in building and structure maintenance.

A comprehensive approach to managing water quality in the Ports also considers potentially polluting on-water activities as well. Vessels discharge fishing wastes, trash, cooling water, and may, despite laws to the contrary, discharge bilge water, black water, and gray water. Leaching from bottom paint and corrosion also releases contaminants from vessels. Leaks and spills from on-water vessel fueling activities also occur. The Port of Long Beach and the Port of Los Angeles will work together to develop guidance manuals for on-water activities and conduct outreach to distribute the manuals and educate the stakeholders; develop port policy and standards for maintenance, in-kind replacement, and eventual phasing out of exposed treated pilings from in-water applications; and develop BMPs and port standards for zinc-based cathodic protection of port structures and vessels.

Potential structural BMPs at the Ports to improve water and sediment quality may include construction/installation of: secondary containment berms, oil water separators, storm drain inserts, stormwater retention tanks, valve-controlled storm drain units, contained hazardous material storage areas, awnings or roofs, and hydrodynamic separation-type stormwater treatment units. Potential structural BMPs may also include diversion of process water or water from maintenance area drainage to the sanitary sewer system and capped storm drains, prohibiting discharge from high-risk areas.

23. Consistent with the Regional Board's substantive obligations under CEQA, the substitute environmental documents do not engage in speculation or conjecture, and only consider the reasonably foreseeable environmental impacts, including those relating to the methods of compliance, reasonably foreseeable feasible mitigation measures to reduce those impacts, and the reasonably foreseeable alternative means of compliance, which would avoid or reduce the identified impacts.

24. The proposed amendment could have a potentially significant adverse effect on the environment. However, there are feasible alternatives, feasible mitigation measures, or both, that if employed, would substantially lessen the potentially significant adverse impacts identified in the substitute environmental documents; however such alternatives or mitigation measures are within the responsibility and jurisdiction of other public agencies, and not the Regional Board. California Water Code section 13360 precludes the Regional Board from dictating the manner in which responsible parties comply with any of the Regional Board's regulations or orders. When the parties responsible for implementing this TMDL determine how they will proceed, the parties responsible for those parts of the project can and should incorporate such alternatives and mitigation into any subsequent projects or project approvals. These feasible alternatives and mitigation measures are described in more detail elsewhere in the substitute environmental documents. (14 California Code Regs. § 15091(a)(2).)

25. The substitute documents for this TMDL, and in particular the Environmental Checklist and staff's responses to comments, identify broad mitigation approaches that should be considered at the project level.

26. To the extent significant adverse environmental effects could occur, the Regional Board has balanced the economic, legal, social, technological, and other benefits of the TMDL against the unavoidable environmental risks and finds that specific economic, legal, social, technological, and other benefits of the TMDL outweigh the unavoidable adverse environmental effects, such that those effects are considered acceptable. The basis for this finding is set forth in the substitute environmental documents. (14 California Code Regs. § 15093.)

27. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subdivision (b). As specified above, federal law and regulations require that TMDLs be incorporated into the state's water quality management plan. The Regional Board's Basin Plan is the Regional Board's component of the state's water quality management plan, and the Basin Plan is how the Regional Board takes quasi-legislative, planning actions. Moreover, the TMDL is a program of implementation for existing water quality objectives, and is, therefore, appropriately a component of the Basin Plan under California Water Code section 13242. The necessity of developing a TMDL is established in the TMDL staff report, the section 303(d) list, and the data contained in the administrative record documenting the sediment, water, and fish tissue impairments of Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters.

28. The Basin Plan amendment incorporating a TMDL and implementation schedule for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters must be submitted for review and approval by the State Board, the State Office of Administrative Law (OAL) and pursuant to CWA section 303(d) and section 303(c) as appropriate, by the U.S. EPA. The Basin Plan amendment will become effective upon approval by OAL and U.S. EPA. A Notice of Decision will be filed with the Resources Agency.

29. If during the State Board's approval process Regional Board staff, the State Board or State Board staff, or OAL determine that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer

should make such changes consistent with the Regional Board's intent in adopting this TMDL, and should inform the Board of any such changes.

30. Considering the record as a whole, this Basin Plan amendment is expected to result in an effect, either individually or cumulatively, on wildlife resources.

THEREFORE, be it resolved that pursuant to sections 13240 and 13242 of the California Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. The Regional Board hereby approves and adopts the CEQA substitute environmental documentation, which was prepared in accordance with Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and directs the Executive Officer to sign the environmental checklist.

2. Pursuant to Sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapter 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment A hereto, to incorporate the elements and implementation schedule of the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDLs.

3. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

4. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it for review and approval to OAL and finally, for review and approval pursuant to CWA section 303(d), and section 303(c) as appropriate, to the U.S. EPA.

5. If during the State Board's approval process, Regional Board staff, the State Board or State Board staff, or OAL determine that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

6. The Executive Officer is authorized to request a "No Effect Determination" from the Department of Fish and Game, or transmit payment of the applicable fee as may be required to the Department of Fish and Game.

I, Samuel Unger, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on May 5, 2011.

Samuel Unger

Samuel Unger, PE
Executive Officer

June 14, 2011
Date

Amendment to the Water Quality Control Plan – Los Angeles Region

to Incorporate the

Total Maximum Daily Load for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on May 5, 2011

Amendments

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Chapter 7. Total Maximum Daily Loads (TMDLs)
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL

This TMDL was adopted by:
The Regional Water Quality Control Board on **May 5, 2011.**

This TMDL was approved by:
The State Water Resources Control Board on **[Insert date].**
The Office of Administrative Law on **[Insert date].**
The U.S. Environmental Protection Agency on **[Insert date].**
This TMDL is effective on **[Insert date].**

The elements of the TMDL are presented in Table 7-40.1 and the Implementation Plan in Table 7-40.2.

7-40.1 Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL – Elements

TMDL Element	Regulatory Provisions
Problem Statement	The waters of Dominguez Channel and the Greater Los Angeles and Long Beach Harbor area[1] are impaired by heavy metals and organic pollutants. These water bodies are included on the State's Clean Water Act 303(d) impaired waters list for one or more of the following pollutants: cadmium, chromium, copper, mercury, lead, zinc, chlordane, dieldrin, toxaphene, DDT, PCBs, certain PAH compounds, benthic community effects and toxicity. These impairments exist in one or more environmental media—water, sediment, or tissue. Impairments in fish tissue are for DDT, PCBs, toxaphene, chlordane and dieldrin. Beneficial uses designated in these waters to protect aquatic life include the marine habitat use (MAR) and rare, threatened or endangered species habitat use (RARE). In addition, the estuaries (EST) are recognized as areas for spawning, reproduction and/or early development (SPWN), migration of aquatic organisms (MIGR), and wildlife habitat (WILD). Dominguez Channel also has an existing designated use of warm freshwater habitat (WARM) and the Los Angeles River Estuary has the designated use of wetland habitat (WET). Beneficial uses associated with human use of these waters include recreational use for water contact (REC1), non-contact water recreation (REC2), industrial service supply (IND), navigation (NAV), commercial and sport fishing (COMM), and shellfish harvesting (SHELL). Because of the impairments, these waterbodies fail to fully support the designated beneficial uses. The goal of this TMDL is to protect and restore fish tissue, water and sediment quality in Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters by remediating contaminated sediment and controlling the sediment loading and accumulation of contaminated sediment in the Harbors.
Numeric Targets	Applicable water quality objectives for this TMDL are narrative objectives for Chemical Constituents, Bioaccumulation, Pesticides, and Toxicity in the Basin Plan and the numeric water quality criteria promulgated in 40 CFR section 131.38 (the California Toxics Rule (CTR)). In addition, sediment condition objectives were determined using the State Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SQO Part 1) and the sediment quality guidelines.[2] The following tables provide the water, sediment and fish tissue targets for the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDLs. **<u>Water Column Targets</u>** Water targets were determined by this Basin Plan and the California Toxics Rule (CTR). Site-specific conversion factors were developed to convert CTR acute dissolved metal criteria to total recoverable metals using *The Metals Translator Guidance for Calculating a Total Recoverable Permit Limit From a Dissolved Criterion* EPA 823-B-96-007. Because exceedances of CTR criteria were only observed in freshwaters of the Dominguez

[1] Dominguez Channel includes the Dominguez Channel Estuary and Torrance Lateral Channel and Greater Los Angeles/Long Beach Harbor waters include Inner and Outer Harbor, Main Channel, Consolidated Slip, Southwest Slip, Fish Harbor, Cabrillo Marina, Inner Cabrillo Beach, Los Angeles River Estuary, and San Pedro Bay.

TMDL Element	Regulatory Provisions

Channel during wet weather, targets are set for wet weather only. Site-specific wet-weather conversion factors were calculated using paired dissolved and total metals data and the statistical method outlined in the Guidance.

Dissolved Metals and Organic Compounds Targets

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

*Freshwater aquatic life criteria for Cu, Pb and Zn are expressed as a function of total hardness (mg/L) in the water body. Values presented correspond to median hardness from 2002 to 2010 of 50 mg/L based upon Los Angeles County Department of Public Works data from Station ID S28 (n = 35).
- means that no criteria were established for California.

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

Total Recoverable Metals, Freshwater Targets

Metal	Acute Dissolved CTR Criteria	Conversion Factor*	Acute Total Recoverable Metals
Copper	6.99	0.722	9.7
Lead	30.14	0.706	42.7
Zinc	65.13	0.935	69.6

***** Site-specific conversion factors were calculated using Los Angeles County Department of Public Works data from Station ID S28 using the data record 2002-2010 (n = 35), which had a median hardness of 50 mg/L. Site-specific conversion factors maybe recalculated based on updated data at the time of permit issuance, modification, or renewal.

[2] Long, ER, LJ Field and DD MacDonald. 1998. *Predicting Toxicity in Marine Sediments with Numerical Sediment Quality Guidelines*, *Environ. Toxicol. Chem*. **17**:4, 714-727. MacDonald, DD, CG Ingersoll and TA Berger. 2000. *Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems*. Arch. Environ. Contam. Toxicol. **39**:20-31.

TMDL Element	Regulatory Provisions

Freshwater toxicity target: This TMDL also establishes a numeric toxicity target of 1.0 toxicity unit, chronic (1.0 TUc) to address toxicity.

TU_c = Toxicity Unit, chronic = 100/NOEC (no observable effects concentration)

Targets based on new toxicity criteria that achieve the narrative Toxicity objective of Chapter 3 of this Basin Plan may substitute for the TU_c of 1, when those new criteria are adopted and in effect.

Sediment Targets

Sediment targets were determined by the narrative standards of this Basin Plan, the SQO Part 1 and the sediment quality guidelines of Long et al. (1998) and MacDonald et al. (2000), which are recommended by the State Listing Policy. The fresh water sediment numeric targets for Dominguez Channel are based on the freshwater Threshold Effect Concentration (TEC) sediment guidelines compiled by the National Oceanic and Atmospheric Administration (NOAA) in the Screening Quick Reference Tables (SQuiRTs). The marine sediment quality guidelines of Effect Range Low (ERL), also from NOAA SQuiRTs, were used to establish the numeric targets for marine sediment for the greater Los Angeles and Long Beach Harbor waters. These TECs and ERLs are set as the sediment quality thresholds for the calculation of loading capacity and allocations. This TMDL anticipates that revisions to specific sediment quality targets may be determined by development of site-specific sediment quality values (SQV).

Sediment targets

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

TMDL Element	Regulatory Provisions

Hi MW PAHs	1700
Lo MW PAHs	552
Total PAHs	4,022
Total DDT	1.58

*Toxaphene value from *Technical Guidance for Screening Contaminated Sediments*, New York State, Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources (1999), assumes 1% TOC.
n/a indicates that a fresh water sediment target is not established in this TMDL for this constituent, since impairments for the constituent is in saltwater only.

These sediment targets are not intended to be used as 'clean-up standards' for navigational, capital or maintenance dredging or capping activities; rather they are long-term sediment concentrations that should be attained after reduction of external loads, targeted actions addressing internal reservoirs of contaminants, and environmental decay of contaminants in sediment. In addition, the categories designated in the SQO Part 1 as **Unimpacted** and **Likely Unimpacted** by the interpretation and integration of multiple lines of evidence shall be considered as the protective narrative objective for sediment toxicity and benthic community effects. The thresholds established in the SQO Part 1 are based on statistical significance and magnitude of the effect. Therefore, this TMDL implicitly includes sediment toxicity and benthic community targets by its use of the SQO Part 1.

Fish Tissue and Associated Sediment Targets

Fish tissue targets were determined from *Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene*, developed by OEHHA (2008) to assist agencies in developing fish tissue-based criteria for pollution mitigation or elimination and to protect humans from consumption of contaminated fish. Associated sediment targets required to achieve the fish tissue targets were determined from several sources depending on the contaminant.

Fish Tissue and Associated Sediment Targets

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

[a] Total PAHs in fish from EPA screening value.
[b] Chlordane and total DDT associated sediment values from SFEI (2007) "Indicator development and framework for assessing indirect effects of sediment contaminants", SFEI Contribution #524.
[c] Total PCBs - associated sediment target from Gobas, F. and J. Arnot (2010) "Food Web Bioaccumulation Model for Polychlorinated Biphenyls in San Francisco Bay, California, USA", ET&C **29**:6, 1385-95.
[d] Toxaphene value from New York State (1999), assumes 1% TOC.
n/a indicates that an associated sediment target is not established in this TMDL at this time because there is no BSAF in literature to use in the calculation. If BSAFs are developed in the future, associated sediment targets for dieldrin and/or PAHs may be added during reconsideration of the TMDL.

Source Analysis	Monitoring data from NPDES discharges and land use runoff coefficients were used to estimate the magnitude of metals, organo-chlorine pesticides, PCBs, and PAHs loads to Dominguez

TMDL Element	Regulatory Provisions
	Channel and Greater Los Angeles and Long Beach Harbor waters. PCBs, DDT, dieldrin, and chlordane are legacy pollutants for the most part, yet, they remain present in the environment, bound to fine-grained particles. Because they are legacy pollutants and are subject to environmental decay, their concentrations are gradually decreasing over time. When these particles become waterborne, the chemicals are ferried to new locations. Urban runoff and rainfall higher in the watersheds mobilize the particles, which are then washed into storm drains and channels that discharge to the Dominguez Channel and greater Harbor waters. Metals and PAHs are currently generated or deposited in the watersheds and are then washed into storm drains and channels that discharge to the Dominguez Channel and greater Harbor waters. Briefly there are several categories of pollutant sources to the waters of concern in these TMDLs. Point sources include stormwater and urban runoff (MS4) and other NPDES discharges, including but not limited to Port operations, Terminal Island Water Reclamation Plant (TIWRP), refineries, and generating plants. Nonpoint sources include existing contaminated sediments and direct (air) deposition. **Dominguez Channel waters:** The major point sources of organo-chlorine pesticides, PCBs, and metals into Dominguez Channel are stormwater and urban runoff discharges. Nonpoint sources include atmospheric deposition and fluxes from contaminated sediments into the overlying water. Current loads of metals into Dominguez Channel were estimated using Loading Simulation Program in C++ (LSPC) model output from simulated flows for 1995-2005. Monitoring data from NPDES discharges and land use runoff coefficients were analyzed along with Channel stream flow rates to estimate the magnitude of metal loadings. In recognition of the wide variety of stream flow rates generated by various rainfall conditions, flow duration curves were utilized to analyze the metals loading during wet weather. **Greater Los Angeles and Long Beach Harbor waters:** A variety of activities over the past decades in the four contributing watersheds (Dominguez Channel, Los Angeles River, San Gabriel River and the nearshore watershed) and in the Harbors themselves have contributed to the sediment contamination. The contaminated sediments are a reservoir of historically deposited pollutants. Stormwater runoff from manufacturing, military facilities, fish processing plants, wastewater treatment plants, oil production facilities, and shipbuilding or repair yards in both Ports discharged untreated or partially treated wastes into Harbor waters. Current activities also contribute pollutants to Harbor sediments. In particular, stormwater runoff from port facilities, commercial vessels (ocean going vessels and harbor craft), recreational vessels, and the re-suspension of contaminated sediments via natural processes and/or anthropogenic activities including (ship) propeller wash within the Ports also contributes to transport of pollutants within the Harbors. Loadings from the four contributing watersheds are also potential sources of metals, pesticides, PCBs, and PAHs to the Harbors. The major nonpoint source of pesticides and PCBs to the greater Harbor waters is the current sediments. The re-suspension of these sediments contributes to the fish tissue impairments. In addition, atmospheric deposition may be a potential nonpoint source of metals to the watershed, through either direct deposition or indirect deposition.

<table>
<tr><th>TMDL Element</th><th>Regulatory Provisions</th></tr>
<tr><td></td><td>Current loading of metals, PAHs, DDT and PCBs to contaminated sediments within the Dominguez Channel Estuary and Greater Harbor waters was estimated using monitoring data from special studies and water body surface area for air deposition; discharge results for refineries and TIWRP; and Environmental Fluid Dynamics Code (EFDC) model output for 2002-2005. Model inputs included the existing average sediment concentration in the top 5 cm of bed sediments and the total sediment deposition rate per waterbody.</td></tr>
<tr><td>Linkage Analysis</td><td>The linkage analysis connects pollutant loads to the numeric targets and protection of beneficial uses of Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters. To represent the linkage between source contributions and ambient water and sediment response, two dynamic water quality models were developed to simulate source loadings and transport of the listed pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters. The Environmental Fluid Dynamics Code (EFDC) and Loading Simulation Program in C++ (LSPC) models were selected to simulate the pollutants in this TMDL.

LSPC for freshwater loadings of metals and total PAHs, DDT, and PCBs. LSPC was developed for Dominguez Channel based on information initially provided by SCCWRP for this watershed. In addition, Los Angeles River and San Gabriel River LSPC models were updated from earlier TMDL models. Model development throughout the Los Angeles Region relies on Event Mean Concentrations (EMC) as well as simulated flows to estimate pollutant loadings. Flow data records for 1995-2005 were used to calibrate LSPC models for each watershed; similar simulation time frames were used to generate simulated flows for each watershed. Dominguez Channel freshwater metals TMDLs examined only wet weather flows; however, LSPC output for dry and wet weather conditions was applied to all estuarine and marine receiving waters.

The nearshore watershed was analyzed and modeled using LSPC by breaking it into 67 subwatersheds that discharge directly to the Greater Los Angeles and Long Beach Harbor waters. These sub-watersheds were then aggregated by receiving waterbody; e.g. nearshore contributions to Inner Harbor consisted of stormdrains and surface (sheet) flows that discharge directly into the Inner Harbor.

The table below shows total loads from the four contributing watersheds to the Greater Harbor waters. Overall, the Los Angeles River is the largest freshwater contributor of pollutants to the greater Harbor waters; flows from the Los Angeles River primarily impact water quality in eastern San Pedro Bay. The Inner Harbor receives the bulk of the loading from the nearshore watershed.

Comparative Watershed Loading to Greater Harbor Waters
<table>
<tr><th rowspan="3">Contaminant</th><th colspan="8">LSPC Modeled Existing Loading by Watershed (1995-2005)</th></tr>
<tr><th colspan="2">Dominguez Channel</th><th colspan="2">Los Angeles River</th><th colspan="2">San Gabriel River</th><th colspan="2">Nearshore Watershed</th></tr>
<tr><th>Percent of Total Loading</th><th>Average Daily Load (kg/day)</th><th>Percent of Total Loading</th><th>Average Daily Load (kg/day)</th><th>Percent of Total Loading</th><th>Average Daily Load (kg/day)</th><th>Percent of Total Loading</th><th>Average Daily Load (kg/day)</th></tr>
<tr><td colspan="9">Wet Conditions</td></tr>
<tr><td>Sediment</td><td>5.6%</td><td>1.88E+05</td><td>72.0%</td><td>2.79E+06</td><td>20.4%</td><td>4.90E+05</td><td>1.9%</td><td>6.54E+04</td></tr>
<tr><td>Total Copper</td><td>4.3%</td><td>3.58E+01</td><td>81.1%</td><td>7.85E+02</td><td>12.5%</td><td>7.51E+01</td><td>2.1%</td><td>1.78E+01</td></tr>
<tr><td>Total Lead</td><td>3.0%</td><td>2.08E+01</td><td>71.5%</td><td>5.67E+02</td><td>23.3%</td><td>1.15E+02</td><td>2.2%</td><td>1.53E+01</td></tr>
</table>
</td></tr>
</table>

TMDL Element	Regulatory Provisions

Total Zinc	5.0%	3.56E+02	72.2%	5.89E+03	20.2%	1.02E+03	2.6%	1.84E+02
Total DDT	9.2%	2.20E-02	89.5%	2.46E-01	0.7%	1.15E-03	0.7%	1.59E-03
Total PAH	8.0%	2.04E+00	70.2%	2.07E+01	16.1%	2.95E+00	5.8%	1.50E+00
Total PCB	2.3%	1.38E-02	97.5%	6.86E-01	0.1%	3.11E-04	0.2%	9.92E-04
Dry Conditions								
Sediment	0.7%	8.57E+01	19.0%	2.27E+03	80.1%	1.01E+04	0.1%	1.54E+01
Total Copper	2.6%	2.56E-01	48.7%	4.69E+00	40.8%	4.18E+00	8.0%	7.78E-01
Total Lead	0.9%	3.48E-02	19.8%	7.86E-01	72.9%	3.07E+00	6.5%	2.59E-01
Total Zinc	0.9%	5.65E-01	30.4%	1.90E+01	62.6%	4.15E+01	6.2%	3.89E+00
Total DDT	7.7%	1.90E-05	83.0%	2.01E-04	9.3%	2.38E-05	0.0%	2.88E-10
Total PAH	6.8%	7.06E-02	62.7%	6.39E-01	30.4%	3.29E-01	0.0%	4.18E-05
Total PCB	1.8%	1.06E-05	97.1%	5.59E-04	1.1%	6.43E-06	0.0%	1.45E-10

The EFDC was used to model hydrodynamics and water and sediment quality of the greater Los Angeles and Long Beach Harbor waters. The EFDC model applied a simulated time period of 2002-2005. The model was calibrated with numerous sediment monitoring studies, including Los Angeles and Long Beach Harbor's 2006 sediment characterization study, which yielded sediment, porewater and overlying water concentrations as well as results from highly sensitive monitoring devices for detecting DDT, PCBs, and PAHs in the water column. The EFDC model also considered ocean water (outside breakwater) conditions and fine and coarse sediment transport and deposition. Ultimately the EFDC model was integrated with LSPC output – hourly for three watersheds, daily for nearshore watersheds – to model metals, PAHs, PCBs, and DDT (total) sediment concentrations in the receiving waters. The annual total (clean) sediment deposition rate for the top 5 cm (active sediment layer) was multiplied by the corresponding existing sediment pollutant level or the TMDL sediment quality target to yield pollutant load within each waterbody.

Annual (clean) Sediment Deposition Rates per (salt)Waterbody

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

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

[2] Sediment deposition rates were calculated by approximating the average mass of total sediment (fine and coarse particles) deposited in each waterbody annually based on 2002-2005 EFDC output. Sediment flux for each grid cell,

TMDL Element	Regulatory Provisions
	which is dependent on watershed inputs as well as tidal movements between waterbodies, was obtained from the EFDC model output. These values were summarized across each TMDL waterbody, resulting in the average deposition of both sediment fines and sand by waterbody. The total deposition rate is simply the sum of the rates for fines and sand and this value is the waterbody-specific average annual (clean) sediment deposition rate. The EFDC model was used to evaluate several management scenarios and relative contributions from various inputs to support water quality management decisions in Dominguez Channel and Greater Los Angeles and Long Beach Harbor waters. Preliminary results for two scenarios indicate that reducing freshwater input loads may not be sufficient to achieve target concentrations in water and sediments; thus reductions in contaminant levels in bed sediments may be required.
Loading Capacity	Loading capacity was calculated for both Dominguez Channel (wet weather) and in the Dominguez Channel Estuary and Greater Harbor waters (dry and wet weather). <u>Dominguez Channel wet weather metals TMDLs</u>: During wet weather, the loading capacity is a function of the volume of water in the Channel. Given the variability in wet-weather flows, the concept of a single critical flow was not justified. Instead, a load duration curve approach was used to establish the wet-weather loading capacity. The load duration curve was developed by multiplying the wet-weather flows by the in-stream numeric targets. The resulting curves identify the allowable load for a given flow. The wet-weather TMDLs for copper and zinc are defined by these load duration curves. Loading capacities were calculated by multiplying the daily volume by the appropriate numeric water quality target or, in the case of lead, the observed existing average concentration. The wet-weather loading capacity applies to any day when the maximum daily flow measured at a location within the Dominguez Channel is equal to or greater than 62.7 cfs, which is the 90th percentile of annual flow rates from estimated/modeled flow rates. The freshwater toxicity TMDL is equal to 1 TUc. <u>Dominguez Channel Estuary and Greater Harbor waters, metals and organics in sediment TMDLs:</u> Loading capacities for Dominguez Channel Estuary and Greater Harbor waters were calculated by estimating the sediment load (based on modeled sediment deposition rates) multiplied by the sediment quality target. The active sediment layer was defined as the top 5 cm of sediment; the habitat of approximately 95% of benthic organisms. In addition, chlordane, dieldrin, toxaphene and mercury TMDLs were defined for specific waterbodies as equivalent to the concentration-based sediment quality target.
Waste Load and Load Allocations	Final waste load allocations (WLA) are assigned to stormwater dischargers (MS4, California Department of Transportation (Caltrans), general construction and general industrial dischargers), and other NDPES dischargers. Final load allocations (LAs) are assigned to direct atmospheric deposition and bed sediments in both wet and dry weather. Dominguez Channel freshwater allocations are set for wet weather only because exceedances have only been observed in wet weather. Mass-based allocations have been set where sufficient data was available to calculate mass-based allocations, otherwise, concentration-based allocations have

TMDL Element	Regulatory Provisions

been set.

Interim WLA and LA are intended to not allow any decrease in current facility performance. Interim allocations shall be met upon the effective date of the TMDL.

Interim and final WLAs and LAs shall be included in permits and/or other Board orders in accordance with state and federal regulations and guidance.

INTERIM ALLOCATIONS

1. Dominguez Channel Freshwater Interim Allocations

A. Freshwater Toxicity Interim Allocation wet weather

An interim allocation of 2 TUc applies to each source, including all point sources assigned a WLA and all nonpoint sources assigned a LA. The freshwater toxicity interim allocation is set at 2 TUc based on current monitoring results performed by the Los Angeles County Department of Public Works, which have shown average values of less than 2 TUc. The fresh water interim allocation shall be implemented as a trigger requiring initiation and implementation of the TRE/TIE process as outlined in US EPA's "Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System Program" (2000) and current NPDES permits. The fresh water interim allocation shall be implemented in accordance with US EPA, State Board and Regional Board resolutions, guidance and policy at the time of permit issuance, modification or renewal.

B. Freshwater Metals Interim Allocations - wet weather only

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

Concentration-based Dominguez Channel and Torrance Lateral freshwater interim metal allocations

	Total Copper	Total Lead	Total Zinc
allocation (µg/L)	207.51	122.88	898.87

2. Dominguez Channel Estuary and Greater Los Angeles and Long Beach Harbor Waters:

Interim sediment allocations are assigned to stormwater dischargers (MS4, Caltrans, general construction and general industrial stormwater dischargers) and other NPDES dischargers. Interim sediment allocations are based on the 95th percentile of sediment data collected from 1998-2006. The use of 95th percentile values to develop interim allocations is consistent with NPDES permitting methodology. For waterbodies where the 95th percentile value has been equal to, or lower than, the numeric target, then the interim allocation is set equal to the final allocation. Regardless of the interim sediment allocations below, permitted dischargers shall

TMDL Element	Regulatory Provisions

ensure that effluent concentrations and mass discharges do not exceed levels that can be attained by performance of the facility's treatment technologies existing at the time of permit issuance, reissuance or modification.

Sediment, interim concentration-based allocations

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

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

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

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

FINAL ALLOCATIONS

1. Dominguez Channel Freshwater Allocations

A. **Freshwater Toxicity Allocation in wet weather**

A final allocation of 1 TUc, or its equivalent based on any Statewide Toxicity Policy, applies to each source, including all point sources assigned a WLA and all nonpoint sources assigned a LA.

B. **Freshwater Metals Allocations in wet weather**

Wet-weather allocations are assigned to Dominguez Channel and all upstream reaches and tributaries of Dominguez Channel (above Vermont Avenue).

Allocations are assigned to both point (WLA) and nonpoint sources (LA). A mass-based LA has been developed for direct atmospheric deposition. A mass-based waste load allocation (WLA) is divided between the MS4 permittees and Caltrans under its NPDES stormwater

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permit by subtracting the other stormwater or NPDES waste load allocations, air deposition and the margin of safety from the total loading capacity. Concentration-based WLAs are assigned for the other point sources including but not limited to General Construction, General Industrial, Power Generating stations, minor permits and irregular dischargers, and other NPDES dischargers.

Mass-based Dominguez Channel Wet-weather Final Allocations

	Total Copper (g/day)	**Total Lead (g/day)**	**Total Zinc (g/day)**
TMDL	1,485.1	6,548.8	10,685.5
Waste Load Allocations:			
MS4 – LA County Permittees	1,300.3	5,733.7	9,355.5
MS4 - Caltrans	32.3	142.6	232.6
Load Allocations:			
Air Deposition	4.0	17.7	28.9
Margin of Safety			
MOS (10%)	148.5	654.9	1,069.6

Based on total recoverable metal targets, a hardness of 50 mg/L, and 90th percentile of annual flow rates (62.7 cfs) in Dominguez Channel. Recalculated mass-based allocations using ambient hardness and flow rate at the time of sampling are considered consistent with the assumptions and requirements of these waste load allocations. In addition to the wasteload allocations above, samples collected during flow conditions less than the 90th percentile of annual flow rates must demonstrate that the acute and chronic hardness dependent water quality criteria provided in the CTR are achieved.

Concentration-based Dominguez Channel Wet-weather Final Allocations (µg/L)

	Total **Copper**	Total **Lead**	Total **Zinc**
Other stormwater/NPDES	**9.7**	**42.7**	**69.7**

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

2. Torrance Lateral Freshwater and Sediment Allocations

Torrance Lateral is a subwatershed that flows directly into Dominguez Channel Estuary. Allocations are assigned to the ExxonMobil Torrance Refinery and all other dischargers. Mass-based sediment allocations are assigned to the ExxonMobil Torrance Refinery. This allocation has been developed based on an average discharge frequency of once every 7 years. If, at the end of Phase I of implementation, due to an increase in discharge frequency or volumes, it appears that the allocations are not supportive of the TMDL, these allocations may be revised. Sediment waste load allocations are assigned to all other dischargers to Torrance Lateral equal to the concentration-based sediment targets.

Torrance Lateral Wet-weather Waste Load Allocations and Sediment Waste Load Allocations, concentration-based

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

Hardness = 50 mg/L. Recalculated concentration-based allocations using ambient hardness at the time of sampling are considered consistent with the assumptions and requirements of these

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waste load allocations. In addition to the wasteload allocations above, samples collected during flow conditions less than the 90th percentile of annual flow rates must demonstrate that the acute and chronic hardness dependent water quality criteria provided in the CTR are achieved.

Waste Load Allocations for ExxonMobil Torrance Refinery into Torrance Lateral, mass-based

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

Based on Q = 3.7 MGD for 7 days/year; and total metals targets
No allocation for PAHs is assigned to ExxonMobil; however, discharges should not exceed existing water quality criteria for those compounds and monitoring shall continue.

Compliance with the freshwater metals allocations for Dominguez Channel and Torrance Lateral may be demonstrated via any one of three different means:
a. Final allocations are met.
b. CTR total metals criteria are met instream.
c. CTR total metals criteria are met in the discharge.

Dominguez Channel Estuary and Greater Harbor Waters Allocations

Concentration-based WLAs for point sources in Dominguez Channel Estuary and Greater Harbor Waters (including refineries) for metals, PAHs, and bioaccumulative compounds in water.

Non-MS4 point sources such as General Construction, General Industrial, individual industrial permittees, including power generating stations, minor permits and irregular dischargers into Dominguez Channel Estuary and Greater Harbor Waters are assigned concentration-based allocations. Mass-based WLA for other refineries based on appropriate data maybe considered during the TMDL reconsideration. (Refineries which have provided discharge flow data along with monitoring results are assigned mass-based allocations, whereas other refineries are assigned concentration-based allocations because no discharge flow data has been provided.) Any future minor NPDES permits or enrollees under a general NPDES permit are also assigned the concentration-based waste load allocations. The allocations are set equal to the saltwater targets for metals and equal to the human health targets for the organic compounds in CTR. The averaging period for the concentration-based WLAs shall be consistent with that specified in the regulation establishing the criterion or objective or relevant implementation guidance published by the establishing agency.

Receiving (salt) Water Column Concentration-Based Waste Load Allocations

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

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

** CTR human health criteria were not established for total PAHs. Therefore, the CTR criterion for individual PAHs of 0.049 µg/L is applied individually to benzo(a)anthracene, benzo(a)pyrene, and chrysene. The CTR criterion for

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	Pyrene of 11,000 µg/L is assigned as an individual WLA to Pyrene. Other PAH compounds in the CTR shall be screened as part of the TMDL monitoring. A. **Mass-based allocations for metals and PAHs compounds** Mass-based WLAs are assigned to the Terminal Island Water Reclamation Plant (TIWRP) (based on current discharge volume) and other point sources that have sufficient discharge flow data. Municipal stormwater sources, including the Los Angeles, Long Beach, Caltrans and other MS4 co-permittees, are assigned a mass-based allocation for each permit in place at the time of TMDL adoption, depending on the waterbody. Discharges from the Port of Los Angeles (POLA) and Port of Long Beach (POLB) are grouped with the MS4 dischargers. Mass-based WLAs are applied as annual limits. Individual mass-based WLAs for an individual MS4 Permittee will be calculated based on its share, on an area basis, of the mass-based WLA or other approved approach available at the time final mass-based WLAs are in effect and incorporated into the permit. TMDLs and allocations were developed based on existing sediment concentrations in the active sediment layer defined herein as the top 5 cm of bed sediment concentrations. Load Allocations are assigned to existing sediments and direct air deposition. All allocations assigned to point sources and non-point sources are subtracted from the loading capacity and the remaining allocatable amount is assigned to the bed sediments. Direct air deposition allocations have been set equal to existing load estimates for Cu, Zn and PAHs based on atmospheric monitoring results collected in 2006. The Pb air deposition allocation has been developed by using the SCAQMD air quality Pb criteria (2010) multiplied by the surface area of each waterbody to produce direct air deposition allocations. Future changes to Cu, Zn and PAH air quality criteria, other regulation such as brake pad requirements, or other improvement in air quality may allow for re-calculations of air deposition allocations in future revisions to the TMDL. If, at some point in the future, a nonpoint source is considered subject to NPDES or WDR regulations, then the corresponding load allocation established herein may be considered a waste load allocation for purposes of implementation and enforcement through a permit or other Board order. Air deposition allocations for copper and zinc are based on existing loads; by assuming no direct deposition reductions, this consumes or partially consumes the available loading capacity. As a result, copper and zinc load allocations for bed sediments are negative values, in Inner and Outer Harbor, indicating that copper and zinc loads must be reduced. (Each negative copper and zinc bed sediment allocation may alternatively be interpreted as zero, or not adversely affecting benthic organisms.) The amount of copper and zinc load reduction may be revised based on future monitoring results. If future air deposition studies show lower existing air deposition copper and zinc loads, or if future copper and zinc sediment characterization studies show lower bed sediment copper and zinc loads, then copper and zinc allocations may be adjusted. The bed sediment LA is assigned to the City of Los Angeles (including the Port of Los Angeles), the City of Long Beach (including the Port of Long Beach) and the State Lands Commission. After remediation activities that address existing sediment contamination are complete and when LAs are attained, if bed sediments are recontaminated as a result of continued polluted discharge from the surrounding watersheds, the WLA compliance monitoring data will be used, along with other available information, to assess the relative contribution of watershed dischargers and determine their responsibility and allocations for secondary remediation activities.

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Final, mass-based TMDLs and Allocations for metals and PAHs (Kg/year)

Waterbody/source	*Total Cu*	*Total Pb*	*Total Zn*	*Total PAHs*
DomCh Estuary - TMDL	84	115.4	370.5	9.94
WLAs				
MS4- LA County et al.	22.4	54.2	271.8	0.134
MS4- City of Long Beach	0.6	1.52	7.6	0.0038
MS4- CalTrans	0.384	0.93	4.7	0.0023
LAs				
Air deposition	4.6	0.031	33.2	0.051
Bed sediments	56.0	58.7	53.3	9.7
Current Load	327.6	457.9	1799.0	28.1
Overall reduction	74%	75%	79%	65%
Consolidated Slip - TMDL	12.1	16.6	53.3	1.43
WLAs				
MS4- LA County et al.	2.73	3.63	28.7	0.0058
MS4 CalTrans	0.043	0.058	0.5	0.00009
LAs				
Air deposition	1.2	0.008	8.6	0.013
Bed sediments	8.13	12.9	15.57	1.41
Current Load	92.1	127.3	398.9	11.5
Overall reduction	***87%***	***87%***	***87%***	***88%***
Inner Harbor - TMDL	76.7	105.3	338.3	9.1
WLAs				
MS4- LA County et al.	1.7	34.0	115.9	0.088
MS4 City of Long Beach	0.463	9.31	31.71	0.024
MS4 CalTrans	0.032	0.641	2.18	0.0017
LAs				
Air deposition	97.6	0.67	710	1.08
Bed sediments	(23.1)	60.7	(521.3)	7.88
Current Load	178.4	105.9	542.1	3.524
Overall reduction	57%	1%	38%	0%
Outer Harbor - TMDL	81.6	112.1	360.1	9.7
WLAs				
MS4- LA County et al.	0.91	26.1	81.5	0.105
MS4 City of Long Beach	0.63	18.1	56.4	0.073
MS4 CalTrans	0.0018	0.052	0.162	0.00021
TIWRP = POTW	80.4	183.6	1845	1.056

TMDL Element	Regulatory Provisions				
	(CTR & MGD)***				
	LAs				
	Air deposition	17.9	0.9	108.1	1.5
	Bed sediments	(18.2)	(116)	(1731)	6.964
	Current Load	119.0	66.7	403.4	0.626
	Overall reduction	31%	0%	11%	0%
	Fish Harbor - TMDL	1.04	1.43	4.59	0.123
	WLAs				
	MS4- LA County et al. (POLA)	0.00017	0.54	1.62	0.007
	MS4 CalTrans	0.0000005	0.00175	0.0053	0.000021
	LAs				
	Air deposition	0.4	0.02	2.4	0.033
	Bed sediments	0.636	0.87	0.5	0.084
	Current Load	1.43	0.60	4.2	0.003
	Overall reduction	27%	0%	0%	0%
	Cabrillo Marina -TMDL	1.32	1.81	5.8	0.156
	WLAs				
	MS4- LA County et al. (POLA)	0.0196	0.289	0.74	0.00016
	MS4 CalTrans	0.00019	0.0028	0.007	0.0000016
	LAs				
	Air deposition	0.34	0.017	2.05	0.028
	Bed sediments	1.0	1.506	3.03	0.1285
	Current Load	9.2	2.3	9.14	0.236
	Overall reduction	86%	21%	36%	34%
	San Pedro Bay - TMDL	648	890	2858	76.6
	WLAs				
	MS4- LA County et al.	20.3	54.7	213.1	1.76
	MS4 City of Long Beach	137.9	372.2	1449.7	12.0
	MS4 CalTrans	0.88	2.39	9.29	0.077
	MS4 Orange County**	9.8	26.4	102.9	0.85
	LAs				
	Air deposition	36	1.8	219	2.9
	Bed sediments	442.9	432	865	59.0
	Current Load	1251	1737	8167	3.63
	Overall reduction	48%	49%	65%	0%
	LA River Estuary - TMDL	735	1009	3242	86.9
	WLAs				
	LAR Estuary dischargers*	[Cu SQV]	[Pb SQV]	[Zn SQV]	[PAH SQV]

TMDL Element	Regulatory Provisions

MS4- LA County et al.	35.3	65.7	242.0	2.31
MS4 City of Long Beach	375.8	698.9	2572.7	24.56
MS4 CalTrans	5.1	9.5	34.8	0.333
LAs				
Air deposition	6.7	0.046	48.9	0.075
Bed sediments	311.8	235.0	343.0	59.6
Current Load	1612	2641	20096	8.72
Overall reduction	54%	62%	84%	0%

Note: Cu and Zn air deposition load allocations are set equal to existing load with no reductions anticipated. Negative (values) for bed sediments indicate that bed sediment loads are expected to be reduced; the amount of reduction may be revised with additional monitoring results.

*SQVs are currently set at ERLs
**Orange County MS4 Permit is issued by the Santa Ana Regional Board. The allocations included, here, for the Seal Beach nearshore area, are for TMDL calculation purposes only, and an allocation is not assigned.
***For TIWRP, the discharge volume at the time of permit modification or reissuance shall be used to calculate the mass-based effluent limitations consistent with the assumptions and requirements of these WLAs. Studies may be conducted to determine the portion of the discharged pollutants that is deposited on bed sediment. The results of any such Executive Officer approved studies shall be evaluated at the TMDL reconsideration to modify these WLAs as appropriate.

Consolidated Slip and Fish Harbor are impaired for mercury in sediments and the average sediment concentration (1.1 mg/kg dry) is significantly higher than the target concentration (0.15 mg/kg dry). Consolidated Slip and Dominguez Channel Estuary are impaired for cadmium in sediments, and Consolidated Slip is also impaired for chromium in sediments.

Final Concentration-Based Sediment WLAs for metals in Dominguez Channel Estuary, Consolidated Slip and Fish Harbor

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

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

Compliance with these sediment TMDLs for Cu, Pb, Zn, Cd, Cr, Hg and total PAHs may be demonstrated via any one of three different means:

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

Compliance with mass-based WLAs shall be measured at designated discharge points. Compliance with concentration-based WLAs for existing sediment shall be determined by pollutant concentrations in ambient sediment in each waterbody. The average ambient bulk sediment level within a waterbody at or below the sediment quality target is considered compliance with these TMDLs.

B. **Mass-based Allocations for Bioaccumulative Compounds**

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	Fish tissue levels of certain bioaccumulative compounds are above desired numeric targets. These TMDLs are designed to reduce contaminated sediment levels, which will result in lower corresponding pollutant levels in fish tissue. These sediment allocations have been derived to support lowering fish tissue levels using biota-sediment accumulation factors (BSAFs) or ERLs, whichever is more protective. For chlordane and dieldrin, the ERL values are lower and more protective than BSAF values. The DDT sediment values are comparable (ERL = 1.58, BSAF = 1.9); the more stringent one was used for calculation. The PCBs sediment value associated with fish tissue is more stringent than the ERL sediment value for PCBs. Mass-based WLAs are assigned for TIWRP and other point sources that have sufficient discharge flow data. Municipal stormwater sources, including the Los Angeles, Long Beach, Caltrans and other MS4 co-permittees, are assigned a single, mass-based allocation by permit, depending on the waterbody. Discharges from the Port of Los Angeles (POLA) and Port of Long Beach (POLB) are grouped with the MS4 dischargers. Mass-based WLAs are applied as annual limits. Individual mass-based WLAs for an individual MS4 Permittee will be calculated based on its share, on an area basis, of the mass based WLA or other approved approach available at the time final mass-based WLAs are in effect and incorporated into the permit. Mass-based LAs are identified for bed sediments and direct air deposition. Direct air deposition allocations for total DDT are based on estimates of existing loads using atmospheric monitoring results collected close to Los Angeles/Long Beach Harbor at SCAQMD Wilmington Station in 2006. Pollutant-specific air deposition values (DDT = 29 ng/m2/day) were multiplied by the surface area of each waterbody to produce direct deposition allocations. Direct deposition allocations for PCBs are not included since air deposition has been measured to be less than water-to-air fluxes. DDT load allocations for bed sediments are negative values, with the exception of those for the Los Angeles River Estuary, indicating that DDT loads must be reduced. (Each negative DDT bed sediment allocation may alternatively be interpreted as zero, or interpreted as minimal bioaccumulation into the food web.) The amount of DDT load reduction may be revised based on future monitoring results. If future air deposition studies show lower existing air deposition DDT loads, or if future DDT sediment characterization studies show lower bed sediment DDT loads, then DDT load allocations may be adjusted. The Greater Harbor Waters (excluding LA River Estuary and Consolidated Slip) bed sediment LA is assigned to the City of Los Angeles (including the Port of Los Angeles), the City of Long Beach (including the Port of Long Beach) and the State Lands Commission. After remediation activities that address existing sediment contamination are complete and when LAs are attained, if bed sediments are recontaminated as a result of continued polluted discharge from the surrounding watersheds, the WLA compliance monitoring data will be used, along with other available information, to assess the relative contribution of watershed dischargers and determine their responsibility and allocations for secondary remediation activities. DDT and PCBs (total) TMDLs apply to all estuarine and marine waters in Greater Harbor area, including Inner Cabrillo Beach, Los Angeles River Estuary and Eastern San Pedro Bay.

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Final mass-based TMDLs and Allocations for total DDT and total PCBs (g/yr)

Waterbody/source	*DDT total*	*PCBs total*
DomCh Estuary – TMDL	3.90	7.90
WLAs		
MS4- LA County et al	0.250	0.207
MS4 City of Long Beach	0.007	0.006
MS4 CalTrans	0.004	0.004
LAs		
Air deposition	6.01	n/a
Bed sediments	(2.4)	7.7
Current Load	54.0	57.5
Overall reduction	93%	86%
Consolidated Slip - TMDL	0.56	1.14
WLAs		
MS4- LA County et al	0.009	0.004
MS4 CalTrans	0.00014	0.00006
LAs		
Air deposition	1.56	n/a
Bed sediments	(1.00)	1.13
Current Load	49.0	83.9
Overall reduction	99%	99%
Inner Harbor - TMDL	3.56	7.22
WLAs		
MS4- LA County et al	0.051	0.059
MS4 City of Long Beach	0.014	0.016
MS4 CalTrans	0.0010	0.0011
LAs		
Air deposition	129	n/a
Bed sediments	(125)	7.14
Current Load	21.67	29.51
Overall reduction	84%	76%
Outer Harbor - TMDL	3.79	7.68
WLAs		
MS4- LA County et al	0.005	0.020
MS4 City of Long Beach	0.004	0.014
MS4 CalTrans	0.000010	0.00004
TIWRP = POTW (CTR & MGD[***])	12.7	0.37

TMDL Element	Regulatory Provisions		
	LAs		
	Air deposition	173	n/a
	Bed sediments	(182)	7.28
	Current Load	30.8	34.7
	Overall reduction	88%	78%
	Fish Harbor - TMDL	0.048	0.098
	WLAs		
	MS4- LA County et al	0.0003	0.0019
	MS4 CalTrans	0.0000010	0.000006
	LAs		
	Air deposition	3.9	n/a
	Bed sediments	(3.85)	0.10
	Current Load	0.168	0.075
	Overall reduction	71%	0%
	Cabrillo Marina -TMDL	0.061	0.124
	WLAs		
	MS4- LA County et al	0.000028	0.000025
	MS4 CalTrans	0.00000028	0.00000024
	LAs		
	Air deposition	3.3	n/a
	Bed sediments	(3.22)	0.12
	Current Load	1.66	1.06
	Overall reduction	96%	88%
	Inner Cabrillo Beach - TMDL	0.04	0.09
	WLAs		
	MS4- LA County et al	0.0001	0.0003
	LAs		
	Air deposition	3.5	n/a
	Bed sediments	(3.5)	0.09
	Current Load	0.98	0.31
	Overall reduction	96%	72%
	San Pedro Bay - TMDL	30.1	61.0
	WLAs		
	MS4- LA County et al	0.049	0.44
	MS4 City of Long Beach	0.333	3.01
	MS4 CalTrans	0.002	0.019
	MS4 Orange County*	0.024	0.213
	LAs		

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Air deposition	350	n/a
Bed sediments	(320)	57.3
Current Load	205.2	110.7
Overall reduction	85%	45%
LA River Estuary - TMDL	34.1	69.2
WLAs		
MS4- LA County et al	0.100	0.324
MS4 City of Long Beach	1.067	3.441
MS4 CalTrans	0.014	0.047
LAR Estuary dischargers	[DDT SQV]	[PCBs SQV]
LAs		
Air deposition	8.9	n/a
Bed sediments	24.09	65.3
Current Load	231.6	402.2
Overall reduction	85%	83%

Note: DDT air deposition load allocation is set equal to existing load with no reductions anticipated. Negative values for bed sediments indicate that DDT bed sediment loads are expected to be reduced; the amount of reduction may be revised with additional monitoring results.
*SQVs are currently set at the more protective of ERLs or fish tissue associated sediment targets.
**Orange County MS4 Permit is issued by the Santa Ana Regional Board. The allocations included, here, for the Seal Beach nearshore area, are for TMDL calculation purposes only, and an allocation is not assigned.
***For TIWRP, the discharge volume at the time of permit modification or reissuance shall be used to calculate the mass-based effluent limitations consistent with the assumptions and requirements of these WLAs. Studies may be conducted to determine the portion of the discharged pollutants that is deposited on bed sediment. The results of any such Executive Officer approved studies shall be evaluated at the TMDL reconsideration to modify these WLAs as appropriate.

In addition, bed sediment concentration-based allocations are assigned for chlordane in Dominguez Channel Estuary, Consolidated Slip, Fish Harbor, Los Angeles River Estuary and Eastern San Pedro Bay. Bed sediment concentration-based allocations are also assigned for dieldrin in Dominguez Channel Estuary and Consolidated Slip. Bed sediment concentration allocations are also assigned for toxaphene in Consolidated Slip. The TMDLs and allocations are set at target sediment concentrations: chlordane = 0.5, dieldrin = 0.02, toxaphene = 0.10 µg/kg dry sediment.

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

a. Fish tissue targets are met in species resident to the TMDL waterbodies[3].
b. Final sediment allocations, as presented above, are met.
c. Sediment numeric targets to protect fish tissue are met in bed sediments over a three-year averaging period.
d. Demonstrate that the sediment quality condition protective of fish tissue is achieved per the Statewide Enclosed Bays and Estuaries Plan, as amended to address contaminants in resident finfish and wildlife.

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

TMDL Element	Regulatory Provisions
	3. <u>Diazinon</u> Los Angeles County monitoring data in Dominguez Channel freshwaters show diazinon exceedences from 2002-2005, but none from 2006-2010. This timing is concurrent with EPA's ban on urban use of diazinon, effective Dec. 31, 2005. Based these results, no diazinon TMDLs are developed at this time.
Margin of Safety	The Dominguez Channel freshwater allocations included an explicit margin of safety (MOS) equal to 10% of the loading capacity or existing load to account for any additional uncertainty in the wet-weather TMDLs. The 10% MOS was subtracted from the loading capacity or existing load, whichever was smaller. Applying an explicit margin of safety is reasonable because a number of uncertain estimates are offset by the explicit margin of safety. While the observed dissolved-to-total metals ratios are not similar to CTR default conversion values, there appears to be very poor correlation between the fraction of particulate metals and TSS. Also, there is added uncertainty regarding stream flow rates during wet weather conditions, when the highest metal loads occur, thus an explicit margin of safety is justified. An implicit margin of safety exists in the final allocations to Dominguez Channel Estuary and Greater Harbor waters. The implicit margin of safety is based on the selection of multiple numeric targets, including targets for water, fish tissue and sediment among other conservative modeling assumptions. An additional explicit margin of safety must be considered and may be applied if any chemical-specific sediment quality target is revised or updated contingent on future sediment quality studies. That is, there may be uncertainty associated with revised sediment quality values, which may warrant including an additional explicit margin of safety.
Seasonal Variations and Critical Conditions	Wet weather events may produce extensive sediment redistribution and transport sediments to the harbors and the CTR-based water column targets are protective of this condition. This would be considered the critical condition for loading. No correlation with flow or seasonality (wet vs. dry season) was found to exist in sediment or tissue data. Given that allocations for this TMDL are expressed in terms pesticides, PCBs, PAHs, and metals concentrations in sediment, a critical condition is not identified based upon flow or seasonality. Because the adverse effects of pesticides, PCBs, PAHs, and metals are related to sediment accumulation and bioaccumulation in the food chain over long periods of time, short term variations in concentrations are less likely to cause significant impacts upon beneficial uses.
Monitoring Plan	Monitoring by assigned responsible parties is required in three waterbody areas: 1. Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary 2. Greater Los Angeles and Long Beach Harbor Waters (including Consolidated Slip) 3. Los Angeles River and San Gabriel River Monitoring shall be conducted under technically appropriate Monitoring and Reporting Plans (MRPs) and Quality Assurance Project Plans (QAPPs). The MRPs shall include a requirement that the responsible parties report compliance and non-compliance with waste load and load allocations as part of annual reports submitted to the Regional Board. The QAPPs shall include protocols for sample collection, standard analytical procedures, and laboratory certification. All samples shall be collected in accordance with SWAMP protocols. Monitoring Plans shall be submitted twenty (20) months after the effective date of the TMDL for public review and,

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	subsequently, Executive Officer approval. Monitoring shall begin six months after the monitoring plan is approved by the Executive Officer. Responsible parties assigned both WLAs and LAs may submit one document that addresses the monitoring requirements (as described below) and implementation activities for both WLAs and LAs. Responsible parties shall submit annual monitoring reports. The Regional Board Executive Officer may reduce, increase, or modify monitoring and reporting requirements, as necessary, based on the results of the TMDL monitoring program. Currently, several of the constituents of concern have numeric targets that are lower than the readily available detection limits. As analytical methods and detection limits continue to improve (i.e., development of lower detection limits) and become more environmentally relevant, responsible parties shall incorporate new method detection limits in the MRP and QAPP. 1. Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary Compliance Monitoring Program For Dominguez Channel, Dominguez Channel Estuary, and Torrance Lateral, water and total suspended solids samples shall be collected at the outlet of the storm drains discharging to the channel and the estuary. Fish tissue samples shall be collected in receiving waters of the Dominguez Channel Estuary. Sediment samples shall also be collected in the estuary. • Water Column Monitoring Water samples and total suspended solids samples shall be collected during two wet weather events and one dry weather event each year. The first large storm event of the season shall be included as one of the wet weather monitoring events. Water samples and total suspended solid samples shall be analyzed for a suite of compounds including, at a minimum, metals, including lead, zinc, and copper, DDT, PCBs, Benzo[a] anthrancene, Benzo[a]pyrene, Chrysene, Phenanthrene, and Pyrene. Sampling shall be designed to collected sufficient volumes of suspended solids to allow for analysis of the pollutants in the bulk sediment. In addition to TMDL constituents, general water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) and a flow measurement will be required at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection, if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements. In addition, toxicity shall be tested for in the freshwater portion of Dominguez Channel. • Sediment Monitoring A sediment monitoring program shall be developed consistent with the selected method for compliance and all samples shall be collected in accordance with SWAMP protocols. a) If compliance will be determined based on achieving sediment quality targets, sediment chemistry samples shall be collected every two years for analysis of general sediment quality constituents and the full chemical suite as specified in SQO Part 1. In addition, benthic community effects shall be assessed in the Dominguez Channel Estuary.

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	b) If compliance will be determined based on the SQO compliance method, sediment chemistry samples shall also be collected every five years (in addition to, and in between, the sediment triad sampling events as described below), beginning after the first sediment triad event, to evaluate trends in general sediment quality constituents and listed constituents relative to sediment quality targets. Chemistry data without accompanying sediment triad data shall be used to assess sediment chemistry trends and shall not be used to determine compliance. Sediment quality objective evaluation as detailed in the SQO Part 1 (sediment triad sampling) shall be performed every five years in coordination with the Biological Baseline and Bight regional monitoring programs, if possible. Sampling and analysis for the full chemical suite, two toxicity tests and four benthic indices as specified in SQO Part 1 shall be conducted and evaluated. If moderate toxicity as defined in the SQO Part 1 is observed, results shall be highlighted in annual reports and further analysis and evaluation to determine causes and remedies shall be required in accordance with the EO approved monitoring plan. Locations for sediment triad assessment and the methodology for combining results from sampling locations to determine sediment conditions shall be specified in the MRP to be approved by the Executive Officer. The sampling design shall be in compliance with the SQO Part 1 Sediment Monitoring section (VII.E.). • Fish Tissue Monitoring Fish tissue samples shall be collected every two years from the Dominguez Channel Estuary and analyzed for chlordane, dieldrin, toxaphene, DDT, and PCBs. The target species in the Dominguez Channel Estuary shall be selected based on residency, local abundance and fish size at the time of field collection. Tissues analyzed shall be based on the most common preparation for the selected fish species. The Dominguez Channel responsible parties are each individually responsible for conducting water, sediment, and fish tissue monitoring. However, they are encouraged to collaborate or coordinate their efforts to avoid duplication and reduce associated costs. Dischargers interested in coordinated monitoring shall submit a coordinated MRP that identifies monitoring to be implemented by the responsible parties. Under the coordinated monitoring option, the compliance point for the stormwater WLAs shall be storm drain outfalls or a point(s) in the receiving water that suitably represents the combined discharge of cooperating parties. The details of the monitoring program including sampling locations and all methods shall be specified in the MRP to be approved by the Executive Officer. 2. Greater Los Angeles and Long Beach Harbor Waters Compliance Monitoring Program At a minimum, compliance monitoring shall be conducted at the locations and for the constituents listed in the table below for water column, total suspended solids, and sediment. The exact locations of monitoring sites shall be specified in the MRP to be approved by the Executive Officer. During aspects of the remedial action(s) for the Montrose Superfund Site that may mobilize sediments and associated pollutants from the on- or near-property soils or "Neighborhood Areas", it is recommended that US EPA, as the regulatory oversight agency, require that Potentially Responsible Parties (PRP) implement monitoring to evaluate pollutant loads and concentrations leaving the site and surrounding area, as well as pollutant

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concentrations in the bed sediments of Dominguez Channel Estuary and Consolidated Slip and coordinate such monitoring with other TMDL compliance monitoring.

- Water Column Monitoring

Water samples and total suspended solids samples shall be collected during two wet weather events and one dry weather event each year. TSS shall be collected at several depths during wet weather events. The first large storm event of the season shall be included as one of the wet weather monitoring events. General water chemistry (temperature, dissolved oxygen, pH, and salinity) and a flow measurement shall be required at each sampling event.

- Sediment Monitoring

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

Sediment chemistry monitoring requirements

Water Body Name	Station Id	Station Location	Sample Media	
			WATER/TSS	SEDIMENT
Consolidated Slip	01	Center of Consolidated Slip	Metals, PCBs, DDT	Metals, Chlordane, DDT PCBs, PAHs
Los Angeles Inner Harbor	02	East Turning Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	03	Center of the POLA West Basin	Metals, PCBs, DDT	
	04	Main Turning Basin north of Vincent Thomas Bridge	Metals, PCBs, DDT	
	05	Between Pier 300 and Pier 400	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	06	Main Channel south of Port O'Call	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
Fish Harbor	07	Center of inner portion of Fish Harbor	Metals, PCBs, DDT	Metals, Toxicity, PCBs, DDT, Chlordane, PAHs
Los Angeles Outer Harbor	08	Los Angeles Outer Harbor between Pier 400 and middle breakwater	Metals, PCBs, DDT	Toxicity
	09	Los Angeles Outer Harbor between the southern end of the reservation point and the San Pedro breakwater	Metals, PCBs, DDT	Toxicity
Cabrillo Marina	10	Center of west Channel	Metals, PCBs, DDT	
Inner Cabrillo	11	Center of Inner	Metals, PCBs,	Metals

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Beach		Cabrillo Beach	DDT	
Long Beach Inner Harbor	12	Cerritos Channel between the Heim Bridge and the Turning Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	13	Back Channel between Turning Basin and West Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	14	Center of West Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
	15	Center of Southeast Basin	Metals, PCBs, DDT	Metals, Toxicity, Benthic Community Effect
Long Beach Outer Harbor	16	Center of Long Beach Outer Harbor	Metals, PCBs, DDT	Toxicity
	17	Between the southern end of Pier J and the Queens Gate	Metals, PCBs, DDT	Toxicity
San Pedro Bay	18	Northwest of San Pedro Bay near Los Angeles River Estuary	Metals, PCBs, DDT	Metals, Chlordane, PAHs, Toxicity
	19	East of San Pedro Bay	Metals, PCBs, DDT	Metals, Chlordane, PAHs, Toxicity
	20	South of San Pedro Bay inside breakwater	Metals, PCBs, DDT	Metals, Chlordane, PAHs, Toxicity
Los Angeles River Estuary	21	Los Angeles River Estuary Queensway Bay	Metals, PCBs, DDT	Metals, Chlordane, DDT, PCBs
	22	Los Angeles River Estuary	Metals, PCBs, DDT	Metals, Chlordane, DDT, PCBs

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

- Fish Tissue Monitoring
  Fish tissue samples shall be collected every two years in San Pedro Bay, Los Angeles Harbor, and Long Beach Harbor, and analyzed for chlordane, dieldrin, toxaphene, DDT, and PCBs. At a minimum, three species shall be collected, including white croaker, a sport

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	fish, and a prey fish. The Greater Los Angeles and Long Beach Harbors[3] responsible parties are each individually responsible for conducting water, sediment, and fish tissue monitoring. However, they are encouraged to collaborate or coordinate their efforts to avoid duplication and reduce associated costs. Dischargers interested in coordinated compliance monitoring shall submit a coordinated MRP that identifies monitoring to be conducted by the responsible parties. Under the coordinated compliance monitoring option, the compliance point for the stormwater WLAs shall be storm drain outfalls or a point(s) in the receiving water that suitably represents the combined discharge of cooperating parties. The Consolidated Slip sub-group responsible parties are responsible for conducting water, sediment, and fish tissue monitoring in Consolidated Slip. The details of the monitoring program including sampling locations and all methods shall be specified in the MRP to be approved by the Executive Officer. 3. Los Angeles River and San Gabriel River Compliance Monitoring Program Los Angeles River Watershed and San Gabriel River Watershed responsible parties identified in effective metals TMDLs for Los Angeles River and San Gabriel River are responsible for conducting water and sediment monitoring above the Los Angeles River Estuary and at the mouth of the San Gabriel River, respectively, to determine the Rivers' contribution to the impairments in the Greater Harbor waters. • Water Column Monitoring Water samples and total suspended solids samples shall be collected at, at least one site during two wet weather events and one dry weather event each year. The first large storm event of the season shall be included as one of the wet weather monitoring events. Water samples and total suspended solid samples shall be analyzed for metals, DDT, PCBs, and PAHs. Sampling shall be designed to collect sufficient volumes of suspended solids to allow for analysis of the listed pollutants in the bulk sediment. General water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) and a flow measurement shall be required at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements. • Sediment Monitoring For sediment chemistry, sediment samples shall be collected at, at least one site every two years for analysis of general sediment quality constituents and the full chemical suite as specified in SQO Part 1. All samples shall be collected in accordance with SWAMP protocols. The details of the monitoring program including sampling locations and all methods shall be specified in the MRP to be approved by the Executive Officer.

Implementation Plan	The regulatory mechanisms to implement the TMDL include, but are not limited to, general NPDES permits, individual NPDES permits, MS4 Permits covering jurisdictions and flood control districts within these waters, the Statewide Industrial Storm Water General Permit, the Statewide Construction Activity Storm Water General Permit, the Statewide Stormwater Permit for Caltrans Activities, and the authority contained in Sections 13263, 13267 and 13383 of the Cal. Water Code. For each discharger assigned a WLA, the appropriate Regional Board Order shall be reopened or amended when the order is reissued, in accordance with applicable laws, to incorporate the applicable WLA(s) as a permit requirement consistent with federal regulation and related guidance (40 CFR 144.22(d)(1)(vii)(B); US EPA Memorandum "Revisions to the November 22, 2002 Memorandum 'Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs'" (November 12, 2010)). LAs will be implemented in a manner consistent with federal and state laws, regulations and policies, including the Nonpoint Source Implementation and Enforcement Policy. Implementation by assigned responsible parties is required in three waterbody areas: 1. Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary 2. Greater Los Angeles and Long Beach Harbor waters (including Consolidated Slip) 3. Los Angeles River and San Gabriel River Actions to achieve WLA and LA may be implemented in phases with information from each phase being used to inform the implementation of the next phase. These sediment targets are not intended to be used as 'clean-up standards' for navigational, capital or maintenance dredging or capping activities; rather they are long-term sediment concentrations that should be attained after reduction of external loads, targeted actions addressing internal reservoirs of contaminants, and environmental decay of contaminants in sediment. The implementation may be adjusted, as necessary, based on information gained during each phase. Table 7-40.2 contains the schedule for responsible parties to develop and implement TMDL implementation plans and sediment management plans to comply with the TMDL. 1. ***Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary*** Responsible parties can implement a variety of implementation strategies to meet the required WLAs and LAs, such as non-structural and structural BMPs, diversion and treatment to reduce sediment transport from the watershed to Dominguez Channel and Greater Harbor waters, and sediment removal activities. Nonpoint source elements include legacy sediments and air deposition across Dominguez Channel and Harbor waters. The responsible parties identified in the Allocation section and in part 6. *Application of Allocations to Responsible Parties* of this section are assigned sediment load allocations and responsibility for remediation of the contaminated sediments to attain the load allocations. ▪ Phase I The purpose of the Phase I implementation is to reduce the amount of sediment transport from point sources that directly or indirectly discharge to Dominguez Channel and the Harbor waters. Phase I should include watershed-wide implementation actions. Important components of Phase I should be to secure the relationships and agreements between cooperating parties and to develop a detailed scope of work with priorities.

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

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

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

- Phase II

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

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

when US EPA develops Records of Decision for the Superfund sites. The TMDL for DDT should be taken into account in the course of the remedial decision-making process. The City of Los Angeles and/or Los Angeles County, should they decide to take action that impacts one of the OUs, shall consult with US EPA's Superfund Division in advance of such action. Detection of DDT compounds in water or sediment samples collected within Torrance Lateral shall trigger additional monitoring, by parties to be determined by the Executive Officer, in coordination with EPA, to evaluate potential contribution from contaminated soils related to upstream Montrose operable units discharging via the Kenwood storm drain. Upon reconsideration of the TMDL, all monitoring results for DDT compounds collected by responsible parties or other entities shall be considered as part of source analysis and to determine potential future allocation(s) that may be necessary to minimize impacts to downstream waters and restore beneficial uses in TMDL waterbodies.

- Phase III

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

2. ***Greater Los Angeles and Long Beach Harbor Waters (including Consolidated Slip)***

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

- Phase I

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

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

Implementation actions at the Ports should be developed to address different sources that contribute loading to the Harbors such as Port-wide activities and associated control measures for water and sediment, control measures to reduce the discharges from various

land uses in the Harbors, nearshore discharges, and on-water discharges. The implementation actions described in the *Water Resources Action Plan* (WRAP) adopted by the Port of Los Angeles and the Port of Long Beach represent a range of activities that could be conducted to control discharges of polluted stormwater and contaminated sediments to the Harbors.

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

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

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

- *Superfund Sites.* Two Superfund sites are located in Dominguez Channel Watershed: the Montrose Superfund Site (DDT) and the Del Amo Superfund Site (benzene). Montrose Superfund Site includes multiple operable units (OUs), which are identified as investigation areas potentially containing site-related contamination. These Superfund Sites are located in a community known as Harbor Gateway, which is situated mostly in the City of Los Angeles and partially in unincorporated land in Los Angeles County. Harbor Gateway lies within the Kenwood Drain subwatershed, which discharges stormwater into Torrance Lateral which flows downstream into saline waters of Dominguez Channel Estuary and Consolidated Slip. The Torrance Lateral,

Dominguez Channel Estuary and Consolidated Slip (OU2) contain sediments contaminated with multiple pollutants including DDT (potentially from various sources). The US Environmental Protection Agency (US EPA) has been working with other government agencies and local agencies including the City of Los Angeles and Los Angeles County to ensure the protection of both the environment and public health in the areas surrounding these Superfund sites.

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

The US EPA has not yet reached a final remedial decision with respect to certain of the Montrose Superfund Site Operable Units (OUs) that remain contaminated with DDT, including the on- and near-property soils (OU1), the current storm water pathway (OU2), and the "Neighborhood Areas" (OU4 and OU6). The TMDL, its waste load and load allocations, and other regulatory provisions of this TMDL may be applicable or relevant and appropriate requirements (ARARs) as set forth in Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. §§ 9621(d)) for those OUs. Whether provisions within the TMDL are ARARs will be determined in accordance with CERCLA when USEPA develops Records of Decision for the Superfund sites. The TMDL for DDT should be taken into account in the course of the remedial decision-making process. US EPA Superfund does not need to make a remedial decision prior to individual or collective action (by City of LA and/or County of LA) to clean up sediments within the OU2 pathway. The City of Los Angeles and/or Los Angeles County, should they decide to take action that impacts one of the OUs, shall consult with US EPA's Superfund Division in advance of such action. The goal of consultation is to ensure the proposed sediment cleanup will not aggravate the situation or further interfere with the OU2 site. Detection of DDT compounds in water or sediment samples collected within Torrance Lateral shall trigger additional monitoring, by parties to be determined by the Executive Officer, in coordination with EPA, to evaluate potential contribution from contaminated soils related to upstream Montrose operable units discharging via the Kenwood storm drain. Upon reconsideration of the TMDL, all monitoring results for DDT compounds collected by responsible parties or other entities shall be considered as part of source analysis and to determine potential future allocation(s) that may be necessary to minimize impacts to downstream waters and restore beneficial uses in TMDL waterbodies.

- Phase II

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

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

- Phase III

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

3. Los Angeles River and San Gabriel River

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

- Phase I

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

- Phases II and III

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

4. Special Studies and Reconsideration of TMDL Targets, Allocations, and Schedule

This TMDL recognizes that as work to understand these waters and the chemical, physical and biological processes, continues, the targets, allocations, and the flow threshold for wet-weather conditions and the implementation actions to reach those targets and allocations may need to be adjusted. Furthermore, if impairments are identified during flow conditions less than the 90th percentile flow in Dominguez Channel and/or Torrance Lateral, additional allocations for those flow conditions will be developed and applied at the TMDL reconsideration. In addition, it may be necessary to make adjustments to the TMDL to be responsive to new State policies including, but not limited to, SQO Part II; toxicity policy; possible changes to air quality criteria and other regulations affecting air quality.

Optional special studies, which could result in changes to these TMDLs, include but are not limited to: studies to further refine the site specific link between sediment pollutant concentrations, depth of bed sediment contamination and fish tissue concentrations; foraging ranges of targeted fish; additional data to refine watershed and hydrodynamic models, including that collected pursuant to this TMDL; additional data on contaminant contributions of the Los Angeles River or San Gabriel River to Greater Harbor waters; stressor identifications; and additional diazinon data. Completion of studies to further refine the site specific link between sediment pollutant concentrations and fish tissue pollutant concentrations and evaluate the range and habitat of specific fish populations will be used to evaluate changes in TMDL targets, WLAs and LAs, and to guide future implementation actions. In addition, further characterization of direct air deposition loadings for heavy metals and legacy pesticides is an optional special study. Allocations of certain pollutants in certain

waterbodies are confounded by the existing estimates of pollutant loading via direct air deposition onto the waterbodies. Additional monitoring of these pollutants at air sampling sites more closely resembling the respective waterbodies will help characterize these loadings. Limited data exist for dry deposition so this study could be extended over longer timeframes. Measurements of wet deposition for each pollutant may also be appropriate to estimate air deposition more completely. Study results could provide data to reconsider pollutant-specific allocations in this TMDL.

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

As allocation-specific data are collected, interim targets for the end of Phase II may be identified.

The TMDL will be reconsidered by the Regional Board at the end of Phase I to consider completed special studies or policy changes.

5. Compliance with Allocations and Attainment of Numeric Targets

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

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

6. Application of Allocations to Responsible Parties

Responsible parties for monitoring and to attain LAs and WLAs for this TMDL include but are

not limited to:

1. Dominguez Channel Responsible Parties
   - Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary MS4 Permittees
     - Los Angeles County
     - Los Angeles County Flood Control District
     - Caltrans
     - City of Carson
     - City of Compton
     - City of El Segundo
     - City of Gardena
     - City of Hawthorne
     - City of Inglewood
     - City of Lawndale
     - City of Long Beach
     - City of Los Angeles
     - City of Manhattan Beach
     - City of Redondo Beach
     - City of Torrance
   - Individual and General Stormwater Permit Enrollees
   - Other Non-stormwater Permittees
   - Dominguez Channel Estuary Subgroup for bed sediment and fish:
     - Los Angeles County
     - Los Angeles County Flood Control District
     - Caltrans
     - City of Carson
     - City of Compton
     - City of Gardena
     - City of Los Angeles
     - City of Long Beach
     - City of Torrance

2. Greater Los Angeles and Long Beach Harbor Waters Responsible Parties
   - Greater Los Angeles and Long Beach Harbor Waters MS4 Permittees
     - Los Angeles County
     - Los Angeles County Flood Control District
     - Caltrans
     - Bellflower
     - City of Lakewood
     - City of Long Beach
     - City of Los Angeles
     - City of Paramount
     - City of Signal Hill
     - City of Rolling Hills
     - City of Rolling Hills Estates
     - Rancho Palos Verdes
   - City of Los Angeles (including the Port of Los Angeles)
   - City of Long Beach (including the Port of Long Beach)
   - State Lands Commission

	• Individual and General Stormwater Permit Enrollees • Other Non-stormwater Permittees, including City of Los Angeles (TIWRP) • <u>Los Angeles River Estuary Subgroup for bed sediment and fish:</u> ➢ Los Angeles County ➢ Los Angeles County Flood Control District ➢ City of Long Beach ➢ City of Los Angeles ➢ City of Signal Hill ➢ Caltrans • Consolidated Slip Responsible Parties subgroup[4] ➢ Consolidated Slip MS4 Permittees ▪ Los Angeles County ▪ Los Angeles County Flood Control District ▪ City of Los Angeles 3. Los Angeles River and San Gabriel River Watershed TMDLs Responsible Parties ➢ Los Angeles River and San Gabriel River metals TMDLs responsible parties (For list of responsible parties, see Chapter 7-13 herein and US EPA, "Total Maximum Daily Loads for Metals and Selenium: San Gabriel River and Impaired Tributaries", March 26, 2007.)

4 US EPA is the regulatory oversight agency pursuant to CERCLA with respect to the two Superfund sites within the Consolidated Slip subarea, but is not identified as a Responsible Party under the TMDL. As the regulatory oversight agency, US EPA is responsible for choosing an appropriate remedy for these sites. Furthermore, under CERCLA, US EPA is responsible for assuring that the CERCLA PRPs clean up the site in compliance with CERCLA and applicable or relevant and appropriate requirements (ARARs) (CERCLA section 121(d)).

Table 7-40.2 Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL: Implementation Schedule

Task Number	Task	Responsible Party	Deadline
1	Interim allocations are achieved.	All Responsible Parties	Effective date of the TMDL
2	Submit a Monitoring Plan to the Los Angeles Regional Board for Executive Officer approval.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup; Los Angeles and San Gabriel River Responsible Parties	20 months after effective date of the TMDL
3	Implement Monitoring Plan	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup; Los Angeles and San Gabriel River Responsible Parties	6 months after monitoring plan approved by Executive Officer.
4	Submit annual monitoring reports to the Los Angeles Regional Board.	All Responsible parties	15 months after monitoring starts and annually thereafter
5	Submit an Implementation Plan and Contaminated Sediment Management Plan (CSMP). The Implementation Plan and CSMP shall be circulated for public review for 30 days. The CSMP shall include concrete milestones with numeric estimates of load reductions or removal, including milestones for remediating hot spots, including but not limited to Dominguez Channel Estuary, Consolidated Slip and Fish Harbor, for Executive Officer approval. The Executive Officer shall consider the Consent Decree for the Montrose Superfund site in determining whether to approve the CSMPs.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	2 years after effective date of the TMDL
6	Submit Report of Implementation to the Los Angeles Regional Board.	Los Angeles and San Gabriel River Responsible Parties	2 years after effective date of the TMDL
7	Submit annual implementation reports to the Los Angeles Regional Board. Report on implementation progress and demonstrate progress toward meeting the assigned LAs and WLAs.	All Responsible parties	3 years after effective date of the TMDL and annually thereafter
8	Complete Phase I of TMDL Implementation Plan and Sediment Management Plan.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties;	5 years after effective date of the TMDL

Task Number	Task	Responsible Party	Deadline
		Consolidated Slip Responsible Parties subgroup	
9	Submit updated Implementation Plan and Contaminated Sediment Management Plan.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	5 years after effective date of the TMDL
10	Regional Board will reconsider targets, WLAs, and LAs based on new policies, data or special studies. Regional Board will consider requirements for additional implementation or TMDLs for Los Angeles and San Gabriel Rivers and interim targets and allocations for the end of Phase II.	Regional Board	6 years after the effective date of the TMDL
11	Report on status of implementation and scope and schedule of remaining Phase II implementation actions to Regional Board.	All Responsible parties	10 years after the effective date of the TMDL
12	Complete Phase II of TMDL Implementation Plan and Sediment Management Plan.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	15 years after effective date of the TMDL
13	Complete Phase III of TMDL Implementation Plan and Sediment Management Plan.	Dominguez Channel Responsible parties; Greater Harbors Responsible Parties; Consolidated Slip Responsible Parties subgroup	20 years after effective date of the TMDL
14	Demonstrate attainment of LAs and WLAs using the means identified under Waste Load and Load Allocations in Table 7-40.1	All Responsible parties	20 years after effective date of the TMDL

STATE OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER R4-2010-0108
NPDES PERMIT NO. CAS004002
WASTE DISCHARGE REQUIREMENTS
FOR
STORM WATER (WET WEATHER) AND NON-STORM WATER (DRY WEATHER) DISCHARGES FROM THE MUNICIPAL SEPARATE STORM SEWER SYSTEMS WITHIN THE VENTURA COUNTY WATERSHED PROTECTION DISTRICT, COUNTY OF VENTURA AND THE INCORPORATED CITIES THEREIN.

July 8, 2010

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FINDINGS

The California Regional Water Quality Control Board, Los Angeles Region (hereinafter called Regional Water Board), finds that:

A. Permit Parties and History

1. Ventura County Watershed Protection District (Principal Permittee and Co-permittee), County of Ventura, cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, San Buenaventura (Ventura), Santa Paula, Simi Valley and Thousand Oaks (hereinafter referred to separately as Permittees) have joined together to form the Ventura Countywide Storm Water Quality Management Program to discharge wastes. The Permittees discharge or contribute to discharges of storm water and non-storm water from municipal separate storm sewer systems (MS4s), also called storm drain systems, into the Watershed Management Areas of Ventura River, Santa Clara River, Calleguas Creek, Malibu Creek and Miscellaneous Ventura Coastal all within Ventura County and Los Angeles County (see Attachment "A").

2. Prior to the issuance of this permit, storm water discharges from the Ventura County MS4 were covered under the countywide waste discharge requirements contained in Order No. 09-0057, adopted by the Regional Water Board on May 7, 2009, which replaced Order No. 00-108, adopted by the Regional Water Board on July 27, 2000, which replaced Order No. 94-082, adopted by the Regional Water Board on August 22, 1994. Order No. 09-0057 also served as a National Pollutant Discharge Elimination System (NPDES) permit for the discharge of municipal storm water.

3. On June 8, 2009, the Building Industry Legal Defense Foundation, Construction Industry Coalition on Water Quality, and the Building Industry Association of Southern California, Inc. (collectively, "BIA") submitted a petition to the State Water Resources Control Board (State Water Board) challenging Order No. 09-0057. On

March 10, 2010, the State Water Board requested that the Regional Water Board agree to a voluntary remand of Order No. 09-0057 in order to address perceived procedural issues in connection with adoption of Order No. 09-0057. The State Water Board also requested that BIA agree to place its petition in abeyance. On March 11, 2010, the Regional Water Board agreed to a voluntary remand, and stated its intention to hold a hearing to reconsider the permit in July 2010. Since BIA did not agree to place its petition in abeyance, BIA's petition was thereafter dismissed by operation of law. On May 5, 2010, the Regional Water Board notified the Permittees, the parties and other interested persons of its intent to reconsider Order No. 09-0057 and has provided them with an opportunity to submit written comments on provisions of the permit that were not previously subject to notice and comment.

4. The Ventura County Board of Supervisors approved the concept of a countywide NPDES permit program and the use of the Flood Management District (presently the Watershed Protection District) benefit assessment authority to finance it on April 14, 1992. On June 30, 1992, the Ventura County Board of Supervisors adopted a benefit assessment levy for storm water and flood management in the unincorporated areas of Ventura County and the cities within the County, to be used in part to finance the implementation of a countywide NPDES municipal storm water permit program. The Ventura County MS4 Permittees have entered into an agreement with the Watershed Protection District to finance the activities related to the Ventura County MS4 Permit for shared and district wide expenses. The Permittees are also given the option to use the Benefit Assessment Program to finance their respective activities related to reducing the discharge of storm water pollutants under the MS4 Permit.

5. The Regional Water Board may require a separate NPDES permit for any entity that discharges storm water into the watersheds of Ventura County. Such an entity can be any State or Federal facility, special district or other public or private party.

B. Nature of Discharge

1. Storm water discharges consist of surface water runoff generated from various land uses in all the hydrologic drainage basins, which discharge into Waters of the State. The quality of these discharges varies and is affected by geology, land use, season, hydrology, and sequence and duration of hydrologic events. Based on the Ventura Countywide Storm Water Monitoring Program's Water Quality Monitoring Reports which were required under Order No. 00-108, the dry weather and wet weather Pollutants of Concern (POC) in urban stormwater include chloride, fecal indicator bacteria, conventional pollutants, metals, nitrogen, organic compounds, and pesticides. The POC are identified in Attachment "B" of this Order. Many of the POC listed are causing impairments identified on the federal Clean Water Act (CWA) § 303(d) list of impaired waterbodies.

The State Water Board submits a report (a list of water quality limited segments (§ 303[d] list)) on the State's water quality to the U.S. EPA pursuant to § 305(b) of the

1972 CWA, and Title 40, CFR 130.7, every 2 years. The Report provides water quality information to the general public and serves as the basis for the U.S. EPA's National Water Quality Inventory Report to Congress. Section 303(d) requires that all waters that are not attaining standards after the implementation of those controls required by 1977, shall be included on the list. Title 40 CFR 130.7(b)(3) defines "water quality standard applicable to such waters" as "those water quality standards established under § 303 of the Clean Water Act, including numeric criteria, narrative criteria, waterbody uses, and antidegradation requirements."

2. Common pollutants in urban storm water and their respective sources include, but are not limited to: bacteria from illegal discharges, illicit connections and animal waste; Polycyclic Aromatic Hydrocarbons (PAHs) from the products of internal combustion engine operation and parking lot sealants; nitrogen compounds from fertilizer application; pesticides from pest mitigating applications and from plant mitigating applications; bis (2-ethylhexyl) phthalate from the break down of plastic products; mercury from atmospheric fallout and improper disposal of mercury switches; lead from fuels, paints and automotive parts; copper from brake pad wear and roofing materials; zinc from tire wear and galvanized sheeting and fencing; sediment from land disturbance and erosion; trash; and dioxins as products of combustion.

3. In general, the pollutants that are found in municipal storm water runoff can harm human health and aquatic ecosystems. In addition, the high volumes and high velocities of storm water discharged from MS4s into receiving waters can adversely impact aquatic ecosystems and stream habitat and cause stream bank erosion and physical modifications; these changes are collectively termed hydromodification. Hydromodification and discharges of runoff and stormwater from urbanized areas remain a leading cause of impairment of surface waters in California and nationwide (U.S. EPA 2009).

4. Ammonia as Nitrogen, and Nitrate plus Nitrite as Nitrogen are biostimulatory substances that can cause or contribute to eutrophic effects such as low dissolved oxygen and algae growth impairing aquatic and wildlife habitats as well as recreational uses. At elevated concentrations, ammonia is highly toxic to fish and other aquatic life.

5. Elevated bacterial indicator densities impair the water contact recreation (REC-1) beneficial use at beaches, creeks, lakes, estuaries, lagoons, and marinas. Swimming in waters with elevated bacterial indicator densities has been associated with adverse health effects. Specifically, local and national epidemiological studies indicate that there is a causal relationship between adverse health effects and recreational water quality, as measured by bacterial indicator densities (Pruss, 1998, Review of epidemiological studies on health effects from exposure to recreational waters, International Journal of Epidemiology; Haile et al., 1996, An epidemiological study of possible adverse health effects of swimming in Santa Monica Bay, Santa Monica Bay Restoration Project; and Haile et al., 1999, The health effects of swimming in

ocean water contaminated by storm drain runoff, Epidemiology). Sources of elevated bacteria to marine and fresh waters may also include illegal discharges from improperly maintained standard septic systems, on-site wastewater treatment systems (OWTS) and illicit discharges from private drains.

6. Pesticides are substances used to prevent, destroy, repel or mitigate pests such as insects, weeds, and microorganisms. Their effects can be direct (e.g. fish die from exposure to a pesticide entering waterways, or birds do not reproduce after ingesting contaminated fish), or indirect (a hawk becomes sick from eating a mouse dying from pesticide poisoning). Pesticide categories include: Organochlorine, Organophosphorus, Organophosphate, and Pyrethroid.

7. Polychlorinated Biphenyls (PCBs) are a subset of the synthetic organic chemicals known as chlorinated hydrocarbons. Concern over PCBs' toxicity, persistence (chemical stability) in the environment and bioconcentration in aquatic organisms has led to prohibitions on PCBs.

8. Rising groundwater and swimming pool water have been found to be sources of pollutants such as salts (chloride). Salts increase the salinity of otherwise freshwater systems and disrupt physiological processes. The Regional Water Board has waterbodies listed on the CWA § 303(d) list for impairment due to salts and has adopted Basin Plan amendments to include Total Maximum Daily Loads (TMDLs) for salts. This Order includes provisions to control the discharges from these activities in order to directly or indirectly reduce or eliminate the discharge of salts to fresh water systems where salts may impair water quality and beneficial uses.

9. Trash and debris are pervasive pollutants which accumulate in streams, rivers, bays, and the ocean throughout Southern California. They pose a serious threat to our oceans and coasts, navigation, biological resources, recreation, human health and safety, aesthetics, and economies.

10. Municipal storm water (wet weather) and non-storm water (dry weather) discharges may contain pollutants that cause or threaten to cause an exceedance of the water quality standards, as outlined in the Los Angeles Region's Basin Plan. Wet weather and dry weather discharges from the MS4 are subject to conditions and requirements established in the Basin Plan for point source discharges. Discharges from the MS4 may not cause or contribute to exceedances of water quality standards.

11. Biological communities act to integrate the effects of water quality conditions in a stream by responding with changes in their population abundances and species composition over time. These populations are sensitive to multiple aspects of water and habitat quality, and provide expressions of ecological health easier to understand than the results of chemical and toxicity tests. Biological assessments and criteria address the cumulative impacts of all stressors, especially habitat degradation, and chemical contamination, which result in a loss of biological diversity. Biological

information can help provide an ecologically based assessment of the status of a waterbody. Bioassessment is a cost-effective tool and protocol for assessing the biological and physical habitat conditions of streams and rivers for evaluation of the overall health of a watershed. The Principal Permittee consents to participate in the Southern California Storm Water Monitoring Coalition (SMC) Southern California Regional Bioassessment Monitoring Program.

12. Studies indicate that facilities with paved surfaces subject to frequent motor vehicular traffic (such as: strip malls, parking lots, commercial business parks, and fast food restaurants), or facilities that perform vehicle repair, maintenance, or fueling (automotive service facilities) are potential sources of POC in storm water (*California Stormwater Quality Association, Stormwater Best Management Practice Handbook, Municipal, January 2003).*

13. Retail Gasoline Outlets (RGOs) are points of convergence for vehicular traffic and are similar to parking lots and urban roads. Studies indicate that storm water discharges from RGOs have high concentrations of hydrocarbons and heavy metals (*California Stormwater Quality Association, Stormwater Best Management Practice Handbook, Municipal, January 2003).*

14. The industries and businesses listed in this Order that are to be inspected by Permittees have the potential to discharge contaminated storm water into the MS4. This storm water is an environmental threat because it can adversely impact public health and safety, and the quality of receiving waters. For example, pretreatment program compliance inspections and audits performed in the Los Angeles and Ventura Counties indicate that automotive service and food service facilities sometimes discharge polluted storm water to the MS4s. The POC in such wash waters include oil and grease, toxic chemicals, and food waste. Spills from clogged sanitary sewer lines have a high likelihood to reach the receiving waters via MS4s. Overall, the most common POC identified in storm water discharge to the MS4s are: (i) heavy metals, (ii) oil and grease/ PAHs, (iii) sediments, (iv) oxygen demanding substances, (v) litter/ trash/ debris, (vi) nutrients, (vii) other toxic materials, such as pesticides. Municipal storm water monitoring data and industrial storm water monitoring data indicate that industrial and commercial sites continue to contribute significant quantities of pollutants in storm water runoff.

15. Development and urbanization increase pollutant loads, volume, and discharge velocity. First, natural vegetated pervious ground cover is converted to impervious surfaces (paved) such as highways, streets, rooftops and parking lots. While natural vegetated soil can both absorb rainwater and remove pollutants providing an effective natural purification process, in contrast, impervious surfaces (such as pavement and concrete) can neither absorb water nor remove pollutants, and thus the natural purification characteristics are lost. Second, urban development creates new pollution sources as the increased density of human population brings proportionately higher levels of vehicle emissions, vehicle maintenance wastes, municipal sewage waste,

pesticides, household hazardous wastes, pet wastes, trash, and other anthropogenic pollutants. Development and urbanization especially threaten environmentally sensitive areas. Such areas have a much lower capacity to withstand pollutant shocks than might be acceptable in the general circumstance. In essence, development that is ordinarily insignificant in its impact on the environment may become significant in a particularly sensitive environment. These environmentally sensitive areas (ESAs) designated by the State in the Ventura County watershed are defined in Part 6 (Definitions).

16. The increased volume, increased velocity, and discharge duration of storm water runoff from developed areas has the potential to accelerate downstream erosion and impair stream habitat in natural drainages. Studies have demonstrated a direct relationship between the degree of imperviousness of an area and waterbody degradation *(Impacts of Impervious Cover on Aquatic Systems, Center for Watershed Protection, March 2003; Management Strategies for Urban Stream Rehabilitation, Booth, D. et al., February 2003).* Significant declines in the biological integrity and physical habitat of streams and other receiving waters have been found to occur with as little as 3-10 percent conversion from natural to impervious surfaces in a subwatershed. Recent studies conducted in California indicate that intermittent and ephemeral streams are even more susceptible to the effects of hydromodification than streams from other regions of the U.S. with stream degradation being recognized when the associated catchment's impervious cover is as little as 3-5% *(Managing Runoff to Protect Natural Streams: The Latest Development on Investigation and Management of Hydromodification in California, Stein, E. and Zaleski, S., December 2005; Effect of Increase in Peak Flows and Imperviousness on the Morphology of Southern California Streams, Coleman, D., April 2005).* The percentage of impervious cover is one indicator and predictor of potential water quality degradation expected from new development.

17. The Order requires projects where it has been demonstrated to be technically infeasible to achieve less than 30% Effective Impervious Area, to mitigate off-site 1.5 times the volume that would normally be required to be retained on site. The increase in off-site mitigation is warranted because it has been concluded that, at impervious land cover over 30%, impacts on streams and wetlands become more severe, and degradation is almost unavoidable without special measures (Prince George's County, MD 1999; BASMAA 1999; Center for Watershed Protection 2003). The off-site mitigation volume requirement may be met through retention and/or biofiltration.

18. Low Impact Development (LID) is an effective approach to minimizing the adverse effects of urbanization and development on waterbodies and their beneficial uses that has been endorsed by California and other states. The California Ocean Protection Council (OPC), in a resolution adopted on May 15, 2008, found that LID is a practicable and superior approach that new and redevelopment projects can implement to minimize and mitigate increases in runoff and runoff pollutants and the resulting impacts on downstream uses, coastal resources and communities. In its

Strategic Plan Update 2008-2012, the State Water Board reiterated sustainability as a key principle, stating its commitment to "enhancing and encouraging sustainability within the administration of Water Board programs and activities by promoting water management strategies such as low impact development..." (SWRCB 2008).

19. LID is a comprehensive source control strategy first pioneered by Prince George's County, Maryland in 1997 to help address the growing economic and environmental limitations of conventional stormwater management practices. As LID was developed by a local government, it is sensitive to addressing local government's unique environmental and regulatory needs in the most economical manner possible by reducing costs associated with stormwater infrastructure design, construction, maintenance and enforcement. LID also provides for local government's need for economic vitality through reasonable and continued growth and redevelopment. LID allows for greater development potential with less environmental impacts through the use of smarter designs and advanced technologies to achieve a better balance between conservation, growth, ecosystem protection and public health / quality of life. (Low Impact Development: Smart Technology For Clean Water Definitions, Issues, Roadblocks, and Next Steps, Coffman, Larry)

20. The implementation of LID techniques across the United States and Canada has demonstrated that the proper implementation of LID techniques results in more benefits than single purpose stormwater and flood control infrastructure, including increased water quality protection, enhanced property values, improved aquatic and terrestrial habitat, aesthetic amenities, and improved quality of life (Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, USEPA Doc No. EPA 841-F-07-006, December 2007). Further, properly implemented LID techniques can help mimic the pre-project runoff volume and time of concentration, thus minimizing the adverse effects of hydromodification on stream habitat and biological condition (A Review of Low Impact Development Policies: Removing Institutional Barriers to Adoption, Low Impact Development Center and State of California, State Water Resources Control Board, December 2007). The requirements of this Order facilitate the implementation of LID strategies to protect water quality, reduce runoff volume, and to garner additional benefits.

21. The implementation of LID techniques have been associated with the following environmental benefits: improved air quality due to the increased use of trees and vegetation, reduced urban temperatures due to the shade offered by increased vegetation and the reduction of heat absorbing materials (concrete, etc.), the moderation of climate change due to reduced urban temperatures, increased energy efficiency due to lower ambient temperatures when LID practices are implemented on and around buildings, and aesthetic benefits due to the increased use of trees and vegetation (U.S. EPA Technical Guidance on Implementing the Storm Water Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act).

22. Furthermore, the implementation of LID not only benefits water quality, but also enhances water supply. LID is consistent with and supports the Governor's 20 x 2020 Water Conservation Plan (February 2010); the State Board's 2008-2012 Strategic Plan Update (i.e. to promote sustainable local water supplies); the State Board's Recycled Water Policy (Resolution No. 2009-0011) objective to increase [beneficial] use of stormwater; requirements of the Water Conservation in Landscaping Act of 2006 (AB 1881, Laird), which requires cities and counties to adopt landscape water conservation ordinances by January 1, 2010; and the Department of Water Resources' Water Efficient Landscape Ordinance (Cal. Code Regs. §492.15).

23. This Order requires specified New Development and Redevelopment projects to control pollutants, pollutant loads, and runoff volume emanating from impervious surfaces by specifying a 5% Effective Impervious Area (EIA) site limitation and a fixed runoff volume to be retained on site. There is a growing acceptance by stormwater professionals and local governments to integrate LID strategies that limit impervious area, and associated onsite retention criteria, into stormwater management programs and MS4 permits. For example, West Virginia's Small MS4 Permit # WV0116025, requires the on-site retention of the volume of runoff produced from the first inch of a 24-hour storm; the U.S. EPA's Technical Guidance on Implementing the Storm Water Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act, requires the on-site retention of the volume of runoff produced from the 95th percentile storm event where technically feasible; the City of Philadelphia requires the onsite retention of the volume of runoff produced from the first inch of a 24-hour storm; and the City of Portland, Oregon requires the onsite infiltration of the runoff volume from a 10-year, 24-hour design storm.

24. Based on a study conducted by Horner (2007) in Ventura County, it was found that a 5% EIA threshold can be met in typical developments. This result was reached assuming the use of native soils typical to Ventura County; soil enhancements can further increase onsite infiltration potential. Using six different development types, the Horner study tested the feasibility of draining all but 3% of impervious area to pervious land on the sites. Five of the six sites had adequate or greater capacity to infiltrate the full annual runoff volume from the "Not-Connected Impervious Area" (NCIA) and pervious areas where EIA is limited to 3% of the total site area. By showing that it is possible to retain all runoff from pervious areas where EIA is limited to 3% of the total site area under typical site conditions (i.e. native soils) and a wide range of development types, the study results provide support for the feasibility of the 5% EIA threshold.

25. Horner (2007) also found that developments implementing low impact strategies can achieve significant reductions in pollutant loading and runoff volume as well as greatly enhanced recharge rates compared to both developments with no BMPs and developments with traditional treatment BMPs.

26. In some circumstances, however, site conditions and the type of development can limit the feasibility of retaining, infiltrating, and reusing stormwater at sites due to a variety of site specific conditions. Factors that affect the feasibility of a fixed volume capture standard include, but are not limited to: successive storms, soil infiltration capacity, subsurface pollution, and infill in urban core centers (e.g. R. Horner, *Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County* (February 2007); E. Strecker, A. Poresky, D. Christsen, *Memorandum: Rainwater Harvesting and Reuse Scenarios and Cost Consideration* (April, 2009)).

27. A major concern expressed by commenters is the 30% EIA limitation may not allow some projects to be built. Part of the rationale supporting the feasibility of on site retention in Order 09-0057 was derived from the Richard Horner (2007) study. The Horner study purports to demonstrate that stormwater infiltration is feasible throughout Ventura County and is the key study for an upper-bound EIA requirement. Horner's approach to demonstrate feasibility is to estimate stormwater runoff volume and compare it to infiltration capacity. While the Horner report has value at a general level and complements findings of other studies in Southern California and elsewhere. Staff has the following concerns with the Horner study conclusions with regard to the universal feasibility of achieving less than 30% EIA:

    - The Horner analysis is based on engineered infiltration basins rather than undisturbed pervious cover.
    - The Horner analysis cites the UCSB infiltration studies which are based on a relatively high permeability soils. However, the EIR cited in the study by Horner shows a significant quantity percentage of the Ventura County soils are described as sandy loamy and are classified as "low permeability and slow draining.
    - The Horner analysis normalizes runoff rates and infiltration capacity to an annual basis which may not address the critical conditions appropriate for the seasonal precipitation patterns in Ventura County.
    - Horner states the study was limited in scope such that its universal applicability throughout Ventura County is not well supported.

    Staff recognizes the significance of the 30% EIA threshold but cannot justify a strict cap.

28. In a letter dated April 10, 2009, the Ventura County Permittees, NRDC and Heal the Bay presented an agreement to the Regional Water Board proposing new development/redevelopment criteria, including on-site retention requirements, a 5% EIA limitation, infeasibility criteria, a 30% EIA cap, and off-site mitigation provisions; the elimination of Municipal Action Levels (MALs); and weekly, year-round beach water quality monitoring at 10 sites. The letter was signed by representatives of the parties, including NRDC, Heal the Bay, Ventura, Oxnard, Simi Valley, and the County of Ventura. At the Regional Board hearing on May 7, 2009,

the Ventura County Permittees, NRDC, and Heal the Bay reiterated their support for the agreement set forth in their joint April 10, 2009 comment letter and advocated that the agreement be incorporated into the permit in its entirety.

29. Specific LID strategies include bioretention and rainwater harvesting for reuse. Bioretention is a method of treating stormwater by pooling water on the surface and allowing filtering and settling of suspended solids and sediment at the mulch layer, prior to entering the plant/soil/microbe complex media for infiltration and pollutant removal. Rain Gardens / bioretention techniques are used to accomplish water quality improvement and water quantity reduction. Prince George's County, Maryland, and Alexandria, Virginia have used this BMP since 1992 with success in many urban and suburban settings. Rain Gardens can be integrated into a site with a high degree of flexibility and can balance nicely with other structural management systems, including porous asphalt parking lots, infiltration trenches, as well as non-structural stormwater BMPs. The Rain Garden vegetation serves to filter (water quality) and transpire (water quantity) runoff, and the root systems can enhance infiltration. The plants take up pollutants; the soil medium filters out pollutants and allows storage and infiltration of stormwater runoff; and the infiltration bed provides additional volume control ("Rain Gardens", River-Friendly Landscaping Coalition, Sacramento, CA). Properly designed bioretention techniques mimic natural forest ecosystems through species diversity, density and distribution of vegetation, and the use of native species, resulting in a system that is resistant to insects, disease, pollution, and climatic stresses (Draft - Pennsylvania Stormwater Management Manual).

    As an alternative to redirection of stormwater to functional landscape, rain gutter flows can be directed into rain barrels or cisterns for later use in irrigating lawns and gardens. Disconnections of rain gutters can effectively be implemented on existing properties with little change to present site designs. The benefits of urban area rainwater harvesting can be huge, providing supplemental water for many local uses. Such as irrigating a vegetable garden and surrounding landscape, which also leaves more treated water in the municipal water supply to help cities through times of drought or other shortages. A number of cities in the Los Angeles Region, including Los Angeles, Long Beach and Santa Monica, have implemented successful rainwater harvesting incentive programs.

30. Traditional approaches to stormwater management involve conveying runoff off-site to receiving waters, to a combined sewer system, or to a regional facility that treats runoff from multiple sites. These designs typically include hard infrastructure, such as curbs, gutters, and piping. LID-based designs, in contrast, are designed to use natural drainage features or engineered swales and vegetated contours for runoff conveyance and treatment. In terms of costs, LID techniques like conservation design can reduce the amount of materials needed for paving roads and driveways and for installing curbs and gutters. Conservation designs can be used to reduce the total amount of impervious surface, which results in reduced road and driveway lengths and reduced costs. Other LID techniques, such as grassed swales, can be used to infiltrate roadway

runoff and eliminate or reduce the need for curbs and gutters, thereby reducing infrastructure costs. Also, by infiltrating or evaporating runoff, LID techniques can reduce the size and cost of flood-control structures (Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, U.S. EPA).

The U.S. EPA looked at 17 case studies throughout the country to determine if LID strategies were a cost effective alternative to conventional storm water control measures. They found that the use of LID practices can be both fiscally and environmentally beneficial to communities. They found total capital cost savings ranging from 15% to 80% when LID strategies were used compared with traditional stormwater control measures, with only a few cases noted where LID projects resulted in higher costs than traditional storm water controls. In the majority of the cases, costs for projects implementing LID strategies were found to be less due to reduced costs for site grading and preparation, stormwater infrastructure, site paving, and landscaping (Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, U.S. EPA).

31. The use of LID strategies also has the potential to create larger economic benefits, including but not limited to, reduced need for flood control, which could save up to $400 million; increased property values, which could amount to up to $5 billion; and creation of additional groundwater supplies worth up to $7.2 billion (Devinny et al. 2004; MacMullan, E., Assessing Low Impact Developments Using a Benefit-Cost Approach, 2nd National Low Impact Development Conference, March 12-14, 2007).

32. The Regional Water Board adopted a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Order No. R4-2005-0080) on November 3, 2005. The objective of the program is to monitor runoff from irrigated agriculture facilities in the coastal watersheds of Ventura and Los Angeles Counties. The Basin Plan, which designates beneficial uses and establishes water quality objectives for the Region, recognizes that agricultural activities can generate pollutants such as sediment, pesticides, and nutrients that upon discharge to receiving water can degrade water quality and impair beneficial uses. A category identified by the Conditional Waiver as a source of pollutants is nursery operations. This Order includes requirements for the municipal operator to confirm that nursery operators implement pollutant reduction and control measures with the objective of reducing pollutants in storm water runoff discharges.

33. Research conducted on the contribution of aerial deposition of trace heavy metals in Los Angeles County watersheds indicates that dry indirect deposition may account for a significant load of pollutants into surface waters. Similar patterns of aerial deposition likely occur in Ventura County. Of the atmospherically deposited pollutants on the watersheds, ten to twenty percent may account før the total load for copper, zinc, nickel, lead, and chromium to the waterbodies. Land reservoirs and sequestration may account for the remaining eighty to ninety percent of the atmospherically deposited pollutants on the watersheds. Emissions of semi-volatile

organics such as polycyclic aromatic hydrocarbons (PAHs) and pesticides and their subsequent deposition may contribute to the contamination of receiving waters but appear to be less significant. The remaining percentage is stored in land reservoirs and eventually shows up in receiving waters.

C. Permit Background

1. The essential components of the Storm Water Management Program, as required by the Code of Federal Regulations (CFR) [40 CFR 122.26(d)] are:
   (a) Adequate Legal Authority.
   (b) Fiscal Resources.
   (c) Storm Water Quality Management Program (SMP)
      (1) Public Information and Participation Program
      (2) Industrial/ Commercial Facilities Program
      (3) Planning and Land Development Program
      (4) Development Construction Program
      (5) Public Agency Activities Program
      (6) Illicit Connection and Illicit Discharges Elimination Program
   (d) Reporting Program (Monitoring Report and Program Report)

2. The Ventura County SMP, dated November 2001 (revision 2) identifies seven program areas, which are listed below and were previously approved under Board Order No. 00-108. For purposes of consistency, they are titled as follows:
   (a) Ventura County SMP.
      (1) Program Management
      (2) Programs for Residents
      (3) Programs for Industrial/ Commercial Businesses
      (4) Programs for Planning and Land Development
      (5) Programs for Construction Sites
      (6) Programs for Public Agency Activities
      (7) Programs for Illicit Connections/ Illegal Discharges
   (b) For purposes of region-wide consistency, the program titles are revised and consolidated into the six areas listed in the preceding C.1(c). All Permittee storm water documents submitted to the Regional Water Board are to follow the organization enumerated in C.1(c).

3. The Permittees filed a Report of Waste Discharge (ROWD), dated January 26, 2005. The Permittees applied for renewal of their waste discharge requirements for a 5-year period, which serves as an NPDES permit to discharge wastes to surface waters.

4. The Regional Water Board reviewed the ROWD and determined it to be partially complete under the reapplication policy for MS4s issued by the United States Environmental Protection Agency (U.S. EPA) (61 Fed. Reg. 41697). The Regional Water Board has prepared this Order so that implementation of provisions contained

in this Order by Permittees will meet the requirements of the federal NPDES regulations at 40 CFR 122.26.

5. The Permittees ROWD contained a proposed Storm Water Management Program and a Monitoring Program to be considered by the Regional Water Board for incorporation into an MS4 NPDES Permit as permit conditions and to demonstrate compliance with federal law.

6. To-date, the monitoring program has consisted of mass emission, receiving water (tributaries), and land-use monitoring stations, toxicity testing, special studies for bioassessment of the Ventura River and hydrology, identification of ESAs, implementation of the Storm Water Quality Urban Impact Mitigation Plan (SQUIMP), and has provided support for volunteer monitoring programs. This Order requires a monitoring program consisting of mass emission, toxicity, TMDL storm water (wet weather) MS4 water quality-based effluent limits, TMDL non-storm water (dry weather) MS4 water quality-based effluent limits, Pyrethroid assessment study, continuation of the hydromodification study, low impact development study, and participation in the Southern California Regional Bioassessment Program and Southern California Bight Project (SCBP).

7. The Principal Permittee is a member of the Southern California Coastal Water Research Project (SCCWRP) Commission. The Principal Permittee also participates in the Regional Monitoring Programs and research partnerships, such as the Southern California Storm Water Monitoring Coalition (SMC) and the Bioassessment Working Group.

D. Permit Coverage

1. The area covered by this Order includes all areas within Ventura County boundaries and all areas within each co-permittee's boundaries (see Figure 1) that drain into the MS4.

2. The Permittees covered under this Order were designated on a system-wide basis under Phase I of the CWA § 402(p)(3)(B)(i). The action of covering all Ventura County municipalities under a single MS4 permit on a system-wide basis was consistent with the provisions of 40 CFR 122.26(a)(3)(iv), which states that one permit application may be submitted for all or a portion of all municipal separate storm sewers within adjacent or interconnected large or medium municipal separate storm sewer systems; and the Regional Water Board may issue one system-wide permit covering all, or a portion of all municipal separate storm sewers in adjacent or interconnected large or medium municipal separate storm sewer systems.

3. Federal, State, Regional, or local entities within the Permittees' boundaries or in jurisdictions outside the Ventura County Watershed Protection District, and not currently named in this Order, may operate storm drain facilities and/ or discharge

storm water to storm drains and receiving waters covered by this Order. The Permittees may lack legal jurisdiction over these entities under State and Federal constitutions. The Regional Water Board will coordinate with these entities to implement programs that are consistent with the requirements of this Order. The Regional Water Board may consider such facilities for coverage under its NPDES permitting scheme pursuant to USEPA Phase II storm water regulations. Permittees have expressed their intention to work cooperatively to control the contribution of pollutants from one portion of the MS4 to another portion of the system. Permittees shall make good faith efforts to control the contribution of pollutants to the MS4 from non-permittee dischargers such as Caltrans, the U.S. Department of Defense, and other state and federal facilities.

4. TMDLs are numerical calculations of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point sources (Waste Load Allocation (WLA)) and non-point sources (Load Allocation (LA)). Discharges from the MS4s are considered point sources discharges, because the MS4 is a point source.

5. This Order incorporates applicable WLAs that have been adopted by the Regional Water Board and have been approved by the Office of Administrative Law and the U.S. EPA. The TMDL WLAs in the Order are expressed as water quality-based effluent limits in a manner consistent with the assumptions and requirements of the TMDL from which they are derived.

6. The CWA and the California Water Code contain specific provisions on how wastewater discharges from point sources are to be permitted. Stormwater discharges (both dry weather and wet weather) are considered point source discharges.

7. Permittees should work cooperatively to control the contribution of pollutants from one portion of the MS4 to another portion of the system through inter-agency agreements or other formal arrangements.

E. Federal, State and Regional Regulations

1. The Water Quality Act of 1987 added § 402(p) to the CWA (33U.S.C. § 1251-1387). This section requires the U.S. EPA to establish regulations setting forth NPDES requirements for storm water discharges in 2 phases.
   (a) U.S. EPA Phase I storm water regulations were directed at MS4s serving a population of 100,000 or more, including interconnected systems and storm water discharges associated with industrial activities, including construction activities. The Phase 1 Final Rule was published on November 16, 1990 (55 Fed. Reg. 47990).
   (b) U.S. EPA Phase II storm water regulations are directed at storm water discharges not covered in Phase I, including small MS4s (population of less than 100,000),

small construction projects (less than 5 acres), municipal facilities with delayed coverage under the Intermodal Surface Transportation Efficiency Act of 1991, and other discharges for which the U.S. EPA Administrator or the State determines that the storm water discharge contributes to a violation of a water quality standard, or is a significant contributor of pollutants to waters of the U.S. The Phase II Final Rule was published on December 8, 1999 (64 Fed. Reg. 68722).

2. The U.S. EPA published an Interpretative Policy Memorandum on Reapplication Requirements for MS4 permits on August 9, 1996 (61 Fed. Reg. 41697). This policy requires that MS4 reapplication for reissuance for a subsequent five-year permit term contain certain basic information and information for proposed changes and improvements to the storm water management program and monitoring program.

3. The U.S. EPA has entered into a Memorandum of Agreement (MOA) with the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service for enhancing coordination regarding the protection of endangered and threatened species under section 7 of the Endangered Species Act, and the CWA's water quality standards and NPDES programs. Among other actions, the MOA establishes a framework for coordination of actions by the U.S. EPA, the Services, and CWA delegated States on CWA permit issuance under § 402 of the CWA [66 Fed. Reg. 11202-11217].

4. The CWA allows the U.S. EPA to authorize states with an approved environmental regulatory program to administer the NPDES program in lieu of the U.S. EPA. The State of California is a delegated State. The Porter-Cologne Water Quality Control Act (California Water Code) authorizes the State Water Resources Control Board (State Water Board), through the Regional Water Boards, to regulate and control the discharge of wastes that could affect the quality of waters of the State, including waters of the United States, and tributaries thereto.

5. Under CWA § 303(d) of the CWA, States are required to identify a list of impaired water-bodies and develop and implement TMDLs for these waterbodies (33 USC § 1313 (d)(1)). The most recent 303(d) list's U.S. EPA approval date was June 28, 2007. The U.S. EPA entered into a consent decree with the Natural Resources Defense Council (NRDC), Heal the Bay, and the Santa Monica Baykeeper on March 22, 1999, under which all TMDLs for the Los Angeles Region must be adopted within 13 years from that date. This Order incorporates provisions incorporating approved WLAs for municipal storm water discharges and requires amending the SMP after subsequent pollutant loads have been allocated and approved.

6. Collectively, the restrictions contained in the TMDL Provisions for Storm Water (Wet Weather) Discharges and Non-Storm Water (Dry Weather) Discharges of this Order on individual pollutants are no more stringent than required to implement the provisions of the TMDL, which have been adopted and approved in a manner that is consistent with the CWA. Where a TMDL has been approved, NPDES permits must

contain effluent limits and conditions consistent with the assumptions and requirements of the available WLAs in TMDLs (40 CFR 122.44(d)(1)(vii)(B)).

7. This Order does not constitute an unfunded local government mandate subject to subvention under Article XIIIB, Section (6) of the California Constitution for several reasons, including, but not limited to, the following. This Order implements federally mandated requirements under CWA § 402, subdivision (p)(3)(B)(33 U.S.C. § 1342(p)(3)(B)) This includes federal requirements to effectively prohibit non-storm water discharges, to reduce the discharge of pollutants to the maximum extent practicable, and to include such other provisions as the Administrator or the State determines appropriate for the control of such pollutants. Federal cases have held these provisions require the development of permits and permit provisions on a case-by-case basis to satisfy federal requirements. (Natural Resources Defense Council, Inc. v. U.S. E.P.A. (9th Cir. 1992) 966 F.2d 1292, 1308, fn. 17.) The authority exercised under this Order is not reserved state authority under the Clean Water Act's savings clause (cf. Burbank v. State Water Resources Control Bd. (2005) 35 Cal.4th 613, 627-628 [relying on 33 U.S.C. § 1370, which allows a state to develop requirements which are not "less stringent" than federal requirements]), but instead, is part of a federal mandate to develop pollutant reduction requirements for municipal separate storm sewer systems. To this extent, it is entirely federal authority that forms the legal basis to establish the permit provisions. (See, City of Rancho Cucamonga v. Regional Water Quality Control Bd.-Santa Ana Region (2006) 135 Cal.App.4th 1377, 1389; Building Industry Ass'n of San Diego County v. State Water Resources Control Bd. (2004) 124 Cal.App.4th 866, 882-883.)

   Likewise, the provisions of this Order to implement TMDLs are federal mandates. The CWA requires TMDLs to be developed for waterbodies that do not meet federal water quality standards (33 U.S.C. § 1313(d)). Once the U.S. EPA or a state develops a TMDL, federal law requires that permits must contain effluent limitations consistent with the assumptions of any applicable wasteload allocation. (40 CFR 122.44(d)(1)(vii)(B)).

   Second, the local agency Permittees' obligations under this Order are similar to, and in many respects less stringent than, the obligations of non-governmental dischargers who are issued NPDES permits for storm water discharges. With a few inapplicable exceptions, the Clean Water Act regulates the discharge of pollutants from point sources (33 U.S.C. § 1342) and the Porter-Cologne regulates the discharge of waste (Wat. Code, § 13263), both without regard to the source of the pollutant or waste. As a result, the "costs incurred by local agencies" to protect water quality reflect an overarching regulatory scheme that places similar requirements on governmental and nongovernmental dischargers. (See *County of Los Angeles v. State of California* (1987) 43 Cal.3d 46, 57-58 [finding comprehensive workers compensation scheme did not create a cost for local agencies that was subject to state subvention].)

The Clean Water Act and the Porter-Cologne Water Quality Control Act largely regulate storm water with an even hand, but to the extent there is any relaxation of this even-handed regulation, it is in favor of the local agencies. Generally, the Clean Water Act requires point source dischargers, including discharges of storm water associated with industrial or construction activity, to comply strictly with water quality standards. (33 U.S.C. § 1311(b)(1)(C), *Defenders of Wildlife v. Browner* (1999) 191 F.3d 1159, 1164-1165 [noting that industrial storm water discharges must strictly comply with water quality standards].) As discussed in prior State Water Resources Control Board decisions, certain provisions of this Order do not require strict compliance with water quality standards. (SWRCB Order No. WQ 2001-15, p. 7.) Therefore, certain provisions of this Order regulate the discharge of waste in municipal storm water more leniently than the discharge of waste from non-governmental sources.

Third, the local agency Permittees have the authority to levy service charges, fees, or assessments sufficient to pay for compliance with this Order subject to certain voting requirements contained in the California Constitution. (See California Constitution XIII D, section 6, subdivision (c); see also *Howard Jarvis Taxpayers Association v. City of Salinas* (2002) 98 Cal. App. 4th 1351, 1358-1359.). The fact sheet demonstrates that numerous activities contribute to the pollutant loading in the municipal separate storm sewer system. Local agencies can levy service charges, fees, or assessments on these activities, independent of real property ownership. (See, e.g., *Apartment Ass'n of Los Angeles County, Inc. v. City of Los Angeles* (2001) 24 Cal.4th 830, 842 [upholding inspection fees associated with renting property].) The ability of a local agency to defray the cost of a program without raising taxes indicates that a program does not entail a cost subject to subvention. (*County of Fresno v. State of California* (1991) 53 Cal.3d 482, 487-488.)

Fourth, the Permittees have requested permit coverage in lieu of compliance with the complete prohibition against the discharge of pollutants contained in federal Clean Water Act section 301, subdivision (a) (33 U.S.C. § 1311(a)) and in lieu of numeric restrictions on their discharges. (See finding C.5., supra.) To the extent that the local agencies have voluntarily availed themselves of the permit, the program is not a state mandate. (Accord *County of San Diego v. State of California* (1997) 15 Cal.4th 68, 107-108.) Likewise, where MS4 Permittees are regulated under a Best Management Practices (BMP) based storm water management program rather than end-of-pipe numeric limits, there exists no compulsion of a specific regulatory scheme that would violate the 10th Amendment to the United States Constitution. (See *City of Abilene v. U.S. E.P.A.* (5th Cir. 2003) 325 F.3d 657, 662-663 [noting that municipalities can choose between a management permit or a permit with numeric limits].) The local agencies' voluntary decision to file a report of waste discharge proposing a program-based permit is a voluntary decision not subject to subvention. (See *Environmental Defense Center v. USEPA* (9th Cir. 2003) 344 F.3d 832, 845-848.)

Fifth, the local agencies' responsibility for preventing discharges of waste that can create conditions of pollution or nuisance from conveyances that are within their ownership or control under state law predates the enactment of Article XIIIB, Section (6) of the California Constitution.

8. Under § 6217(g) of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), Coastal States with approved coastal zone management programs are required to address non-point pollution impacting or threatening coastal water quality. CZARA addresses five sources of non-point pollution: 1) agriculture; 2) silviculture; 3) urban; 4) marinas; and 5) hydromodification. This Waste Discharge Requirement addresses the management measures required for the urban category and the hydromodification category, with the exception of septic systems.

9. The Regional Water Board addresses septic systems through the administration of non-Chapter 15 regulatory programs and the implementation of Regional Water Board Order No.R4-2004-0146. Septic systems are also addressed under State Assembly Bill (AB) 885 (2000). The Regional Water Board will implement and enforce regulations issued by the State Board pursuant to AB 885. Taken together, these State and Local agency requirements when imposed on septic system operators are expected to reduce the bacterial contamination of storm water from improperly maintained septic systems.

10. The State Water Board has issued waste discharge requirements for discharges from utility vaults (CAG990002). The Regional Water Board has issued waste discharge requirements for discharges from well heads and hydrostatic pipe testing (CAG674001). These discharges to the MS4 shall be conducted under coverage of a separate NPDES permit specific to that activity.

11. On May 18, 2000, the U.S. EPA established numeric criteria for priority toxic pollutants for the State of California (California Toxics Rule (CTR) 65 Fed. Reg. 31682 (40 CFR 131.38)) for the protection of human health and aquatic life. These apply as ambient water quality criteria for inland surface waters, enclosed bays and estuaries.

12. The State Water Board adopted a revised Water Quality Control Plan for Ocean Waters of California (Ocean Plan) in 2005. The California Ocean Plan establishes water quality objectives for California's ocean waters and provides the basis for regulation of wastes discharged into the State's coastal waters. It applies to point and nonpoint source discharges. The Ocean Plan identifies the applicable beneficial uses of marine waters that include preservation and enhancement of designated Areas of Special Biological Significance (ASBS) (now called "State Water Quality Protection Areas") and establishes a set of narrative and numerical water quality objectives designed to protect beneficial uses. The SWRCB adopted the California Ocean Plan, and both the SWRCB and the six coastal Regional Water Quality Control Boards (RWQCBs) implement and interpret the California Ocean Plan.

13. This Regional Water Board adopted a revised Water Quality Control Plan (Basin Plan) for the Los Angeles Region on June 13, 1994. The Basin Plan specifies the beneficial uses of Ventura County waterbodies and their tributary streams, and contains both narrative and numerical water quality objectives for these receiving waters. The following beneficial uses identified in the Basin Plan apply to all or portions of each watershed covered by this Order:
    (a) Municipal and domestic supply
    (b) Agricultural supply
    (c) Industrial service supply
    (d) Industrial process supply
    (e) Ground water recharge
    (f) Freshwater replenishment
    (g) Navigation
    (h) Hydropower generation
    (i) Water contact recreation
    (j) Non-contact water recreation
    (k) Ocean commercial and sport fishing
    (l) Warm freshwater habitat
    (m) Cold freshwater habitat
    (n) Preservation of Areas of Special Biological Significance
    (o) Saline water habitat
    (p) Wildlife habitat
    (q) Preservation of rare and endangered species
    (r) Marine habitat
    (s) Fish migration
    (t) Fish spawning
    (u) Shellfish harvesting

14. On March 22, 1999 the Consent Decree in Heal the Bay, Inc.; Santa Monica Baykeeper, Inc. v. Browner, Case No. 98-4825 SBA was approved. Under Establishment of TMDLs- The parties understand that California has the initial opportunity pursuant to § 303(d) of the CWA to adopt and submit to U.S. EPA for approval TMDLs to be established under this Consent Decree. TMDLs developed by Regional Water Boards are generally adopted through Basin Plan amendments. Basin plan amendments adopted by the State Board pursuant to Water Code section 13246, and the regulatory portions must be approved by the Office of Administrative Law pursuant to Government Code section 11353(b). TMDLs established pursuant to CWA section 303(d)(1) must be submitted to U.S. EPA for approval pursuant to section 303(d)(2), and incorporated into the state's water quality management plan.

15. The Regional Water Board has adopted amendments to the Basin Plan, to incorporate TMDLs for the following:
    (a) The following TMDLs have been or will be incorporated into the Basin Plan within the term of the Order.

(1) Santa Clara River - Nitrogen Compounds
  (A) Regional Water Board Resolution No. 2003-011
  (B) State Water Board Resolution No. 2003-0073
  (C) OAL file No. 04-0123-35
  (D) U.S. EPA approval date March 18, 2004
  (E) Final fee exemption date March 23, 2004 (effective date).
  (F) Compliance is 1 year after effective date (March 23, 2005)

(2) Malibu Creek and Lagoon - Bacteria.
  (A) Regional Water Board Resolution No. 2004-019
  (B) State Water Board Resolution No. 2005-0072
  (C) OAL file No. 05-1018-03 S
  (D) U.S. EPA approval date January 10, 2006
  (E) Final fee exemption date January 24, 2006 (effective date)
  (F) Compliance for Summer Dry is 3 years after effective date (January 24, 2009)
  (G) Compliance for Winter Dry is 6 years after effective date (January 24, 2012)
  (H) Compliance for Wet Weather is 10 years after effective date (January 24, 2016), which is beyond the term of this Order

(3) Toxicity, Chlorpyrifos and Diazinon in the Calleguas Creek, Its Tributaries and Mugu Lagoon.
  (A) Regional Water Board Resolution No. 2005-009
  (B) State Water Board Resolution No. 2005-0067
  (C) OAL file No. 05-1110-02 S
  (D) U.S. EPA approval date March 14, 2006
  (E) Final fee exemption date March 24, 2006 (effective date)
  (F) Compliance for Toxicity and Interim WLA is effective date (March 24, 2006)
  (G) Compliance for Final WLA is 2 years after effective date (March 24, 2008)

(4) Organochlorine (OC) Pesticides, Polychlorinated Biphenyls (PCBs), and Siltation in Calleguas Creek, Its Tributaries and Mugu Lagoon.
  (A) Regional Water Board Resolution No. 2005-010
  (B) State Water Board Resolution No. 2005-0068
  (C) OAL file No. 05-1206-03 S
  (D) U.S. EPA approval date March 14, 2006
  (E) Final fee exemption date March 24, 2006 (effective date)
  (F) Compliance for Interim WLA is effective date (March 24, 2006)
  (G) Compliance for Final WLA is 20 years after effective date (March 24, 2026), which is beyond the term of this Order

(5) Calleguas Creek Watershed Metals

(A) Regional Water Board Resolution No. 2006-012
(B) State Water Board Resolution No. 2006-0078
(C) OAL file No. 06-1222-015 S
(D) U.S. EPA approval date March 26, 2007
(E) Final fee exemption date March 27, 2007 (effective date)
(F) Compliance for Interim WLA is effective date (March 27, 2007)
(G) Compliance for Final WLA is Within 15 years after the effective date (March 27, 2022), which is beyond the term of this Order

(6) Revolon Slough & Beardsley Wash Trash TMDL
(A) Regional Water Board Resolution No. 2007-007
(B) State Water Board Resolution No 2007-0076
(C) OAL file No 2007-1227-05 S
(D) U.S. EPA approval date February 27, 2008
(E) Final fee exemption date March 6, 2008 (effective date)
(F) Compliance for Trash Monitoring & Reporting Plan Submittal is 6 months from effective date (September 6, 2008)
(G) Compliance for Final WLA is 8 years from effective date (March 6, 2016)

(7) Ventura River Estuary Trash TMDL
(A) Regional Water Board Resolution No. 2007-008
(B) State Water Board Resolution No 2007-0072
(C) OAL file No 2007-1227-01 S
(D) U.S. EPA approval date February 27, 2008
(E) Final fee exemption date March 6, 2008 (effective date)
(F) Compliance for Trash Monitoring & Reporting Plan Submittal is 6 months from effective date (September 6, 2008)
(G) Compliance for Final WLA is 8 years from effective date (March 6, 2016)

(8) Harbor Beaches of Ventura County Bacteria TMDL
(A) Regional Water Board Resolution No. 2007-017
(B) State Water Board Resolution No 2008-0072
(C) OAL file No 2007-1023-01 S
(D) U.S. EPA approval date December 18, 2008
(E) Final fee exemption date January 17, 2009 (effective date)

16. The Regional Water Board adopted and approved requirements for new development and significant redevelopment projects in Ventura County to control the discharge of storm water pollutants in post-construction storm water, on January 26, 2000, in Board Resolution No. R-00-02. The Regional Water Board Executive Officer issued the approved Standard Urban Storm Water Mitigation Plans (SUSMPs) on March 8, 2000 for Los Angles County and the Cities in Los Angeles County. Since 2000, new development and redevelopment water quality criteria have been implemented by the Permittees to be consistent with SUSMP. The State Board affirmed the Regional

Water Board action and SUSMPs in State Board Order No. WQ 2000-11, issued on October 5, 2000.

(a) A statewide policy memorandum (dated December 26, 2000), which interprets the Order to provide broad discretion to Regional Water Boards and identifies potential future areas for inclusion in SUSMPs and the types of evidence and findings necessary. Such areas include ministerial projects, projects in environmentally sensitive areas, and water quality design criteria for Retail Gasoline Outlets (RGOs, see Part 6 for definition). The Regional Water Board properly justified the extensions of SUSMPs and water quality criteria to ministerial projects, projects in environmentally sensitive areas, and RGOs, during the adoption of Regional Water Board Order 01-182. The Regional Water Board's action was upheld by the County of Los Angeles Superior Court (In Re: *County of Los Angeles v. State Water Resources Control Board* (2006) 143 Cal.App.4th 985).

(b) The State Water Board's Chief Counsel interpreted the Order to encourage regional solutions and endorsed a mitigation fund or "bank" as alternatives for new development and significant redevelopment. The Regional Water Board has included provisions for regional solutions and the establishment of a mitigation bank in this Order.

17. The Regional Water Board supports Watershed Management planning to address water quality protection in the region. The objective of the Watershed Management planning is to provide a comprehensive and integrated strategy towards water resource protection, enhancement, and restoration while balancing economic and environmental impacts within a hydrologically defined drainage basin or watershed. It emphasizes cooperative relationships between regulatory agencies, the regulated community, environmental groups, and other stakeholders in the watershed to achieve the greatest environmental improvements with available resources.

18. To facilitate compliance with federal regulations, the State Water Board has issued the following 4 Statewide General NPDES Permits associated with storm water:

(a) Industrial General Permit (IASGP- Industrial Activities Storm Water General Permit), NPDES No. CAS000001, issued on November 19, 1991, reissued on September 17, 1992 and April 17, 1997, currently under review for reissuance.

(b) Construction General Permit (CASGP- Construction Activities Storm Water General Permit), NPDES No. CAS000002, issued on August 20, 1992, reissued August 19, 1999, and September 2, 2009.

(c) Small Linear Underground/ Overhead Construction Projects General Permit (small LUPs), NPDES No. CAS000005, issued on June 18, 2003.

(d) Small MS4 Permit WQ Order No. 2003-0005-DWQ, NPDES No. CAS000004, adopted on April 30, 2003.

19. Facilities discharging storm water associated with industrial activities, construction projects that disturb one or more acres of soil, or construction projects that disturb less than one acre but are part of a larger common plan of development or sale that in

total disturbs 1 or more acres, and construction activities associated with small linear underground/ overhead projects that result in land disturbances greater than one acre, but less than five acres (small LUPs), are all required to obtain individual NPDES permits for storm water discharges, or be covered by the statewide General Permits by completing and filing a Notice of Intent (NOI) with the State Board. The U.S. EPA guidance anticipates coordination of the state-administered programs for industrial and construction activities with the local agency program to reduce pollutants in storm water discharges to the MS4.

20. State Water Board Resolution No. 68-16 contains the state Antidegradation Policy, titled "Statement of Policy with Respect to Maintaining High Quality Waters in California" (Resolution 68-16), which applies to all waters of the state, including ground waters of the state, whose quality meets or exceeds (is better than) water quality objectives. Resolution No. 68-16 is considered to incorporate the federal Antidegradation Policy (40 CFR 131.12) where the federal policy applies, (State Water Board Order WQO 86-17). Administrative policies that implement both, federal and state antidegradation policies acknowledge that an activity that results in a minor water quality lowering, even if incrementally small, can result in violation of Antidegradation Policies through cumulative effects, for example, when the waste is a cumulative, persistent, or bioaccumulative pollutant.

(a) Federal Antidegradation Policy (40 CFR 131.12) states that the State shall develop and adopt a statewide antidegradation policy and identify the methods for implementing such policy pursuant to this subpart. The antidegradation policy and implementation methods shall, at a minimum, be consistent with the following:

(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(2) Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.

(3) Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

(4) In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act.

(b) State Water Board Resolution No. 68-16 establishes essentially a 2-step process for compliance with the policy.

(1) Step 1- if a discharge will degrade high quality water, the discharge may be allowed if any change in water quality:

(A) Will be consistent with maximum benefit to the people of the State.

(B) Will not unreasonably affect present and anticipated beneficial use of such water.

(C) Will not result in water quality less than that prescribed in state policies (e.g., water quality objectives in Water Quality Control Plans).

(2) Step 2- any activities that result in discharges to high quality waters are required to:

(A) Meet waste discharge requirements that will result in the best practicable treatment or control of the discharge necessary to avoid a pollution or nuisance.

(B) Maintain the highest water quality consistent with the maximum benefit to the people of the State.

21. The State Water Board on June 17, 1999, adopted Order No. WQ 99-05, which specifies standard receiving water limitation language to be included in all municipal storm water permits issued by the State and Regional Water Boards.

22. Cal. Water Code § 13263(a) requires that waste discharge requirements issued by Water Boards shall implement any relevant water quality control plans that have been adopted; shall take into consideration the beneficial uses to be protected and the water quality objectives reasonably required for that purpose; other waste discharges; and the need to prevent nuisance.

23. Clean Water Act section 402(p)(3)(B)(iii) requires municipal separate storm sewer system (MS4) operators to reduce the discharge of pollutants to the "maximum extent practicable" (MEP). The MEP requirement is analogous to a technology-based requirement in that it focuses upon the feasibility of pollutant reduction measures rather than achievement of water quality standards in the receiving waters to achieve improvements in the quality of the storm water that is discharged. Compliance with the MEP requirement can range from implementation of structural and nonstructural best management practices to installation of end-of-pipe treatment systems. MEP generally provides the MS4 operators the flexibility to determine what controls should be implemented through the development of a storm water management plan, subject to the Regional Water Board's approval. Nevertheless, MEP does not define the limits of pollution control measures that may be required of MS4 operators, and the requirement to implement controls that reduce pollutants to the MEP is not limited by the goal of attaining water quality standards. In some circumstances, compliance with MEP may result in controls more stringent than applicable WQS,

and in others, less stringent. The Regional Water Board may use its discretion to impose other provisions beyond MEP, as it determines appropriate for the control of pollutants, including ensuring strict compliance with water quality standards. (Defenders of Wildlife v. Browner (1999) 191 F.3d 1159, 1168.)

24. The California Supreme Court has ruled that although Water Code section 13263 requires the Water Boards to consider the factors set forth in Water Code section 13241 when issuing an NPDES permit, the Water Boards may not consider the factors to justify imposing pollutant restrictions that are less stringent than the applicable federal regulations require (City of Burbank v. State Water Resources Control Bd. (2005) 35 Cal.4th 613). However, when the pollutant restrictions in an NPDES are more stringent than federal law requires, Water Code section 13263 requires that the Water Boards consider the factors described in section 13241 as they apply to those specific restrictions.

25. The City of Burbank case related to NPDES permits for publicly owned treatment works, not permits for municipal separate storm sewer systems (MS4s). Among other requirements, federal law requires MS4 permits to include requirements to effectively prohibit non-storm water discharges into the storm sewers, in addition to requiring controls to reduce the discharge of pollutants to the maximum extent practicable. Therefore, a 13241 analysis is not required for permit requirements that implement the effective prohibition on the discharge of non-storm water into the MS4, or for practicable controls to reduce the discharge of pollutants to the maximum extent, as those requirements are mandated by federal law.

26. The requirements in this Order may be more specific or detailed than those enumerated in federal regulations under 40 CFR 122.26 or in U.S. EPA guidance. However, the requirements have been designed to be consistent with and within the federal statutory mandates described in CWA § 402(p)(3)(B)(ii) and (iii) and the related federal regulations. Consistent with federal law, all of the conditions in this permit could have been included in a permit adopted by U.S. EPA in the absence of the in lieu authority of California to issue NPDES permits.

27. The Board finds that all requirements in this order are practicable. Moreover, while commenters have alleged that the permit requirements are "beyond MEP," no commenter has presented evidence that demonstrates that any particular permit requirement is not actually practicable.

28. Notwithstanding findings 23 through 27, the Regional Water Board has developed an economic analysis of the permit's requirements, consistent with Water Code section 13241. That analysis is contained in the "Economic Considerations of the Proposed Storm Water (Wet Weather) and Non-Storm Water (Dry Weather) Discharges form the Municipal Separate Storm Sewer Systems within the Ventura County Watershed Protection District, County of Ventura and the Incorporated Cities Therein, June 2, 2008, which is contained in the administrative record for this Order. The Regional

Water Board has considered all of the evidence that has been presented regarding the 13241 factors in adopting this permit, both as contained in the economic analysis and as reflected in the fact sheet and comments (and responses thereto) submitted to the many drafts of this permit. The Regional Water Board finds that the requirements in this Order are reasonably necessary to protect beneficial uses identified in the Basin Plan, and the economic information related to costs of compliance and other 13241 factors are not sufficient to justify failing to protect those beneficial uses. Where appropriate, additional time to implement certain measures and achieve water quality objectives can be provided through the iterative storm water management plan process.

F. Implementation

1. The California Environmental Quality Act (CEQA) (Cal. Pub. Resources Code § 2100 et seq.) requires that public agencies consider the environmental impacts of the projects they approve for development. CEQA applies to projects that are considered discretionary (a governmental agency can use its judgment in deciding whether and how to carry out or approve a project, § 15357) and does not apply to ministerial projects (the law requires a governmental agency to act on a project in a set way without allowing the agency to use its own judgment, § 15369). A ministerial project may be made discretionary by adopting local ordinance provisions or imposing conditions to create decision-making discretion in approving the project. In the alternative, Permittees may establish standards and objective criteria administratively for storm water mitigation for ministerial projects. For water quality purposes regardless of whether a project is discretionary or ministerial, the Regional Water Board considers that all new development and significant redevelopment activity in specified categories, that receive approval or permits from a municipality, are subject to storm water mitigation requirements in a manner that is consistent with and complies with the provisions of CEQA.

2. The objective of this Order is to ensure that discharges from the MS4 in Ventura County comply with water quality standards, including protecting the beneficial uses of receiving waters. To meet this objective, the Order requires that Best Management Practices (BMPs) will be implemented to reduce the discharge of pollutants in storm water to the maximum extent practicable (MEP), and achieve water quality objectives and standards. The U.S. EPA envisioned that municipal storm water programs would be implemented in an iterative manner and improved with each iteration by using information and experience gained during the previous permit term (*Interpretative Policy Memorandum on Reapplication Requirements for MS4 permits* - 61 Fed. Reg. 41697). Municipalities are required to evaluate what is effective and make improvements in order to protect beneficial uses of receiving waters. This Order requires implementation of an effective combination of pollution control and pollution prevention measures, education, public outreach, planning, and implementation of source control BMPs and Structural and Treatment Control BMPs.

The better–tailored BMPs combined with the performance objectives outlined in this Order have the purpose of attaining water quality objectives and standards (*Interim Permitting Approach for Water Quality-Based Effluent Limitations in Storm Water Permits*- 61 Fed. Reg. 43761). Where WLAs have been adopted for storm water (wet weather) and non-storm water (dry weather) discharges from MS4s, this Order requires Permittees to implement controls to achieve the WLAs within the compliance schedule provided in the TMDLs.

3. The implementation of measures set forth in this Order are reasonably expected to reduce the discharge of pollutants conveyed in storm water discharges into receiving waters, and to meet the TMDL WLAs for discharges from MS4s that have been adopted by the Regional Water Board.

4. The U.S. EPA has recommended that all future TMDLs and TMDL amendments be expressed as daily increments consistent with a federal court ruling (*Friends of the Earth, Inc. v. EPA, et al.* No. 05-5015 (D.C. Cir. 2006)). However, this interpretation does not affect the discretionary authority of the Regional Water Board to express NPDES permit limits and conditions in non daily terms because there is no express or implied statutory limitation (CWA §502(11)) (*Establishing TMDL "Daily Loads" in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA, et al. (April 2006) and Implications for NPDES Permits*, U.S. EPA Office of Water, memorandum, Nov 15, 2006). This Order translates MS4 TMDL WLAs adopted by the Regional Water Board into forms "consistent with the assumptions and requirements of the TMDL".

5. During the term of the Order, the Permittees shall implement all necessary control measures to reduce pollutant(s) which cause or continue to cause or contribute to water quality impairments, but for which TMDLs have not yet been developed or approved, to eliminate the water quality impairment(s). Successful efforts to reverse the wet weather impairments during the permit term for such pollutants, may avoid the need for a WLA for wet weather or the need to develop a TMDL in the future.

6. This Order promotes land development and redevelopment strategies that consider water quality and water management benefits associated with smart growth techniques. Such measures may include hydromodification mitigation requirements, minimization of effective impervious area, integrated water resources planning, and low impact development guidelines. (Reference: *Protecting Water Resources with Smart Growth*, EPA 231-R- 04-002, U.S. EPA 2004; *Using Smart Growth Techniques as Storm Water Best Management Practices,* EPA 231-B-05-002, U.S. EPA 2005; *Parking Spaces/Community Places: Finding the Balance through Smart Growth Solutions*, EPA 231-K-06-001, U.S. EPA 2006; *Protecting Water Resources with Higher-Density Development*, EPA 231-R-06-001, U.S. EPA 2006.)

7. The implementation of an effective Public Information and Participation Program is a critical component of a storm water management program. While commercial and

industrial facilities are traditionally subject to multiple environmental regulations and receive environmental protection guidance from multiple sources, the general public, in comparison, receives significantly less education in environmental protection. An effective Public Information and Participation Program is required because:

(a) Activities conducted by the public such as vehicle maintenance, improper household waste materials disposal, improper pet waste disposal and the improper application of fertilizers and pesticides have the potential to generate a significant amount of pollutants that could be discharged in storm water.

(b) An increase in public knowledge of storm water regulations, proper storage and disposal of household wastes, proper disposal of pet wastes and appropriate home vehicle maintenance practices can lead to a significant reduction of pollutants discharged in storm water.

8. This Order also provides flexibility for Permittees to seek authorization from the Regional Water Board Executive Officer to substitute a BMP under this Order with an alternative BMP, if they can provide information and documentation on the effectiveness of the alternative, equal to or greater than the prescribed BMP in meeting the objectives of this Order.

9. This Order contemplates that the Permittees are responsible for considering potential storm water impacts when making planning decisions in order to fulfill the Permittees' CWA requirement to reduce the discharge of pollutants in municipal storm water to the MEP and attain water quality objectives from new development and redevelopment activities. However, the Permittees retain authority to make the final land-use decisions and retain full statutory authority for deciding what land uses are appropriate at specific locations within each Permittee's jurisdiction. This Order and its requirements are not intended to restrict or control local land use decision-making authority.

10. The State Water Board amended the Policy for the Implementation of Toxics Standards In Inland Surface Waters, Enclosed Bays and Estuaries of California (State Implementation Policy – SIP) on February 24, 2005. The SIP does not apply directly to the stormwater discharges. However, this Order includes a Monitoring Program that incorporates Minimum Levels (MLs) established under the State Implementation Policy. The MLs represent the lowest quantifiable concentration for priority toxic pollutants that is measurable with the use of proper method-based analytical procedures and factoring out matrix interference. The SIP's MLs therefore represent the best available science for determining MLs and are appropriate for a storm water monitoring program. The use of MLs allows the detection of toxic priority pollutants at concentrations of concern using recent advances in chemical analytical methods.

11. The International Storm Water Best Management Practices (BMP) Database was established in 1996 as a cooperative initiative between the U.S. EPA and the American Society of Civil Engineers (ASCE) to provide scientifically sound information to improve the design, selection and performance of storm water BMPs.

The BMP database includes standardized BMP monitoring and reporting protocols, a storm water BMP database, BMP performance evaluation protocols, and BMP monitoring guidance. The storm water BMP database is updated approximately semi-annually to add new BMP studies and performance data. The International Storm Water Database is now maintained by the Water Environment Research Foundation (WERF).

12. This Order is not intended to prohibit the inspection for or abatement of vectors by the State Department of Public Health or local vector agencies in accordance with CA Health and Safety Code, § 116110 et seq. Certain Treatment Control BMPs if not properly designed, operated or maintained may create habitats for vectors (e.g. mosquitoes and rodents). This Order contemplates that the Permittees will closely cooperate and collaborate with local vector control agencies and the State Department of Public Health for the implementation, operation, and maintenance of Treatment Control BMPs in order to minimize the risk to public health from vector borne diseases.

13. This Order contemplates that Permittees will ensure that implemented Treatment Control BMPs will not pose a safety or health hazard to the public. This Order contemplates that Permittees will ensure that the maintenance of implemented Treatment Control BMPs will comply with all applicable health and safety regulations, such as, but not limited to requirements for worker entry into confined spaces under OSHA Safety and Training education, § 1926.21(b)(6)(i).

14. This Order incorporates presumptive BMPs to reduce pollutants in storm water discharges from construction sites to the MEP. The BMPs are identified in Table 6 (BMPs at Construction sites less than 1 acre), Table 7 (BMPs at Construction Sites 1 acre or greater but less than 5 acres), and Table 8 (BMPs at Construction sites 5 acres or greater). These BMPs include erosion control, sediment control, and construction site waste management practices. The BMPs listed in part 4.F of the Order were selected based on the Water Boards' experience of regulating such sites since 1992, and are referenced in the *California Stormwater Quality Association (CASQA) Storm Water Best Management Practice Handbook Construction (January 2003)* and from the *Stormwater Quality Handbooks, Project Planning and Design Guide, Stormwater Pollution Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual, Construction Site Best Management Practices (BMPs) Reference Manual, March 2007* (Caltrans Document Number CTSW-RT-06-171.11-1) which serve as an industry standard for California. The BMPs identified in the Tables are technically feasible, practicable, and cost-effective. Where an identified BMP may be impracticable on a particular site, this Order includes a provision to select and implement an alternative BMP, through the BMP substitution provisions in subpart 4.A.2.

15. This Order incorporates presumptive BMPs to reduce pollutants in storm water discharges from commercial and industrial sites to the MEP. The BMPs are

identified in Table 2 (BMPs at Restaurants), Table 3 (BMPs at Automotive Service Facilities), Table 4 (BMPs at Retail Gasoline Outlets), and Table 5 (BMPs at Nurseries). These BMPs include the implementation of good housekeeping practices designed to control pollutants at the source, promote the use of proper waste management practices, and implement control practices to keep pollutants away from any entrance to the storm drainage system. The BMPs listed in part 4.D of the Order were selected based on the Water Boards' experience of regulating such sites since 1992 and referenced in the California Stormwater Quality Association (CASQA) Storm Water Best Management Practice Handbook Commercial/Industrial Activity (January 2003) and from the Caltrans Storm Water Quality Handbook Maintenance Staff Guide May 2003 (Caltrans Document Number CTSW-RT-02-057), which serve as an industry standard for California. The BMPs identified in the Tables are technically feasible, practicable, and cost-effective. Where an identified BMP may be impracticable, this Order includes a provision to select and implement an alternative BMP, through the BMP substitution provisions in subpart 4.A.2.

16. This Order incorporates presumptive BMPs to reduce pollutants in storm water discharges from Public Agency Activities to the MEP. The BMPs are identified in Table 10 (BMPs at Vehicle Maintenance/ Material Storage Facilities/ Corporation Yards). These BMPs include the implementation of good housekeeping practices designed to control pollutants at the source, promote the use of proper waste management practices, implement control practices to keep pollutants away from any entrance to the storm drainage system and from being deposited or discharged directly into waters of the U.S. The BMPs listed in part 4.G of the Order were selected based on the Water Boards' experience of regulating such sites since 1990, and are referenced in the Caltrans Storm Water Quality Handbook Maintenance Staff Guide May 2003 (Caltrans Document Number CTSW-RT-02-057), which serves as a statewide standard for the California Department of Transportation (Caltrans). The BMPs identified in the Table are technically feasible, practicable, and cost-effective, and are the standard of practice for Caltrans sites statewide. Where an identified BMP may be impracticable, this Order includes a provision to select and implement an alternative BMP, through the BMP substitution provisions in subpart 4.A.2.

17. This Order incorporates BMPs to ensure that authorized Non-Storm Water Discharges are not a source of pollutants to the MS4, Table 1 (Required Conditions for Non-Storm Water Discharges). The BMPs included are for the purpose of dechlorination and/or for prevention of erosion and sediment loss, or to reduce other harmful pollutants during the discharge of authorized non-storm water discharges to the MS4. The BMPs listed in part 1.A of the Order were selected from the *American Water Works Association AWWA Guidelines For The Development Of Your Best Management Practices (BMP) Manual For Drinking Water System Releases Developed by the CA-NV AWWA Environmental Compliance Committee (2005)* which serves as an industry standard for California, from the results of studies directed by the Los Angeles Water Board, - *Evaluation of Non-Storm Water Discharges to California Storm Drains and Potential Policies for Effective*

Prohibition Methods, Final Report, University of California, Los Angeles, Contract No. 5-104-140-0 (1997), and *Water Quality Concerns and Regulatory Controls for Non Storm Water Discharges to Storm Drains*, Duke L.D. and M. Kihara, Journal of the American Water Resources Association, Vol. 34: 661-676, (1998), and from the Water Boards' experience of controlling authorized non-storm discharges to the MS4 since 1990. The BMPs identified in the Table are technically feasible, practicable, and cost-effective. Where an identified BMP may be impracticable, this Order includes a provision to select and implement an alternative BMP, through the BMP substitution provisions in subpart 4.A.2.

18. In accordance with Federal regulations at 40 CFR 124.8, a Fact Sheet has been prepared to explain the principal facts and the significant factual, legal, methodological, policy, and economic matters considered in preparing the Order. This Fact Sheet has been made a part of the Administrative Record.

19. The State Water Board adopted statewide General Waste Discharge Requirements for Sanitary Sewer Systems, (WQ Order No. 2006-0003) on May 2, 2006, to provide a consistent, statewide regulatory framework to address sanitary sewer overflows ("SSO Orders"). The SSO Order establishes requirements for public agencies that own or operate sanitary sewer systems to develop and implement sewer system management plans and to report SSOs. SSOs that enter MS4s have the potential to impair the recreational use of receiving waters, and to harm public health. This Order establishes coordination, response, and notification requirements for MS4 Permittees when SSOs result in a discharge to the MS4 system.

20. This Order takes into consideration the housing needs in the area under the Permittees' jurisdiction by balancing the implementation of Smart Growth and Low Impact Development techniques with the protection of the water resources of the region. Although not required, the Regional Water Board considered the need for housing and the appropriate techniques to allow for reasonable development while protecting the receiving waters from degradation.

21. This Order may have an effect on costs required for compliance with the provisions contained herein. Although not required, the Regional Water Board has considered costs in preparing this Order. Though also not required, the Regional Water Board has also considered the factors set forth in Water Code section 13241.

G. Public Notification

1. The issuance of waste discharge requirements pursuant to California Water Code section 13370 et seq. is exempt from the California Environmental Quality Act in accordance with California Water Code section 13389. *County of Los Angeles et al., v. California Water Boards et al.*, (2006), 143 Cal.App.4th 985.

2. The Regional Water Board has notified the Permittees, and interested agencies and persons of its intent to reconsider Order No. 09-0057 and issue waste discharge requirements for this discharge, and has provided them with an opportunity to make statements and submit their comments.

3. The Regional Water Board staff has conducted more than 35 meetings from February 9, 2007 through December 19, 2008, with Permittees, their representatives (Larry Walker Associates, and Somach, Simmons & Dunn), and various stakeholders (Building Industry Association of Southern California/Greater Los Angeles Ventura Chapter (BIA/LAV), California State Dept. of Public Health, Calleguas Municipal Water District, California Stormwater Quality Association (CASQA), City of Downey, City of Los Angeles-EMD, Coalition for Practical Regulation (CPR), Construction Industry Coalition on Water Quality (CICWQ), County of Orange, Geosyntec Consultants, Golden State, Heal the Bay; Local Government Commission, Los Angeles City; Los Angeles County Department of Public Works, Los Angeles County-SD, Los Angeles Department of Water and Power, Metropolitan Water District, Natural Resources Defense Council (NRDC), Richard Watson and Associates, San Bernardino Flood Control District, Santa Monica Bay Restoration Commission, Southern California Coastal Water Research Project, University of California Sea Grant, Ventura CoastKeeper). On April 5, 2007 and September 20, 2007, the Regional Water Board conducted workshops to discuss drafts of the NPDES Order and received input from the Permittees and the public regarding proposed changes.

4. This Order shall serve as a NPDES permit, pursuant to CWA § 402, and shall take effect on (Order adoption date) provided the Regional Administrator of the U.S. EPA has no objections.

5. Pursuant to Cal. Water Code § 13320, any aggrieved party may seek review of this Order by filing a petition with the State Board within 30 days of the date of adoption of the Order by the Regional Water Board. A petition must be sent to:

   State Water Resources Control Board
   Office of the Chief Counsel
   P.O. Box 100
   Sacramento, CA 95812-0100

6. This Order may be modified or alternatively revoked or reissued prior to its expiration date or any administrative extension thereto, in accordance with 40 CFR 122.41(f) and 122.62.

IT IS HEREBY ORDERED that the Permittees, in order to meet the provisions contained in Division 7 of the Cal. Water Code and regulations adopted thereunder, and the provisions of the CWA and regulations adopted thereunder, shall comply with the following:

PART 1 - DISCHARGE PROHIBITIONS

A. Prohibitions - Non-Storm Water Discharges

1. The Permittees shall, within their respective jurisdictions, effectively prohibit non-storm discharges into the MS4 and receiving waters, except where such discharges:
   (a) Originate from a State, Federal, or other source for which they are pre-empted from regulating by State or Federal law; or
   (b) Are covered by a separate individual or general NPDES permit, or conditional waiver for irrigated lands; or
   (c) Flows from fire fighting activities.
   (d) Fall within one of the categories below, are not a source of pollutants that exceed water quality standards, and meet all conditions where specified by the Regional Water Board Executive Officer:
      (1) Category A – Natural flows
         (A) Stream diversions authorized by the State Water Board
         (B) Natural springs and rising ground water
         (C) Uncontaminated ground water infiltration [as defined by 40 CFR 35.2005(20)][1]
         (D) Flows from riparian habitats or wetlands
      (2) Category B – Flows incidental to urban activities, providing conditions listed in table below:
         (A) Discharges from potable water sources[2]
         (B) Gravity flow from foundation, footing and crawl space drains.
         (C) Air conditioning condensate
         (D) Reclaimed and potable landscape irrigation runoff
         (E) Dechlorinated/ debrominated swimming pool discharges [see def. part 6]
         (F) Non-commercial car washing by residents or non-profit organizations
         (G) Sidewalk rinsing
         (H) Pooled non-storm water from treatment BMPs[3]

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[1] NPDES permit for ground water dewatering is required within the Los Angeles Region including Ventura County.

[2] The term applies to low volume, incidental and infrequent releases that are innocuous from a water quality perspective. Those releases for dewatering or hydro-testing or flushing of water supply and distribution mains and incidental and infrequent releases from well heads shall be allowed with the implementation of appropriate BMPs until such time as a new General Permit is adopted that addresses those types of releases. Discharges from hydrostatic pipe testing shall be subject to separate NPDES general permit coverage (CAG674001) and discharges from utility vaults shall be conducted under coverage of a separate NPDES permit specific to that activity.

[3] All storm water BMPs shall at a minimum be maintained at a frequency as specified by the manufacturer, and designed to drain within 72 hours of the end of a rain. Storm water treatment BMPs may be drained to the MS4 under this Order if the discharge is not a source of pollutants. Sediments shall be disposed of properly, in compliance with all applicable local, state, and federal policies, acts, laws, regulations, ordinances, and statutes.

Table 1 – Required Conditions for Non-Storm Water Discharges

Type of Discharges:	**Conditions under which allowed:**	**Required conditions for discharge to occur:**
Stream diversions permitted by the State Board	Authorization by the State Water Board	Permittees shall comply with all conditions in the authorization.
Natural springs and rising ground water	1. Ground water dewatering requires a separate NPDES permit. 2. Segregate flow to prevent introduction of pollutants.	Permittees shall comply with all conditions in the authorization.
Uncontaminated ground water infiltration [as defined by 40 CFR 35.2005(20)] (Utility vault dewatering requires a separate NPDES permit.)	NPDES permit for ground water dewatering is required within the Los Angeles Region including Ventura County	Permittees shall comply with all conditions in the authorization.
Flows from riparian habitats or wetlands	Provided that all necessary permits or authorizations are received prior to diverting the stream flow.	Permittees shall comply with all conditions in the authorization.
Discharges from potable water sources	See Footnote #2. Provided discharges from water lines and potable water sources shall be dechlorinated, pH adjusted if necessary, reoxygenated, and volumetrically and velocity controlled to prevent resuspension of sediments.	See Footnote #2. To be discharged, this type of water shall be dechlorinated using aeration and/ or sodium thiosulfate and/ or other appropriate means and/or be allowed to infiltrate to the ground. BMPs such as sand bags or gravel bags, or other appropriate means shall be utilized to prevent sediment transport. All sediments shall be collected and disposed of in a legal and appropriate manner.
Drains for foundation, footing and crawl drains	Dewatering requires a separate NPDES permit.	Permittees shall comply with all conditions in the authorization.
Air conditioning condensate	Segregation of flow to prevent introduction of pollutants. Percolation whenever possible.	Permittees shall comply with all conditions in the authorization.
Water from crawl space pumps	Dewatering requires a separate NPDES permit within the Los Angeles Region including Ventura County	Permittees shall comply with all conditions in the authorization.
Reclaimed and potable landscape irrigation runoff	Segregation of flow to prevent introduction of pollutants.	Implement conservation programs to minimize this type of discharge by using less water.
Dechlorinated/ debrominated	Where the discharge is not excepted by the sanitary sewer operator. Swimming pool	Pool water may be dechlorinated using time,

Type of Discharges:	Conditions under which allowed:	Required conditions for discharge to occur:
swimming pool discharges [see definition Part 6]	discharges are to be dechlorinated, pH adjusted if necessary, aerated to remove chlorine if necessary, and volumetrically and velocity controlled to prevent resuspension of sediments. Cleaning waste water and filter back wash shall not be discharged to municipal separate storm sewers. No discharges are allowed containing salts in excess of Water Quality Standards. Chlorine residual in discharge shall not exceed 0.1mg/L.	aeration, and/ or sodium thiosulfate.
Non-commercial car washing by residents or non-profit organizations	Preferably at a commercial carwash or designated area where wash water can percolate. Pumps or vacuums may be used to direct water to pervious areas.	Permittees shall comply with all conditions in the authorization.
Sidewalk rinsing	This may be undertaken only if high pressure low volume is used as described in the glossary under "Sidewalk Rinsing".	
Pooled storm water from treatment BMPs	All storm water BMPs shall at a minimum be maintained at a frequency as specified by the manufacturer. All storm water BMPs shall be designed to drain within 72 hours of the end of the rain event to avoid the breeding of vectors. Storm water treatment BMPs may be drained to the MS4 under this Order if the discharge is not a source of pollutants. The discharge shall cease before the discharge has become a source of a pollutant(s), (bottom sediment included). Sediments shall be disposed of properly, in compliance with all applicable local, state, and federal policies, acts, laws, regulations, ordinances, and statutes.	

2. If the Regional Water Board Executive Officer determines that any of the preceding categories of non-storm water discharges are a source of pollutants that exceed water quality standards, the Permittee(s) shall either:
   (a) Prohibit the discharge from entering the MS4; or
   (b) Authorize the discharge category and require implementation of appropriate or additional BMPs to ensure that the discharge will not be a source of pollutants; or
   (c) Require or obtain coverage under a separate RWQCB or SWRCB permit for discharge into the MS4.

PART 2 – RECEIVING WATER LIMITATIONS

1. Discharges from the MS4 that cause or contribute to a violation of water quality standards are prohibited.

2. Discharges from the MS4 of storm water, or non-storm water, for which a Permittee is responsible, shall not cause or contribute to a condition of nuisance.

3. The Permittee shall comply with Receiving Water Limitations 1 and 2 through timely implementation of control measures and other actions to reduce pollutants in the storm water discharges in accordance with the requirements of this Order including any modifications. The Permittees' Program shall be designed to achieve compliance with Receiving Water Limitations 1 and 2. If exceedance(s) of water quality objectives or water quality standards (collectively WQS) persist, notwithstanding implementation of this permit, the Permittees shall ensure compliance with Receiving Water Limitations 1 and 2 by complying with the following procedure:
   (a) Upon determination by either the Permittees or the Regional Water Board that discharges are causing or contributing to an exceedance of an applicable WQS, the Permittee(s) upstream of the point of discharge shall promptly notify and thereafter submit a report to the Regional Water Board Executive Officer that describes BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedance of WQSs. The report may be included with the Annual Report, unless the Regional Water Board Executive Officer directs an earlier submittal. The Regional Water Board Executive Officer may require modifications to the report.
   (b) Submit any modifications to the report required by the Regional Water Board Executive Officer within 30 days of notification.
   (c) Within 30 days following approval of the Report described above by the Regional Water Board Executive Officer, the Permittees shall revise their Program and monitoring program to incorporate the approved modified BMPs that have been and will be implemented, the implementation schedule, and any additional monitoring required.
   (d) Implement the revised Program and monitoring program according to the approved schedule.

4. Permittees shall annually report the effectiveness of BMPs in reducing exceedances of receiving water limitations. The Regional Water Board Executive Officer may direct implementation of additional BMPs if there are continuing or recurring exceedances of the same receiving water limitation.

PART 3 - STORM WATER QUALITY MANAGEMENT PROGRAM IMPLEMENTATION

A. General Requirements

1. Each Permittee shall, at a minimum, adopt and implement applicable terms of this Order within its jurisdictional boundary. The Principal Permittee shall be responsible for program coordination as described in this Order as well as compliance with applicable portions of the permit within its jurisdiction. This Order shall be implemented no later than July 8, 2010, unless a later date has been specified for a particular provision in this Order and provided the Regional Administrator of the U.S. EPA has no objections.

2. Each Permittee shall comply with the requirements of 40 CFR 122.26(d)(2) and implement programs and control measures so as to reduce the discharges of pollutants in storm water to the MEP and achieve water quality standards.

3. Each Permittee shall require that treatment control BMPs being implemented under the provisions of this Order shall be designed, at a minimum, to achieve the BMP performance criteria for storm water pollutants likely to be discharged as identified in Attachment "C", for an 85th percentile 24-hour runoff event determined as the maximized capture storm water volume for the area using a 48 to 72-hour draw down time, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998). Expected BMP pollutant removal performance for effluent quality was developed from the WERF-ASCE/ U.S. EPA International BMP Database. Permittees shall select Treatment BMPs based on the primary class of pollutants likely to be discharged from the site/facility (e.g. metals from an auto repair shop). Permittees may develop guidance for appropriate Treatment BMPs for project type based on Attachment "C". For the treatment of pollutants causing impairments within the drainage of the impaired waterbody, permittees shall select BMPs from the top three performing BMP categories or alternative BMPs that are designed to meet or exceed the performance of the highest performing BMP for the pollutant causing impairment.

4. Each Permittee shall implement programs and measures to comply with the TMDLs' WLAs for the MS4 as specified in Part 5.

5. If TMDL requirements, including Implementation Plans and Reports, address substantially similar requirements as the MS4 permit, the Executive Officer may approve the applicable reports, plans, data or submittals under the applicable TMDL as fulfilling requirements under the MS4.

B. Legal Authority

1. Permittees shall possess the necessary legal authority to prohibit, including, but not limited to:
   (a) Illicit connections and illicit discharges, and to remove illicit connections.
   (b) The discharge of non-storm water to the MS4 from:
      (1) Washing or cleaning of gas stations, auto repair garages, or other types of automotive service facilities
      (2) Mobile auto washing, carpet cleaning, steam cleaning, sandblasting and other such mobile commercial and industrial operations
      (3) Areas where repair of machinery and equipment which are visibly leaking oil, fluid or antifreeze, is undertaken
      (4) Storage areas for materials containing grease, oil, or other hazardous substances, and uncovered receptacles containing hazardous materials
      (5) Swimming pools[1] that have a concentration greater than:
         (A) Chlorine/ bromine- 0.1mg/L
         (B) Chloride- 250mg/L
      (6) Swimming pool filter backwash
      (7) Decorative fountains and ponds
      (8) Industrial/ Commercial areas, including restaurant mats
      (9) Concrete truck cement, pumps, tools, and equipment washout
      (10) Spills, dumping, or disposal of materials other, such as:
         (A) Litter, landscape and construction debris, garbage, food, animal waste, fuel or chemical wastes, batteries, and any other materials which have the potential to adversely impact water quality; and
         (B) Any pesticide, fungicide or herbicide
      (11) Stationary and mobile pet grooming facilities
      (12) Trash container leachate

2. The Permittees shall possess adequate legal authority to:
   (a) Control through interagency agreement, the contribution of pollutants from one portion of the MS4 to another portion of the MS4.
   (b) Require persons within their jurisdiction to comply with conditions in the Permittees' ordinances, permits, contracts, model programs, or orders (i.e. hold dischargers to its MS4 accountable for their contributions of pollutants and flows).
   (c) Utilize enforcement measures (e.g., stop work orders, notice of violations, fines, referral to City, County, and/ or District Attorneys, referral to strikeforces, etc.) by ordinances, permits, contracts, orders, administrative authority, and civil and criminal prosecution.[2]

[1] MS4s discharging directly to the ocean are not subject to this prohibition.
[2] In the case of private responsible parties such as, HOAs, the Permittee must retain enforcement authority.

(d) Control pollutants, including potential contribution[1] in discharges of storm water runoff associated with industrial activities, including construction activities to its MS4, and control the quality of storm water runoff from industrial sites, including construction sites.
(e) Carry out all inspections, surveillance and monitoring procedures necessary to determine compliance and non-compliance with permit conditions including the prohibition on illicit discharges to the MS4.
(f) Require the use of control measures to prevent or reduce the discharge of pollutants to achieve water quality objectives.
(g) Require that Treatment Control BMPs be properly operated and maintained.

3. Each Permittee has adopted a Storm Water Quality Ordinance based upon a countywide model. Each Permittee shall ensure, no later than [two years after Order adoption date], that its Storm Water Quality Ordinance authorizes the Permittee to enforce all requirements of this Order.

4. Each Permittee shall submit no later than (two years after Order adoption date), a statement by its legal counsel that the Permittee has obtained and possesses all necessary legal authority to comply with this Order through adoption of ordinances and/ or municipal code modifications.

C. Fiscal Resources

1. The Permittees shall implement the activities required to comply with the provisions of this Order.[2] Each Permittee shall:
   (a) Submit an Annual Budget Summary that shall include:
      (1) Budgets for the upcoming report year (estimated expenditure) for the following specific categories (estimated percentages and written explanations where necessary):
         (A) Program Management Activities.
            (i) Overall Administrative costs
         (B) Program Implementation Activities (permit related activities only). Provide figures breakdown of expenditures for the categories below:
            (i) Illicit connection/ illicit discharge program.
            (ii) Development planning and approval
            (iii) Construction program including inspection activities
            (iv) Industrial/ Commercial program including inspection activities
            (v) Public Agency Activities
               (I) Maintenance and inspection of Treatment Control BMPs
               (II) Municipal Street Sweeping

[1] "Potential contributions" and "potential to discharge," means adequate legal authority to prevent an actual discharge of pollutants to the municipal separate storm sewer system.
[2] The sources of funding may be the general funds, and/or Benefit Assessment, plan review fees, permit fees, industrial/ commercial user fee, revenue bonds, grants or other similar funding mechanism.

(III) Municipal Drainage Maintenance including catch basin clean-outs
(IV) Other costs associated with storm water management (describe)

(vi) Public Information and Participation.
(vii) Monitoring Program
(viii) Miscellaneous Expenditures (describe)

D. Modifications/ Revisions

1. No later than (two years after the Order adoption date), each Permittee shall modify its storm water management programs, protocols, practices, and municipal codes to make them consistent with the requirements herein.

E. Designation and Responsibilities of the Principal Permittee

1. The Ventura County Watershed Protection District is hereby designated as the Principal Permittee. The Principal Permittee shall:
   (a) Participate in the County Environmental Crimes Task Force
   (b) Coordinate and facilitate activities necessary to comply with the requirements of this Order, but the Principal Permittee is not responsible for ensuring compliance of any other individual Permittee
   (c) Coordinate permit activities among Permittees and act as liaison between the Permittees and the Regional Water Board on permitting issues
   (d) Provide technical and administrative support for committees that will be organized to implement this Order and its requirements
   (e) Evaluate, assess, and synthesize the results of the monitoring program and the effectiveness of the implementation of BMPs
   (f) Convene the Committee Meetings constituted pursuant to subpart 4.F.1., below, upon designation of representatives
   (g) Implement the Countywide Monitoring Program required under the Order and evaluate, assess and synthesize the results of the monitoring program
   (h) Provide personnel and fiscal resources for the collection, processing and submittal to the Regional Water Board of monitoring and annual reports, and summaries of other reports required under this Order

F. Responsibilities of the Permittees

1. Each Permittee is required to comply with the requirements of this Order applicable to discharges within its boundaries (see Findings- Permit Coverage D.1 and D.2). Permittees are not responsible for the implementation of the provisions applicable to the Principal Permittee or other Permittees. Each Permittee shall:
   (a) Comply with the requirements of this Order and any modifications thereto

(b) Coordinate among its internal departments and agencies, as necessary, to facilitate the implementation of the requirements of this Order applicable to such Permittees in an efficient and cost-effective manner
(c) Participate in intra-agency coordination (e.g., Planning Department, Fire Department, Building and Safety, Code Enforcement, Public Health, Parks and Recreation, and others) necessary to successfully implement the provisions of this Order
(d) Report, in addition to the Budget Summary, any supplemental dedicated budgets for the same categories
(e) Participate in Committee Meetings, as necessary

PART 4 - SPECIAL PROVISIONS (BASELINE)

A. General Requirements

1. This Order and the provisions herein are intended to develop, achieve, and implement a timely, comprehensive, cost-effective storm water pollution control program to reduce the discharge of pollutants in storm water to the MEP and not cause or contribute to exceedances of water quality standards for the permitted areas in the County of Ventura.

2. Best Management Practice Substitution
   (a) The Regional Water Board Executive Officer may approve any site-specific BMP substitution upon written request by a Permittee(s) and after public notice, if the Permittee can document that:
      (1) The proposed alternative BMP or program will meet or exceed the objective of the original BMP or program in the reduction of storm water pollutants.
      (2) The fiscal burden of the original BMP or program is greater than the proposed alternative and does not achieve a greater improvement in storm water quality.
      (3) The proposed alternative BMP or program will be implemented within a similar period of time.
      (4) BMP substitution will be in accordance with the public review provisions of the Order (Part 7.C.1 and Part 7.C.2).

B. Watershed Initiative Participation

1. The Principal Permittee shall participate in water quality meetings for watershed management and planning, including but not limited to the following:
   (a) Southern California Stormwater Monitoring Coalition (SMC)
   (b) Other Watershed planning groups as appropriate

2. The Principal Permittee shall participate in the following regional water quality programs, and projects for watershed management and planning:

(a) SMC Regional Monitoring Programs
  (1) Southern California Regional Bioassessment
    (A) Level of effort per watershed
      (i) Probabilistic sites per watershed
        (I) Ventura River - Six
        (II) Santa Clara River - Three
        (III) Calleguas Creek - Six
      (ii) Integrator sites per watershed
        (I) Ventura River - One
        (II) Santa Clara River - One
        (III) Calleguas Creek – One
      (iii) Fixed bioassessment sites
        (I) The Permittees shall perform bioassessment at one fixed urban site in each major watershed. Site selection shall be determined by the results of the first year SMC results, as approved by the Executive Officer.

(b) Southern California Bight Projects
  (1) Regional Monitoring Survey – 2008, and successive years.

C. Public Information and Participation Program (PIPP)

1. The Principal Permittee shall implement a Public Information and Participation Program (PIPP) that includes, but is not limited to, the requirements listed in this part. The Principal Permittee shall coordinate with Permittees to implement specific PIPP requirements. The objectives of the PIPP are as follows:

   (a) To increase the knowledge of the target audience about the MS4, the adverse impacts of storm water pollution on receiving waters and potential solutions to mitigate the impacts

   (b) To change the waste disposal and storm water pollution generation behavior of target audiences by encouraging implementation of appropriate solutions

   (c) To involve and engage communities in Ventura County to participate in mitigating the impacts of storm water pollution

2. Residential Program

   (a) "No Dumping" Message

   Each Permittee shall label all storm drain inlets that they own with a legible "no dumping" message. In addition, signs with prohibitive language discouraging illegal dumping shall be posted at designated public access points to creeks, other relevant waterbodies, and channels. Signage and storm drain messages shall be legible and maintained.

   (b) Public Reporting

   Each Permittee shall identify staff who will serve as the contact person(s) for reporting clogged catch basin inlets and illicit discharges/dumping, faded or missing catch basin labels, and general storm water management information.

Permittees shall include this information, updated by July 1 of each year, in public information media such as the government pages of the telephone book, and internet web sites. The Principal Permittee shall compile a list of the general public reporting contacts submitted by all Permittees and make this information available on the web site (http://www.vcstormwater.org/contact.htm) and upon request. Each Permittee is responsible for providing current, updated information to the Principal Permittee.

(c) Outreach and Education

(1) Collaboratively, the Permittees shall implement the following activities:

(A) Conduct a Storm Water pollution prevention advertising campaign.

(B) Conduct Storm Water pollution prevention public service announcements.

(C) Distribute storm water pollution prevention public education materials no later than (365 days after Order adoption date) to:

(i) Automotive parts stores

(ii) Home improvement centers/ lumber yards/ hardware stores

(iii) Pet shops/ feed stores

(D) Public education materials shall include, but are not limited to information on the proper disposal, storage, and use of:

(i) Vehicle waste fluids

(ii) Household waste materials

(iii) Construction waste materials

(iv) Pesticides and fertilizers (including integrated pest management practices-IPM)

(v) Green waste (including lawn clippings and leaves)

(vi) Animal wastes

(E) Work with existing local watershed groups or organize watershed Citizen Advisory Groups/ Committees to develop effective methods to educate the public about storm water pollution no later than (365 days after Order adoption date).

(F) Organize events targeted to residents and population subgroups; and

(G) Maintain the Countywide storm water website (www.vcstormwater.org), which shall include educational material listed in the preceding subpart C.2(c)(1)(D).

(2) The Principal Permittee shall develop a strategy to educate ethnic communities through culturally effective methods. Details of this strategy should be incorporated into the PIPP, and implemented, no later than (365 days after Order adoption date).

(3) Each Permittee shall continue the existing outreach program to residents on the proper disposal of litter, green waste, pet waste, proper vehicle maintenance, lawn care and water conservation practices.

(4) Each Permittee shall conduct educational activities within its jurisdiction and participate in countywide events.

(5) The Permittees shall make a minimum of 5 million impressions per year to the general public related to storm water quality, with a minimum of 2.5

million impressions via newspaper, local TV access, local radio and/ or internet access.

(6) The Principal Permittee, in cooperation with the Permittees, shall provide schools within each School District in the County with materials, including, but not limited to, videos, live presentations, and other information necessary to educate a minimum of 50 percent of all school children (K-12) every 2 years on storm water pollution. Alternatively, a Permittee may submit a plan to the Regional Water Board Executive Officer for consideration no later than (90 days after Order adoption date), to provide outreach in lieu of the school curriculum. Pursuant to Water Code section 13383.6, the Permittees, in lieu of providing educational materials/ funding to School Districts in the County, may opt to provide an equivalent amount of funds or fraction thereof to the Environmental Education Account established within the State Treasury.

(7) Each Permittee shall provide the contact information for their appropriate staff responsible for storm water public education activities to the Principal Permittee and contact information changes no later than 30 days after a change occurs.

(8) The Permittees shall develop and implement a behavioral change assessment strategy no later than (365 days after Order adoption date) in order to determine whether the PIPP is demonstrably effective in changing the behavior of the public. The strategy shall be developed based on current sociological data and studies.

(d) Pollutant-Specific Outreach

The Principal Permittee, in cooperation with the Permittees, shall coordinate to develop outreach programs that focus on metals, urban pesticides, bacteria and nutrients as the pollutants of concern no later than (365 days after Order adoption date). Metals may be appropriately addressed through the Industrial/ Commercial Facilities Program (e.g. the distribution of educational materials on appropriate BMPs for metal fabrication and recycling facilities that have been identified as a potential source). Region-wide pollutants may be included in the Principal Permittee's mass media outreach program.

3. Businesses Program

(a) Corporate Outreach

(1) The Permittees shall work with other regional or statewide agencies and, associations such as the California Storm Water Quality Association (CASQA), to develop and implement a Corporate Outreach program to educate and inform corporate franchise operators and/or local facility managers about storm water regulations and BMPs. Once developed, the program shall target a minimum of four Retail Gasoline Outlets (RGO) franchisers and cover a minimum of 80% of RGO franchisees in the county, four retail automotive parts franchisers, two home improvement center franchisers and six restaurant franchisers. Corporate outreach for all target facilities shall be conducted not less than twice during the term of this

Order, with the first outreach contact to begin no later than two years after Order adoption date. At a minimum, this program shall include:

(A) Confer with franchise operators and/or local facility managers to explain storm water regulations.

(B) Distribution and discussion of educational material regarding storm water pollution and BMPs, and provide managers with recommendations to facilitate employee and facility compliance with storm water regulations.

(b) Business Assistance Program

(1) The Permittees shall implement a Business Assistance Program to provide technical information to small businesses to facilitate their efforts to reduce the discharge of pollutants in storm water. The Program shall include:

(A) On-site, telephone or e-mail consultation regarding the responsibilities of businesses to reduce the discharge of pollutants, procedural requirements, and available guidance documents.

(B) Distribution of storm water pollution prevention education materials to operators of auto repair shops, car wash facilities (including mobile car detailing), mobile carpet cleaning services, commercial pesticide applicator services and restaurants.

D. Industrial/ Commercial Facilities Program

I. Each Permittee shall require implementation of pollutant reduction and control measures, unless precluded by local ordinances, at industrial and commercial facilities, with the objective of reducing pollutants in storm water. Except where specified otherwise in this Order, pollutant reduction and control measures may be used alone or in combination, and may include Treatment Control, Source Control BMPs, and operation and maintenance procedures, which may be applied before, during, and/ or after pollutant generating activities. At a minimum, the Industrial/ Commercial Facilities Control Program shall include requirements to:

(a) Track

(b) Inspect

(c) Ensure compliance with municipal ordinances at industrial and commercial facilities that are critical sources of pollutants in storm water

1. Inventory of Critical Sources

(a) Each Permittee shall maintain a watershed-based inventory or database of all facilities within its jurisdiction that are critical sources of storm water pollution. Critical Sources to be tracked are summarized below, and specified in Attachment "D":

(1) Commercial Facilities

(A) Restaurants

(B) Automotive service facilities

(C) RGOs and automotive dealerships

(D) Nurseries and nursery centers
(2) U.S. EPA Phase I, II Facilities
(3) Other Federally-mandated Facilities [as specified in 40 CFR 122.26(d)(2)(iv)(C)]
(A) Municipal landfills
(B) Hazardous waste treatment, disposal, and recovery facilities
(C) Facilities subject to SARA Title III (also known as the Emergency Planning and Community Right-to-Know Act (EPCRA))

(b) Each Permittee shall include the following minimum fields of information for each critical source industrial and commercial facility
(1) Name of facility and name of owner/ operator.
(2) Address of facility
(3) Coverage under the IASGP or other individual or general NPDES permits or any applicable waiver issued by the Regional or State Board pertaining to runoff discharges.
(4) A narrative description including Standard Industrial Classification (SIC) System/ North American Industry Classification System (NAICS) codes that best describe the industrial activities performed and principal products used at each facility and status of exposure to storm water.

(c) The Regional Water Board recommends that Permittees include additional fields of information, such as material usage and/ or industrial output, and discrepancies between SIC System/ NAICS Code designations (as reported by facility operators) and identify the actual type of industrial activity that has the potential to pollute storm water. In addition, the Regional Water Board recommends the use of an automated database system, such as a Geographical Information System (GIS) or Internet-based system.

(d) Each Permittee shall update its inventory of critical sources at least annually. The update may be accomplished through collection of new information obtained through field activities or through other readily available inter and intra-agency informational databases (e.g. business licenses, pretreatment permits, sanitary sewer hook-up permits, and similar information).

2. Inspect Critical Sources

(a) Commercial Facilities

Permittee shall inspect all facilities identified in subpart 4.D.1. twice during the 5-year term of the Order, provided that the first inspection occurs no later than (2 years after Order adoption date). A minimum interval of 6 months between the first and the second mandatory compliance inspection is required. In addition, each Permittee shall implement the activities outlined in the following subparts. At each facility, inspectors shall verify that the operator is implementing the source control BMPs. The Permittees may require implementation of additional BMPs where storm water flows from the MS4 discharge to an environmentally sensitive area (ESA, see Part 6 for definition) or a CWA § 303(d) listed waterbody (see subpart 3(b) below).

(1) Restaurants-
Level of inspections: Each Permittee shall inspect all restaurants within its jurisdiction to confirm that storm water BMPs are being effectively implemented in compliance with State law, County and municipal ordinances. BMPs in Table 2 (BMPs at Restaurants) shall be implemented, unless the pollutant generating activity does not occur.

Table 2 - BMPs at Restaurants

Pollutant-Generating Activity	**BMP Narrative Description**	**2003 California Stormwater BMP Handbook Industrial and Commercial BMP Identification #**
Waste/ Hazardous Materials Storage, Handling and Disposal	Implementation of effective storage, handling and disposal procedures for hazardous materials.	By Municipality
Unauthorized Non-Storm Water Discharges	Effective elimination of non-storm water discharges.	SC-10
Accidental Spills/ Leaks	Implementation of effective spills/ leaks prevention and response procedures.	SC-11
Outdoor Storage of Raw Materials	Implementation of effective source control practices and structural devices.	SC-33
Storage and Handling of Solid Waste	Implementation of effective solid waste storage/ handling practices and appropriate control measures	SC-34
Parking/ Storage Area Maintenance	Implementation of effective parking/ storage area designs and housekeeping/ maintenance practices	SC-43
Storm Water Conveyance System Maintenance	Implementation of proper conveyance system operation and maintenance protocols.	SC-44

(2) Automotive Service Facilities-

Level of Inspection: Each Permittee shall confirm that BMPs are being effectively implemented at each facility within its jurisdiction, in compliance with County and municipal ordinances. The inspections shall verify that BMPs in Table 3 (BMPs at Automotive Service Facilities) are being implemented, unless the pollutant generating activity does not occur.

Table 3 - BMPs at Automotive Service Facilities

Pollutant-Generating Activity	**BMP Narrative Description**	**2003 California Stormwater BMP Handbook Industrial and Commercial BMP Identification #**
Unauthorized Non-Storm Water Discharges	Effective elimination of non-storm water discharges.	SC-10
Accidental Spills/ Leaks	Implementation of effective spills/ leaks prevention and response procedures.	SC-11
Vehicle/ Equipment Fueling	Implementation of effective fueling source control devices and practices.	SC-20
Vehicle/ Equipment Cleaning	Implementation of effective equipment/ vehicle cleaning practices and appropriate wash water management practices	SC-21
Vehicle/ Equipment Repair	Implementation of effective vehicle/ equipment repair practices and source control devices.	SC-22
Outdoor Liquid Storage	Implementation of effective outdoor liquid storage source controls and practices.	SC-31
Outdoor Storage of Raw Materials	Implementation of effective source control practices and structural devices.	SC-33
Storage and Handling of Solid Waste	Implementation of effective solid waste storage/ handling practices and appropriate control measures	SC-34
Parking/ Storage Area Maintenance	Implementation of effective parking/ storage area designs and housekeeping/ maintenance practices	SC-43
Storm Water Conveyance System Maintenance Practices	Implementation of proper conveyance system operation and maintenance protocols.	SC-44

(3) Retail Gasoline Outlets and Automotive Dealerships-
Level of Inspections: Each Permittee shall confirm that BMPs are being effectively implemented at each facility within its jurisdiction, in compliance with County and municipal ordinances. The inspections shall verify that BMPs in Table 4 (BMPs at Retail Gasoline Outlets) are being implemented, unless the pollutant generating activity does not occur.

Table 4 - BMPs at Retail Gasoline Outlets

Pollutant-Generating Activity	**BMP Narrative Description**	**2003 California Stormwater BMP Handbook Industrial and Commercial BMP Identification #**
Unauthorized Non-Storm Water Discharges	Effective elimination of non-storm water discharges.	SC-10
Accidental Spills/ Leaks	Implementation of effective spills/ leaks prevention and response procedures.	SC-11
Vehicle/ Equipment Fueling	Implementation of effective fueling source control devices and practices.	SC-20
Vehicle/ Equipment Cleaning	Implementation of effective wash water control devices.	SC-21
Outdoor Storage of Raw Materials	Implementation of effective source control practices and structural devices.	SC-33
Storage and Handling of Solid Waste	Implementation of effective solid waste storage/ handling practices and appropriate control measures	SC-34
Building and Grounds Maintenance	Implementation of effective facility maintenance practices.	SC-41
Parking/ Storage Area Maintenance	Implementation of effective parking/ storage area designs and housekeeping/ maintenance practices	SC-43

(4) Commercial Nurseries and Nursery Centers (Merchant Wholesalers, Nondurable Goods, and Retail Trade)-

Level of Inspection: Each Permittee shall confirm that BMPs are being effectively implemented at each facility within its jurisdiction, in compliance with County and municipal ordinances. The inspections shall verify that BMPs in Table 5 (BMPs at Nurseries) are being implemented, unless the pollutant generating activity does not occur.

Table 5 - BMPs at Nurseries

Pollutant-Generating Activity	BMP Narrative Description	2003 California Stormwater BMP Handbook Industrial and Commercial BMP Identification #
Unauthorized Non-Storm Water Discharges	Effective elimination of non-storm water discharges.	SC-10
Outdoor Loading/ Unloading	Implementation of effective outdoor loading/ unloading practices.	SC-30
Outdoor Liquid Storage	Implementation of effective outdoor liquid storage source controls and practices.	SC-31
Outdoor Equipment Operations	Implementation of effective outdoor equipment source control devices and practices.	SC-32
Outdoor Storage of Raw Materials	Implementation of effective source control practices and structural devices.	SC-33
Building and Grounds Maintenance	Implementation of effective facility maintenance practices.	SC-41

(b) Industrial Facilities

Each Permittee shall conduct compliance inspections as specified below.

(1) **Frequency of Inspection**

(A) Each Permittee shall perform an initial inspection at all industrial facilities identified by the U.S. EPA in 40 CFR 122.26(c) no later than (2 years after Order adoption date). After the initial inspection, all facilities determined as having exposure of industrial activities to storm water are subject to a second mandatory compliance inspection. A minimum interval of 6 months between the first and the second compliance inspection is required.

(B) Following the first mandatory compliance inspection, a Permittee shall perform a second mandatory compliance inspection yearly at a minimum of 20% of the facilities determined not to have exposure of industrial activities to storm water. The purpose of this inspection is to verify the continuity of the no exposure status. Facilities determined

as having exposure will be notified that they must obtain coverage under the IASGP. A facility need not be inspected more than twice during the term of the Order unless subject to an enforcement action. A minimum interval of 6 months in between the first and the second compliance inspection is required.

(C) Applicable to all facilities: A Permittee need not inspect facilities that have been inspected by the Regional Water Board within the previous 24 month interval. However, if the Regional Water Board performed only one inspection, the Permittee shall conduct the second required mandatory compliance inspection.

(2) **Level of Inspection:** Each Permittee shall confirm that each operator:

(A) Has a current Waste Discharge Identification (WDID) number for facilities discharging storm water associated with industrial activity, and that a Storm Water Pollution Prevention Plan (SWPPP) is available on-site.

(B) Is effectively implementing BMPs in compliance with County and municipal ordinances. Facilities must implement the source control BMPs identified in subpart 4.D.2. and Appendix D, *California Stormwater Industrial and Commercial BMP Handbook (2003)*; or

(C) Has applied and has a current No Exposure Certification (and WDID number) for facilities subject to this requirement.

3. Ensure Compliance of Critical Sources

(a) **BMP Implementation:** Facilities must implement the source control BMPs identified in Part 4.D.2. and, as applicable, Appendix D, *California Stormwater Industrial and Commercial BMP Handbook (2003)*. In the event that a Permittee determines that a BMP is infeasible at any site, the Permittee shall require implementation of similar BMPs that will achieve the equivalent reduction of pollutants in the storm water discharges. Likewise, for those BMPs that are not protective of water quality standards, Permittees may require additional site-specific controls.

(b) **Environmentally Sensitive Areas (ESAs) and Impaired Waters:** For critical sources that discharge to MS4s that directly discharge to ESAs or to CWA § 303(d) listed impaired waterbodies, the Permittees shall require operators to implement additional pollutant specific controls to reduce pollutants in storm water runoff that are causing or contributing to exceedances of water quality objectives. A Regional Water Board approved TMDL Implementation Plan for the receiving water will substitute for this requirement.

(c) **Progressive Enforcement:** Each Permittee shall implement a progressive enforcement policy to ensure that facilities are brought into compliance with all storm water requirements within a reasonable time period as specified below.

(1) In the event that a Permittee determines, based on an inspection conducted, that an operator has failed to adequately implement all necessary BMPs, that Permittee shall take progressive enforcement actions which, at a minimum,

shall include a follow-up inspection within 4 weeks from the date of the initial inspection.

(2) In the event that a Permittee determines that an operator has failed to adequately implement BMPs after a follow-up inspection, that Permittee shall take enforcement action as established through authority in its municipal code and ordinances or through the judicial system.

(3) Each Permittee shall maintain records and make them available on request to the Regional Water Board, including inspection reports, warning letters, notices of violations, and other enforcement records, demonstrating a good faith effort to bring facilities into compliance.

4. Interagency Coordination

(a) **Referral of Violations of the Municipal Storm Water Ordinances and California Water Code § 13260:** A Permittee may refer a violation(s) of § 13260 by Industrial and Commercial facilities to the Regional Water Board provided that under its municipal storm water ordinance the Permittee has made a good faith effort of progressive enforcement. At a minimum, a Permittee's good faith effort must be documented with:

(1) Two follow-up inspections
(2) Two warning letters or notices of violation

(b) **Referral of Violations of the Industrial Activities Storm Water General Permit (IASGP), including Requirements to File a Notice of Intent or No Exposure Certification:** For those facilities in violation of the municipal storm water ordinance and subject to the IASGP, Permittees may escalate referral of such violations to the Regional Water Board (electronically on a quarterly basis to the Regional Water Board's Storm Water Site at MS4stormwaterrb4@waterboards.ca.gov) after one inspection and one written notice (copied to the Regional Water Board) to the operator regarding the violation. In making such referrals, Permittees shall include, at a minimum, the following documentation:

(1) Name of the facility
(2) Operator of the facility
(3) Owner of the facility
(4) WDID Number (if applicable)
(5) Industrial activity being conducted at the facility that is subject to the IASGP
(6) Records of communication with the facility operator regarding the violation, which shall include at least an inspection report
(7) The written notice of the violation copied to the Regional Water Board

(c) **Investigation of Complaints Regarding Facilities – Transmitted by the Regional Water Board Staff:** Each Permittee shall initiate, within one business day,[1] investigation of complaints (other than non-storm water discharges) to the MS4 from facilities within its jurisdiction. The initial investigation shall include, at a minimum, a limited inspection of the facility to confirm the complaint to determine if the facility is effectively complying with the municipal storm water urban runoff ordinances and, if necessary, to oversee corrective action.

(d) **Assistance of Regional Water Board Enforcement Actions:** As directed by the Regional Water Board Executive Officer, Permittees shall assist Regional Water Board enforcement actions by: helping in identification of current owners, operators, and lessees of facilities; providing staff, when available, for joint inspections with Regional Water Board inspectors; appearing as witnesses in Regional Water Board enforcement hearings; and providing copies of inspection reports and other progressive enforcement documentation.

(e) **Participation in a Task Force:** The Permittees shall participate with the Regional Water Board, and other public agencies on an enforcement task force such as the Storm Water Task Force, to communicate concerns regarding special cases of storm water violations by industrial and commercial facilities and to develop a coordinated approach to enforcement action.

E. Planning and Land Development Program

I. Purpose

1. The Permittees shall implement a Planning and Land Development Program pursuant to part 4.E. for all New Development and Redevelopment projects subject to this Order to:
   (a) Lessen the water quality impacts of development by using smart growth practices such as compact development, directing development towards existing communities via infill or redevelopment, safeguarding of environmentally sensitive areas, mixing of land uses (e.g., homes, offices, and shops), transit accessibility, and better pedestrian and bicycle amenities.
   (b) Minimize the adverse impacts from storm water runoff on the biological integrity of Natural Drainage Systems and the beneficial uses of waterbodies in accordance with requirements under CEQA (Cal. Pub. Resources Code § 21100).
   (c) Minimize the percentage of effective impervious surfaces on land developments to mimic predevelopment water balance through infiltration, evapotranspiration and reuse.

[1] Permittees may comply with the Permit by taking initial steps (such as logging, prioritizing, and tasking) to "initiate" the investigation within that one business day. However, the Regional Water Board would expect that the initial investigation, including a site visit, to occur within four business days.

(d) Minimize pollutant loadings from impervious surfaces such as roof-tops, parking lots, and roadways through the use of properly designed, technically appropriate BMPs (including Source Control BMPs such as good housekeeping practices), Low Impact Development Strategies, and Treatment Control BMPs.
(e) Properly select, design and maintain Treatment Control BMPs and Hydromodification Control BMPs to address pollutants that are likely to be generated, assure long-term function, and to avoid the breeding of vectors.[1]
(f) Prioritize the selection of BMPs suites to remove storm water pollutants, reduce storm water runoff volume, and beneficially reuse storm water to support an integrated approach to protecting water quality and managing water resources in the following order of preference:
  (1) Infiltration BMPs
  (2) BMPs that store and reuse storm water runoff.
  (3) BMPs that incorporate vegetation to promote pollutant removal and runoff volume reduction and integrate multiple uses
  (4) BMPs which percolate runoff through engineered soil and allow it to discharge downstream slowly
  (5) Approved modular/ proprietary treatment control BMPs that are based on LID concepts and that meet pollution removal goals

II. Applicability

1. New Development Projects.
(a) Development projects subject to Permittee conditioning and approval for the design and implementation of post-construction controls to mitigate storm water pollution, prior to completion of the project(s), are:
  (1) All development projects equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet of impervious surface area
  (2) Industrial park 10,000 square feet or more of surface area
  (3) Commercial strip mall 10,000 square feet or more of impervious surface area
  (4) Retail gasoline outlet 5,000 square feet or more of surface area
  (5) Restaurant (SIC 5812) 5,000 square feet or more of surface area
  (6) Parking lot 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces
  (7) Streets, roads, highways, and freeway construction of 10,000 square feet or more of impervious surface area shall incorporate USEPA guidance regarding Managing Wet Weather with Green Infrastructure: Green Streets to the maximum extent practicable.
  (8) Automotive service facilities (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) [5,000 square feet or more of surface area]

[1] Treatment BMPs when designed to drain within 72 hours of the end of rainfall minimize the potential for the breeding of vectors.

(9) Redevelopment projects in subject categories that meet Redevelopment thresholds (identified in subpart E.II.2 below)

(10) Projects located in or directly adjacent to, or discharging directly to an Environmentally Sensitive Area (ESA), where the development will:
   (A) Discharge storm water runoff that is likely to impact a sensitive biological species or habitat; and
   (B) Create 2,500 square feet or more of impervious surface area

(11) Single-family hillside homes. To the extent that a Permittee may lawfully impose conditions, mitigation measures or other requirements on the development or construction of a single-family home in a hillside area as defined in the applicable Permittee's Code and Ordinances, each Permittee shall require that during the construction of a single-family hillside home, the following measures to be implemented:
   (A) Conserve natural areas
   (B) Protect slopes and channels
   (C) Provide storm drain system stenciling and signage
   (D) Divert roof runoff to vegetated areas before discharge unless the diversion would result in slope instability
   (E) Direct surface flow to vegetated areas before discharge unless the diversion would result in slope instability

2. Redevelopment Projects

(a) Redevelopment projects subject to Permittee conditioning and approval for the design and implementation of post-construction controls to mitigate storm water pollution, prior to completion of the project(s), are:
   (1) Land-disturbing activity that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site on development categories identified in subpart 4.E.III.1.
   (2) Where Redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post development storm water quality control requirements, the entire project must be mitigated.
   (3) Where Redevelopment results in an alteration to less than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post development storm water quality control requirements, only the alteration must be mitigated, and not the entire development.

(b) Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of facility or emergency redevelopment activity required to protect public health and safety. Impervious surface replacement, such as the reconstruction of parking lots and roadways which does not disturb additional area and maintains the original grade and alignment, is considered a routine maintenance activity. Redevelopment does not include the repaving of existing roads to maintain original line and grade.

(c) Existing single-family dwelling and accessory structures are exempt from the Redevelopment requirements unless such projects create, add, or replace 10,000 square feet of impervious surface area.

3. Effective Date –The New Development and Redevelopment requirements contained in Section E of the Order shall begin (90 calendar days) after Regional Water Board Executive Officer approval of the changes to the Technical Guidance Manual needed to comply with this permit. After that date all discretionary permit projects or project phases that have not been deemed complete for processing, or discretionary permit projects without vesting tentative maps that have not requested and received an extension of previously granted approvals must comply with the requirements in Section E. Projects that have been deemed complete prior to the update of the technical design manual are not subject to this section. For Permittee's projects the effective date shall be the date the governing body or their designee approves initiation of the project design.

III. New Development/ Redevelopment Performance Criteria

1. Integrated Water Quality/ Flow Reduction/Resources Management Criteria
   (a) Except as provided in subpart 4.E.III.1.(c) below, Permittees shall require all New Development and Redevelopment projects identified in subpart 4.E.II to control pollutants, pollutant loads, and runoff volume emanating from impervious surfaces through infiltration, storage for reuse, evapotranspiration, or bioretention/ biofiltration by reducing the percentage of Effective Impervious Area (EIA) to 5 percent or less of the total project area.
   (b) Impervious surfaces may be rendered "ineffective", and thus not count toward the 5 percent EIA limitation, if the stormwater runoff from those surfaces is fully retained on-site for the design storm event specified in provision (c), below. To satisfy the EIA limitation and low-impact development requirements, the permittees must require stormwater runoff to be infiltrated, reused, or evapotranspired on-site through a stormwater management technique allowed under the terms of this permit and implementing documents. If on-site retention is determined to be technically infeasible pursuant to 4.E.III.2(b), an on-site biofiltration system that achieves equivalent stormwater volume and pollutant load reduction as would have been achieved by on-site retention shall satisfy the EIA limitation. An on-site biofiltration system that releases above the design volume shall achieve 1.5 times the amount of stormwater volume and pollutant load reduction as would have been achieved by on-site retention and, thereby, shall satisfy the EIA limitation.
   (c) The permittees shall require all features constructed or otherwise utilized to render impervious surfaces "ineffective", as described in provision (b), above, to be properly sized to infiltrate, store for reuse, or evapotranspire, without any runoff at least the volume of water, or in the case of biofiltration with release above the design volume, 1.5 times the volume of water, that results from:

(1) The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area using a 48 to 72-hour draw down time, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998);
(2) The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in the Ventura County Technical Guidance Manual for Storm Water Quality Control Measures (July 2002 and its revisions); or
(3) The volume of runoff produced from a 0.75 inch storm event.

(d) To address any impervious surfaces that may not be rendered "ineffective", surface discharge of stormwater runoff if any, that results from New Development and Redevelopment projects identified in subpart 4.E.II which have complied with subparts 4.E.III.1.(a)-(c), above, shall be mitigated in accordance with subpart 4.E.III.4.

2. Alternative Compliance for Technical Infeasibility

(a) To encourage smart growth and infill development of existing urban centers where on-site compliance with post-construction requirements may be technically infeasible, the permittees may allow projects that are unable to meet the Integrated Water Quality/Flow Reduction/Resources Management Criteria in subpart 4.E.III.1, above, to comply with this permit through the alternative compliance measures described in subpart 4.E.III.2.(c), below.

(b) To utilize alternative compliance measures, the project applicant must demonstrate that compliance with the applicable post-construction requirements would be technically infeasible by submitting a site-specific hydrologic and/or design analysis conducted and endorsed by a registered professional engineer, geologist, architect, and/or landscape architect. Technical infeasibility may result from conditions including the following:
(1) Locations where seasonal high groundwater is within 5 feet of the surface
(2) Locations within 100 feet of a groundwater well used for drinking water
(3) Brownfield development sites or other locations where pollutant mobilization is a documented concern
(4) Locations with potential geotechnical hazards
(5) Smart growth and infill or redevelopment locations where the density and/or nature of the project would create significant difficulty for compliance with the on-site volume retention requirement
(6) Other site or implementation constraints identified in the LID Technical Guidance document required by subpart 4.E.IV.4.

(c) Alternative Compliance Measures. When a permittee finds that a project applicant has demonstrated technical infeasibility, the permittee shall identify alternative compliance measures that the project will need to comply with as a substitute for the otherwise applicable post-construction requirements listed in subparts 4.E.III.1.(a)-(c) of this permit. The Ventura County Technical Guidance Manual shall be revised to identify the alternative compliance measures and shall include the following requirement:

(1) Minimum on-site requirement. The project must take all feasible measures to reduce the percentage of Effective Impervious Area to no more than 30 percent of the total project area and treat all remaining runoff pursuant to the design and sizing requirements of subparts 4.E.III.1.(b)-(d).

(2) Offsite mitigation volume. The difference in volume between the amount of stormwater infiltrated, reused, and/ or evapotranspired and/or biofiltered by the project on-site and the otherwise applicable requirements of subparts 4.E.III.1.(a)-(c) (the "offsite mitigation volume'), above, must be mitigated by the project applicant either by performing offsite mitigation that is approved by the permittee or by providing sufficient funding for public or private offsite mitigation to achieve equivalent stormwater volume and pollutant load reduction through infiltration, reuse, evapotranspiration and/ or biofiltration.
   - For projects with demonstrable technical infeasibility that cannot reduce the Effective Impervious Area to 5% or less of the total project, but are able to reduce the Effective Impervious Area to no more than 30 percent of the total project, mitigation or payment in lieu must be equivalent to the amount of stormwater not managed on site.
   - For projects with demonstrable technical infeasibility that cannot reduce the Effective Impervious Area to 30% of the total project or less, mitigation or payment in lieu must be for 1.5 times the amount of stormwater not managed on site

(3) Location of off site mitigation. Offsite mitigation projects must be located in the same sub-watershed (defined as draining to the same hydrologic area in the Basin Plan) as the new development or redevelopment project. A list of eligible public and private offsite mitigation projects available for funding shall be identified by the Permittees and provided to the project applicant. Off site mitigation projects include green streets projects, parking lot retrofits, other site specific LID BMPs, and regional BMPs. Project applicants seeking to utilize these alternative compliance provisions may propose other offsite mitigation projects, which the Permittees may approve if they meet the requirements of this subpart.

(4) Timing and Reporting Requirements for Offsite Mitigation Projects. The Permittee(s) shall develop a schedule for the completion of offsite mitigation projects, including milestone dates to identify fund, design, and construct the projects. Offsite mitigation projects shall be completed as soon as possible, and at the latest, within 4 years of the certificate of occupancy for the first project that contributed funds toward the construction of the offsite mitigation project, unless a longer period is otherwise authorized by the Executive Officer. For public offsite mitigation projects, the permittees must provide in their annual reports a summary of total offsite mitigation funds raised to date and a description (including location, general design concept, volume of water expected to be retained, and total estimated budget) of all pending public offsite mitigation projects. Funding sufficient to address the offsite mitigation volume must be

transferred to the permittee (for public offsite mitigation projects) or to an escrow account (for private offsite mitigation projects) within one year of the initiation of construction.

(5) The project applicant must demonstrate that the EIA achieved on-site is as close to 5 percent EIA as technically feasible, given the site's constraints.

(d) Watershed equivalence. Regardless of the methods through which permittees allow project applicants to implement alternative compliance measures, the sub-watershed -wide (defined as draining to the same hydrologic area in the Basin Plan) result of all development must be at least the same level of water quality protection as would have been achieved if all projects utilizing these alternative compliance provisions had complied with subparts 4.E.III.1.(a)-(d) of the permit. The permittees shall provide in their annual report to the Regional Board a list of mitigation project descriptions and pollutant and flow reduction analyses (compiled from design specifications submitted by project applicants and approved by the permittee(s)) comparing the expected aggregate results of alternative compliance projects to the results that would otherwise have been achieved by meeting the 5 percent EIA requirement on-site.

3. Hydromodification (Flow/ Volume/ Duration) Control Criteria

(a) Each Permittee shall require all New Development and Redevelopment projects identified in subpart 4.E.II to implement hydrologic control measures, to prevent accelerated downstream erosion and to protect stream habitat in natural drainage systems. The purpose of the hydrologic controls is to minimize changes in post-development hydrologic storm water runoff discharge rates, velocities, and duration. This shall be achieved by maintaining the project's pre-project storm water runoff flow rates and durations.

(1) Description

(A) Hydromodification control in natural drainage systems shall be achieved by maintaining the Erosion Potential (E_p) in streams at a value of 1, unless an alternative value can be shown to be protective of the natural drainage systems from erosion, incision, and sedimentation that can occur as a result of flow increases from impervious surfaces and damage stream habitat (see Attachment "E" - Determination of Erosion Potential)

(B) Hydromodification control may include one, or a combination of on-site, regional subregional hydromodification control BMPs, LID strategies, or stream restoration measures, with preference given to LID strategies and hydromodification control BMPs. Any in-stream restoration measure shall not adversely affect the beneficial uses of the natural drainage systems

(C) Natural drainage systems, which include unlined or unimproved (not engineered) creeks, streams, rivers and their tributaries, are located in the following watersheds:

(i) Ventura River

(ii) Santa Clara River

(iii) Calleguas Creek
(iv) Malibu Creek
(v) Miscellaneous Ventura Coastal

(D) The Southern California Storm Water Monitoring Coalition (SMC) is developing a regional methodology to eliminate or mitigate the adverse impacts of hydromodification as a result of urbanization, including hydromodification assessment and management tools.
(i) The SMC has identified the following objectives for the Hydromodification Control Study (HCS):
(I) Establishment of a stream classification for Southern California streams
(II) Development of a deterministic or predictive relationship between changes in watershed impervious cover and stream-bed/ stream bank enlargement
(III) Development of a numeric model to predict stream-bed/ stream bank enlargement and evaluate the effectiveness of mitigation strategies

(E) The Permittees shall participate in the SMC HCS to develop:
(i) A regional stream classification system
(ii) A numerical model to predict the hydrological changes resulting from new development
(iii) A numerical model to identify effective mitigation strategies

(F) Until the completion of the SMC HCS, Permittees shall implement the Interim Hydromodification Control Criteria, described in subpart 4.E.III.3(a)(3)(A) below, to control the potential adverse impacts of changes in hydrology that may result from new development and redevelopment projects identified in subpart 4.E.II

(G) Existing single-family structures are exempt from the Hydromodification control requirements unless such projects disturb one acre or more of land or create, add, or replace 10,000 square feet or more of impervious surface area

(2) Exemptions to Hydromodification Controls. Permittees may exempt the following New Development and Redevelopment projects from implementation of Hydromodification controls where assessments of downstream channel conditions and proposed discharge hydrology indicate that adverse Hydromodification effects to present and future beneficial uses of Natural Drainage Systems are unlikely:
(A) All projects that disturb less than one acre.
(B) Projects that are replacement, maintenance or repair of a Permittee's existing flood control facility, storm drain, or transportation network.
(C) Redevelopment Projects in the Urban Core that do not increase the effective impervious area or decrease the infiltration capacity of pervious areas compared to the pre-project conditions.

(D) Projects that have any increased discharge go directly or via a storm drain to a sump, lake, area under tidal influence, into a waterway that has a 100-year peak flow (Q100) of 25,000 cfs or more, or other receiving water that is not susceptible to Hydromodification impacts;

(E) Projects that discharge directly or via a storm drain into concrete or improved (not natural) channels (e.g., rip rap, sackcrete, etc.), which, in turn, discharge into receiving water that is not susceptible to Hydromodification impacts (as in D above).

(3) Interim Hydromodification Control Criteria

(A) The Interim Hydromodification Control Criteria to protect natural drainage systems until Permittees complete Hydromodification Control Plans (HCPs), described in subpart 4.E.III.3(a)(4) below, are as follows:

(i) **Projects disturbing land area of less than fifty acres** will be subject to LID and/or source or treatment BMPs as addressed in this permit. The combined effects of LID and the treatment BMPs are considered adequate for Hydromodification control for projects that disturb less than 50 acres.

(ii) **Projects disturbing land areas of fifty acres or greater**
Projects in this category shall develop and implement a Hydromodification Analysis Study (HAS) that demonstrates that post development conditions are expected to approximate the pre-project erosive effect of sediment transporting flows in receiving waters. The HAS must lead to the incorporation into the project design features intended to approximate, to the extent feasible, an Erosion Potential value of 1 or any alternative value that can be shown to be protective of the natural drainage systems from erosion, incision, and sedimentation that can occur as a result of flow increases from impervious surfaces and damage stream habitat in natural drainage systems, or

(I) Alternatively, project proponents in this category may elect to develop, in partnership with Permittees, an equivalent implementation method based on flow duration control in the form of nomographs relating planned impervious area and local soil type (infiltration rates) to determine hydromodification control BMP volume and land area requirements for the proposed project. The nomographs shall be derived from continuous simulation modeling using Ventura County specific rain gauge records and soil types, and calibrated using data from a local undeveloped watershed with similar conditions; or

(II) Alternatively, the Co-Permittees may revise the Ventura County Technical Guidance Manual for Stormwater

Quality Control Measures to address projects that disturb more than 50 acres.

(4) Final Criteria

(A) The Permittees shall develop and implement watershed specific HCPs no later than (180 days) after the completion of the SMC HCS.

(i) The HCP shall identify:

(I) Stream classifications

(II) Flow rate and duration control methods

(III) Sub-watershed mitigation strategies

(IV) Stream restoration measures, which will maintain the stream and tributary Erosion Potential at 1 unless an alternative value can be shown to be protective of the natural drainage systems from erosion, incision, and sedimentation that can occur as a result of flow increases from impervious surfaces and damage stream habitat in natural drainage system tributaries

(B) The HCP shall contain the following elements:

(i) Hydromodification Management Standards

(ii) Natural Drainage Areas and Hydromodification Management Control Areas

(iii) New Development and Redevelopment Projects subject to the HCP

(iv) Description of authorized Hydromodification Management Control BMPs

(v) Hydromodification Management Control BMP Design Criteria.

(vi) For flow duration control methods, the range of flows to control for, and goodness of fit criteria

(vii) Allowable low critical flow, Q_c, which initiates sediment transport

(viii) Description of the approved Hydromodification Model.

(ix) Any alternate Hydromodification Management Model and Design

(x) Stream Restoration Measures Design Criteria

(xi) Monitoring and Effectiveness Assessment

(xii) Record Keeping

(C) The HCP shall be deemed in effect upon Executive Officer approval.

4. Water Quality Mitigation Criteria

(a) Each Permittee shall require all New Development and Redevelopment projects identified in subpart 4.E.II to implement post-construction storm water treatment BMPs and control measures to mitigate storm water pollution as follows:

(1) Projects disturbing land areas less than 50 acres

(A) Volumetric Treatment Control BMP

(i) The 85th percentile 24-hour runoff event determined as the maximized capture storm water volume for the area using a 48 to

72-hour draw down time, from the formula recommended in *Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998)*; or

(ii) The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in the Ventura County Technical Guidance Manual for Storm Water Quality Control Measures (July 2002 and its revisions); or

(iii) The volume of runoff produced from a 0.75 inch storm event, prior to its discharge to a storm water conveyance system;[1] and/ or

(B) Flow Based Treatment Control BMP

(i) The flow of runoff produced from a rain event equal to at least 0.2 inches per hour intensity; or

(ii) The flow of runoff produced from a rain event equal to at least 2 times the 85th percentile hourly rainfall intensity as determined from local rainfall records; or

(iii) Eight percent of the 50-year storm design flow rate as determined from the method recommended in the Ventura County Technical Guidance Manual for Storm Water Quality Control Measures (July 2002 and its revisions)

(2) Projects disturbing land area of 50 acres or greater

(A) Eighty percent of the average runoff volume using an appropriate public domain continuous flow model (such as Storm Water Management Model (SWMM) or Hydrologic Engineering Center – Hydrologic Simulation Program – Fortran (HEC-HSPF), using the local rainfall record and relevant BMP Performance data.

IV. Implementation

1. Maintenance Agreement and Transfer

(a) Prior to issuing approval for final occupancy each Permittee shall require that all new development and redevelopment projects subject to post-construction BMP requirements provide an operation and maintenance plan and verification of ongoing maintenance provisions for LID practices, Treatment Control BMPs, and Hydromodification Control BMPs including but not limited to: final map conditions, legal agreements, covenants, conditions or restrictions, CEQA mitigation requirements, conditional use permits, and/ or other legally binding maintenance agreements.

(1) Verification at a minimum shall include the developer's signed statement accepting responsibility for maintenance until the responsibility is legally transferred; and either

[1] This option is available only for construction projects that disturb land area less than 5 acres.

(A) A signed statement from the public entity assuming responsibility for BMP maintenance; or
(B) Written conditions in the sales or lease agreement, which require the property owner or tenant to assume responsibility for BMP maintenance and conduct a maintenance inspection at least once a year; or
(C) Written text in project covenants, conditions, and restrictions (CCRs) for residential properties assigning BMP maintenance responsibilities to the Home Owners Association (HOA); or
(D) Any other legally enforceable agreement or mechanism that assigns responsibility for the maintenance of BMPs.

(b) Each Permittee shall require all development projects subject to post-construction BMP requirements to provide a plan for the operation and maintenance of all structural and treatment controls. The Operation and Maintenance plan shall follow the Technical Guidance Manual Appendix D "Maintenance Plan Guidance" (or subsequent guidance manual) for each BMP component. The plan shall be submitted for examination of relevance to keeping the BMPs in proper working order. Where BMPs are transferred to Permittee for ownership and maintenance, the plan shall also include all relevant costs for upkeep of BMPs in the transfer. Operation and Maintenance plans for private BMPs shall be kept on-site for periodic review by Permittee inspectors.

2. Tracking, Inspection, and Enforcement of Post-Construction BMPs

(a) Each Permittee shall implement a tracking system and an inspection and enforcement program for new development and redevelopment post-construction storm water BMPs as set forth in part 4.E. no later than (one year after Order adoption date).

(1) Implement a GIS or other electronic system for tracking projects that have been conditioned for post-construction BMPs. The electronic system, at a minimum, should contain the following information:

(A) Municipal Project ID
(B) State WDID No
(C) Project Acreage
(D) BMP Type and Description
(E) BMP Location (coordinates)
(F) Date of Acceptance
(G) Date of Maintenance Agreement
(H) Maintenance Records
(I) Inspection Date and Summary
(J) Corrective Action
(K) Date Certificate of Occupancy Issued
(L) Replacement or Repair Date

(b) Inspect all development sites upon completion of construction and prior to the issuance of occupancy certificates to ensure proper installation of LID measures,

structural BMPs, treatment control BMPs and Hydromodification control BMPs. The inspection may be combined with other inspections provided it is conducted by trained personnel.

(c) Verify proper maintenance and operation of post-construction BMPs previously approved for new development and redevelopment and operated by the Permittees. The post construction BMP maintenance inspection program shall incorporate the following elements:
   (1) Post-construction BMP Maintenance Inspection checklist.
   (2) Inspection at least once every 2 years, beginning (Order adoption date), of post-construction BMPs to assess operation conditions with particular attention to:
   (3) Criteria and procedures for post construction Treatment Control and Hydromodification Control BMP repair, replacement, or re-vegetation.

(d) For post construction BMPs operated and maintained by parties other than the Permittees, the Permittees shall require annual reports by the other parties demonstrating proper maintenance and operations.

(e) Undertake enforcement as appropriate based on the results of the inspection.

3. Alternative Post Construction Storm Water Mitigation Programs

(a) A Permittee or a coalition of Permittees may apply to the Regional Water Board for approval of a Redevelopment Project Area Master Plan (RPAMP) for redevelopment projects within the Redevelopment Project Areas, in consideration of exceptional site constraints that inhibit site-by-site or project-by-project implementation of post-construction requirements.

(b) Upon review and a determination by the Regional Water Board Executive Officer that the proposal is technically valid and appropriate, the Regional Water Board may consider for approval such a program if its implementation will:
   (1) Result in equivalent or superior reduction of storm water pollutant loads in comparison to individual projects regulated by this permit.
   (2) Satisfy, on a Redevelopment Project Area-wide basis, the hydromodification criteria of this section.
   (3) Reduce the percentage of Effective Impervious Area (EIA) to a target of 5 percent or less of the Redevelopment Project Area, using properly sized storm water treatment/ collection features, as described in this Section.
   (4) Be fiscally sustainable and have secure funding; and
   (5) Be completed in four years of the adoption date of this permit.

(c) The RPAMP should prioritize the implementation of LID storm water mitigation measures, as described in this section.

(d) A Permittee or a coalition of Permittees may apply to the Regional Water Board for approval of a Redevelopment Project Area Master Plan (RPAMP) that takes into consideration the balancing of water quality protection with the needs for adequate housing, population growth, public transportation and management, land recycling, and urban revitalization.

(e) For the RPAMP to be considered, a technical panel of the Local Government Commission or an equivalent state or regional planning agency must have

reviewed and approved the proposed RPAMP, prior to its submittal to the Regional Water Board. The Regional Water Board Executive Officer may then consider the RPAMP for approval, or elect to submit it to the Regional Water Board for consideration.

(f) The RPAMP, on approval, may substitute in part or wholly for post-construction requirements.

(g) Redevelopment Project Areas include the following:
   (1) City Center areas
   (2) Historic District areas
   (3) Brownfield areas
   (4) Infill Development areas
   (5) Urban Transit Villages
   (6) Any other redevelopment area so designated by the Regional Water Board

(h) Nothing in these provisions shall be construed as to delay the implementation of post-construction control requirements, as approved in this Order.

4. Developer Technical Guidance and Information

(a) The Permittees shall update the Ventura County Technical Guidance Manual for Storm Water Quality Control Measures to include, at a minimum, the following:
   (1) Hydromodification Control criteria described in this Order, including numerical criteria.
   (2) Expected BMP pollutant removal performance including effluent quality (ASCE/ U.S. EPA International BMP Database, CASQA New Development BMP Handbook, technical reports, local data on BMP performance, and the scientific literature appropriate for southern California geography and climate).
   (3) Selection of appropriate BMPs for storm water pollutants of concern.
   (4) Data on Observed Local Effectiveness and performance of implemented BMPs.
   (5) BMP Maintenance and Cost Considerations.
   (6) Guiding principles to facilitate integrated water resources planning and management in the selection of BMPs, including water conservation, groundwater recharge, public recreation, multipurpose parks, open space preservation, and redevelopment retrofits.
   (7) LID principles and specifications, including the objectives and specifications for integration of LID strategies in the areas of:
      (A) Site Assessment.
      (B) Site Planning and Layout.
      (C) Vegetative Protection, Revegetation, and Maintenance.
      (D) Techniques to Minimize Land Disturbance.
      (E) Techniques to Implement LID Measures at Various Scales
      (F) Integrated Water Resources Management Practices.
      (G) LID Design and Flow Modeling Guidance.
      (H) Hydrologic Analysis.
      (I) LID Credits.

(b) Permittees shall update the Technical Guidance Manual within (120 days after Order adoption date).
(c) The Permittees shall facilitate implementation of LID by providing key industry, regulatory, and other stakeholders with information regarding LID objectives and specifications contained in the LID Technical Guidance Section through a training program. The LID training program will include the following:
(1) LID targeted sessions and materials for builders, design professionals, regulators, resource agencies, and stakeholders
(2) A combination of awareness on national efforts and local experience gained through LID pilot projects and demonstration projects
(3) Materials and data from LID pilot projects and demonstration projects including case studies
(4) Guidance on how to integrate LID requirements into the local regulatory program(s) and requirements
(5) Availability of the LID Technical Guidance regarding integration of LID measures at various project scales
(6) Guidance on the relationship among LID strategies, Source Control BMPs, Treatment Control BMPs, and Hydromodification Control requirements
(d) The Permittees shall submit revisions to the Ventura County Technical Guidance Manual to the Regional Water Board for Executive Officer approval.

5. Project Coordination
(a) Each Permittee shall facilitate a process for effective approval of post-construction storm water control measures. The process shall include:
(1) Detailed BMP review including BMP sizing calculations, BMP pollutant removal performance, and municipal approval; and
(2) An established structure for communication and delineated authority between and among municipal departments that have jurisdiction over project review, plan approval, and project construction through memoranda of understanding (MOU) or an equivalent agreement.

V. State Statute Conformity

1. California Environmental Quality Act (CEQA) Document Update
(a) Each Permittee shall incorporate into its CEQA process no later than (365 days after Order adoption date) those additional procedures necessary for considering potential storm water quality impacts and providing for appropriate mitigation when preparing and reviewing CEQA documents.
(1) The procedures shall require consideration of the following:
(A) Potential impact of project construction on storm water runoff.
(B) Potential impact of project post-construction activity on storm water runoff.
(C) Potential for discharge of storm water from areas from material storage, vehicle or equipment fueling, vehicle or equipment

maintenance (including washing), waste handling, hazardous materials handling or storage, delivery areas or loading docks, or other outdoor work areas.

(D) Potential for discharge of storm water to impair the beneficial uses of the receiving waters.

(E) Potential for the discharge of storm water to cause significant harm on the biological integrity of the waterways and waterbodies.

(F) Potential for significant changes in the flow velocity or volume of storm water runoff to cause harm to or impair the beneficial uses of natural drainage systems.

(G) Potential for significant increases in erosion at the project site or surrounding areas.

2. General Plan Update

(a) Each Permittee shall amend, revise or update its General Plan to include watershed and storm water quality and quantity management considerations and policies when any of the following General Plan elements are updated or amended:

(1) Land Use
(2) Housing
(3) Conservation
(4) Open Space

(b) Each Permittee shall provide the Regional Water Board with the draft amendment or revision when a listed General Plan element or General Plan is noticed for comment in accordance with Cal. Govt. Code § 65350 *et seq.*

F. Development Construction Program

(I) Each Permittee shall implement a construction program that prevents illicit construction-related discharges of pollutants into the MS4, implements and maintains structural and non-structural BMPs to reduce pollutants in stormwater runoff from construction sites, reduces construction site discharges of pollutants from the MS4 to the MEP, and prevents construction site discharges from the MS4 from causing or contributing to a violation of water quality standards.

1. BMP Implementation - Construction Sites Less Than One Acre

(a) Each Permittee shall require the implementation of an effective combination of erosion and sediment control BMPs from Table 6 to prevent erosion and sediment loss, and the discharge of construction wastes.[1]

[1] The BMPs are taken from the *California BMP Handbook, Construction, January 2003* and the *Caltrans Stormwater Quality Handbooks, Construction Site Best Management Practices (BMPs) Manual, March 2003*, and addenda.

Table 6 - BMPs at Construction sites less than 1 acre

Minimum Set of BMPs for All Construction Sites	CASQA Handbook	Caltrans Handbook
For Erosion Control		
Scheduling	EC-1	SS-1
Preservation of Existing Vegetation	EC-2	SS-2
Sediment Controls		
Silt Fence	SE-1	SC-1
Sand Bag Barrier	SE-8	SC-8
Stabilized Construction Site Entrance/Exit	TC-1	TC-1
Non-Storm Water Management		
Water Conservation Practices	NS-1	NS-1
Dewatering Operations (Groundwater dewatering only under NPDES Permit No. CAG994004).[1]	NS-2	NS-2
Waste Management		
Material Delivery and Storage	WM-1	WM-1
Stockpile Management	WM-3	WM-2
Spill Prevention and Control	WM-4	WM-4
Solid Waste Management	WM-5	WM-5
Concrete Waste Management	WM-8	WM-8
Sanitary/ Septic Waste Management	WM-9	WM-9

2. BMP Implementation - Construction Sites One Acre but Less than 5 acres.
   (a) Each Permittee shall require the implementation of an effective combination of appropriate erosion and sediment control BMPs from Table 7 in addition to the ones identified in Table 6 to prevent erosion and sediment loss, and the discharge of construction wastes:

Table 7 - BMPs at Construction sites 1 acre or greater but less than 5 acres

BMPs	CASQA Handbook	Caltrans Handbook
For Erosion Control		
Hydraulic Mulch	EC-3	SS-3
Hydroseeding	EC-4	SS-4
Soil Binders	EC-5	SS-5
Straw Mulch	EC-6	SS-6
Geotextiles and Mats	EC-7	SS-7
Wood Mulching	EC-8	SS-8
Sediment Controls		
Fiber Rolls	SE-5	SC-5
Gravel Bag Berm	SE-6	SC-6
Street Sweeping and/ or Vacuum	SE-7	SC-7
Storm Drain Inlet Protection	SE-10	SC-10
Additional Controls		
Wind Erosion Controls	WE-1	WE-1

[1] Ponded storm water may be discharged at a concentration of Total Suspended Solids (TSS) of 100mg/L or less.

BMPs	CASQA Handbook	Caltrans Handbook
Stabilized Construction Entrance/ Exit	TC-1	TC-1
Stabilized Construction Roadway	TC-2	TC-2
Entrance/ Exit Tire Wash	TC-3	TC-3
Non-Storm Water Management		
Vehicle and Equipment Washing	NS-8	NS-8
Vehicle and Equipment Fueling	NS-9	NS-9

3. BMP Implementation - Construction Sites 5 acres and Greater
   (a) Each Permittee shall require the implementation of an effective combination of the following BMPs in Table 8 (BMPs at Construction sites 5 acres or greater) in addition to the ones identified in Table 6 (BMPs at Construction sites less than 1 acre) and Table 7 (BMPs at Construction sites 1acre or greater but less than 5 acres) at all construction sites 5 acres and greater to prevent erosion and sediment loss, and the discharge of construction wastes. Erosion control BMPs shall be preferred to sediment control BMPs.

Table 8 - BMPs at Construction sites 5 acres or greater

BMPs	CASQA Handbook	Caltrans Handbook
Sediment Controls		
Sediment Basin	SE-2	SC-2
Check Dam	SE-4	SC-4
Tracking Control BMPs		
Stabilized Construction Entrance/ Exit	TR-1	TC-1
Non-Storm Water Management		
Vehicle and Equipment Maintenance	NS-10	NS-10
Waste Management		
Material Delivery and Storage	WM-1	WM-1
Spill Prevention and Control	WM-4	WM-4
Concrete Waste Management	WM-8	WM-8
Sanitary/ Septic Waste Management	WM-9	WM-9

4. Enhanced Construction BMP Implementation.
   (a) Each Permittee shall implement, or require implementation of, enhanced practices that preclude impacts to water quality posed by all construction sites on hillsides as defined in this Order and construction sites that directly discharge to a waterbody listed on the CWA § 303 (d) list for siltation or sediment, or that occur within or directly adjacent to an Environmentally Sensitive Area (ESAs). Construction sites located on hillsides, adjacent to CWA 303(d) listed waters for siltation or sediment, and directly adjacent to ESAs are termed "High risk sites."
   (b) Each Permittee shall require implementation of enhanced practices for high risk sites which shall include increased BMP inspection and maintenance requirements.
      (1) Each Permittee shall require that high risk sites shall be inspected by the project proponent's Qualified SWPPP Developer or Qualified SWPPP Practitioner or personnel or consultants who are Certified Professionals in Erosion and Sediment Control (CPESC) at the time of BMP installation, at least weekly during the wet season, and at least once each 24 hour period during a storm event that generates runoff from the site, to identify BMPs that need maintenance to operate effectively, that have failed or could fail to operate as intended.
      (2) During the wet season, the area of disturbance shall be limited to the area that can be controlled with an effective combination of erosion and sediment control BMPs. Enhanced sediment controls should be used in combination with erosion controls and should target portions of the site that cannot be effectively controlled by standard erosion controls described above. Effective sediment and erosion control BMPs proposed by the proponent shall include the BMPs listed in Table 9 below. The project proponents are responsible to implement the BMPs below unless shown unnecessary. The Permittee shall require that the project proponent retain records of the inspection and a determination and rationale of the BMPs selected to control runoff.

Table 9 - Enhanced Construction BMP Implementation.

CONSTRUCTION SITE BMPs	CASQA Handbook	Caltrans Handbook
Erosion Controls		
Scheduling	EC-1	SS-1
Preservation of Existing Vegetation	EC-2	SS-2
Hydraulic Mulch	EC-3	SS-3
Hydroseeding	EC-4	SS-4
Soil Binders	EC-5	SS-5
Straw Mulch	EC-6	SS-6
Geotextiles and Mats	EC-7	SS-7
Wood Mulching	EC-8	SS-8
Slope Drains	EC-11	SS-11
Sediment Controls		

CONSTRUCTION SITE BMPs	CASQA Handbook	Caltrans Handbook
Silt Fence	SE-1	SC-1
Fiber Rolls	SE-5	SC-5
Sediment Basin	SE-2	SC-2
Check Dam	SE-4	SC-4
Gravel Bag Berm	SE-6	SC-6
Street Sweeping and/or Vacuum	SE-7	SC-7
Sand Bag Barrier	SE-8	SC-8
Storm Drain Inlet Protection	SE-10	SC-10
Additional Controls		
Wind Erosion Controls	WE-1	WE-1
Stabilized Construction Entrance/Exit	TC-1	TC-1
Stabilized Construction Roadway	TC-2	TC-2
Entrance/Exit Tire Wash	TC-3	TC-3
Advanced Treatment Systems[1]		
Non-Storm Water Management		
Water Conservation Practices	NS-1	NS-1
Dewatering Operations (Groundwater dewatering only under NPDES Permit No. CAG994004).19	NS-2	NS-2
Vehicle and Equipment Washing	NS-8	NS-8
Vehicle and Equipment Fueling	NS-9	NS-9
Vehicle and Equipment Maintenance	NS-10	NS-10
Waste Management		
Material Delivery and Storage	WM-1	WM-1
Stockpile Management	WM-3	WM-2
Spill Prevention and Control	WM-4	WM-4
Solid Waste Management	WM-5	WM-5
Concrete Waste Management	WM-8	WM-8
Sanitary/Septic Waste Management	WM-9	WM-9

5. Local Agency Requirements
   (a) Each Permittee shall require for all construction sites 1 acre or greater, compliance with all conditions identified in the preceding subparts F.1 - F.4, and the following requirements:
      (1) Local Storm Water Pollution Prevention Plan (Local SWPPP),
         (A) Each Permittee shall require the preparation and submittal of a Local SWPPP, for the Permittee's review and written approval prior to issuance of a grading or construction permit for construction or demolition projects. The Permittees' approval signature shall be contained within the first pages of the Local SWPPP

[1] If appropriate given natural background stormwater runoff and receiving water quality conditions.

(i) The Permittee shall not approve any Local SWPPP unless it contains appropriate site-specific construction site BMPs, specific locations, and maintenance schedules.

(ii) The Local SWPPP must include the rationale used for selecting or rejecting BMPs for various construction phases and weather conditions. The project architect, or engineer of record, or authorized qualified designee, must sign a statement on the Local SWPPP to the effect:

(I) *"As the architect/ engineer of record, I have selected appropriate BMPs to effectively minimize the negative impacts of this project's construction activities on storm water quality. The project owner and contractor are aware that the selected BMPs must be installed, monitored, and maintained to ensure their effectiveness. The BMPs not selected for implementation are redundant or deemed not applicable to the proposed construction activity."*

(2) Certification Statement

(A) Each Permittee shall require that each landowner or the landowner's agent sign a statement on the Local SWPPP to the effect:

(i) *"I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that submitting false and/ or inaccurate information, failing to update the Local SWPPP to reflect current conditions, or failing to properly and/ or adequately implement the Local SWPPP may result in revocation of grading and/ or other permits or other sanctions provided by law."*

(ii) The Local SWPPP certification shall be signed by the property owner or owner's representative/designee. If the Local SWPPP or SWPPP is being prepared by the local agency then the appropriate authority of the local agency shall sign the document.

6. Roadway Paving or Repaving Operations (For Private or Public Projects)

(a) Each Permittee shall require that for any project that includes roadbed or street paving, repaving, patching, digouts, or resurfacing roadbed surfaces, that the following BMPs be implemented for each project:

(1) Restrict paving and repaving activity to exclude periods of rainfall or predicted rainfall unless required by emergency conditions

(2) Install sand bags or gravel bags and filter fabric at all susceptible storm drain inlets and at manholes to prevent spills of paving products and tack coat

(3) Prevent the discharge of release agents including soybean oil, other oils, or diesel to the storm water drainage system or receiving waters.
(4) Minimize non storm water runoff from water use for the roller and for evaporative cooling of the asphalt
(5) Clean equipment over absorbent pads, drip pans, plastic sheeting or other material to capture all spillage and dispose of properly
(6) Collect liquid waste in a container, with a secure lid, for transport to a maintenance facility to be reused, recycled or disposed of properly
(7) Collect solid waste by vacuuming or sweeping and securing in an appropriate container for transport to a maintenance facility to be reused, recycled or disposed of properly
(8) Cover the "cold-mix" asphalt (i.e., pre-mixed aggregate and asphalt binder) with protective sheeting during a rainstorm
(9) Cover loads with tarp before haul-off to a storage site, and do not overload trucks
(10) Minimize airborne dust by using water spray during grinding
(11) Avoid stockpiling soil, sand, sediment, asphalt material and asphalt grindings materials or rubble in or near storm water drainage system or receiving waters
(12) Protect stockpiles with a cover or sediment barriers during a rain

7. Electronic Site Tracking System
(a) Each Permittee shall use an electronic system to track grading permits, encroachment permits, demolition permits, building permits, or construction permits (and any other municipal authorization to move soil and/ or construct or destruct that involves land disturbance) issued by each Permittee. To satisfy this requirement, the use of a database or GIS system is encouraged, but not required.

8. Inspections
(a) Each Permittee shall inspect all construction sites for the implementation of storm water quality controls a minimum of once during the wet season. Concurrently, each Permittee shall ensure that:
(1) The Local SWPPP is reviewed for compliance with local codes, ordinances, and permits.
(2) A follow-up inspection takes place within two weeks for inspected sites that have not adequately implemented their Local SWPPP.
(b) Each Permittee shall take additional enforcement actions to achieve compliance as specified in municipal codes, if compliance with municipal codes, ordinances, or permits has not been attained.
(c) Each Permittee can refer sites to the Regional Water Board for joint enforcement actions for violation of municipal storm water ordinances and the Construction Activities Storm Water General Permit (CASGP), or Small Linear Underground/ Overhead Construction Projects General Permit (small LUPs), after conducting a minimum of 2 site inspections and issuing a minimum of 2 written notices to the operator regarding the violation (copied to the Regional Water Board). In making

such referrals, Permittees shall include, at a minimum, the following documentation:

(1) Name of the site
(2) WDID number
(3) Site developer
(4) Site owner
(5) Records of communication with the site operator regarding the violation(s), which shall include at least an inspection report
(6) Written notice of the violation copied to the Regional Water

(d) Prior to approving and/ or signing off for occupancy and issuing the Certificate of Occupancy for all construction projects subject to post-construction controls, each Permittee shall inspect the constructed site design, source control and treatment control BMPs to verify that they have been constructed in compliance with all specifications, plans, permits, ordinances, and this Order. The initial/ acceptance BMP verification inspection does not constitute a maintenance and operation inspection, as required in the preceding subpart E.IV.2(c).

9. State Conformity Requirements

(a) Each Permittee shall ensure that no grading permit, encroachment permit, demolition permit, building permit, electrical permit, or construction permit (or any other municipal authorization to move soil and/ or construct or destruct that involves land disturbance) is issued for any project requiring coverage under the CASGP or Small LUP General Permit[1] unless:

(1) Proof of filing a Notice of Intent for coverage under a State NPDES permit is demonstrated).
(2) Demonstration or Certification that a SWPPP has been prepared by the project developer.
(3) Proof of Change of Information form (COI) and a copy of the modified SWPPP(s) at any time a transfer of ownership takes place for the entire development or portions of the common plan of development where construction activities are still on-going.

10. Interagency Coordination

(a) **Referral of Violations:**

A Permittee may refer a violator of the municipal storm water ordinance and CWC § 13260 to the Regional Water Board provided that the Permittee has made a good faith effort at progressive enforcement consistent with the preceding subpart F.8(c). At a minimum, the Permittee's good faith effort shall be documented with:

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[1] NPDES Permit No. CAS000005, Waste Discharge Requirements For Discharges of Storm Water Runoff Associated with Small Linear Underground/ Overhead Construction Projects (Small LUP General Permit) for any linear land disturbing activity or activities (cumulatively) that will cause one acre or more of land disturbance but not more than 5 acres.

(1) A minimum of 2 follow-up inspection reports (inspections completed within 3 months).
(2) A minimum of two warning letters or NOVs.

(b) **Referral of Non-filers under the CASGP or the Small LUP General Permit:** Each Permittee shall refer non-filers (i.e., those projects which cannot demonstrate that they have a WDID number) under the CASGP or Small LUP General Permit, to the Regional Water Board, no later than 15 days after making a determination of failure to file. In making such referrals, Permittees shall include, at a minimum, the following documentation:
(1) Project location address
(2) Project description
(3) Developer or owners name with complete mailing address
(4) Project size
(5) Records of communication with the developer or owner regarding filing requirements

(c) **Investigation of Complaints Regarding Facilities – Transmitted by the Regional Water Board Staff:**
(1) Each Permittee shall initiate, within one business day,[1] an initial investigation of complaint(s) (other than non-storm water discharges) on the construction site(s) within its jurisdiction.
(A) The initial investigation shall include, at a minimum, an inspection on the facility and its perimeter to confirm the complaint and to determine if the site operator is effectively complying with the municipal storm water/ urban runoff ordinances, and to oversee corrective action.

(d) **Support of Regional Water Board Enforcement Actions – As directed by the Regional Water Board Executive Officer:**
(1) Each Permittee shall support Regional Water Board enforcement actions by:
(A) Assisting in identification of current owners, operators, and lessees of properties and sites.
(B) Providing staff, when available, for joint inspections with Regional Water Board inspectors.
(C) Appearing to testify as witnesses in Regional Water Board enforcement hearings.
(D) Providing copies of inspection reports and other progressive enforcement documentation.

[1] Permittees may comply with the Permit by taking initial steps (such as logging, prioritizing, and tasking) to "initiate" the investigation within that one business day. However, the Regional Water Board would expect that the initial investigation, including a site visit, to occur within four business days.

G. Public Agency Activities Program

I. Each Permittee shall implement a Public Agency Activities Program to minimize storm water pollution impacts from public agency activities. Public Agency requirements consist of:
   i. Public Construction Activities Management.
   ii. Vehicle Maintenance/ Material Storage Facilities/ Corporation Yards Management/ Municipal Operations.
   iii. Vehicle and Equipment Wash Areas
   iv. Landscape and Recreational Facilities Management
   v. Storm Drain Operation and Management
   vi. Streets and Roads Maintenance
   vii. Public Industrial Activities Management
   viii. Emergency Procedures
   ix. Employee Training
   x. Infrastructure Maintenance

1. Public Construction Activities Management
   (a) Each Permittee shall implement and comply with the Planning and Land Development Program requirements in part 4.E. of this Order at Permittee owned or operated public construction projects for project types identified in part 4.E of this Order.
   (b) Each Permittee shall implement and comply with the appropriate Development Construction Program requirements in part 4.F. of this Order at Permittee owned or operated construction projects as applicable.
   (c) For public projects including those under a Capital Improvement Project Plan that disturb less than one acre of soil the Permittees shall require the development and implementation of a Storm Water Pollution Control Plan. The SWPCP shall include BMPs as identified in Table 6.
2. Vehicle Maintenance/ Material Storage Facilities/ Corporation Yards Management/ Long Term Maintenance Programs
   (a) Each Permittee shall implement the activity specific BMPs[1] listed in Table 10 when such activities occur at Permittee owned/leased facilities and job sites including but not limited to vehicle/ equipment maintenance facilities, material storage facilities, and corporation yards, and at any area that includes the activities as described in the following Tables. Additionally, for any activity or area described in the footnote below,[2] each Permittee shall also implement the BMPs in the Caltrans Storm Water Quality Handbook Maintenance Staff Guide

[1] These BMPs are identified in Appendix B of the *Caltrans Storm Water Quality Handbook Maintenance Staff Guide, May 2003*, and its addenda. Other BMPs may be substituted upon approval by the Executive Officer.
[2] Scheduling and Planning; Spill Prevention and Control; Sanitary/ Septic Waste Management; Material Use; Safer Alternative Products; Vehicle/ Equipment Cleaning, Fueling, and Maintenance; Illicit Connections Detection, Reporting and Removal; Illegal Spill / Discharge Control and Maintenance Facility Housekeeping Practices.

described as B-4 in Table 10 (BMPs at Vehicle Maintenance/ Material Storage Facilities/ Corporation Yards).

Table 10 - BMPs at Vehicle Maintenance/ Material Storage Facilities/ Corporation Yards

From the Caltrans Storm Water Quality Handbook Maintenance Staff Guide **Appendix B**

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3. Vehicle and Equipment Wash Areas
   (a) Each Permittee shall eliminate discharges of wash waters from vehicle and equipment washing no later than (365 days after Order adoption date) by implementing any of the following measures at existing facilities with vehicle or equipment wash areas:
      (1) Self-contain, and haul off for disposal
      (2) Equip with a clarifier
      (3) Equip with an alternative pre-treatment device; or
      (4) Plumb to the sanitary sewer
   (b) Each Permittee shall ensure that any municipal facilities constructed, redeveloped, or replaced has all vehicle and equipment wash areas plumbed to the sanitary sewer or be self contained and all wastewater/ washwater hauled for legal disposal.

4. Landscape, Park, and Recreational Facilities Management
   (a) Integrated Pest Management (IPM)
   IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control,

habitat manipulation, modification of cultural practices, and use of resistant varieties. Each Permittee shall implement an IPM program within (365 days after Order adoption date) that includes the following:

(1) Pesticides are used only if monitoring indicates they are needed according to established guidelines.
(2) Treatments are made with the goal of removing only the target organism.
(3) Pest controls are selected and applied in a manner that minimizes risks to human health, beneficial, non-target organisms, and the environment.
(4) Its use of pesticides, including Organophosphates and Pyrethroids do not threaten water quality.
(5) Partner with other agencies and organizations to encourage the use of IPM.
(6) Adopt and verifiably implement policies, procedures, and/ or ordinances requiring the minimization of pesticide use and encouraging the use of IPM techniques (including beneficial insects) in the Permittees' overall operations and on municipal property.
(7) Policies, procedures, and ordinances shall include commitments and timelines to reduce the use of pesticides that cause impairment of surface waters by implementing the following procedures:
    (A) Quantify pesticide use by its staff and hired contractors.
    (B) Prepare and annually update an inventory of pesticides used by all internal departments, divisions, and other operational units.
    (C) Demonstrate reductions in pesticide use.

(b) Each Permittee shall implement the following requirements no later than (180 days after Order adoption date):

(1) Use a standardized protocol for the routine and non-routine application of pesticides (including pre-emergents), and fertilizers.
(2) Ensure no application of pesticides or fertilizers are applied to an area immediately prior to, during, or immediately after a rain event, or when water is flowing off the area.
(3) Ensure that no banned or unregistered pesticides are stored or applied.
(4) Ensure that all staff applying pesticides are certified in the appropriate category by the California Department of Pesticide Regulation, or are under the direct supervision of a pesticide applicator certified in the appropriate category.
(5) Implement procedures to encourage the retention and planting of native vegetation to reduce water, pesticide and fertilizer needs; and
(6) Store pesticides and fertilizers indoors or under cover on paved surfaces or use secondary containment.
    (A) Reduce the use, storage, and handling of hazardous materials to reduce the potential for spills.
    (B) Regularly inspect storage areas.
(7) Comply with the provisions and the monitoring requirements for application of aquatic pesticides to surface waters (WQ Order No. 2004-0008-DWQ) (Vector Control) and Order No. 2004-0009-DWQ (Weed Control).

5. Storm Drain Operation and Management
   (a) Catch Basin Cleaning
      (1) Each Permittee shall designate catch basin inlets within its jurisdiction as one of the following:
         Priority A: Catch basins that are designated as consistently generating the highest volumes of trash.
         Priority B: Catch basins that are designated as consistently generating moderate volumes of trash.
         Priority C: Catch basins that are designated as generating low volumes of trash.
         Within one year of Order adoption (July 8, 2011), Permittees shall submit a map or list of Catch Basins with their GPS coordinates and their designations. The map or list shall contain the rationale or data to support designations.
      (2) Each Permittee shall inspect catch basins according to the following schedule:
         Priority A: A minimum of 3 times during the wet season and once during the dry season every year.
         Priority B: A minimum of once during the wet season and once during the dry season every year.
         Priority C: A minimum of once per year.
         Catch basins shall be cleaned as necessary on the basis of inspections. Permittees shall maintain inspection records for Regional Water Board review.
      (3) In addition to the preceding schedule, Permittees shall ensure that any catch basin that is determined to be at least 25% full of trash shall be cleaned out.

   (b) Trash Management at Public Events
      (1) Each Permittee shall require for any event in the public right of way or wherever it is foreseeable that substantial quantities of trash and litter may be generated, the following measures:
         (A) Proper management of trash and litter generated; and
         (B) Arrangement for temporary screens to be placed on catch basins; or
         (C) Provide clean out of catch basins, trash receptacles, and grounds in the event area within 24 hours subsequent to the event.
   (c) Trash Receptacles
      (1) Each Permittee shall install trash receptacles, or equivalent trash capturing devices in areas subject to high trash generation within its jurisdiction no later than one year after Order adoption date (July 8, 2011).
      (2) Each Permittee shall ensure that all trash receptacles are cleaned out and maintained as necessary to prevent trash overflow.
   (d) Catch Basin Labels
      (1) Each Permittee shall inspect the legibility of the catch basin stencil or label nearest each catch basin and inlet before the wet season begins.

(2) Each Permittee shall record and re-stencil or re-label within 15 days of inspection, catch basins with illegible stencils.

(e) Additional Trash Management Practices

(1) Each Permittee shall install trash excluders, or equivalent devices on or in catch basins or outfalls to prevent the discharge of trash to the storm drain system or receiving water no later than two years after Order adoption date in areas defined as Priority A (subpart 5.(a)(1)) except in sites where the application of such BMP(s) alone will cause flooding. Lack of maintenance that causes flooding is not an acceptable exception to the requirement to install BMPs. Alternatively the Permittee may implement alternative or enhanced BMPs beyond the provisions of this permit (such as but not limited to increased street sweeping, adding trash cans near trash generation sites, prompt enforcement of trash accumulation, increased trash collection on public property, increased litter prevention messages or trash nets within the MS4) that provide substantially equivalent removal of trash. Permittees shall demonstrate that BMPs, which substituted for trash excluders provide equivalent trash removal performance as excluders. When outfall trash capture is provided, revision of the schedule for inspection and cleanout of catch basins in task 5.(a)(2) may be proposed by the Permittee for approval by the Executive Officer.

(f) Storm Drain Maintenance

(1) Each Permittee shall implement a program for Storm Drain Maintenance no later than 90 days after Order adoption (October 6, 2010) that includes the following:

(A) Visual monitoring of Permittee-owned open channels and other drainage structures for debris at least annually.

(B) Remove trash and debris from open channel storm drains a minimum of once per year before the wet season.

(C) Eliminate the discharge of contaminants during MS4 maintenance and clean outs.

(D) Quantify the amount of materials removed using techniques appropriate for quantifying solid waste and ensure the materials are properly disposed of.

(g) Spill Response Plan

(1) Each Permittee shall implement a response plan for spills to the MS4 within their respective jurisdiction. The response Plan shall clearly identify agencies responsible and telephone numbers and e-mail address for contact and shall contain at a minimum the following:

(A) Investigation of all complaints received within 24 hours of the incident report.

(B) Response within 2 hours to spills for containment upon notification, except where such overflows occur on private property, in which case the response should be within 2 hours of gaining legal access to the property.

(C) Notification to appropriate public health agencies and the Office of Emergency Services (OES).

(h) Permittee Owned Treatment Control BMPs

(1) Each Permittee shall implement an inspection and maintenance program for all Permittee owned treatment control BMPs, including post-construction treatment control BMPs.

(2) Each Permittee shall ensure proper operation of all treatment control BMPs and maintain them as necessary for proper operation, including all post-construction treatment control BMPs.

(3) Any residual water produced by a treatment control BMP and not being internal to the BMP performance when being maintained shall be:

(A) Hauled away and legally disposed of; or

(B) Applied to the land without runoff; or

(C) Discharged to the sanitary sewer system (with permits or authorization); or

(D) Treated or filtered to remove bacteria, sediments, nutrients, and meet the limitations set in Table 11 (Discharge Limitations for Dewatering Treatment BMPs) prior to discharge to the MS4.

Table 11 - Discharge Limitations for Dewatering Treatment BMPs[1]

Parameter	Units	Limitation
Total Suspended Solids	mg/L	100
Turbidity	NTU	50
Oil and Grease	mg/L	10

6. Streets and Roads Maintenance

(a) Maintenance

(1) Each Permittee shall perform street sweeping of curbed streets in commercial areas and areas subject to high trash generation to control trash and debris at least two times per month.

(b) Road Reconstruction

(1) Each Permittee shall require that for any project that includes roadbed or street paving, repaving, patching, digouts, or resurfacing roadbed surfaces, that the following BMPs be implemented for each project.

(A) Restrict paving and repaving activity to exclude periods of rainfall or predicted rainfall[2] unless required by emergency conditions.

(B) Install sand bags or gravel bags and filter fabric at all susceptible storm drain inlets and at manholes to prevent spills of paving products and tack coat;

(C) Prevent the discharge of release agents including soybean oil, other oils, or diesel to the storm water drainage system or receiving waters.

[1] Technology based effluent limits.
[2] A probability of precipitation (POP) of 50% is required.

(D) Minimize non storm water runoff from water use for the roller and for evaporative cooling of the asphalt.
(E) Clean equipment over absorbent pads, drip pans, plastic sheeting or other material to capture all spillage and dispose of properly.
(F) Collect liquid waste in a container, with a secure lid, for transport to a maintenance facility to be reused, recycled or disposed of properly.
(G) Collect solid waste by vacuuming or sweeping and securing in an appropriate container for transport to a maintenance facility to be reused, recycled or disposed of properly.
(H) Cover the "cold-mix" asphalt (i.e., pre-mixed aggregate and asphalt binder) with protective sheeting during a rainstorm.
(I) Cover loads with tarp before haul-off to a storage site, and do not overload trucks.
(J) Minimize airborne dust by using water spray during grinding.
(K) Avoid stockpiling soil, sand, sediment, asphalt material and asphalt grindings materials or rubble in or near storm water drainage system or receiving waters.
(L) Protect stockpiles with a cover or sediment barriers during a rain.

7. Emergency Procedures
   (a) Each Permittee may conduct repairs of essential public service systems and infrastructure in emergency situations with a self-waiver of the provisions of this Order.
      (1) Where the self-waiver has been invoked, the Permittee shall submit to the Regional Water Board Executive Officer a statement of the occurrence of the emergency, an explanation of the circumstances, and the measures that were implemented to reduce the threat to water quality, no later than 30 business days after the situation of emergency has passed.
      (2) Minor repairs of essential public service systems and infrastructure in emergency situations (can be completed in less than one day) are not subject to the notification provisions. Appropriate BMPs to reduce the threat to water quality shall be implemented.

8. Municipal Employee and Municipal Contractor Training
   (a) Each Permittee shall, no later than one year after Order adoption (July 8, 2011) and annually thereafter before June 30, train all of their employees and contractors in targeted positions (whose interactions, jobs, and activities affect storm water quality) on the requirements of the overall storm water management program to:
      (1) Promote a clear understanding of the potential for activities to pollute storm water.
      (2) Identify opportunities to require, implement, and maintain appropriate BMPs in their line of work.
   (b) Each Permittee shall, no later than one year after Order adoption (July 8, 2011) and annually thereafter before June 30, train all of their employees and

contractors who use or have the potential to use pesticides or fertilizers (whether or not they normally apply these as part of their work). Training programs shall address:

(1) The potential for pesticide-related surface water toxicity.
(2) Proper use, handling, and disposal of pesticides.
(3) Least toxic methods of pest prevention and control, including IPM.
(4) Reduction of pesticide use.

(c) Each Permittee shall, no later than one year after Order adoption (July 8, 2011) and annually thereafter before June 30, train all of their employees and contractors who are responsible for illicit connections and illicit/ illegal discharges. Training programs shall address:

(1) Identification
(2) Investigation
(3) Termination
(4) Cleanup
(5) Reporting of Incidents
(6) Documentation of Incidents

H. Illicit Connections and Illicit Discharges Elimination Program

I. Each Permittee shall implement an Illicit Connections and Illicit Discharges (IC/ IDs) program to eliminate IC/IDs to the storm drain system, and shall document, track, and report all such cases in accordance with the elements and performance measures specified in the following subsections.

1. General

(a) Implementation - Each Permittee shall implement an IC/ ID Program. The IC/ ID procedures shall be documented and made available for public review.

(b) Tracking - All Permittees shall, no later than May 7, 2012, map at a scale and in a format specified by the Principal Permittee all known connections to their storm drain system. All Permittees shall map at a scale and in a format specified by the Principal Permittee incidents of illicit connections and discharges since January 2009 on their baseline maps, and shall transmit this information to the Principal Permittee no later than May 7, 2012. Permittees shall use this information to identify priority areas for further investigation and elimination of IC/ ID.

2. Public Reporting

(a) Permittees shall establish and maintain a phone hotline and internet site to receive all reports of IC/ ID complaints.

(b) Permittees shall document the location of the reported IC/ ID and the actions undertaken in response to all IC/ ID complaints.

3. Illicit Connections

(a) Screening for Illicit Connections

(1) Each Permittee shall submit to the Principal Permittee:

(A) A map at a scale and in a format specified by the Principal Permittee showing the location and length of underground pipes 18 inches and greater in diameter, and channels within their permitted area and operated by the Permittee in accordance with the following schedule:
(i) All channeled portions of the storm drain system no later than 90 days after Order adoption date (October 6, 2010).
(ii) All portions of the storm drain system consisting of storm drain pipes 36 inches in diameter or greater, no later than May 7, 2012.
(iii) All portions of the storm drain system consisting of storm drain pipes 18 inches in diameter or greater, no later than May 7, 2014.
(B) The status of suspected, confirmed, and terminated illicit connections.

(2) Permittees shall conduct field screening of their storm drain systems in accordance with screening procedures described in the Illicit Discharge Detection and Elimination, A Guidance Manual for Program Development and Technical Assessments (2004)[1] or other equally effective alternative methods not listed in the manual. Permittees shall conduct field screening of their storm drain system that has not been previously screened and reported to the Regional Water Board, for illicit connections in accordance with the following schedule:
(A) All portions of the storm drain system consisting of storm drain pipes 36 inches in diameter or greater, no later than May 7, 2012.
(B) High priority areas identified during the mapping of illicit connections and discharges, no later than May 7, 2012.
(C) All portions of storm drain systems 50 years or older in age, no later than May 7, 2012.

(3) Each Permittee shall maintain a list containing all connections under investigation for possible illicit connection and their status.

(b) Response to Illicit Connections

(1) Investigation -
Each Permittee, upon discovery or upon receiving a report of a suspected illicit connection, shall complete an investigation within 21 days, to determine the following:
(A) Source of the connection.
(B) Nature and volume of discharge through the connection.
(C) Responsible party for the connection.

(2) Termination -
Each Permittee, upon confirmation of an illicit storm drain connection, shall ensure the following:
(A) Termination of the connection within 180 days of completion of the investigation, using formal enforcement authority to eliminate the illicit connection.

(3) Documentation -

[1] *Illicit Discharge Detection and Elimination, A Guidance Manual for Program Development and Technical Assessments*. The Center for Watershed Protection, Pitt R., October 2004. Chapter 13, 13.1,13.2, 13.3, 13.4

Each Permittee shall keep records of all illicit connection investigations and the formal enforcement taken to eliminate all illicit connections.

4. Illicit Discharges
   (a) Investigation -
   Each Permittee shall investigate an illicit/ illegal discharge during or immediately following containment and cleanup activities, and shall take appropriate enforcement action to eliminate the illegal discharge.
   (b) Abatement and Cleanup -
   Each Permittee shall respond, within 1 business day of discovery or a report of a suspected illicit/ illegal discharge, with actions to abate, contain, and/or clean up all illegal discharges, including hazardous waste.
   (c) Documentation -
   Each Permittee shall maintain records of all illicit/ illegal discharge discoveries, reports of suspected illicit/ illegal discharges, their response to the illicit/ illegal discharges and suspected illicit/ illegal discharges, and the formal enforcement taken to eliminate all illicit/ illegal discharges.

I. REPORTING PROGRAM

1. The Principal Permittee in consultation with the Permittees and Regional Water Board staff shall convene an adhoc working group to develop an Electronic Reporting Program, the basis of which shall be the requirements in this Order. The Committee shall no later than one year after Order adoption date (July 8, 2011) submit the electronic reporting form in each subsequent year.

2. Each Permittee shall submit information required in the Reporting Program in a method as appropriate to the format approved by the Regional Water Board Executive Officer.

3. The Principal Permittee shall submit by December 15th of each year, an Annual Report to the Regional Water Board Executive Officer in the form one hard copy and three compact disk (CD) copies (or an electronic equivalent).

4. The Annual Report shall document the status of the Municipal Storm Water Program, an integrated summary of the results of analyses from:
   (a) The monitoring program described under Part 1- Monitoring Report.
   (b) The requirements described under Part 2- Program Report.

5. Plans shall be submitted to the Regional Water Board Executive Officer in the form of one hard copy and three compact disk (CD) copies (or an electronic equivalent).

6. Study Reports shall be submitted to the Regional Water Board Executive Officer in the form of one hard copy and three compact disk (CD) copies (or an electronic equivalent).

7. Progress Reports shall be submitted to the Regional Water Board Executive Officer in the form of one hard copy and three compact disk (CD) copies (or an electronic equivalent).

PART 5 - TOTAL MAXIMUM DAILY LOAD PROVISIONS

I. Part 5 of this Order incorporates provisions to assure that Ventura County MS4 Permittees comply with WLAs and other requirements of TMDLs covering impaired waters impacted by the Permittees' discharges.

II. Each Permittee shall attain the storm water WLAs incorporated into this Order by implementing BMPs in accordance with the TMDL Technical Reports, Implementation Plans, or as identified as a result of TMDL special studies specified in the Basin Plan Amendment.

III. The Permittees shall comply with the following Wasteload Allocations, consistent with the assumptions and requirements of the Wasteload Allocations documented in the Implementation Plans, including compliance schedules, associated with the State adoption and approval of the TMDL at compliance monitoring points established in each TMDL (40 CFR 122.44(d)(1)(vii)(B).

IV. TMDLs in effect and covered in this Order are the following:
1. TMDL for Nutrients for Malibu Creek Watershed (Effective date: March 21, 2003)
2. TMDL for Nitrogen Compounds and Related Effects in Calleguas Creek (Effective date: July 16, 2003)
3. TMDL for Nitrogen Compounds for the Santa Clara River (Effective date: March 23, 2004).
4. TMDL for Chloride in Santa Clara River, Reach 3 (Effective date: June 18, 2003)
5. TMDL for Chloride in Upper Santa Clara River (Effective date: May 4, 2005)
6. TMDL for Toxicity, Chlorpyrifos and Diazinon in the Calleguas Creek, its Tributaries and Mugu Lagoon - (Effective date: March 24, 2006).
7. TMDL for Organochlorine Pesticides, Polychlorinated Biphenyls, and Siltation in Calleguas Creek, its Tributaries and Mugu Lagoon (Effective date: March 24, 2006).
8. TMDL for Bacteria in Malibu Creek and Lagoon (Effective date: January 24, 2006).
9. TMDL for Metals and Selenium in the Calleguas Creek, its Tributaries and Mugu Lagoon (Effective date: March 26, 2007)
10. TMDL for Trash in Revolon Slough and Beardsley Wash (Effective date: March 6, 2008).
11. TMDL for Boron, Chloride, Sulfate, and TDS in Calleguas Creek Watershed (Effective date: December 2, 2008)

12. TMDL for Trash in the Ventura River Estuary (Effective date: March 6, 2008).
13. TMDL for Bacteria in Harbor Beaches of Ventura County (Effective date: September 23, 2008).

V. TMDL Interim WLAs incorporated into this Order due to compliance dates which exceed the term of this Order are the following:

1. Final Wet Weather Bacteria WLAs for Malibu Creek and Lagoon – (Compliance date: January 24, 2016).
2. Final Chloride WLAs for Upper Santa Clara River – (Compliance date: May 4, 2016)
3. Final Organochlorine Pesticides, Polychlorinated Biphenyls, and Siltation WLAs for Calleguas Creek, its Tributaries and Mugu Lagoon – (Compliance date: March 24, 2026).
4. Final Metals and Selenium WLAs for Calleguas Creek, its Tributaries and Mugu Lagoon (Compliance date: March 26, 2022)
5. Final Boron, Chloride, Sulfate, and TDS WLAs for Calleguas Creek watershed (Compliance date: December 2, 2023)

VI. TMDL WLAs and Other TMDL Provisions Incorporated into this Order are as follows:

1. TMDL for Nutrients for Malibu Creek Watershed

(a) Summer Load Allocations

	Nitrogen (lbs/day)	Phosphorus (lbs/day)
- Runoff from developed areas	26	2.6
- Golf Course Fertilization	37	6.6
- Dry Weather Urban Runoff	52	4.6
- Other	56	4.1

(b) Winter concentration-based Load Allocations

	Nitrogen (Nitrate-N + Nitrite-N) (mg/L)
- Runoff from Developed Areas	8
- Golf Course Fertilization	8
- Dry Weather Urban Runoff	8
- Other	8

(c) Compliance Monitoring:
This TMDL was established and approved by U.S. EPA and did not include an implementation plan.

(d) Actions and Special Studies required for Malibu Creek MS4 permittees
(1) Extent of algal impairment. EPA recommends studies to investigate the current extent of impairment due to excessive algal growth in the creek by

surveying algal biomass and species composition at multiple sites within the creek.
(2) Limiting factor analysis. EPA recommends further study to assess whether total nitrogen or total phosphorus or other parameters such as flow and light limit algal growth in the Malibu Creek watershed.
(3) Fate of nutrients in Malibu Lagoon. EPA recommends this special study to determine if the expected upstream reductions in nutrient loadings would result in desired improvements in water quality in the lagoon.

2. TMDL for Nitrogen Compounds and Related Effects in Calleguas Creek Watershed

The stormwater permitted discharges were considered minor sources of nitrogen to the Calleguas Creek. Therefore, WLAs are not assigned to storm water permitted discharges. The monitoring program of this TMDL includes data collection to quantify loadings and associated WLAs from these sources.

3. TMDL for Nitrogen Compounds in the Santa Clara River

(a) Waste Load Allocations:
(1) The Ventura County MS4 permittees discharging to the Santa Clara River (the cities of Fillmore and Santa Paula) ("Santa Clara MS4 permittees") shall implement BMPs to achieve the following MS4 wasteload allocations applicable to River Reach 3:

Ammonia nitrogen 30-day average	2.0 mg/L
Ammonia nitrogen 1-hour average	4.2 mg/L
Nitrate + Nitrite nitrogen 30-day average	8.1 mg/L

(b) Compliance Monitoring:
(1) Compliance with the WLAs is to be determined through receiving water monitoring conducted in accordance with the Santa Clara River Nitrogen TMDL Monitoring Program approved by the Executive Officer.
(2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.
(c) Actions and Special Studies required of Santa Clara MS4 permittees:
(1) Annual Progress Reports. Santa Clara River MS4 permittees, either independently or in conjunction with other stakeholders, shall submit an annual progress report with respect to achievement of the WLAs.

4. TMDL for Chloride in Santa Clara River, Reach 3

(a) Waste Load Allocation:
MS4 permittees discharging to Santa Clara River, Reach 3 shall implement BMPs to achieve the following MS4 WLAs:

Chloride (mg/L) 80

(b) Compliance Monitoring: This TMDL was established and approved by U.S. EPA and did not include an implementation plan.

(c) Actions and Special Studies required of Santa Clara MS4 permittees:

(1) Annual Progress Reports. Santa Clara River MS4 permittees, either independently or in conjunction with other stakeholders, shall submit an annual progress report with respect to achievement of the WLAs.

5. TMDL for Chloride in Upper Santa Clara River

(a) Waste Load Allocation:
MS4 permittees discharging to Upper Santa Clara River shall implement BMPs to achieve the following WLAs
Chloride (mg/L) 100

(b) Compliance monitoring:

(1) Compliance with the WLAs is to be determined through receiving water monitoring conducted in accordance with the Santa Clara River Chloride TMDL Monitoring Program approved by the Executive Officer.

(2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports and Implementation Plans. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(c) Actions and Special Studies required of Santa Clara MS4 permittees:

(1) Annual Progress Reports. Santa Clara River MS4 permittees, either independently or in conjunction with other stakeholders, shall submit an annual progress report with respect to achievement of the WLAs.

6. TMDL for Toxicity, Chlorpyrifos, and Diazinon in the Calleguas Creek, its Tributaries and Mugu Lagoon.

(a) Waste Load Allocations:

(1) MS4 permittees discharging to Calleguas Creek, its tributaries and Mugu Lagoon (Ventura County Watershed Protection District, County of Ventura and the cities of Camarillo, Moorpark, Oxnard, Simi Valley and Thousand Oaks) ("Calleguas MS4 permittees") shall implement BMPs to achieve the following MS4 WLAs:

Toxicity WLA	1.0 TUc
Chlorpyrifos WLA	0.014 ug/L
Diazinon WLA	0.10 ug/L

(2) Pursuant to the TMDL, the final storm water WLAs for Toxicity, Chlorpyrifos and Diazinon, listed above, are receiving water concentrations measured in-stream at the base of each subwatershed within the Calleguas Creek watershed.

(b) Compliance Monitoring:

(1) Compliance with the WLAs is to be determined through the measurement of in-stream water quality at the base of each of the Calleguas Creek subwatersheds, in accordance with the Calleguas Creek Watershed TMDL Monitoring Program approved by the Executive Officer.

(2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(3) If as a result of compliance monitoring and subsequent investigations it is determined that a Calleguas MS4 permittee is responsible for exceedance of the in-stream Toxicity WLA, that permittee shall initiate the TRE/TIE process as outlined in U.S. EPA's "Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System Program" (2000) or the approved Toxicity TMDL monitoring plan, and take appropriate action to eliminate the identified source of the toxicity.

(c) Actions and Special Studies required of Calleguas MS4 permittees:

(1) Special Study #1. Together with Calleguas POTW permittees, investigate the pesticides that will replace diazinon and chlorpyrifos in the urban environment, their potential impact on receiving waters and potential control measures. Special Study #1 was completed by March 24, 2008.

(2) Special Study #2. Together with Calleguas Agricultural Dischargers, consider results of monitoring of sediment concentrations by source/land use type through the special study required in the Calleguas OC Pesticide, PCB and Siltation TMDL Implementation Plan. Complete within 6 months of completion of the OCs TMDL special study #1.

(3) Pesticide Collection Program. Together with Calleguas POTW permittees, develop and implement a collection program for diazinon and chlorpyrifos and an educational program. Collection and education could occur through existing programs such as household hazardous waste collection events. The Pesticide Collection Program is to be implemented by March 24, 2009.

(4) Special Study #3. Together with Calleguas Agricultural Dischargers, consider the findings of transport rates developed through the OC Pesticide, PCB and Siltation TMDL Implementation Plan. Complete within 6 months of completion of the OCs TMDL special study #1.

7. TMDL for Organochlorine (OC) Pesticides, Polychlorinated Biphenyls (PCBs) and Siltation in the Calleguas Creek, its Tributaries and Mugu Lagoon.

(a) Waste Load Allocations:

(1) MS4 permittees discharging to Calleguas Creek, its tributaries or Mugu Lagoon (Ventura County Watershed Protection District, County of Ventura and the cities of Camarillo, Moorpark, and Simi Valley) ("Calleguas MS4 permittees") shall implement BMPs to achieve the interim WLAs listed in Table 12.

Table 12 - Interim Sediment Concentration WLAs (ng/g)

Constituent	Subwatershed					
	Mugu Lagoon	Calleguas Creek	Revolon Slough	Arroyo Las Posas	Arroyo Simi	Conejo Creek
Chlordane	25	17	48	3.3	3.3	3.4
4,4-DDD	69	66	400	290	14.0	5.3
4,4-DDE	300	470	1600	950	170	20
4.4-DDT	39	110	690	670	25	2
Dieldrin	19	3	5.7	1.1	1.1	3
PCBs	180	3800	7600	25700	25700	3800
Toxaphene	22900	260	790	230	230	260

(2) Pursuant to the TMDL, the interim storm water WLAs for OC Pesticides, PCBs and Siltation, listed above, are annual average, sediment-based concentrations measured in surface waters at the base of each subwatershed within the Calleguas Creek watershed.

(b) Compliance Monitoring:

(1) Compliance with the WLAs is to be determined through the measurement of in-stream water quality at the base of each of the Calleguas Creek subwatersheds, in accordance with the Calleguas Creek Watershed TMDL Monitoring Program approved by the Executive Officer.

(2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(c) Actions and Special Studies required of Calleguas MS4 permittees:

(1) Pesticide Collection Program. Together with Calleguas POTW permittees, implement a collection program and source control measures pursuant to a work plan approved by the Executive Officer. The Pesticide Collection Program is to be implemented by March 24, 2011.

(2) Special Study #1. Together with Calleguas POTW permittees, Calleguas Agricultural Dischargers, and the Point Mugu Naval Base, submit a work plan to quantify sedimentation in the Calleguas Creek Watershed, evaluate management methods to control siltation and contaminated sediment transport to Calleguas Creek, identify appropriate BMPs to reduce sediment loadings and evaluate the effect of sediment on habitat preservation in Mugu Lagoon for approval by the Executive Officer. This special study is also to evaluate the concentration of OC pesticides and PCBs in sediments from various sources/land use types. Special Study #1 is to be completed by March 24, 2014.

(3) Special Study #2. Together with Calleguas Agricultural Dischargers, identify areas of high OC concentrations and evaluate the effects of watershed protection and land use practices on water quality. Such practices

include but are not limited to management of sediment reduction practices and structures, streambank stabilization, and other projects related to stormwater conveyance and flood control improvements in the Calleguas Creek watershed. Special Study #2 is to be completed based on the schedule provided in the workplan, submitted in March, 2007

(4) Special Study #3 – Together with Calleguas POTW permittees, Calleguas Agricultural Dischargers, and the Point Mugu Naval Base, evaluate natural attenuation rates and evaluate methods to accelerate organochlorine pesticide and polychlorinated biphenyl attenuation and examine the attainability of wasteload and load allocations in the Calleguas Creek Watershed. Special Study #3 is to be completed by March 24, 2016.

8. TMDL for Metals and Selenium in the Calleguas Creek, its Tributaries and Mugu Lagoon.

(a) Waste Load Allocations:

(1) MS4 permittees discharging to Calleguas Creek, its tributaries or Mugu Lagoon (Ventura County Watershed Protection District, County of Ventura and the cities of Camarillo, Moorpark, Oxnard, Simi Valley and Thousand Oaks) ("Calleguas MS4 permittees") shall implement BMPs to achieve the interim WLAs listed in Table 13 and Table 14.

Table 13 - Interim WLAs for Copper, Nickel and Selenium (ug/L)

Constituent	Calleguas and Conejo Creek (a)			Revolon Slough		
	Dry Daily Maximum (ug/L)	Dry Monthly Average (ug/L)	Daily Maximum (ug/L)	Dry Daily Maximum (ug/L)	Dry Monthly Average (ug/L	Daily Maximum (ug/L)
Copper	23	19	204	23	19	204
Nickel	15	13	(a)	15	13	(a)
Selenium	(b)	(b)	(b)	14(c)	13(c)	(a)

(A) The current loads do not exceed the TMDL under wet conditions, interim limits are not required

(B) Selenium allocations have not been developed for this reach as it is not on the 303(d) list

(C) Attainment of interim limits will be evaluated in consideration of background loading data, if available

(2) Pursuant to the TMDL, the interim storm water WLAs for copper, nickel, and selenium are receiving water concentrations measured in-stream at the base of Calleguas Creek and Revolon Slough and in Mugu Lagoon.

Table 14 – Interim Mass-based WLAs for mercury

Annual Cumulative Flow (million gallons per year)	Calleguas Creek (lbs/yr)	Revolon Slough (lbs/yr)
0-15,000	3.3	1.7
15,000-25,000	10.5	4
Above 25,000	64.6	10.2

(3) Pursuant to the TMDL, the interim storm water WLAs for mercury are suspended sediment loads measured in-stream at the base of Calleguas Creek and Revolon Slough and in Mugu Lagoon.

(4) Determination of the applicable interim WLA will be determined by calculating the total annual flow (October 1-September 30) in the Calleguas Creek watershed as measured by the flow gage at CSUCI.

(b) Compliance Monitoring:

(1) Compliance with the WLAs is to be determined through the measurement of in-stream water quality and total suspended solids (TSS) at the base of Calleguas Creek, Revolon Slough and in Mugu Lagoon, in accordance with the Calleguas Creek Watershed TMDL Monitoring Program approved by the Executive Officer.

(2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(c) Actions and Special Studies required of Calleguas MS4 permittees:

(1) Conduct a source control study, develop and submit an Urban Water Quality Management Program (UWQMP) for copper, mercury, nickel, and selenium. Complete by March 26, 2009.

(2) Implement the UWQMP within one year of approval by Executive Officer.

(3) In cooperation with agricultural dischargers, evaluate the results of the OCs TMDL special study on sediment transport rates for applicability to the metals and selenium TMDL. Complete within 6 months of completion of the OCs TMDL special study #1.

(4) In cooperation with agricultural dischargers, include monitoring for copper, mercury, nickel and selenium in the OC pesticides TMDL special study – Monitoring of Sediment by Source and Land Use Type. The special study is to be completed by March 26, 2014.

(5) Evaluate the results of the OC Pesticides TMDL Special Study – Effects of BMPs on Sediment and Siltation, to determine the impacts on metals and selenium. Complete within 6 months of completion of the OC Pesticides special study #1.

(6) Evaluate the effectiveness of BMPs implemented under the UWQMP in controlling metals and selenium discharges. This is to be completed by March 26, 2013.

(7) Re-evaluate agricultural and urban waste load allocations for copper, mercury, nickel and selenium based on the evaluation of BMP effectiveness. By March 26, 2012, urban dischargers will have a required 25% reduction in the difference between the loadings at the time of the TMDL preparation and the final WLAs effective in 2022.

(8) In cooperation with POTW permittees and agricultural dischargers, conduct a study to identify selenium contaminated groundwater sources. Special Study is to be completed within one year of the approval of the workplan.

(9) In cooperation with agricultural dischargers, conduct a study to investigate metals "hot spots" and natural soils concentrations. This special study is to be completed within 2 years of the approval of the workplan.

9. TMDL for Bacteria in Malibu Creek and Lagoon

(a) Waste Load Allocations:

(1) MS4 permittees discharging to Malibu Creek or its tributaries (Ventura County Watershed Protection District, County of Ventura and the cities of Thousand Oaks and Simi Valley) ("Malibu MS4 permittees") shall achieve the WLAs identified in Resolution 2004-19. These WLAs are expressed as the number of daily or weekly sample days that may exceed the single sample limits or 30-day geometric mean bacteria targets in Resolution 2004-19.

Table 15 - Bacteria Targets

Parameters	Unit	Fresh Water Targets	
		Geometric Mean	Single Sample
E. coli	mg	126/ 100	235/ 100
Fecal coliform	mg	200/ 100	400/ 100

(2) The summer dry weather wasteload allocations are to be achieved no later than January 24, 2009. The winter dry weather wasteload allocations are to be achieved no later than January 24, 2012.

(b) Compliance Monitoring:

(1) Achievement of the WLAs is to be determined through receiving water monitoring conducted in accordance with the Malibu Creek and Lagoon Bacteria TMDL Compliance Monitoring Program approved by the Executive Officer.

(2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(c) Actions and Special Studies required of Malibu MS4 permittees:

(1) If TMDL compliance monitoring indicates that the Malibu MS4 permittees are causing or contributing to an exceedance of the WLAs in the receiving waters, the permittees shall conduct a source identification study and implement additional controls sufficient to achieve the WLAs in the receiving waters.

10. TMDL for Trash in Revolon Slough and Beardsley Wash
    (a) Wasteload Allocations
        (1) MS4 permittees discharging to Revolon Slough and Beardsley Wash (Ventura County Watershed Protection District, County of Ventura and the cities of Camarillo and Oxnard) shall implement BMPs to achieve the WLAs of zero trash.
    (b) Compliance Monitoring
        (1) Responsible jurisdictions will develop a TMRP for Executive Officer approval that describes the methodologies that will be used to assess and monitor trash in Revolon Slough and Beardsley Wash and/or within responsible jurisdiction land areas. The TMRP shall include a plan to establish the trash Baseline WLAs.
        (2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.
    (c) Actions and Special Studies required of Revolon Slough and Beardsley Wash MS4 permittees
        (1) Per the adopted Basin Plan Amendment, compliance with the TMDL may be either through a progressive implementation schedule of full capture devices or implementation of other measures to attain the required trash reduction.

11. TMDL for Trash in the Ventura River Estuary
    (a) Wasteload Allocations
        (1) MS4 permittees discharging to the Ventura River Estuary (Ventura County Watershed Protection District, County of Ventura and the City of Ventura) shall implement BMPs to achieve the WLAs of zero trash.
    (b) Compliance Monitoring
        (1) Responsible jurisdictions will develop a TMRP for Executive Officer approval that describes the methodologies that will be used to assess and monitor trash in the Ventura River Estuary and/or within responsible jurisdiction land areas. The TMRP shall include a plan to establish the trash Baseline WLAs.
        (2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies

identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(c) Actions and Special Studies required of Revolon Slough and Beardsley Wash MS4 permittees

(1) Per the adopted Basin Plan Amendment, compliance with the TMDL may be either through a progressive implementation schedule of full capture devices or implementation of other measures to attain the required trash reduction.

12. TMDL for Boron, Chloride, Sulfate and TDS in Calleguas Creek Watershed

(a) Waste Load Allocation

Table 16 - Interim Dry Weather WLAs for Permitted Stormwater Dischargers

Constituent	Interim Limit 30-day average (mg/L)
Boron Total	1.3
Chloride Total	230
Sulfate Total	1289
TDS Total	1720

Table 17 - Final Dry Weather WLAs for Permitted Stormwater Dischargers

Subwatershed	Critical Condition Flow Rate (mgd)	Chloride Allocation (lb/day)	TDS Allocation (lb/day)	Sulfate Allocation (lb/day)	Boron Allocation (lb/day)
Simi	1.39	1,738	9,849	2,897	12
Las Posas	0.13	157	887	261	N/A
Conejo	1.26	1,576	8,931	2,627	N/A
Camarillo	0.06	72	406	119	N/A
Pleasant Valley (Calleguas)	0.12	150	850	250	N/A
Pleasant Valley (Revolon)	0.25	314	1,778	523	2

(b) Compliance Monitoring

(1) A monitoring plan will be submitted to the RWQCB for Executive Officer approval on June 2, 2009. Monitoring will begin one year after Executive Officer approval of the monitoring plan to allow time for the installation of automated monitoring equipment.

(2) Compliance with the WLAs is to be determined through the measurement of in-stream water quality at the base of each of the Calleguas Creek

subwatersheds, in accordance with the Calleguas Creek Watershed TMDL Monitoring Program approved by the Executive Officer.

(3) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(c) Actions and Special Studies required of Calleguas Creek Watershed MS4 permittees

Responsible jurisdictions including MS4 permittees shall submit compliance monitoring plan to the Los Angeles Regional Water Board for Executive Officer approval on June 2, 2009. Monitoring shall begin as outlined in the approved monitoring plan one year after approval of the work plan.

Responsible jurisdictions including MS4 permittees shall demonstrate that implementation actions have reduced the boron, sulfate, TDS, and chloride imbalance by 20%, 40%, 70% by December 2 of 2011, 2015, and 2018 respectively. Stormwater dischargers shall achieve WLAs, which shall be expressed as NPDES mass-based limits specified in accordance with federal regulations and state policy on water quality control by December 2, 2023.

13. TMDL for Bacteria in Harbor Beaches of Ventura County

(a) Waste Load Allocations

(1) MS4 permittees discharging to the Channel Islands Harbor Beaches (the County of Ventura, the Ventura County Watershed Protection District (VCWPD) and associated Municipal Separate Storm Sewer System (MS4) permittees in the Channel Islands Harbor subwatershed, and the City of Oxnard shall implement BMPs to achieve the interim WLAs listed in Table 18. All WLAs for summer dry-weather single sample bacteria densities at the Harbor Beaches of Ventura County are zero (0) days of allowable exceedances; winter dry weather and wet weather final WLAs are listed in Table 19 below.

The Basin Plan objectives that serve as the numeric targets for this TMDL are (single sample limits):

a. Total coliform density shall not exceed 10,000/100 ml.
b. Fecal coliform density shall not exceed 400/100 ml.
c. Enterococcus density shall not exceed 104/100 ml.
d. Total coliform density shall not exceed 1,000/100ml, if the ratio of fecal-to-total coliform exceeds 0.1.

Table 18 - Interim WLAs for Single Sample Exceedance Days

Location	Summer Dry Weather		Winter Dry Weather		Wet Weather	
	Daily Sampling	Weekly Sampling	Daily Sampling	Weekly Sampling	Daily Sampling	Weekly Sampling
Kiddie Beach	54	8	23	4	32	5
Hobie Beach	40	6	25	4	38	6

Table19 - Final Allowable Exceedance Days by Location

Location	Summer Dry-weather		Winter Dry-weather		Wet-weather	
	Daily Sampling	Weekly Sampling	Daily Sampling	Weekly Sampling	Daily Sampling	Weekly Sampling
Hobie Beach	0	0	3	1	17	3
Kiddie Beach	0	0	3	1	17	3

(2) Pursuant to the TMDL, the interim storm water WLAs for bacteria are from samples taken at existing monitoring sites in ankle to knee- high depths.

(b) Compliance Monitoring

(1) Compliance and monitoring for Harbor Beaches of Ventura County is based on existing monitoring protocols and locations. Monitoring shall continue at sampling locations (VCEHD 36000 and VCEHD37000) and at the current weekly monitoring frequency, consistent with AB411 compliance monitoring. Monitoring shall be conducted on a year-round basis at the current monitoring locations including the summer months (i.e., April to October) and winter months (i.e., November to March). Bacteria sampling shall be conducted in ankle- to knee-high water, consistent with AB411. However, if additional monitoring stations are added or if changes are made to the sampling frequencies or existing monitoring locations, then submittal of a monitoring plan is required for Executive Officer approval.

(2) If any WLA is exceeded at a compliance monitoring site, permittees shall implement BMPs in accordance with the TMDL Technical Reports, Implementation Plans or as identified as a result of TMDL special studies identified in the Basin Plan Amendment. Following these actions, Regional Water Board staff will evaluate the need for enforcement action.

(c) Actions and Special Studies required of Harbor Beaches of Ventura County MS4 permittees

(1) Per the adopted Basin Plan Amendment, compliance with the TMDL may be either through structural and non-structural BMPs or implementation of other measures to attain the required source control.

(2) Special studies are not required for implementation of the TMDL though conducting special studies is within the discretion of the responsible parties.

PART 6 - DEFINITIONS

The following are definitions for terms in this Order:

Adverse Impact - means a detrimental effect upon water quality or beneficial uses caused by a discharge or loading of a pollutant or pollutants.

Agriculture - means the science, art, and business of cultivating the soil, producing crops, and raising livestock.

Antidegradation Policies - means policies which protect surface and ground waters from degradation, and federal policies, which protect high quality surface waters. In particular, this policy protects waterbodies where existing quality is higher than that necessary for the protection of beneficial uses including the protection of fish and wildlife propagation and recreation on and in the water. (*Statement of Policy with Respect to Maintaining High Quality Water in California*, State Board Resolution No. 68-16; 40 CRF 131.12).

Applicable Standards and Limitations - means all State, interstate, and Federal standards and limitations to which a "discharge" or a related activity is subject under the CWA, including effluent limitations, water quality standards, standards of performance, toxic effluent standards or prohibitions, best management practices, and pretreatment standards under § 301, § 302, § 303, § 304, § 306, § 307, § 308, § 403, and § 404 of CWA.

Areas of Special Biological Significance (ASBS) - means all those areas of this state listed as ASBS, listed specifically within the California Ocean Plan or so designated by the State Board which, among other areas, includes the area from Mugu Lagoon to Latigo Point: Ocean water within a line originating from Laguna Point at 34° 5' 40" north, 119° 6'30" west, thence southeasterly following the mean high tideline to a point at Latigo Point defined by the intersection of the mean high tide line and a line extending due south of Benchmark 24; thence due south to a distance of 1000 feet offshore or to the 100 foot isobath, whichever distance is greater; thence northwesterly following the 100 foot isobath or maintaining a 1,000-foot distance from shore, whichever maintains the greater distance from shore, to a point lying due south of Laguna Point, thence due north to Laguna Point.

Authorized Discharge - means any discharge that is authorized pursuant to an NPDES permit, waste discharge requirement, conditional waiver from waste discharge requirements, or meets the conditions set forth in this Order.

Automotive Repair Shop - means a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.

Automotive Service Facilities - means a facility that is categorized in any one of the following Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes. For inspection purposes, Permittees need not inspect facilities with SIC codes

5013, 5014, 5541, 5511, provided that these facilities have no outside activities or materials that may be exposed to storm water.

SIC Code	Corresponding NAICS Code
5013	425120, 441310, 425110, & 423120
5014	425120, 425110, 423130, & 441320
5511	441110
5541	447110, & 447190
7532	811121
7533	811112
7534	326212, & 811198
7536	811122
7537	811113
7538	811111
7539	811198, & 811118

Bacteria Total Maximum Daily Load (TMDL) Dry Weather - defined in the Bacteria TMDLs as those days with less than 0.1 inch of rainfall and those days occurring more than 3 days after a rain.

Bacteria Total Maximum Daily Load (TMDL) Wet Weather - defined in the Bacteria TMDLs as a day with 0.1 inch or more of rain and 3 days following the rain event.

Basin Plan - means the Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, adopted by the Regional Water Board on June 13, 1994 and subsequent amendments.

Beneficial Uses - means the existing or potential uses of receiving waters in the permit area as designated by the Regional Water Board in the Basin Plan.

Best Management Practices (BMPs) - means methods, measures, or practices designed and selected to reduce or eliminate the discharge of pollutants to surface waters from point and nonpoint source discharges including storm water. BMPs include structural and nonstructural controls, and operation and maintenance procedures, which can be applied before, during, and/or after pollution producing activities.

California Environmental Quality Act (CEQA) - means a California statute that requires state and local agencies to identify significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible (Reference: California Public Resources Code § 21000 et seq.)

Channel - means an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two waterbodies.

Chronic Toxicity - means a measurement of a sublethal effect (e.g., reduced growth, reproduction) to experimental test organisms exposed to an effluent or ambient waters compared to that of the control organisms.

Commercial Area(s) - means any geographic area of the Permittees' jurisdiction that is not heavy industrial or residential. A commercial area includes, but is not limited to areas surrounding: commercial activity, hospitals, laboratories and other medical facilities, educational institutions, recreational facilities, plant nurseries, car wash facilities, mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses and other light industrial complexes.

Commercial Development - means any development on private land that is not heavy industrial or residential. The category includes, but is not limited to: hospitals, laboratories and other medical facilities, educational institutions, recreational facilities, plant nurseries, car wash facilities, mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses and other light industrial complexes.

Construction - Construction activity includes any construction or demolition activity, clearing, grading, grubbing, or excavation or any other activity that results in a land disturbance. Construction does not include emergency construction activities required to immediately protect public health and safety or routine maintenance activities required to maintain the integrity of structures by performing minor repair and restoration work, maintain original line and grade, hydraulic capacity, or original purpose of the facility. See "Routine Maintenance" definition for further explanation. Where clearing, grading or excavating of underlying soil takes place during a repaving operation, State General Construction Permit coverage is required if more than one acre is disturbed or the activities are part of a larger plan.

Construction Activities Storm Water General Permit (CASGP) - means the general NPDES permit adopted by the State Board, which authorizes the discharge of storm water from construction activities under certain conditions.

Control - means to minimize, reduce, eliminate, or prohibit by technological, legal, contractual or other means, the discharge of pollutants from an activity or activities.

Critical Sources - means commercial facilities and businesses that have a potential to contribute pollutants to stormwater runoff if effective BMPs are not implemented. Attachment "D" specifies the commercial facilities and businesses that have been identified as Critical Sources.

Dechlorinated/ Debrominated Swimming Pool Discharge - means any swimming pool discharge with a residual chlorine or bromine level of 0.1mg/L or less; and does not contain any detergents, wastes, algaecides, or cyanuric acid in excess of 50 ppm, or any other chemicals including salts from pools commonly referred to as "salt water pools". The term does not include swimming pool filter backwash or swimming pool water containing bacteria.

Development - means any construction, rehabilitation, redevelopment or reconstruction of any public or private residential project (whether single-family, multi-unit or planned unit development); industrial, commercial, retail and any other non-residential projects, including public agency projects; or mass grading for future construction.

Directly Adjacent - means situated within 200 feet of the contiguous zone required for the continued maintenance, function, and structural stability of the environmentally sensitive area.

Directly Discharging - means outflow from a drainage conveyance system that is composed entirely or predominately of flows from the subject, property, development, subdivision, or industrial facility and not commingled with the flows from adjacent lands.

Discharge - means when used without qualification the "discharge of a pollutant."

Discharging Directly - means outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject, property, development, subdivision, or industrial facility, and not commingled with the flows from adjacent lands.

Discharge of a Pollutant - means any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source" or, any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft, which is being used as a means of transportation. The term discharge includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

Disturbed Area - means any area that is altered as a result of land disturbance. Examples include but are not limited to: clearing, grading, grubbing, stockpiling and/ or excavation, etc...

Dry Day - means a non-wet day for Malibu Creek and Lagoon Bacteria TMDL WLA. A wet day is defined as a day with a 0.1 inch or more of rain and 3 days following the rain event.

Effect Concentration (EC) - means a point estimate of the toxicant concentration that would cause an observable adverse effect (e.g., death, immobilization, or serious incapacitation) in a given percent of the test organisms, calculated from a continuous model (e.g., Probit Model). EC_{25} is a point estimate of the toxicant concentration that would cause an observable adverse effect in 25 percent of the test organisms.

Effective Impervious Surface - means that portion of the surface area that is hydrologically connected via sheet flow over a hardened conveyance or impervious surface without any intervening medium to mitigate flow volume.

Effluent limitation - means any restriction imposed by the Permitting Authority (PA) on quantities, discharge rates, concentrations, and/ or mass loadings of "pollutants" which are "discharged" from "point sources" into "waters of the United States," the waters of the "contiguous zone," or the ocean.

Emergency - means a sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services. "Emergency" includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage. (Reference: California Public Resources Code § 21060.3. Emergency).

End-of-Pipe - means the end of the major outfall as defined in 40 CFR 122.26 (b)(5) and 40 CFR 122.26 (b)(6).

Endpoint - means a biological measurement used to quantify the results obtained from analytical methods such as whole effluent toxicity testing [e.g., lethal concentration (LC_{50}); inhibition concentration (IC_{25}); and no observed effect concentration (NOEC)]. Such endpoints are quantitative measurements of the responses of test organisms (e.g., survival, growth, mobility, reproduction, and weight gain or loss) in response to exposure to a serial dilution of effluent.

Environment - means the physical conditions, which exist within the area and which will be affected by a proposed project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. The area involved shall be the area in which significant effects would occur either directly or indirectly as a result of the project. The "environment" includes both natural and man-made conditions.

Environmentally Sensitive Area (ESA) - means an area "in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments" (Reference: California Public Resources Code § 30107.5). ESAs will include Clean Water Act 303d Listed Water Bodies in all reaches that are unimproved, all California Coastal Commission's Environmentally Sensitive Habitat Areas as delineated on maps in Local Coastal Plans and Regional Water Quality Control Board's Basin Plan Rare, Threatened or Endangered Species (RARE) and Preservation of Biological Habitats (BIOL) designated waterbodies. The California Department of Fish and Game's Significant Natural Areas map will be considered for inclusion as the department field verifies the designated locations. Watershed restoration projects will be considered for inclusion as the department field verifies the designated locations.

Erosivity Factor - The Erosivity Factor is a criterion that to assess the risk of erosion on disturbed land. It is described in "Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE), Agricultural Handbook 703, USDA-ARS, U.S. Government Printing Office, Washington, D.C., 1997 by Renard, K.C., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder.

Federal Clean Water Act (CWA) - means (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Public Law 92—500, as amended by Public Law 95—217, Public Law 95—576, Public Law 96—483 and Public Law 77—117, codified at 33 U.S.C. 1251 et seq.

First Storm Event - means the first storm event of the wet season that produces at least 0.25 inches of rain.

Forest Land - means land at least 10 percent stocked with live trees, or land that had this minimum tree stocking in the past and is not currently developed for nonforest use. The minimum area recognized is 1 acre.

Groundwater Dewatering - means the active practice of removing standing water from soil excavations using a pump(s) or other means.

Hillside - means property located in an area with known erosive soil conditions, where the development will result in grading on any slope that is 20% or greater or an area designated by the Municipality under a General Plan or ordinance as a "hillside area".

Horse Stables - means a property where at least one horse is stabled at least part of the year.

Hydromodification - means the alteration away from a natural state of stream flows or the beds or banks of rivers, streams, or creeks, including ephemeral washes, which results in hydrogeomorphic changes.

Illegal Discharge - means any discharge to the municipal separate storm sewer (storm drain system) that is prohibited under local, state, or federal statutes, ordinances, codes, or regulations. The term illegal discharge includes all non-storm water discharges not composed entirely of storm water except discharges pursuant to an NPDES permit, discharges that are identified in part 1, "Discharge Prohibitions" of this order, or discharges authorized by the Regional Water Board Executive Officer.

Illicit Connection - means any engineered conveyance that is connected to the storm drain system without a permit or municipal authorization. It also means any engineered conveyance through which discharges of pollutants to the separate storm drainage systems, which are not composed entirely of storm water or are not authorized by an NPDES permit, may occur.

Illicit Discharge - means any discharge to a municipal separate storm sewer (storm drain system) that is prohibited under local, state, or federal statutes, ordinances, codes, or regulations. The term illicit discharge includes all non-storm water discharges not composed entirely of storm water except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges that are identified in part 1, "Discharge Prohibitions" of this order, or authorized by the Regional Water Board Executive Officer.

Illicit Disposal - means any disposal, either intentionally or unintentionally, of material(s) or waste(s) that can pollute storm water.

Industrial/ Commercial Facility - means any facility involved and/ or used in the production, manufacture, storage, transportation, distribution, exchange or sale of goods and/ or

commodities, and any facility involved and/ or used in providing professional and non-professional services. This category of facilities includes, but is not limited to, any facility defined by either the Standard Industrial Classifications (SIC) or the North American Industry Classification System (NAICS). Facility ownership (federal, state, municipal, private) and profit motive of the facility are not factors in this definition.

Industrial Activities Storm Water General Permit (IASGP) - means the general NPDES permit adopted by the State Board, which authorizes the discharge of storm water from certain industrial activities under certain conditions.

Industrial Park - means a land development that is set aside for industrial development. Industrial parks are usually located close to transport facilities, especially where more than one transport modalities coincide: highways, railroads, airports, and navigable rivers. It includes office parks, which have offices and light industry.

Inhibition Concentration (IC) - means a point estimate of the toxicant concentration that would cause a given percent reduction in a non-lethal biological measurement (e.g., reproduction or growth), calculated from a continuous model (i.e., Interpolation Method). IC25 is a point estimate of the toxic concentration that would cause a 25-percent reduction in a non-lethal biological measurement.

Inspection - means entry and the conduct of an on-site review of a facility and its operations, at reasonable times, to determine compliance with specific municipal or other legal requirements. The steps involved in performing an inspection, include, but are not limited to:

1. Pre-inspection documentation research
2. Request for entry
3. Interview of facility personnel
4. Facility walk-through
5. Visual observation of the condition of facility premises
6. Examination and copying of records as required
7. Sample collection (if necessary or required)
8. Exit conference (to discuss preliminary evaluation)
9. Report preparation, and if appropriate, recommendations for coming into compliance

Integrated Pest Management (IPM) - means a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health, and environmental risks.

Large Municipal Separate Storm Sewer System (MS4) - means all MS4s that serve a population greater than 250,000 (1990 Census) as defined in 40 CFR 122.26 (b)(4). The Regional Water Board designated Ventura County as a large MS4 in 1990, based on: (i) the U.S. Census Bureau 1990 population count of 669,016 thousand, and (ii) the interconnectivity of the MS4s in the incorporated and unincorporated areas within the County.

Local SWPPP - means the Local Storm Water Pollution Prevention Plan (LSWPPP) required by the local agency for a project that disturbs one or more acres of land. Shall mean a plan identifying potential pollutant sources from a construction site and describing proposed design, placement and implementation of BMPs, to effectively prevent non-storm water discharges and reduce pollutants in storm water discharges to the storm drain system, during construction activities. Also referred as a Storm Water Pollution Control Plan (SWPCP).

Low Impact Development (LID) – means a design strategy with the goal of maintaining or replicating the pre-development hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic site design. Hydrologic functions of storage, infiltration and ground water recharge, as well as the volume and frequency of discharges are maintained through the use of integrated and distributed micro-scale storm water retention and detention areas, reduction of impervious surfaces, and the lengthening of runoff flow paths and flow time. Other strategies include the preservation/protection of environmentally sensitive site features such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands, and highly permeable soils.

Major Municipal Separate Storm Sewer Outfall ("or major outfall") - means a major municipal separate storm sewer outfall that discharges from a single pipe with an inside diameter of 36 inches or more or its equivalent (discharge from a single conveyance other than circular pipe which is associated with a drainage area of more than 50 acres); or for municipal separate storm sewers that receive storm water from lands zoned for industrial activity (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe with an inside diameter of 12 inches or more or from its equivalent (discharge from other than a circular pipe associated with a drainage area of 2 acres or more), as defined in 40 CFR 122.26 (b)(5).

Major Outfall - means a major municipal separate storm sewer outfall, as defined in 40 CFR 122.26 (b)(6).

Maximum Extent Practicable (MEP) – The technology-based permit requirement established by Congress in CWA section 402(p)(3)(B)(iii) that municipal dischargers of storm water must meet. Technology-based requirements, including MEP, establish a level of pollutant control that is derived from available technology or other controls. MEP requires municipal dischargers to perform at maximum level that is practicable. Compliance with MEP may be achieved by emphasizing pollution prevention and source control BMPs in combination with structural and treatment methods where appropriate. The MEP approach is an ever evolving and advancing concept, which considers technical and economic feasibility.

Method Detection Limit (MDL) - means the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, as defined in 40 CFR 136, Appendix "G" of this Order.

Minimum Level (ML) - means the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed. The ML value represents the lowest quantifiable concentration in a sample based on the proper application of all method-based analytical procedures and the absence of any matrix interferences. Assuming that all method-specific analytical steps are followed, the ML value will also represent, after the appropriate application of method-specific factors, the lowest standard in the calibration curve for that specific analytical technique.

Minimum Significant Difference (MSD) - means a measure of test sensitivity that establishes the minimum difference required between a control and a test treatment in order for that difference to be considered statistically significant.

Municipal Separate Storm Sewer System (MS4) - means a conveyance or system of conveyances (including roads w/ drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains), as defined in 40 CFR 122.26(b)(8):

1. Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under § 208 of the Federal Clean Water Act (CWA) that discharges into waters of the United States
2. Designed or used for collecting or conveying storm water
3. Which is not a combined sewer
4. Which is not part of a Publicly Owned Treatment Works (POTW), as defined in 40 CFR 122.2

NAICS - means North American Industry Classification System.

National Pollutant Discharge Elimination System (NPDES) - means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under CWA § 307, 402, 318, and 405.

Natural Drainage Systems - means unlined or unimproved (not engineered) creeks, streams, rivers or similar waterways.

New Development - means land disturbing activities; structural development, including construction or installation of a building or structure, creation and replacement of impervious surfaces; and land subdivision.

Non-Storm Water Discharge - means any discharge to a storm drain that is not composed entirely of storm water.

No Observed Effect Concentration (NOEC) - means the highest tested concentration of an effluent or toxicant that causes no observable adverse effect on the test organisms (i.e., the highest concentration of toxicant at which the values for the observed responses are not statistically different from the controls).

Nuisance - means anything that meets all of the following requirements: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property; (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal; (3) occurs during, or as a result of, the treatment or disposal of wastes.

Nursery - means nursery operations that are generally classified under 4 broad NAICS classification sectors: (a) 111xxx - Crop Production – Agriculture; (b) 424xxx - Merchant Wholesalers, Nondurable Goods; (c) 44xxxx - Retail Trade; and (d) 454xxx - Non-store retailers. Retail nursery operations shall be covered by this Order. This Order does not cover wholesale nursery stock operations or agricultural nursery operations, unless such operations are not covered by another Regional Water Board Order.

(1) **Retail Nursery Operations** - means Nursery, Garden Center, and Farm Supply Stores typically classified under NAICS Code 444220 and non-store retailers typically classified under NAICS Code 454xxx. Retail nursery operations are primarily engaged in retailing nursery and garden products, such as trees, shrubs, plants, seeds, bulbs, floriculture products and sod, which are predominantly grown elsewhere. These establishments may sell a limited amount of a product they grow themselves.

Open Channel - means a storm drainage channel that is not a natural water course.

Parking Lot - means land area or facility for the parking or storage of motor vehicles used for businesses, commerce, industry, or personal use.

Percent Minimum Significant Difference (PMSD) - means the minimum significant difference divided by the control mean, expressed as a percent (see minimum significant difference).

Permit - means an authorization, license, or equivalent control document issued by U.S. EPA or an "approved State" to implement the requirements of 40 CFR Parts 122, 123, and 124. "Permit" includes an NPDES "general permit" (§ 122.28). Permit does not include any permit, which has not yet been the subject of final agency action, such as a "draft permit" or a "proposed permit."

Permittee(s) - means co-permittee(s) and any agency named in this Order as being responsible for permit conditions within its jurisdiction, as defined by Federal Regulation. Permittees to this Order include the Ventura Water Protection District, Ventura County, and the

cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, San Buenaventura, Santa Paula, Simi Valley and Thousand Oaks.

Point Source - means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

Point Zero - means in the context of the TMDLs, the point at which water from the storm drain or creek initially mixes with water.

Pollutants - means those "pollutants" defined in CWA § 502(6) (33.U.S.C.§ 1362(6)), and incorporated by reference into California Water Code § 13373.

Pollutants of Concern - means constituents that have exceeded Basin Plan Objectives, and CTR- Chronic or Acute Objectives during monitoring at Mass Emission, Receiving Water, and Land Use stations.

Potable Water Sources - means the potable water system for the treatment, distribution, and provision of water for residential, commercial, industrial, or institutional use that meets all California safe drinking water regulatory standards for human consumption.

Pre-Developed Condition - means native vegetation and soils that existed at a site prior to first development. The pre-developed condition may be assumed to be an area with the typical vegetation, soil, and storm water runoff characteristics of open space areas in coastal Southern California unless reasonable historic information is provided that the area was atypical.

Priority Pollutants - means those constituents referred to in 40 CFR 401.15 and listed in the U.S. EPA NPDES Application Form 2C, pp. V-3 through V-9.

Project - means all development, redevelopment, and land disturbing activities. The term is not limited to "Project" as defined under CEQA (Reference: California Public Resources Code § 21065).

Qualified SWPPP Developer or Qualified SWPPP Practitioner – refer to State of California General Construction Stormwater Permit for definition.

Rare, Threatened, or Endangered Species (RARE) - means a beneficial use for waterbodies in the Los Angeles Region, as designated in the Basin Plan (Tables 2-1, 2-3, and 2-4), that supports habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Redevelopment - means land-disturbing activity that results in the creation, addition, or replacement of 5,000 square feet or more of impervious surface area on an already developed

site. Redevelopment includes, but is not limited to: the expansion of a building footprint; addition or replacement of a structure; replacement of impervious surface area that is not part of a routine maintenance activity; and land disturbing activities related to structural or impervious surfaces. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

Regional Administrator - means the Regional Administrator of the Regional Office of the U.S. EPA or the authorized representative of the Regional Administrator.

Report of Waste Discharge (ROWD) - means an application for renewal of the NPDES Permit for Waste Discharge Requirements for Municipal Separate Storm Sewer Discharges Within the Ventura County Watershed Protection District, County of Ventura and the Incorporated Cities Therein.

Restaurant - means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC Code 5812).

Restoration - means the reestablishment of predisturbance aquatic functions and related physical, chemical and biological characteristics (Reference: National Research Council. 1992. Restoration of Aquatic Ecosystems: Science, Technology and Public Policy. National Academy Press, Washington, D.C.).

Retail Gasoline Outlet (RGO) - means any facility engaged in selling gasoline and lubricating oils- SIC 5541 and NAICS 447110 & 447190.

1. RGOs: 447190 Other Gasoline Stations:
   This industry comprises establishments known as gasoline stations (except those with convenience stores) primarily engaged in one of the following: (1) retailing automotive fuels (e.g., diesel fuel, gasohol, gasoline) or (2) retailing these fuels in combination with activities, such as providing repair services; selling automotive oils, replacement parts, and accessories; and/ or providing food services.
2. RGOs: 447110 Gasoline Stations with Convenience Stores:
   Retailing automotive fuels in combination with a convenience store or food mart.

Routine Maintenance – Routine maintenance projects include, but are not limited to projects conducted to:

1. Maintain the original line and grade, hydraulic capacity, or original purpose of the facility.
2. Perform as needed restoration work to preserve the original design grade, integrity and hydraulic capacity of flood control facilities.
3. Includes road shoulder work, regrading dirt or gravel roadways and shoulders and performing ditch cleanouts.
4. Update existing lines* and facilities to comply with applicable codes, standards, and regulations regardless if such projects result in increased capacity.
5. Repair leaks

Routine maintenance does not include construction of new** lines or facilities resulting from compliance with applicable codes, standards and regulations.
* Update existing lines includes replacing existing lines with new materials or pipes.
** New lines are those that are not associated with existing facilities and are not part of a project to update or replace existing lines.

Screening - means using proactive methods to identify illicit connections through a continuously narrowing process. The methods may include: performing baseline monitoring of open channels, conducting special investigations using a prioritization approach, analyzing maintenance records for catch basin and storm drain cleaning and operation, and verifying all permitted connections into the storm drains. Special investigation techniques may include: dye testing, visual inspection, smoke testing, flow monitoring, infrared, aerial and thermal photography, and remote control camera operation.

Sidewalk Rinsing - means only sidewalk rinsing using high pressure and low volume of water with no additives and at an average usage of 0.006 gallons per square foot of surface area to be rinsed. Any waste generated from the activity must be collected and properly and legally disposed of. It does not mean hosing of any sidewalk or street with a garden hose with a pressure nozzle.

Site - means the land or water area where any "facility or activity" is physically located or conducted, including adjacent land used in connection with the facility or activity.

Small Construction - means any soil disturbing activities less than 5 acres.

Smart Growth - development in or near cities intended to lessen or reverse suburban sprawl, decrease the use of automobiles, and shorten daily travel. It uses compact building design to cluster together residential, shopping, and work areas and encourages walking and public transportation. Smart Growth is considered a stormwater BMP in the 2005 publication *Using Smart Growth Techniques as Stormwater Best Management Practices*, EPA 231-B-05-002.

Source Control BMP - means any schedules of activities, prohibitions of practices, maintenance procedures, managerial practices or operational practices that aim to prevent storm water pollution by reducing the potential for contamination at the source of pollution.

Southern California Stormwater Monitoring Coalition (SMC) - means the Stormwater Monitoring Coalition, which is a collaborative research/ monitoring partnership of the Southern California Water Boards, Municipal Storm Water Agencies, and municipalities to develop the methodologies and assessment tools to more effectively understand urban storm water and non-storm water (anthropogenic) impacts to receiving waters and to conduct research/ monitoring through Subsequent Research Implementation Agreements. The first original cooperative agreement was entered into on February 8, 2001.

Stream - means a body of flowing water; natural water course containing water at least part of the year. In hydrology, it is generally applied to the water flowing in a natural channel as distinct from a canal (Reference: US Geological Survey).

Strip Mall - means a commercial development that is a shopping center where the stores are arranged in a row, with a sidewalk in front. Strip malls are typically developed as a unit and have large parking lots in front. They face major traffic arterials and tend to be self-contained with few pedestrian connections to surrounding neighborhoods. It is also called a plaza.

Storm Event Monitoring - means a rainfall event that produces more than 0.25 inch of precipitation and is separated from the previous storm event by at least 1 week of dry weather, for the purpose of monitoring.

Storm Water - means storm water runoff, snow melt runoff, and surface runoff and drainage, as defined in 40 CFR 122.26(b)(13).

Storm Water Discharge Associated with Industrial Activity - means industrial discharge, as defined in 40 CFR 122.26(b)(14).

Storm Water Quality Management Program - means the Ventura Countywide Storm Water Quality Management Plan, which includes descriptions of programs, collectively developed by the Permittees in accordance with provisions of the NPDES Permit, to comply with applicable federal and state law, as the same is amended from time to time.

Structural BMP - means any structural facility designed and constructed to mitigate the adverse impacts of storm water runoff pollution (e.g. canopy, structural enclosure). The category may include both Treatment Control BMPs and Source Control BMPs.

Summer Dry Weather - means dry weather days occurring from April 1 through October 31 of each year.

t-Test (formally Student's t-test) - means a statistical analysis comparing two sets of replicate observations, in the case of WET, only two test concentrations (e.g., a control and 100% effluent). The purpose of this test is to determine if the means of the two sets of observations are different [e.g., if the 100% effluent concentration differs from the control (i.e., the test pass or fails)].

Targeted Employees - means management and staff who perform or direct activities that directly or indirectly have an effect of storm water quality. The employees generally are employed in the following areas: department of public works, engineering, sanitation, storm water maintenance, drainage and flood control, transportation, streets and roads, parks and recreation, public landscaping and corporation yards, planning or community development, code enforcement, building and safety, harbor or port departments, airports, or general services and fleet services.

Total Maximum Daily Load (TMDL) - means the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background.

Toxicity Identification Evaluation (TIE) - means a set of procedures to identify the specific chemical(s) responsible for toxicity through a process of chemical/ physical manipulations of samples followed by toxicity tests. These procedures are performed in 3 phases (Phase I- Toxicity Characterization Procedure, Phase II- Toxicity Identification Procedure, and Phase III- Toxicity Confirmation Procedure) using aquatic organism toxicity tests.

Toxicity Reduction Evaluation (TRE) - means a study conducted in a step-wise process to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity.

Toxicity Test - means a procedure using living organisms to determine whether a chemical or an effluent is toxic. A toxicity test measures the degree of the effect of a specific chemical or effluent on exposed test organisms.

Toxic Unit (TU) - means a measure of toxicity in an effluent as determined by the acute toxicity units (TUa) or chronic toxicity units (TUc) measured. The larger the TU, the greater the toxicity.

Toxic Unit - Chronic (TUc) - means 100 times the reciprocal of the effluent concentration that causes no observable effect on the test organisms in a chronic toxicity test (TUc = 100/NOEC or 100/EC25) (see NOEC).

Treatment - means the application of engineered systems that use physical, chemical, or biological processes to remove pollutants. Such processes include, but are not limited to, filtration, gravity settling, media absorption, biodegradation, biological uptake, chemical oxidation and UV radiation.

Treatment Control BMP - means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media absorption or any other physical, biological, or chemical process.

Urbanization - means the process of changing of land use and land patterns from rural characteristics to urban (city-like) characteristics. These changes include (i) the replacement of pervious surfaces with impervious surfaces such as rooftops and buildings, and impervious materials such as asphalt and concrete; and (ii) the conversion of rural land to house new residents, support new businesses, and facilitate vehicular traffic flow.

U.S. EPA Phase I Facilities - means facilities in specified industrial categories that are required to obtain an NPDES permit for storm water discharges, as required by 40 CFR 122.26(c). These categories include:

1. Facilities subject to storm water effluent limitation guidelines, new source performance standards, or toxic pollutant effluent standards (40 CFR N)
2. Manufacturing facilities

3. Oil and gas/ mining facilities
4. Hazardous waste treatment, storage, or disposal facilities
5. Landfills, land application sites, and open dumps
6. Recycling facilities
7. Steam electric power generating facilities
8. Transportation facilities
9. Sewage of wastewater treatment works
10. Light manufacturing facilities

Vehicle Maintenance/ Material Storage Facilities/ Corporation Yards - means any Permittee owned or operated facility or portion thereof that:

1. Conducts industrial activity, operates or stores equipment or materials, and provides services similar to Federal Phase I facilities;
2. Performs fleet vehicle service/ maintenance including repair, maintenance, washing, or fueling;
3. Performs maintenance and/ or repair of machinery/ equipment; or
4. Stores chemicals, raw materials, or waste materials.

Waste Load Allocations (WLAs) - means a portion of a receiving water's Total Maximum Daily Pollutant Load (TMDL) that is allocated to one of its existing or future point sources of pollution (Reference: 40 CFR 130.2(h)).

Water Quality Objectives - means water quality criteria contained in the Basin Plan, the California Ocean Plan, the National Toxics Rule, the California Toxics Rule, and other state or federally approved surface water quality plans. Such plans are used by the Regional Water Board to regulate all discharges, including storm water discharges.

Water Quality Standards - means the State Water Quality Standards, which are comprised of beneficial uses, water quality objectives and the State's Antidegradation Policy.

Waters of the State - means any surface water or groundwater, including saline waters, within boundaries of the state (Reference: California Water Code § 13050).

Waters of the United States or Waters of the US - means:

1. All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters, including interstate "wetlands";
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds where the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:
   a. Which are or could be used by interstate or foreign travelers for recreational or other purposes
   b. From which fish or shellfish are or could be taken and sold in interstate or

foreign commerce; or
   c. Which are used or could be used for industrial purposes by industries in interstate commerce
4. All impoundments of waters otherwise defined as waters of the United States under this definition;
5. Tributaries of waters identified in the preceding paragraph (1) through (4) of this definition;
6. The territorial sea; and
7. "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in the preceding paragraph (1) through (6) of this definition. (Reference: 33 CFR 328)

Watercourse - means any natural or artificial channel for passage of water, including the VCFCD jurisdictional channels included in the List of Channels within the Comprehensive Plan of the VCFCD, as approved by the Board of Supervisors of the VCFCD on October 4, 1993, and any amendments thereto.

Watershed Management - means approach for water resources protection. It is a strategy for integrating and managing resources, both human and fiscal that focuses on regulation of point sources, to a more regional approach that acknowledges environmental impacts from other activities.

Watershed Management Areas (WMA) - means the geographically-defined watershed areas where the Regional Water Board will implement the watershed approach. These generally involve a single large watershed within which exists smaller subwatersheds but in some cases may be an area that does not meet the strict hydrologic definition of a watershed e.g., several small Ventura coastal waterbodies in the region are grouped together into one WMA.

Wet Season - means the calendar period beginning October 1 through April 15.

Winter Dry Weather - means dry weather days occurring from November 1 - March 31 of each year.

Whole Effluent Toxicity - means the aggregate toxic effect of an effluent measured directly by a toxicity test.

PART 7 - STANDARD PROVISIONS

A. General Requirements

1. The Permittee shall comply with all provisions and requirements of this Order.

2. Should the Permittee discover that it failed to submit any relevant facts or that it submitted incorrect information in a report it shall promptly submit the missing or correct information.

3. The Permittee shall report all instances of non-compliance not otherwise reported at the time monitoring reports are submitted.

4. This Order includes Attachment "I", the Reporting Program, which is a part of this Order and must be complied with.

B. Regional Water Board Review

1. The Regional Water Board may review any formal determinate or approval made by the Regional Water Board Executive Officer pursuant to the provisions of this Order.
   (a) Permittee(s) or a member of the public may request such review upon petition within 30 day of the effective date of the notification of such decision to the Permittee(s) and interested parties on file at the Regional Water Board.

C. Public Review

1. All documents submitted to the Regional Water Board in compliance with the terms and conditions of this Order shall be made available to members of the public pursuant to the Freedom of Information Act (5 U.S.C. § 552), as amended, and the Public Records Act (California Government Code § 6250 et seq.).

2. All documents submitted to the Regional Water Board Executive Officer for approval shall be made available to the public for a 30-day period to allow for public comment.

D. Duty to Comply [40 CFR 122.41(a)]

1. Each Permittee must comply with all of the terms, requirements, and conditions of this Order. Any violation of this order constitutes a violation of the Clean Water Act, its regulations and the California Water Code, and is grounds for enforcement action, Order termination, Order revocation and reissuance, denial of an application for reissuance, or a combination thereof [40 CFR 122.41(a), Cal. Wat. Code § 13261, 13263, 13265, 13268, 13300, 13301, 13304, 13340, 13350].

2. A copy of these waste discharge specifications shall be maintained by each Permittee so as to be available during normal business hours to Permittee employees and members of the public.

3. Any discharge of wastes at any point(s) other than specifically described in this Order is prohibited, and constitutes a violation of the Order.

E. Duty to Mitigate [40 CFR 122.41 (d)]

1. Each Permittee shall take all reasonable steps to minimize or prevent any discharge that has a reasonable likelihood of adversely affecting human health or the environment.

F. Inspection and Entry; Investigations; Responsibilities [40 CFR 122.41(i), Cal. Water Code § 13225 and § 13267]

1. The Regional Water Board, U.S. EPA, and other authorized representatives shall be allowed:
   (a) Entry upon premises where a regulated facility is located or conducted, or where records are kept under conditions of this Order;
   (b) Access to copy any records, at reasonable times that are kept under the conditions of this Order;
   (c) To inspect at reasonable times any facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order;
   (d) To photograph, sample, and monitor at reasonable times for the purpose of assuring compliance with this Order, or as otherwise authorized by the CWA and the CAL. WATER CODE;
   (e) To review any water quality control plan or waste discharge requirements, or in connection with any action relating to any plan or requirement to investigate the quality of any waters of the state within its region; and,
   (f) To require as necessary any state or local agency to investigate and report on any technical factors involved in water quality control or to obtain and submit analyses of water.

G. Proper Operation and Maintenance [40 CFR 122.41 (e), Cal. Water Code § 13263(f)]

1. The Permittees shall at all times properly operate and maintain all facilities and systems of treatment (and related appurtenances) that are installed or used by the Permittees to achieve compliance with this Order. Proper operation and maintenance includes:
   (a) Adequate laboratory controls; and
   (b) Appropriate quality assurance procedures.

2. This provision requires the operation of backup or auxiliary facilities or similar system that are installed by a Permittee only when necessary to achieve compliance with the conditions of this Order.

H. Signatory Requirements [40 CFR 122.41(k) & 122.22]

1. Except as otherwise provided in this Order, all applications, reports, or information submitted to the Regional Water Board shall be signed by the City Manager or Mayor, or authorized designee and certified as set forth in 40 CFR 122.22.

I. Reopener and Modification [40 CFR 122.41(f) & 122.62]

1. This Order may only be modified, revoked, or reissued, prior to the expiration date, by the Regional Water Board, in accordance with the procedural requirements of the Cal. Water Code and CCR Title 23 for the issuance of waste discharge requirements, 40 CFR 122.62, and upon prior notice and hearing, to:
   (a) Address changed conditions identified in the required reports or other sources deemed significant by the Regional Water Board;
   (b) Incorporate applicable requirements or statewide water quality control plans adopted by the State Board or amendments to the Basin Plan, including TMDLs;
   (c) Comply with any applicable requirements, guidelines, and/ or regulations issued or approved pursuant to CWA § 402(p); and/ or,
   (d) Consider any other federal, or state laws or regulations that became effective after adoption of this Order.

2. After notice and opportunity for a hearing, this Order may be terminated or modified for cause, including, but not limited to:
   (a) Violation of any term or condition contained in this Order;
   (b) Obtaining this Order by misrepresentation, or failure to disclose all relevant facts; or,
   (c) A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

3. The filing of a request by the Principal Permittee or Permittees for a modification, revocation and re-issuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.

4. This Order may be modified to make corrections or allowances for changes in the permitted activity listed in this section, following the procedures at 40 CFR 122.63, if processed as a minor modification. Minor modifications may only:
   (a) Correct typographical errors; or
   (b) Require more frequent monitoring or reporting by the Permittee.

J. Severability

1. The provisions of this Order are severable; and if any provision of this Order or the application of any provision of this Order to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this Order shall not be affected.

K. Duty to Provide Information [40 CFR 122.41(h)]

1. The Permittees shall furnish, within a reasonable time, any information the Regional Water Board or U.S. EPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order.

2. The Permittees shall also furnish to the Regional Water Board, upon request, copies of records required to be kept by this Order.

L. Twenty-Four Hour Reporting [40 CFR 122.41(l)(6)][1]

1. The Permittees shall report to the Regional Water Board any noncompliance that may endanger health or the environment. Any information shall be provided orally within 24 hours from the time any Permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

2. The Regional Water Board may waive the required written report on a case-by-case basis.

M. Bypass [40 CFR 122.41(m)][2]

1. Bypass (the intentional diversion of waste streams from any portion of a treatment facility) is prohibited. The Regional Water Board may take enforcement action against Permittees for bypass unless:
   (a) Bypass was unavoidable to prevent loss of life, personal injury or severe property damage. (Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.);
   (b) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated waste, or maintenance during normal periods of equipment down time. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that could occur during normal periods of equipment downtime or preventive maintenance;

---

[1] This provision applies to incidents where effluent limitations (numerical or narrative) as provided in this Order or in the Ventura County SMP are exceeded, and which endanger public health or the environment.
[2] This provision applies to the operation and maintenance of storm water controls and BMPs as provided in this Order or in the Ventura County SMP.

(c) The Permittee submitted a notice at least ten days in advance of the need for a bypass to the Regional Water Board; or,
(d) Permittees may allow a bypass to occur that does not cause effluent limitations to be exceeded, but only if it is for essential maintenance to assure efficient operation. In such a case, the above bypass conditions are not applicable. The Permittee shall submit notice of an unanticipated bypass as required.

N. Upset [40 CFR 122.41(n)][1]

1. Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
2. A Permittee that wishes to establish the affirmative defense of an upset in an action brought for non compliance shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
   (a) An upset occurred and that the Permittee can identify the cause(s) of the upset;
   (b) The permitted facility was being properly operated by the time of the upset;
   (c) The Permittee submitted notice of the upset as required; and,
   (d) The Permittee complied with any remedial measures required.
3. No determination made before an action for noncompliance, such as during administrative review of claims that non-compliance was caused by an upset, is final administrative action subject to judicial review.
4. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

O. Property Rights [40 CFR 122.41(g)]

1. This Order does not convey any property rights of any sort, or any exclusive privilege.

P. Enforcement

1. Violation of any of the provisions of the NPDES permit or any of the provisions of this Order may subject the violator to any of the penalties described herein, or any combination thereof, at the discretion of the prosecuting authority; except that only one kind of penalties may be applied for each kind of violation. The CWA provides the following:
   (a) Criminal Penalties for:

[1] This provision applies to incidents where effluent limitations (numerical or narrative) as provided in this Order or in the Ventura County SMP are exceeded, and which endanger public health or the environment.

(1) Negligent Violations [CWA § 309 (c)(1)(B)]:
The CWA provides that any person who negligently violates permit conditions implementing CWA § 301, 302, 306, 307, 308, 318, or 405 is subject to a fine of not less than $2,500 nor more than $25,000 per day for each violation, or by imprisonment for not more than 1 year, or both.

(2) Knowing Violations [CWA § 309 (c)(2)(B)]:
The CWA provides that any person who knowingly violates permit conditions implementing CWA § 301, 302, 306, 307, 308, 318, or 405 is subject to a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or both.

(3) Knowing Endangerment [CWA § 309 (c)(3)(A)]:
The CWA provides that any person who knowingly violates permit conditions implementing CWA § 301, 302, 307, 308, 318, or 405 and who knows at that time that he is placing another person in imminent danger of death or serious bodily injury is subject to a fine of not more than $250,000, or by imprisonment for not more than 15 years, or both.

(4) False Statement [CWA § 309 (c)(4)]:
The CWA provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under the Act or who knowingly falsifies, tampers with, or renders inaccurate, any monitoring device or method required to be maintained under the Act, shall upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than two years, or by both. If a conviction is for a violation committed after a first conviction of such person under this paragraph, punishment shall be by a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four years, or by both.

(b) Civil Penalties [[CWA § 309 (d)]
The CWA provides that any person who violates a permit condition implementing CWA § 301, 302, 306, 307, 308, 318, or 405 is subject to a civil penalty not to exceed $27,500 per day for each violation.

2. Violation of any of the provisions of the NPDES permit or any of the provisions of this Order may subject the violator to any of the penalties described herein, or any combination thereof, at the discretion of the prosecuting authority; except that only one kind of penalties may be applied for each kind of violation. The Cal. Water Code §13885 provides the following:
   (a) Any person who violates any of the following shall be liable civilly in accordance with this section:
      (1) Section 13375 or 13376.
      (2) Any waste discharge requirements or dredged or fill material permit issued pursuant to this chapter or any water quality certification issued pursuant to Section 13160.
      (3) Any requirements established pursuant to Section 13383.

(4) Any order or prohibition issued pursuant to Section 13243 or Article 1 (commencing with Section 13300) of Chapter 5, if the activity subject to the order or prohibition is subject to regulation under this chapter.
(5) Any requirements of Section 301, 302, 306, 307, 308, 318, 401, or 405 of the Clean Water Act, as amended.
(6) Any requirement imposed in a pretreatment program approved pursuant to waste discharge requirements issued under Section 13377 or approved pursuant to a permit issued by the administrator.

Q. Need to Halt or Reduce Activity not a Defense [40 CFR 122.41(c)]

1. It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order.

R. Termination of Board Order

1. Except for enforcement purposes, Regional Water Board Order No. 09-0057 is hereby terminated.

S. Board Order Expiration Date

1. This Order expires on July 8, 2015. The Permittees must submit a Report of Waste Discharge (ROWD) and a proposed Storm Water Quality Management Program in accordance with CCR Title 23 as application for reissuance of waste discharge requirements no later than 180 days in advance of such date.

T. MS4 Annual Reporting Program [40 CFR 122.42(c)]

1. The Annual Program Reporting shall include the following information:
   (a) *Municipal separate storm sewer systems.*
   The operator of a large or medium municipal separate storm sewer system or a municipal separate storm sewer that has been designated by the Director under 40 CFR 122.26(a)(1)(v) of this part must submit an annual report by the anniversary of the date of the issuance of the permit for such system. The report shall include:
   (1) The status of implementing the components of the storm water management program that are established as permit conditions;
   (2) Proposed changes to the storm water management programs that are established as permit condition. Such proposed changes shall be consistent with 40 CFR 122.26(d)(2)(iii) of this part;
   (3) Revisions, if necessary, to the assessment of controls and the fiscal analysis reported in the permit application under 40 CFR 122.26(d)(2)(iv) and (d)(2)(v) of this part;
   (4) A summary of data, including monitoring data that is accumulated throughout the reporting year;

(5) Annual expenditures and budget for year following each annual report;
(6) A summary describing the number and nature of enforcement actions, inspections, and public education programs; and
(7) Identification of water quality improvements or degradation.

I, Samuel Unger, Interim Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on July 8, 2010.

Samuel Unger
Interim Executive Officer

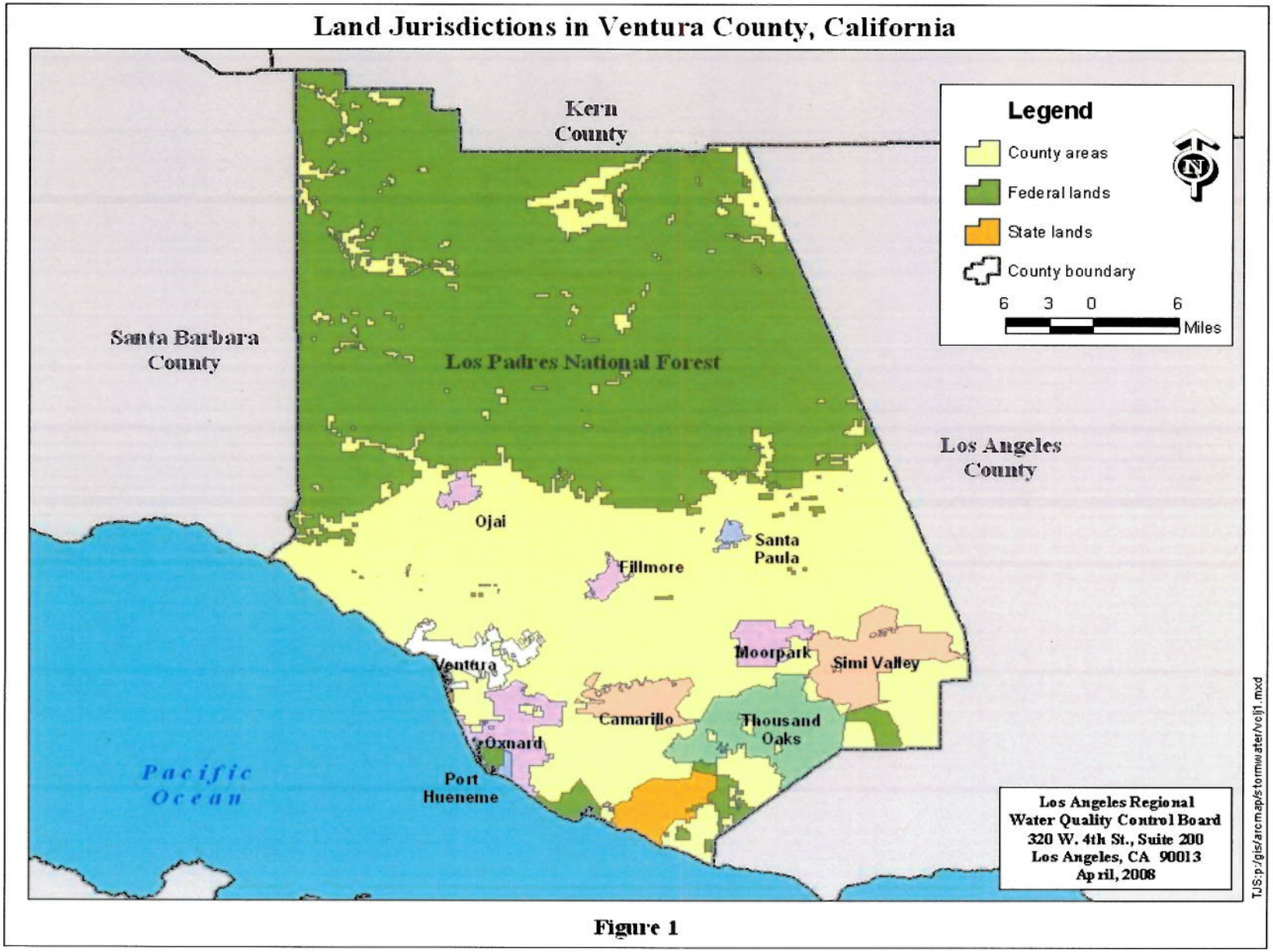
Land Jurisdictions in Ventura County, California
Kern County
Santa Barbara County
Los Padres National Forest
Los Angeles County
Legend
County areas
Federal lands
State lands
County boundary
6 3 0 6
Miles
Ojai
Fillmore
Santa Paula
Moorpark
Simi Valley
Ventura
Camarillo
Thousand Oaks
Oxnard
Port Hueneme
Pacific Ocean
Los Angeles Regional Water Quality Control Board
320 W. 4th St., Suite 200
Los Angeles, CA 90013
April, 2008
T:\GIS\p:/gis/arcmap/stormwater/vcj1.mxd

Figure 1

STATE OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. 01-182
NPDES PERMIT NO. CAS004001
WASTE DISCHARGE REQUIREMENTS
FOR
MUNICIPAL STORM WATER AND URBAN RUNOFF DISCHARGES WITHIN THE COUNTY OF LOS ANGELES, AND THE INCORPORATED CITIES THEREIN, EXCEPT THE CITY OF LONG BEACH

December 13, 2001
(Amended on September 14, 2006 by Order R4-2006-0074; August 9, 2007 by Order R4-2007-0042; December 10, 2009 by Order R4-2009-0130; and October 19, 2010 and April 14, 2011 pursuant to the peremptory writ of mandate in L.A. Superior Court Case No. BS122724)

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STATE OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. 01-182
NPDES PERMIT NO. CAS004001
WASTE DISCHARGE REQUIREMENTS
FOR
MUNICIPAL STORM WATER AND URBAN RUNOFF DISCHARGES WITHIN THE COUNTY OF LOS ANGELES, AND THE INCORPORATED CITIES THEREIN, EXCEPT THE CITY OF LONG BEACH

The California Regional Water Quality Control Board, Los Angeles Region (hereinafter referred to as the Regional Board) finds:

A. Existing Permit

The Los Angeles County Flood Control District, the County of Los Angeles, and 84 incorporated cities within the Los Angeles County Flood Control District (see Attachment A, List of Permittees), hereinafter referred to separately as Permittees and jointly as the Discharger, discharge or contribute to discharges of storm water and urban runoff from municipal separate storm sewer systems (MS4s), also called storm drain systems. The discharges flow to water courses within the Los Angeles County Flood Control District and into receiving waters of the Los Angeles Region. These discharges are covered under countywide waste discharge requirements contained in Order No. 96-054 adopted by this Regional Board on July 15, 1996, which replaced Order No. 90-079 adopted by this Regional Board on June 18, 1990. Order No. 96-054 also serves as a National Pollutant Discharge Elimination System (NPDES) permit for the discharge of municipal storm water.

B. Nature of Discharges and Sources of Pollutant

1. Storm water discharges consist of surface runoff generated from various land uses in all the hydrologic drainage basins that discharge into water bodies of the State. The quality of these discharges varies considerably and is affected by the hydrology, geology, land use, season, and sequence and duration of hydrologic events. The primary constituents of concern currently identified by the Los Angeles County Flood Control District Integrated Receiving Water Impacts Report (1994-2000) are cyanide, indicator bacteria, total dissolved solids, turbidity, total suspended solids, nutrients, total aluminum, dissolved cadmium, copper, lead, total mercury, nickel, zinc, bis(2-ethylhexyl)phthalate, polycyclic aromatic hydrocarbons (PAHs), diazinon, and chlorpyrifos.

2. Certain pollutants present in storm water and/or urban runoff may be derived from extraneous sources that Permittees have no or limited

jurisdiction over. Examples of such pollutants and their respective sources are: PAHs which are products of internal combustion engine operation, nitrates, bis (2-ethylhexyl) phthalate and mercury from atmospheric deposition, lead from fuels, copper from brake pad wear, zinc from tire wear, dioxins as products of combustion, and natural-occurring minerals from local geology. However, the implementation of the measures set forth in this Order is intended to reduce the entry of these pollutants into storm water and their discharge to receiving waters.

3. Water quality assessments conducted by the Regional Board identified impairment, or threatened impairment, of beneficial uses of water bodies in the Los Angeles Region. The causes of impairments include pollutants of concern identified in municipal storm water discharges by the County of Los Angeles in the Integrated Receiving Water Impacts Report (1994-2000). Pollutants in storm water can have damaging effects on both human health and aquatic ecosystems.

4. The Los Angeles County Grand Jury, September 2000, completed an investigation into the health risks of swimming near beaches in Los Angeles County and made several recommendations to reduce public health risks (Final Report, Grand Jury, Los Angeles County, 1999-2000). The Grand Jury recommended that the Regional Board consider among other actions, (i) a focus on setting contaminant limits rather than programmatic evaluations, (ii) audit of MS4 Permittee programs; and (iii) clarifying enforcement responsibilities between the State and local governments.

5. Studies and research conducted by other Regional agencies, academic institutions, and universities have also identified storm water and urban runoff as significant sources of pollutants to surface waters in Southern California. See, e.g., [*Surface Runoff to the Southern California Bight*, Southern California Coastal Water Research Project, (1992); *Impacts of Urban Runoff on Santa Monica Bay and Surrounding Ocean Waters* (Gersberg, R.M., 1995); *State of the Bay 1998*, Santa Monica Bay Restoration Project; *Storm Water Impact*, In, Southern California Environmental Report Card 1999, Institute of the Environment, University of California, Los Angeles (Stenstrom, M.S., 1999); *Distribution of Anthropogenic and Natural Debris on the Mainland Shelf of Southern California Bight,* Shelly L. Moore and M. James Allen (1999); *The Health Effects of Swimming in Ocean Water Contaminated by Storm Drain Runoff*, Haile, R.W. et al. (1999); *Huntington Beach Closure Investigation: Technical Review* (University of Southern California, 2000); *A Regional Survey of the Microbiological Water Quality Along the Shoreline of the Southern California Bight,* Rachel T. Noble *et al.* (2001*); Integrated Receiving Water Impacts Report (1994-2000)*, County of Los Angeles (2001)].

6. Development and urbanization increase pollutant load, volume, and discharge velocity. First, natural vegetated pervious ground cover is converted to impervious surfaces such as paved highways, streets, rooftops and parking lots. Natural vegetated soil can both absorb rainwater and remove pollutants providing an effective natural purification

process. In contrast, pavement and concrete can neither absorb water nor remove pollutants, and thus the natural purification characteristics are lost. Second, urban development creates new pollution sources as the increased density of human population brings proportionately higher levels of vehicle emissions, vehicle maintenance wastes, municipal sewage waste, pesticides, household hazardous wastes, pet wastes, trash, and other anthropogenic pollutants. Development and urbanization especially threaten environmentally sensitive areas. Such areas have a much lower capacity to withstand pollutant shocks than might be acceptable in the general circumstance. In essence, development that is ordinarily insignificant in its impact on the environment may in a particular sensitive environment become significant. These environmentally sensitive areas designated by the State and/or the County of Los Angeles include Areas of Special Biological Significance (ASBS), water bodies designated as supporting a RARE beneficial use, Significant Natural Areas (SNAs), and Significant Ecological Areas (SEAs).

7. The increased volume, increased velocity, and discharge duration of storm water runoff from developed areas has the potential to greatly accelerate downstream erosion and impair stream habitat in natural drainages. Studies have demonstrated a direct correlation between the degree of imperviousness of an area and the degradation of its receiving waters. Significant declines in the biological integrity and physical habitat of streams and other receiving waters have been found to occur with as little as 10 percent conversion from natural to impervious surfaces. Percentage impervious cover is a reliable indicator and predictor of potential water quality degradation expected from new development. (*Impervious Cover as An Urban Stream Indicator and a Watershed Management Tool*, Schueler, T. and R. Claytor, In, Effects of Water Development and Management on Aquatic Ecosystems (1995), ASCE, New York; Leopold, L. B., (1973), *River Channel Change with Time: An Example*, Geological Society of America Bulletin, v. 84, p. 1845-1860; Hammer, T. R., (1972), *Stream Channel Enlargement Due to Urbanization: Water Resources Research*, v. 8, p. 1530-1540; Booth, D. B., (1991), *Urbanization and the Natural Drainage System--Impacts, Solutions and Prognoses*: The Northwest Environmental Journal, v. 7, p. 93-118; Klein, R. D., (1979), *Urbanization and Stream Quality Impairment*: Water Resources Bulletin, v. 15, p. 948-963; May, C. W., Horner, R. R., Karr, J. R., Mar, B. W., and Welch, E. B., (1997), *Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion*: Watershed Protection Techniques, v. 2, p. 483-494; Morisawa, M. and LaFlure, E. *Hydraulic Geometry, Stream Equilibrium and Urbanization* In Rhodes, D. P. and Williams, G. P. *Adjustments to the Fluvial System* p.333-350. (1979); Dubuque, Iowa, Kendall/Hunt. Tenth Annual Geomorphology Symposia Series; and *The Importance of Imperviousness*: Watershed Protection Techniques, 1(3), Schueler, T. (1994).)

8. The County of Los Angeles has identified as the seven highest priority industrial and commercial critical source types, (i) wholesale trade (scrap recycling, auto dismantling); (ii) automotive repair/parking; (iii) fabricated

metal products; (iv) motor freight; (v) chemical and allied products; (vi) automotive dealers/gas stations; (vii) primary metal products (*Critical Source Selection and Monitoring Report*, Los Angeles County Department of Public Works -Sept 1996). Monitoring conducted by Los Angeles County and the Regional Board demonstrates that the priority industrial sectors and auto repair facilities (one of the commercial sectors) on the list, contribute significant concentrations of heavy metals to storm water (*Los Angeles County 1999-2000 Storm Water Monitoring Report*, Los Angeles County Department of Public Works -July 2000; *Compliance Assessment of the Auto Dismantling Industry; Evaluation of the California General Industrial Storm Water Permit*, H. Chang, (2001), 70 pp., California Regional Water Quality Control Board, Los Angeles Region).

9. The discharge of washwaters and contaminated storm water from industries and businesses specified in this Order for inspection by Permittees is an environmental threat and can also adversely impact public health and safety. For example, a review of industrial waste/ pretreatment records performed in 1995 in the County of Los Angeles on illicit discharges indicates that automotive service facilities and food service facilities sometimes discharge polluted washwaters to the MS4. The pollutants of concern in such washwaters include food waste, oil and grease, and toxic chemicals. Other storm water/industrial waste programs in California have reported similar observations. Illicit discharges from automotive service facilities and food service facilities have been identified elsewhere as a major cause of widespread contamination and water quality problems (Washtenaw County Statutory Drainage Board - 1987 Huron River Pollution Abatement Program).

10. Studies indicate that facilities with paved surfaces subject to frequent motor vehicular traffic (such as parking lots and fast food restaurants), or facilities that perform vehicle repair, maintenance, or fueling (automotive service facilities) are potential sources of pollutants of concern in storm water. [References: Pitt *et a*l., *Urban Storm Water Toxic Pollutants: Assessment, Sources, and Treatability*, Water Environment Res., 67, 260 (1995)*; Results of Retail Gas Outlet and Commercial Parking Lot Storm Water Runoff Study*, Western States Petroleum Association and American Petroleum Institute, (1994); *Action Plan Demonstration Project, Demonstration of Gasoline Fueling Station Best Management Practices*, Final Report, County of Sacramento (1993); *Source Characterization*, R. Pitt, In Innovative Urban Wet-Weather Flow Management Systems (2000) Technomic Press, Field, R *et al*. editors; *Characteristics of Parking Lot Runoff Produced by Simulated Rainfall*, , L.L. Tiefenthaler *et al*. Technical Report 343, Southern California Coastal Water Research Project (2001).]

11. Retail Gasoline Outlets (RGOs) are points of convergence for vehicular traffic and are similar to parking lots and urban roads. Studies indicate that storm water discharges from RGOs have high concentrations of hydrocarbons and heavy metals. [*The Quality of Trapped Sediments and Poor Water within Oil Grit Separators in Suburban MD,* Schueler T. and

Shepp D. (1992), and *Concentrations of Selected Constituents in Runoff from Impervious Surfaces in Four Urban Catchments of Different Landuse*, Ranabal, F.I., and T.J. Gizzard (1995), In Proceedings of the Fourth Biennial Stormwater Research Conference, Florida, pp-42-52]. Pilot studies indicate that treatment control best management practices installed at retail gasoline stations are effective in removing pollutants, reasonable in capital cost, easy to operate, and do not present safety risks [*Rouge River National Wet Weather Demonstration Project, Task Product Memorandum – Evaluation of On-line Media Filters RPO-NPS-TPM59.00*, Wayne County, MI, March 1999]. The Regional Board and the San Diego Regional Board have jointly prepared a Technical Report on the applicability of new development BMP design criteria for retail gasoline outlets, (*Retail Gasoline Outlets: New Development Design Standards for Mitigation of Storm Water Impacts*, (June 2001)). Retail Gasoline Outlets in Western U.S. States (such as Washington and Oregon) are already subject to numerical BMP design criteria, as well in other U.S. States.

C. Permit Background

1. The essential components of the Storm Water Management Program, as established by federal regulations [40 CFR 122.26(d)] are: (i) Adequate Legal Authority, (ii) Fiscal Resources, (iii) Storm Water Quality Management Program (SQMP) - (Public Information and Participation Program, Industrial/Commercial Facilities Program, Development Planning Program, Development Construction Program, Public Agency Activities Program, Illicit Connection and Illicit Discharges Elimination Program), and (iv) Monitoring and Reporting Program.

2. The Permittees have filed a Report of Waste Discharge (ROWD), dated February 1, 2001, and applied for renewal of their waste discharge requirements that serves as an NPDES permit to discharge wastes to surface waters. The ROWD includes a proposed SQMP and a Monitoring Program. The proposed SQMP contains programs previously approved under Board Order No. 96-054 in the following areas:

   Public Information and Participation
   Development Planning
   Development Construction
   Public Agency Activities
   Illicit Connection/Illicit Discharge Elimination Program

   These programs are revised pursuant to the provisions of this Order after adoption.

3. The County of Los Angeles has previously conducted source identification and pollutant characterization consistent with 40 CFR 122.26(d)(1)(ii) and (iii) under its storm water Monitoring Program. The Monitoring Program submitted with the ROWD proposes to advance the assessment of receiving water impacts, identification of sources of pollution, evaluation of Best Management Practices (BMPs), and measurement of long term trends in mass emissions.

4. The Regional Board has reviewed the ROWD and has determined it to be complete under the reapplication policy of MS4s issued by the U.S. Environmental Protection Agency (USEPA) (61 *Fed. Reg*. 41697). The Regional Board finds that the Permittees' proposed SQMP, incorporating the additional and/or revised provisions contained in this Order would meet the minimum requirements of federal regulations.

5. The City of Los Angeles has conducted shoreline and nearshore water quality monitoring off the Santa Monica Bay since the 1950s under the monitoring program for the Hyperion Waste Water Treatment Plant (NPDES No. CA0109991). The monitoring results indicate that effluent from Hyperion's 5-Mile Outfall does not impinge the shoreline, and that elevated bacterial counts are associated with runoff from storm drains and discharges from piers. In 1994, the Regional Board approved the relocation of Hyperion's shoreline stations to implement a bay-wide, regional shoreline-monitoring program associated with storm drain outfalls in the Santa Monica Bay. The City of Los Angeles requested that the shoreline-monitoring requirement be incorporated in this Order. The shoreline pathogen monitoring requirements are outlined in the Monitoring Program for this Order.

D. Permit Coverage

1. The requirements in this Order cover all areas within the boundaries of the Permittee municipalities (see Attachment A) over which they have regulatory jurisdiction as well as unincorporated areas in Los Angeles County within the jurisdiction of the Regional Board. The Permittees serve a population of about 9.5 million [Reference: *2000 Census of Population and Housing,* Bureau of the Census, U.S. Department of Commerce (2001)] in an area of approximately 3,100 square miles.

2. Federal, state, regional or local entities within the Permittees' boundaries or in jurisdictions outside the Los Angeles County Flood Control District, and not currently named in this Order, may operate storm drain facilities and/or discharge storm water to storm drains and watercourses covered by this Order. The Permittees may lack legal jurisdiction over these entities under state and federal constitutions. The Regional Board will coordinate with these entities to implement programs that are consistent with the requirements of this Order. The Regional Board will consider such facilities for coverage in 2003 under its NPDES permitting scheme pursuant to USEPA Phase II storm water regulations.

3. Sources of discharges into receiving waters in the County of Los Angeles but in jurisdictions outside its boundary include the following:

   About 34 square miles of unincorporated area in Ventura County, which drain into Malibu Creek and then to Santa Monica Bay,

   About 9 square miles of the City of Thousand Oaks, which also drain into Malibu Creek and then to Santa Monica Bay, and

About 86 square miles of area in Orange County, which drain into Coyote Creek and then into the San Gabriel River.

The Regional Board will ensure that storm water management programs for the areas in Ventura County and the City of Thousand Oaks that drain into Santa Monica Bay are consistent with the requirements of this Order. The Regional Board will coordinate with the Santa Ana Regional Board so that storm water management programs for the areas in Orange County that drain into Coyote Creek are consistent with the requirements of this Order.

4. This permit is intended to develop, achieve, and implement a timely, comprehensive, cost-effective storm water pollution control program to reduce the discharge of pollutants in storm water to the Maximum Extent Practicable (MEP) from the permitted areas in the County of Los Angeles to the waters of the U.S. subject to the Permittees' jurisdiction.

5. Permittees have expressed their intention to work cooperatively to control the contribution of pollutants from one portion of the MS4 to another portion of the system. Permittees may control the contribution of pollutants to the MS4 from non-permittee dischargers such as Caltrans, the U.S. Department of Defense, and other state and federal facilities, through interagency agreements.

E. Federal, State, and Regional Regulations

1. The Water Quality Act of 1987 added Section 402(p) to the federal Clean Water Act (CWA) (33 U.S.C. § 1251-1387). This section requires the USEPA to establish regulations setting forth NPDES requirements for storm water discharges in two phases.

   - The USEPA Phase I storm water regulations were directed at MS4s serving a population of 100,000 or more, including interconnected systems and storm water discharges associated with industrial activities, including construction activities. The Phase I Final Rule was published on November 16, 1990 (55 *Fed. Reg*. 47990).

   - The USEPA Phase II storm water regulations are directed at storm water discharges not covered in Phase I, including small MS4s (serving a population of less than 100,000), small construction projects (one to five acres), municipal facilities with delayed coverage under the Intermodal Surface Transportation Efficiency Act of 1991, and other discharges for which the USEPA Administrator or the State determines that the storm water discharge contributes to a violation of a water quality standard, or is a significant contributor of pollutants to waters of the United States. The Phase II Final Rule was published on December 8, 1999 (64 *Fed. Reg*. 68722).

2. The USEPA published an 'Interim Permitting Approach for Water Quality-Based Effluent Limitations in Storm Water Permits' on August 26, 1996 (61 *Fed. Reg.* 43761). This policy discusses the appropriate kinds of

water quality-based effluent limitations to be included in NPDES storm water permits to provide for the attainment of water quality standards.

3. The USEPA published an 'Interpretative Policy Memorandum on Reapplication Requirements' for MS4 permits on August 9, 1996 (61 *Fed. Reg*. 41697). This policy requires that MS4 reapplication for reissuance for a subsequent five-year permit term contain certain basic information and information for proposed changes and improvements to the storm water management program and monitoring program.

4. The USEPA has entered into a Memorandum of Agreement (MOA) with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for enhancing coordination regarding the protection of endangered and threatened species under Section 7 of the Endangered Species Act and the CWA's Water Quality Standards and NPDES programs. Among other actions, the MOA establishes a framework for coordination of actions by the USEPA, the Services, and CWA delegated States on CWA permit issuance under Section 402 of the CWA [66 *Fed. Reg*. 11202 – 11217].

5. USEPA regulations at 40 CFR 122.26(d)(2)(iv)(A) and 40 CFR 122.26(d)(2)(iv)(C) require that MS4 permittees implement a program to monitor and control pollutants in discharges to the municipal system from industrial and commercial facilities that contribute a substantial pollutant load to the MS4. The regulations require that permittees establish priorities and procedures for inspection of industrial facilities and priority commercial establishments. This permit, consistent with the USEPA policy, incorporates a cooperative partnership, including the specifications of minimum expectations, between the Regional Board and the Permittees for the inspection of industrial facilities and priority commercial establishments to control pollutants in storm water discharges (58 *Fed. Reg.* 61157).

6. Section 402 (p) of the CWA (33 U.S.C. § 1342(p) provides that MS4 permits must "require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design engineering method and such other provisions as the [EPA] Administrator or the State determines appropriate for the control of such pollutants." The State Water Resources Control Board's (State Board) Office of Chief Counsel (OCC) has issued a memorandum interpreting the meaning of MEP to include technical feasibility, cost, and benefit derived with the burden being on the municipality to demonstrate compliance with MEP by showing that a BMP is not technically feasible in the locality or that BMPs costs would exceed any benefit to be derived (dated February 11, 1993).

7. The CWA authorizes the USEPA to permit a state to serve as the NPDES permitting authority in lieu of the USEPA. The State of California has in-lieu authority for an NPDES program. The Porter-Cologne Water Quality Control Act authorizes the State Board, through the Regional Boards, to regulate and control the discharge of pollutants into waters of the State. The State Board entered into a MOA with the USEPA, on

September 22, 1989, to administer the NPDES Program governing discharges to waters of the U.S.

8. Section 303(d) of the CWA requires that the State identify a list of impaired water-bodies and develop and implement Total Maximum Daily Loads (TMDLs) for these waterbodies (33 U.S.C. §1313(d)(1)). A TMDL specifies the maximum amount of a pollutant that a water-body can receive, still meet applicable water quality standards and protect beneficial uses. The USEPA entered into a consent decree with the Natural Resources Defense Council (NRDC), Heal the Bay, and the Santa Monica BayKeeper on March 22, 1999, under which the Regional Board must adopt all TMDLs for the Los Angeles Region within 13 years from that date. This permit incorporates a provision to implement and enforce approved load allocations for municipal storm water discharges and requires amending the SQMP after pollutants loads have been allocated and approved.

9. Section 6217(g) of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) requires coastal states with approved coastal zone management programs to address non-point pollution impacting or threatening coastal water quality. CZARA (16 U.S.C. § 1451-1465) amends the Coastal Zone Management Act of 1972, to address five sources of non-point pollution: agriculture, silviculture, urban, marinas, and hydromodification. This NPDES permit addresses the management measures required for the urban category, with the exception of septic systems. The Regional Board addresses septic systems through the administration of other programs.

10. On May 18, 2000, the USEPA established numeric criteria for priority toxic pollutants for the State of California (California Toxics Rule (CTR)) 65 *Fed. Reg*. 31682 (40 CFR 131.38), for the protection of human health and aquatic life. These apply as ambient water quality criteria for inland surface waters, enclosed bays, and estuaries. The State Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP) – 2000,* on March 2, 2000, for implementation of the CTR (State Board Resolution No. 2000-15 as amended by Board Resolution No. 2000-030). This policy requires that discharges comply with TMDL-derived load allocations as soon as possible but no later than 20 years from the effective date of the policy.

11. The State Board adopted a revised Water Quality Control Plan for Ocean Waters of California (Ocean Plan) on July 23, 1997. The Ocean Plan contains water quality objectives which apply to all discharges to the coastal waters of California.

12. The State Board in *In Re*: California Department of Transportation (State Board Order WQ 2001-08), determined that the discharge of storm water to ASBS is subject to the prohibition in the Ocean Plan against the discharge of wastes to an ASBS.

13. The Regional Board adopted an updated Water Quality Control Plan (Basin Plan) for the Los Angeles Region on June 13, 1994, *'Water Quality Control Plan, Los Angeles Region: Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*, (1994).' The Basin Plan designates beneficial uses of receiving waters and specifies both narrative and numerical water quality objectives for the receiving waters in Los Angeles County.

14. The Regional Board on September 19, 2001, adopted amendments to the Basin Plan, to incorporate TMDLs for trash in the Los Angeles River Watershed (Resolution No. R01-013) and Ballona Creek Watershed (Resolution No. R01-014). The amendments were subsequently approved by the State Board, the Office of Administrative Law, and the United States Environmental Protection Agency. Twenty-two cities[1] ("Cities") sued the Regional Board and State Board to set aside the Los Angeles River Trash TMDL. The trial court entered an order deciding some claims in favor of the Water Boards and some in favor of the Cities. Both sides appealed, and on January 26, 2006, the Court of Appeal decided every one of the Cities' claims in favor of the Water Boards, except with respect to California Environmental Quality Act (CEQA) compliance (*City of Arcadia et al. v. Los Angeles Regional Water Quality Control Board et al.* (2006) 135 Cal.App.4th 1392). The Court therefore declared the Los Angeles River Trash TMDL void, and issued a writ of mandate that ordered the Water Boards to set aside and not implement the TMDL, until it had been brought into compliance with CEQA. As a result of the appellate court's decision, in 2006, the Regional Board set aside its 2001 action incorporating the TMDL into the Basin Plan (Resolution R06-013) (*City of Arcadia et al. v. Los Angeles Regional Water Quality Control Board et al.* (2006) 135 Cal.App.4th 1392). After conducting the required CEQA analysis, the Regional Board readopted the Los Angeles River Watershed Trash TMDL on August 9, 2007 (Resolution No. R07-012). This TMDL was subsequently approved by the State Board (Resolution No. 2008-0024), the Office of Administrative Law (File No. 2008-0519-02 S), and the United States Environmental Protection Agency, and became effective on September 23, 2008. The Water Boards filed their final return to the writ of mandate on August 6, 2008, and on August 26, 2008, the superior court entered an order discharging the writ, and dismissing the case, thus concluding the legal challenges to the Trash TMDL.

15. The Regional Board on April 13, 1998, approved BMPs for sidewalk rinsing to minimize the discharge of wash waters to the storm drain system (Resolution No. 98-08). By the same resolution, the Regional Board prohibited the discharge of municipal street wash waters to the storm drain system.

[1] The cities include Arcadia, Baldwin Park, Bellflower, Cerritos, Commerce, Diamond Bar, Downey, Irwindale, Lawndale, Monrovia, Montebello, Monterey Park, Pico Rivera, Rosemead, San Gabriel, Santa Fe Springs, Sierra Madre, Signal Hill, South Pasadena, Vernon, West Covina, and Whittier.

16. The Regional Board on April 13, 1998, approved recommended BMPs for industrial/commercial facilities (Resolution No. 98-08).

17. The Regional Board on April 22, 1999, approved a list of BMPs for use in development planning and development construction (Resolution No. 99-03)

18. The Regional Board adopted and approved requirements for new development and significant redevelopment projects in Los Angeles County to control the discharge of storm water pollutants in post-construction storm water, on January 26, 2000, in Board Resolution No. R-00-02. The Regional Board Executive Officer issued the approved Standard Urban Storm Water Mitigation Plans (SUSMPs) on March 8, 2000. The State Board in large part affirmed the Regional Board action and SUSMPs in State Board Order No. WQ 2000-11 issued on October 5, 2000.

    - The State Board's Chief Counsel has issued a statewide policy memorandum (dated December 26, 2000), which interprets the Order to provide broad discretion to Regional Boards and identifies potential future areas for inclusion in SUSMPs and the types of evidence and findings necessary. Such areas include ministerial projects, projects in environmentally sensitive areas, and water quality design criteria for RGOs.

    - The State Board's Chief Counsel interprets the Order to encourage regional solutions and endorses a mitigation fund or "bank" that may be funded by developers who obtain waivers from the numerical design standards for new development and significant redevelopment.

19. 40 CFR 131.10(a) prohibits states from designating waste transport or waste assimilation as a use for any water of the U.S. Authorizing the construction of a storm water/ urban runoff treatment facility in a jurisdictional water body would be tantamount to accepting waste assimilation as an appropriate use for that water body. Furthermore, the construction and operation of a pollution control facility in a water body can impact the physical, chemical, and biological integrity as well as the beneficial uses of the water body. Therefore, storm water treatment and/or mitigation in accordance with SUSMPs and any other requirements of this Order must occur prior to the discharge of storm water into a water of the U.S.

20. The Regional Board supports a Watershed Management Approach to address water quality protection in the region. The objective of the Watershed Management Approach should be to provide a comprehensive and integrated strategy towards water resource protection, enhancement, and restoration while balancing economic and environmental impacts within a hydrologically defined drainage basin or watershed. It emphasizes cooperative relationships between regulatory agencies, the regulated community, environmental groups, and other

stakeholders in the watershed to achieve the greatest environmental improvements with available resources.

21. To promote a watershed management approach, the County of Los Angeles is divided into six Watershed Management Areas (WMAs) as follows:

    Malibu Creek and Rural Santa Monica Bay WMA
    Ballona Creek and Urban Santa Monica Bay WMA
    Los Angeles River WMA
    San Gabriel River WMA
    Dominguez Channel/Los Angeles Harbor WMA, and
    Santa Clara River WMA

    Attachment A shows the list of Permittees under each WMA and some Permittees have expressed an intent to form sub-watershed groups within the WMA to promote regional solutions for the mitigation of storm water discharge pollution.

22. To facilitate compliance with federal regulations, the State Board has issued two statewide general NPDES permits for storm water discharges: one for storm water from industrial sites [NPDES No. CAS000001, General Industrial Activity Storm Water Permit (GIASP)] and the other for storm water from construction sites [NPDES No. CAS000002, General Construction Activity Storm Water Permit (GCASP)]. The GCASP was reissued on August 19, 1999. The GIASP was reissued on April 17, 1997. Facilities discharging storm water associated with industrial activities and construction projects with a disturbed area of five acres or more are required to obtain individual NPDES permits for storm water discharges, or to be covered by a statewide general permit by completing and filing a Notice of Intent (NOI) with the State Board. The USEPA guidance anticipates coordination of the state-administered programs for industrial and construction activities with the local agency program to reduce pollutants in storm water discharges to the MS4.

    The Regional Board is the enforcement authority in the Los Angeles Region for the two statewide general permits regulating discharges from industrial facilities and construction sites, and all NPDES storm water and non-storm water permits issued by the Regional Board. These industrial and construction sites and discharges are also regulated under local laws and regulations.

23. The State Board, on October 28, 1968, adopted Resolution No. 68-16, which established an anti-degradation policy for the State and Regional Boards. This policy restricts the degradation of surface waters and protects waterbodies where existing water quality is higher than is necessary for the protection of beneficial uses.

24. The State Board, on June 17, 1999, adopted Order No. WQ 99-05, which, in a precedential decision, identifies acceptable receiving water limitations language to be included in municipal storm water permits issued by the State and Regional Boards. The receiving water limitations included herein are consistent with the State Board Order, USEPA Policy,

and the U.S. Appellate court decision in, *Defenders of Wildlife v. Browner* (9th. Cir, 1999). The State Board OCC has determined that the federal court decision did not conflict with State Board Order No. WQ 99-05 (memorandum dated October 14, 1999)

25. California Water Code (CWC) § 13263(a) requires that waste discharge requirements issued by the Regional Board shall implement any relevant water quality control plans that have been adopted; shall take into consideration the beneficial uses to be protected and the water quality objectives reasonably required for that purpose; other waste discharges; the need to prevent nuisance; and provisions of CWC § 13241. The Regional Board has considered the requirements of § 13263 and § 13241, and applicable plans, policies, rules, and regulations in developing these waste discharge requirements.

26. CWC § 13370 *et seq.* requires that waste discharge requirements issued by the Regional Boards be consistent with provisions of the federal CWA and its amendments.

27. On March 12, 2001, the U.S. Court of Appeals ruled that it is necessary to obtain a NPDES permit for application of aquatic pesticides to waterways. (*Headwaters, Inc. vs. Talent Irrigation District,* 243 F.3d. 526 (9th Cir., 2001)) This decision is controlling in California for nonagricultural applications of pesticides to waterways. The State Board adopted a general NPDES permit (Order No. 2001-12-DWQ) on July 19, 2001, for public entities that discharge pollutants to waters of the U.S. associated with the application of aquatic pesticides for resource or pest management. Public entities that conduct such activities must seek coverage under the general permit.

The Marina Del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL

28. [Intentionally left blank]

29. The Regional Board adopted the Marina del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL (hereinafter "MDR Bacteria TMDL") on August 7, 2003. The TMDL was subsequently approved by the SWRCB, the OAL, and the USEPA and became effective on March 18, 2004.

30. Tables 7-5.1, 7-5.2, and 7-5.3 of the Basin Plan set forth the pertinent provisions of the MDR Bacteria TMDL.

31. [Intentionally left blank]

32. [Intentionally left blank]

33. On March 14, 2007, Marina del Rey watershed responsible agencies submitted to the Regional Board the results of a non-point source study conducted over a one year period between July 2005 and July 2006, which was required under the terms of the MDR TMDL. The study was designed to determine the relative bacterial loading to the harbor from sources including but not limited to storm drains, boats, birds, and other non-point sources. The study has not yet been peer reviewed, and is currently under review by Regional Board staff.

34. On January 8, 2007, as required by the MDR Bacterial TMDL, Marina del Rey watershed responsible agencies submitted to the Regional Board an implementation plan describing the strategy by which they intend to comply with the MDR Bacterial TMDL. This implementation plan was developed through a process that included both Regional Board staff and representatives from Heal the Bay and Santa Monica Baykeeper.

35. The Regional Board acknowledges the County's timely submittals of reports required by the TMDL and implementation measures initiated thus far towards meeting water quality standards for bacteria in Marina del Rey. As a result of the adoption of the MDR Bacterial TMDL in 2003, the County has funded or received grants to initiate the following activities:

- Marina Beach Water Quality Improvement Project, Phase I and Phase II through a CBI grant;
- Mothers' Beach and Back Basins Bacterial TMDL Non-point Source Study;
- Marina del Rey Harbor Mothers Beach and Back Basins Report of Small Drain Identification;
- Marina del Rey Vessel Discharge Report;
- Marina del Rey Harbor Mothers' Beach and Back Basins Bacterial TMDL Coordinated Monitoring Plan; and
- Three low-flow diversion projects, which were partially funded by a grant, two of which have been completed.

In addition to participation in the above studies, the County and other Marina del Rey watershed responsible agencies continue to implement BMPs proposed in the January 8, 2007, Implementation Plan.

36. [Intentionally left blank][2]

37. [Intentionally left blank]

a) [Intentionally left blank]

[2] [Intentionally left blank]

b) [Intentionally left blank]

c) [Intentionally left blank]

d) [Intentionally left blank]

38. [Intentionally left blank]

39. [Intentionally left blank]

Findings Related to the Incorporation of the Los Angeles River Watershed Trash TMDL

40. The Regional Board adopted the Los Angeles River Trash Total Maximum Daily Load (TMDL) on August 9, 2007 as an amendment to the region's Water Quality Control Plan (Basin Plan) to address water quality impairments due to trash in the Los Angeles River Watershed that were identified in 1998 on the State's Clean Water Act Section 303(d) List. This TMDL was subsequently approved by the State Board, the Office of Administrative Law (OAL), and the USEPA, and it became effective on September 23, 2008.

41. By its adoption of the Trash TMDL, the Regional Board determined that trash discharged to the Los Angeles River and its tributaries discourages recreational activity, degrades aquatic habitat, threatens wildlife through ingestion and entanglement, and also poses risks to human health. Existing beneficial uses impaired by trash in the Los Angeles River are contact recreation (REC-1) and non-contact recreation (REC-2); warm fresh water habitat (WARM); wildlife habitat (WILD); estuarine habitat (EST) and marine habitat (MAR); rare, threatened or endangered species (RARE); migration of aquatic organisms (MIGR) and spawning, reproduction and early development of fish (SPWN); commercial and sport fishing (COMM); wetland habitat (WET); and cold freshwater habitat (COLD).

42. The Los Angeles River Watershed Trash TMDL identifies discharges from the municipal separate storm sewer system as the principal source of trash to the Los Angeles River and its tributaries. As such, WLAs were assigned to MS4 Permittees that discharge to the MS4 in the watershed. The WLAs are expressed as progressively decreasing allowable amounts of trash discharges from jurisdictional areas within the watershed. The Trash TMDL requires MS4 Permittees to make annual reductions of their discharges of trash to the Los Angeles River Watershed over a 9-year period, until the numeric target of zero trash discharged from the MS4 is achieved for the 2013-2014 storm year. The Basin Plan assigns MS4 Permittees within the Los Angeles River Watershed baseline Waste Load Allocations from which annual reductions are to be made. (See Basin Plan, Table 7-2.2.) The Basin Plan also specifies interim and final Waste Load Allocations as decreasing percentages of the Table 7-2.2 baseline

WLAs, and specifies the corresponding "Compliance Points". (See Basin Plan, Table 7-2.3.)

43. The Los Angeles River Watershed Trash TMDL specifies that the WLAs shall be implemented through MS4 permits. Federal regulations require that NPDES permits be consistent with the assumptions and requirements of any available waste load allocation. (40 CFR 122.44(d)(1)(vii)(B).) State law requires both that the Regional Board implement its Basin Plan when adopting waste discharge requirements (WDRs) and that NPDES permits apply "any more stringent effluent standards or limitations necessary to implement water quality control plans…" (Wat. Code §§ 13263, 13377).

44. The Ninth Circuit Court of Appeals in *Defenders of Wildlife v. Browner* ruled that the Clean Water Act grants the permitting agency discretion either to require "strict compliance" with water quality standards through the imposition of numeric effluent limitations, or to employ an iterative approach toward compliance with water quality standards, by requiring improved BMPs over time (*Defenders of Wildlife v. Browner* (9th Cir. 1999) 191 F.3d 1159). In a precedential decision, the State Board acknowledged that the holding in *Browner* allows the issuance of MS4 permits that limit their provisions to BMPs that control pollutants to the MEP, and which do not require compliance with water quality standards. However, the Water Boards have declined to adopt that approach in light of the impacts of discharges from MS4s on waters throughout the State and Los Angeles region (see Order WQ 2001-15 and Part 2 of the LA County MS4 Permit). The State Board concluded and the Regional Board agrees that "where urban runoff is causing or contributing to exceedances of water quality standards, it is appropriate to require improvements to BMPs that address those exceedances" (Order WQ 2001-15, p. 8).

45. In a recent decision, the State Board also concluded that incorporation of the provisions of TMDLs into MS4 permits requires extra consideration. Specifically, the State Board held: "TMDLs, which take significant resources to develop and finalize, are devised with specific implementation plans and compliance dates designed to bring impaired waters into compliance with water quality standards. It is our intent that federally mandated TMDLs be given substantive effect. Doing so can improve the efficacy of California's NPDES storm water permits." The State Board stated that TMDLs should not be an "academic exercise", and indicated that in some instances when implementing TMDLs, numeric effluent limitations may be an appropriate means of controlling pollutants in storm water, provided the Regional Board's determination is adequately supported in the permit findings (Order WQ 2009-0008). The following paragraphs support the Regional Board's determination to implement the Trash TMDL with numeric effluent limitations.

46. The Trash TMDL specified a specific formula for calculating and allocating annual reductions in trash discharges from each jurisdiction.

The formula results in specified annual amounts of trash that may be discharged from each jurisdiction into the receiving waters. Translation of the compliance points described in the TMDL into jurisdiction-specific load reductions from the baseline levels, as specified in the TMDL, logically results in the articulation of an annual limit on the amount of a pollutant that may be discharged. The specification of allowable annual trash discharge amounts meets the definition of an "effluent limitation", as that term is defined in subdivision (c) of section 13385.1 of the California Water Code. Specifically, the trash discharge limitations constitute a "numeric restriction … on the quantity [or] discharge rate … of a pollutant or pollutants that may be discharged from an authorized location." While there may be other ways to incorporate the compliance points from the TMDL into permit conditions, the Regional Board is not aware of any other mechanisms that would result in actual compliance with the requirements of the TMDL as it was intended.

47. The process to establish the Trash TMDL was exceedingly lengthy, heavily litigated and scrutinized, and contained extensive analysis. The essence of this TMDL has been twice adopted by the Regional Board, and approved by the State Board, OAL, and the US EPA, and has been subject to considerable judicial review. Therefore, the assumptions underlying this TMDL have been thoroughly vetted by staff, stakeholders, other agencies, and the courts over a significant period of time.

48. In its resolution establishing the Trash TMDL, the Regional Board already determined that the implementation schedule was reasonable and feasible, and noted that the MS4 Permittees had notice of the trash impairment since at least 1998 (with its listing on the 1998 303(d) list) and had been required to attain water quality standards for trash in the receiving waters since this order was first adopted in December of 2001. (See e.g., Resolution R07-012, finding 14.) The Court of Appeal affirmed the Regional Board's determination that the final waste load allocations were attainable and not inordinately expensive. (*Cities of Arcadia*, 135 Cal.App.4th at 1413 and 1427-1430.) Full capture systems, partial capture devices, and institutional controls are presently available to feasibly and practicably attain the interim and final effluent limitations, and it is anticipated that this order will precipitate additional innovations in control strategies and technologies, just as the adoption of the Trash TMDL resulted in the proffering and certification of seven full capture systems.

49. The Trash TMDL and this order include provisions that allow Permittees to be deemed in compliance with their effluent limitations through the installation of certain best management practices (certified full capture systems). Any Permittee that is deemed in compliance through the use of certified full capture systems would not be in violation of the effluent limitations even if some trash is discharged in excess of the annual limitations.

50. The Trash TMDL includes provisions requiring its reconsideration after a trash reduction of 50% has been achieved and sustained in the

watershed, which provides an opportunity to reexamine some of the assumptions of the TMDL after tangible and meaningful progress has been made in the watershed. (See Basin Plan, Table 7-2.3, fn. 2.) Should this reconsideration result in a modification to the final waste load allocations, the permit will be reopened pursuant to Part 6., paragraph I.1.b, to ensure the effluent limitations contained in Tables 1a and 1b of Appendix 7-1 are consistent with the assumptions and requirements of any revised waste load allocations. (40 CFR § 122.44(d)(1)(vii)(B).)

51. Depending upon the compliance strategy selected by each Permittee, compliance with the effluent limitations set forth in Appendix 7-1 may require a demonstration that the Permittee is in strict compliance with water quality standards. It remains the Permittee's choice, however, to comply via certified full capture systems (which do not require a demonstration of strict compliance with water quality standards), or partial capture devices and/or institutional controls.

52. Section 402(p)(3)(B)(iii) of the Clean Water Act, requires MS4 Permittees to reduce the pollutants in their storm water discharges to the "maximum extent practicable" (MEP). As set forth herein, "practicable" options presently exist to achieve compliance with the effluent limitations. Since the effluent limitations can be practicably achieved, their imposition is within the federally mandated MEP standard, and no analysis contemplated by *City of Burbank v. SWRCB* (2005) 35 Cal.4th 613 pursuant to Water Code section 13241 is necessary to support these effluent limitations.

53. In its discretion, the Regional Board may administratively impose civil liability of up to $10,000 for "each day in which the violation [of waste discharge requirements] occurs." (Wat. C. § 13385, subd (c).) Not every storm event may result in trash discharges. The Los Angeles River Trash TMDL adopted by the Regional Board states that improperly deposited trash is mobilized during storm events of greater than 0.25 inches of precipitation. Therefore, violations of the effluent limitations are limited to the days of a storm event of greater than 0.25 inches. Once a Permittee has violated the annual effluent limitation, any subsequent discharges of trash during any day of a storm event of greater than 0.25 inches during the same storm year constitutes an additional "day in which the violation [of the effluent limitation] occurs".

54. Unlike subdivision (c) of Water Code section 13385 where violations of effluent limitations are assessed on a per day basis, the mandatory minimum penalties subdivisions (Wat. Code § 13385, subd. (h) and (i)) require the Regional Board to assess mandatory minimum penalties for "each violation" of an effluent limitation. The effluent limitations in Appendix 7-1 are expressed as annual limitations. Therefore, there can be no more than one violation of each interim or final effluent limitation per year. Trash is considered a Group I pollutant, as specified in Appendix A to section 123.45 of Title 40 of the Code of Federal Regulations. Therefore, each annual violation of an effluent limitation in

Appendix 7-1 by forty percent or more would be considered a "serious violation" under subdivision (h). With respect to the final effluent limitation of zero trash, any detectable discharge of trash necessarily is a serious violation, in accordance with the State Board's Enforcement Policy. Violations of the effluent limitations in Appendix 7-1 would not constitute "chronic" violations that would give rise to mandatory liability under subdivision (i) because four or more violations of the effluent limitations subject to a mandatory penalty cannot occur in a period of six consecutive months.

55. Therefore, the modifications to the Order include effluent limitations in a manner consistent with the assumptions and requirements of the WLAs from which they are derived as well as an allowance to comply with these effluent limitations [*i.e.* WLAs] through proper installation and maintenance of certified full capture systems.

56. Modifications consistent with the assumptions and requirements of the TMDL are therefore included in Parts 4 (Special Provisions) and 5 (Definitions) of this Order. Part 7 (Total Maximum Daily Load Provisions) is added to this Order and incorporates provisions to assure that Los Angeles County MS4 Permittees achieve the Waste Load Allocations (WLAs) and comply with other requirements of Total Maximum Daily Loads (TMDLs) covering impaired waters impacted by the Permittees' discharges. These modifications are made pursuant to 40 CFR sections 122.41(f), 122.44.(d)(1)(vii)(B), and 122.62, and Part 6.I.1 of this Order. Tables 7-2.1, 7-2.2, and 7-2.3 of the Basin Plan set forth the pertinent provisions of the Los Angeles River Watershed Trash TMDL. The interim and final effluent limitations consistent with the assumptions and requirements of the waste load allocations, and related provisions required of Permittees within the watershed are provided in Part 7 of this Order.

57. Permittees identified as responsible agencies in the Trash TMDL may achieve compliance with interim and final effluent limitations through progressive installation of BMPs meeting the definition of "full capture" throughout their jurisdictions' drainage areas. Alternatively, Permittees may install "partial capture" devices and/or implement institutional controls to meet their respective interim and final effluent limitations. Where partial capture devices are utilized as the sole trash control measure, the degree of compliance may be demonstrated based upon performance data specific to the jurisdictional area. However, compliance with the final effluent limitation cannot be achieved through the exclusive use of partial capture devices. Where a combination of partial capture devices and institutional controls are used, compliance shall be determined based on the approximation of jurisdiction-specific trash discharges.

58. The Executive Officer will develop a standard reporting form, consistent with these provisions, which shall be used by Permittees to report compliance with the effluent limitations on an annual basis.

60. Pursuant to federal regulations at 40 CFR sections 124.8 and 125.56, a Fact Sheet was prepared to provide the basis for incorporating the Los Angeles River Watershed Trash TMDL into this Order. This Fact Sheet is hereby incorporated by reference into these findings.

F. Implementation

1. The California Environmental Quality Act (CEQA) (Cal. Pub. Resources Code § 21000 *et seq.*) requires that public agencies consider the environmental impacts of the projects they approve for development. CEQA applies to projects that are considered discretionary and does not apply to ministerial projects, which involve the use of established standards or objective measurements. A ministerial project may be made discretionary by adopting local ordinance provisions or imposing conditions to create decision-making discretion in approving the project. In the alternative, Permittees may establish standards and objective criteria administratively for storm water mitigation for ministerial projects. For water quality purposes, the Regional Board considers that all new development and significant redevelopment activity in specified categories, that receive approval or permits from a municipality, are subject to storm water mitigation requirements.

2. The objective of this Order is to protect the beneficial uses of receiving waters in Los Angeles County. To meet this objective, this Order requires that the SQMP specify BMPs that will be implemented to reduce the discharge of pollutants in storm water to the maximum extent practicable. Further, Permittees are to assure that storm water discharges from the MS4 shall neither cause nor contribute to the exceedance of water quality standards and objectives nor create conditions of nuisance in the receiving waters, and that the discharge of non-storm water to the MS4 has been effectively prohibited.

3. The SQMP required in this Order builds upon the programs established in Order Nos. 90-079, and 96-054, consists of the components recommended in the USEPA guidance manual, and was developed with the cooperation of representatives from the regulated community and environmental groups. The SQMP includes provisions that promote customized initiatives, both on a countywide and watershed basis, in developing and implementing cost-effective measures to minimize discharge of pollutants to the receiving water. The various components of the SQMP, taken as a whole rather than individually, are expected to reduce pollutants in storm water and urban runoff to the maximum extent practicable. Provisions of the SQMP are fully enforceable under provisions of this Order.

4. The emphasis of the SQMP is pollution prevention through education, public outreach, planning, and implementation as source control BMPs first and then Structural and Treatment Control BMPs next. Successful implementation of the provisions of the SQMP will require cooperation

and coordination of all public agencies in each Permittee's organization, among Permittees, and with the regulated community.

5. The implementation of a Public Information and Participation Program is a critical component of a storm water management program. An informed and knowledgeable community is critical to the success of a storm water management program since it helps insure the following: (i) greater support for the program as the public gains a greater understanding of the reasons why it is necessary and important, and (ii) greater compliance with the program as the public becomes aware of the personal responsibilities expected of them and others in the community, including the individual actions they can take to protect or improve the quality of area waters.

6. This Order includes a Monitoring Program that incorporates Minimum Levels (MLs) established under the SIP. The SIP's MLs represent the lowest quantifiable concentration for priority toxic pollutants that is measurable with the use of proper method-based analytical procedures and factoring out matrix interference. The SIP's MLs therefore represent the best available science for determining MLs and are appropriate for a storm water monitoring program. The use of MLs allows the detection of toxic priority pollutants at concentrations of concern using recent advances in chemical analytical methods.

7. This Order provides flexibility for Permittees to petition the Regional Board Executive Officer to substitute a BMP under the SQMP with an alternative BMP, if they can provide information and documentation on the effectiveness of the alternative, equal to or greater than the prescribed BMP in meeting the objectives of this Order.

8. This Order contemplates that the Permittees are responsible for considering potential storm water impacts when making planning decisions in order to fulfill the Permittees' CWA requirement to reduce the discharge of pollutants in municipal storm water to the MEP from new development and redevelopment activities. However, the Permittees retain authority to make the final land-use decisions and retain full statutory authority for deciding what land uses are appropriate at specific locations within each Permittee's jurisdiction. This Order and its requirements are not intended to restrict or control local land use decision-making authority.

9. This Order is not intended to prohibit the inspection for or abatement of vectors by the State Department of Health Services or local vector agencies in accordance with Cal. Health and Safety Code § 2270 *et seq*. and §116110 *et seq*. Certain Treatment Control BMPs if not properly designed, operated or maintained may create habitats for vectors (e.g. mosquito and rodents). This Order contemplates that the Permittees will closely cooperate and collaborate with local vector control agencies and the State Department of Health Services for the implementation, operation, and maintenance of Treatment Control BMPs in order to minimize the risk to public health from vector borne diseases.

G. Public Process

1. The Regional Board has notified the Permittees and interested agencies and persons of its intent to issue waste discharge requirements for this discharge, and has provided them with an opportunity to submit their written view and recommendations.

2. The Regional Board, in a public hearing, heard and considered all comments pertaining to the discharge and to the tentative requirements.

3. The Regional Board has conducted public workshops to discuss drafts of the permit. On April 24, 2001, Regional Board staff conducted a workshop outlining the reasoning behind the changes proposed for the new permit and received input from the Permittees and the public regarding those proposed changes. On July 26, 2001, a second public workshop was held at a special Regional Board meeting. The Permittees and the public had another opportunity to express their opinions regarding the proposed changes to the permit in front of the Regional Board members. A significant number of working meetings with the Permittees and other interested parties have occurred throughout the period from the submittal of the ROWD and completion of the tentative draft, in an attempt to incorporate and address all the comments presented.

4. The Los Angeles County Flood Control District, the County of Los Angeles and the other municipalities are co-permittees as defined in 40 CFR 122.26 (b)(1). Los Angeles County Flood Control District will coordinate with the other municipalities and facilitate program implementation. Each Permittee is responsible only for a discharge for which it is the operator.

5. This Order shall serve as a NPDES Permit, pursuant to CWA § 402, or amendments thereto, and shall take effect 50 days from Order adoption provided the Regional Administrator of the USEPA has no objections.

6. The action to adopt an NPDES permit is exempt from the provisions of Chapter 3 of CEQA (Cal. Pub. Resources Code § 21100 *et seq.*), in accordance with CWC § 13389.

7. Pursuant to CWC §13320, any aggrieved party may seek review of this Order by filing a petition with the State Board. A petition must be sent to: State Water Resources Control Board, P.O. Box 100, Sacramento, California, 95812, within 30 days of adoption of the Order by the Regional Board.

8. This Order may be modified or alternatively revoked or reissued prior to its expiration date, in accordance with the procedural requirements of the NPDES program, and the CWC for the issuance of waste discharge requirements.

IT IS HEREBY ORDERED that the Los Angeles County Flood Control District, Los Angeles County, and the Cities of Agoura Hills, Alhambra, Arcadia, Artesia, Azusa, Baldwin Park, Bell,

Bellflower, Bell Gardens, Beverly Hills, Bradbury, Burbank, Calabasas, Carson, Cerritos, Claremont, Commerce, Compton, Covina, Cudahy, Culver City, Diamond Bar, Downey, Duarte, El Monte, El Segundo, Gardena, Glendale, Glendora, Hawaiian Gardens, Hawthorne, Hermosa Beach, Hidden Hills, Huntington Park, Industry, Inglewood, Irwindale, La Cañada Flintridge, La Habra Heights, Lakewood, La Mirada, La Puente, La Verne, Lawndale, Lomita, Los Angeles, Lynwood, Malibu, Manhattan Beach, Maywood, Monrovia, Montebello, Monterey Park, Norwalk, Palos Verdes Estates, Paramount, Pasadena, Pico Rivera, Pomona, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Rosemead, San Dimas, San Fernando, San Gabriel, San Marino, Santa Clarita, Santa Fe Springs, Santa Monica, Sierra Madre, Signal Hill, South El Monte, South Gate, South Pasadena, Temple City, Torrance, Vernon, Walnut, West Covina, West Hollywood, Westlake Village, and Whittier, in order to meet the provisions contained in Division 7 of the CWC and regulations adopted thereunder, and the provisions of the CWA, as amended, and regulations and guidelines adopted thereunder, shall comply with the following:

Part 1. DISCHARGE PROHIBITIONS

Part 1. A. The Permittees shall effectively prohibit non-storm water discharges into the MS4 and watercourses, except where such discharges:

1. Are covered by a separate individual or general NPDES permit for non-storm water discharges; or

2. Fall within one of the categories below, and meet all conditions when specified by the Regional Board Executive Officer:

   a) Category A - Natural flow:

      (1) Natural springs and rising ground water;

      (2) Flows from riparian habitats or wetlands;

      (3) Stream diversions, permitted by the State Board; and

      (4) Uncontaminated ground water infiltration [as defined by 40 CFR 35.2005(20)].

   b) Category B - Flows from emergency fire fighting activity.

   c) Category C - Flows incidental to urban activities:

      (1) Reclaimed and potable landscape irrigation runoff;

      (2) Potable drinking water supply and distribution system releases (consistent with American Water Works Association guidelines for dechlorination and suspended solids reduction practices);

      (3) Drains for foundations, footings, and crawl spaces;

      (4) Air conditioning condensate;

(5) Dechlorinated/debrominated swimming pool discharges;

(6) Dewatering of lakes and decorative fountains;

(7) Non-commercial car washing by residents or by non-profit organizations; and

(8) Sidewalk rinsing.

The Regional Board Executive Officer may add or remove categories of non-storm water discharges above. Furthermore, in the event that any of the above categories of non-storm water discharges are determined to be a source of pollutants by the Regional Board Executive Officer, the discharge will no longer be exempt from this prohibition unless the Permittee implements conditions approved by the Regional Board Executive Officer to ensure that the discharge is not a source of pollutants. Notwithstanding the above, the Regional Board Executive Officer may impose additional prohibitions of non-storm water discharges in consideration of antidegradation policies and TMDLs.

Part 1. B. [Intentionally left blank][3,4]

Part 2. RECEIVING WATER LIMITATIONS

1. Discharges from the MS4 that cause or contribute to the violation of Water Quality Standards or water quality objectives are prohibited.

2. Discharges from the MS4 of storm water, or non-storm water, for which a Permittee is responsible for, shall not cause or contribute to a condition of nuisance.

3. The Permittees shall comply with Part 2.1. and 2.2. through timely implementation of control measures and other actions to reduce pollutants in the discharges in accordance with the SQMP and its components and other requirements of this Order including any modifications. The SQMP and its components shall be designed to achieve compliance with receiving water limitations. If exceedances of Water Quality Objectives or Water Quality Standards (collectively, Water Quality Standards) persist, notwithstanding implementation of the SQMP and its components and other requirements of this permit, the Permittee shall assure compliance with discharge prohibitions and receiving water limitations by complying with the following procedure:

   a) Upon a determination by either the Permittee or the Regional Board that discharges are causing or contributing to an exceedance of an applicable Water Quality Standard, the Permittee shall promptly notify and thereafter submit a Receiving Water Limitations (RWL) Compliance Report (as

[3] [Intentionally left blank]

[4] [Intentionally left blank]

described in the Program Reporting Requirements, Section I of the Monitoring and Reporting Program) to the Regional Board that describes BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedances of Water Quality Standards. This RWL Compliance Report may be incorporated in the annual Storm Water Report and Assessment unless the Regional Board directs an earlier submittal. The RWL Compliance Report shall include an implementation schedule. The Regional Board may require modifications to the RWL Compliance Report.

b) Submit any modifications to the RWL Compliance Report required by the Regional Board within 30 days of notification.

c) Within 30 days following the approval of the RWL Compliance Report, the Permittee shall revise the SQMP and its components and monitoring program to incorporate the approved modified BMPs that have been and will be implemented, an implementation schedule, and any additional monitoring required.

d) Implement the revised SQMP and its components and monitoring program according to the approved schedule.

4. So long as the Permittee has complied with the procedures set forth above and is implementing the revised SQMP and its components, the Permittee does not have to repeat the same procedure for continuing or recurring exceedances of the same receiving water limitations unless directed by the Regional Board to develop additional BMPs.

5. [Intentionally left blank][5]

6. During Summer Dry Weather there shall be no discharges of bacteria from MS4s into Marina del Rey Harbor Basins D, E, or F, including Mothers' Beach that cause or contribute to exceedances of the applicable bacteria objectives. The applicable bacteria objectives include both the single sample and geometric mean bacteria objectives set to protect the Water Contact Recreation (REC-1) beneficial use, as set forth in the Basin Plan.[6]

[5] [Intentionally left blank]

[6] Samples collected for determining compliance with the receiving water limitations of Part 2.6 shall be processed in accordance with the sampling procedures and analytical methodology set forth in the *Marina del Rey Harbor Mothers' Beach and Back Basins Bacterial TMDL Coordinated Shoreline Monitoring Plan* dated April 13, 2007 and the Monitoring and Reporting Program CI 6948.

Part 3. STORM WATER QUALITY MANAGEMENT PROGRAM (SQMP) IMPLEMENTATION

A. General Requirements

1. Each Permittee shall, at a minimum, implement the SQMP. The SQMP is an enforceable element of this Order. The SQMP shall be implemented no later than February 1, 2002, unless a later date has been specified for a particular provision in this Order.

2. The SQMP shall, at a minimum, comply with the applicable storm water program requirements of 40 CFR 122.26(d)(2). The SQMP and its components shall be implemented so as to reduce the discharges of pollutants in storm water to the MEP.

3. Each Permittee shall implement additional controls, where necessary, to reduce the discharges of pollutants in storm water to the MEP.

4. Permittees that modify the countywide SQMP (i.e., implement additional controls, implement different controls than described in the countywide SQMP, or determine that certain BMPs in the countywide SQMP are not applicable in the area under its jurisdiction), shall develop a local SQMP, no later than August 1, 2002. The local SQMP shall be customized to reflect the conditions in the area under the Permittee's jurisdiction and shall specify activities being implemented under the appropriate elements described in the countywide SQMP.

B. Best Management Practice Implementation

The Permittees shall implement or require the implementation of the most effective combination of BMPs for storm water/urban runoff pollution control. When implemented, BMPs are intended to result in the reduction of pollutants in storm water to the MEP.

C. Revision of the Storm Water Quality Management Program

The Permittees shall revise the SQMP, at the direction of the Regional Board Executive Officer, to incorporate program implementation amendments so as to comply with regional, watershed specific requirements, and/or waste load allocations developed and approved pursuant to the process for the designation and implementation of Total Maximum Daily Loads (TMDLs) for impaired water bodies.

D. Designation and Responsibilities of the Principal Permittee

The Los Angeles County Flood Control District is hereby designated as the Principal Permittee. As such, the Principal Permittee shall:

1. Coordinate and facilitate activities necessary to comply with the requirements of this Order, but is not responsible for ensuring compliance of any individual Permittee;

2. Coordinate permit activities among Permittees and act as liaison between Permittees and the Regional Board on permitting issues;

3. Provide personnel and fiscal resources for the necessary updates of the SQMP and its components;

4. Provide technical and administrative support for committees that will be organized to implement the SQMP and its components;

5. Convene the Watershed Management Committees (WMCs) constituted pursuant to Part F, below, upon designation of representatives;

6. Implement the Countywide Monitoring Program required under this Order and evaluate, assess and synthesize the results of the monitoring program;

7. Provide personnel and fiscal resources for the collection, processing and submittal to the Regional Board of annual reports and summaries of other reports required under the SQMP; and

8. Comply with the "Responsibilities of the Permittees" in Part 3.E., below.

E. Responsibilities of the Permittees

Each Permittee is required to comply with the requirements of this Order applicable to discharges within its boundaries (see Findings D.1, D.2. and D.3.) and not for the implementation of the provisions applicable to the Principal Permittee or other Permittees. Each Permittee shall, within its geographic jurisdiction:

1. Comply with the requirements of the SQMP and any modifications thereto;

2. Coordinate among its internal departments and agencies, as appropriate, to facilitate the implementation of the requirements of the SQMP applicable to such Permittee in an efficient and cost-effective manner;

3. Designate a technically knowledgeable representative to the appropriate WMC;

4. Participate in intra-agency coordination (e.g. Fire Department, Building and Safety, Code Enforcement, Public Health, etc.) necessary to successfully implement the provisions of this Order and the SQMP.

5. Prepare an annual Budget Summary of expenditures applied to the storm water management program. This summary shall identify the storm water budget for the following year, using estimated percentages and written explanations where necessary, for the specific categories noted below:

   a) Program management
      - Administrative costs

   b) Program Implementation

Where information is available, provide an estimated percent breakdown of expenditures for the categories below:

- Illicit connection/illicit discharge
- Development planning
- Development construction
- Construction inspection activities
- Industrial/Commercial inspection activities
- Public Agency Activities
  - Maintenance of Structural BMPs and Treatment Control BMPs
  - Municipal Street Sweeping
  - Catch basin clean-up
  - Trash collection
  - Capital costs

c) Public Information and Participation

d) Monitoring Program

e) Miscellaneous Expenditures

6. Each Permittee, in addition to the Budget Summary, shall report any supplemental dedicated budgets for the same categories.

F. Watershed Management Committees (WMCs)

1. Each WMC shall be comprised of a voting representative from each Permittee in the WMA.

2. The WMC's chair and secretary shall be chosen by the WMC upon Order adoption and on an annual basis, thereafter. In the absence of volunteer Permittee(s) for the positions, the Principal Permittee shall assume those roles until the WMC chooses members of the committee for the positions.

3. Each WMC shall:

   a) Facilitate cooperation and exchange of information among Permittees;

   b) Establish additional goals and objectives and associated deadlines for the WMA, as the program implementation progresses;

   c) Prioritize pollution control efforts based on beneficial use impairment(s), watershed characteristics and analysis of results from studies and the monitoring program;

   d) Develop and/or update and monitor the adequate implementation, on an annual basis, of the tasks identified for the WMA;

   e) Assess the effectiveness of, prepare revisions for, and recommend appropriate changes to the SQMP and its components;

f) Continue to prioritize the Industrial/Commercial critical sources for investigation, outreach and follow-up; and

g) Meet four times per year and, as necessary.

G. Legal Authority

1. Permittees shall possess the necessary legal authority to prohibit non-storm water discharges to the storm drain system, including, but not limited to:

   a) Illicit discharges and illicit connections and require removal of illicit connections;

   b) The discharge of wash waters to the MS4 from the cleaning of gas stations, auto repair garages, or other types of automotive service facilities;

   c) The discharge of runoff to the MS4 from mobile auto washing, steam cleaning, mobile carpet cleaning, and other such mobile commercial and industrial operations;

   d) The discharge of runoff to the MS4 from areas where repair of machinery and equipment which are visibly leaking oil, fluid or antifreeze, is undertaken;

   e) The discharge of runoff to the MS4 from storage areas of materials containing grease, oil, or other hazardous substances, and uncovered receptacles containing hazardous materials;

   f) The discharge of chlorinated/ brominated swimming pool water and filter backwash to the MS4;

   g) The discharge of runoff from the washing of toxic materials from paved or unpaved areas to the MS4;

   h) Washing impervious surfaces in industrial/commercial areas that results in a discharge of runoff to the MS4;

   i) The discharge of concrete or cement laden wash water from concrete trucks, pumps, tools, and equipment to the MS4; and

   j) Dumping or disposal of materials into the MS4 other than storm water, such as:

      (1) Litter, landscape debris and construction debris;

      (2) Any state or federally banned or unregistered pesticides;

      (3) Food and food processing wastes; and

      (4) Fuel and chemical wastes, animal wastes, garbage, batteries, and other materials that have potential adverse impacts on water quality.

2. The Permittees shall possess adequate legal authority to:

   a) Require persons within their jurisdiction to comply with conditions in Permittees' ordinances, permits, contracts, model programs, or orders (i.e. hold dischargers to its MS4 accountable for their contributions of pollutants and flows);

   b) Utilize enforcement mechanisms to require compliance with Permittees ordinances, permits, contracts, or orders;

   c) Control pollutants, including potential contribution, in discharges of storm water runoff associated with industrial activities (including construction activities) to its MS4 and control the quality of storm water runoff from industrial sites (including construction sites). This requirement applies to Source Control, and Treatment Control BMPs;

   d) Carry out all inspection, surveillance and monitoring procedures necessary to determine compliance and non-compliance with permit conditions, including the prohibition of illicit discharges to the MS4. Permittees must possess authority to enter, sample, inspect, review and copy records, and require regular reports from industrial facilities (including construction sites) discharging polluted or with the potential to discharge polluted storm water runoff into its MS4;

   e) Require the use of BMPs to prevent or reduce the discharge of pollutants to MS4s to MEP; and

   f) Require that Treatment Control BMPs be properly operated and maintained to prevent the breeding of vectors.

3. Each Permittee shall, no later than November 1, 2002, amend and adopt (if necessary), a Permittee-specific storm water and urban runoff ordinance to enforce all requirements of this permit.

4. Each Permittee shall submit no later than December 2, 2002, a new or updated statement by its legal counsel that the Permittee has obtained all necessary legal authority to comply with this Order through adoption of ordinances and/or municipal code modifications.

Part 4. SPECIAL PROVISIONS

Maximum Extent Practicable Standard

This permit, and the provisions herein, are intended to develop, achieve, and implement a timely, comprehensive, cost-effective storm water pollution control program to reduce the discharge of pollutants in storm water to the MEP from the permitted areas in the County of Los Angeles to the waters of the State.

A. General Requirements

1. Best Management Practice Substitution

The Regional Board Executive Officer may approve any site-specific BMP substitution upon petition by a Permittee(s), if the Permittee can document that:

a) The proposed alternative BMP or program will meet or exceed the objective of the original BMP or program in the reduction of storm water pollutants; or

b) The fiscal burden of the original BMP or program is substantially greater than the proposed alternative and does not achieve a substantially greater improvement in storm water quality; and,

c) The proposed alternative BMP or program will be implemented within a similar period of time.

B. Public Information and Participation Program (PIPP)

The Principal Permittee shall implement a Public Information and Participation Program (PIPP) that includes, but is not limited to, the requirements listed in this section. The Principal Permittee shall be responsible for developing and implementing the Public Education Program, as described in the SQMP, and shall coordinate with Permittees to implement specific requirements.

The objectives of the PIPP are as follows:

- To measurably increase the knowledge of the target audiences regarding the MS4, the impacts of storm water pollution on receiving waters, and potential solutions to mitigate the problems caused;
- To measurably change the waste disposal and runoff pollution generation behavior of target audiences by encouraging implementation of appropriate solutions; and
- To involve and engage socio-economic groups and ethnic communities in Los Angeles County to participate in mitigating the impacts of storm water pollution.

The Principal Permittee shall convene an advisory committee to provide input and assistance in meeting the goals and objectives of the public education campaign. The advisory committee shall be consulted during the process of developing the PIPP campaign, and shall provide comments and advice during the process of preparing a Request For Proposals for a storm water public education contractor. The committee may participate as a part of a working group that evaluates contractor proposals and other tasks as appropriate. The committee shall be comprised of representatives of the environmental community, Permittee cities, Regional Board staff, and experts in the fields of public education and marketing. The Principal Permittee shall ensure that the committee meets at least once a year.

1. Residential Program

a) "No Dumping" Message

Each Permittee shall mark all storm drain inlets that they own with a legible “no dumping” message. In addition, signs with prohibitive language discouraging illegal dumping must be posted at designated public access points to creeks, other relevant water bodies, and channels no later than February 2, 2004. Signage and storm drain messages shall be legible and maintained as necessary during the term of the permit.

b) Countywide Hotline

The 888-CLEAN-LA hotline will serve as the general public reporting contact for reporting clogged catch basin inlets and illicit discharges/dumping, faded or lack of catch basin stencils, and general storm water management information. Each Permittee may establish its own hotline if preferred. Permittees shall include this information, updated when necessary, in public information, and the government pages of the telephone book, as they are developed or published. The Principal Permittee shall compile a list of the general public reporting contacts from all Permittees and make this information available on the web site (888CleanLA.com) and upon request. Permittees shall provide the Principal Permittee with their reporting contacts no later than March 1, 2002. Permittees are responsible for providing current, updated information to the Principal Permittee.

c) Outreach and Education

(1) The Principal Permittee shall continue to implement the following activities that were components of the first five-year PIPP:

(i) Advertising;

(ii) Media relations;

(iii) Public service announcements;

(iv) "How To" instructional material distributed in a targeted and activity-related manner;

(v) Corporate, community association, environmental organization and entertainment industry tie-ins; and

(vi) Events targeted to specific activities and population subgroups.

(2) The Principal Permittee shall develop a strategy to educate ethnic communities and businesses through culturally effective methods. Details of this strategy should be incorporated into the Public Education Program, and implemented, no later than February 3, 2003.

(3) The Principal Permittee shall enhance the existing outreach efforts to residents and businesses related to the proper disposal of cigarette butts.

(4) Each Permittee shall conduct educational activities within its jurisdiction and participate in countywide events.

(5) The Principal Permittee shall organize Public Outreach Strategy meetings for Permittees on a quarterly basis, beginning no later than May 1, 2002. The Principal Permittee shall provide guidance for Permittees to augment the countywide outreach and education program. Permittees shall coordinate regional and local outreach and education to reduce duplication of efforts. Permittees are encouraged to include other interested parties in the outreach strategy to strengthen and coordinate educational efforts.

(6) The Principal Permittee shall ensure that a minimum of 35 million impressions per year are made on the general public about storm water quality via print, local TV access, local radio, or other appropriate media.

(7) The Principal Permittee, in cooperation with the Permittees, shall provide schools within each School District in the County with materials, including, but not limited to, videos, live presentations, and other information necessary to educate a minimum of 50 percent of all school children (K-12) every 2 years on storm water pollution.

(8) Permittees shall provide the contact information for their appropriate staff responsible for storm water public education activities to the Principal Permittee no later than April 1, 2002, and changes to contact information no later than 30 days after a change occurs.

(9) The Principal Permittee shall develop a strategy to measure the effectiveness of in-school educational programs. The protocol shall include assessment of students' knowledge of storm water pollution problems and solutions before and after educational efforts are conducted. The protocol shall be developed and submitted to the Regional Board Executive Officer for approval no later than May 1, 2002. It shall be implemented upon approval.

(10) In order to ensure that the PIPP is demonstrably effective in changing the behavior of the public, the Principal Permittee shall develop a behavioral change assessment strategy no later than May 1, 2002. The strategy shall be developed based on sociological data and studies (such

as the County Segmentation Study). The Principal Permittee shall submit the assessment strategy to the Regional Board Executive Office for approval. It shall be implemented on approval.

d) Pollutant-Specific Outreach

The Principal Permittee, in cooperation with Permittees, shall coordinate to develop outreach programs that focus on the watershed-specific pollutants listed in Table 1 no later than February 3, 2003. Metals may be appropriately addressed through the Industrial/Commercial Facilities Program (e.g. distribute education materials on appropriate BMPs for metal waste management to facilities that have been identified as a potential source, such as metal fabricating facilities). Region-wide pollutants may be included in the Principal Permittee's mass media outreach efforts.

Table 1.

Watershed	***Target Pollutants for Outreach***
Ballona Creek	Trash, Indicator Bacteria, Metals, PAHs
Malibu Creek	Trash, Nutrients (Nitrogen), Indicator Bacteria, Sediments
Los Angeles River	Trash, Nutrients (Nitrogen), Indicator Bacteria, Metals, Pesticides, PAHs
San Gabriel River	Trash, Nutrients (Nitrogen), Indicator Bacteria, Metals
Santa Clara River	Nutrients (Nitrogen), Coliform
Dominguez Channel	Trash, Indicator Bacteria, PAHs

Each Permittee shall make outreach materials available to the general public and target audiences, such as schools, community groups, contractors and developers, and at appropriate public counters and events. Outreach material shall include information on pollutants, sources of concern, and source abatement measures.

2. Businesses Program

a) Corporate Outreach

The Principal Permittee shall develop and implement a Corporate Outreach program to educate and inform corporate managers about storm water regulations. The program shall target RGOs and restaurant chains. At a minimum, this program shall include:

(1) Conferring with corporate management to explain storm water regulations;

(2) Distribution and discussion of educational material regarding storm water pollution and BMPs, and provide

managers with suggestions to facilitate employee compliance with storm water regulations.

Corporate Outreach for all RGOs and restaurant chain corporations shall be conducted not less than twice during the permit term, with the first outreach contact to begin no later than February 3, 2003.

b) Business Assistance Program

The Principal Permittee and Permittees may implement a Business Assistance Program to provide technical resource assistance to small businesses to advise them on BMPs implementation to reduce the discharge of pollutants in storm water runoff. Programs may include:

(1) On-site technical assistance or consultation via telephone to identify and implement storm water pollution prevention methods and best management practices; and

(2) Making available, distributing, and discussing of applicable BMP and educational materials.

C. Industrial/Commercial Facilities Control Program

Each Permittee shall require implementation of pollutant reduction and control measures at industrial and commercial facilities, with the objective of reducing pollutants in storm water runoff. Except as specified in other sections of this Order, pollutant reduction and control measures can be used alone or in combination, and can include Structural and Source Control BMPs, and operation and maintenance procedures, which can be applied before, during, and/or after pollution generating activities. At a minimum, the Industrial/Commercial Facilities Control Program shall include requirements to: (1) track, (2) inspect, and (3) ensure compliance at industrial and commercial facilities that are critical sources of pollutants in storm water.

1. Track Critical Sources

a) Each Permittee shall maintain a watershed-based inventory or database of all facilities within its jurisdiction that are critical sources of storm water pollution. Critical sources to be tracked are summarized below, and also specified in Attachment B:

(1) Commercial Facilities

- restaurants;
- automotive service facilities; and
- RGOs and automotive dealerships.

(2) USEPA Phase I Facilities (Tier 1 and 2)

(3) Other Federally-mandated Facilities [as specified in 40 CFR 122.26(d)(2)(iv)(C)]

- municipal landfills;
- hazardous waste treatment, disposal, and recovery facilities; and
- facilities subject to SARA Title III (also known as EPCRA).

b) Each Permittee shall include the following minimum fields of information for each industrial and commercial facility:

- name of facility and name of owner/operator;
- address;
- coverage under the GIASP or other individual or general NPDES permits; and
- a narrative description including SIC codes that best reflects the industrial activities at and principal products of each facility.

The Regional Board encourages Permittees to add other fields of information, such as material usage and/or industrial output, and discrepancies between SIC Code designations (as reported by facility operators) and the actual type of industrial activity has the potential to pollute storm water. In addition, the Regional Board recommends use of an automated database system, such as a Geographical Information System (GIS) or Internet-based system; however, this is not required.

c) Each Permittee shall update its inventory of critical sources at least annually. The update may be accomplished through collection of new information obtained through field activities or through other readily available intra-agency informational databases (e.g. business licenses, pretreatment permits, sanitary sewer hook-up permits).

2. Inspect Critical Sources

Each Permittee shall inspect all facilities in the categories and at a level and frequency as specified in the following subsections.

a) Commercial Facilities

(1) Restaurants

Frequency of Inspections: Twice during the 5-year term of the Order, provided that the first inspection occurs no later than August 1, 2004, and that there is a minimum interval of one year in between the first compliance inspection and the second compliance inspection.

Level of inspections: Each Permittee, in cooperation with its appropriate department (such as health or public works), shall inspect all restaurants within its jurisdiction to confirm that storm water BMPs are being effectively

implemented in compliance with State law, County and municipal ordinances, Regional Board Resolution 98-08, and the SQMP. At each restaurant, inspectors shall verify that the restaurant operator:

- has received educational materials on storm water pollution prevention practices;
- does not pour oil and grease or oil and grease residue onto a parking lot, street or adjacent catch basin;
- keeps the trash bin area clean and trash bin lids closed, and does not fill trash bins with washout water or any other liquid;
- does not allow illicit discharges, such as discharge of washwater from floormats, floors, porches, parking lots, alleys, sidewalks and street areas (in the immediate vicinity of the establishment), filters or garbage/trash containers;
- removes food waste, rubbish or other materials from parking lot areas in a sanitary manner that does not create a nuisance or discharge to the storm drain.

(2) Automotive Service Facilities

Frequency of Inspections: Twice during the 5-year term of the Order, provided that the first inspection occurs no later than August 1, 2004, and that there is a minimum interval of one year in between the first compliance inspection and the second compliance inspection.

Level of inspections: Each Permittee shall inspect all automotive service facilities within its jurisdiction to confirm that storm water BMPs are effectively implemented in compliance with County and municipal ordinances, Regional Board Resolution 98-08, and the SQMP. At each automotive service facility, inspectors shall verify that each operator:

- maintains the facility area so that it is clean and dry and without evidence of excessive staining;
- implements housekeeping BMPs to prevent spills and leaks;
- properly discharges wastewaters to a sanitary sewer and/or contains wastewaters for transfer to a legal point of disposal;
- is aware of the prohibition on discharge of non-storm water to the storm drain;
- properly manages raw and waste materials including proper disposal of hazardous waste;

- protects outdoor work and storage areas to prevent contact of pollutants with rainfall and runoff;
- labels, inspects, and routinely cleans storm drain inlets that are located on the facility's property; and
- trains employees to implement storm water pollution prevention practices.

(3) Retail Gasoline Outlets and Automotive Dealerships

Frequency of Inspection: Twice during the 5-year term of the Order, provided that the first inspection occurs no later than August 1, 2004, and that there is a minimum interval of one year in between the first compliance inspection and the second compliance inspection.

Level of Inspection: Each Permittee shall confirm that BMPs are being effectively implemented at each RGO and automotive dealership within its jurisdiction, in compliance with the SQMP, Regional Board Resolution 98-08, and the Stormwater Quality Task Force Best Management Practice Guide for RGOs. At each RGO and automotive dealership, inspectors shall verify that each operator:

- routinely sweeps fuel-dispensing areas for removal of litter and debris, and keeps rags and absorbents ready for use in case of leaks and spills;
- is aware that washdown of facility area to the storm drain is prohibited;
- is aware of design flaws (such as grading that doesn't prevent run-on, or inadequate roof covers and berms), and that equivalent BMPs are implemented;
- inspects and cleans storm drain inlets and catch basins within each facility's boundaries no later than October 1st of each year;
- posts signs close to fuel dispensers, which warn vehicle owners/operators against "topping off" of vehicle fuel tanks and installation of automatic shutoff fuel dispensing nozzles;
- routinely checks outdoor waste receptacle and air/water supply areas, cleans leaks and drips, and ensures that only watertight waste receptacles are used and that lids are closed; and
- trains employees to properly manage hazardous materials and wastes as well as to implement other storm water pollution prevention practices.

b) Phase I Facilities

Permittees need not inspect facilities that have been inspected by the Regional Board within the past 24 months. For the remaining Phase I facilities that the Regional Board has not inspected, each Permittee shall conduct compliance inspections as specified below.

Frequency of Inspection

Facilities in Tier 1 Categories: Twice during the 5-year term of the Order, provided that the first inspection occurs no later than August 1, 2004, and that there is a minimum interval of one year in between the first compliance inspection and the second compliance inspection.

Facilities in Tier 2 Categories: Twice during the 5-year term of the permit, provided that the first inspection occurs no later than August 1, 2004. Permittees need not perform additional inspections at those facilities determined to have no risk of exposure of industrial activity to storm water. For those facilities that do have exposure of industrial activities to storm water, a Permittee may reduce the frequency of additional compliance inspections to once every 5 years, provided that the Permittee inspects at least 20% of the facilities in Tier 2 each year.

Level of Inspection: Each Permittee shall confirm that each operator:

- has a current Waste Discharge Identification (WDID) number for facilities discharging storm water associated with industrial activity, and that a Storm Water Pollution Prevention Plan is available on-site, and
- is effectively implementing BMPs in compliance with County and municipal ordinances, Regional Board Resolution 98-08, and the SQMP.

c) Other Federally-mandated Facilities

Frequency of Inspection: Twice during the 5-year term of the Order, provided that the first inspection occurs no later than August 1, 2004, and that there is a minimum interval of one year in between the first compliance inspection and the second compliance inspection.

Level of Inspection: Each Permittee shall confirm that each operator:

- has a current Waste Discharge Identification (WDID) number for facilities discharging storm water associated with industrial activity, and that a Storm Water Pollution Prevention Plan is available on-site, and
- is effectively implementing BMPs in compliance with County and municipal ordinances, Regional Board Resolution 98-08, and the SQMP.

3. Ensure Compliance of Critical Sources

a) **BMP Implementation:** In the event that a Permittee determines that a BMP specified by the SQMP or Regional Board Resolution 98-08 is infeasible at any site, that Permittee shall require implementation of other BMPs that will achieve the equivalent reduction of pollutants in the storm water discharges. Likewise, for those BMPs that are not adequate to achieve water quality objectives, Permittees may require additional site-specific controls, such as Treatment Control BMPs.

b) **Environmentally Sensitive Areas and Impaired Waters:** For critical sources that are in ESAs or that are tributary to CWA § 303(d) impaired water bodies, Permittees shall consider requiring operators to implement additional controls to reduce pollutants in storm water runoff that are causing or contributing to the exceedences of Water Quality Objectives.

c) **Progressive Enforcement:** Each Permittee shall implement a progressive enforcement policy to ensure that facilities are brought into compliance with all storm water requirements within a reasonable time period as specified below.

(1) In the event that a Permittee determines, based on an inspection conducted above, that an operator has failed to adequately implement all necessary BMPs, that Permittee shall take progressive enforcement action which, at a minimum, shall include a follow-up inspection within 4 weeks from the date of the initial inspection.

(2) In the event that a Permittee determines that an operator has failed to adequately implement BMPs after a follow-up inspection, that Permittee shall take further enforcement action as established through authority in its municipal code and ordinances or through the judicial system.

(3) Each Permittee shall maintain records, including inspection reports, warning letters, notices of violations, and other enforcement records, demonstrating a good faith effort to bring facilities into compliance.

d) Interagency Coordination

(1) **Referral of Violations of the SQMP, Regional Board Resolution 98-08, and Municipal Storm Water Ordinances:** A Permittee may refer a violation(s) to the Regional Board provided that that Permittee has made a good faith effort of progressive enforcement. At a minimum, a Permittee's good faith effort must include documentation of:

- Two follow-up inspections, and
- Two warning letters or notices of violation.

(2) **Referral of Violations of the GIASP, including Requirements to File a Notice of Intent:** For those facilities in violation of the GIASP, Permittees may escalate referral of such violations to the Regional Board after one inspection and one written notice to the operator regarding the violation. In making such referrals, Permittees shall include, at a minimum, the following documentation:

- Name of the facility;
- Operator of the facility;
- Owner of the facility;
- Industrial activity being conducted at the facility that is subject to the GIASP; and
- Records of communication with the facility operator regarding the violation, which shall include at least an inspection report and one written notice of the violation.

Permittees shall, at a minimum, make such referrals on a quarterly basis.

(3) **Investigation of Complaints Regarding Facilities – Transmitted by the Regional Board Staff:** Each Permittee shall initiate, within one business day, investigation of complaints (other than non-storm water discharges) regarding facilities within its jurisdiction. The initial investigation shall include, at a minimum, a limited inspection of the facility to confirm the complaint to determine if the facility is effectively complying with the SQMP and municipal storm water/urban runoff ordinances, and to oversee corrective action.

(4) **Support of Regional Board Enforcement Actions:** As directed by the Regional Board Executive Officer, Permittees shall support Regional Board enforcement actions by: assisting in identification of current owners, operators, and lessees of facilities; providing staff, when available, for joint inspections with Regional Board

inspectors; appearing as witnesses in Regional Board enforcement hearings; and providing copies of inspection reports and other progressive enforcement documentation.

(5) **Participation in a Task Force:** The Permittees, Regional Board, and other stakeholders may form a Storm Water Task Force, the purpose of which is to communicate concerns regarding special cases of storm water violations by industrial and commercial facilities and to develop a coordinated approach to enforcement action.

D. Development Planning Program

The Permittees shall implement a development-planning program that will require all Planning Priority development and Redevelopment projects to:

- Minimize impacts from storm water and urban runoff on the biological integrity of Natural Drainage Systems and water bodies in accordance with requirements under CEQA (Cal. Pub. Resources Code § 21100), CWC § 13369, CWA § 319, CWA § 402(p), CWA § 404, CZARA § 6217(g), ESA § 7, and local government ordinances ;
- Maximize the percentage of pervious surfaces to allow percolation of storm water into the ground;
- Minimize the quantity of storm water directed to impervious surfaces and the MS4;
- Minimize pollution emanating from parking lots through the use of appropriate Treatment Control BMPs and good housekeeping practices;
- Properly design and maintain Treatment Control BMPs in a manner that does not promote the breeding of vectors; and
- Provide for appropriate permanent measures to reduce storm water pollutant loads in storm water from the development site.

1. Peak Flow Control

The Permittees shall control post-development peak storm water runoff discharge rates, velocities, and duration (peak flow control) in Natural Drainage Systems (i.e., mimic pre-development hydrology) to prevent accelerated stream erosion and to protect stream habitat. Natural Drainage Systems are located in the following areas:

a) Malibu Creek;

b) Topanga Canyon Creek;

c) Upper Los Angeles River;

d) Upper San Gabriel River;

e) Santa Clara River; and

f) Los Angeles County Coastal streams (see Basin Plan Table 2-1).

The Principal Permittee in consultation with Permittees shall develop numerical criteria for peak flow control, based on the results of the Peak Discharge Impact Study (see Monitoring Program Section II.I).

Each Permittee shall, no later than February 1, 2005, implement numerical criteria for peak flow control.

A Permittee or group of Permittees may substitute for the countywide peak flow control criteria with a Hydromodification Control Plan (HCP), on approval by the Regional Board, in the following circumstances:

(1) Stream or watershed-specific conditions indicate the need for a different peak flow control criteria, and the alternative numerical criteria is developed through the application of hydrologic modeling and supporting field observations; or

(2) A watershed-wide plan has been developed for implementation of control measures to reduce erosion and stabilize drainage systems on a watershed basis.

2. Standard Urban Storm Water Mitigation Plans (SUSMPs)

a) Each Permittee shall amend codes and ordinances not later than August 1, 2002 to give legal effect to SUSMP changes contained in this Order. Changes to SUSMP requirements shall take effect not later than September 2, 2002.

b) Each Permittee shall require that a single-family hillside home:

(1) Conserve natural areas;

(2) Protect slopes and channels;

(3) Provide storm drain system stenciling and signage;

(4) Divert roof runoff to vegetated areas before discharge unless the diversion would result in slope instability; and

(5) Direct surface flow to vegetated areas before discharge unless the diversion would result in slope instability.

c) Each Permittee shall require that a SUSMP as approved by the Regional Board in Board Resolution No. R 00-02 be implemented for the following categories of developments:

(1) Ten or more unit homes (includes single family homes, multifamily homes, condominiums, and apartments);

(2) A 100,000 or more square feet of impervious surface area industrial/ commercial development;

(3) Automotive service facilities (SIC 5013, 5014, 5541, 7532-7534, and 7536-7539);

(4) Retail gasoline outlets;

(5) Restaurants (SIC 5812);

(6) Parking lots 5,000 square feet or more of surface area or with 25 or more parking spaces; and

(7) Redevelopment projects in subject categories that meet Redevelopment thresholds.

d) Each Permittee shall submit an ESA Delineation Map for its jurisdictional boundary, based on the Regional Board's ESA Definition, no later than June 3, 2002, for approval by the Regional Board Executive Officer in consultation with the California Department of Fish and Game, and the California Coastal Commission.

e) Each Permittee shall require the implementation of SUSMP provisions no later than September 2, 2002, for all projects located in or directly adjacent to or discharging directly to an ESA, where the development will:

(1) Discharge storm water and urban runoff that is likely to impact a sensitive biological species or habitat; and

(2) Create 2,500 square feet or more of impervious surface area.

3. Numerical Design Criteria

The Permittees shall require that post-construction Treatment Control BMPs incorporate, at a minimum, either a volumetric or flow based treatment control design standard, or both, as identified below to mitigate (infiltrate, filter or treat) storm water runoff:

a) Volumetric Treatment Control BMP

(1) The 85th percentile 24-hour runoff event determined as the maximized capture storm water volume for the area, from the formula recommended in *Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998*); or

(2) The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in *California Stormwater Best Management Practices Handbook – Industrial/ Commercial,* (1993); or

(3) The volume of runoff produced from a 0.75 inch storm event, prior to its discharge to a storm water conveyance system; or

(4) The volume of runoff produced from a historical-record based reference 24-hour rainfall criterion for "treatment" (0.75 inch average for the Los Angeles County area) that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event.

b) Flow Based Treatment Control BMP

(1) The flow of runoff produced from a rain event equal to at least 0.2 inches per hour intensity; or

(2) The flow of runoff produced from a rain event equal to at least two times the 85th percentile hourly rainfall intensity for Los Angeles County; or

(3) The flow of runoff produced from a rain event that will result in treatment of the same portion of runoff as treated using volumetric standards above.

4. Applicability of Numerical Design Criteria

The Permittees shall require the following categories of Planning Priority Projects to design and implement post-construction treatment controls to mitigate storm water pollution:

a) Single-family hillside residential developments of one acre or more of surface area;

b) Housing developments (includes single family homes, multifamily homes, condominiums, and apartments) of ten units or more;

c) A 100,000 square feet or more impervious surface area industrial/ commercial development;

d) Automotive service facilities (SIC 5013, 5014, 5541, 7532-7534 and 7536-7539) [5,000 square feet or more of surface area];

e) Retail gasoline outlets [5,000 square feet or more of impervious surface area and with projected Average Daily Traffic (ADT) of 100 or more vehicles]. Subsurface Treatment Control BMPs which may endanger public safety (i.e., create an explosive environment) are considered not appropriate;

f) Restaurants (SIC 5812) [5,000 square feet or more of surface area];

g) Parking lots 5,000 square feet or more of surface area or with 25 or more parking spaces;

h) Projects located in, adjacent to or discharging directly to an ESA that meet threshold conditions identified above in 2.e; and

i) Redevelopment projects in subject categories that meet Redevelopment thresholds.

5. Not later than March 10, 2003, each Permittee shall require the implementation of SUSMP and post-construction control requirements for the industrial/commercial development category to projects that disturb one acre or more of surface area.

6. Site Specific Mitigation

Each Permittee shall, no later than September 2, 2002, require the implementation of a site-specific plan to mitigate post-development storm water for new development and redevelopment not requiring a SUSMP but which may potentially have adverse impacts on post-development storm water quality, where one or more of the following project characteristics exist:

a) Vehicle or equipment fueling areas;

b) Vehicle or equipment maintenance areas, including washing and repair;

c) Commercial or industrial waste handling or storage;

d) Outdoor handling or storage of hazardous materials;

e) Outdoor manufacturing areas;

f) Outdoor food handling or processing;

g) Outdoor animal care, confinement, or slaughter; or

h) Outdoor horticulture activities.

7. Redevelopment Projects

The Permittees shall apply the SUSMP, or site specific requirements including post-construction storm water mitigation to all Planning Priority Projects that undergo significant Redevelopment in their respective categories.

a) Significant Redevelopment means land-disturbing activity that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site.

Where Redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post development storm water quality control requirements, the entire project must be mitigated. Where Redevelopment results in an alteration to less than fifty percent of impervious surfaces of

a previously existing development, and the existing development was not subject to post development storm water quality control requirements, only the alteration must be mitigated, and not the entire development.

b) Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of facility or emergency redevelopment activity required to protect public health and safety.

c) Existing single family structures are exempt from the Redevelopment requirements.

8. Maintenance Agreement and Transfer

Each Permittee shall require that all developments subject to SUSMP and site specific plan requirements provide verification of maintenance provisions for Structural and Treatment Control BMPs, including but not limited to legal agreements, covenants, CEQA mitigation requirements, and or conditional use permits. Verification at a minimum shall include:

a) The developer's signed statement accepting responsibility for maintenance until the responsibility is legally transferred; and either

b) A signed statement from the public entity assuming responsibility for Structural or Treatment Control BMP maintenance and that it meets all local agency design standards; or

c) Written conditions in the sales or lease agreement, which requires the recipient to assume responsibility for maintenance and conduct a maintenance inspection at least once a year; or

d) Written text in project conditions, covenants and restrictions (CCRs) for residential properties assigning maintenance responsibilities to the Home Owners Association for maintenance of the Structural and Treatment Control BMPs; or

e) Any other legally enforceable agreement that assigns responsibility for the maintenance of post-construction Structural or Treatment Control BMPs.

9. Regional Storm Water Mitigation Program

A Permittee or Permittee group may apply to the Regional Board for approval of a regional or sub-regional storm water mitigation program to substitute in part or wholly SUSMP requirements. Upon review and a determination by the Regional Board Executive Officer that the proposal is technically valid and appropriate, the Regional Board may consider for approval such a program if its implementation will:

a) Result in equivalent or improved storm water quality;

b) Protect stream habitat;

c) Promote cooperative problem solving by diverse interests;

d) Be fiscally sustainable and has secure funding; and

e) Be completed in five years including the construction and start-up of treatment facilities.

Nothing in this provision shall be construed as to delay the implementation of SUSMP requirements, as approved in this Order.

10. Mitigation Funding

The Permittees may propose a management framework, for endorsement by the Regional Board Executive Officer, to support regional or sub-regional solutions to storm water pollution, where any of the following situations occur:

a) A waiver for impracticability is granted;

b) Legislative funds become available;

c) Off-site mitigation is required because of loss of environmental habitat; or

d) An approved watershed management plan or a regional storm water mitigation plan exists that incorporates an equivalent or improved strategy for storm water mitigation.

11. California Environmental Quality Act (CEQA) Document Update

Each Permittee shall incorporate into its CEQA process, with immediate effect, procedures for considering potential storm water quality impacts and providing for appropriate mitigation when preparing and reviewing CEQA documents. The procedures shall require consideration of the following:

a) Potential impact of project construction on storm water runoff;

b) Potential impact of project post-construction activity on storm water runoff;

c) Potential for discharge of storm water from areas from material storage, vehicle or equipment fueling, vehicle or equipment maintenance (including washing), waste handling, hazardous materials handling or storage, delivery areas or loading docks, or other outdoor work areas;

d) Potential for discharge of storm water to impair the beneficial uses of the receiving waters or areas that provide water quality benefit;

e) Potential for the discharge of storm water to cause significant harm on the biological integrity of the waterways and water bodies;

f) Potential for significant changes in the flow velocity or volume of storm water runoff that can cause environmental harm; and

g) Potential for significant increases in erosion of the project site or surrounding areas.

12. General Plan Update

a) Each Permittee shall amend, revise or update its General Plan to include watershed and storm water quality and quantity management considerations and policies when any of the following General Plan elements are updated or amended: (i) Land Use, (ii) Housing, (iii) Conservation, and (iv) Open Space.

b) Each Permittee shall provide the Regional Board with the draft amendment or revision when a listed General Plan element or the General Plan is noticed for comment in accordance with Cal. Govt. Code § 65350 *et seq*.

13. Targeted Employee Training

Each Permittee shall train its employees in targeted positions (whose jobs or activities are engaged in development planning) regarding the development planning requirements on an annual basis beginning no later than August 1, 2002, and more frequently if necessary. For Permittees with a population of 250,000 or more (2000 U.S. Census), training shall be completed no later than February 3, 2003.

14. Developer Technical Guidance and Information

a) Each Permittee shall develop and make available to the developer community SUSMP (development planning) guidelines immediately.

b) The Principal Permittee in partnership with Permittees shall issue no later than February 2, 2004, a technical manual for the siting and design of BMPs for the development community in Los Angeles County. The technical manual may be adapted from the revised California Storm Water Quality Task Force Best Management Practices Handbooks scheduled for publication in September 2002. The technical manual shall at a minimum include:

(1) Treatment Control BMPs based on flow-based and volumetric water quality design criteria for the purposes of countywide consistency;

(2) Peak Flow Control criteria to control peak discharge rates, velocities and duration;

(3) Expected pollutant removal performance ranges obtained from national databases, technical reports and the scientific literature;

(4) Maintenance considerations; and

(5) Cost considerations.

E. Development Construction Program

1. Each Permittee shall implement a program to control runoff from construction activity at all construction sites within its jurisdiction. The program shall ensure the following minimum requirements are effectively implemented at all construction sites:

   a) Sediments generated on the project site shall be retained using adequate Treatment Control or Structural BMPs;

   b) Construction-related materials, wastes, spills, or residues shall be retained at the project site to avoid discharge to streets, drainage facilities, receiving waters, or adjacent properties by wind or runoff;

   c) Non-storm water runoff from equipment and vehicle washing and any other activity shall be contained at the project site; and

   d) Erosion from slopes and channels shall be controlled by implementing an effective combination of BMPs (as approved in Regional Board Resolution No. 99-03), such as the limiting of grading scheduled during the wet season; inspecting graded areas during rain events; planting and maintenance of vegetation on slopes; and covering erosion susceptible slopes.

2. For construction sites one acre and greater, each Permittee shall comply with all conditions in section E.1. above and shall:

   a) Require the preparation and submittal of a Local Storm Water Pollution Prevention Plan (Local SWPPP), for approval prior to issuance of a grading permit for construction projects.

   The Local SWPPP shall include appropriate construction site BMPs and maintenance schedules. (A Local SWPPP may substitute for the State SWPPP if the Local SWPPP is at least as inclusive in controls and BMPs as the State SWPPP). The Local SWPPP must include the rationale used for selecting or rejecting BMPs. The project architect, or engineer of record, or authorized qualified designee, must sign a statement on the Local SWPPP to the effect:

   "As the architect/engineer of record, I have selected appropriate BMPs to effectively minimize the negative impacts of this project's construction activities on storm water quality. The project owner and contractor are aware that the selected BMPs must be installed, monitored, and maintained to ensure their effectiveness. The BMPs not selected for implementation are redundant or deemed not applicable to the proposed construction activity."

The landowner or the landowner's agent shall sign a statement to the effect:

"I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that submitting false and/or inaccurate information, failing to update the Local SWPPP to reflect current conditions, or failing to properly and/or adequately implement the Local SWPPP may result in revocation of grading and/or other permits or other sanctions provided by law."

The Local SWPPP certification shall be signed by the landowner as follows, for a corporation: by a responsible corporate officer which means (a) a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or (b) the manager of the construction activity if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures; for a partnership or sole proprietorship: by a general partner or the proprietor; or for a municipality or other public agency: by an elected official, a ranking management official (e.g., County Administrative Officer, City Manager, Director of Public Works, City Engineer, District Manager), or the manager of the construction activity if authority to sign Local SWPPPs has been assigned or delegated to the manager in accordance with established agency policy.

b) Inspect all construction sites for storm water quality requirements during routine inspections a minimum of once during the wet season. The Local SWPPP shall be reviewed for compliance with local codes, ordinances, and permits. For inspected sites that have not adequately implemented their Local SWPPP, a follow-up inspection to ensure compliance will take place within 2 weeks. If compliance has not been attained, the Permittee will take additional actions to achieve compliance (as specified in municipal codes). If compliance has not been achieved, and the site is also covered under a statewide general construction storm water permit, each Permittee shall enforce their local ordinance requirements, and if non-compliance continues the Regional Board shall be notified for further joint enforcement actions.

c) Require, no later than March 10, 2003, prior to issuing a grading permit for all projects less than five acres requiring coverage under a statewide general construction storm water permit, proof of a Waste Discharger Identification (WDID) Number for filing a Notice of Intent (NOI) for permit coverage and a certification that a

SWPPP has been prepared by the project developer. A Local SWPPP may substitute for the State SWPPP if the Local SWPPP is at least as inclusive in controls and BMPs as the State SWPPP.

3. For sites five acres and greater, each Permittee shall comply with all conditions in Sections E.1. and E.2. and shall:

   a) Require, prior to issuing a grading permit for all projects requiring coverage under the state general permit, proof of a Waste Discharger Identification (WDID) Number for filing a Notice of Intent (NOI) for coverage under the GCASP and a certification that a SWPPP has been prepared by the project developer. A Local SWPPP may substitute for the State SWPPP if the Local SWPPP is at least as inclusive in controls and BMPs as the State SWPPP.

   b) Require proof of an NOI and a copy of the SWPPP at any time a transfer of ownership takes place for the entire development or portions of the common plan of development where construction activities are still on-going.

   c) Use an effective system to track grading permits issued by each Permittee. To satisfy this requirement, the use of a database or GIS system is encouraged, but not required.

4. GCASP Violation Referrals

   a) Referral of Violations of the SQMP, Regional Board Resolution 98-08, and municipal storm water ordinances:

      A Permittee may refer a violation(s) to the Regional Board provided that the Permittee has made a good faith effort of progressive enforcement. At a minimum, a Permittee's good faith effort must include documentation of:
      - Two follow-up inspections within 3 months, and
      - Two warning letters or notices of violation.

   b) Referral of Violations of GCASP Filing Requirements:

      For those projects subject to the GCASP, Permittees shall refer non-filers (i.e., those projects which cannot demonstrate that they have a WDID number) to the Regional Board, within 15 days of making a determination. In making such referrals, Permittees shall include, at a minimum, the following documentation:
      - Project location;
      - Developer;
      - Estimated project size; and
      - Records of communication with the developer regarding filing requirements.

5. Each Permittee shall train employees in targeted positions (whose jobs or activities are engaged in construction activities including construction inspection staff) regarding the requirements of the storm water management program no later than August 1, 2002, and annually

thereafter. For Permittees with a population of 250,000 or more (2000 U.S. Census), initial training shall be completed no later than February 3, 2003. Each Permittee shall maintain a list of trained employees.

F. Public Agency Activities Program

Each Permittee shall implement a Public Agency program to minimize storm water pollution impacts from public agency activities. Public Agency requirements consist of:

- Sewage Systems Maintenance, Overflow, and Spill Prevention
- Public Construction Activities Management
- Vehicle Maintenance/Material Storage Facilities/Corporation Yards Management
- Landscape and Recreational Facilities Management
- Storm Drain Operation and Management
- Streets and Roads Maintenance
- Parking Facilities Management
- Public Industrial Activities Management
- Emergency Procedures
- Treatment Feasibility Study

1. Sewage System Maintenance, Overflow, and Spill Prevention

   a) Each Permittee shall implement a response plan for overflows of the sanitary sewer system within their respective jurisdiction, which shall consist at a minimum of the following:

      (1) Investigation of any complaints received;

      (2) Upon notification, immediate response to overflows for containment; and

      (3) Notification to appropriate sewer and public health agencies when a sewer overflows to the MS4.

   b) In addition to 1.a.1, 1.a.2, and 1.a.3 above, for those Permittees, which own and/or operate a sanitary sewer system, the Permittee shall also implement the following requirements:

      (1) Procedures to prevent sewage spills or leaks from sewage facilities from entering the MS4; and

      (2) Identify, repair, and remediate sanitary sewer blockages, exfiltration, overflow, and wet weather overflows from sanitary sewers to the MS4.

2. Public Construction Activities Management

   a) Each Permittee shall implement the Development Planning Program requirements (Permit Part 4.D) at public construction projects.

   b) Each Permittee shall implement the Development Construction Program requirements (Permit Part 4.E) at Permittee owned construction sites.

   c) Each Permittee shall obtain coverage under the GCASP for public construction sites 5 acres or greater (or part of a larger area of development) except that a municipality under 100,000 in population (1990 U.S. Census) need not obtain coverage under a separate permit until March 10, 2003.

   d) Each Permittee, no later than March 10, 2003, shall obtain coverage under a statewide general construction storm water permit for public construction sites for projects between one and five acres.

3. Vehicle Maintenance/Material Storage Facilities/Corporation Yards Management

   a) Each Permittee, consistent with the SQMP, shall implement SWPPPs for public vehicle maintenance facilities, material storage facilities, and corporation yards which have the potential to discharge pollutants into storm water.

   b) Each Permittee shall implement BMPs to minimize pollutant discharges in storm water including but not be limited to:

      (1) Good housekeeping practices;

      (2) Material storage control;

      (3) Vehicle leaks and spill control; and

      (4) Illicit discharge control.

   c) Each Permittee shall implement the following measures to prevent the discharge of pollutants to the MS4:

      (1) For existing facilities, that are not already plumbed to the sanitary sewer, all vehicle and equipment wash areas (except for fire stations) shall either be:

         (i) Self-contained;

         (ii) Equipped with a clarifier;

         (iii) Equipped with an alternative pre-treatment device; or

(iv) Plumbed to the sanitary sewer.

(2) For new facilities, or during redevelopment of existing facilities (including fire stations), all vehicle and equipment wash areas shall be plumbed to the sanitary sewer and be equipped with a pre-treatment device in accordance with requirements of the sewer agency.

4. Landscape and Recreational Facilities Management

Each Permittee shall implement the following requirements:

a) A standardized protocol for the routine and non-routine application of pesticides, herbicides (including pre-emergents), and fertilizers;

b) Consistency with State Board's guidelines and monitoring requirements for application of aquatic pesticides to surface waters (WQ Order No. 2001-12 DWQ);

c) Ensure no application of pesticides or fertilizers immediately before, during, or immediately after a rain event or when water is flowing off the area to be applied;

d) Ensure that no banned or unregistered pesticides are stored or applied;

e) Ensure that staff applying pesticides are certified by the California Department of Food and Agriculture, or are under the direct supervision of a certified pesticide applicator;

f) Implement procedures to encourage retention and planting of native vegetation and to reduce water, fertilizer, and pesticide needs;

g) Store fertilizers and pesticides indoors or under cover on paved surfaces or use secondary containment;

h) Reduce the use, storage, and handling of hazardous materials to reduce the potential for spills; and

i) Regularly inspect storage areas.

5. Storm Drain Operation and Management

a) Each Permittee shall designate catch basin inlets within its jurisdiction as one of the following:

Priority A: Catch basins that are designated as consistently generating the highest volumes of trash and/or debris.

Priority B: Catch basins that are designated as consistently generating moderate volumes of trash and/or debris.

Priority C: Catch basins that are designated as generating low volumes of trash and/or debris.

b) Permittees subject to a trash TMDL (Ballona Creek WMA) shall continue to implement the requirements listed below until trash TMDL implementation measures are adopted. Thereafter, the subject Permittees shall implement programs in conformance with the TMDL implementation schedule, which shall include an effective combination of measures such as street sweeping, catch basin cleaning, installation of treatment devices and trash receptacles, or other BMPs. Default requirements include:

(1) Inspection and cleaning of catch basins between May 1 and September 30 of each year;

(2) Additional cleaning of any catch basin that is at least 40% full of trash and/or debris;

(3) Record keeping of catch basins cleaned; and

(4) Recording of the overall quantity of catch basin waste collected.

If the implementation phase for the Los Angeles River and Ballona Creek Trash TMDLs has not begun by October 2003, subject Permittees shall implement the requirements described below in subsection 5(c), until such time programs in conformance with the subject Trash TMDLs are being implemented.

Permittees subject to the Los Angeles River Watershed Trash TMDL shall implement the requirements set forth in Part 7. Total Maximum Daily Load Provisions, subsection 1 “TMDL for Trash in the Los Angeles River Watershed”.

c) Permittees not subject to a trash TMDL shall:

(1) Clean catch basins according to the following schedule:

Priority A: A minimum of three times during the wet season and once during the dry season every year.

Priority B: A minimum of once during the wet season and once during the dry season every year.

Priority C: A minimum of once per year.

In addition to the schedule above, between February 1, 2002 and July 1, 2003, Permittees shall ensure that any catch basin that is at least 40% full of trash and/or debris shall be cleaned out. After July 1, 2003, Permittees shall

ensure that any catch basin that is at least 25% full of trash and debris shall be cleaned out.

(2) For any special event that can be reasonably expected to generate substantial quantities of trash and litter, include provisions that require for the proper management of trash and litter generated, as a condition of the special use permit issued for that event. At a minimum, the municipality who issues the permit for the special event shall arrange for either temporary screens to be placed on catch basins or for catch basins in that area to be cleaned out subsequent to the event and prior to any rain event.

(3) Place trash receptacles at all transit stops within its jurisdiction that have shelters no later than August 1, 2002, and at all other transit stops within its jurisdiction no later than February 3, 2003. All trash receptacles shall be maintained as necessary.

d) Each Permittee shall inspect the legibility of the catch basin stencil or label nearest the inlet. Catch basins with illegible stencils shall be recorded and re-stenciled or re-labeled within 180 days of inspection.

e) Each Permittee shall implement BMPs for Storm Drain Maintenance that include:

(1) A program to visually monitor Permittee-owned open channels and other drainage structures for debris at least annually and identify and prioritize problem areas of illicit discharge for regular inspection;

(2) A review of current maintenance activities to assure that appropriate storm water BMPs are being utilized to protect water quality;

(3) Removal of trash and debris from open channel storm drains shall occur a minimum of once per year before the storm season;

(4) Minimize the discharge of contaminants during MS4 maintenance and clean outs; and

(5) Proper disposal of material removed.

6. Streets and Roads Maintenance

a) Each Permittee shall designate streets and/or street segments within its jurisdiction as one of the following:

Priority A: Streets and/or street segments that are designated as consistently generating the highest volumes of trash and/or debris.

Priority B: Streets and/or street segments that are designated as consistently generating moderate volumes of trash and/or debris.

Priority C: Streets and/or street segments that are designated as generating low volumes of trash and/or debris.

b) Each Permittee shall perform street sweeping of curbed streets according to the following schedule:

Priority A: These streets and/or street segments shall be swept at least two times per month.

Priority B: Each Permittee shall ensure that each street and/or street segments is swept at least once per month.

Priority C: These streets and/or street segments shall be swept as necessary but in no case less than once per year.

c) Each Permittee shall require that:

(1) Sawcutting wastes be recovered and disposed of properly and that in no case shall waste be left on a roadway or allowed to enter the storm drain;

(2) Concrete and other street and road maintenance materials and wastes shall be managed to prevent discharge to the MS4; and

(3) The washout of concrete trucks and chutes shall only occur in designated areas and never discharged to storm drains, open ditches, streets, or catch basins.

d) Each Permittee shall, no later than August 1, 2002, train their employees in targeted positions (whose interactions, jobs, and activities affect storm water quality) regarding the requirements of the storm water management program to:

(1) Promote a clear understanding of the potential for maintenance activities to pollute storm water; and

(2) Identify and select appropriate BMPs.

For Permittees with a population of 250,000 or more (2000 U.S. Census) training shall be completed no later than February 1, 2003.

7. Parking Facilities Management

Permittee-owned parking lots exposed to storm water shall be kept clear of debris and excessive oil buildup and cleaned no less than 2 times per month and/or inspected no less than 2 times per month to determine if

cleaning is necessary. In no case shall a Permittee-owned parking lot be cleaned less than once a month.

8. Public Industrial Activities Management

Each Permittee shall, for any municipal activity considered a discharge of storm water associated with industrial activity, obtain separate coverage under the GIASP except that a municipality under 100,000 in population (1990 U.S. Census) need not file the Notice Of Intent to be covered by said permit until March 10, 2003 (with the exception of power plants, airports, and uncontrolled sanitary landfills).

9. Emergency Procedures

Each Permittee shall repair essential public services and infrastructure in a manner to minimize environmental damage in emergency situations such as: earthquakes; fires; floods; landslides; or windstorms. BMPs shall be implemented to the extent that measures do not compromise public health and safety. After initial emergency response or emergency repair activities have been completed, each Permittee shall implement BMPs and programs as required under this Order.

10. Treatment Feasibility Study

The Permittees in cooperation with the County Sanitation Districts of Los Angeles County shall conduct a study to investigate the possible diversion of dry weather discharges or the use of alternative Treatment Control BMPs to treat flows from their jurisdiction which may impact public health and safety and/or the environment. The Permittees shall collectively review their individual prioritized lists and create a watershed based priority list of drains for potential diversion or treatment and submit the priority listing to the Regional Board Executive Officer, no later than July 1, 2003.

G. Illicit Connections and Illicit Discharges Elimination Program

Permittees shall eliminate all illicit connections and illicit discharges to the storm drain system, and shall document, track, and report all such cases in accordance with the elements and performance measures specified in the following subsections.

1. General

a) Implementation: Each Permittee must develop an Implementation Program which specifies how each Permittee is implementing revisions to the IC/ID Program of the SQMP. This Implementation Program must be documented, and available for review and approval by the Regional Board Executive Officer, upon request.

b) Tracking: All Permittees shall, no later than February 3, 2003, develop and maintain a listing of all permitted connections to their storm drain system. All Permittees shall map at a scale and in a format specified by the Principal Permittee all illicit connections and discharges on their baseline maps, and shall transmit this information to the Principal Permittee. No later than February 3, 2003, the Principal Permittee shall use this information as well as results of baseline and priority screening for illicit connections (as set forth in subsection 2 below) to start an annual evaluation of patterns and trends of illicit connections and illicit discharges, with the objectives of identifying priority areas for elimination of illicit connections and illicit discharges.

c) Training: All Permittees shall train all targeted employees who are responsible for identification, investigation, termination, cleanup, and reporting of illicit connections and discharges. For Permittees with a population of less than 250,000 (2000 U.S. Census), training shall be completed no later than August 1, 2002. For Permittees with a population of 250,000 or more (2000 U.S. Census), training shall be completed no later than February 3, 2003. Furthermore, all Permittees shall conduct refresher training on an annual basis thereafter.

2. Illicit Connections

a) Screening for Illicit Connections

(1) Field Screening: All Permittees shall field Screen the storm drain system for illicit connections in accordance with the following schedule:

(i) Open channels: No later than February 3, 2003;

(ii) Underground pipes in priority areas: No later than February 1, 2005; and

(iii) Underground pipes with a diameter of 36 inches or greater: No later than December 12, 2006.

Permittees shall report, to the Principal Permittee, on the location and length of open channels or underground pipes that have been Screened *vis a vis* the entire storm drain network, and on the status of suspected, confirmed, and terminated illicit connections. Permittees shall maintain a list containing all permitted connections and the status of connections under investigation for possible illicit connection.

(2) Permit Screening: No later than December 12, 2006, Permittees shall complete a review of all permitted connections to the storm drain system, to confirm compliance with Part 1 (Discharge Prohibition).

b) Response to Illicit Connections

(1) Investigation: Upon discovery or upon receiving a report of a suspected illicit connection, Permittees shall initiate an investigation within 21 days, to determine the source of the connection, the nature and volume of discharge through the connection, and the responsible party for the connection.

(2) Termination: Upon confirmation of the illicit nature of a storm drain connection, Permittees shall ensure termination of the connection within 180 days, using enforcement authority as needed.

3. Illicit Discharges

a) Abatement and Cleanup: Permittees shall respond, within one business day of discovery or a report of a suspected illicit discharge, with activities to abate, contain, and clean up all illicit discharges, including hazardous substances.

b) Investigation: Permittees shall investigate illicit discharges as soon as practicable (during or immediately following containment and cleanup activities), and shall take enforcement action as appropriate.

Part 5. DEFINITIONS

The following are definitions for terms applicable to this Order:

"Adverse Impact" means a detrimental effect upon water quality or beneficial uses caused by a discharge or loading of a pollutant or pollutants.

"Anti-degradation policies" means the *Statement of Policy with Respect to Maintaining High Quality Water in California* (State Board Resolution No. 68-16) which protects surface and ground waters from degradation. In particular, this policy protects waterbodies where existing quality is higher than that necessary for the protection of beneficial uses including the protection of fish and wildlife propagation and recreation on and in the water.

"Applicable Standards and Limitations" means all State, interstate, and federal standards and limitations to which a "discharge" or a related activity is subject under the CWA, including "effluent limitations, "water quality standards, standards of performance, toxic effluent standards or prohibitions, "best management practices," and pretreatment standards under sections 301, 302, 303, 304, 306, 307, 308, 403 and 404 of CWA.

"**Areas of Special Biological Significance (ASBS)**" means all those areas of this state as ASBS, listed specifically within the California Ocean Plan or so designated by the State Board which, among other areas, includes the area from Mugu Lagoon to Latigo Point: Oceanwater within a line originating from Laguna Point at 34° 5' 40" north, 119° 6'30" west, thence southeasterly following the mean high tideline to a point at Latigo Point defined by the intersection of the meanhigh tide line and a line extending due south of Benchmark 24; thence

due south to a distance of 1000 feet offshore or to the 100 foot isobath, whichever distance is greater; thence northwesterly following the 100 foot isobath or maintaining a 1,000-foot distance from shore, whichever maintains the greater distance from shore, to a point lying due south of Laguna Point, thence due north to Laguna Point.

"Authorized Discharge" means any discharge that is authorized pursuant to an NPDES permit or meets the conditions set forth in this Order.

"Automotive Service Facilities" means a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 5511, 7532-7534, or 7536-7539. For inspection purposes, Permittees need not inspect facilities with SIC codes 5013, 5014, 5541, 5511, provided that these facilities have no outside activities or materials that may be exposed to storm water.

"Baseline Waste Load Allocation" means the Waste Load Allocation assigned to a Permittee before reductions are required. The progressive reductions in the Waste Load Allocations are based on a percentage of the Baseline Waste Load Allocation. The Baseline Waste Load Allocation for each jurisdiction was calculated based on the annual average amount of trash discharged to the storm drain system from a representative sampling of land use areas, as determined during the Baseline Monitoring Program. The Baseline Waste Load Allocations are incorporated into the Basin Plan at Table 7-2.2.

"Basin Plan" means the Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, adopted by the Regional Board on June 13, 1994 and subsequent amendments.

"Beneficial Uses" means the existing or potential uses of receiving waters in the permit area as designated by the Regional Board in the Basin Plan.

"Best Management Practices (BMPs)" means methods, measures, or practices designed and selected to reduce or eliminate the discharge of pollutants to surface waters from point and nonpoint source discharges including storm water. BMPs include structural and nonstructural controls, and operation and maintenance procedures, which can be applied before, during, and/or after pollution producing activities.

"Commercial Development" means any development on private land that is not heavy industrial or residential. The category includes, but is not limited to: hospitals, laboratories and other medical facilities, educational institutions, recreational facilities, plant nurseries, car wash facilities, mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses and other light industrial complexes.

"Construction" means constructing, clearing, grading, or excavation that results in soil disturbance. Construction includes structure teardown. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility; emergency construction activities required to immediately protect public health and safety; interior remodeling with no outside exposure of construction material or construction waste to storm water; mechanical permit work; or sign permit work.

"Control" means to minimize, reduce, eliminate, or prohibit by technological, legal, contractual or other means, the discharge of pollutants from an activity or activities.

Amended by Orders R4-2006-0074, R4-2007-0042, and R4-2009-0130, and further amended pursuant to L.A. Superior Court Case No. BS122724

"Daily Generation Rate (DGR)" means the estimated amount of trash deposited within a representative drainage area during a 24-hour period, derived from the amount of trash collected from streets and catch basins in the area over a 30-day period.

"Dechlorinated/Debrominated Swimming Pool Discharge" means swimming pool discharges which have no measurable chlorine or bromine and do not contain any detergents, wastes, or additional chemicals not typically found in swimming pool water. The term does not include swimming pool filter backwash.

"Development" means any construction, rehabilitation, redevelopment or reconstruction of any public or private residential project (whether single-family, multi-unit or planned unit development); industrial, commercial, retail and other non-residential projects, including public agency projects; or mass grading for future construction. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Directly Adjacent" means situated within 200 feet of the contiguous zone required for the continued maintenance, function, and structural stability of the environmentally sensitive area.

"Director" means the Director of a municipality and Person(s) designated by and under the Director's instruction and supervision.

"Discharge" means when used without qualification the "discharge of a pollutant."

"Discharging Directly" means outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject, property, development, subdivision, or industrial facility, and not commingled with the flows from adjacent lands.

"Discharge of a Pollutant" means: any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source" or, any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. The term discharge includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

"Disturbed Area" means an area that is altered as a result of clearing, grading, and/or excavation.

"Environmentally Sensitive Areas (ESAs)" means an area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments (California Public Resources Code § 30107.5). Areas subject to storm water mitigation requirements are: areas designated as Significant Ecological Areas by the County of Los Angeles (*Los Angeles County Significant Areas Study, Los Angeles County Department of Regional Planning (1976)* and amendments); an area designated as a Significant Natural Area

by the California Department of Fish and Game's Significant Natural Areas Program, provided that area has been field verified by the Department of Fish and Game; an area listed in the Basin Plan as supporting the "Rare, Threatened, or Endangered Species (RARE)" beneficial use; and an area identified by a Permittee as environmentally sensitive.

"Full Capture System" means any single device or series of devices, certified by the Executive Officer, that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate Q resulting from a one-year, one-hour storm in the sub-drainage area. The Rational Equation is used to compute the peak flow rate:

$$Q = C \times I \times A,$$

Where:
Q = design flow rate (cubic feet per second, cfs);
C = runoff coefficient (dimensionless);
I = design rainfall intensity (inches per hour, as determined per the Los Angeles County rainfall isohyetal maps relevant to the Los Angeles River watershed),[7] and
A = sub-drainage area (acres).

"General Construction Activities Storm Water Permit (GCASP)" means the general NPDES permit adopted by the State Board which authorizes the discharge of storm water from construction activities under certain conditions.

"General Industrial Activities Storm Water Permit (GIASP)" means the general NPDES permit adopted by the State Board which authorizes the discharge of storm water from certain industrial activities under certain conditions.

"Hillside" means property located in an area with known erosive soil conditions, where the development contemplates grading on any natural slope that is 25% or greater and where grading contemplates cut or fill slopes.

"Illicit Connection" means any man-made conveyance that is connected to the storm drain system without a permit, excluding roof drains and other similar type connections. Examples include channels, pipelines, conduits, inlets, or outlets that are connected directly to the storm drain system.

"Illicit Discharge" means any discharge to the storm drain system that is prohibited under local, state, or federal statutes, ordinances, codes, or regulations. The term illicit discharge includes all non storm-water discharges except discharges pursuant to an NPDES permit, discharges that are identified in Part 1, "Discharge Prohibitions" of this order, and discharges authorized by the Regional Board Executive Officer.

"Illicit Disposal" means any disposal, either intentionally or unintentionally, of material(s) or waste(s) that can pollute storm water.

[7] The isohyetal map may be updated annually by the Los Angeles County hydrologist to reflect additional rain data gathered during the previous year. Annual updates published by the Los Angeles County Department of Public Works are prospectively incorporated by reference into this Order.

"Industrial/Commercial Facility" means any facility involved and/or used in the production, manufacture, storage, transportation, distribution, exchange or sale of goods and/or commodities, and any facility involved and/or used in providing professional and non-professional services. This category of facilities includes, but is not limited to, any facility defined by the Standard Industrial Classifications (SIC). Facility ownership (federal, state, municipal, private) and profit motive of the facility are not factors in this definition.

"Infiltration" means the downward entry of water into the surface of the soil.

"Inspection" means entry and the conduct of an on-site review of a facility and its operations, at reasonable times, to determine compliance with specific municipal or other legal requirements. The steps involved in performing an inspection, include, but are not limited to:

1. Pre-inspection documentation research.;
2. Request for entry;
3. Interview of facility personnel;
4. Facility walk-through.
5. Visual observation of the condition of facility premises;
6. Examination and copying of records as required;
7. Sample collection (if necessary or required);
8. Exit conference (to discuss preliminary evaluation); and,
9. Report preparation, and if appropriate, recommendations for coming into compliance.

In the case of restaurants, a Permittee may conduct an inspection from the curbside, provided that such "curbside" inspection provides the Permittee with adequate information to determine an operator's compliance with BMPs that must be implemented per requirements of this Order, Regional Board Resolution 98-08, County and municipal ordinances, and the SQMP.

"Institutional Controls" means programmatic trash control measures that do not require construction or structural modifications to the MS4. Examples include street sweeping, public education, and clean out of catch basins that discharge to storm drains.

"Large Municipal Separate Storm Sewer System (MS4)" means all MS4s that serve a population greater than 250,000 (1990 Census) as defined in 40 CFR 122.26 (b)(4). The Regional Board designated Los Angeles County as a large MS4 in 1990, based on: (i) the U.S. Census Bureau 1990 population count of 8.9 million, and (ii) the interconnectivity of the MS4s in the incorporated and unincorporated areas within the County.

"Local SWPPP" means the Storm Water Pollution Prevention Plan required by the local agency for a project that disturbs one or more acres of land.

"Maximum Extent Practicable (MEP)" means the standard for implementation of storm water management programs to reduce pollutants in storm water. CWA § 402(p)(3)(B)(iii) requires that municipal permits "shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants. See also State Board Order WQ 2000-11 at page 20.

"Method Detection Limit (MDL)" means the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, as defined in 40 CFR 136, Appendix B.

"Minimum Level (ML)" means the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed.

"Municipal Separate Storm Sewer System (MS4)" means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, alleys, catch basins, curbs, gutters, ditches, manmade channels, or storm drains) owned by a State, city, county, town or other public body, that is designed or used for collecting or conveying storm water, which is not a combined sewer, and which is not part of a publicly owned treatment works, and which discharges to Waters of the United States.

"National Pollutant Discharge Elimination System (NPDES)" means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under CWA §307, 402, 318, and 405. The term includes an "approved program."

"Natural Drainage Systems" means unlined or unimproved (not engineered) creeks, streams, rivers or similar waterways.

"New Development" means land disturbing activities; structural development, including construction or installation of a building or structure, creation of impervious surfaces; and land subdivision.

"Non-Storm Water Discharge" means any discharge to a storm drain that is not composed entirely of storm water.

"Nuisance" means anything that meets all of the following requirements: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property; (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.; (3) occurs during, or as a result of, the treatment or disposal of wastes.

"Parking Lot" means land area or facility for the parking or storage of motor vehicles used for businesses, commerce, industry, or personal use, with a lot size of 5,000 square feet or more of surface area, or with 25 or more parking spaces.

"Partial Capture Device" means any structural trash control device that has not been certified by the Executive Officer as meeting the "full capture" performance requirements.

"Permittee(s)" means Co-Permittees and any agency named in this Order as being responsible for permit conditions within its jurisdiction. Permittees to this Order include the Los Angeles County Flood Control District, Los Angeles County, and the cities of Agoura Hills, Alhambra, Arcadia, Artesia, Azusa, Baldwin Park, Bellflower, Bell Gardens, Beverly Hills,

Bradbury, Burbank, Calabasas, Carson, Cerritos, Claremont, Commerce, Compton, Covina, Cudahy, Culver City, Diamond Bar, Downey, Duarte, El Monte, El Segundo, Gardena, Glendale, Glendora, Hawaiian Gardens, Hawthorne, Hermosa Beach, Hidden Hills, Huntington Park, Industry, Inglewood, Irwindale, La Canada Flintridge, La Habra Heights, Lakewood, La Mirada, La Puente, La Verne, Lawndale, Lomita, Los Angeles, Lynwood, Malibu, Manhattan Beach, Maywood, Monrovia, Montebello, Monterey Park, Norwalk, Palos Verdes Estates, Paramount, Pasadena, Pico Rivera, Pomona, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Rosemead, San Dimas, San Fernando, San Gabriel, San Marino, Santa Clarita, Santa Fe Springs, Santa Monica, Sierra Madre, Signal Hill, South El Monte, South Gate, South Pasadena, Temple City, Torrance, Vernon, Walnut, West Covina, West Hollywood, Westlake Village, and Whittier.

"Planning Priority Projects" means those projects that are required to incorporate appropriate storm water mitigation measures into the design plan for their respective project. These types of projects include:

1. Ten or more unit homes (includes single family homes, multifamily homes, condominiums, and apartments)
2. A 100,000 or more square feet of impervious surface area industrial/ commercial development (1 ac starting March 2003)
3. Automotive service facilities (SIC 5013, 5014, 5541, 7532-7534, and 7536-7539)
4. Retail gasoline outlets
5. Restaurants (SIC 5812)
6. Parking lots 5,000 square feet or more of surface area or with 25 or more parking spaces
7. Redevelopment projects in subject categories that meet Redevelopment thresholds
8. Projects located in or directly adjacent to or discharging directly to an ESA, which meet thresholds; and
9. Those projects that require the implementation of a site-specific plan to mitigate post-development storm water for new development not requiring a SUSMP but which may potentially have adverse impacts on post-development storm water quality, where the following project characteristics exist:

    a) Vehicle or equipment fueling areas;
    b) Vehicle or equipment maintenance areas, including washing and repair;
    c) Commercial or industrial waste handling or storage;
    d) Outdoor handling or storage of hazardous materials;
    e) Outdoor manufacturing areas;
    f) Outdoor food handling or processing;
    g) Outdoor animal care, confinement, or slaughter; or
    h) Outdoor horticulture activities.

"Pollutants" means those "pollutants" defined in CWA §502(6) (33.U.S.C.§1362(6)), and incorporated by reference into California Water Code §13373.

"Potable Water Distribution Systems Releases" means sources of flows from drinking water storage, supply and distribution systems including flows from system failures, pressure releases, system maintenance, distribution line testing, fire hydrant flow testing; and flushing and dewatering of pipes, reservoirs, vaults, and minor non-invasive well maintenance activities not involving chemical addition(s). It does not include wastewater discharges from activities that occur at wellheads, such as well construction, well development (i.e., aquifer pumping tests, well purging, etc.), or major well maintenance.

"Project" means all development, redevelopment, and land disturbing activities. The term is not limited to "Project" as defined under CEQA (Pub. Resources Code §21065).

"Rain Event" means any rain event greater than 0.1 inch in 24 hours except where specifically stated otherwise.

"Rare, Threatened, or Endangered Species (RARE)" means a beneficial use for waterbodies in the Los Angeles Region, as designated in the Basin Plan (Table 2-1), that supports habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

"Receiving Waters" means all surface water bodies in the Los Angeles Region that are identified in the Basin Plan.

"Redevelopment" means land-disturbing activity that results in the creation, addition, or replacement of 5,000 square feet or more of impervious surface area on an already developed site. Redevelopment includes, but is not limited to: the expansion of a building footprint; addition or replacement of a structure; replacement of impervious surface area that is not part of a routine maintenance activity; and land disturbing activities related to structural or impervious surfaces. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Regional Administrator" means the Regional Administrator of the Regional Office of the USEPA or the authorized representative of the Regional Administrator.

"Restaurant" means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC Code 5812).

"Retail Gasoline Outlet" means any facility engaged in selling gasoline and lubricating oils.

"Runoff" means any runoff including storm water and dry weather flows from a drainage area that reaches a receiving water body or subsurface. During dry weather it is typically comprised of base flow either contaminated with pollutants or uncontaminated, and nuisance flows.

"Screening" means using proactive methods to identify illicit connections through a continuously narrowing process. The methods may include: performing baseline monitoring of open channels, conducting special investigations using a prioritization approach, analyzing

maintenance records for catch basin and storm drain cleaning and operation, and verifying all permitted connections into the storm drains. Special investigation techniques may include: dye testing, visual inspection, smoke testing, flow monitoring, infrared, aerial and thermal photography, and remote control camera operation.

"Sidewalk Rinsing" means pressure washing of paved pedestrian walkways with average water usage of 0.006 gallons per square foot, with no cleaning agents, and properly disposing of all debris collected, as authorized under Regional Board Resolution No. 98-08.

"Significant Ecological Area (SEA)" means an area that is determined to possess an example of biotic resources that cumulatively represent biological diversity, for the purposes of protecting biotic diversity, as part of the Los Angeles County General Plan.[8]
Areas are designated as SEAs, if they possess one or more of the following criteria:

1. The habitat of rare, endangered, and threatened plant and animal species.
2. Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind, or are restricted in distribution on a regional basis.
3. Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind or are restricted in distribution in Los Angeles County.
4. Habitat that at some point in the life cycle of a species or group of species, serves as a concentrated breeding, feeding, resting, migrating grounds and is limited in availability either regionally or within Los Angeles County.
5. Biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or represent an unusual variation in a population or community.
6. Areas important as game species habitat or as fisheries.
7. Areas that would provide for the preservation of relatively undisturbed examples of natural biotic communities in Los Angeles County.
8. Special areas.[9]

"Significant Natural Area (SNA)" means an area defined by the California Department of Fish and Game (DFG), Significant Natural Areas Program, as an area that contains an important example of California's biological diversity. The most current SNA maps, reports, and descriptions can be downloaded from the DFG website at ftp://maphost.dfg.ca.gov/outgoing/whdab/sna/. These areas are identified using the following biological criteria only, irrespective of any administrative or jurisdictional considerations:

1. Areas supporting extremely rare species or habitats.
2. Areas supporting associations or concentrations of rare species or habitats.
3. Areas exhibiting the best examples of rare species and habitats in the state.

[8] The 61 existing SEAs represent the findings of a study that was completed in 1976 by England and Nelson, Environmental Consultants, as amended through the adoption of a revised Los Angeles County General Plan in 1980. The results of an update study to evaluate existing SEAs within unincorporated Los Angeles County is currently being proposed to the Los Angeles County Planning Commission (*Los Angeles County Significant Ecological Area Update Study 2000, Background Report*, PCR Services Corporation). The *Update Study 2000*, which contains existing and proposed SEA boundaries, can be downloaded from the Los Angeles County Department of Planning website at http://planning.co.la.ca.us/drp_revw.html#SEA

[9] These criteria from the 1976 study have been modified in the *Update Study 2000*.

"Site" means the land or water area where any "facility or activity" is physically located or conducted, including adjacent land used in connection with the facility or activity.

"Source Control BMP" means any schedules of activities, prohibitions of practices, maintenance procedures, managerial practices or operational practices that aim to prevent storm water pollution by reducing the potential for contamination at the source of pollution.

"SQMP" means the Los Angeles Countywide Stormwater Quality Management Program.

"State Storm Water Pollution Prevention Plan (State SWPPP)" means a plan, as required by a State General Permit, identifying potential pollutant sources and describing the design, placement and implementation of BMPs, to effectively prevent non-stormwater Discharges and reduce Pollutants in Stormwater Discharges during activities covered by the General Permit.

"Storm Water" means storm water runoff, snow melt runoff, and surface runoff and drainage.

"Storm Water Discharge Associated with Industrial Activity" means industrial discharge as defined in 40 CFR 122.26(b)(14)

"Stormwater Quality Management Program" means the Los Angeles Countywide Stormwater Quality Management Program, which includes descriptions of programs, collectively developed by the Permittees in accordance with provisions of the NPDES Permit, to comply with applicable federal and state law, as the same is amended from time to time.

"Structural BMP" means any structural facility designed and constructed to mitigate the adverse impacts of storm water and urban runoff pollution (e.g. canopy, structural enclosure). The category may include both Treatment Control BMPs and Source Control BMPs.

"SUSMP" means the Los Angeles Countywide Standard Urban Stormwater Mitigation Plan. The SUSMP shall address conditions and requirements of new development.

"Total Maximum Daily Load (TMDL)" means the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background.

"Toxicity Identification Evaluation (TIE)" means a set of procedures to identify the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.

"Toxicity Reduction Evaluation (TRE)" means a study conducted in a step-wise process to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity.

"Treatment" means the application of engineered systems that use physical, chemical, or biological processes to remove pollutants. Such processes include, but are not limited to, filtration, gravity settling, media absorption, biodegradation, biological uptake, chemical oxidation and UV radiation.

"Treatment Control BMP" means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media absorption or any other physical, biological, or chemical process.

"USEPA Phase I Facilities" means facilities in specified industrial categories that are required to obtain an NPDES permit for storm water discharges, as required by 40 CFR 122.26(c). These categories include:

i. facilities subject to storm water effluent limitation guidelines, new source performance standards, or toxic pollutant effluent standards (40 CFR N)
ii. manufacturing facilities
iii. oil and gas/mining facilities
iv. hazardous waste treatment, storage, or disposal facilities
v. landfills, land application sites, and open dumps
vi. recycling facilities
vii. steam electric power generating facilities
viii. transportation facilities
ix. sewage of wastewater treatment works
x. light manufacturing facilities

"Vehicle Maintenance/Material Storage Facilities/Corporation Yards" means any Permittee owned or operated facility or portion thereof that:

i. Conducts industrial activity, operates equipment, handles materials, and provides services similar to Federal Phase I facilities;
ii. Performs fleet vehicle service/maintenance on ten or more vehicles per day including repair, maintenance, washing, and fueling;
iii. Performs maintenance and/or repair of heavy industrial machinery/equipment ; and
iv. Stores chemicals, raw materials, or waste materials in quantities that require a hazardous materials business plan or a Spill Prevention, Control , and Counter-measures (SPCC) plan.

"Water Quality Standards and Water Quality Objectives" means water quality criteria contained in the Basin Plan, the California Ocean Plan, the National Toxics Rule, the California Toxics Rule, and other state or federally approved surface water quality plans. Such plans are used by the Regional Board to regulate all discharges, including storm water discharges.

"Waters of the State" means any surface water or groundwater, including saline waters, within boundaries of the state.

"Waters of the United States" or "Waters of the U.S." means:

a. All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
b. All interstate waters, including interstate "wetlands";
c. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

1. Which are or could be used by interstate or foreign travelers for recreational or other purposes;
2. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
3. Which are used or could be used for industrial purposes by industries in interstate commerce;

d. All impoundments of waters otherwise defined as waters of the United States under this definition;
e. Tributaries of waters identified in paragraphs (a) through (d) of this definition;
f. The territorial sea; and
g. "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in paragraph (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.22(m), which also meet the criteria of this definition) are not waters of the United States. This exclusion applies only to man-made bodies of water, which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with USEPA.

"Wet Season" means the calendar period beginning October 1 through April 15.

Part 6. STANDARD PROVISIONS

A. Standard Requirements

1. Each Permittee shall comply with all provisions and requirements of this permit.

2. Should a Permittee discover a failure to submit any relevant facts or that it submitted incorrect information in a report, it shall promptly submit the missing or correct information.

3. Each Permittee shall report all instances of non-compliance not otherwise reported at the time monitoring reports are submitted.

4. This Order includes the attached Monitoring and Reporting Program, and SUSMP(Regional Board Resolution No. R00-02), which are a part of the permit and must be complied with in the same manner as with the rest of the requirements in the permit.

B. Regional Board Review

Any formal determination or approval made by the Regional Board Executive Officer pursuant to the provisions of this Order may be reviewed by the Regional Board. A Permittee(s) or a member of the public may request such review upon petition within 30 days of the effective date of the notification of such decision to the Permittee(s) and interested parties on file at the Regional Board.

Amended by Orders R4-2006-0074, R4-2007-0042, and R4-2009-0130, and further amended pursuant to L.A. Superior Court Case No. BS122724

C. Public Review

1. All documents submitted to the Regional Board in compliance with the terms and conditions of this Order shall be made available to members of the public pursuant to the Freedom of Information Act (5 U.S.C. § 552 (as amended) and the Public Records Act (Cal. Government Code § 6250 *et seq.*).

2. All documents submitted to the Regional Board Executive Officer for approval shall be made available to the public for a 30-day period to allow for public comment.

D. Duty to Comply

1. Each Permittee must comply with all of the terms, requirements, and conditions of this Order. Any violation of this order constitutes a violation of the Clean Water Act, its regulations and the California Water Code, and is grounds for enforcement action, Order termination, Order revocation and reissuance, denial of an application for reissuance; or a combination thereof [40 CFR 122.41(a), CWC § 13261, 13263, 13265, 13268, 13300, 13301, 13304, 13340, 13350].

2. A copy of these waste discharge specifications shall be maintained by each Permittee so as to be available during normal business hours to Permittee employees and members of the public.

3. Any discharge of wastes at any point(s) other than specifically described in this Order is prohibited, and constitutes a violation of the Order.

E. Duty to Mitigate [40 CFR 122.41 (d)]

Each Permittee shall take all reasonable steps to minimize or prevent any discharge that has a reasonable likelihood of adversely affecting human health or the environment.

F. Inspection and Entry [40 CFR 122.41(i), CWC § 13267]

The Regional Board, USEPA, and other authorized representatives shall be allowed:

1. Entry upon premises where a regulated facility is located or conducted, or where records are kept under conditions of this Order;

2. Access to copy any records, at reasonable times, that are kept under the conditions of this Order;

3. To inspect at reasonable times any facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and,

4. To photograph, sample, and monitor at reasonable times for the purpose of assuring compliance with this Order, or as otherwise authorized by the CWA and the CWC.

G. Proper Operation and Maintenance [40 CFR 122.41 (e), CWC § 13263(f)]

The Permittees shall at all times properly operate and maintain all facilities and systems of treatment (and related appurtenances) that are installed or used by the Permittees to achieve compliance with this Order. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar system that are installed by a Permittee only when necessary to achieve compliance with the conditions of this Order.

H. Signatory Requirements [40 CFR 122.41(k) & 122.22]

Except as otherwise provided in this Order, all applications, reports, or information submitted to the Regional Board shall be signed by the Director of Public Works, City Engineer, or authorized designee and certified as set forth in 40 CFR 122.22.

I. Reopener and Modification [40 CFR 122.41(f) & 122.62]

1. This Order may only be modified, revoked, or reissued, prior to the expiration date, by the Regional Board, in accordance with the procedural requirements of the CWC and CCR Title 23 for the issuance of waste discharge requirements, 40 CFR 122.62, and upon prior notice and hearing, to:

    a) Address changed conditions identified in the required reports or other sources deemed significant by the Regional Board;

    b) Incorporate applicable requirements or statewide water quality control plans adopted by the State Board or amendments to the Basin Plan;

    c) Comply with any applicable requirements, guidelines, and/or regulations issued or approved pursuant to CWA Section 402(p); and/or,

    d) Consider any other federal, or state laws or regulations that became effective after adoption of this Order.

2. After notice and opportunity for a hearing, this Order may be terminated or modified for cause, including, but not limited to:

    a) Violation of any term or condition contained in this Order;

    b) Obtaining this Order by misrepresentation, or failure to disclose all relevant facts; or,

    c) A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

3. The filing of a request by the Principal Permittee or Permittees for a modification, revocation and re-issuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.

4. This Order may be modified to make corrections or allowances for changes in the permitted activity listed in this section, following the procedures at 40 CFR 122.63, if processed as a minor modification. Minor modifications may only:

   a) Correct typographical errors, or

   b) Require more frequent monitoring or reporting by the Permittee.

J. Severability

The provisions of this permit are severable; and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected.

K. Duty to Provide Information [40 CFR 122.41(h)]

The Permittees shall furnish, within a reasonable time, any information the Regional Board or USEPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order. The Permittees shall also furnish to the Regional Board, upon request, copies of records required to be kept by this Order.

L. Twenty-four Hour Reporting [40 CFR 122.41(l)(6)][10]

1. The Permittees shall report to the Regional Board any noncompliance that may endanger health or the environment. Any information shall be provided orally within 24 hours from the time any Permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

2. The Regional Board may waive the required written report on a case-by-case basis.

M. Bypass [40 CFR 122.41(m)][11]

[10] This provision applies to incidents where effluent limitations (numerical or narrative) as provided in this Order or in the Los Angeles County SQMP are exceeded, and which endanger public health or the environment.

Bypass (the intentional diversion of waste streams from any portion of a treatment facility) is prohibited. The Regional Board may take enforcement action against Permittees for bypass unless:

1. Bypass was unavoidable to prevent loss of life, personal injury or severe property damage. (Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.);

2. There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated waste, or maintenance during normal periods of equipment down time. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that could occur during normal periods of equipment downtime or preventive maintenance;

3. The Permittee submitted a notice at least ten days in advance of the need for a bypass to the Regional Board; or,

4. Permittees may allow a bypass to occur that does not cause effluent limitations to be exceeded, but only if it is for essential maintenance to assure efficient operation. In such a case, the above bypass conditions are not applicable. The Permittee shall submit notice of an unanticipated bypass as required.

N. Upset [40 CFR 122.41(n)][12]

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

1. A Permittee that wishes to establish the affirmative defense of an upset in an action brought for non compliance shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a) An upset occurred and that the Permittee can identify the cause(s) of the upset;

   b) The permitted facility was being properly operated by the time of the upset;

[11] This provision applies to the operation and maintenance of storm water controls and BMPs as provided in this Order or in the SQMP.
[12] *Supra*. See footnote number 3.

c) The Permittee submitted notice of the upset as required; and,

d) The Permittee complied with any remedial measures required.

2. No determination made before an action for noncompliance, such as during administrative review of claims that non-compliance was caused by an upset, is final administrative action subject to judicial review.

3. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

O. Property Rights [40 CFR 122.41(g)]

This Order does not convey any property rights of any sort, or any exclusive privilege.

P. Enforcement

1. Violation of any of the provisions of the NPDES permit or any of the provisions of this Order may subject the violator to any of the penalties described herein, or any combination thereof, at the discretion of the prosecuting authority; except that only one kind of penalties may be applied for each kind of violation. The CWA provides the following:

a) Criminal Penalties for:

(1) Negligent Violations:

The CWA provides that any person who negligently violates permit conditions implementing § 301, 302, 306, 307, 308, 318, or 405 is subject to a fine of not less than $2,500 nor more than $25,000 per day for each violation, or by imprisonment for not more than 1 year, or both.

(2) Knowing Violations:

The CWA provides that any person who knowingly violates permit conditions implementing § 301, 302, 306, 307, 308, 318, or 405 is subject to a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or both.

(3) Knowing Endangerment:

The CWA provides that any person who knowingly violates permit conditions implementing § 301, 302, 307, 308, 318, or 405 and who knows at that time that he is placing another person in imminent danger of death or serious bodily injury is subject to a fine of not more than $250,000, or by imprisonment for not more than 15 years, or both.

(4) False Statement:

The CWA provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under the Act or who knowingly falsifies, tampers with, or renders inaccurate, any monitoring device or method required to be maintained under the Act, shall upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than two years, or by both. If a conviction is for a violation committed after a first conviction of such person under this paragraph, punishment shall be by a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four years, or by both. (See CWA § 309(c)(4))

b) Civil Penalties

The CWA provides that any person who violates a permit condition implementing § 301, 302, 306, 307, 308, 318, or 405 is subject to a civil penalty not to exceed $27,500 per day for each violation.

2. The CWC provides that any person who violates a waste discharge requirement provision of the CWC is subject to civil penalties of up to $5,000 per day, $10,000 per day, or $25,000 per day of violation; or when the violation involves the discharge of pollutants, is subject to civil penalties of up to $10 per gallon per day or $25 per gallon per day of violation; or some combination thereof, depending on the violation or combination of violations.

Q. Need to Halt or Reduce Activity not a Defense [40 CFR 122.41(c)]

It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order.

R. Rescission

Regional Board Order No. 96-054 is hereby rescinded.

S. Expiration

This Order expires on December 12, 2006. The Permittees must submit a Report of Waste Discharges and a proposed Storm Water Quality Management Program in accordance with CCR Title 23 as application for reissuance of waste discharge requirements no later than June 12, 2006.

Part 7. TOTAL MAXIMUM DAILY LOAD PROVISIONS

The provisions of this Part implement and are consistent with the assumptions and requirements of Waste Load Allocations from TMDLs for which some or all of the Permittees in this Order are responsible.

1. TMDL for Trash in the Los Angeles River Watershed

A. Waste Load Allocations: Each Permittee identified in Appendix 7-1 shall comply with the interim and final effluent limitations set forth in Appendix 7-1 hereto.[13]

B. Compliance:

(1) Permittees may comply with the effluent limitations using any lawful means. Such compliance options are broadly classified as *full capture*, *partial capture*, or *institutional controls*, as described below, and any combination of these may be employed to achieve compliance:

(a) Full Capture Systems:

1) The Basin Plan authorizes the Executive Officer to certify *full capture systems*, which are systems that meet the operating and performance requirements as described in this Order, and the procedures identified in "Procedures and Requirements for Certification of a Best Management Practice for Trash Control as a Full Capture System." (See Appendix 7-2.)[14]

2) Permittees are authorized to comply with their effluent limitations through certified *full capture systems* provided the requirements of paragraph 3), immediately below, and any conditions in the certification, continue to be met.

3) Permittees may comply with their effluent limitations through progressive installation of *full capture systems* throughout their jurisdiction until all areas draining to the Los Angeles River system are addressed. For purposes of this Permit, attainment of the effluent limitations shall be conclusively presumed for any drainage area to the Los Angeles River (or its tributaries)[15] where certified *full capture systems* treat all drainage from the area, provided that the *full capture systems* are adequately sized and maintained, and that maintenance records are up-to-date and available for inspection by the Regional Board.

i. A Permittee relying entirely on *full capture systems* shall be deemed in compliance with its final effluent limitation if it demonstrates that all drainage areas

[13] The interim and final effluent limitations set forth in Appendix 7-1 are equivalent to the Compliance Points identified in Table 7-2.3 of the Basin Plan.

[14] The Regional Board currently recognizes eight *full capture systems*. These are: Vortex Separation Systems (VSS) and seven other Executive Officer certified *full capture systems*, including specific types or designs of trash nets; two gross solids removal devices (GSRDs); catch basin brush inserts and mesh screens; vertical and horizontal trash capture screen inserts; and a connector pipe screen device.

[15] Tributaries to the Los Angeles River include, but are not limited to, Pacoima Wash, Tujunga Wash, Burbank Western Channel, Verdugo Wash, Arroyo Seco, Rio Hondo, and Compton Creek.

under its jurisdiction are serviced by appropriate certified *full capture systems* as described in paragraph (a)(3).

ii. A Permittee relying entirely on *full capture systems* shall be deemed in compliance with its interim effluent limitations:

1. By demonstrating that *full capture systems* treat the percentage of drainage areas in the watershed that corresponds to the required trash abatement.
2. Alternatively, a Permittee may propose a schedule for jurisdiction-wide installation of *full capture systems*, targeting first the areas of greatest trash generation (based upon the information on drainage area and litter generation rates by land use provided in Appendices I and III of the Los Angeles River Trash TMDL Staff Report) for the Executive Officer's approval. The Executive Officer shall not approve any such schedule that does not result in timely compliance with the final effluent limitations. A Permittee shall be deemed in compliance with its interim effluent limitations provided it is fully in compliance with any such approved schedule.

(b) Partial Capture Devices and Institutional Controls: Permittees may comply with their interim and final effluent limitations through the installation of *partial capture devices* and the application of *institutional controls*.[16]

1) Trash discharges from areas serviced solely by *partial capture devices* may be estimated based on demonstrated performance of the device(s) in the jurisdictional area.[17] That is, trash reduction is equivalent to the *partial capture devices'* trash removal efficiency multiplied by the percentage of drainage area serviced by the devices.
2) Except as provided in subdivision 3), below, trash discharges from areas addressed by *institutional controls* and/or *partial capture devices* (where site-specific performance data is not available) shall be calculated using a mass balance approach, based on the daily generation rate (DGR) for a representative area.[18] The DGR shall be determined from direct measurement of

[16] While interim effluent limitations may be complied with using partial capture devices, compliance with final effluent limitations cannot be achieved with the exclusive use of partial capture devices.
[17] Performance shall be demonstrated under different conditions (e.g. low to high trash loading).
[18] The area should be representative of the land uses within the jurisdiction and shall be approved by the Executive Officer prior to the 30-day collection period.

trash deposited in the drainage area during any thirty-day period between June 22nd and September 22nd exclusive of rain events[19], and shall be re-calculated every year thereafter. The DGR shall be calculated as the total amount of trash collected during this period divided by 30 (the length of the collection period).

DGR = (Amount of trash collected during a 30-day collection period[20]) / (30 days)

The DGR for the applicable area of the jurisdiction shall be extrapolated from that of the representative drainage area. A mass balance equation shall be used to estimate the amount of trash discharged during a storm event.[21] The *Storm Event Trash Discharge* for a given rain event in a Permittee's drainage area shall be calculated by multiplying the number of days since the last street sweeping by the DGR and subtracting the amount of any trash recovered in the catch basins.[22] For each day of a storm event that generates precipitation greater than 0.25 inches, the Permittee shall calculate a *Storm Event Trash Discharge*.

Storm Event Trash Discharge = [(Days since last street sweeping*DGR)] – [Amount of trash recovered from catch basins][23]

The sum of the *Storm Event Trash Discharges* for the storm year shall be the Permittee's calculated annual trash discharge.

Total Storm Year Trash Discharge = ∑Storm Event Trash Discharges from Drainage Area

3) The Executive Officer may approve alternative compliance monitoring approaches for calculating total storm year trash discharge, upon finding that the program will provide a scientifically-based estimate of the amount of trash discharged from the MS4.

(c) Combined Compliance Approaches:

[19] Provided no special events are scheduled that may affect the representative nature of that collection period.
[20] Between June 22nd and September 22nd
[21] Amount of trash shall refer to the uncompressed volume (in gallons) or drip-dry weight (in pounds) of trash collected.
[22] Any negative values shall be considered to represent a zero discharge.
[23] When more than one storm event occurs prior to the next street sweeping the discharge shall be calculated from the date of the last assessment.

Permittees may comply with their interim and final effluent limitations through a combination of *full capture systems*, *partial capture devices*, and *institutional controls*. Permittees relying on a combination of approaches shall demonstrate compliance with the interim and final effluent limitations as specified in (a)(3) in areas where *full capture systems* are installed and as specified in (b)(2) in areas where *partial capture devices* and *institutional controls* are applied.

(2) Permittees that are not in compliance with the applicable interim and/or final effluent limitations as identified in Appendix 7-1 shall be in violation of this permit.

(a) Permittees relying on *partial capture devices* and/or *institutional controls* that have violated their interim or final effluent limitations as identified in Appendix 7-1 shall be presumed to have violated the applicable limitation for each day of each storm event that generated precipitation greater than 0.25 inches during the applicable storm year, except those storm days on which they establish that their cumulative Storm Event Trash Discharges have not exceeded the applicable effluent limitation.

(b) For Permittees relying on full capture systems who have failed to demonstrate that the *full capture systems* for any drainage area are adequately sized and maintained, and that maintenance records are up-to-date and available for inspection by the Regional Board, and that they are in compliance with any conditions of their certification, shall be presumed to have discharged trash in an amount that corresponds to the percentage of the baseline waste load allocation represented by the drainage area in question.

1) A Permittee may overcome this presumption by demonstrating (using any of the methods authorized in this Part 7.1.B(1)(b)) that the actual or calculated discharge for that drainage area is in compliance with the applicable interim or final effluent limitations as specified in Appendix 7-1.

(3) Each Permittee shall be held liable for violations of the Effluent Limitations assigned to its jurisdiction in Appendix 7-1. Any Permittee whose compliance strategy includes full or partial capture devices and who chooses to install a full or partial capture device in the MS4 physical infrastructure of another public entity is responsible for obtaining all necessary permits to do so. If a Permittee believes it is unable to obtain the permits needed to install a full capture or partial capture device within another Permittee's MS4 physical infrastructure, either Permittee may request the Executive Officer to hold a conference with the Permittees. Nothing in this Order shall affect the right of that public entity or a Permittee to seek indemnity or other recourse from the other as they deem appropriate. Nothing in this subsection shall be construed as relieving a Permittee of any liability that the Permittee would otherwise have under this Order.

C. Monitoring and Reporting Requirements (pursuant to Water Code section 13383)

(1) Within 60 days of adoption of Part 7, Section 1 (Los Angeles River Trash TMDL) and on October 31, 2010 and every year thereafter, each Permittee identified in Appendix 7-1 shall submit a TMDL Compliance Report detailing compliance with the interim and final effluent limitations. Reporting shall include the information specified below. The report shall be submitted on a reporting form to be specified by the Executive Officer. The report shall be signed under penalty of perjury by the Director of Public Works or other agency head (or their delegee) that is responsible for ensuring compliance with this permit. Permittees shall be charged with and shall demonstrate compliance with the relevant effluent limitations beginning with their October 31, 2010 TMDL Compliance Report.

(a) Reporting Compliance based on Full Capture Systems: Permittees identified in Appendix 7-1 shall provide information on the number and location of full capture installations, the sizing of each full capture installation, the drainage areas addressed by these installations, and compliance with the applicable interim or final effluent limitation, in their TMDL Compliance Report. The Regional Board will periodically audit sizing, performance, and other data to validate that a system satisfies the criteria established for a *full capture system* and any conditions established by the Executive Officer in the certification.

(b) Reporting Compliance based on Partial Capture Systems and/or Institutional Controls:

(1) Using Performance Data Specific to the Jurisdictional Area: Permittees identified in Appendix 7-1 shall provide (i) site-specific performance data for the applicable device(s), (ii) information on the number and location of such installations, and the drainage areas addressed by these installations, and (iii) calculated compliance with the applicable effluent limitations, in their TMDL Compliance Report.

(2) Using Direct Measurement of Trash Discharge: Permittees identified in Appendix 7-1 shall provide an accounting of DGR and trash removal via street sweeping, catch basin clean outs, etc., in a database to facilitate the calculation of discharge for each rain event. The database shall be maintained and provided to the Regional Board for inspection upon request. Permittees identified in Appendix 7-1 shall provide the annual DGR, calculated storm year discharge, and compliance with the applicable effluent limitation, in their TMDL Compliance Report.

(c) Reporting Compliance based on Combined Compliance Approaches:
Permittees identified in Appendix 7-1 shall provide the information specified in subsection (a) for areas where full capture systems are installed and that specified in subsection (b)(1) or (b)(2), as appropriate, for areas where partial capture devices and institutional controls are applied. Permittees shall also provide information on compliance with the applicable effluent limitation based on the combined compliance approaches, in their TMDL Compliance Report

(2) Violation of the reporting requirements of this Part shall be punishable pursuant to inter alia Water Code subdivision (a)(1) of section 13385.1 and/or subdivision (a)(3) of section 13385.

I, Samuel Unger, Regional Board Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of the Order amended by the California Regional Water Quality Control Board, Los Angeles Region, pursuant to the peremptory writ of mandate in L.A. Superior Court Case No. BS122724, and that such action occurred on April 14, 2011.

Samuel Unger

Samuel Unger, P.E.
Executive Officer

City of Torrance, California

MACHADO LAKE NUTRIENT TOTAL MAXIMUM DAILY LOAD

SPECIAL STUDY WORK PLAN

May 18, 2011

3031 Torrance Boulevard • Torrance, California 90503 • Phone: 310.618.5880 • Fax: 310.618.5891

City of Torrance, California

MACHADO LAKE
NUTRIENT TOTAL MAXIMUM DAILY LOAD

SPECIAL STUDY WORK PLAN

May 18, 2011

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SPECIAL STUDY WORK PLAN

1.0 INTRODUCTION

This Field Sampling Plan (FSP) presents the approach and procedures to implement stormwater sampling activities in 2011 for a Special Study of the City of Torrance (City) storm drains discharging stormwater into Machado Lake. The field study sampling procedures, methods, and analyses for stormwater are described in this document.

1.1 Background

The City is subject to the requirements of the Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) Total Maximum Daily Load (TMDL) per the Los Angeles Regional Quality Control Board's (Regional Board's) Resolution R08-006. Under the Regional Board's resolution, the City shall submit to the Regional Board's Executive Officer a Monitoring and Reporting Plan (MRP) within 1 year of the effective date of the resolution or propose a Special Study Work Plan following the requirements of one of three optional studies. This Special Study Work Plan details the approach proposed by the City to perform Optional Study No. 3, to assess compliance with the Waste Load Allocations (WLA) on a mass basis for total nitrogen and total phosphorus originating from the City's watersheds. The Special Study Work Plan proposes a pre-Best Management Practices (BMP) Implementation Study including field sampling and data collection to be followed by submittals to the Regional Board including a BMP Evaluation and Selection Report, a MRP, and a BMP Implementation Report to be provided at a later date.

Machado Lake is identified on the 1998 and 2002 Clean Water Act 300(d) list of impaired water bodies as impaired due to eutrophic conditions, algae, ammonia, and odors. Resource agencies, local governments, project implementers, the scientific community, environmental groups, decision-makers at the city, county, state, and federal levels, and many others have continued to take meaningful steps towards the restoration of Machado Lake and its basin. Among these efforts, restoration activities are expanding through continued implementation of erosion control, stormwater management, and riparian restoration projects, development of the Machado Lake Nutrient TMDL that is providing a quantitative, science-based approach for pollutant reduction, and a strong research/monitoring effort to evaluate key ecological processes and response to water quality improvement projects.

The Machado Lake Nutrient TMDL allows for the establishment of annual mass-based WLAs for total phosphorus (TP) and total nitrogen (TN) equivalent to monthly average concentrations of 0.1 mg/L TP and 1.0 mg/L TN, based on approved flow conditions. When the concentration based WLAs are met under the approved flow condition of 8.45 hm3, the annual mass of the TP discharged to the lake will be 845 kg and the annual mass of TN discharged to the lake will be 8,450 kg. The City of Torrance mass-based WLA will be proportional to the City owned area in the sub-watershed. The City of Torrance area

accounts for 35.6% of the Machado Lake Watershed. Table 1 lists the interim and final WLAs based on this area.

Table 1 Waste Load Allocations

Responsible Party	Years after TMDL Effective Date	TP (kg)	TN (kg)
City of Torrance	5	3,760	7,370
	9.5 (final WLAs)	301	3,008

1.2 Site Conditions and Characteristics

1.2.1 Study Site Location

The City is located about 15 miles south of Downtown Los Angeles (LA), in southern LA County, just north of the Palos Verdes Hills. The City was incorporated on May 12, 1921, and is just over 20.5 square miles in area. The City is bounded by Redondo Beach on the west and north, Lawndale and Gardena on the north, LA on the east, Lomita to the southeast, and Rolling Hills Estates and Palos Verdes Estates on the south. The City is also bounded by approximately 4,000 feet of Santa Monica Bay coastline. The City's storm conveyance systems are interconnected with neighboring city systems. Neighboring cities located at generally higher elevation such as Rolling Hills Estate and Palos Verde Estate discharge stormwater into the City's and/or LA County's storm conveyance systems located within the City's boundaries. Figure 1 shows a regional location map of the City.

1.2.2 Hydrology and Hydraulics

The Machado Lake subwatershed is located in the southwestern area of the Dominguez Watershed and includes portions of the Cities of Los Angeles, Torrance, Lomita, Rolling Hills, Rolling Hills Estates, Carson, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, and the communities of unincorporated Los Angeles County, including Wilmington and Harbor City. However, much of the Machado Lake watershed consists of the hilly regions of Rolling Hills Estates and Rolling Hills. This portion of the watershed is unique, as it consists of relatively steep hills with drainage into the canyons. The Machado Lake Watershed covers an area of approximately 20 square miles and is itself divided into six primary subdrainage areas. These subdrainages are the Walteria Lake, Project 77/510, Wilmington Drain, Project 643 (72-inch Storm Drain), Project 643 (Figueroa Drain), and Private Drain 553.

Machado Lake, about 40 acres in area and the Machado Lake Wetlands (64 acres) are located within the Ken Malloy Harbor Regional Park in the southeastern corner of the Machado Lake Watershed. Both Machado Lake and the Machado Lake wetlands serve as flood retention basins for the Machado Lake Watershed.

1.2.2.1 Storm Drain

As the area is highly urbanized, drainage is primarily conducted through an extensive network of underground storm drain facilities. The Los Angeles County Department of Public Works maintains the system of storm drains in the City of Rolling Hills Estates. The primary use of the Dominguez Channel and all other open channels in the Dominguez Watershed (including Wilmington Drain, Machado Lake, and Madrona Marsh) is flood protection.

Machado Lake receives urban and storm water runoff from a complex network of storm drain systems. The first of three primary storm drain channels that flow into Machado Lake is the Wilmington Drain. Approximately 65 percent of the runoff from the Machado Lake Watershed flows through the Wilmington Drain into Machado Lake. The other two primary storm drain channels are the Project No. 77 Drain and the Harbor City Relief Drain. Several smaller storm drains also discharges into Machado Lake, including Project No. 643's Figueroa Street Outlet and a 72-inch storm drain outlet. Machado Lake discharges at the southern end by overflowing a concrete dam into the Machado Lake wetland. Water discharges from the wetland through the Harbor Outflow structure and into the West Basin of the Los Angeles Harbor.

The Walteria Lake, located within the City's boundaries, is owned and operated by LA County. It is approximately 1,005 acre-feet in capacity and receives raw stormwater mainly from Rolling Hills Estates and Palos Verdes Estates. Effluent from the lake is pumped at a maximum rate of 57 cubic feet per second (cfs) through a force main system into a 54-inch drain line that lies under Skypark Drive. The discharge eventually leaves the City near the intersection of Crenshaw Boulevard and Amsler Street.

Figure 2 shows the drainage basins and stormwater conveyance infrastructure in the City. The figure also shows nearby communities discharging stormwater into the City's drainage system.

1.2.3 Land Use

The City of Torrance is predominantly residential land use, with concentrations of industrial and commercial uses. This reflects the City's history as a "company town," where homes were built to house the local work force of industries. Residential development covered almost half of the City's land area. Industrial uses occupied the second largest land area, at 22 percent. Commercial and Public/Quasi-Public/Open Space uses represent the third largest land uses in the City, about 12 percent each. Torrance also had a limited supply of vacant land mostly within commercial and industrial areas. Given the built-out character of the community, only minor land use changes from baseline year 2010 conditions will occur over the long term.

Residential uses are located throughout Torrance at varying development densities. The highest residential densities occur along major streets and near major transportation corridors, in older neighborhoods, and in apartment or condominium developments and Planned Development communities around Sepulveda Boulevard and Plaza Del Amo between Hawthorne and Crenshaw Boulevards. The lowest residential densities are largely

located in the western and southern portions of the City. Figure 3 identifies the land uses in Torrance.

1.2.4 Water Quality Issues

Machado Lake, located in the Dominguez Channel watershed in southern LA County, is identified on the 1998 and 2002 Clean Water Act 303(d) list of impaired water bodies as impaired due to eutrophic conditions, algae, ammonia, and odors. The Machado Lake eutrophic, algae, and odor impairments are caused by excessive loading of nutrients, including nitrogen and phosphorus, to Machado Lake (Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Revised Draft – April 2008). Ammonia is found to be at levels below the toxicity standards, but nevertheless, these concentrations contribute to the total nitrogen loading in the Lake. Table 2 provides a summary of the quantifiable loads entering Machado Lake on an annual basis (Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Revised Draft – April 2008). Nutrient flux from the sediments and atmospheric nitrogen deposition are the two directly quantifiable non-point sources included as part of the total nutrient load. The total annual nitrogen and phosphorus loads are estimated to be 24,327 kg and 10,421 kg, respectively.

Machado Lake is located in the Ken Malloy Harbor Regional Park (KMHRP), which is a 231 acres LA City Park serving the Wilmington and Harbor City areas. As shown on Figure 4, the park is located west of the Harbor freeway (110) and east of Vermont Avenue between the Tosco Refinery on the south and the Pacific Coast Highway on the North. Machado Lake is one of the last lake and wetland systems in LA; the area is approximately 103.5 acres in total size. The upper portion, which includes the open water area, is approximately 40 acres and the lower wetland portion is about 63.5 acres. Machado Lake is a shallow polymictic lake; the depth is generally 0.5 to 1.5 meters; the *average* depth is approximately 1.0 meter. The lake was originally developed as part of Harbor Regional Park in 1971 and intended for boating and fishing. Over the years water quality generally declined; boating was stopped and signs were posted warning of the risk of eating fish from the lake.

Table 2 Total Annual Nutrient Load Entering Machado Lake[(1)]

Source	Total N (kg)	Total P (kg)	Ortho-P (kg)	Inorg-N (kg)
External Load	7,587	3,260	737	3,736
Sediment Flux	16,520	7,161	4,963	16,520
Atmospheric Deposition	220			
Total Annual Load	**24,327**	**10,421**	**5,700**	**20,256**

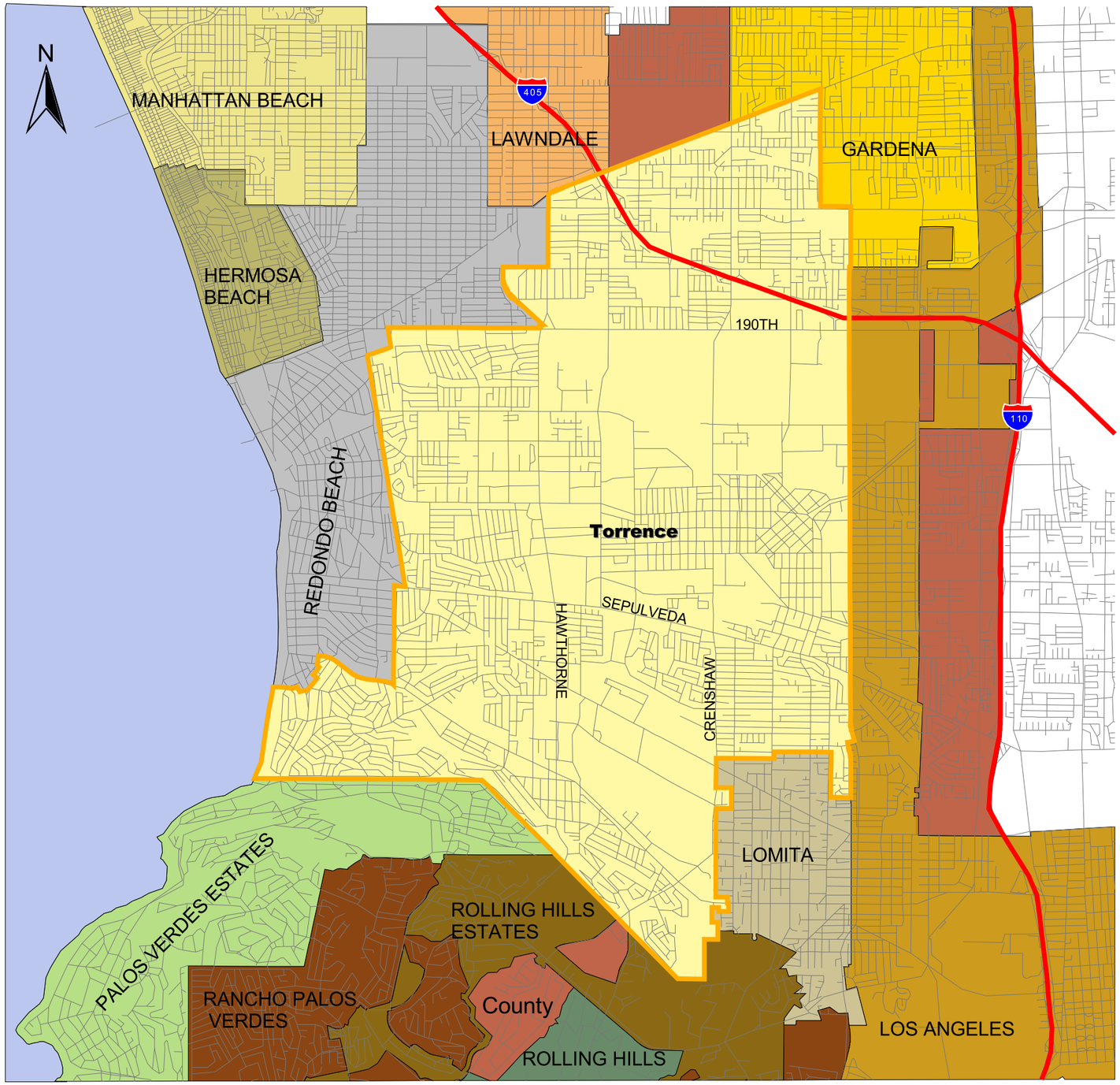
Notes:
1. Source: Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Revised Draft - April 2008.

The dominant land use in the Machado Lake Watershed is high-density single-family residential, accounting for approximately 45 percent of the land use. Industrial, vacant, retail/commercial, multi-family residential, transportation, and educational institutions each account for 5 to 7 percent of the land use, while "all other" accounts for the remaining 23

percent. Machado Lake is a receiving body of urban and stormwater runoff from a network of storm drains throughout the watershed. As indicated on Figure 4, there are three discharge points into Machado Lake from the following storm drain channels:

- Wilmington Drain.
- Project No. 77.
- Harbor City Relief Drain.

Approximately 88 percent of the Machado Lake Watershed drainage area flows through the Wilmington Drain into Machado Lake.



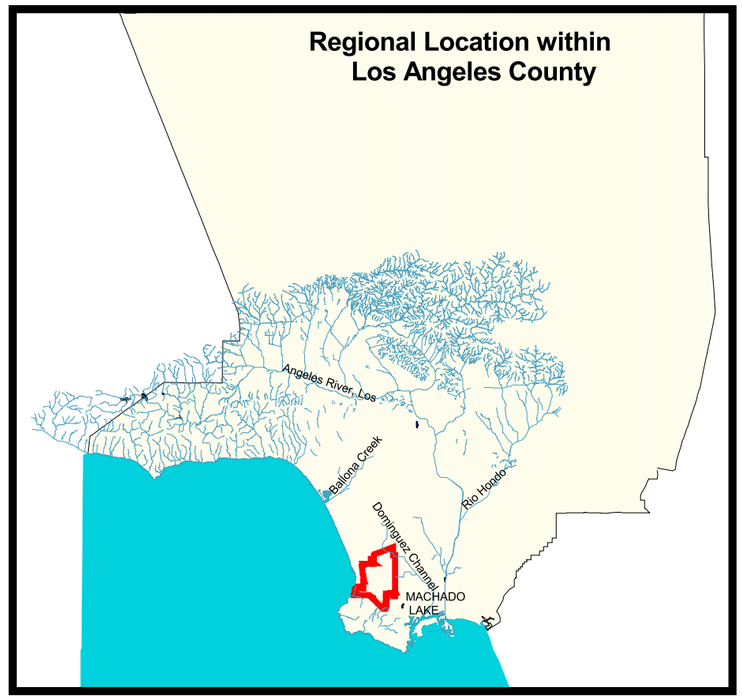


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Figure 1 Regional Map of Torrance

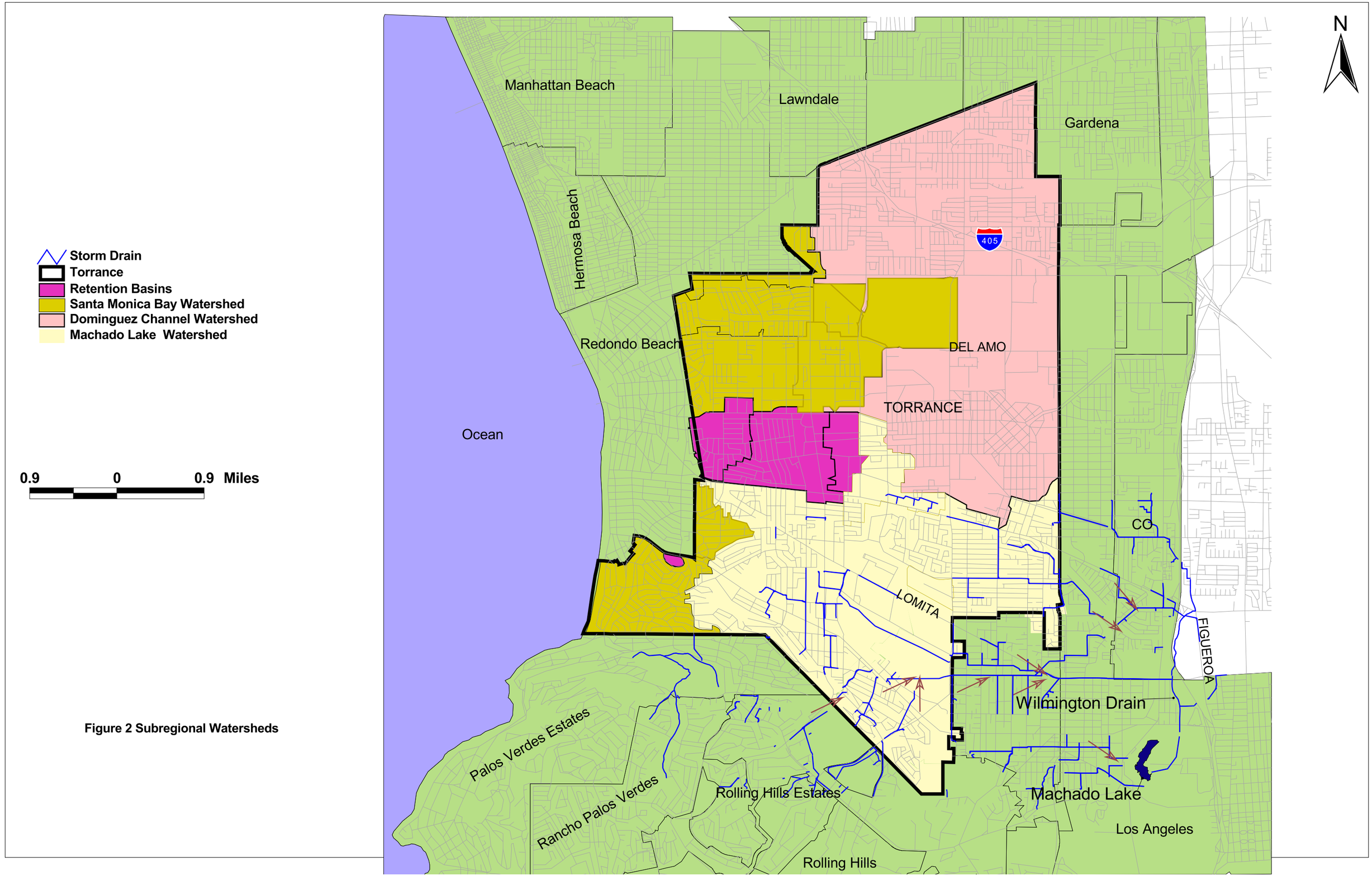


Figure 2 Subregional Watersheds

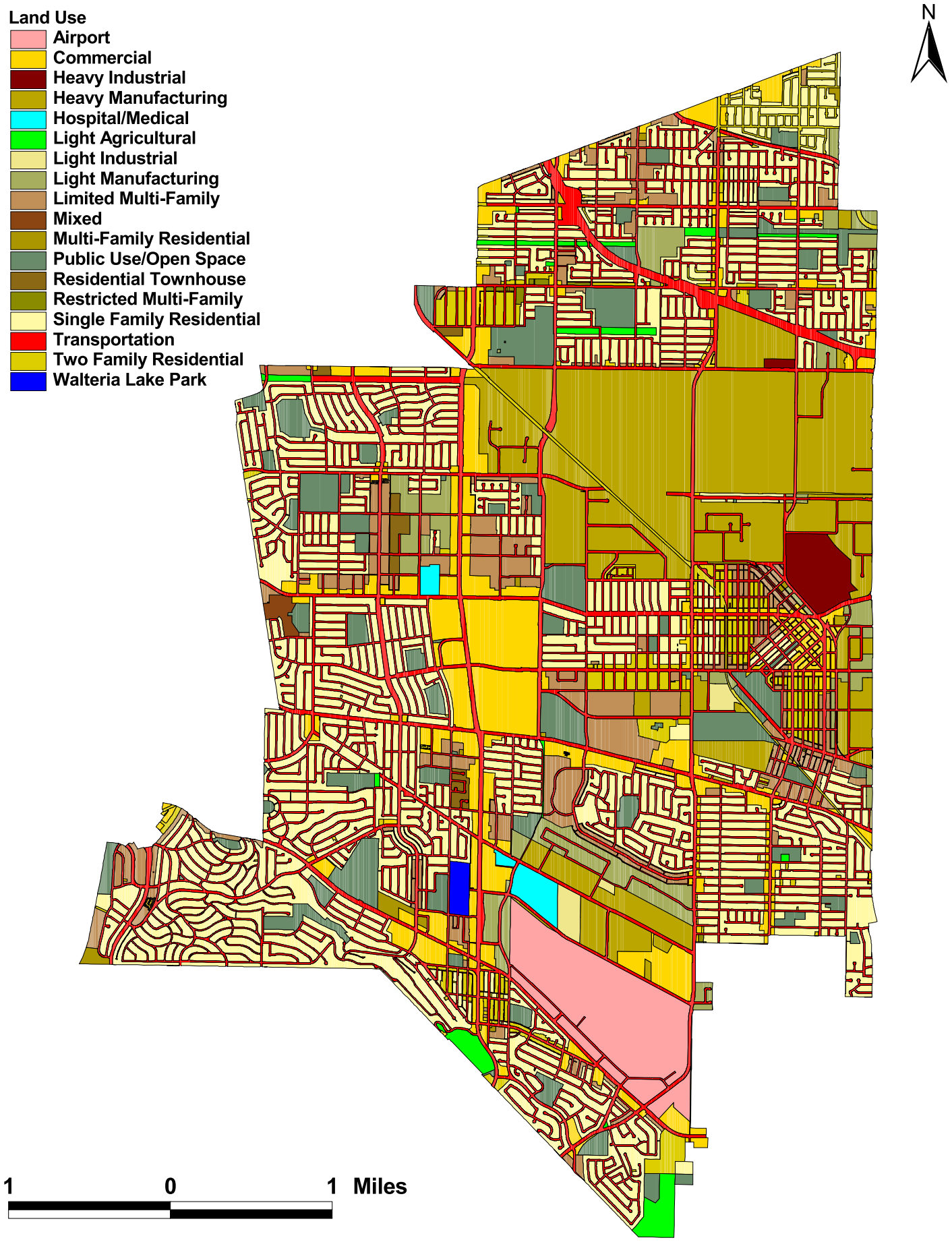


Figure 3 Existing Land Use of Torrance

Figure 4 2007 Satellite Imagery of Machado Lake and Ken Malloy Harbor Park Overview

1.3 Special Study Work Plan

This document provides the overall structure of the Special Study Work Plan with submittals to the Regional Board, as well as providing the initial Pre-BMP Implementation Study Plan (including a proposed field data collection and sampling plan). The Special Study Work Plan addresses the requirements of Optional Study No. 3 to assess compliance with WLAs for total nitrogen and total phosphorus originating from the City's watersheds. The scope of work for this plan includes the following:

- Pre-BMP Implementation Study Period - Including conducting dry weather sampling as outlined within this submittal as well as reviewing water quality models developed by LA County for wet weather events and Machado Lake.
- BMP Evaluation and Selection Study Report - This study report is to be submitted at a later date (see proposed schedule of work plan elements), and will summarize the collected field data and the applicable results obtained from the regional water quality model being developed by LA County for wet weather conditions. The field data and the water quality model data will be used to assess compliance with WLAs under the TMDL. Based on the assessment of compliance, the BMP and Selection Study Report will identify and screen structural BMPs for mitigation to bring the City into compliance with the TMDL.
- Monitoring and Reporting Plan - Subsequent to acceptance by the Regional Board of the findings and conclusions of the City's BMP Evaluation and Selection Study Report, the City will submit an MRP specific to the needs for assessment of future compliance with the TMDL.
- BMP Implementation Report - This report will summarize the monitoring data collected after 12 months of BMP implementation and will provide to the Regional Board an assessment of the success of the structural BMPs implemented by the City to support compliance with the TMDL.

The actual start date for the sampling will be determined following the Regional Board's approval of this Special Study Work Plan. Other conditions that may affect the sampling schedule are weather and equipment conditions and availability. The schedule for the work plan is summarized in Table 3.

The Special Study Work Plan identifies the proposed tasks the City agrees to perform, their timelines, and the roles and responsibilities of various parties in completing the work. The purpose of this document is to serve as a starting point for work planning discussions between the City and the Regional Board.

Table 3 Schedule or Work Plan Elements		
ID	**Work Plan Element**	**Schedule**
1	Special Study Work Plan	May, 2011 (submittal)
2	Regional Board Review/Approval	June, 2011 (approval)
3	Pre-BMP Implementation Study	July, 2011 – July, 2012 (field sampling)
4	BMP Evaluation, Monitoring and Reporting Plan	September, 2011 (submittal)
5	Regional Review/Approval	August, 2012 (approval)
6	BMP Implementation	Nov., 2012 (implementation)
7	BMP Implementation Report	Nov., 2013 (submittal)

2.0 PRE-BMP IMPLEMENTATION STUDY

2.1 Introduction

The Pre-BMP Implementation Study includes a 12-month FSP and evaluation of regional water quality models for wet weather conditions and Machado Lake to assess the City's current compliance with WLAs. The FSP covers sample collection methods, analytical procedures, data analysis and reporting, and health and safety aspects. The FSP will generate a variety of data including discharge rates and flow volumes, the concentrations of chemical parameters, and the measurement of physical parameters. Utilizing the mass balance approach, the data will be used to estimate the mass of nutrients originating from the City as well as nearby agencies discharging stormwater into the City's storm drain system. The data will also be examined for patterns and trends, comparing stormwater quality between different sampling locations over time.

The Pre-BMP Implementation Study will be undertaken once approval is obtained from the Regional Board for the Special Study Work Plan.

The remaining sections of this document contain the FSP providing field sampling methods and analytical procedures that will be used to collect dry weather water quality data and continuous flow data.

2.2 Objectives of the Pre-BMP Implementation Study

The Pre-BMP Implementation Study will provide the City data needed to assess water quality impacts to the City's drainage network. The objective of this study is to support the City's compliance with the Machado Lake Nutrient TMDL by performing Special Study No. 3. Data and information elements that are part of the Pre-BMP Implementation Study include:

1. Dry weather flow data including calculation of continuous volume data and water quality data obtained through field monitoring and sampling (data to be collected by implementing the FSP included within this document).

2. Estimates of wet weather stormwater quality impacts identified using an integrated water quality model developed by the City of Torrance. The water quality model is described in Section 2.2.1.
3. Identification of BMPs that will be implemented by the City to mitigate observed water quality impacts in the City's outflows to Machado Lake.

2.2.1 Pollutant Loading and Analysis Tool (PLAT)

In order to estimate wet weather stormwater quality impacts, the City has developed an integrated watershed modeling tool to simulate watershed hydrology, nutrient, sediment, and contaminant dynamics. This tool called Pollutant Loading and Analysis Tool (PLAT), incorporates existing and commonly used watershed models. The main models used by PLAT are PLOAD, Program for Predicting Polluting Particle Passage thru Pits, Puddles, and Ponds (P8), and U.S EPA SUSTAIN model. PLAT is based on spatially distributed inputs derived from high resolution satellite imagery. PLAT has four main components: pollutant hot-spots characterization, BMP screening, continuous simulation, and BMP design, optimization, and placement. The SUSTAIN model provides an optimization routine that helps identify the appropriate size of BMPs for treating stormwater runoff from respective source areas to meet TMDL reduction goals. The tool has been validated with results from the LA County Watershed Management Model System (WMMS).

3.0 FIELD SAMPLING PLAN

The 12-month FSP is designed to collect continuous flow data and discrete dry weather water quality data to support the overall study objectives summarized in Section 2.

3.1 Sampling Locations and Access

Site selection is a major challenge, given the scarcity of funding for sampling and laboratory analysis. The number of locations to be sampled was decided based on the program objectives, regulatory requirements, and the size and complexity of the drainage sub-basins and conveyance system. In addition, the frequency of sampling at each location was considered.

As a first step in the selection process, the City's watersheds, sub-basins and drainage system network were reviewed. Based on this review, nine locations were identified that could be used to characterize the flows in and out of each subbasin. Four of these locations are needed at a minimum to characterize the flows conveyed to Machado Lake. The final selection of sample locations was based on factors such as site permission, access, clustering, personal safety, equipment safety, and the likelihood that stormwater would flow at the location. Table 4 summarizes the proposed stormwater sampling locations, types, and characteristics. The general sampling locations are depicted on Figure 5. Appendix A shows detailed characteristics of each sampling location.

At a minimum, four sampling locations will meet the objectives of this program. However, the City will sample five additional locations, Tor-S3, Tor-S6, Tor-S7, Tor-S8, and Tor-S9 as shown on Figure 4 because the results will support critical decisions including identifying sources originating outside of the City's boundaries or sources not under the direct control of the City. The sampling locations Tor-S6, Tor-S7, Tor-S8, and Tor-S9 are discharge points for Rolling Hills and Palos Verdes Estates.

The sampling locations are described below.

Tor-S1

This site is located 40 ft north and 80 ft east of the intersection of Plaza Del Amo and Western Avenue. The total upstream drainage area is approximately 63 acres. The drainage area is mainly residential and commercial land use. Residential and commercial land uses represent 36 percent and 33 percent, respectively, of the drainage area. This site is easily accessible and safe for conducting sampling during both dry and wet weather conditions. The storm sewer conveying stormwater to this site is a 36-inch reinforced concrete pipe. This site is one of the four sites that will provide information on the amount of pollutants leaving the City limits.

Sampling Site: TOR-S1

Table 4 Sampling Location Characteristics

Sampling Location Name	Description	Land Use	GPS Coordinates	Associated Upstream Storm Drain Name	Diameter (in) and Material
Tor-S1	Located 40 ft north and 80 ft east of the intersection of Plaza Del Amo and Western Avenue. .	Residential/ commercial	33° 49.3572' 118° 18.5208'	City	36 RCP
Tor-S2	Approximately 50 ft west of 246th Place and Pennsylvania Avenue intersection.	Mixed	33°48.093' 118° 19.5252'	City	33 RCP
Tor-S3	Effluent of Walteria Lake, approximately 100 ft east of Madison St. and Skypark Drive intersection.	Mixed	33°48.6312 118° 20.8674'	Walteria Lake	54
Tor-S4	Approximately 210 ft north and 85 ft east of 236th Street and Western Avenue intersection.	Mostly residential	33° 48.7056' 118° 18.5196'	City	9'-2"Wx11'H RCB
Tor-S5	About 25 ft west of intersection of Bani Avenue and 250th Street (two pipes intersect from south and west).	Residential/ Airport	33° 47.8956' 118° 19.6872'	City	8'-9"Wx9'-7"H RCB
Tor-S6	Approximately 600 ft east of Estates Lane and Crenshaw Boulevard.	Mostly residential	33° 47.1822' 118° 20.43'	Rolling Hills Estates	36 RCP
Tor-S7	About 160 ft south and 280 ft east of Rolling Hills Road and Hawthorne Blvd. intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	Mostly residential	33° 47.6826 118° 20.9232'	Rolling Hills Estates	10'x10' RCB
Tor-S8	About 500 ft northwest of Paseo De Las Tortugas and Mesa St. intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	Mostly residential	33° 48.0522' 118° 21.4254'	Rolling Hills Estates	24 RCP
Tor-S9	About 830 ft east and 120 ft south of Paseo de las Tortugas and Vista Montana intersection. Will monitor dry weather flow originating from Palos Verdes Estates.	Mostly residential	33° 48.2742' 118° 21.7776'	Palos Verdes Estates	42 RCP

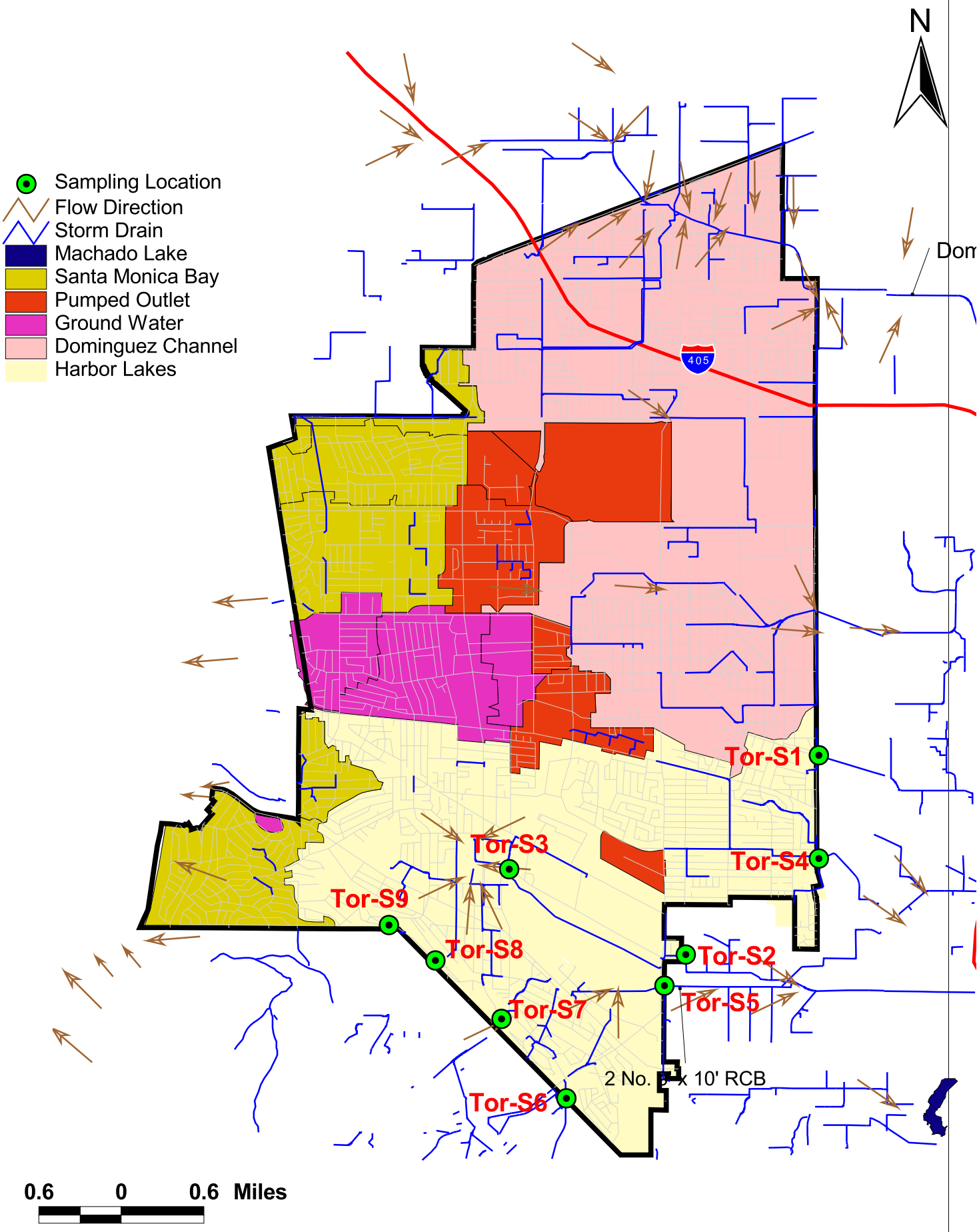


Figure 5 General Location Map of Sampling Locations

Tor-S2

Tor-S2 is approximately 50 ft west of the intersection of 246th Place and Pennsylvania Avenue. The total upstream drainage area is about 2,605 acres. The drainage area is a mixed land use, about 32 percent residential, 10 percent commercial and 11 percent industrial. The Torrance Airport accounts for 12 percent of the drainage area. Tor-S2 is easily accessible and safe for conducting sampling during both dry and wet weather conditions. Stormwater is conveyed to this site through an 8' x 7' reinforced concrete box. This site is one the four sites that will provide information to quantify the amount of pollutants leaving the City limits.

Sampling Site: TOR-S2

Tor-S3

This site, which is approximately 100 ft east of Madison St. and Skypark Drive intersection, will assist the City in characterizing discharges from Walteria Lake. The total upstream drainage area is approximately 2,285 acres. This site is upstream of Tor-S2. Land use is mixed with 37 percent residential, 10 percent commercial and 9 percent industrial. A 54-inch pipe conveys stormwater to this site. The site is easily accessible and safe for all weather sampling.

Sampling Site: TOR-S3

Tor-S4

Tor-S4 is approximately 210 ft north and 85 ft east of 236th Street and Western Avenue intersection. The total drainage area upstream of this sampling location is approximately 1,014 acres. Residential land use represents nearly 60 percent of the drainage area. Commercial and industrial land uses represent only 9 percent of the drainage area. The storm drain serving this site is a 9'-2" x 11' RCB. The site is safe for all weather sampling and it is easily accessible.

Sampling Site: TOR-S4

Tor-S5

This site is about 25 ft west of the intersection of Bani Avenue and 250th Street (two pipes intersect from south and west). This sampling site serves an upstream drainage area of approximately 661 acres. This site is mainly residential and airport land use; residential and airport land uses represent 43 and 24 percent of the drainage area, respectively. The storm drain discharging stormwater to this site is an 8'-9" x 9'-7' RCB. This site is easily accessible and safe for sampling activities.

Sampling Site: TOR-S5

Tor-S6

Tor-S6 is located at approximately 600 ft east of Estates Lane and Crenshaw Boulevard. This site will monitor flow entering the City's storm drain from Rolling Hills Estate. The sampling site is safe and easily accessible.

Sampling Site: TOR-S6

Tor-S7

This site is about 160 ft south and 280 ft east of Rolling Hills Road and Hawthorne Blvd. intersection. It will monitor dry weather flow originating from Rolling Hills Estates. The site is easily accessible and safe for sampling at all weather conditions.

Sampling Site: TOR-S7

Tor-S8

This site is located at about 500 ft northwest of Paseo De Las Tortugas and Mesa St. intersection. It will monitor dry weather flow originating from Rolling Hills Estates. The site is easily accessible and safe for sampling at all weather conditions.

Sampling Site: TOR-S8

Tor-S9

Tor-S9 is about 830 ft east and 120 ft south of Paseo de Las Tortugas and Vista Montana intersection. This site will monitor dry weather flow originating from Palos Verdes Estates. The site is accessible and safe for sampling activities.

Sampling Site: TOR-S9

3.2 Sample Collection Frequency

The City's sampling program consists of three major elements:

1. Monthly sampling during dry weather conditions for all sampling locations. Grab samples will be collected from each sampling location. Dry weather conditions must be preceded by at least 24 hours of no greater than trace precipitation or have an intensity of less than 0.1 inches of rain in a 24-hour period.

2. Samples will be collected from Tor-S3 during four discrete storm events and anytime time the LA County pumps stormwater from the Walteria Lake into the 54-inch storm drain. Pumping schedule will be obtained from LA County.

3. Continuous recording of stage or flow depth during dry weather periods for flow estimation will be collected from the proposed sample locations during dry weather flow conditions.

Regarding Tor-S3, one grab sample for each of the four storm events will be collected under the following conditions:

1. Sampling will occur during a storm event with at least 0.1 inch of precipitation (defined as a "measurable" event). Weather forecasts will be evaluated before deciding whether or not to sample a particular rain event. The monitoring manager will periodically establish a modem connection with each sampling unit to monitor rainfall, flow rates, and sampling activity. The monitoring manager will download stored data from the National Weather Service as needed.
2. Sampling will not occur at a frequency greater than once every 72 hours.
3. Sampling will not occur unless there has been at least 72 hours of continuous dry weather immediately preceding the "measurable" event.
4. Grab samples will be collected from this location during approximately the first 30 minutes to 1 hour of stormwater discharge (where possible).

The intention of the sample collection frequency and stormwater event requirements described above is to collect samples that are representative of runoff conditions from Tor-S3. No samples will be collected from the remaining eight sampling locations during storm events. The City's Pollutant Loading and Analysis Tool (PLAT) will be used to estimate nutrient loading for these sampling location during storm events.

3.3 Selection of Analytical Parameters

The City proposes to use a mass based WLA compliance option to evaluate TMDL compliance. Samples submitted for nutrients will be tested for ammonia-N (NH_3^+), ammonium, nitrite (NO_2), nitrate (NO_3), total Kjeldahl nitrogen (TKN), total phosphorus (TP), and phosphate (PO_4). Water samples submitted for conventional water parameters (general chemistry) will be tested for alkalinity, pH, chloride, total suspended solids (TSS), total solids, dissolved solids, turbidity, dissolved organic carbon (DOC), total organic carbon (TOC), and standard metals. The constituents to be sampled are listed in Table 5.

Table 5 Monitoring Constituents		
Analyte	**Method of Analysis**	**Detection Limits**
NH_3^+	SM 4500-NH_3-H	0.02 mg/l
NO_3	SM 4500-NO_3-F	0.02 mg/l
NO_2	SM 4500-NO_3-F	0.01 mg/l
TKN	EPA 351.3	0.1 mg/l
TP	EPA 365.4	0.06 mg/l
PO_4	SM 4500-P-F	0.01 mg/l
TSS	EPA 160.2	0.5 mg/l
Turbidity	n/a	0.01 NTU

3.4 Continuous Flow Monitoring

Accurate assessment of flow is crucial to pollutant loads assessments and analysis. Continuous flow data will be collected as part of this sampling effort for all nine sampling locations. The primary benefit of these continuous monitoring sites is the ability to gauge the increase in flow due to a storm event and apply concentration data to calculate pollutant loading.

Global Water's FL16 Water Flow Logger will be used for flow data collection. The FL16 Water Flow Loggers will record over 81,000 depth, temperature, water flow and velocity readings in the drainage pipes. The specially engineered, non-fouling water level sensor works in depths as little as ½ inch and allows for deployment in manholes and other difficult to access areas without the need to enter the confined space.

FL16 Water Flow Recorder's user-friendly Windows-based software is tailored specifically for calculating water flows in partially filled sewer and drainage pipes using the Manning's Equation, with pull-down menus for selecting and entering the necessary information. The Water Flow Recorder software has a unique calibration feature which allows users to view calculated water velocity, compare this to actual measured data, and adjust the water flow parameters to calibrate for the water flow conditions of a specific application.

The flow measuring systems will be calibrated before data collection begins and that these will be re-calibrated monthly.

3.5 The Sampling Team

Grab samples from the nine sampling locations will be collected by a contract lab retained by the City. Pre-labeled sample bottles will be provided by the certified laboratory that will be conducting the analyses. The Sampling Team will be responsible for ensuring that all required equipment is ready for field operation. They are also responsible for performing the entire field sampling activities and most of the sampling preparation. Any member of the Sampling Team may recommend canceling sampling if the predicted conditions do not materialize or if health or safety of the team could be imperiled due to site conditions or extreme weather.

4.0 SAMPLE COLLECTION PROCEDURES

This section describes the sampling procedures, record keeping, sample handling, storage, and field quality control procedures that will be used during stormwater sampling.

4.1 Preparation for conducting the sampling

Several things will be done to prepare to conduct stormwater sampling. First, the laboratory to analyze the samples will be contacted. The following information will be sought from the lab:

- Type and size of bottles needed
- Procedures to filling the bottles
- Sample volume requirements
- Labels or additional forms required
- Explanation of the chain of custody form
- Sample preservation requirements and/or holding time restrictions
- Means of sample delivery to the lab
- Overnight delivery requirements
- Costs

Once a lab has been selected the sampling equipment (sampling bottles from a lab, sampling instruments, and personal safety equipment) will be made ready, as well as the field sheet to document the required information. Table 6 lists constituents and sample container requirements.

Field personnel will complete a field condition data sheet. The following items will be listed on the field sampling sheet and included in the stormwater discharge monitoring report:

- Person who conducted the sampling
- Date and time of discharge
- Length of storm event
- Time between sampled storm event and previous storm event (at least 72 hrs)
- Total rainfall during storm event
- Photo documentation

A field data sheet is attached as Appendix B.

4.1.1 Sampling Equipment

Monitoring equipment will be gathered ahead of time because opportunities to sample during rainfall events often come with little advanced notice. The following equipments will be required for the sampling efforts:

- Field forms
- Waterproof pens
- Permanent markers

- Powder-free nitrile gloves
- Clear glass jar for visual examinations
- Sample containers
- Sample preservatives
- Sample container labels
- COC forms
- COC seals
- Ice chests
- Ice
- Foul-weather gear
- Manhole sampler

Table 6 Monitoring Constituents and Sample Container Requirements

Analyte	Container	Volume	Preservation	Holding Time
NH_3^+	Plastic	50 ml	≤ 6°C H2SO4 PH < 2	28 days
NO_3	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	48 hours
NO_2	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	48 hours
TKN	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	28 days
TP	Plastic	50 ml	≤ 6°C, H2SO4 PH <2	28 days
PO_4	Plastic	50 ml	≤ 6°C	48 hours
TSS	Plastic	200 ml	≤ 6°C	7 days

4.2 Sampling Method

Water samples will be collected from storm sewer manhole and outfall sites. All samples will be collected as individual grabs. Samples will be collected directly into sample containers or with a laboratory-supplied container attached to a pole with duct tape or other means. Sampling containers will be held with container openings facing upstream to prevent contamination during sampling. Field personnel will wear powder-free nitrile disposable gloves. Each sample will be given a field identification, tagged, and kept cool at 4 degrees C. Chain-of-custody (COC) procedures will be observed and samples delivered to the laboratory within the allowable holding times for each parameter.

It is assumed that sampling locations will have well-mixed conditions so that single grabs are representative of water quality. Field personnel will record the degree of turbulence or quiescence as well as the dimensions of the conveyance sampled and/or a description of water flowing in the conveyance. Field personnel will also record the date and time of sample collection and the flow rate.

Sampling containers for direct grabs (either by hand or with pole attached to laboratory supplied container) will be pre-cleaned by the laboratory. It will be made certain that if a sample is transferred (either for collection purposes or to form grab-composite samples), that only laboratory-supplied containers are permitted to come in contact with the sample.

4.3 Personal Safety

A Health and Safety Plan approved by the contract lab will be reviewed by the all field personnel before the sampling operations covered in this monitoring plan begin. Personal safety will be of primary concern while conducting all stormwater sampling related activities. All persons involved in the sampling operation will be made aware of the hazards associated with monitoring and should freely voice any concerns if potential hazards become apparent. The Occupational Safety and Health Administration (OSHA) provides regulations and guidance on occupational safety, many of which are directly applicable to the types of activities involved in stormwater monitoring. It is the direct responsibility of each person involved in the monitoring program to read the Health and Safety Plan and adhere to its requirements. The following list provides a few basic health and safety procedures that will help to create a safer sampling environment.

- Do not sample alone, a minimum of two-person field crews will be used for stormwater sampling.
- Do not enter a confined space without proper training, equipment, and surface support.
- Never remove or replace manhole covers with your bare hands or feet.
- Never leave an open manhole unattended.
- Do not start staging or sampling until traffic control has been established.

4.4 Clean Sampling Techniques

Clean sample collection techniques will be followed to minimize the potential for contamination of stormwater runoff samples. Care will be taken during all sampling operations to avoid contamination of the water samples by human, atmospheric, or other potential sources of contamination. The monitoring team should prevent contamination of any of the following items: composite bottles, lids, sample, tubing, and strainers.

4.5 Sample Packing and Shipping

Monitoring personnel will deliver the samples to the laboratory. Sample bottles will be placed in coolers or some other package that is rigid enough to provide protection of the samples and is insulated to keep samples cold. During packing, the sample from one monitoring location will not be separated into separate shipping containers unless bottles of one size need to be shipped together because of container size. If samples from a location are separated a copy of the field-sampling sheet pertaining to the bottles will be enclosed in each shipping container. Prior to shipping, all sample bottles will be recorded on the packing lists, which will include the shipping date and the method of transporting the samples. Samples will be delivered to the analytical laboratory within 4 hours of sampling to ensure the maximum holding time for bacteria of 6 hours is not exceeded.

4.6 Chain of Custody

After samples have been obtained and the collection procedures properly documented, a written record of the COC of each sample will be made. This record ensures that samples will not be tampered with or inadvertently compromised in any way, and it also tracks the requested analysis for the analytical laboratory. COC refers to the documented account of changes in possession that occur for samples.

The COC record tracks the sampling path from origin through laboratory analysis. Information necessary in the COC includes:

- Name of the persons collecting the sample(s).
- Date and time of sample collection.
- Location of sample collection.
- Names and signatures of all persons handling the samples in the field and in the laboratory.
- Laboratory analysis requested and control information (e.g., duplicate or spiked samples etc.) and any special instructions (e.g., time sensitive analyses).

To ensure that all necessary information is documented a COC form will accompany each sample or set of samples. COC forms will be printed on multipart carbonless paper so that all personnel handling the samples may obtain a copy. A COC record should accompany all sample shipments and the sample originator will retain a copy of the forms. When transferring custody of samples the transferee will sign and record the date and time of each transfer. Each person who takes custody will complete the appropriate portion of the chain of custody documentation. A sample COC form to be used for this field sampling is attached as Appendix C.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

5.1 Data Quality Objective

The quality assurance/quality control (QA/QC) program will be implemented to satisfy the data quality objectives of the monitoring program. The primary data quality objectives are to obtain defensible data of acceptable sensitivity and quality to:

- Evaluate the stormwater management program.
- Evaluate stormwater quality.
- Evaluate of BMP as corrective measure.

The analytical laboratory selected for this study will evaluate the accuracy of its sample extraction and/or analytical procedures using spiked samples, which may include matrix spikes (MS), laboratory control samples (LCS) and surrogate spikes. Acceptable spike recoveries must fall within statistically derived laboratory “control limits.” Precision is the agreement among a set a replicate measurements of the same parameter. The analytical laboratory will evaluate precision by performing matrix spike duplicate (MSD), laboratory control sample duplicate (LCSD) and duplicate stormwater sample analyses (typically

performed for inorganic parameters only). The data quality objectives also include obtaining data that are comparable and representative of the water quality conditions at each monitoring location. Comparable data will be collected if comparable sampling, analysis, QA/QC and reporting procedures are implemented throughout the monitoring program. Representative samples will be collected by performing sampling activities compliant with the procedures described in this monitoring plan. Duplicate samples will be collected and the results will be used to evaluate representativeness. Comparability expresses the confidence with which one data set can be compared to another. Data are comparable if collection techniques, measurement procedures, methods, and reporting are equivalent for the samples within a sample set. Data quality assurance objectives are summarized in Table 7.

Table 7 Quality Assurance Objective

Analyte	Units	Precision	Accuracy	Reporting Limit	Completeness
NH_3^+	mg/l	±20%	±30%	0.10 mg/l	90%
NO_3	mg/l	±20%	±30%	0.1 mg/l	90%
NO_2	mg/l	±20%	±30%	0.1 mg/l	90%
TKN	mg/l	±20%	±30%	0.1 mg/l	90%
TP	mg/l	±20%	±30%	0.1 mg/l	90%
PO_4	mg/l	±20%	±30%	0.025 mg/l	90%
TSS	mg/l	±20%	±30%	1 mg/l	90%

5.1.1 Field Quality Control Samples

Field quality control samples will be collected at a 10% frequency in order to provide quality performance information for the sampling program. One in ten samples submitted for analysis will be one of three field QC sample types: field blank; field duplicate; and/or performance evaluation blank. Table 8 lists the quality performance goals that each of the three types of field QC sample types is intended to address.

Table 8 Field Quality Control Sample Types

Quality Performance Goal	Field Blank	Field Duplicate	Performance Evaluation Blank
Minimize false positive results	**X**		**X**
Sample bottles free of contamination	**X**		
No contamination introduced by sampling process	**X**		
Measurement error attributable to sample inhomogeneity		**X**	

5.2 Field Quality Assurance/Quality Control

This section summarizes the QA/QC procedures that will be implemented by field personnel to evaluate sample contamination, sampling precision, and matrix interference.

5.2.1 Equipment Blanks

After the intermediate sample container or scoop is cleaned, an equipment blank will be collected by pouring reagent-grade water into the apparatus. The water will be transferred into sample bottles and analyzed for the full analytical suite.

5.2.2 Field Duplicate Samples

Field duplicate samples will be collected to evaluate the precision and representativeness of the sample collection procedures as well as sample homogeneity. The duplicate sample will be collected using the specified manual grab sampling techniques. Twice the volume required for the analytical suite will be collected with each duplicate sample. For grab samples, intermediate sample containers will be used, and the volume collected will be apportioned equally between the intermediate containers. The water in each intermediate container will be poured into a discrete set of sample bottles. One set of bottles will be labeled with fictitious sample identification and submitted “blind” to the laboratory.

5.2.3 Matrix Spike Samples

MS and MSD analyses will be performed by the laboratory using project samples. Field crews will submit twice the required sample volume for the sample selected as the matrix spike sample. Field personnel will identify the MS/MSD sample on the COC form.

5.3 Laboratory Quality Control

This sub-section summarizes the QC procedures the laboratory will perform and report with the analytical data packages. These procedures are not inclusive of the QA/QC that is required for compliance with the analytical method.

5.3.1 Method Blanks

A method blank is prepared using reagent-grade water, and is extracted and analyzed with each sample batch (typically 20 samples extracted and/or analyzed on a given day). Method blank results are used to identify potential sources of sample contamination resulting from laboratory procedures. Target analytes should not be detected in the method blank above the practical quantitative limit.

5.3.2 Matrix Spike and Laboratory Control Samples

MS, MSDs, LCS, and LCSDs will be performed by the laboratory to evaluate the accuracy of the sample extraction and analysis procedures. MS/MSDs will also be performed to evaluate matrix interference. Matrix interference is the effect of the sample matrix on the analysis, which may partially or completely mask the response of the analytical instrumentation to the target analyte(s). Matrix interference may affect the accuracy of the extraction and/or analysis procedures to varying degrees, and may bias the sample results high or low. The

MS/MSD is prepared by adding known quantities of target analytes to a sample. The sample is then extracted and/or analyzed as a typical environmental sample, and the results are reported as percent recovery.

6.0 DATA MANAGEMENT AND REPORTING

The sampling results will be reported by the laboratory as hard copy and as electronic files. Hard copy data will be entered into an electronic format, and checked at least once by a different person. Electronic submittal of results will be discussed with the analytical laboratory in advance of delivery and its format arranged. A separate record will be generated for each sample analysis.

In addition, the key information such as station ID, sample date and time, name of sampler, name of constituent, all results, units, detection limits, methods used, name of the laboratory, and any field notes will be entered into the database. Additional information, such as compositing of multiple samples, or the use of grab will also be included.

When reporting the laboratory results for each stormwater sample the following information will be provided:

- Sample site.
- Sample date and time.
- Sample number (or identification).
- Sampling technician(s).
- Detection limit and reliability limit of analytical procedure(s).
- Sample results with clearly specified units.

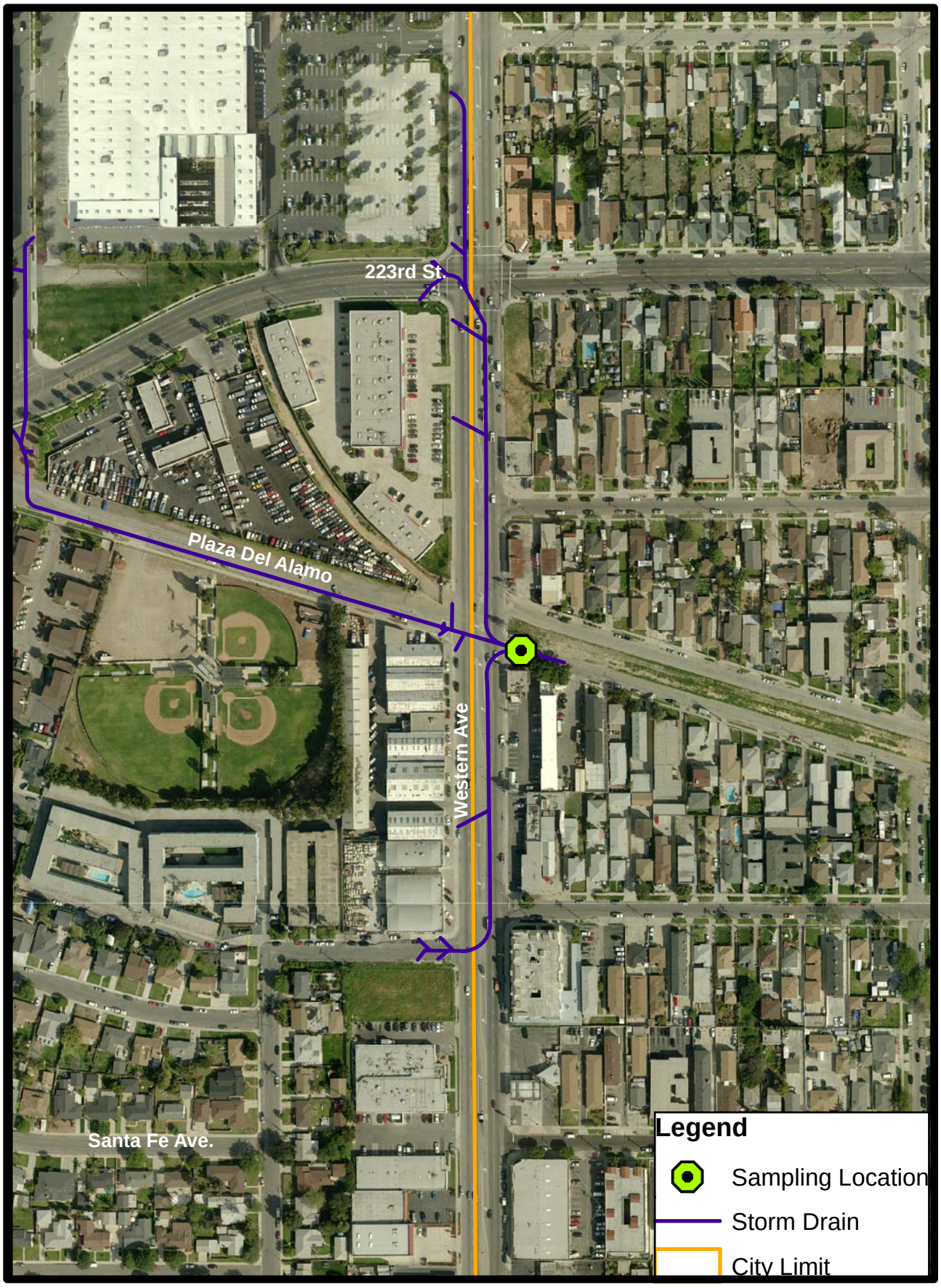
The results of all samples collected under this plan will be submitted to Regional Board in a monitoring report. Monitoring report will include:

- Introduction and background information
- Documentation and summary of each sampling event, including photos
- Electronic copies of field conditions data sheets
- Summary discussion of results
- Tabular results of all samples, including quality assurance quality control samples, in electronic format, (Excel)
- Evaluation data quality based on QAPP requirements.

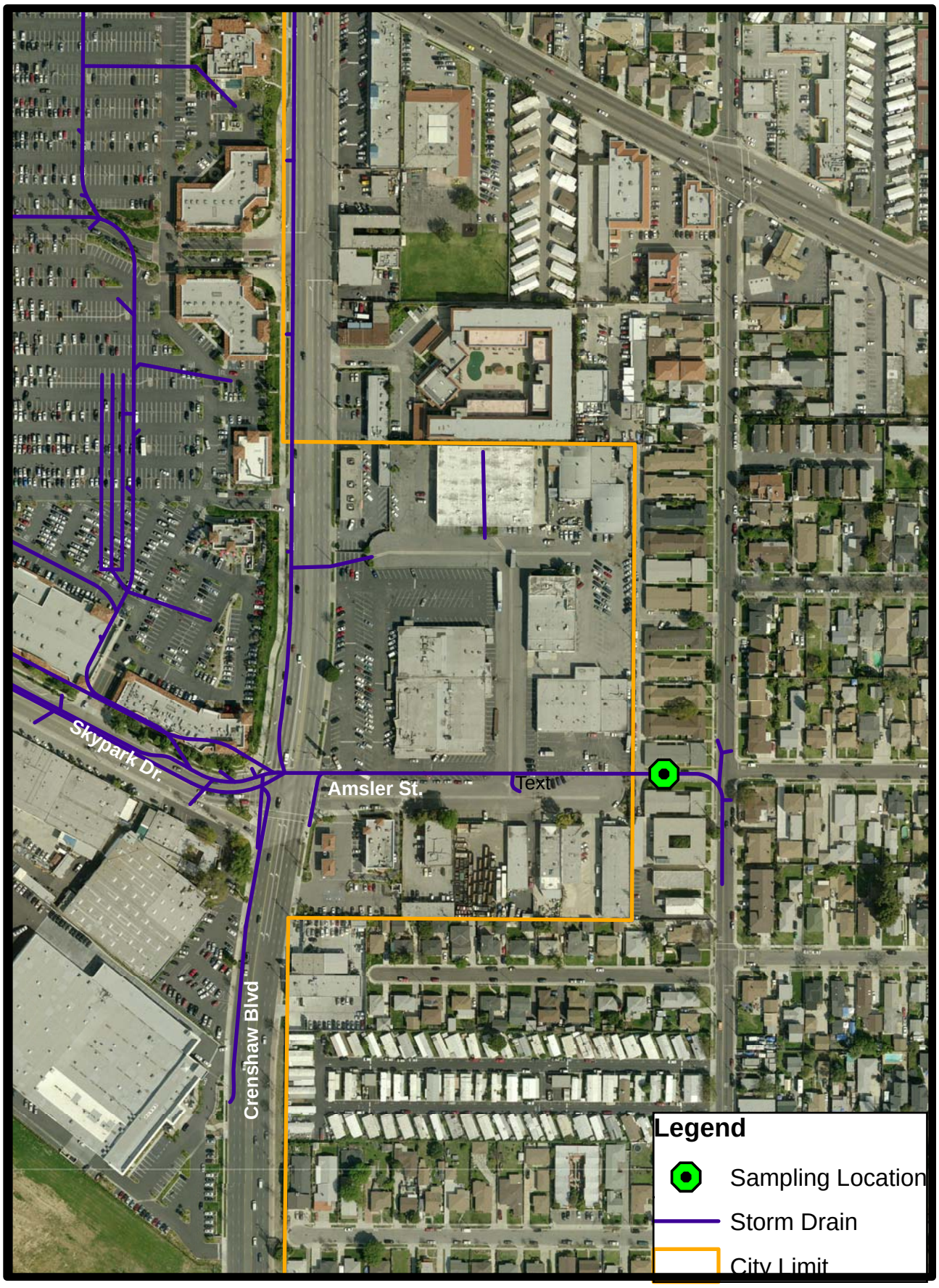
APPENDIX A

Detailed Maps of Sampling Locations

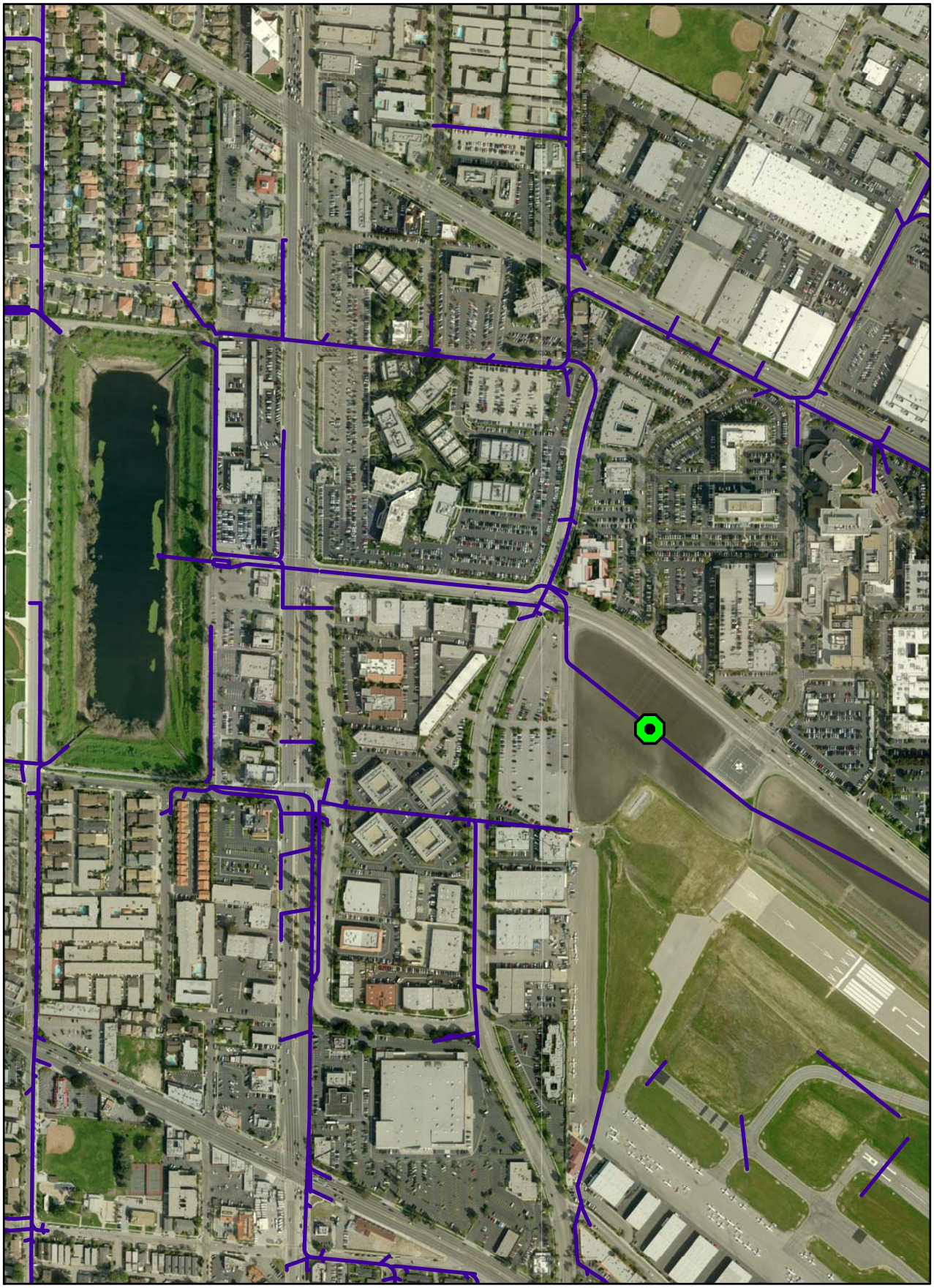
Stormwater Sampling Location - Tor-S1



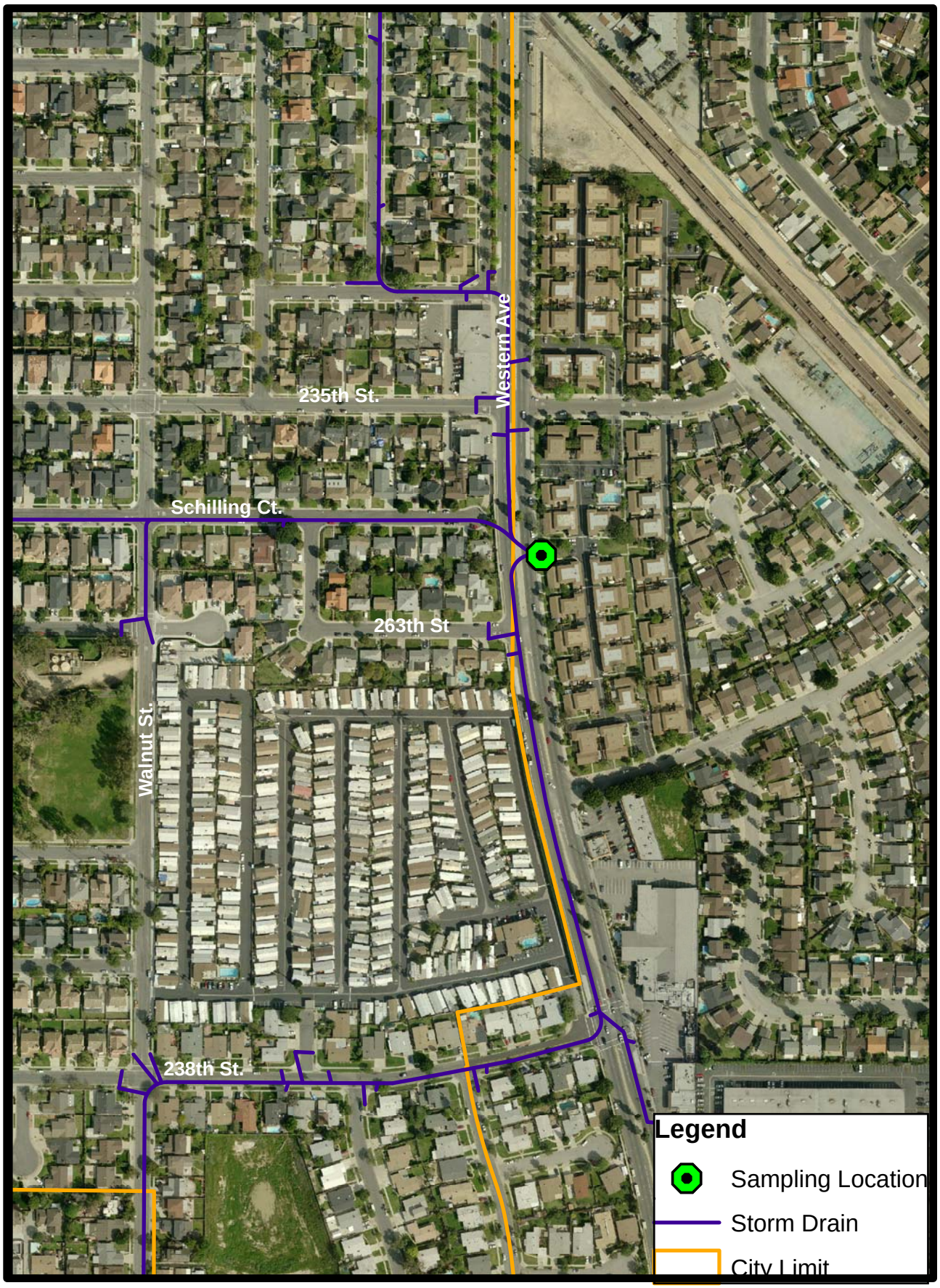
Stormwater Sampling Location - Tor-S2



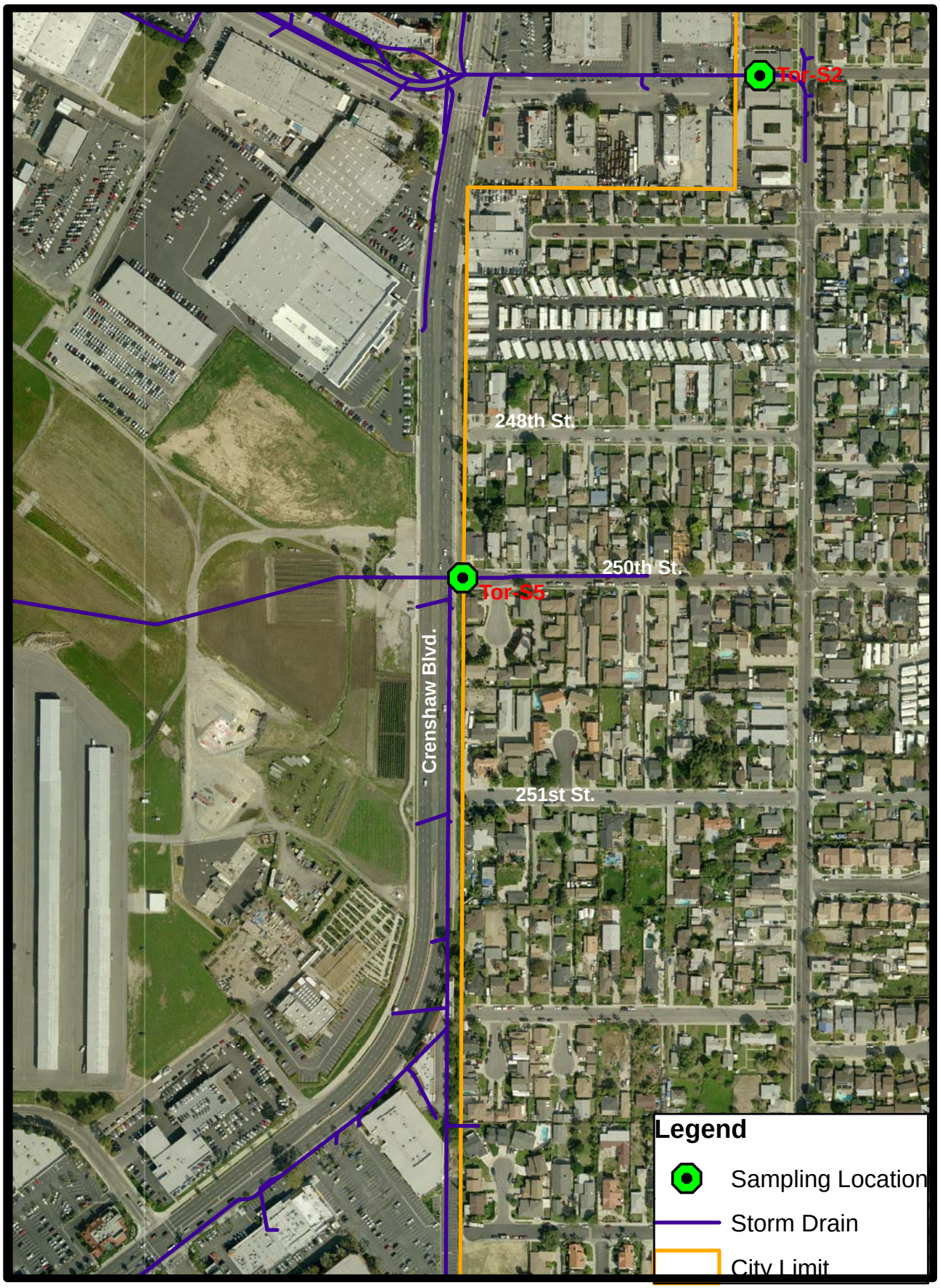
Stormwater Sampling Location: Tor-S3



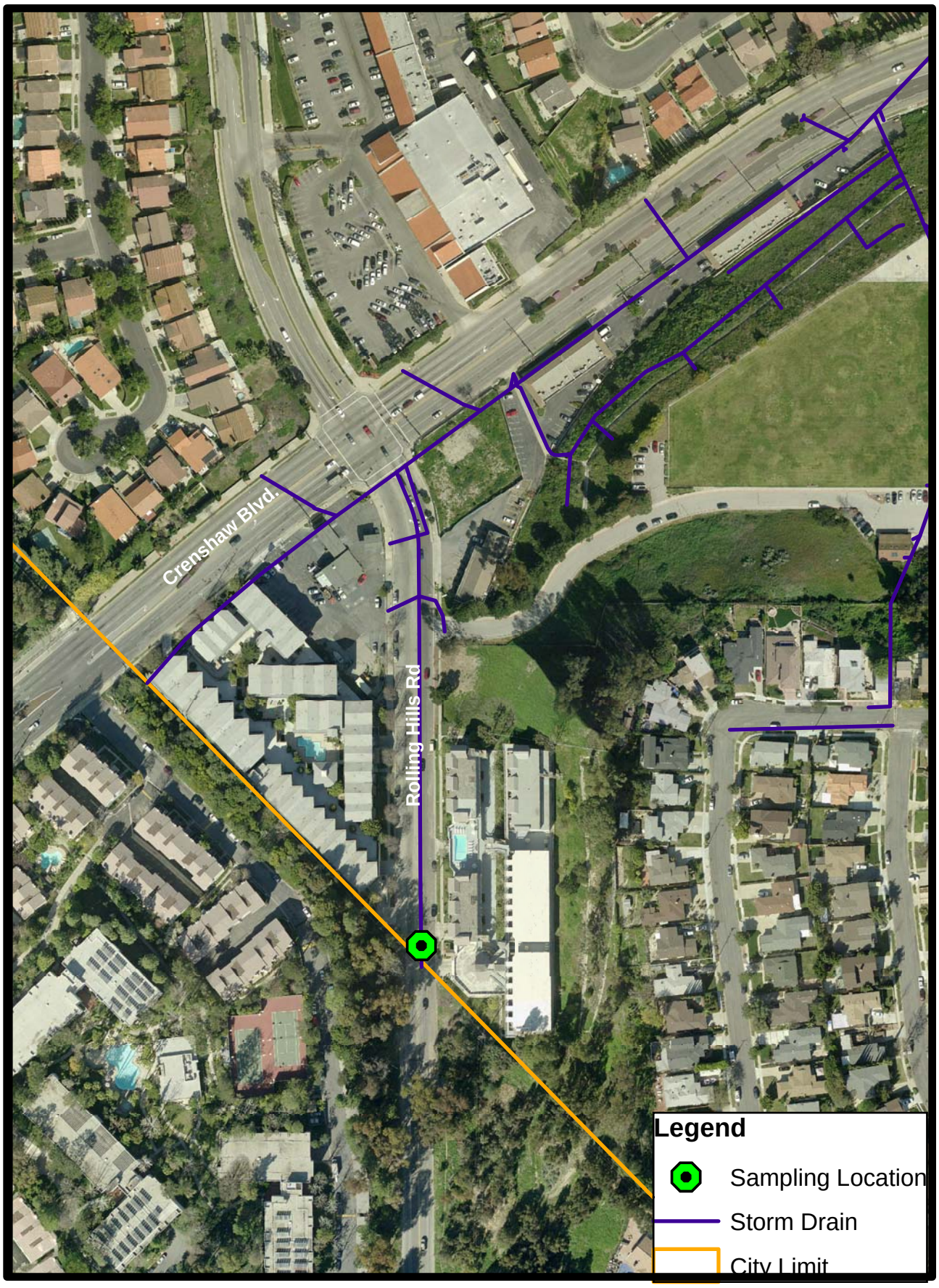
Stormwater Sampling Location - Tor-S4



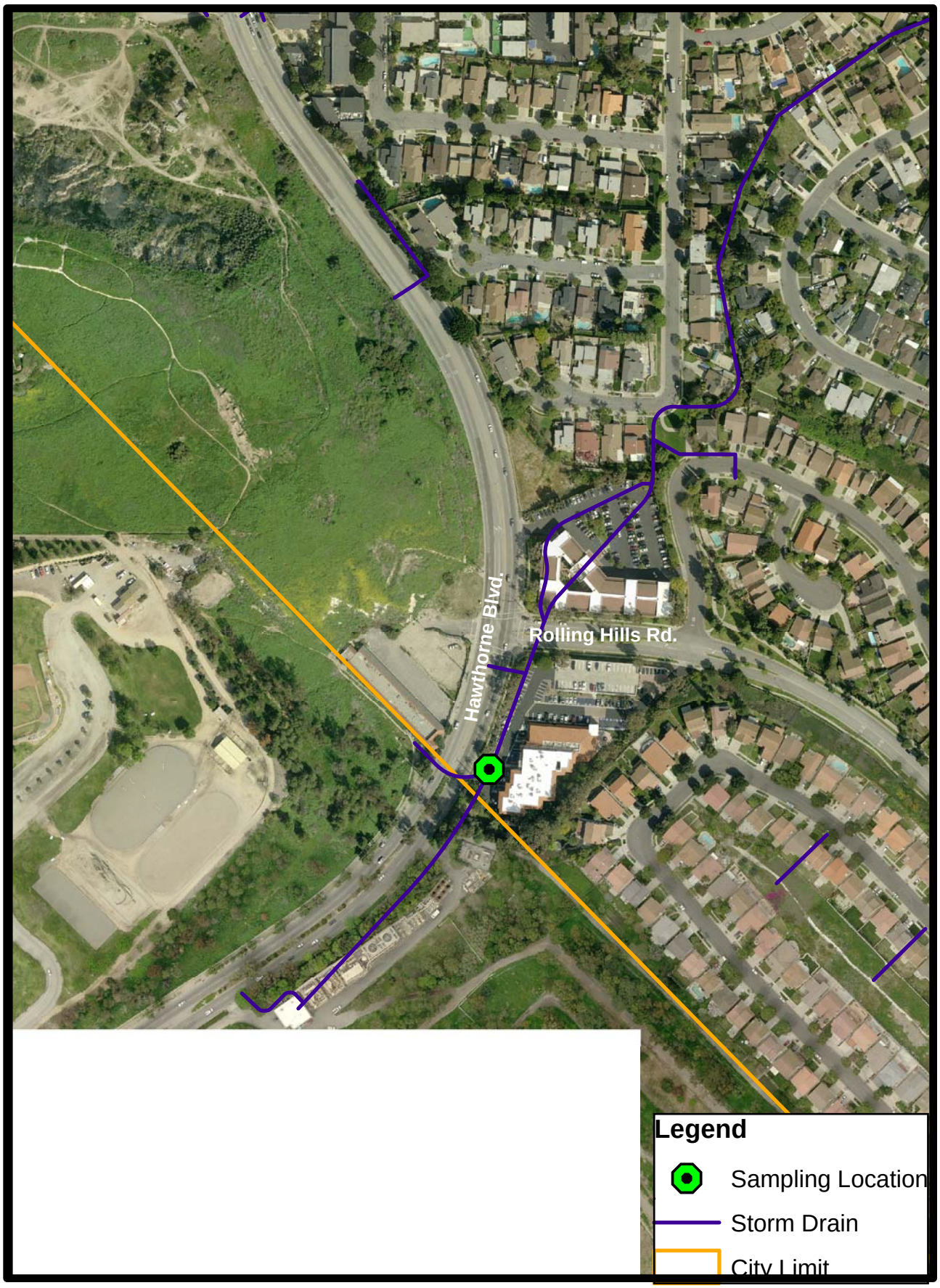
Stormwater Sampling Location - Tor-S5



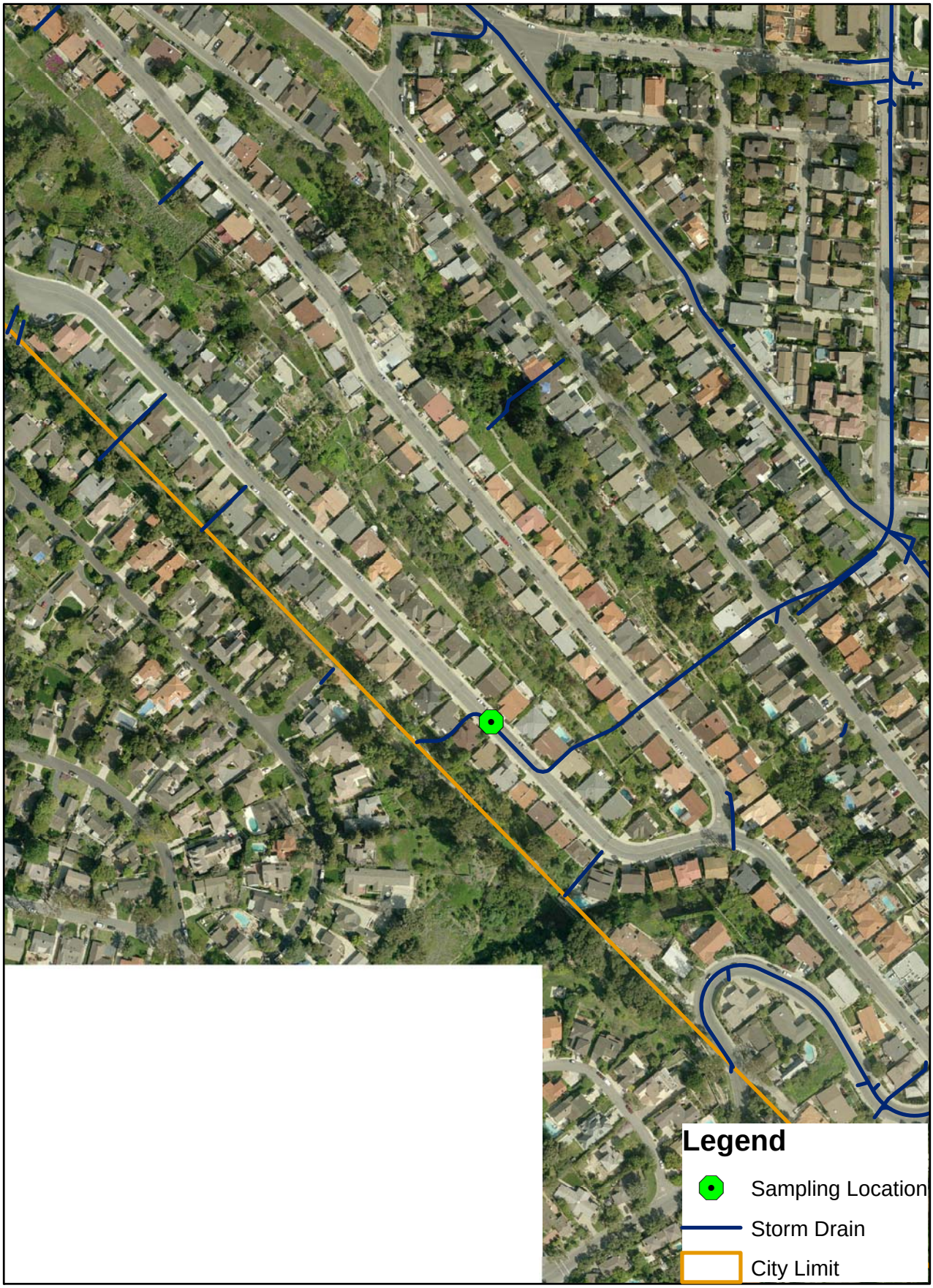
Stormwater Sampling Location - Tor-S6



Stormwater Sampling Location - Tor-S7



Stormwater Sampling Location - Tor-S8



Stormwater Sampling Location - Tor-S9

APPENDIX B

Field Data Sheet

Sampling Field Data

City of Torrance, California

Page_____ of_____

Area Letter & Name or Run #: _____

Run: Scheduled / Makeup / Reopen / Extra

Collected by: _____ **Initiated by:** _____

Date Collected: _____ **Date/time Initiated:** _____

Missed Station	Area Letter	Station #	Military Time	Boat /Land/ Clams/Mussels	Temp °C	Random / Adverse/ Extra	Condition or Adversity	Open or Closed	Wind	Salinity ‰	A-1 MPN/100 ml MF CFU/100ml EC MPN/100 ml	Comments

Remarks:

CHAIN OF CUSTODY:

Relinquished by:	Date, Time & Temp°C	# Samples	Relinquished to:	Received by:	Date, Time & Temp°C	# Samples

Circle Water Quality Lab: Boothbay or Lamoine | **WQ Lab Staff Acceptance:**

Entered by: _____ **Date:** _____

APPENDIX C

Chain of Custody

GENERAL CHAIN-OF-CUSTODY FORM

EVIDENCE/PROPERTY CUSTODY	Tracking Number Investigation ID Number	
NAME OF RECIPIENT FACILITY	LOCATION	
NAME, TITLE AND CONTACT NUMBER OF PERSON FROM WHOM RECEIVED	ADDRESS	
LOCATION FROM WHERE OBTAINED	REASON OBTAINED	DATE/TIME OBTAINED

ITEM NO	QUANTITY	DESCRIPTION OF ARTICLES (Include model, serial number, condition and unusual marks or scratches)

		CHAIN OF CUSTODY		
ITEM NO.	DATE	RELEASES BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	

Chain-of-Custody (continued)

ITEM NO.	DATE	RELEASES BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	

FINAL DISPOSAL ACTION
RELEASE TO OWNER OR OTHER (NAME/ORGANIZATION)
DESTROY
OTHER (Specify)
FINAL DISPOSAL AUTHORITY
ON THIS DOCUMENT PERTAINING TO THE INQUIRY/INVESTIGATION INVOLVING;
ITEM(S) (IS)(ARE) NO LONGER REQUIRED AS EVIDENCE AND MAY BE DOSPOSED AS INDICATED ABOVE. *If articles must be retained do not sign, but explain in separate correspondence.*
(Typed or Printed Name & Organization) (Signature) (Date)
WITNESS TO DESTRUCTION EVIDENCE
THE ARTICLES LISTED AT ITEM NUMBERS (WAS)(WERE) DESTROYED BY THE EVIDENCE CUSTODIAN IN MY PRESENCE, ON THE DATE INDICATED ABOVE
(Typed or Printed Name & Organization) (Signature) (pole)

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. 02-004
January 24, 2002

Amendment to the Water Quality Control Plan (Basin Plan) for the Los Angeles Region to Incorporate a Dry Weather Total Maximum Daily Load for Bacteria at Santa Monica Bay Beaches

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angeles Region (Regional Board) to develop water quality objectives which are sufficient to protect beneficial uses for each water body found within its region.

2. A consent decree between the U.S. Environmental Protection Agency (USEPA), Heal the Bay, Inc. and BayKeeper, Inc. was approved on March 22, 1999. This court order directs the USEPA to complete Total Maximum Daily Loads (TMDLs) for all the Los Angeles Region's impaired waters within 13 years. A schedule was established in the consent decree for the completion of 29 TMDLs within 7 years, including completion of a TMDL to reduce bacteria at Santa Monica Bay beaches by March 2002. The remaining TMDLs will be scheduled by Regional Board staff within the 13-year period.

3. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d) of the CWA, as well as in USEPA guidance documents (e.g., USEPA, 1991). A TMDL is defined as "the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR 130.2). Regulations further stipulate that TMDLs must be set at "levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR 130.7(c)(1)). The provisions in 40 CFR 130.7 also state that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters.

4. Upon establishment of TMDLs by the State or USEPA, the State is required to incorporate the TMDLs along with appropriate implementation measures into the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). The Water Quality Control Plan for the Los Angeles Region (Basin Plan), and applicable statewide plans, serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Regional Board.

5. Santa Monica Bay is located in Los Angeles County, California. The proposed TMDL addresses documented bacteriological water quality impairments at 44 beaches from the Los Angeles/Ventura County line, to the northwest, to Outer Cabrillo Beach, just south of the Palos Verdes Peninsula.

6. The Regional Board's goal in establishing the above-mentioned TMDL is to reduce the risk of illness associated with swimming in marine waters contaminated with human sewage and

other sources of bacteria. Local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects, such as gastroenteritis, and recreational water quality, as measured by bacteria indicator densities.

7. Interested persons and the public have had reasonable opportunity to participate in review of the amendment to the Basin Plan. Efforts to solicit public review and comment include staff presentations to the Santa Monica Bay Restoration Project's Bay Watershed Council and Technical Advisory Committee between May 1999 and October 2001 and creation of a Steering Committee in July 1999 to provide input on scientific and technical components of the TMDL with participation by the Southern California Coastal Water Research Project, City of Los Angeles, County of Los Angeles Department of Public Works, County Sanitation Districts of Los Angeles County, Heal the Bay, and Santa Monica Bay Restoration Project. In addition, a draft of the TMDL for bacteria at Santa Monica Bay beaches was released for public comment on November 9, 2001; a Notice of Hearing and Notice of Filing were published and circulated 45 days preceding Board action; Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on January 24, 2002 to consider adoption of the TMDL.

8. On October 25, 2001, the Regional Board adopted Resolution 2001-018 establishing revised bacteriological water quality objectives for the Water Contact Recreation (REC-1) beneficial use, and the TMDL is intended to accompany and to implement the revised water quality objectives. While the Regional Board has approved the water quality objective change, the change is not yet effective because the State Water Resources Control Board, the Office of Administrative Law, and the USEPA have not yet approved the revised water quality objective.

9. The amendment is consistent with the State Antidegradation Policy (State Board Resolution No. 68-16), in that the changes to water quality objectives (i) consider maximum benefits to the people of the state, (ii) will not unreasonably affect present and anticipated beneficial use of waters, and (iii) will not result in water quality less than that prescribed in policies. Likewise, the amendment is consistent with the federal Antidegradation Policy (40 CFR 131.12).

10. The basin planning process has been certified as functionally equivalent to the California Environmental Quality Act requirements for preparing environmental documents (Public Resources Code, Section 21000 et seq.) and as such, the required environmental documentation and CEQA environmental checklist have been prepared.

11. The proposed amendment results in no potential for adverse effect (de minimis finding), either individually or cumulatively, on wildlife.

12. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subdivision (b).

13. The Basin Plan amendment incorporating a TMDL for bacteria at Santa Monica Bay beaches must be submitted for review and approval by the State Water Resources Control Board (State Board), the State Office of Administrative Law (OAL), and the USEPA. The Basin Plan amendment will become effective upon approval by OAL and USEPA. A Notice of Decision will be filed.

THEREFORE, be it resolved that pursuant to Section 13240 and 13242 of the Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. Pursuant to sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendment to Chapter 7 the Water Quality Control Plan for the Los Angeles Region to incorporate the elements of the Santa Monica Bay Beaches Bacteria TMDL for dry weather as set forth in Attachment A hereto.

2. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

3. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it to OAL and the USEPA.

4. The Basin Plan amendment set forth in Attachment A shall only become effective if the water quality objectives revised by Regional Board Resolution 2001-018, or equivalent water quality objectives, have been approved by the State Board, OAL, and USEPA, and are consistent with the TMDL.

5. If during its approval process the State Board or OAL determines that minor, non-substantive corrections to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

6. The Executive Officer is authorized to sign a Certificate of Fee Exemption.

I, Dennis A. Dickerson, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on January 24, 2002.

Dennis A. Dickerson
Executive Officer

Attachment A to Resolution No. 02-004

Proposed Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate the Santa Monica Bay Beaches Bacteria TMDL

Proposed for adoption by the California Regional Water Quality Control Board, Los Angeles Region on January 24, 2002.

Amendments:

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Add:

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries
7-4 Santa Monica Bay Beaches Bacteria TMDL*

List of Figures, Tables and Inserts
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables
7-4 Santa Monica Bay Beaches Bacteria TMDL
7-4.1. Santa Monica Bay Beaches Bacteria TMDL (Dry Weather Only): Elements
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Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries
Santa Monica Bay Beaches Bacteria TMDL (Dry Weather Only)*

This TMDL was adopted by:

The Regional Water Quality Control Board on January 24, 2002.
The State Water Resources Control Board on [Insert Date].
The Office of Administrative Law on [Insert Date].
The U.S. Environmental Protection Agency on [Insert Date].

The following table summarizes the key elements of this TMDL.

Table 7-4.1. Santa Monica Bay Beaches Bacteria TMDL (Dry Weather Only): Elements

Element	Key Findings and Regulatory Provisions
Problem Statement	Elevated bacterial indicator densities are causing impairment of the water contact recreation (REC-1) beneficial use at many Santa Monica Bay (SMB) beaches. Swimming in waters with elevated bacterial indicator densities has long been associated with adverse health effects. Specifically, local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects and recreational water quality, as measured by bacterial indicator densities.
Numeric Target *(Interpretation of the numeric water quality objective, used to calculate the waste load allocations)*	The TMDL has a multi-part numeric target based on the bacteriological water quality objectives for marine water to protect the water contact recreation use. These targets are the most appropriate indicators of public health risk in recreational waters. These bacteriological objectives are set forth in Chapter 3 of the Basin Plan, as amended by the Regional Board on October 25, 2001. The objectives are based on four bacterial indicators and include both geometric mean limits and single sample limits. The Basin Plan objectives are as follows: 1. Rolling 30-day Geometric Mean Limits a. Total coliform density shall not exceed 1,000/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. c. Enterococcus density shall not exceed 35/100 ml. 2. Single Sample Limits a. Total coliform density shall not exceed 10,000/100 ml. b. Fecal coliform density shall not exceed 400/100 ml. c. Enterococcus density shall not exceed 104/100 ml. d. Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1. The targets apply throughout the year. The compliance point for the targets is the wave wash[1], where there is a freshwater outlet (i.e., storm drain or creek) to the beach, or at ankle depth at beaches without a freshwater outlet. The geometric mean targets may not be exceeded at any time. For the single sample targets, each existing shoreline monitoring site is assigned an allowable number of exceedance days for two time periods (summer dry weather and winter dry weather as defined in Table 7-4.2a). (A separate amendment will address the allowable number of wet weather exceedance days.) The allowable number of exceedance days is set such that (1) bacteriological water quality at any site is at least as good as at a designated reference site within the watershed and (2) there is no degradation of existing shoreline bacteriological water quality.
Source Analysis	With the exception of isolated sewage spills, dry weather urban runoff conveyed by storm drains and creeks is the primary source of elevated bacterial indicator densities to SMB beaches during dry weather. Limited natural runoff and groundwater may also potentially contribute to elevated bacterial indicator densities during winter dry weather. This

[1] The wave wash is defined as the point at which the storm drain or creek empties and the effluent from the storm drain initially mixes with the receiving ocean water.

	is supported by the finding that historical monitoring data from the reference beach indicate no exceedances of the single sample targets during summer dry weather and on average only three percent exceedance during winter dry weather.

Loading Capacity	Studies show that bacterial degradation and dilution during transport from the watershed to the beach do not significantly affect bacterial indicator densities at SMB beaches. Therefore, the loading capacity is defined in terms of bacterial indicator densities, which is the most appropriate for addressing public health risk, and is equivalent to the numeric targets, listed above.
Waste Load Allocations	Waste load allocations are expressed as the number of sample days at a shoreline monitoring site that may exceed the single sample targets identified under "Numeric Target." Waste load allocations are expressed as allowable exceedance days because the bacterial density and frequency of single sample exceedances are the most relevant to public health protection. For each shoreline monitoring site and corresponding subwatershed, the allowable number of exceedance days is set for two time periods. These two periods are: 1. summer dry weather (April 1 to October 31), and 2. winter dry weather (November 1 to March 31). The allowable number of exceedance days for a shoreline monitoring site for each time period is based on the lesser of two criteria (1) exceedance days in the designated reference system and (2) exceedance days based on historical bacteriological data at the monitoring site. This ensures that shoreline bacteriological water quality is at least as good as that of a largely undeveloped system and that there is no degradation of existing shoreline bacteriological water quality.[2] All responsible jurisdictions and responsible agencies[3] within a subwatershed are jointly responsible for complying with the allowable number of exceedance days for each associated shoreline monitoring site identified in Table 7-4.2a below. The three Publicly Owned Treatment Works (POTWs)[4] discharging to Santa Monica Bay are each given individual WLAs of zero (0) days of exceedance during both summer dry weather and winter dry weather.
Implementation	This TMDL will be implemented in two phases over a 6-year period. The regulatory mechanisms used to implement the TMDL will include primarily the Los Angeles County Municipal Storm Water NPDES Permit, the Caltrans Storm Water Permit, the three NPDES permits for the POTWs, and the authority vested in the Executive Officer via 13267 of the Porter-Cologne Water Quality Control Act. Within 3 years of the effective date of the TMDL, summer dry-weather allowable exceedance days and the rolling 30-day geometric mean

[2] In order to fully protect public health, no exceedances are permitted at any shoreline monitoring location during summer dry weather (April 1 to October 31). In addition to being consistent with the two criteria, waste load allocations of zero (0) exceedance days are further supported by the fact that the California Department of Health Services has established minimum protective bacteriological standards – the same as the numeric targets in this TMDL – which, when exceeded during the period April 1 to October 31, result in posting a beach with a health hazard warning (California Code of Regulations, title 17, section 7958).

[3] For the purposes of this TMDL, "responsible jurisdictions and responsible agencies" includes: (1) local agencies that are responsible for discharges from a publicly owned treatment works to the Santa Monica Bay watershed or directly to the Bay, (2) local agencies that are permittees or co-permittees on a municipal storm water permit, (3) local or state agencies that have jurisdiction over a beach adjacent to Santa Monica Bay, and (4) the California Department of Transportation pursuant to its storm water permit.

[4] Hyperion Wastewater Treatment Plant, Joint Water Pollution Control Plant, and Tapia Wastewater Reclamation Facility.

Table 7-4.2a: Santa Monica Bay Beaches Bacteria TMDL Implementation Schedule (Dry Weather Only): Allowable Number of Days that May Exceed Any Single Sample Bacterial Indicator Target for Existing Shoreline Monitoring Stations

Compliance Deadline			3 years after effective date		6 years after effective date	
			Summer Dry Weather^ Apr. 1-Oct. 31		Winter Dry Weather^* Nov. 1-Mar. 31	
Station ID	Location Name	Subwatershed	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)
City of Los Angeles, Environmental Monitoring Division Sites						
S1	Surfrider Beach (breach point) - daily	Malibu Canyon	0	0	3	1
S2	Topanga State Beach	Topanga Canyon	0	0	3	1
S3	Pulga Canyon storm drain - 50 yards east (Will Rogers)	Pulga Canyon	0	0	3	1
S4	Santa Monica Canyon, Will Rogers State Beach	Santa Monica Canyon	0	0	3	1
S5	Santa Monica Municipal Pier - 50 yards southeast	Santa Monica	0	0	3	1
S6	Santa Monica Beach at Pico/Kenter storm drain	Santa Monica	0	0	3	1
S7	Ashland Av. storm drain - 50 yards south (Venice)	Santa Monica	0	0	3	1
S8	Venice City Beach at Windward Av. - 50 yards north	Ballona	0	0	2	1
S10	Ballona Creek entrance - 50 yards south (Dockweiler)	Dockweiler	0	0	3	1
S11	Dockweiler State Beach at Culver Bl.	Dockweiler	0	0	3	1
S12	Imperial Highway storm drain - 50 yards north (Dockweiler)	Dockweiler	0	0	2	1
S13	Manhattan State Beach at 40th Street	Hermosa	0	0	1	1
S14	Manhattan Beach Pier - 50 yards south	Hermosa	0	0	1	1
S15	Hermosa Beach Pier - 50 yards south	Hermosa	0	0	2	1
S16	Redondo Municipal Pier - 50 yards south	Redondo	0	0	3	1
S17	Redondo State Beach at Avenue I	Redondo	0	0	3	1
S18	Malaga Cove, Palos Verdes Estates - daily	Palos Verdes	0	0	1	1
Los Angeles County Department of Health Services Sites						
DHS (010)	Leo Carillo Beach (REFERENCE BEACH)	Arroyo Sequit Canyon	0	0	3	1
DHS (009)	Nicholas Beach	Nicholas Canyon	0	0	0	0
DHS (010a)	Broad Beach	Trancas Canyon	0	0	3	1
DHS (008)	Trancas Beach entrance	Trancas Canyon	0	0	0	0
DHS (007)	Westward Beach, SE end	Zuma Canyon	0	0	0	0
DHS (006)	Paradise Cove	Ramirez Canyon	0	0	3	1
DHS (005)	29610 Latigo Shore Drive	Latigo Canyon	0	0	3	1
DHS (005a)	Corral Beach	Latigo Canyon	0	0	3	1
DHS (004)	Puerco Beach	Corral Canyon	0	0	3	1
DHS (003)	Malibu Point, Malibu Colony Dr.	Malibu Canyon	0	0	3	1
DHS (003a)	Surfrider Beach, Malibu, 50 yds.	Malibu Canyon	0	0	3	1
DHS (002)	Malibu Pier	Malibu Canyon	0	0	3	1
DHS (001a)	Las Flores Beach	Las Flores Canyon	0	0	3	1
DHS (001)	Big Rock Beach	Piedra Gorda Canyon	0	0	3	1
DHS (101)	17200 Pacific Coast Hwy.	Santa Ynez Canyon	0	0	3	1
DHS (102)	Bel Air Bay Club, 16801 Pacific	Santa Ynez Canyon	0	0	3	1
DHS (103)	Temescal Storm Drain	Pulga Canyon	0	0	3	1
DHS (104a)	San Vicente Blvd. extended	Santa Monica	0	0	3	1
DHS (104)	Montana Ave. Storm Drain	Santa Monica	0	0	3	1
DHS (105)	Wilshire Blvd., Santa Monica	Santa Monica	0	0	3	1
DHS (106)	Strand Street extended	Santa Monica	0	0	3	1
DHS (106a)	Ashland Storm Drain	Santa Monica	0	0	3	1
DHS (107)	Venice City Beach at Brooks Av.	Ballona	0	0	3	1
DHS (108)	Venice Pier, Venice	Ballona	0	0	3	1
DHS (109)	Topsail Street extended	Ballona	0	0	3	1
DHS (110)	World Way extended	Dockweiler	0	0	3	1
DHS (111)	Opposite Hyperion Plant, 1 mile	Dockweiler	0	0	3	1
DHS (112)	Grand Avenue extended	Dockweiler	0	0	3	1
DHS (113)	26th Street extended	Hermosa	0	0	0	0
DHS (114)	Herondo Street extended	Hermosa	0	0	3	1
DHS (115)	Topaz Street extended	Redondo	0	0	3	1
County Sanitation Districts of Los Angeles County Sites						
LACSD1	Long Point	Palos Verdes	0	0	1	1
LACSD2	Abalone Cove	Palos Verdes	0	0	0	0
LACSD3	Portuguese Bend Cove	Palos Verdes	0	0	1	1
LACSD5	Royal Palms	Palos Verdes	0	0	1	1
LACSD6	Wilder Annex	Palos Verdes	0	0	1	1
LACSD7	Cabrillo Beach, oceanside	Palos Verdes	0	0	1	1
LACSDMC	Malaga Cove	Palos Verdes	0	0	1	1
LACSDBC	Bluff Cove	Palos Verdes	0	0	1	1

Notes: The allowable number of exceedance days during winter dry weather is calculated based on the 10th percentile year in terms of non-rain days at the LAX meteorological station. The number of allowable exceedances during winter dry weather is based on the lesser of (1) the reference system or (2) existing levels of exceedance based on historical shoreline data.
^Dry weather days are defined as those with <0.1 inch of rain and those days not less than 3 days after a rain day. Rain days are defined as those with >=0.1 inch of rain.
* A re-opener is scheduled for two years after the effective date of the TMDL in order to re-evaluate the allowable exceedance days during winter dry weather based on additional monitoring data.

Table 7-4.2b. Santa Monica Bay Beaches Bacteria TMDL Implementation Schedule (Dry Weather): Required Reduction in Number of Days Exceeding Single Sample Bacterial Indicator Targets for Existing Shoreline Monitoring Stations

Compliance Deadline		3 years after effective date	6 years after effective date
Location Name	Subwatershed	Summer Dry Weather (Apr. 1- Oct. 31)	Winter Dry Weather (Nov. 1- Mar. 31)*
City of Los Angeles, Environmental Monitoring Division Sites			
Surfrider Beach (breach point) - daily	Malibu Canyon	48	31
Topanga State Beach	Topanga Canyon	10	8
Pulga Canyon storm drain - 50 yards east (Will Rogers)	Pulga Canyon	4	6
Santa Monica Canyon, Will Rogers State Beach	Santa Monica Canyon	36	7
Santa Monica Municipal Pier - 50 yards southeast (Santa Monica)	Santa Monica	54	22
Santa Monica Beach at Pico/Kenter storm drain (Santa Monica)	Santa Monica	15	20
Ashland Av. storm drain - 50 yards south (Venice)	Santa Monica	16	6
Venice City Beach at Windward Av. - 50 yards north	Ballona	3	0
Ballona Creek entrance - 50 yards south (Dockweiler)	Dockweiler	7	3
Dockweiler State Beach at Culver Bl.	Dockweiler	6	1
Imperial Highway storm drain - 50 yards north (Dockweiler)	Dockweiler	7	0
Manhattan State Beach at 40th Street	Hermosa	1	0
Manhattan Beach Pier - 50 yards south	Hermosa	1	0
Hermosa Beach Pier - 50 yards south	Hermosa	2	0
Redondo Municipal Pier - 50 yards south	Redondo	16	9
Redondo State Beach at Avenue I	Redondo	2	0
Malaga Cove, Palos Verdes Estates - daily	Palos Verdes	1	0
Los Angeles County Department of Health Services Sites			
Leo Carillo Beach (REFERENCE BEACH)	Arroyo Sequit Canyon	0	0
Nicholas Beach	Nicholas Canyon	7	0
Broad Beach	Trancas Canyon	3	3
Trancas Beach entrance	Trancas Canyon	5	0
Westward Beach, SE end	Zuma Canyon	8	0
Paradise Cove	Ramirez Canyon	16	9
26610 Latigo Shore Drive	Latigo Canyon	11	13
Corral Beach	Latigo Canyon	3	5
Puerco Beach	Corral Canyon	0	7
Malibu Point, Malibu Colony Dr.	Malibu Canyon	23	6
Surfrider Beach, Malibu, 50 yds.	Malibu Canyon	58	25
Malibu Pier	Malibu Canyon	42	14
Las Flores Beach	Las Flores Canyon	18	7
Big Rock Beach	Piedra Gorda Canyon	32	20
17200 Pacific Coast Hwy.	Santa Ynez Canyon	3	9
Bel Air Bay Club, 16801 Pacific	Santa Ynez Canyon	14	5
Temescal Storm Drain	Pulga Canyon	17	0
San Vicente Blvd. extended	Santa Monica	7	0
Montana Ave. Storm Drain	Santa Monica	7	0
Wilshire Blvd., Santa Monica	Santa Monica	15	4
Strand Street extended	Santa Monica	8	6
Ashland Storm Drain	Santa Monica	24	2
Venice City Beach at Brooks Av.	Ballona	3	10
Venice Pier, Venice	Ballona	4	0
Topsail Street extended	Ballona	11	0
World Way extended	Dockweiler	5	1
Opposite Hyperion Plant, 1 mile	Dockweiler	3	4
Grand Avenue extended	Dockweiler	8	5
26th Street extended	Hermosa	5	0
Herondo Street extended	Hermosa	5	1
Topaz Street extended	Redondo	8	12
County Sanitation Districts of Los Angeles County Sites			
Long Point	Palos Verdes	1	0
Abalone Cove	Palos Verdes	1	0
Portuguese Bend Cove	Palos Verdes	1	0
Royal Palms	Palos Verdes	1	0
Wilder Annex	Palos Verdes	1	0
Cabrillo Beach, oceanside	Palos Verdes	1	0
Malaga Cove	Palos Verdes	2	0
Bluff Cove	Palos Verdes	0	0

* A re-opener is scheduled for two years after the effective date of the TMDL in order to re-evaluate the allowable exceedance days and necessary reductions during winter dry weather based on additional monitoring data.

** Required reductions are based on the assumption of daily sampling.

	targets must be achieved. Within 6 years of the effective date, winter dry-weather allowable exceedance days and the rolling 30-day geometric mean targets must be achieved.
Margin of Safety	WLAs of zero days of exceedance during the summer include an implicit margin of safety. The WLAs of a maximum of three days of exceedance during winter dry weather include an implicit margin of safety because the maximum allowable days of exceedance are based on samples collected 50 yards downcurrent of the freshwater outlet at the reference beach. Findings from a bacterial dispersion study of selected freshwater outlets show that there is typically significant dilution between the freshwater outlet, the wave wash (the compliance point), and a point 50 yards downcurrent.
Seasonal Variations and Critical Conditions	Seasonal variations are addressed by developing separate waste load allocations for two time periods (summer dry weather and winter dry weather) based on public health concerns and observed natural background levels of exceedance of bacterial indicators. The critical period for this dry weather bacteria TMDL is during winter months, when historic shoreline monitoring data for the reference beach indicate that the single sample bacteria objectives are exceeded on average 3% of the dry weather days sampled.

Note: The complete staff report for the TMDL is available for review upon request.

Table 7-4.3. Santa Monica Bay Beaches Bacteria TMDL (Dry Weather Only): Significant Dates

Date	Action
120 days after the effective date of the TMDL	Responsible jurisdictions and responsible agencies must submit coordinated shoreline monitoring plan(s), including a list of new sites or sites relocated to the wave wash at which time responsible jurisdictions and responsible agencies will select between daily and weekly shoreline sampling.
120 days after the effective date of the TMDL	Responsible jurisdictions and responsible agencies must identify and provide documentation on 342 potential discharges to Santa Monica Bay beaches listed in Appendix C of the TMDL Staff Report dated January 11, 2002. Documentation must include a Report of Waste Discharge (ROWD) where necessary. Responsible jurisdictions and responsible agencies must identify and provide documentation on potential discharges to the Area of Special Biological Significance (ASBS) in northern Santa Monica Bay from Latigo Point to the County line. Cessation of the discharges into the ASBS shall be required in conformance with the California Ocean Plan.
2 years after effective date of TMDL	Re-open TMDL to re-evaluate allowable winter dry weather exceedance days based on additional data on bacterial indicator densities in the wave wash, a re-evaluation of the reference system selected to set allowable exceedance levels, and a re-evaluation of the reference year used in the calculation of allowable exceedance days.
3 years after effective date of the TMDL	Achieve compliance with allowable exceedance days as set forth in Table 7-4.2a and rolling 30-day geometric mean targets during summer dry weather (April 1 to October 31).
6 years after effective date of the TMDL	Achieve compliance with allowable exceedance days as set forth in Table 7-4.2a and rolling 30-day geometric mean targets during winter dry weather (November 1 to March 31).

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. 2002-022
December 12, 2002

Amendment to the Water Quality Control Plan (Basin Plan) for the Los Angeles Region to Incorporate Implementation Provisions for the Region's Bacteria Objectives and to Incorporate a Wet-Weather Total Maximum Daily Load for Bacteria at Santa Monica Bay Beaches

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angeles Region (Regional Board) to develop water quality standards which include beneficial use designations and criteria to protect beneficial uses for each water body found within its region.

2. The Regional Board carries out its CWA responsibilities through California's Porter-Cologne Water Quality Control Act and establishes water quality objectives designed to protect beneficial uses contained in the Water Quality Control Plan for the Los Angeles Region (Basin Plan).

3. Section 303(d) of the CWA requires states to identify and to prepare a list of water bodies that do not meet water quality standards and then to establish load and waste load allocations, or a total maximum daily load (TMDL), for each water body that will ensure attainment of water quality standards and then to incorporate those allocations into their water quality control plans.

4. Many of the beaches along Santa Monica Bay were listed on California's 1998 section 303(d) list, due to impairments for coliform or for beach closures associated with bacteria generally. The beaches appeared on the 303(d) list because the elevated bacteria and beach closures prevented full support of the beaches' designated use for water contact recreation (REC-1).

5. A consent decree between the U.S. Environmental Protection Agency (USEPA), Heal the Bay, Inc. and BayKeeper, Inc. was approved on March 22, 1999. This court order directs the USEPA to complete TMDLs for all the Los Angeles Region's impaired waters within 13 years. A schedule was established in the consent decree for the completion of 29 TMDLs within 7 years, including completion of a TMDL to reduce bacteria at Santa Monica Bay beaches by March 2002. The remaining TMDLs will be scheduled by Regional Board staff within the 13-year period.

6. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d) of the CWA, as well as in USEPA guidance documents (e.g., USEPA, 1991). A TMDL is defined as "the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR 130.2). Regulations further stipulate that TMDLs must be set at "levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations

and water quality" (40 CFR 130.7(c)(1)). The provisions in 40 CFR 130.7 also state that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters.

7. Upon establishment of TMDLs by the State or USEPA, the State is required to incorporate the TMDLs along with appropriate implementation measures into the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). The Basin Plan and applicable statewide plans serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Regional Board.

8. Santa Monica Bay is located in Los Angeles County, California. The proposed TMDL addresses documented bacteriological water quality impairments at 44 beaches from the Los Angeles/Ventura County line, to the northwest, to Outer Cabrillo Beach, just south of the Palos Verdes Peninsula.

9. The Regional Board is establishing the above-mentioned TMDL to preserve and enhance the water quality at Santa Monica Bay beaches and for the benefit of the 55 million beachgoers, on average, that visit these beaches each year. At stake is the health of swimmers and surfers and associated health costs as well as sizeable revenues to the local and state economy. Estimates are that visitors to Santa Monica Bay beaches spend approximately $1.7 billion annually.

10. The Regional Board's goal in establishing the above-mentioned TMDL is to reduce the risk of illness associated with swimming in marine waters contaminated with bacteria. Local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects, such as gastroenteritis and upper respiratory illness, and recreational water quality, as measured by bacteria indicator densities. The water quality objectives on which the TMDL numeric targets are based will ensure that the risk of illness to the public from swimming at Santa Monica Bay beaches generally will be no greater than 19 illnesses per 1,000 swimmers, which is defined by the US EPA as an "acceptable health risk"in marine recreational waters.

11. Interested persons and the public have had reasonable opportunity to participate in review of the amendment to the Basin Plan. Efforts to solicit public review and comment include staff presentations to the Santa Monica Bay Restoration Project's Bay Watershed Council and Technical Advisory Committee between May 1999 and October 2001 and creation of a Steering Committee in July 1999 to provide input on scientific and technical components of the TMDL with participation by the Southern California Coastal Water Research Project, City of Los Angeles, County of Los Angeles Department of Public Works, County Sanitation Districts of Los Angeles County, Heal the Bay, and Santa Monica Bay Restoration Project.

12. A first draft of the TMDL for bacteria at Santa Monica Bay beaches was released for public comment on November 9, 2001; an interim draft TMDL covering wet weather only was released on June 21, 2002, for discussion at a public workshop; and a public workshop on the draft Wet-Weather TMDL was held on June 27, 2002 at a regularly scheduled Regional Board meeting.

13. A final draft of the Wet-Weather TMDL along with a Notice of Hearing and Notice of Filing were published and circulated 45 days preceding Board action; Regional Board staff responded to oral and written comments received from the public; and the Regional Board

held a public hearing on September 26, 2002 to consider adoption of the Wet-Weather TMDL.

14. The Regional Board continued the item from the September 26, 2002 Board meeting to the December 12, 2002 Board meeting to give staff time to make revisions based on public comments and Board discussion at the September 26, 2002 Board meeting. Specifically, the Board wanted an implementation program that was reasonable and as short as practicable given the testimony on impairments to the REC-1 beneficial use.

15. The Regional Board recognizes that there are two broad approaches to implementing the TMDL. One approach is an integrated water resources approach that takes a holistic view of regional water resources management by integrating planning for future wastewater, storm water, recycled water, and potable water needs and systems; focuses on beneficial re-use of storm water, including groundwater infiltration, at multiple points throughout a watershed; and addresses multiple pollutants for which Santa Monica Bay or its watershed are listed on the CWA section 303(d) List as impaired. The other approach is a non-integrated water resources approach.

    Some responsible jurisdictions and agencies have indicated a preference to take an integrated water resources approach to realize the benefits of re-using storm water to preserve local groundwater resources and to reduce reliance on imported water. The Regional Board recognizes that an integrated water resources approach not only provides water quality benefits to the people of the Los Angeles Region, but also recognizes that the responsible jurisdictions implementing this TMDL can serve a variety of public purposes by adopting an integrated water resources approach. An integrated water resources approach will address multiple pollutants, and as a result, responsible jurisdictions can recognize cost-savings because capital expenses for the integrated approach will implement several TMDLs that address pollutants in storm water. In addition, jurisdictions serve multiple roles for their citizenry, and an integrated approach allows for the incorporation and enhancement of other public goals such as water supply, recycling and storage; environmental justice; parks, greenways and open space; and active and passive recreational and environmental education opportunities.

    The Regional Board acknowledges that a longer timeframe is reasonable for an integrated water resources approach because it requires more complicated planning and implementation such as identifying markets for the water and efficiently siting storage and transmission infrastructure within the watershed(s) to realize the multiple benefits of such an approach.

16. Therefore, after considering testimony, the Regional Board directed staff to adjust the implementation provisions of the TMDL to allow for a longer implementation schedule (up to 18 years) only when the responsible jurisdictions and agencies clearly demonstrate their intention to undertake an integrated water resources approach and justify the need for a longer implementation schedule. In contrast, testimony indicated that a shorter implementation schedule (up to 10 years) is reasonable and practicable for non-integrated approaches because the level of planning is not as complicated.

17. A revised draft of the Basin Plan amendment and Tentative Resolution were circulated 45 days preceding Board action. Regional Board staff responded to oral and written comments received from the public on the revised draft. The Regional Board held a second public hearing on December 12, 2002 to consider adoption of the Wet-Weather TMDL.

18. On October 25, 2001, the Regional Board adopted Resolution 2001-018 establishing revised bacteriological water quality objectives for the Water Contact Recreation (REC-1) beneficial use, and the TMDL is intended to accompany and to implement the revised water quality objectives. The State Water Resources Control Board approved the Regional Board's Basin Plan amendment on July 18, 2002 in State Board Resolution 2002-0142, the Office of Administrative Law approved it on September 19, 2002 in OAL File No. 02-0807-01-S, and the US EPA approved it on September 25, 2002.

19. Under certain circumstances and through the TMDL development process, the Regional Board proposes to implement the aforementioned revised bacteria objectives using either a 'reference system/anti-degradation approach' or a 'natural sources exclusion approach.' As required by the CWA and Porter-Cologne Water Quality Control Act, the Basin Plan includes beneficial uses of waters, water quality objectives to protect those uses, an anti-degradation policy, collectively referred to as water quality standards, and other plans and policies necessary to implement water quality standards. This TMDL and its associated waste load allocations, which will be incorporated into relevant permits, are the vehicles for implementation of the bacteria standards as required under Water Code section 13242.

20. Both the 'reference system/anti-degradation approach' and the 'natural sources exclusion approach' recognize that there are natural sources of bacteria that may cause or contribute to exceedances of the single sample objectives.

21. The Regional Board's intent in implementing the bacteria objectives using a 'reference system/anti-degradation approach' is to ensure that bacteriological water quality is at least as good as that of a reference site and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of a reference site. The Regional Board's intent in implementing the bacteria objectives using a 'natural sources exclusion approach' is to ensure that all anthropogenic sources of bacteria are controlled such that they do not cause an exceedance of the single sample objectives. These approaches are consistent with state and federal anti-degradation policies (State Board Resolution No. 68-16 and 40 C.F.R. 131.12), while acknowledging that it is not the intent of the Regional Board to require treatment or diversion of natural coastal creeks or to require treatment of natural sources of bacteria from undeveloped areas. While treatment and diversion of natural sources may fully address the impairment of the water contact recreation beneficial use, such an approach may adversely affect valuable aquatic life and wildlife beneficial uses in the Region.

22. For the Wet-Weather and Dry-Weather Bacteria TMDLs at Santa Monica Bay beaches, Leo Carrillo Beach and its associated drainage area, Arroyo Sequit Canyon, were selected as the local reference system until other reference sites or approaches are evaluated and the necessary data collected to support the use of alternative reference sites or approaches when the TMDL is revised four years after the effective date. Leo Carrillo Beach was selected as the interim reference site because it best met the three criteria for selection of a reference system. Specifically, its drainage is the most undeveloped subwatershed in the larger Santa Monica Bay watershed, the subwatershed has a freshwater outlet (i.e., creek) to the beach, and adequate historical shoreline monitoring data were available. It is the intent of the Regional Board to re-evaluate the use of Leo Carrillo Beach due to potential problems arising from the heavy recreational use of the beach and the close proximity of two campgrounds.

23. Northern Bay beach monitoring sites are fewer in number and provide less comprehensive data than the extensive shoreline monitoring network elsewhere in Santa Monica Bay.

24. The numeric targets in this TMDL are not water quality objectives and do not create new bases for enforcement against dischargers apart from the water quality objectives they translate. The targets merely establish the bases through which load allocations and wasteload allocations (WLAs) are calculated. WLAs are only enforced for a dicharger's own discharges, and then only in the context of it National Pollutant Discharge Elimination System (NPDES) permit, which must be consistent with the assumptions and requirements of the WLA. The Regional Board will develop permit requirements through a subsequent permit action that will allow all interested persons, including but not limited to municipal storm water dischargers, to provide comments on how the waste load allocations will be translated into permit requirements.

25. The Regional Board has the authority to authorize compliance schedules through the basin planning process. In this Basin Plan amendment, the Regional Board establishes a schedule for implementation that affords the responsible jurisdictions and agencies up to ten or eighteen years, depending on the implementation approaches pursued, to implement this Wet-Weather Bacteria TMDL.

26. Previously, the Regional Board adopted a Dry-Weather Bacteria TMDL for the Santa Monica Bay Beaches. The Dry-Weather TMDL includes implementation provisions contained in Table 7-4.3 of the Basin Plan, including a provision to reconsider two years after the effective date the Dry-Weather TMDL and specifically the reference beach(es) used. Because that effort overlaps with reconsideration of the reference beach(es) anticipated by this Wet-Weather TMDL, the Regional Board proposes to coordinate the reconsiderations of the reference beach approach to assure efficiency and consistency in implementing the two Santa Monica Beaches TMDLs.

27. The basin planning process has been certified as functionally equivalent to the California Environmental Quality Act requirements for preparing environmental documents (Public Resources Code, Section 21000 et seq.) and as such, the required environmental documentation and CEQA environmental checklist have been prepared.

28. The proposed amendment results in no potential for adverse effect (de minimis finding), either individually or cumulatively, on wildlife.

29. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subdivision (b).

30. The Basin Plan amendment incorporating a TMDL for bacteria at Santa Monica Bay beaches must be submitted for review and approval by the State Water Resources Control Board (State Board), the State Office of Administrative Law (OAL), and the USEPA. The Basin Plan amendment will become effective upon approval by OAL and USEPA. A Notice of Decision will be filed.

THEREFORE, be it resolved that pursuant to Section 13240 and 13242 of the Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. Pursuant to sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapters 3 and 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment A hereto, to incorporate the elements of the Santa Monica

Bay Beaches Bacteria TMDL for wet weather and to implement the water quality objectives for bacteria set to protect the water contact recreation beneficial use.

2. Pursuant to sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapter 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment B hereto, to amend Table 7-4.3 of the Santa Monica Bay Beaches Bacteria TMDL for dry weather to change the date for revision of the TMDL from two years after the effective date to four years after the effective date [of the Wet-Weather TMDL] to achieve consistency in scheduling between the Dry-Weather and Wet-Weather TMDLs.

3. The Executive Officer is directed to exercise authority under Water Code section 13267, or other applicable law, to require additional monitoring data in the northern Bay beach regions to ensure that wet weather bacteria exposure is adequately quantified before the TMDL is reconsidered in four years.

4. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

5. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it to OAL and the USEPA.

6. If during its approval process the State Board or OAL determines that minor, non-substantive corrections to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

7. The Executive Officer is authorized to sign a Certificate of Fee Exemption.

I, Dennis A. Dickerson, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on December 12, 2002.

ORIGINAL SIGNED BY
Dennis A. Dickerson
Executive Officer

Attachment A to Resolution No. 2002-022

Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate Implementation Provisions for the Region's Bacteria Objectives and to incorporate the Santa Monica Bay Beaches Wet-Weather Bacteria TMDL

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on December 12, 2002.

Amendments:

List of Figures, Tables and Inserts
Add under Chapter 7, Section 7-4 (Santa Monica Bay Beaches Bacteria TMDL):
Tables

7-4.4. Santa Monica Bay Beaches Bacteria TMDL (Wet Weather Only): Elements
7-4.5. Santa Monica Bay Beaches Bacteria TMDL (Wet Weather Only): Final Allowable Exceedance Days by Beach Location
7-4.6. Santa Monica Bay Beaches Bacteria TMDL (Wet Weather Only): Interim Compliance Targets by Jurisdictional Groups
7-4.7. Santa Monica Bay Beaches Bacteria TMDL (Wet Weather Only): Significant Dates

Chapter 3. Water Quality Objectives, "Bacteria, Coliform"

Add under "Implementation Provisions for Water Contact Recreation Bacteria Objectives"

The single sample bacteriological objectives shall be strictly applied except when provided for in a Total Maximum Daily Load (TMDL). In all circumstances, including in the context of a TMDL, the geometric mean objectives shall be strictly applied. In the context of a TMDL, the Regional Board may implement the single sample objectives in fresh and marine waters by using a 'reference system/antidegradation ap□roach' or 'natural sources exclusion approach' as discussed below. A reference system is defined as an area and associated monitoring point that is not impacted by human activities that potentially affect bacteria densities in the receiving water body.

These approaches recognize that there are natural sources of bacteria, which may cause or contribute to exceedances of the single sample objectives for bacterial indicators. They also acknowledge that it is not the intent of the Regional Board to require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas. Such requirements, if imposed by the Regional Board, could adversely affect valuable aquatic life and wildlife beneficial uses supported by natural water bodies in the Region.

Under the reference system/antidegradation implementation procedure, a certain frequency of exceedance of the single sample objectives above shall be permitted on the basis of the observed exceedance frequency in the selected reference system or the targeted water body, whichever is less. The reference system/anti-degradation approach ensures that bacteriological water quality is at least as good as that of a reference system and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of the selected reference system.

Under the natural sources exclusion implementation procedure, after all anthropogenic sources of bacteria have been controlled such that they do not cause or contribute to an exceedance of the single sample objectives and natural sources have been identified and quantified, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific water body. The residual exceedance frequency shall define the background level of exceedance due to natural sources. The 'natural sources exclusion' approach may be used if an appropriate reference system cannot be identified due to unique characteristics of the target water body. These approaches are

consistent with the State Antidegradation Policy (State Board Resolution No. 68-16) and with federal antidegradation requirements (40 CFR 131.12).

The appropriateness of these approaches and the specific exceedance frequencies to be permitted under each will be evaluated within the context of TMDL development for a specific water body, at which time the Regional Board may select one of these approaches, if appropriate.

These implementation procedures may only be implemented within the context of a TMDL addressing municipal storm water, including the municipal storm water requirements of the Statewide Permit for Storm Water Discharges from the State of California Department of Transportation (Caltrans), and non-point sources discharges. These implementation provisions do not apply to NPDES discharges other than MS4 discharges.[1]

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries, Section 7-4 (Santa Monica Bay Beaches Bacteria TMDL)

Santa Monica Bay Beaches Bacteria TMDL (Wet Weather Only)*

This TMDL was adopted by the Regional Water Quality Control Board on December 12, 2002.

This TMDL was approved by:

The State Water Resources Control Board on [Insert Date].
The Office of Administrative Law on [Insert Date].
The U.S. Environmental Protection Agency on [Insert Date].

The following table summarizes the key elements of this TMDL.

[1] Municipal storm water discharges in the Los Angeles Region are those with permits under the Municipal Separate Storm Sewer System (MS4) NPDES Program. For example, the MS4 permits at the time of this amendment are the Los Angeles County Municipal Storm Water NPDES Permit, Ventura County Municipal Storm Water NPDES Permit, City of Long Beach Municipal Storm Water NPDES Permit, and elements of the statewide storm water permit for the California Department of Transportation (Caltrans).

Attachment A to Resolution No. 2002-022

Table 7-4.4. Santa Monica Bay Beaches Bacteria TMDL (Wet Weather Only): Elements

Element	Key Findings and Regulatory Provisions
Problem Statement	Elevated bacterial indicator densities are causing impairment of the water contact recreation (REC-1) beneficial use at many Santa Monica Bay (SMB) beaches. Swimming in waters with elevated bacterial indicator densities has long been associated with adverse health effects. Specifically, local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects and recreational water quality, as measured by bacterial indicator densities.
Numeric Target *(Interpretation of the numeric water quality objective, used to calculate the waste load allocations)*	The TMDL has a multi-part numeric target based on the bacteriological water quality objectives for marine water to protect the water contact recreation (REC-1) use. These targets are the most appropriate indicators of public health risk in recreational waters. These bacteriological objectives are set forth in Chapter 3 of the Basin Plan, as amended by the Regional Board on October 25, 2001. The objectives are based on four bacterial indicators and include both geometric mean limits and single sample limits. The Basin Plan objectives that serve as numeric targets for this TMDL are: 1. Rolling 30-day Geometric Mean Limits a. Total coliform density shall not exceed 1,000/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. c. Enterococcus density shall not exceed 35/100 ml. 2. Single Sample Limits a. Total coliform density shall not exceed 10,000/100 ml. b. Fecal coliform density shall not exceed 400/100 ml. c. Enterococcus density shall not exceed 104/100 ml. d. Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1. These objectives are generally based on an acceptable health risk for marine recreational waters of 19 illnesses per 1,000 exposed individuals as set by the US EPA (US EPA, 1986). The targets apply throughout the year. The final compliance point for the targets is the wave wash[2] where there is a freshwater outlet (i.e., publicly-owned storm drain or natural creek) to the beach, or at ankle depth at beaches without a freshwater outlet. Implementation of the above bacteria objectives and the associated TMDL numeric targets is achieved using a 'reference system/anti-degradation approach' rather than the alternative 'natural sources exclusion approach' or strict application of the single sample objectives. As required by the CWA and Porter-Cologne Water Quality Control Act, Basin Plans include beneficial uses of waters, water quality objectives to protect those uses, an anti-degradation policy, collectively referred to as water quality standards, and other plans and policies necessary to implement water quality standards. This TMDL and its associated waste load allocations, which shall be incorporated into relevant permits, are the vehicles for implementation of the Region's

[2] The wave wash is defined as the point at which the storm drain or creek empties and the effluent from the storm drain initially mixes with the receiving ocean water.

Element	Key Findings and Regulatory Provisions
	standards. The 'reference system/anti-degradation approach' means that on the basis of historical exceedance levels at existing shoreline monitoring locations, including a local reference beach within Santa Monica Bay, a certain number of daily exceedances of the single sample bacteria objectives are permitted. The allowable number of exceedance days is set such that (1) bacteriological water quality at any site is at least as good as at a designated reference site within the watershed and (2) there is no degradation of existing shoreline bacteriological water quality. This approach recognizes that there are natural sources of bacteria that may cause or contribute to exceedances of the single sample objectives and that it is not the intent of the Regional Board to require treatment or diversion of natural coastal creeks or to require treatment of natural sources of bacteria from undeveloped areas. The geometric mean targets may not be exceeded at any time. The rolling 30-day geometric means will be calculated on each day. If weekly sampling is conducted, the weekly sample result will be assigned to the remaining days of the week in order to calculate the daily rolling 30-day geometric mean. For the single sample targets, each existing shoreline monitoring site is assigned an allowable number of exceedance days during wet weather, defined as days with 0.1 inch of rain or greater and the three days following the rain event. (A separate amendment incorporating the Santa Monica Bay Beaches Dry-Weather Bacteria TMDL addressed the allowable number of summer and winter dry-weather exceedance days.)
Source Analysis	With the exception of isolated sewage spills, storm water runoff conveyed by storm drains and creeks is the primary source of elevated bacterial indicator densities to SMB beaches during wet weather. Because the bacterial indicators used as targets in the TMDL are not specific to human sewage, storm water runoff from undeveloped areas may also be a source of elevated bacterial indicator densities. For example, storm water runoff from natural areas may convey fecal matter from wildlife and birds or bacteria from soil. This is supported by the finding that, at the reference beach, the probability of exceedance of the single sample targets during wet weather is 0.22.
Loading Capacity	Studies show that bacterial degradation and dilution during transport from the watershed to the beach do not significantly affect bacterial indicator densities at SMB beaches. Therefore, the loading capacity is defined in terms of bacterial indicator densities, which is the most appropriate for addressing public health risk, and is equivalent to the numeric targets, listed above. As the numeric targets must be met in the wave wash and throughout the day, no degradation allowance is provided.
Waste Load Allocations (for point sources)	Waste load allocations are expressed as the number of sample days at a shoreline monitoring site that may exceed the single sample targets identified under "Numeric Target." Waste load allocations are expressed as allowable exceedance days because the bacterial density and frequency of single sample exceedances are the most relevant to public health protection.

Element	Key Findings and Regulatory Provisions
	For each shoreline monitoring site and corresponding subwatershed, an allowable number of exceedance days is set for wet weather. The allowable number of exceedance days for a shoreline monitoring site for each time period is based on the lesser of two criteria (1) exceedance days in the designated reference system and (2) exceedance days based on historical bacteriological data at the monitoring site. This ensures that shoreline bacteriological water quality is at least as good as that of a largely undeveloped system and that there is no degradation of existing shoreline bacteriological water quality. All responsible jurisdictions and responsible agencies[3] within a subwatershed are jointly responsible for complying with the allowable number of exceedance days for each associated shoreline monitoring site identified in Table 7-4.5 below. The three Publicly Owned Treatment Works (POTWs), the City of Los Angeles' Hyperion Wastewater Treatment Plant, Los Angeles County Sanitation Districts' Joint Water Pollution Control Plant, and the Las Virgenes Municipal Water Districts' Tapia Wastewater Reclamation Facility, discharging to Santa Monica Bay are each given individual WLAs of zero (0) days of exceedance during wet weather.

[3] For the purposes of this TMDL, "responsible jurisdictions and responsible agencies" are defined as: (1) local agencies that are responsible for discharges from a publicly owned treatment works to the Santa Monica Bay watershed or directly to the Bay, (2) local agencies that are permittees or co-permittees on a municipal storm water permit, (3) local or state agencies that have jurisdiction over a beach adjacent to Santa Monica Bay, and (4) the California Department of Transportation pursuant to its storm water permit.

Element	Key Findings and Regulatory Provisions
***Load Allocations** (for nonpoint sources)*	Because all storm water runoff to SMB beaches is regulated as a point source, load allocations of zero days of exceedance are set in this TMDL. If a nonpoint source is directly impacting shoreline bacteriological quality and causing an exceedance of the numeric target(s), the permittee(s) under the Municipal Storm Water NPDES Permits are not responsible through these permits. However, the jurisdiction or agency adjacent to the shoreline monitoring location may have further obligations as described under "Compliance Monitoring" below.
Implementation	The regulatory mechanisms used to implement the TMDL will include primarily the Los Angeles County Municipal Storm Water NPDES Permit (MS4 Permit), the Caltrans Storm Water Permit, the three NPDES permits for the POTWs, the authority contained in sections 13267 and 13263 of the Water Code, and regulations to be adopted pursuant to section 13291 of the Water Code. Each NPDES permit assigned a waste load allocation shall be reopened or amended at reissuance, in accordance with applicable laws, to incorporate the applicable waste load allocation(s) as a permit requirement. The implementation schedule will be determined on the basis of the implementation plan(s), which must be submitted to the Regional Board by responsible jurisdictions and agencies within two years of the effective date of the TMDL (see Table 7-4.7). After considering the implementation plan(s), the Regional Board shall amend the TMDL at a public hearing and, in doing so, will adopt an individual implementation schedule for each jurisdictional group (described in paragraph 3 below) that is as short as possible taking into account the implementation approach being undertaken. Responsible jurisdictions and agencies must clearly demonstrate in the above-mentioned plan whether they intend to pursue an integrated water resources approach.[4] If an integrated water resources approach is pursued, responsible jurisdictions and agencies may be allotted up to an 18-year implementation timeframe, based on a clear demonstration of the need for a longer schedule in the implementation plan, in recognition of the additional planning and time needed to achieve the multiple benefits of this approach. Otherwise, at most a 10-year implementation timeframe will be allotted, depending upon a clear demonstration of the time needed in the implementation plan. The subwatersheds associated with each beach monitoring location may

[4] An integrated water resources approach is one that takes a holistic view of regional water resources management by integrating planning for future wastewater, storm water, recycled water, and potable water needs and systems; focuses on beneficial re-use of storm water, including groundwater infiltration, at multiple points throughout a watershed; and addresses multiple pollutants for which Santa Monica Bay or its watershed are listed on the CWA section 303(d) List as impaired. Because an integrated water resources approach will address multiple pollutants, responsible jurisdictions can recognize cost-savings because capital expenses for the integrated approach will implement several TMDLs that address pollutants in storm water. An integrated water resources approach shall not only provide water quality benefits to the people of the Los Angeles Region, but it is also anticipated that an integrated approach will incorporate and enhance other public goals. These may include, but are not limited to, water supply, recycling and storage; environmental justice; parks, greenways and open space; and active and passive recreational and environmental education opportunities.

Element	Key Findings and Regulatory Provisions
	include multiple responsible jurisdictions and responsible agencies. Therefore, a "primary jurisdiction," defined as the jurisdiction comprising greater than fifty percent of the subwatershed land area, is identified for each subwatershed (see Table 7-4.6).[5] Seven primary jurisdictions are identified within the Santa Monica Bay watershed, each with a group of associated subwatersheds and beach monitoring locations. These are identified as "jurisdictional groups" (see Table 7-4.6). The primary jurisdiction of each "jurisdictional group" shall be responsible for submitting the implementation plan described above, which will determine the implementation timeframe for the subwatershed. A jurisdictional group may change its primary jurisdiction by submitting a joint, written request, submitted by the current primary jurisdiction and the proposed primary jurisdiction, to the Executive Officer requesting a reassignment of primary responsibility. Two jurisdictional groups may also choose to change the assignment of monitoring locations between the two groups by submitting a joint, written request, submitted by the current primary jurisdiction and the proposed primary jurisdiction, to the Executive Officer requesting a reassignment of the monitoring location. If an integrated water resources approach is pursued, the jurisdictional group(s) must achieve a 10% cumulative percentage reduction from the total exceedance-day reduction required for the group of beach monitoring locations within 6 years, a 25% reduction within 10 years, and a 50% reduction within 15 years of the effective date of the TMDL. These interim milestones for the jurisdictional group(s) will be re-evaluated, considering planning, engineering and construction tasks, based on the written implementation plan submitted to the Regional Board two years after the effective date of the TMDL (see Table 7-4.7). If an integrated water resources approach is not pursued, the jurisdictional group(s) must achieve a 25% cumulative percentage reduction from the total exceedance-day reduction required for the group of beach monitoring locations within 6 years, and a 50% reduction within 8 years of the effective date of the TMDL (see Table 7-4.7). For those beach monitoring locations subject to the antidegradation provision, there shall be no increase in exceedance days during the implementation period above that estimated for the beach monitoring location in the critical year as identified in Table 7-4.5. The final implementation targets in terms of allowable wet-weather exceedance days must be achieved at each individual beach location no later than 18 years after the TMDL's effective date if an integrated water resources approach is pursued, or no later than 10 years after the TMDL's effective date if an integrated water resources approach is not pursued. In addition, the geometric mean targets must be achieved for each individual beach location no later than 18 years or 10 years after the effective date, respectively, depending on whether a integrated

[5] Primary jurisdictions are not defined for the Ballona Creek subwatershed or the Malibu Creek subwatershed, since separate bacteria TMDLs are being developed for these subwatersheds.

Element	Key Findings and Regulatory Provisions
	water resources approach is pursued or not.

Element	Key Findings and Regulatory Provisions
Margin of Safety	The TMDL is set at levels that are exactly equivalent to the applicable water quality standards along with the proposed reference system/antidegradation implementation procedure. An implicit margin of safety is included in the supporting water quality model by assuming no dilution between the storm drain and the wave wash, the point of compliance. This is a conservative assumption since studies have shown that there is a high degree of variability in the amount of dilution between the storm drain and wave wash temporally, spatially and among indicators, ranging from 100% to 0%.
Seasonal Variations and Critical Conditions	Seasonal variations are addressed by developing separate waste load allocations for three time periods (wet weather, summer dry weather and winter dry weather) based on public health concerns and observed natural background levels of exceedance of bacterial indicators. (The two dry-weather periods are addressed in the Santa Monica Bay Beaches Dry-Weather Bacteria TMDL.) The critical condition for this bacteria TMDL is wet weather generally, when historic shoreline monitoring data for the reference beach indicate that the single sample bacteria objectives are exceeded on 22% of the wet-weather days sampled. To more specifically identify a critical condition within wet weather in order to set the allowable exceedance days shown in Tables 7-4.5 and 7-4.6, the 90th percentile 'storm year'[6] in terms of wet days is used as the reference year. Selecting the 90th percentile year avoids a situation where the reference beach is frequently out of compliance. It is expected that because responsible jurisdictions and agencies will be planning for this 'worst-case' scenario, there will be fewer exceedance days than the maximum allowed in drier years. Conversely, in the 10% of wetter years, it is expected that there may be more than the allowable number of exceedance days.
Compliance Monitoring	Responsible jurisdictions and agencies as defined in Footnote 2 shall conduct daily or systematic weekly sampling in the wave wash at all major drains[7] and creeks or at existing monitoring stations at beaches without storm drains or freshwater outlets to determine compliance.[8] At all locations, samples shall be taken at ankle depth and on an incoming wave. At locations where there is a freshwater outlet, during wet weather, samples should be taken as close as possible to the wave wash, and no further away than 10 meters down current of the storm drain or outlet.[9] At locations where there is a freshwater outlet, samples shall be taken when the freshwater outlet is flowing into the surf zone. If the number of exceedance days is greater than the allowable number of exceedance days for any jurisdictional group at the interim implementation milestones the responsible jurisdictions and agencies

[6] For purposes of this TMDL, a 'storm year' means November 1 to October 31. The 90th percentile storm year was 1993 with 75 wet days at the LAX meteorological station.

[7] Major drains are those that are publicly owned and have measurable flow to the beach during dry weather.

[8] The frequency of sampling (i.e., daily versus weekly) will be at the discretion of the implementing agencies. However, the number of sample days that may exceed the objectives will be scaled accordingly.

[9] Safety considerations during wet weather may preclude taking a sample in the wave wash.

Element	Key Findings and Regulatory Provisions
	shall be considered out-of-compliance with the TMDL. If the number of exceedance days exceeds the allowable number of exceedance days for a target beach at the final implementation deadline, the responsible jurisdictions and agencies within the contributing subwatershed shall be considered out-of-compliance with the TMDL. Responsible jurisdictions or agencies shall not be deemed out of compliance with the TMDL if the investigation described in the paragraph below demonstrates that bacterial sources originating within the jurisdiction of the responsible agency have not caused or contributed to the exceedance. If a single sample shows the discharge or contributing area to be out of compliance, the Regional Board may require, through permit requirements or the authority contained in Water Code section 13267, daily sampling in the wave wash or at the existing open shoreline monitoring location (if it is not already) until all single sample events meet bacteria water quality objectives. Furthermore, if a beach location is out-of-compliance as determined in the previous paragraph, the Regional Board shall require responsible agencies to initiate an investigation, which at a minimum shall include daily sampling in the wave wash or at the existing open shoreline monitoring location until all single sample events meet bacteria water quality objectives. If bacteriological water quality objectives are exceeded in any three weeks of a four-week period when weekly sampling is performed, or, for areas where testing is done more than once a week, 75% of testing days produce an exceedence of bacteria water quality objectives, the responsible agencies shall conduct a source investigation of the subwatershed(s) pursuant to protocols established under Water Code 13178. If a beach location without a freshwater outlet is out-of-compliance or if the outlet is diverted or being treated, the adjacent municipality, County agency(s), or State or federal agency(s) shall be responsible for conducting the investigation and shall submit its findings to the Regional Board to facilitate the Regional Board exercising further authority to regulate the source of the exceedance in conformance with the Porter-Cologne Water Quality Control Act.

Note: The complete staff report for the TMDL is available for review upon request.

Attachment A to Resolution No. 2002-022

Table 7-4.5. Final Allowable Wet-Weather Exceedance Days by Beach Location

Beach Monitoring Location	Estimated no. of wet weather exceedance days in critical year (90th percentile)*	Final allowable no. of wet weather exceedance days (daily sampling)*
DHS 010 - Leo Carrillo Beach, at 35000 PCH	17	17
DHS 009 - Nicholas Beach- 100 feet west of lifeguard tower	14	14
DHS 010a - Broad Beach	15	15
DHS 008 - Trancas Beach entrance, 50 yards east of Trancas Bridge	19	17
DHS 007 - Westward Beach, east of Zuma Creek	17	17
DHS 006 - Paradise Cove, adjacent to west side of Pier	23	17
DHS 005 - Latigo Canyon Creek entrance	33	17
DHS 005a - Corral State Beach	17	17
DHS 001a - Las Flores Beach	29	17
DHS 001 - Big Rock Beach, at 19900 PCH	30	17
DHS 003 - Malibu Point	18	17
DHS 003a - Surfrider Beach (second point)- weekly	45	17
S1 - Surfrider Beach (breach point)- daily	47	17
DHS 002 - Malibu Pier- 50 yards east	45	17
S2 - Topanga State Beach	26	17
DHS 101 - PCH and Sunset Bl.- 400 yards east	25	17
DHS 102 - 16801 Pacific Coast Highway, Bel Air Bay Club (chain fence)	28	17
S3 - Pulga Canyon storm drain- 50 yards east	23	17
DHS 103 - Will Rogers State Beach- Temescal Canyon (25 yrds. so. of drain)	31	17
S4 - Santa Monica Canyon, Will Rogers State Beach	25	17
DHS 104a - Santa Monica Beach at San Vicente Bl.	34	17
DHS 104 - Santa Monica at Montana Av. (25 yrds. so. of drain)	31	17
DHS 105 - Santa Monica at Arizona (In front of the drain)	31	17
S5 - Santa Monica Municipal Pier- 50 yards southeast	35	17
S6 - Santa Monica Beach at Pico/Kenter storm drain	42	17
DHS 106 - Santa Monica Beach at Strand St. (In front of the restrooms)	36	17
DHS 106a - Ashland Av. storm drain- 50 yards north	39	17
S7 - Ashland Av. storm drain- 50 yards south	22	17
DHS 107 - Venice City Beach at Brooks Av. (in front of the drain)	40	17

Attachment A to Resolution No. 2002-022

Beach Monitoring Location	Estimated no. of wet weather exceedance days in critical year (90th percentile)*	Final allowable no. of wet weather exceedance days (daily sampling)*
S8 - Venice City Beach at Windward Av.- 50 yards north	13	13
DHS 108 - Venice Fishing Pier- 50 yards south	17	17
DHS 109 - Venice City Beach at Topsail St.	38	17
S11 - Dockweiler State Beach at Culver Bl.	23	17
DHS 110 - Dockweiler State Beach- south of D&W jetty	30	17
S12 - Imperial HWY storm drain- 50 yards north	17	17
DHS 111 - Hyperion Treatment Plant One Mile Outfall	18	17
DHS 112 - Dockweiler State Beach at Grand Av. (in front of the drain)	25	17
S10 - Ballona Creek entrance- 50 yards south	34	17
S13 - Manhattan State Beach at 40th Street	4	4
S14 - Manhattan Beach Pier- 50 yards south	5	5
DHS 114 - Hermosa City Beach at 26th St.	12	12
S15 - Hermosa Beach Pier- 50 yards south	8	8
DHS 115 - Herondo Street storm drain- (in front of the drain)	19	17
S16 - Redondo Municipal Pier- 50 yards south	14	14
DHS 116 - Redondo State Beach at Topaz St. - north of jetty	19	17
S17 - Redondo State Beach at Avenue I	6	6
S18 - Malaga Cove, Palos Verdes Estates-daily	3	3
LACSDM - Malaga Cove, Palos Verdes Estates-weekly	14	14
LACSDB - Palos Verdes (Bluff) Cove, Palos Verdes Estates	0	0
LACSD1 - Long Point, Rancho Palos Verdes	5	5
LACSD2 - Abalone Cove Shoreline Park	1	1
LACSD3 - Portuguese Bend Cove, Rancho Palos Verdes	2	2
LACSD5 - Royal Palms State Beach	6	6
LACSD6 - Wilder Annex, San Pedro	2	2
LACSD7 - Cabrillo Beach, oceanside	3	3

Notes: * The compliance targets are based on existing shoreline monitoring data and assume daily sampling. If systematic weekly sampling is conducted, the compliance targets will be scaled accordingly. These are the compliance targets until additional shoreline monitoring data are collected prior to revision of the TMDL. Once additional shoreline monitoring data are available, the following will be re-evaluated when the TMDL is revised 1) estimated number of wet-weather exceedance days in the critical year at all beach locations, including the reference system(s) and 2) final allowable wet-weather exceedance days for each beach location.

Table 7-4.6. Interim Compliance Targets by Jurisdictional Group

Jurisdiction Group	Primary Jurisdiction	Additional Responsible Jurisdictions & Agencies	Subwatershed(s)	Monitoring Site(s)***	Interim Compliance Targets as Maximum Allowable Exceedance Days during Wet Weather*,**		
					10% Reduction Milestone	25% Reduction Milestone	50% Reduction Milestone
1	County of Los Angeles	Caltrans Malibu City of Los Angeles (Topanga only) Calabasas (Topanga only)	Arroyo Sequit	DHS 010	221	212	197
			Carbon Canyon	none			
			Corral Canyon	DHS 005a			
			Encinal Canyon	DHS 010a#			
			Escondido Canyon	none			
			Las Flores Canyon	DHS 001a			
			Latigo Canyon	DHS 005			
			Los Alisos Canyon	none			
			Pena Canyon	none			
			Piedra Gorda Canyon	DHS 001			
			Ramirez Canyon	DHS 006			
			Solstice Canyon	none			
			Topanga Canyon	S2			
			Trancas Canyon	DHS 008			
			Tuna Canyon	none			
			Zuma Canyon	DHS 007			
2	City of Los Angeles	Caltrans County of Los Angeles El Segundo (DW only) Manhattan Beach (DW only) Culver City (MDR only) Santa Monica	Castlerock	none	342	324	294
			Dockweiler	S11, DHS 110, S12, DHS 111, DHS 112			
			Marina del Rey	DHS 107, S8#, DHS 108, DHS 109			
			Pulga Canyon	S3, DHS 103			
			Santa Monica Canyon	S4			
			Santa Ynez Canyon	DHS 101, DHS 102			

Attachment A to Resolution No. 2002-022

Jurisdiction Group	Primary Jurisdiction	Additional Responsible Jurisdictions & Agencies	Subwatershed(s)	Monitoring Site(s)***	Interim Compliance Targets as Maximum Allowable Exceedance Days during Wet Weather***		
					10% Reduction Milestone	25% Reduction Milestone	50% Reduction Milestone
3	Santa Monica	Caltrans City of Los Angeles County of Los Angeles	Santa Monica	DHS 104a, DHS 104, DHS 105, S5, S6, DHS 106, DHS 106a, S7	257	237	203
4	Malibu	Caltrans County of Los Angeles	Nicholas Canyon	DHS 009#	14	14	14
5	Manhattan Beach	Caltrans El Segundo Hermosa Beach Redondo Beach	Hermosa	S13#, S14#, DHS 114#, S15#	29	29	29
6	Redondo Beach	Caltrans Hermosa Beach Manhattan Beach Torrance County of Los Angeles	Redondo	DHS 115, S16#, DHS 116, S17#	58	57	56

Jurisdiction Group	Primary Jurisdiction	Additional Responsible Jurisdictions & Agencies	Subwatershed(s)	Monitoring Site(s)***	Interim Compliance Targets as Maximum Allowable Exceedance Days during Wet Weather***		
					10% Reduction Milestone	25% Reduction Milestone	50% Reduction Milestone
7	Rancho Palos Verdes	Caltrans City of Los Angeles Palos Verdes Estates Redondo Beach Rolling Hills Rolling Hills Estates Torrance County of Los Angeles	Palos Verdes Peninsula	S18#, LACSDM#, LACSDB#, LACSD1#, LACSD2#, LACSD3#, LACSD5#, LACSD6#, LACSD7#	36	36	36

Notes: *Interim milestones will be re-calculated during the revision of the TMDL based on shoreline monitoring data collected from the wave wash and a re-evaluation of the most appropriate reference system and reference year. Furthermore, if an integrated water resources approach is pursued, as demonstrated by the implementation plans to be submitted to the Regional Board by the primary jurisdictions within two years of the effective date of the TMDL, the interim milestones will be re-evaluated on the basis of the implementation plan, considering planning, engineering and construction tasks. **Interim milestones for the Malibu and Ballona shoreline monitoring locations will be identified in subsequent bacteria TMDLs to be developed for these two watersheds. ***Monitoring sites are those shoreline locations currently monitored by the City of Los Angeles, County Sanitation Districts of Los Angeles County, and the Los Angeles County Department of Health Services at the time of adoption of this TMDL by the Regional Board. This list does not preclude the establishment of additional monitoring stations. For those subwatersheds without an existing shoreline monitoring site, responsible jurisdictions and agencies must establish a shoreline monitoring site if there is measurable flow from a creek or publicly owned storm drain to the beach during dry weather. # For those beach monitoring locations subject to the antidegradation provision, there shall be no increase in exceedance days during the implementation period above that estimated for the beach monitoring location in the critical year as identified in Table 7-4.5.

Table 7-4.7. Santa Monica Bay Beaches Bacteria TMDL (Wet Weather Only): Significant Dates

Date	Action
120 days after the effective date of the TMDL	Pursuant to a request from the Regional Board, responsible jurisdictions and responsible agencies must submit coordinated shoreline monitoring plan(s) to be approved by the Executive Officer, including a list of new sites* and/or sites relocated to the wave wash at which time responsible jurisdictions and responsible agencies shall select between daily or systematic weekly shoreline sampling.
20 months after the effective date of the TMDL	Responsible jurisdictions and agencies shall provide a draft written report to the Regional Board outlining how each intends to cooperatively (through Jurisdictional Groups) achieve compliance with the TMDL. The report shall include implementation methods, an implementation schedule, and proposed milestones.
Two years after effective date of TMDL	Responsible jurisdictions and agencies shall provide a written report to the Regional Board outlining how each intends to cooperatively (through Jurisdictional Groups) achieve compliance with the TMDL. The report shall include implementation methods, an implementation schedule, and proposed milestones. Under no circumstances shall final compliance dates exceed 10 years for non-integrated approaches or 18 years for integrated water resources approaches. Regional Board staff shall bring to the Regional Board the aforementioned plans as soon as possible for consideration.
4 years after effective date of TMDL	The Regional Board shall reconsider the TMDL to: (1) refine allowable wet weather exceedance days based on additional data on bacterial indicator densities in the wave wash and an evaluation of site-specific variability in exceedance levels, (2) re-evaluate the reference system selected to set allowable exceedance levels, including a reconsideration of whether the allowable number of exceedance days should be adjusted annually dependent on the rainfall conditions and an evaluation of natural variability in exceedance levels in the reference system(s), (3) re-evaluate the reference year used in the calculation of allowable exceedance days, and (4) re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision.

Date	Action
Significant Dates for Responsible Jurisdictions and Agencies *Not* Pursuing an Integrated Water Resources Approach	
6 years after effective date of the TMDL	Each defined jurisdictional group must achieve a 25% cumulative percentage reduction from the total exceedance-day reductions required for that jurisdictional group as identified in Table 7-4.6.
8 years after effective date of the TMDL	Each defined jurisdictional group must achieve a 50% cumulative percentage reduction from the total exceedance-day reductions required for that jurisdictional group as identified in Table 7-4.6.
10 years after effective date of the TMDL	Final implementation targets in terms of allowable wet-weather exceedance days must be achieved at each individual beach as identified in Table 7-4.5. In addition, the geometric mean targets must be achieved for each individual beach location.
Significant Dates for Responsible Jurisdictions and Agencies Pursuing an Integrated Water Resources Approach to Implementation	
6 years after effective date of the TMDL	Each defined jurisdictional group must achieve a 10% cumulative percentage reduction from the total exceedance-day reductions required for that jurisdictional group as identified in Table 7-4.6.
10 years after effective date of the TMDL	Each defined jurisdictional group must achieve a 25% cumulative percentage reduction from the total exceedance-day reductions required for that jurisdictional group as identified in Table 7-4.6.
15 years after effective date of the TMDL	Each defined jurisdictional group must achieve a 50% cumulative percentage reduction from the total exceedance-day reductions required for that jurisdictional group as identified in Table 7-4.6.
18 years after effective date of the TMDL	Final implementation targets in terms of allowable wet-weather exceedance days must be achieved at each individual beach as identified in Table 7-4.5. In addition, the geometric mean targets must be achieved for each individual beach location.

Notes: *For those subwatersheds without an existing shoreline monitoring site, responsible jurisdictions and agencies must establish a shoreline monitoring site if there is measurable flow from a creek or publicly owned storm drain to the beach during dry weather.

Attachment B to Resolution No. 2002-022

Amendment to the Water Quality Control Plan – Los Angeles Region to Revise the Santa Monica Bay Beaches Dry-Weather Bacteria TMDL

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on December 12, 2002.

Amendments:

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries
Santa Monica Bay Beaches Bacteria TMDL (Dry Weather Only)*

Table 7-4.3. Santa Monica Bay Beaches Bacteria TMDL (Dry Weather Only): Significant Dates

Date	Action
120 days after the effective date of the TMDL	Responsible jurisdictions and responsible agencies must submit coordinated shoreline monitoring plan(s), including a list of new sites or sites relocated to the wave wash at which time responsible jurisdictions and responsible agencies will select between daily and weekly shoreline sampling.
120 days after the effective date of the TMDL	Responsible jurisdictions and responsible agencies must identify and provide documentation on 342 potential discharges to Santa Monica Bay beaches listed in Appendix C of the TMDL Staff Report dated January 11, 2002. Documentation must include a Report of Waste Discharge (ROWD) where necessary. Responsible jurisdictions and responsible agencies must identify and provide documentation on potential discharges to the Area of Special Biological Significance (ASBS) in northern Santa Monica Bay from Latigo Point to the County line. Cessation of the discharges into the ASBS shall be required in conformance with the California Ocean Plan.
~~2~~ 4 years after effective date of TMDL	Re-open TMDL to re-evaluate allowable winter dry weather exceedance days based on additional data on bacterial indicator densities in the wave wash, a re-evaluation of the reference system selected to set allowable exceedance levels, and a re-evaluation of the reference year used in the calculation of allowable exceedance days.
3 years after effective date of the TMDL	Achieve compliance with allowable exceedance days as set forth in Table 7-4.2a and rolling 30-day geometric mean targets during summer dry weather (April 1 to October 31).
6 years after effective date of the TMDL	Achieve compliance with allowable exceedance days as set forth in Table 7-4.2a and rolling 30-day geometric mean targets during winter dry weather (November 1 to March 31).

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. 2006-008
April 6, 2006

Statement of support for the efforts of responsible jurisdictions and agencies in Jurisdictional Group 7 to maintain and improve water quality in compliance with the Santa Monica Bay Beaches Bacteria Wet Weather TMDL

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angeles Region (Regional Board) to develop water quality standards which include beneficial use designations and criteria to protect beneficial uses for each water body found within its region.

2. The Regional Board carries out its CWA responsibilities through California's Porter-Cologne Water Quality Control Act and establishes water quality objectives designed to protect beneficial uses contained in the Water Quality Control Plan for the Los Angeles Region (Basin Plan).

3. Section 303(d) of the CWA requires states to identify and to prepare a list of water bodies that do not meet water quality standards and then to establish load and waste load allocations, or a total maximum daily load (TMDL), for each water body that will ensure attainment of water quality standards and then to incorporate those allocations into their water quality control plans.

4. Many of the beaches along Santa Monica Bay were listed on California's 1998 section 303(d) List, due to impairments for coliform or for beach closures associated with bacteria generally. The beaches appeared on the 303(d) List because the elevated bacteria and beach closures prevented full support of the beaches' designated use for water contact recreation (REC-1).

5. A consent decree between the U.S. Environmental Protection Agency (USEPA), Heal the Bay, Inc. and Santa Monica BayKeeper, Inc. was approved on March 22, 1999. This court order required completion of a TMDL to reduce bacteria at Santa Monica Bay beaches by March 2002.

6. The Regional Board adopted two TMDLs to address bacteriological water quality impairments for 44 beaches along Santa Monica Bay located in Los Angeles County, California. The Regional Board adopted a TMDL to address water quality impairments during dry weather on January 24, 2002 and a TMDL to address wet weather impairments on December 12, 2002 (Resolutions 2002-004 and 2002-022, respectively).

7. The Regional Board incorporated the dry weather and wet weather TMDLs along with appropriate implementation measures into its Basin Plan as required (40 CFR 130.6(c)(1), 130.7). The Basin Plan and applicable statewide plans serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Regional Board.

8. The Regional Board established the above-mentioned TMDLs to preserve and enhance the water quality at Santa Monica Bay beaches and for the benefit of the 55 million beachgoers, on average, that visit these beaches each year. At stake is the health of swimmers and surfers and associated health costs as well as sizeable revenues to the local and state economy. Estimates are that visitors to Santa Monica Bay beaches spend approximately $1.7 billion annually.

9. The Regional Board's goal in establishing the above-mentioned TMDLs is to reduce the risk of illness associated with swimming in marine waters contaminated with bacteria. Local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects, such as gastroenteritis and upper respiratory illness, and recreational water quality, as measured by bacteria indicator densities. The water quality objectives on which the TMDL numeric targets are based will ensure that the risk of illness to the public from swimming at Santa Monica Bay beaches generally will be no greater than 19 illnesses per 1,000 swimmers, which is defined by the USEPA as an "acceptable health risk" in marine recreational waters.

10. The Dry Weather and Wet Weather Santa Monica Bay Beaches Bacteria TMDLs cover 44 beaches and 29 subwatersheds, with multiple jurisdictions and agencies that are responsible for compliance. Therefore, in the Wet Weather TMDL for implementation planning the Regional Board grouped the subwatersheds into Jurisdictional Groups. Each Jurisdictional Group is comprised of one or more subwatersheds, the beach(es) associated with these subwatersheds, and all responsible jurisdictions and agencies within the subwatershed(s). Each Jurisdictional Group is assigned a primary jurisdiction. A primary jurisdiction is that jurisdiction comprising greater than fifty percent of the subwatershed land area. The primary jurisdiction is responsible for submitting an implementation plan for the Jurisdictional Group per the requirements of the Wet Weather TMDL.

11. Jurisdictional Group 7 is responsible for one subwatershed, referred to as the Palos Verdes Peninsula subwatershed. The primary jurisdiction is the City of Rancho Palos Verdes. Other participating responsible jurisdictions and agencies in Jurisdictional Group 7 include the County of Los Angeles and the Cities of Los Angeles, Palos Verdes Estates, Rolling Hills and Rolling Hills Estates.

12. During the adoption of the wet weather TMDL, the Regional Board recognized two broad approaches to implementing the TMDL. One possible approach is an integrated water resources approach that takes a holistic view of regional water resources management by integrating planning for future wastewater, storm water, recycled water, and potable water needs and systems; focuses on beneficial re-use of storm water, including groundwater infiltration, at multiple points throughout a watershed; and addresses multiple pollutants for which Santa Monica Bay or its watershed are listed on the CWA section 303(d) List as impaired. The other possible approach is a non-integrated water resources approach in which implementation is achieved by focusing on narrowly tailored, end-of-the-pipe solutions to improve bacteriological water quality without incorporating other environmental and public goals.

13. The Regional Board recognized that an integrated water resources approach not only provides water quality benefits to the people of the Los Angeles Region, but also that the responsible jurisdictions implementing this TMDL can serve a variety of public purposes by adopting an integrated water resources approach. An integrated water resources approach will address

multiple pollutants, and as a result, responsible jurisdictions can recognize cost-savings because capital expenses for the integrated approach will implement several TMDLs that address pollutants in storm water. In addition, jurisdictions serve multiple roles for their citizenry, and an integrated approach allows for the incorporation and enhancement of other public goals such as water supply, recycling and storage; environmental justice; parks, greenways and open space; and active and passive recreational and environmental education opportunities.

14. The Regional Board acknowledged that a longer timeframe is reasonable for an integrated water resources approach because it requires more complicated planning and implementation such as identifying markets for the water and efficiently siting storage and transmission infrastructure within the watershed(s) to realize the multiple benefits of such an approach. Therefore, after considering testimony, the Regional Board revised the implementation provisions of the TMDL to allow for a longer implementation schedule (*up to* 18 years) if the responsible jurisdictions and agencies clearly demonstrate their intention to undertake an integrated water resources approach and justify the need for a longer implementation schedule. In contrast, the Regional Board required a shorter implementation schedule (*up to* 10 years) for non-integrated approaches because the level of planning is not as complicated.

15. The Regional Board has the authority to provide compliance schedules through the basin planning process. In the wet weather TMDL, adopted by the Regional Board, the Regional Board established dual schedules for implementation that afford the responsible jurisdictions and agencies up to ten or eighteen years, depending on the implementation approaches pursued, to implement the wet weather TMDL.

16. The implementation provisions in Table 7-4.4 of the wet weather TMDL state that, "the implementation schedule will be determined on the basis of the implementation plan(s), which must be submitted to the Regional Board by responsible jurisdictions and agencies within two years of the effective date of the TMDL" (Resolution 2002-022, Attachment A).

17. The implementation provisions in Table 7-4.4 further state that, "responsible jurisdictions and agencies must clearly demonstrate in the above-mentioned plan whether they intend to pursue an integrated water resources approach." If the responsible jurisdictions and agencies prefer an integrated approach, there must be a clear demonstration of need for the longer implementation schedule in the implementation plan. Otherwise, at most a 10-year implementation timeframe will be allotted by the Regional Board, depending upon a clear demonstration of the time needed in the implementation plan.

18. Per the requirements set forth in the wet weather TMDL, responsible jurisdictions and agencies in Jurisdictional Group 7 submitted a draft Implementation Plan to the Regional Board on March 15, 2005. Regional Board staff met with the responsible jurisdictions and agencies in Jurisdictional Group 7 to review and provide comments on the draft Implementation Plan. Regional Board staff concluded that no revisions to the draft Implementation Plan were necessary. The draft Implementation Plan was resubmitted as the final Implementation Plan on July 15, 2005.

19. The Implementation Plan submitted by Jurisdictional Group 7 differs from other Implementation Plans because the beaches along the Palos Verdes Peninsula have had historically fewer exceedances than the reference beach used in the Santa Monica Bay Beaches TMDLs to establish the allowable exceedance frequency. Therefore, the anti-

degradation provision applies, which requires responsible jurisdictions and agencies to maintain existing water quality.

20. The Implementation Plan for Jurisdictional Group 7 adopts a non-integrated approach, since existing water quality is equivalent to compliance with the Santa Monica Bay Beaches Wet-Weather TMDL.

21. No milestones are proposed in the Implementation Plan, since existing conditions are equivalent to compliance. The Implementation Plan for Jurisdictional Group 7 consists of three primary actions. First, Jurisdictional Group has committed to continue to implement Best Management Practices (BMPs) with the goal of reducing the number of bacterial exceedance days. Second, Jurisdictional Group 7 will review data collected by the County Sanitation Districts of Los Angeles County and explore the feasibility of posting sampling results on a website. Finally, should unanticipated exceedances occur, Jurisdictional Group 7 shall initiate investigations and corrective action through a Memorandum of Understanding established among the responsible jurisdictions and agencies.

22. The Implementation Plan for Jurisdictional Group 7 submitted by the responsible jurisdictions and agencies to the Regional Board was posted on the Regional Board's website in advance of the April 6, 2006 Board hearing. A Notice of Hearing was published and circulated 30 days preceding Board action; Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on April 6, 2006 to consider the Implementation Plan for Jurisdictional Group 7.

THEREFORE, be it resolved that pursuant to Regional Board Resolution 2002-022, Attachment A, Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate Implementation Provisions for the Region's Bacteria Objectives and to incorporate the Santa Monica Bay Beaches Wet Weather Bacteria TMDL, Table 7-4.4, "Implementation", adopted by the Regional Board on December 12, 2002 and effective on July 15, 2003:

1. The Regional Board hereby acknowledges the submission of a final Implementation Plan on July 15, 2005 by responsible jurisdictions and agencies in Jurisdictional Group 7, including the Cities of Rancho Palos Verdes, Los Angeles, Palos Verdes Estates, Rolling Hills and Rolling Hills Estates per requirements of the Santa Monica Bay Beaches Bacteria Wet Weather TMDL as set forth in Resolution 2002-022, Attachment A, Table 7-4.7.

2. The Regional Board hereby acknowledges that the responsible jurisdictions and agencies in Jurisdictional Group 7 as identified in (1) have chosen to pursue a non-integrated water resources approach as defined in the Santa Monica Bay Beaches Bacteria Wet Weather TMDL, Table 7-4.4.

3. The Regional Board hereby acknowledges that the responsible jurisdictions and agencies in Jurisdictional Group 7 as identified in (1) have not included any milestones in the Implementation Plan, as existing water quality conditions at the beaches along the Palos Verdes Peninsula are equivalent to compliance with the Santa Monica Bay Beaches Wet-Weather TMDL.

4. Given the commitments to maintain and improve water quality along the Palos Verdes Peninsula as outlined in the Implementation Plan for Jurisdictional Group 7, the Regional Board strongly supports and encourages the efforts of the responsible jurisdictions and agencies to (1) aggressively address unanticipated exceedances through investigations and corrective action and (2) make timely adjustments and refinements to the Implementation Plan to ensure that bacteriological water quality is maintained and improved at the beaches along the Palos Verdes Peninsula.

5. The Regional Board directs staff to develop draft language for Board consideration that incorporates into the Los Angeles County Municipal Separate Storm Sewer System (MS4) NPDES permit at reissuance explicit requirements for responsible jurisdictions and agencies to submit regular reports to the Board. The regular reports may be submitted as part of the Los Angeles County MS4 Annual Program and Annual Monitoring reports. Reports shall include data and information on (1) any changes in water quality in the receiving water and (2) investigations and corrective actions taken to address unanticipated exceedances, if any. Reports shall also include documentation on changes and refinements to the Implementation Plan based on the results of shoreline monitoring data and other investigations conducted under the Implementation Plan. Data on water quality shall include at a minimum changes in exceedance days compared to historical data; the proportion of wet weather days that exceed the water quality objectives by storm year as defined in the TMDLs; and corresponding rainfall data as set forth in the Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan submitted by responsible jurisdictions and agencies.

6. The Regional Board further directs staff to develop draft language for Board consideration that incorporates into the Los Angeles County MS4 NPDES permit at reissuance specific provisions to reopen the TMDL section of the permit and incorporate, after providing the opportunity for public comment, TMDL-related provisions as well as additional implementation actions, if necessary, to achieve compliance with Santa Monica Bay Beaches Bacteria TMDLs.

I, Jonathan Bishop, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on April 6, 2006.

Jonathan S. Bishop
Executive Officer

Attachment A to Resolution No. R10-010

Proposed Amendments

to the

Water Quality Control Plan – Los Angeles Region

for the

Santa Monica Bay Nearshore and Offshore

Debris TMDL

Amendments:

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Add:

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Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables
7-34 Santa Monica Bay Nearshore and Offshore Debris TMDL
7-34.1. Santa Monica Bay Nearshore and Offshore Debris TMDL, Elements

7-34.2. Santa Monica Bay Nearshore and Offshore Debris TMDL, Implementation Schedule – Trash and Plastic Pellets from Point Sources

7-34.3. Santa Monica Bay Nearshore and Offshore Debris TMDL, Implementation Schedule – Minimum Frequency of Assessment and Collection Program for Trash from Nonpoint Sources

Chapter 7. Total Maximum Daily Loads (TMDLs)
Santa Monica Bay Nearshore and Offshore Debris TMDL

This TMDL was adopted by:

The Regional Water Quality Control Board on November 4, 2010.

This TMDL was approved by:

The State Water Resources Control Board on [Insert Date].
The Office of Administrative Law on [Insert Date].
The U.S. Environmental Protection Agency on [Insert Date].

The elements of the TMDL are presented in Table 7-34.1 and the

Implementation Plan in Tables 7-34.2 and 7-34.3.

Table 7-34.1 Santa Monica Bay Nearshore and Offshore Debris TMDL:

Elements

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
Problem Statement	Discharges of debris[1], including trash and plastic pellets, into Santa Monica Bay violate water quality objectives, impair beneficial uses, and cause pollution and nuisance. Nearshore and offshore areas of the Santa Monica Bay were listed on the 1998, 2002, and 2006 Federal Clean Water Act Section 303(d) lists of impaired waterbodies for debris. The water quality objectives applicable to debris include "Floating Material" and "Solid, Suspended, or Settleable Materials" in Chapter 3, and "Floating Particulates" in the California Ocean Plan (2005). The following designated beneficial uses of Santa Monica Bay are impaired by debris: industrial service supply (IND), navigation (NAV), water contact recreation (REC-1), non-contact water recreation (REC-2), commercial and sport fishing (COMM), estuarine habitat (EST), marine habitat (MAR), preservation of biological habitats (BIOL), migration of aquatic organisms (MIGR), wildlife habitat (WILD), rare, threatened, or endangered species (RARE), spawning, reproduction, and or early development (SPWN), shellfish harvesting (SHELL), and wetland habitat (WET).
Numeric Target *(interpretation of the narrative water quality objectives for floating materials/particulates, and solid, suspended, or settleable materials[2], used to calculate the load allocations)*	<u>Trash</u> Zero trash in Santa Monica Bay. <u>Plastic Pellets</u> Zero plastic pellets in Santa Monica Bay.
Source Analysis	Along the West Coast, land-based debris comprises more than half of the debris observed in the marine environment, undetermined sources of debris comprise less than half of the debris observed in the marine environment, and ocean-based debris comprises only

[1] According to the National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program, debris is defined as "any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment" (NOAA 2010). In this TMDL, trash does not include naturally occurring vegetation waste. Plastic pellets, also known as plastic resin pellets, are small, round pellets that are the raw form of plastic. These pellets are melted down to form plastic products.

[2] Narrative objectives are specified in the 1994 Los Angeles Regional Board Basin Plan, and in the 2005 California Ocean Plan.

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	approximately one-tenth of the debris observed in the marine environment.[3] Most of the land-based debris is discharged to the marine environment through storm drains. The primary sources of debris discharged from storm drains include litter, debris from commercial establishments and public venues, industrial discharges, garbage transportation, landfills, and construction debris. The principal source of plastic pellets is point source discharges through storm drains from industry that imports, manufactures, processes, transports, stores, recycles or otherwise handles plastic pellets. Accidental spills during transfer and transportation also contribute to plastic pellets entering storm drains and, ultimately, the Santa Monica Bay. Land-based nonpoint sources of debris include inappropriate disposal of debris at land areas such as beaches and marinas adjacent to Santa Monica Bay or waterbodies within the Santa Monica Bay WMA. Other nonpoint sources of debris include direct deposition and dumping. Marine-based sources of trash include boats and vessels.
Loading Capacity	Zero for both trash and plastic pellets, as defined in the Numeric Target.
Margin of Safety	Zero is a conservative numeric target for both trash and plastic pellets, which contains an implicit margin of safety.
Seasonal Variations and Critical Conditions	Discharge of trash and plastic pellets from storm drains and open channels occurs primarily during or shortly after a major rain event. Discharge of trash from nonpoint sources occurs during all seasons, but can increase during high wind events, which are defined as periods of wind advisories issued by the National Weather Service. Additionally weekends and holidays, particularly those between April 15 through October 15, result in a substantial increase of trash littered on beaches, open space and parks.

[3] S.B. Sheavly. 2007. "National Marine Debris Monitoring Program: Final Program Report, Data Analysis and Summary." Prepared for U.S. Environmental Protection Agency by Ocean Conservancy, Grant Number X83053401-02. 76 pp.

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
Waste Load Allocations (for point sources)	Trash The WLA is zero trash. Zero trash is defined as no trash discharged into waterbodies within the Santa Monica Bay Watershed Management Area (WMA) and then into Santa Monica Bay or on the shoreline of Santa Monica Bay. Waste Load Allocations for trash (WLAs) are assigned to the California Department of Transportation (Caltrans, permittee for Statewide National Pollutant Discharge Elimination System (NPDES) Storm Water Permit, No. 99-06-DWQ); Los Angeles County and the Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Torrance, and Westlake Village (co-permittees within the Santa Monica Bay WMA under the Los Angeles County MS4 NPDES Permit, No. CAS004001); and County of Ventura, and City of Thousand Oaks (co-permittees within the Santa Monica Bay WMA under the Ventura County MS4 NPDES Permit, No. CAS 004002). Responsible agencies and jurisdictions covered by the Ballona Creek Watershed Trash TMDL including Caltrans, County of Los Angeles, and the Cities of Beverly Hills, Culver City, Inglewood, Los Angeles, Santa Monica, and West Hollywood, and responsible agencies and jurisdictions identified in the Malibu Creek Trash TMDL including Caltrans, Los Angeles County, Ventura County, Ventura County Watershed Protection District, and the Cities of Agoura Hills, Calabasas, Hidden Hills, Malibu, Thousand Oaks, and Westlake Village are also responsible for point source discharges of trash into the Santa Monica Bay via open channels and storm drains. The WLA applicable to MS4 Permittees that is established herein, and the associated requirements for these responsible agencies and jurisdictions shall be complied with through the Ballona Creek Trash TMDL (Regional Board Resolution No. R01-014 and any amendments thereto) and the Malibu Creek Trash TMDL (Regional Board Resolution No. R08-007 and any amendments thereto). Each responsible jurisdiction and agency, identified above, shall comply with the interim or final Waste Load Allocations for trash assigned to it and, therefore, should utilize all compliance strategies within its authority to achieve these allocations. If these strategies include installation of full or partial capture systems in the infrastructure of a flood control district, the jurisdiction is responsible for obtaining all necessary permits to do so.

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	Flood control districts, such as the Los Angeles County Flood Control District or Ventura County Watershed Protection District, are not assigned Waste Load Allocations, based on jurisdictional area, if channel maintenance is performed in compliance with the municipal stormwater permit. However, they may be held responsible with a jurisdiction and/or agency for non-compliance where the flood control district has either: (i) without good cause denied necessary authority to a responsible jurisdiction or agency for the timely installation and/or maintenance of full and/or partial capture trash control devices for purposes of TMDL compliance in parts of the MS4 physical infrastructure that are under its authority, or (ii) not fulfilled its obligations under its MS4 permit regarding proper BMP installation, operation and maintenance for purposes of TMDL compliance within the MS4 physical infrastructure under its authority, thereby causing or contributing to a responsible jurisdiction and/or agency to be out of compliance with its interim or final Waste Load Allocations. Under these circumstances, the flood control district's responsibility shall be limited to non-compliance related to the drainage area(s) within the jurisdiction where the flood control district has authority over the relevant portions of the MS4 physical infrastructure. The WLA may be assigned to additional responsible jurisdictions or agencies discharging urban runoff and stormwater in the future. <u>Plastic Pellets</u> The WLA for plastic pellets is zero. Zero plastic pellets is defined as no discharge of plastic pellets from the premises of industrial facilities that import, manufacture, process, transport, store, recycle or otherwise handle plastic pellets. The WLA is consistent with Cal. Water Code § 13367 and 40 CFR 122.26(b)(12). WLAs for plastic pellets are assigned to permittees of the Industrial Storm Water General Permit (Order No. 97-03-DWQ, and NPDES Permit No. CAS 000001) within the Santa Monica Bay WMA. The Standard Industry Classification (SIC) codes associated with industrial

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	activities involving plastic pellets may include, but are not limited to, 282X, 305X, 308X, 39XX, 25XX, 3261, 3357, 373X, and 2893. Additionally, industrial facilities with the term "plastic" in the facility or operator name, regardless of the SIC code, may be subject to the WLA for plastic pellets. Other industrial permittees within the Santa Monica Bay WMA that fall within the above categories, but are regulated through other general permits and/or individual industrial storm water permits are also required to comply with the WLA for plastic pellets.
Load Allocations (for nonpoint sources)	The Load Allocation (LA) is zero trash. Zero trash is defined for nonpoint sources as no trash on the shoreline or beaches, or in harbors adjacent to Santa Monica Bay, immediately following each assessment and collection event consistent with an established Minimum Frequency of Assessment and Collection Program (MFAC Program). The MFAC Program is established at an interval that prevents trash from accumulating in deleterious amounts that cause nuisance or adversely affect beneficial uses between collections. LAs are assigned to jurisdictions that own and/or manage beaches and harbors along Santa Monica Bay, which include California Department of Parks and Recreation, County of Los Angeles Department of Beaches and Harbors, and Cities of Hermosa Beach, Los Angeles, Santa Monica, and Redondo Beach. The National Park Service, California Department of Parks and Recreation, County of Los Angeles, County of Ventura, and State Lands Commission, which have jurisdiction over non-beach open space and/or parks are assigned LAs. The LA may be assigned to additional responsible jurisdictions and/or agencies in the future under appropriate regulatory programs.
Implementation	**Point Sources** <u>Trash</u> WLAs for trash shall be implemented through municipal separate storm sewer system (MS4) permits and via the authority vested in the Executive Officer by California Water Code sections 13267 and/or 13383. Dischargers may comply with the WLA in any lawful manner, including the use of full capture systems; partial capture systems; and/or institutional controls. (1) Compliance with the final WLA may be achieved through an adequately sized and maintained full capture

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	system, once the Executive Officer has certified that the system meets the following minimum criteria. A full capture system, at a minimum, consists of any device or series of devices that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate (Q) resulting from a one-year, one-hour, storm in the subdrainage area. The rational equation is used to compute the peak flow rate: $Q = C \times I \times A$, where Q = design flow rate (cubic feet per second, cfs); C = runoff coefficient (dimensionless); I = design rainfall intensity (inches per hour); and A= subdrainage area (acres). Point source discharges that choose to comply using full capture systems must demonstrate a phased implementation of full capture devices over an 8-year period until the final WLA of zero is attained. Zero will be deemed to have been met if full capture systems have been installed on all conveyances discharging to the waterbodies within the Santa Monica Bay WMA and the Santa Monica Bay. (2) Responsible agencies and jurisdictions may achieve compliance by using partial capture systems and/or institutional controls. Point source dischargers that elect to use partial capture systems or institutional controls shall use a mass balance approach based on the trash daily generation rate (DGR)[4], to demonstrate compliance. <u>Plastic Pellets</u> The WLA of no discharge of plastic pellets shall be implemented through the statewide Waste Discharge Requirements for Discharges of Storm Water Associated with Industrial Activity (NPDES Permit No. CAS00001) (IGP), other general permits, individual industrial stormwater permits, or other Regional Board orders, consistent with California Water Code § 13367 and 40 CFR 122.26(b)(12). Jurisdictions and agencies identified as responsible jurisdictions for point sources of trash in this Santa Monica Bay Debris TMDL and in the existing Malibu Creek and Ballona Creek Trash TMDLs, including the Los Angeles County Flood Control District and the Ventura County Watershed Protection District, shall either prepare a Plastic Pellet Monitoring and Reporting Plan (PMRP), or

[4] The DGR is the average amount of trash deposited during a 24-hour period, as measured in a specified drainage area.

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	demonstrate that a PMRP is not required under certain circumstances, as follows: (1) Responsible jurisdictions that have industrial facilities or activities related to the manufacturing, handling, or transportation of plastic pellets within their jurisdiction shall prepare a PMRP to (i) monitor the amount of plastic pellets being discharged from the MS4; (ii) establish triggers for increased industrial facility inspections and enforcement of SWPPP requirements for industrial facilities identified as responsible for the plastic pellet WLA herein; and (iii) address possible plastic pellet spills. (2) Responsible jurisdictions that have no industrial facilities or activities related to the manufacturing, handling, or transportation of plastic pellets, may not be required to conduct monitoring at MS4 outfalls, but shall be required to include a response plan in the PMRP. In order to be absolved of the requirement to conduct monitoring at MS4 outfalls, documentation of the absence of industrial facilities and activities within the jurisdiction that are related to the manufacturing, handling and transportation of plastic pellets must be provided in the proposed PMRP. (3) A MS4 Permittee may demonstrate to the Regional Board that it has only residential areas within its jurisdiction, and that it has limited commercial or industrial transportation corridors (rail and roadway), such that it is not considered a potential source of plastic pellets to Santa Monica Bay. Such demonstration may be submitted in lieu of a PMRP and must include the municipal zoning plan and other appropriate documentation. The Executive Officer may approve an exemption from the requirement to prepare a PMRP for the MS4 Permittee on the basis of this demonstration, if appropriate. If a jurisdiction changes its zoning and land use plans, or issues operating licenses to industries that import, manufacture, process, transport, store, recycle or otherwise handle plastic pellets within its jurisdiction, then it shall be subject to the requirement to submit a PMRP, if it has not already done so, within 90 days of any one of those actions. The Regional Board shall be notified by the agency or jurisdiction within 24 hours of the responsible agency or

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	jurisdiction becoming aware of a spill. The PMRP shall include protocols for a timely and appropriate response to possible plastic pellets spills within their jurisdictional area, and a comprehensive plan to ensure that plastic pellets are contained. The Regional Board may reconsider the TMDL to assign the WLA for plastic pellets to additional jurisdictions and agencies including, but not limited to, industrial permittees, MS4 permittees, and any agencies or jurisdictions which are responsible for discharging plastic pellets to the Santa Monica Bay. **Nonpoint Sources** LAs shall be implemented consistent with the Statewide Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program through a general waiver of waste discharge requirements (WDR), individual waivers, a general WDR, an individual WDR, a memorandum of understanding (MOU), a cleanup and abatement order, or any other appropriate order or orders, provided the program is consistent with the assumptions and requirements of the reductions described in Table 7-34.3, below. Nonpoint source dischargers may achieve the LAs by implementing an MFAC/BMP program approved by the Executive Officer. Responsible jurisdictions will be deemed in compliance with the LAs if an MFAC/BMP program, approved by the Executive Officer, demonstrates that there is no accumulation of trash, as defined in "Numeric Targets". An MFAC/BMP Program must, to the satisfaction of the Executive Officer, meet the following criteria: a) The MFAC/BMP Program includes an initial minimum frequency of trash assessment and collection and suite of structural and/or nonstructural BMPs. The MFAC/BMP program shall include collection and disposal of all trash found in the source areas and along the shoreline. Responsible jurisdictions shall implement an initial suite of BMPs based on current trash management practices in land areas that are found to be sources of trash to waterbodies within the Santa Monica Bay WMA and to Santa Monica Bay. <u>Beaches and Harbors along Santa Monica Bay</u> For beaches and harbors along Santa Monica Bay,

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	the initial minimum frequency shall be set as follows: 1. The trash source areas of beaches and harbors shall be cleaned on a daily basis year round. 2. Trash on Santa Monica Bay shorelines shall be collected daily. An assessment shall immediately follow at the frequency specified in the TMRP. 3. The assessment performed immediately after the collection events shall focus on the shorelines or interface along Santa Monica Bay. 4. The protocol for conducting the assessment immediately after the collection event shall include methods and frequencies of assessment, specific locations on the beaches and harbors, in the TMRP. 5. Responsible jurisdictions for beaches and harbors shall conduct routine trash generation rate evaluation on the nonpoint source areas at selected beaches or harbors under their management. Protocols, as specified in the TMRP, for this evaluation include: i) The evaluation shall be performed in the late afternoon before dusk. Data collected may represent the daily trash quantity littered or deposited on the nonpoint source areas. ii) Methods, locations and frequencies of evaluation on the beaches and harbors shall be included in the TMRP. 6. Water in harbors shall be inspected and all trash found on the water shall be removed at a frequency and during critical conditions as defined in the approved TMRP. 7. Compliance for jurisdictions responsible for nonpoint source trash at areas where daily cleanup is implemented, is determined by the following conditions: i) The assessment conducted immediately after cleanup shall demonstrate that all trash on the shoreline or harbor is 100% removed and no trash remains. ii) Responsible jurisdictions for beaches and

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	harbors where daily cleanup is performed, shall demonstrate that the trash generation rate of the source areas does not show an increasing trend and does not exceed the benchmark of 310 pounds (lbs) per mile of beach/harbor per day, or 113,150 lbs/mile/year. 8. Responsible jurisdictions shall initiate additional BMPs as specified in the TMRP, should trash amounts collected during evaluation at the source areas exceed 113,150 lbs/mile/year, or not indicate a decreasing trend. <u>Non-Beach Open Space and Parks</u> For open space and parks within the Santa Monica Bay WMA other than beaches and harbors, the initial minimum frequency shall be as follows: 1. Trash in open space and parks managed by responsible jurisdictions and agencies identified in the LA section of this table shall be 100% removed at each assessment and collection event as specified in the TMRP, within 72 hours after critical conditions, and immediately after special events when no safety hazards exist. 2. The TMRP shall include protocols for trash assessment immediately after each cleanup event, assessment locations and frequencies. 3. Compliance for jurisdictions responsible for open space and parks is determined by the following criteria: i) The assessment performed immediately after each cleanup event shall demonstrate that no trash remains. ii) The trash amount accumulated between cleanup events in open space and parks shall not exceed the LAs of 640 gallons per square mile per year (gal/mi^2/yr), or 162,468 lbs/ mi^2/yr, and shall show a decreasing trend. iii) Responsible jurisdictions shall increase the frequency of collection and/or implement additional BMPs, should trash amounts collected at cleanup events not indicate a decreasing trend.

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	b) The MFAC/BMP Program includes assurances that it will be implemented by the responsible jurisdictions. c) The TMRP includes a MFAC/BMP Program, as described below, and a requirement that the responsible jurisdictions will self-report any non-compliance with its provisions. The results and report of the TMRP must be submitted to Regional Board on an annual basis. d) MFAC protocols may be based on SWAMP protocols for rapid trash assessment, or alternative protocols proposed by dischargers and approved by the Executive Officer of the Regional Board. e) Implementation of the MFAC/BMP program should include a Health and Safety Plan to protect personnel. The MFAC/BMP shall not require responsible jurisdictions to access and collect trash from areas where access by personnel is prohibited. The Executive Officer may approve or require a revised assessment and collection frequency and definition of the critical conditions: (a) To prevent trash from accumulating in deleterious amounts that cause nuisance or adversely affect beneficial uses between collections; (b) To reflect the results of trash assessment and collection; (c) If the amount of trash collected does not show a decreasing trend, where necessary to prevent nuisance or adverse effects on beneficial uses, such that a shorter interval between collections is warranted; or (d) If the amount of trash collected is decreasing such that a longer interval between collections is warranted. At the end of the implementation period, a revised MFAC/BMP program may be required if the Executive Officer determines that the amount of trash accumulating between collections is causing pollution or nuisance or otherwise adversely affecting beneficial uses. With regard to (a), (b) or (c), above, the Executive Officer is authorized to allow responsible jurisdictions to implement additional structural or non-structural BMPs in lieu of modifying the monitoring frequency.

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
Monitoring and Reporting Plan	Trash Responsible agencies and jurisdictions shall develop a Trash Monitoring and Reporting Plan (TMRP) for Executive Officer approval that describes the methodologies that will be used to assess and monitor trash in their responsible areas within the Santa Monica Bay WMA or along Santa Monica Bay. For purposes of compliance determination, the default Baseline WLA for County of Ventura, Cities of Agoura Hills, Calabasas, Malibu, Thousand Oaks, and Westlake Village is 640 gal/mi^2/yr, which is the same Baseline WLA set forth in the Malibu Creek Trash TMDL (Regional Board Resolution No. R08-007) for responsible jurisdictions of Los Angeles County, Ventura County, Ventura County Watershed Protection District, the Cities of Agoura Hills, Calabasas, Hidden Hills, Malibu, Thousand Oaks, and Westlake Village. The default Baseline WLA for Los Angeles County, Cities of Los Angeles, Culver City, Santa Monica, El Segundo, Manhattan Beach, Hermosa Beach, Redondo Beach, Torrance, Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills, and Rolling Hills Estates is 807 gal/mi^2/ yr. The default Baseline WLA for Caltrans is 33,452.8 gal/mi^2/yr excluding Caltrans' jurisdictional area in the Ballona Creek Watershed. The existing Ballona Creek Trash TMDL assigned a Baseline WLA of 86 cubic feet per square mile per year (ft^3/mi^2/yr) (equivalent to 643.3 gal/mi^2/yr) to jurisdictions including the County of Los Angeles, the Cities of Beverly Hills, Culver City, Inglewood, Los Angeles, Santa Monica, and West Hollywood, and 893 ft^3/mi^2/yr (or 6,679.6 gal/mi^2/yr) to Caltrans for their jurisdictional areas within the Ballona Creek Watershed. The TMRP shall include a plan to establish a site specific trash Baseline WLA if responsible agencies and jurisdictions elect to not use the default Baseline WLAs assigned above. Requirements for the TMRP shall include, but are not limited to, assessment and quantification of trash collected from source areas in the Santa Monica Bay WMA, and shoreline of the Santa Monica Bay. The monitoring plan shall provide details on the frequency, location, and reporting format. Responsible jurisdictions shall propose

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	a metric (e.g., weight, volume, pieces of trash) to measure the amount of trash discharged from their jurisdictional areas. The TMRP shall include a prioritization of areas that have the highest trash generation rates. The TMRP shall give preference to this prioritization when scheduling the installation of full capture devices, BMPs, or trash assessment and collection (MFAC) programs. The TMRP shall also evaluate and identify the most appropriate BMPs to implement given the nature of the trash impairment. The TMRP shall also include an evaluation of effectiveness of the MFAC/BMP program to prevent trash from accumulating in deleterious amounts that cause pollution or nuisance or adversely affect beneficial uses between collections, proposals to enhance BMPs, and a revised MFAC for Executive Officer review. Responsible agencies and jurisdictions in Tables 7-34.2 and 7-34.3 may cooperate and coordinate their TMRP activities to fulfill requirements in this Santa Monica Bay Debris TMDL. Consistent with the requirements of their respective MS4 permits, the flood control districts, including the Los Angeles County Flood Control District and the Ventura County Watershed Protection District, and other MS4 Permittees are responsible for visually monitoring and removing trash and debris from all open channels and other MS4 drainage structures under their ownership. These requirements are intended to address fugitive trash and debris that has been deposited either illegally or through wind transport into the open channels. The flood control districts and other MS4 Permittees shall also identify and prioritize problem areas of illicit discharge. For these problem areas, the flood control districts and other MS4 Permittees shall propose a more frequent schedule of inspection and removal beyond the standard requirements of their MS4 permits. Alternatively, the flood control districts and other MS4 Permittees shall demonstrate that fugitive trash and debris is captured or removed prior to its discharge from the MS4 to Santa Monica Bay. <u>Plastic Pellets</u> Industries responsible for discharge of plastic pellets shall enroll with the California State Water Resources Control Board (State Board) as a permittee of the statewide Waste Discharge Requirements for Discharges of Storm Water

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	Associated with Industrial Activity (IGP) or apply for a general permit or an individual industrial stormwater permit from the Regional Board. Permittees of the IGP shall prepare a SWPPP and keep it onsite for inspection. Permittees for other general permits or individual industrial stormwater permits shall submit a Best Management Practices Plan and/or SWPPP to the Regional Board. All responsible permittees as defined under the Waste Load Allocation section are required to prepare and submit annual monitoring reports with monitoring designed to ensure compliance with the assigned WLAs, to the Regional Board. The requirements for the monitoring report preparation shall be consistent with provisions specified in the IGP, any appropriate general permit, or individual industrial permit. MS4 permittees identified as responsible jurisdictions and agencies for point sources of trash in this Santa Monica Bay Debris TMDL and in the existing Malibu Creek and Ballona Creek Trash TMDLs, including the Los Angeles County Flood Control District and the Ventura County Watershed Protection District, shall either prepare a Plastic Pellet Monitoring and Reporting Plan (PMRP) , or demonstrate that a PMRP is not required under certain circumstances, as follows: (1) Responsible jurisdictions that have industrial facilities or activities related to the manufacturing, handling, or transportation of plastic pellets within their jurisdiction shall prepare a PMRP to (i) monitor the amount of plastic pellets being discharged from the MS4 at critical locations and times (including, at a minimum, once during the dry season and once during the wet season); (ii) establish triggers for increased industrial facility inspections and enforcement of SWPPP requirements for industrial facilities identified as responsible for the plastic pellet WLA herein; and (iii) address possible plastic pellet spills. (2) Responsible jurisdictions that have no industrial facilities or activities related to the manufacturing, handling, or transportation of plastic pellets, may not be required to conduct monitoring at MS4 outfalls, but shall be required to include a response plan in the PMRP. In order to be absolved of the requirement to conduct monitoring at MS4 out falls, documentation of the absence of industrial facilities and activities within the jurisdiction that are related to the manufacturing, handling and transportation of plastic pellets must be provided in the proposed

Elements	Santa Monica Bay Nearshore and Offshore Debris TMDL
	PMRP. (3) A MS4 Permittee may demonstrate to the Regional Board that it has only residential areas within its jurisdiction, and that it has limited commercial or industrial transportation corridors (rail and roadway), such that it is not considered a potential source of plastic pellets to Santa Monica Bay. Such demonstration may be submitted in lieu of a PMRP and must include the municipal zoning plan and other appropriate documentation. The Executive Officer may approve an exemption from the requirement to prepare a PMRP for the MS4 Permittee on the basis of this demonstration, if appropriate. The PMRP shall include protocols for a timely and appropriate response to possible plastic pellets spills within a Permittee's jurisdictional area, and a comprehensive plan to ensure that plastic pellets are contained.

Table 7-34.2 Santa Monica Bay Nearshore and Offshore Debris TMDL: Implementation Schedule - Trash and Plastic Pellets from Point Sources

Task No.	Task	Responsible Jurisdiction	Date
1a	Submit Trash Monitoring and Reporting Plan (TMRP), including a plan for defining the trash baseline WLA, a proposed definition of "major rain event" and "proper operation and maintenance".	California Department of Transportation, Los Angeles County Flood Control District, Los Angeles County, Ventura County Watershed Protection District, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village.	6 months from effective date of TMDL. If a plan is not approved by the Executive Officer within 9 months, the Executive Officer will establish appropriate monitoring plans.
1b	Submit a Plastic Pellet Monitoring and Reporting Plan (PMRP) for monitoring plastic pellet discharges from the MS4, increased industrial facility inspections and enforcement, and response to possible plastic pellet spills, or a demonstration that a PMRP is not required[5].	California Department of Transportation, Los Angeles County Flood Control District, Los Angeles County, Ventura County Watershed Protection District, County of Ventura, and Cities of Agoura Hills, Beverly Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Hidden Hills, Inglewood, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, West Hollywood, and Westlake Village.	18 months from effective date of this TMDL.
2a	Implement TMRP.	California Department of Transportation, Los Angeles County Flood Control District, Los Angeles County, Ventura County Watershed Protection District, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village.	6 months from receipt of letter of approval from Regional Board Executive Officer, or the date a plan is established by the Executive Officer.

[5] The responsible jurisdictions and agencies shall provide documentation as specified in Table 7-34.1.

Task No.	Task	Responsible Jurisdiction	Date
2b	Implement PMRP.	California Department of Transportation, Los Angeles County Flood Control District, Los Angeles County, Ventura County Watershed Protection District, County of Ventura, and Cities of Agoura Hills, Beverly Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Hidden Hills, Inglewood, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, West Hollywood, and Westlake Village.	4 years from Effective Date of TMDL.
3	Submit results of implementing TMRP and PMRP, recommend trash baseline WLA, and propose prioritization of Full Capture System installation or implementation of other measures to attain the required trash and plastic pellet reduction.	California Department of Transportation, Los Angeles County Flood Control District, Los Angeles County, Ventura County Watershed Protection District, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village. For PMRP ONLY[6] The Cities of Beverly Hills, Inglewood, West Hollywood, and Hidden Hills.	Twenty (20) months from receipt of letter of approval for the Trash Monitoring and Reporting Plan and PMRP from Regional Board Executive Officer, and annually thereafter.
4	Installation of Full Capture Systems or other measures to achieve 20% reduction of trash from Baseline WLA[6].	California Department of Transportation, Los Angeles County, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village.[7]	Four years from effective date of TMDL.

[6] Compliance with percent reductions from the Baseline WLA will be assumed wherever properly-sized full capture systems are installed and properly operated and maintained in corresponding percentages of the conveyance discharging to waterbodies within the Santa Monica Bay Watershed or directly to Santa Monica Bay.

[7] Each responsible jurisdiction and agency, identified above, shall comply with the interim or final Waste Load Allocations for trash assigned to it and, therefore, should utilize all compliance strategies within its authority to achieve these allocations.

Task No.	Task	Responsible Jurisdiction	Date
5	Installation of Full Capture Systems or other measures to achieve 40% reduction of trash from Baseline WLA[7].	California Department of Transportation, Los Angeles County, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village.	Five years from effective date of TMDL.
6	Compliance with General or Individual Industrial NPDES permit requirements to achieve the plastic pellet WLA.	Permittees of the Industrial Storm Water General Permit (NPDES Permit No. CAS 000001), other general permits, or individual industrial storm water permits for industrial activities with SIC codes that may include, but are not limited to, 282X, 305X, 308X, 39XX, 25XX, 3261, 3357, 373X, 2893, or with the term "plastic" in the facility or operator name, regardless of SIC code.	Five years from the effective date of TMDL.
7	1. Evaluate the effectiveness of Full Capture Systems or other measures to achieve trash WLA, 2. Evaluate BMPs implemented at	Regional Board.	Five years from effective date of TMDL.

Flood control districts, such as the Los Angeles County Flood Control District or Ventura County Watershed Protection District, may be held responsible with a jurisdiction and/or agency for non-compliance where the flood control district has either:

(i) without good cause denied necessary authority to a responsible jurisdiction or agency for the timely installation and/or maintenance of full and/or partial capture trash control devices for purposes of TMDL compliance in parts of the MS4 physical infrastructure that are under its authority, or

(ii) not fulfilled its obligations under its MS4 permit regarding proper BMP installation, operation and maintenance for purposes of TMDL compliance within the MS4 physical infrastructure under its authority,

thereby causing or contributing to a responsible jurisdiction and/or agency to be out of compliance with its interim or final Waste Load Allocations.

Under these circumstances, the flood control district's responsibility shall be limited to non-compliance related to the drainage area(s) within the jurisdiction where the flood control district has authority over the relevant portions of the MS4 physical infrastructure.

Task No.	Task	Responsible Jurisdiction	Date
	industrial facilities for effectiveness in achieving plastic pellet WLA, 3. Reconsider the trash and plastic pellet WLAs, if warranted.		
8	Installation of Full Capture Systems or other measures to achieve 60% reduction of trash from Baseline WLA[7].	California Department of Transportation, Los Angeles County, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village.[8]	Six years from effective date of TMDL.
9	Installation of Full Capture Systems or other measures to achieve 80% reduction of trash from Baseline WLA[7].	California Department of Transportation, Los Angeles County, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village.[8]	Seven years from effective date of TMDL.
10	Installation of Full Capture Systems or other measures to achieve 100% reduction of trash from Baseline WLA[7].	California Department of Transportation, Los Angeles County, County of Ventura, and Cities of Agoura Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Thousand Oaks, Torrance, and Westlake Village.[8]	Eight years from effective date of TMDL.
11	If within three (3) years of Regional Board adoption date of this TMDL, a city or county voluntarily adopts local ordinances to ban plastic bags, smoking in public places and single use expanded polystyrene food	California Department of Transportation, Los Angeles County Flood Control District, Los Angeles County, Ventura County Watershed Protection District, County of Ventura, and Cities of Agoura Hills, Beverly Hills, Calabasas, Culver City, El Segundo, Hermosa Beach, Hidden Hills, Inglewood, Los Angeles, Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills	11 years from effective date of TMDL.

Task No.	Task	Responsible Jurisdiction	Date
	packaging, it shall receive a three-year extension of the final compliance date.	Estates, Santa Monica, Thousand Oaks, Torrance, West Hollywood, and Westlake Village.	

Table 7-34.3 Santa Monica Bay Nearshore and Offshore Debris TMDL: Implementation Schedule
Minimum Frequency of Assessment and Collection Program[8] - Trash from Nonpoint Sources

Task No.	Task	Responsible Jurisdiction	Date
1	Submit a TMRP including an MFAC/BMP Program.	National Park Service, California Department of Parks and Recreation, County of Los Angeles, County of Ventura, State Lands Commission for open space and parks, and California Department of Parks and Recreation, Los Angeles County Department of Beaches and Harbors, Cities of Hermosa Beach, Los Angeles, Santa Monica and Redondo Beach for beaches and harbors.	Six months from TMDL effective date. If a plan is not approved by the Executive Officer within 9 months, the Executive Officer will establish an appropriate monitoring plan.
2	Implement the TMRP and the MFAC/BMP Program.	National Park Service, California Department of Parks and Recreation, County of Los Angeles, County of Ventura, State Lands Commission for open space and parks, and California Department of Parks and Recreation, Los Angeles County Department of Beaches and Harbors, Cities of Hermosa Beach, Los Angeles, Santa Monica and Redondo Beach for beaches and harbors.	6 months from receipt of letter of approval from Regional Board Executive Officer, or the date a plan is established by the Executive Officer.
3	Achieve LA immediately after each collection and assessment event.	National Park Service, California Department of Parks and Recreation, County of Los Angeles, County of Ventura, State Lands Commission for open space and parks, and California Department of Parks and Recreation, Los Angeles County Department of Beaches and Harbors, Cities of Hermosa Beach, Los Angeles, Santa Monica and Redondo Beach for beaches and harbors.	6 months from receipt of letter of approval from Regional Board Executive Officer, or the date a plan is established by the Executive Officer.
4	Submit annual TMRP reports including	National Park Service, California Department of Parks and	Twenty (20) months from

[8] Based on annual reports, the Executive Officer may adjust the minimum frequency of assessment and collection as necessary to ensure compliance between the required trash assessment and collection events.

Task No.	Task	Responsible Jurisdiction	Date
	proposal for revising MFAC/BMP for Executive Officer approval.	Recreation, County of Los Angeles, County of Ventura, State Lands Commission for open space and parks, and California Department of Parks and Recreation, Los Angeles County Department of Beaches and Harbors, Cities of Hermosa Beach, Los Angeles, Santa Monica and Redondo Beach for beaches and harbors.	receipt of letter of approval for the Trash Monitoring and Reporting Plan from Regional Board Executive Officer, and annually thereafter.
5	Demonstrate full compliance by achieving LA between required trash collection and assessment events.	National Park Service, California Department of Parks and Recreation, County of Los Angeles, County of Ventura, State Lands Commission for open space and parks, and California Department of Parks and Recreation, Los Angeles County Department of Beaches and Harbors, Cities of Hermosa Beach, Los Angeles, Santa Monica and Redondo Beach for beaches and harbors.	Five years from effective date of TMDL.
6	Reconsider the TMDL based on evaluation of effectiveness of MFAC/BMP program, if warranted.	Regional Board.	Five years from effective date of TMDL.
7	If within three (3) years of Regional Board adoption date of this TMDL, a city or county voluntarily adopts local ordinances to ban plastic bags, smoking in public places and single use expanded polystyrene food packaging, it shall receive a three-year extension of the final compliance date.	National Park Service, California Department of Parks and Recreation, County of Los Angeles, County of Ventura, State Lands Commission for open space and parks, and California Department of Parks and Recreation, Los Angeles County Department of Beaches and Harbors, Cities of Hermosa Beach, Los Angeles, Santa Monica and Redondo Beach for beaches and harbors.	Eight (8) years from effective date of TMDL.

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. R10-010
November 4, 2010

Amendment to the *Water Quality Control Plan for the Los Angeles Region* to Incorporate a Total Maximum Daily Load for Debris for Nearshore and Offshore Santa Monica Bay

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The Federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board, Los Angeles Region (Regional Board) to establish water quality standards for each waterbody within its region. Water quality standards include beneficial uses, water quality objectives that are established at levels sufficient to protect those beneficial uses, and an antidegradation policy to prevent degrading high quality waters. Waterbodies that do not meet water quality standards are considered impaired.

2. CWA section 303(d)(1) requires each state to identify the waters within its boundaries that do not meet water quality standards. Those waters are placed on the state's "303(d) List" or "Impaired Waters List". For each listed water, the state is required to establish the Total Maximum Daily Load (TMDL) of each pollutant impairing the water quality standards in that waterbody. Both the identification of impaired waters and TMDLs established for those waters must be submitted to the United States Environmental Protection Agency (U.S. EPA) for approval pursuant to CWA section 303(d)(2).

3. The Clean Water Act also requires protection of downstream beneficial uses, and section 303(d)(3) gives the Regional Board authority to establish a TMDL for unassessed and/or unimpaired upstream waterbodies to assure protection of beneficial uses of those waters as well as downstream waters.

4. A consent decree between U.S. EPA, Heal the Bay, Inc. and Santa Monica BayKeeper, Inc. was approved on March 22, 1999, which resolved litigation between those parties relating to the pace of TMDL development in the Los Angeles Region. The court order directs the U.S. EPA to ensure that TMDLs for all 1998-listed impaired waters in the Los Angeles Region be established within 13 years of the consent decree. The consent decree combined waterbody pollutant combinations in the Los Angeles Region into 92 TMDL analytical units. In accordance with the consent decree, the Santa Monica Bay Nearshore and Offshore Debris TMDL addresses the listings for analytical unit 66. Based on the consent decree schedule, TMDLs must be approved or established by U.S. EPA by March 2012.

5. Pursuant to Water Code Section 13367, the Regional Board must implement a program to control point and nonpoint discharges of preproduction plastic. The program shall, at a minimum, require plastic manufacturing, handling, and transportation facilities to implement best management practices to control discharges of preproduction plastics, including: appropriate containment systems; sealed containers durable enough so as not to rupture during transfer and storage; use of capture devices during loading, unloading, and transferring; the availability of a vacuum or vacuum like system to clean up loose pellets. However, nothing in California Water Code Section 13367 limits the authority of the Regional Board to establish requirements in addition to the BMPs for the elimination of discharges of preproduction plastic. Based on Section 13367, this program was to be implemented on January 1, 2009.

6. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d)(1)(C) and (D) of the CWA, as well as in U.S. EPA guidance documents (Report No. EPA/440/4-91/001). A TMDL is defined as the sum of the individual waste load allocations for point sources, load allocations for non-point sources and natural background (40 CFR 130.2). TMDLs must be set at levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.7(c)(1)). 40 CFR 130.7 also dictates that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters. TMDLs typically include one or more numeric "targets", i.e., numerical translations of the existing water quality standards, which represent attainment of those standards, contemplating the TMDL elements described above. Since a TMDL must represent the "total" load, TMDLs must account for all sources of the relevant pollutants, irrespective of whether the pollutant is discharged to impaired or unimpaired upstream reaches.

7. Neither TMDLs nor their targets or other components are water quality objectives, and thus their establishment does not implicate California Water Code section 13241. Rather, under California Law, TMDLs are programs to implement existing standards (including objectives), and are thus established pursuant to Cal. Water Code section 13242. Moreover, they do not create new bases for direct enforcement against dischargers apart from the existing water quality standards they translate. Like most other parts of the Water Quality Control Plan for the Los Angeles Region (Basin Plan), TMDLs are not generally self-implementing. The targets merely establish the bases through which load allocations (LAs) and waste load allocations (WLAs) are calculated. The LAs and WLAs may be implemented in any manner consistent with the Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options, adopted by the State Water Resources Control Board (State Board) on June 16, 2005 (Resolution 2005-0050). Federal regulations

also require that National Pollutant Discharge Elimination System (NPDES) permits be consistent with the assumptions and requirements of available WLAs (40 C.F.R. 122.44(d)(vii)(B)).

8. As envisioned by California Water Code section 13242, the TMDL contains a "description of surveillance to be undertaken to determine compliance with objectives." The Compliance Monitoring element of the TMDL recognizes that monitoring will be necessary to assess the progress of pollutant load reductions and improvements in water quality in Santa Monica Bay. The TMDL establishes the types of information that will be necessary to secure. The Regional Board's Executive Officer will ensure that appropriate entities develop and submit monitoring programs and technical reports necessary to achieve the purposes of the TMDL. The Executive Officer will determine the scope of these programs and reports, taking into account any legal requirements, including this TMDL, and if necessary issue appropriate orders to appropriate entities.

9. Upon establishment of TMDLs by the State or U.S. EPA, the State is required to incorporate, or reference, TMDLs in the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). The Basin Plan and applicable statewide plans serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Los Angeles Regional Board. Attachment A to this resolution contains the language to be incorporated into the Basin Plan for this TMDL.

10. The Santa Monica Bay is an integral part of the larger geographic region commonly known as the Southern California Bight. It is bordered offshore by the Santa Monica Basin, to the north by the rocky headlands of Point Dume and to the south by the Palos Verdes Peninsula, and onshore by the Los Angeles Coastal Plain and the Santa Monica Mountains. The 414 square mile area of land that drains naturally to the Bay, known as the Santa Monica Bay watershed, is bordered on the north by the Santa Monica Mountains from the Ventura-Los Angeles County line to Griffith Park, extending south and west across the Los Angeles coastal plain to include the area east of Ballona Creek and north of Baldwin Hills. South of Ballona Creek, a narrow coastal strip between Playa del Rey and the Palos Verdes Peninsula forms the southern boundary of the watershed. The Santa Monica Bay itself is the submerged portion of the Los Angeles Coastal Plain. The continental shelf extends seaward to the shelf break about 265 feet underwater, then drops steeply to the Santa Monica Basin at about 2,630 feet. Nearshore Santa Monica Bay is defined by the Ocean Plan as, within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot contour, whichever is further from the shoreline. Offshore is defined as the waters between the nearshore zone and the limit of state waters. Lastly, state waters, according to section 13200 of the California Water Code, extend three nautical miles into the Pacific Ocean from the line of mean lower low water marking the seaward limits of inland waters and three nautical miles from the line of mean lower low water on the mainland

and each offshore island. The primary land use in the Santa Monica Bay Watershed is open space (55%), while high-density residential areas represent the largest developed area (25% of the total watershed). Low-density residential constitutes 5% of the land area. Commercial, industrial and mixed urban areas cover 10%. The remaining 5% of land area is covered by transportation (1.7%), educational institutions (1.6%), agriculture (0.8%), recreational uses (0.8%), public facilities and military installations (0.2%), and water (0.4%). Santa Monica Bay receives urban and stormwater runoff from a network of storm drains throughout the watershed.

11. Numeric targets for the TMDL are based on narrative water quality objectives (WQOs) for Floating Material and Solid, Suspended, or Settleable Materials contained in the Basin Plan, and the narrative water quality objective for Floating Particulates contained in the California Ocean Plan (2005).

12. The Regional Board's goal in establishing the TMDL for debris in nearshore/offshore Santa Monica Bay is to protect the beneficial uses of: industrial service supply (IND), navigation (NAV), water contact recreation (REC-1), non-contact water recreation (REC-2), commercial and sport fishing (COMM), estuarine habitat (EST), marine habitat (MAR), preservation of biological habitats (BIOL), migration of aquatic organisms (MIGR), wildlife habitat (WILD), rare, threatened, or endangered species (RARE), spawning, reproduction, and or early development (SPWN), shellfish harvesting (SHELL), and wetland habitat (WET) in Santa Monica Bay by achieving the numeric and narrative water quality objectives set to protect those uses.

13. Marine debris has impacted at least 267 species world-wide, primarily through ingestion and entanglement (Heal the Bay, 2007). Entanglement of marine life can cause strangulation or suffocation, and wounds that can lead to infections or loss of limbs. Marine debris and beach litter injures and kills marine wildlife, damages the Bay's aesthetic qualities, and is expensive for coastal communities to clean up.

14. Debris can threaten the health of people who wade or swim in the Santa Monica Bay. Of particular concern are the bacteria and viruses associated with diapers, medical waste (e.g., used hypodermic needles and pipettes), and human or pet waste. Additionally, sharp objects left on the beach can cause cuts and injuries. Such injuries can then expose a person's bloodstream to microbes in the water that may cause illness.

15. Buoyant (floatable) elements are easily transported through water ways and into the marine environment. Birds, fish and mammals often mistake plastic for food. Plastic resin pellets (a by-product of plastic manufacturing) are harmful to aquatic life, since they can be ingested by a large number of small organisms which can then suffer malnutrition or internal injuries. In addition, plastic pellets may contain chemicals that are toxic (e.g. persistent organic pollutants).

These substances may be additives that were intentionally mixed into the resin to achieve specific properties, or contaminants that were adsorbed by the pellets from the environment (U.S. EPA, 1992).

16. Regional Board staff has prepared a detailed technical document that analyzes and describes the specific necessity and rationale for the development of this TMDL. The technical document entitled "Santa Monica Bay Nearshore and Offshore Debris TMDL" is an integral part of this Regional Board action and was reviewed, considered, and accepted by the Regional Board before acting. Further, the technical document provides the detailed factual basis and analysis supporting the problem statement, numeric targets (interpretation of the narrative water quality objectives, used to calculate the waste load and load allocations), source analysis, linkage analysis, waste load allocations (for point sources), load allocations (for non-point sources), margin of safety, and seasonal variations and critical conditions of this TMDL.

17. On November 4, 2010, prior to the Board's action on this resolution, a public hearing was conducted on the Santa Monica Bay Debris TMDL. Notice of the hearing was published in accordance with the requirements of California Water Code Section 13244. This notice was published in the Los Angeles Times and the Ventura County Star on July 30, 2010.

18. The public has had a reasonable opportunity to participate in the review of the amendment to the Basin Plan. Stakeholder meetings were held on November 10, 2009, February 18, 2010, March 23, 2010, April 29, 2010, June 7, 2010, June 8, 2010, June 17, 2010, June 23, 2010; August 10, 2010, August 17, 2010, August 26, 2010, and September 2, 2010. A draft of the TMDL was released for public comment on July 30, 2010. A Notice of Hearing and Notice of Filing were published and circulated more than 45 days preceding Board action. An additional notice of hearing was published on September 7, 2010, and a notice of postponement was published on September 9, 2010, in order to give industrial facilities that manufacture, handle or transport plastic pellets time to review and comment on the Basin Plan Amendment. Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on November 4, 2010 to consider adoption of the TMDL.

19. In amending the Basin Plan to establish this TMDL, the Regional Board considered the requirements set forth in Sections 13240 and 13242 of the California Water Code.

20. Because the TMDL implements existing narrative and numeric water quality objectives (i.e., water quality objectives in the Basin Plan and California Ocean Plan), the Regional Board (along with the State Board) has determined that adopting a TMDL does not require the Regional Board to consider the factors of California Water Code section 13241. The consideration of the California

Water Code section 13241 factors, by section 13241's express terms, only applies "in establishing water quality objectives." Here the Regional Board is not establishing water quality objectives, but as required by section 303(d)(1)(C) of the Clean Water Act is adopting a TMDL that will implement the previously established objectives that have not been achieved. In making this determination, the Regional Board has considered and relied upon a legal memorandum from the Office of Chief Counsel to the State Board's basin planning staff detailing why TMDLs cannot be considered water quality objectives. (See Memorandum from Staff Counsel Michael J. Levy, Office of Chief Counsel, to Ken Harris and Paul Lillebo, Division of Water Quality: The Distinction Between a TMDL's Numeric Targets and Water Quality Standards, dated June 12, 2002.)

21. While the Regional Board is not required to consider the factors of California Water Code section 13241, it nonetheless has developed and received significant information pertaining to the California Water Code section 13241 factors and has considered that information in developing and adopting this TMDL. Section 13241 at a minimum requires that water quality objectives ensure reasonable protection of beneficial uses. The designated beneficial uses for Santa Monica Bay and its coastal features include industrial service supply (IND), navigation (NAV), water contact recreation (REC-1), non-contact water recreation (REC-2), commercial and sport fishing (COMM), estuarine habitat (EST), marine habitat (MAR), preservation of biological habitats (BIOL), migration of aquatic organisms (MIGR), wildlife habitat (WILD), rare, threatened, or endangered species (RARE), spawning, reproduction, and or early development (SPWN), shellfish harvesting (SHELL), and wetland habitat (WET). The past, present and probable future beneficial uses of water have been considered in that Santa Monica Bay is designated for a number of beneficial uses in the Basin Plan. The environmental characteristics of Santa Monica Bay are spelled out at length in the Basin Plan and in the technical documents supporting this Basin Plan amendment, and have been considered in developing this TMDL. Water quality conditions that reasonably could be achieved through the coordinated control of all factors which affect water quality in the area have been considered. This TMDL provides several compliance options, including structural and/or non-structural best management practices (BMPs) such as full capture devices for point sources and a program of minimum frequency of assessment and collection in conjunction with BMPs (MFAC/BMP program) for nonpoint sources that could be implemented directly in the watershed to reduce trash loading to Santa Monica Bay. These options provide flexibility for responsible jurisdictions to reduce trash loading to the waterbodies in the Santa Monica Bay Watershed. Establishing a plan that will ensure the waterbodies in the Santa Monica Bay Watershed attain and continue to attain water quality standards is a reasonable water quality condition. However, to the extent that there would be any conflict between the consideration of the factor in Water Code section 13241, subdivision (c), if the consideration were required, and the Clean Water Act, the Clean Water Act

requirements would prevail. Economic considerations were considered throughout the development of the TMDL. Some of these economic considerations arise in the context of Public Resources Code section 21159 and are equally applicable here. The implementation program for this TMDL recognizes the economic limitations on achieving immediate compliance and allows a flexible implementation schedule of 8 years for point sources, and 5 years for nonpoint sources.

22. The amendment is consistent with the State Antidegradation Policy (State Board Resolution No. 68-16), and the federal Antidegradation Policy (40 CFR 131.12), in that it does not allow degradation of water quality, but requires restoration of water quality and attainment of water quality standards.

23. Pursuant to Public Resources Code section 21080.5, the Resources Agency has approved the Regional Boards' basin planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) (Public Resources Code, § 21000 et seq.) requirements for preparing environmental documents (14 Cal. Code Regs. § 15251(g); 23 Cal. Code Regs. § 3782). The Regional Board staff has prepared "substitute environmental documents" for this project that contain the required environmental documentation under the State Board's CEQA regulations. (23 Cal. Code Regs. § 3777.) The substitute environmental documents include the TMDL staff report entitled "Santa Monica Bay Debris TMDL", the environmental checklist, the comments and responses to comments, the basin plan amendment language, and this resolution. The project itself is the establishment of a TMDL for debris in Santa Monica Bay. While the Regional Board has no discretion to not establish a TMDL (the TMDL is required by federal law), the Board does exercise discretion in assigning waste load allocations and load allocations, determining the program of implementation, and setting various milestones in achieving the water quality standards. The CEQA checklist and other portions of the substitute environmental documents contain significant analysis and numerous findings related to impacts and mitigation measures.

24. A CEQA Scoping meeting was conducted on March 23, 2010 at the Hyperion Treatment Plant, 12000 Vista del Mar, Playa del Rey, California 90293. A notice of the CEQA Scoping meeting was sent to interested persons within the subwatershed.

25. In preparing the substitute environmental documents, the Regional Board has considered the requirements of Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and intends those documents to serve as a tier 1 environmental review. This analysis is not intended to be an exhaustive analysis of every conceivable impact, but an analysis of the reasonably foreseeable consequences of the adoption of this regulation, from a programmatic perspective. The "Lead" agencies for tier 2 projects will assure compliance with project-level CEQA analysis of this

programmatic project. Project level impacts will need to be considered in any subsequent environmental analysis performed by other public agencies, pursuant to Public Resources Code section 21159.2.

26. The foreseeable methods of compliance with trash control elements of this TMDL entail construction and operation of structural best management practices such as full capture devices including catch basin inserts and vortex separation systems for point sources or combinations of partial capture and/or institutional controls. Foreseeable methods of compliance also include nonstructural best management practices such as Minimum Frequency of Assessment and Collection Programs for nonpoint sources.

27. The foreseeable methods of compliance with the plastic pellet Waste Load Allocation assigned to industrial permittees, include the implementation of best management practices such as appropriate containment systems, sealed containers, vacuum devices for cleaning, and frequent inspection and cleaning at operational areas and outlets of water discharge, to effectively control and prevent discharges of pre-production plastics pellets. In addition, necessary best management practices shall be exercised to eliminate spillage of plastic pellets during transportation that could be later mobilized and transported to waters of the State.

28. Consistent with the Regional Board's substantive obligations under CEQA, the substitute environmental documents do not engage in speculation or conjecture, and only consider the reasonably foreseeable environmental impacts, including those relating to the methods of compliance, reasonably foreseeable feasible mitigation measures to reduce those impacts, and the reasonably foreseeable alternative means of compliance, which would avoid or reduce the identified impacts.

29. The proposed amendment could have a potentially significant adverse effect on the environment. However, there are feasible alternatives, feasible mitigation measures, or both, that if employed, would substantially lessen the potentially significant adverse impacts identified in the substitute environmental documents; however such alternatives or mitigation measures are within the responsibility and jurisdiction of other public agencies, and not the Regional Board. California Water Code section 13360 precludes the Regional Board from dictating the manner in which responsible parties comply with any of the Regional Board's regulations or orders. When the parties responsible for implementing this TMDL determine how they will proceed, the parties responsible for those parts of the project can and should incorporate such alternatives and mitigation into any subsequent projects or project approvals. These feasible alternatives and mitigation measures are described in more detail elsewhere in the substitute environmental documents. (14 Cal. Code Regs. § 15091(a)(2).)

30. The substitute documents for this TMDL, and in particular the Environmental Checklist and staff's responses to comments, identify broad mitigation approaches that should be considered at the project level.

31. To the extent significant adverse environmental effects could occur, the Regional Board has balanced the economic, legal, social, technological, and other benefits of the TMDL against the unavoidable environmental risks and finds that specific economic, legal, social, technological, and other benefits of the TMDL outweigh the unavoidable adverse environmental effects, such that those effects are considered acceptable. The basis for this finding is set forth in the substitute environmental documents. (14 Cal. Code Regs. § 15093.)

32. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subdivision (b). As specified above, federal law and regulations require that TMDLs be incorporated or referenced in the state's water quality management plan. The Regional Board's Basin Plan is the Regional Board's component of the water quality management plan, and the Basin Plan is how the Regional Board takes quasi-legislative, planning actions. Moreover, the TMDL is a program of implementation for existing water quality objectives, and is, therefore, appropriately a component of the Basin Plan under Water Code section 13242. The necessity of developing a TMDL is established in the TMDL staff report, the section 303(d) list, and the data contained in the administrative record documenting the debris impairment in Santa Monica Bay.

33. The Basin Plan amendment incorporating a TMDL for Debris in nearshore/offshore Santa Monica Bay must be submitted for review and approval by the State Board, the State Office of Administrative Law (OAL), and the U.S. EPA. The Basin Plan amendment will become effective upon approval by OAL and U.S. EPA. A Notice of Decision will be filed with the Resources Agency.

34. If during the State Board's approval process Regional Board staff, the State Board or State Board staff, or OAL determine that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer should make such changes consistent with the Regional Board's intent in adopting this TMDL, and should inform the Board of any such changes.

35. Considering the record as a whole, this Basin Plan amendment is expected to result in an effect, either individually or cumulatively, on wildlife resources.

THEREFORE, be it resolved that pursuant to sections 13240 and 13242 of the Cal. Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. The Regional Board hereby approves and adopts the CEQA substitute environmental documentation, which was prepared in accordance with Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and directs the Executive Officer to sign the environmental checklist.

2. Pursuant to Sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapter 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment A hereto, to incorporate the elements and implementation schedule of the Santa Monica Bay Debris TMDL.

3. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

4. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it to OAL and the U.S. EPA.

5. If during the State Board's approval process, Regional Board staff, the State Board or State Board staff, or OAL determine that minor, non-substantive modifications to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

6. The Executive Officer is authorized to request a "No Effect Determination" from the Department of Fish and Game, or transmit payment of the applicable fee as may be required to the Department of Fish and Game.

I, Samuel Unger, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on November 4, 2010.

Samuel Unger
Executive Officer

Nov. 4, 2010
Date

City of Torrance, California

MACHADO LAKE PESTICIDES AND PCBS TOTAL MAXIMUM DAILY LOAD

SPECIAL STUDY WORK PLAN

August 31, 2011

3031 Torrance Boulevard • Torrance, California 90503 • Phone: 310.618.5880 • Fax: 310.618.5891

City of Torrance, California

MACHADO LAKE
PESTICIDES AND PCBS TOTAL MAXIMUM DAILY LOAD

SPECIAL STUDY WORK PLAN

August 31, 2011

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SPECIAL STUDY WORK PLAN

1.0 INTRODUCTION

This Field Sampling Plan (FSP) presents the approach and procedures to implement stormwater sampling activities in 2011 for a Special Study of the City of Torrance (City) storm drains discharging stormwater into Machado Lake. The field study sampling procedures, methods, and analyses for stormwater are described in this document.

1.1 Background

The City is subject to the requirements of the Machado Lake Pesticides and PCBs Total Maximum Daily Load (TMDL) per the Los Angeles Regional Quality Control Board's (Regional Board's) Resolution R10-008. Under the Regional Board's resolution, the City shall submit to the Regional Board's Executive Officer a Monitoring and Reporting Plan (MRP) within 1'5 year of the effective date of the resolution or propose a Special Study Work Plan following the requirements of one of three optional studies. This Special Study Work Plan details the approach proposed by the City to perform Optional Study No. 3, to assess compliance with the Waste Load Allocations (WLA) on a mass basis for pesticides and PCBs originating from the City's watersheds. The Special Study Work Plan proposes a pre-Best Management Practices (BMP) Implementation Study including field sampling and data collection to be followed by submittals to the Regional Board including a BMP Evaluation and Selection Report, a MRP, and a BMP Implementation Report to be provided at a later date.

Machado Lake is identified on the 1998, 2002, 2006, and 2008 Clean Water Act 300(d) list of impaired water bodies as impaired due to chlordane, DDT, dieldrin, Chem A (chemical group A), and PCBs (Polychlorinated biphenyls) in tissue. Resource agencies, local governments, project implementers, the scientific community, environmental groups, decision-makers at the city, county, state, and federal levels, and many others have continued to take meaningful steps towards the restoration of Machado Lake and its basin. Among these efforts, restoration activities are expanding through continued implementation of erosion control, stormwater management, and riparian restoration projects, development of the Machado Lake Pesticides and PCBs TMDL that is providing a quantitative, science-based approach for pollutant reduction, and a strong research/monitoring effort to evaluate key ecological processes and response to water quality improvement projects.

The Machado Lake Pesticides and PCBs TMDL allows for the establishment of WLAs as concentration-based allocations (equal to the sediment numeric targets) for suspended sediment-associated contaminants shown in Table 1. This approach ensures that targets in the lake will not be exceeded and applies the same standard throughout the watershed, instilling equal protection. Furthermore, because organochlorine (OC) pesticides and PCBs bioaccumulate, the risk to human health and the environment does not occur as the result of a single discharge event. Therefore, the WLAs are applied with a 3-year averaging period. The impacts of OC pesticides and PCBs are manifested over long time periods. Short-term

variations in pollutant concentrations are not likely to significantly impact the impairment and/or protection of beneficial uses. Thus, it is reasonable to evaluate discharges and improvements in water quality over a longer time period. The 3-year averaging period protects the beneficial uses of the lake over long time periods.

The City of Torrance mass-based WLA will be proportional to the City owned area in the sub-watershed. The City of Torrance area accounts for 35.6% of the Machado Lake Watershed.

Table 1 Waste Load Allocations for OC Pesticides and PCBs

Responsible Party	Pollutant	WLA for Suspended Sediment-Associated Contaminants (ug/kg dry weight)
MS4 Permittees[1], Caltrans, General Construction and Industrial Stormwater Permits, and other Non-stormwater NPDES Permits	Total PCB	59.8
	DDT (all congeners)	4.16
	DDE (all congeners)	3.16
	DDD (all congeners)	4.88
	Total DDT	5.28
	Chlordane	3.24
	Dieldrin	1.9

[1]WLA are applied with a 3-year averaging period

1.2 Site Conditions and Characteristics

1.2.1 Study Site Location

The City is located about 15 miles south of Downtown Los Angeles (LA), in southern LA County, just north of the Palos Verdes Hills. The City was incorporated on May 12, 1921, and is just over 20.5 square miles in area. The City is bounded by Redondo Beach on the west and north, Lawndale and Gardena on the north, LA on the east, Lomita to the southeast, and Rolling Hills Estates and Palos Verdes Estates on the south. The City is also bounded by approximately 4,000 feet of Santa Monica Bay coastline. The City's storm conveyance systems are interconnected with neighboring city systems. Neighboring cities located at generally higher elevation such as Rolling Hills Estate and Palos Verde Estate discharge stormwater into the City's and/or LA County's storm conveyance systems located within the City's boundaries. Figure 1 shows a regional location map of the City.

1.2.2 Hydrology and Hydraulics

The Machado Lake subwatershed is located in the southwestern area of the Dominguez Watershed and includes portions of the Cities of Los Angeles, Torrance, Lomita, Rolling Hills, Rolling Hills Estates, Carson, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, and the communities of unincorporated Los Angeles County, including Wilmington and Harbor City. However, much of the Machado Lake watershed consists of the hilly regions of Rolling Hills Estates and Rolling Hills. This portion of the watershed is unique, as it consists of relatively steep hills with drainage into the canyons. The Machado Lake Watershed covers an area of approximately 20 square miles and is itself divided into six primary subdrainage areas. These subdrainages are the Walteria Lake, Project 77/510, Wilmington Drain, Project 643 (72-inch Storm Drain), Project 643 (Figueroa Drain), and Private Drain 553.

Machado Lake, about 40 acres in area and the Machado Lake Wetlands (64 acres) are located within the Ken Malloy Harbor Regional Park in the southeastern corner of the Machado Lake Watershed. Both Machado Lake and the Machado Lake wetlands serve as flood retention basins for the Machado Lake Watershed.

1.2.2.1 Storm Drain

As the area is highly urbanized, drainage is primarily conducted through an extensive network of underground storm drain facilities. The Los Angeles County Department of Public Works maintains the system of storm drains in the City of Rolling Hills Estates. The primary use of the Dominguez Channel and all other open channels in the Dominguez Watershed (including Wilmington Drain, Machado Lake, and Madrona Marsh) is flood protection.

Machado Lake receives urban and storm water runoff from a complex network of storm drain systems. The first of three primary storm drain channels that flow into Machado Lake is the Wilmington Drain. Approximately 65 percent of the runoff from the Machado Lake Watershed flows through the Wilmington Drain into Machado Lake. The other two primary storm drain channels are the Project No. 77 Drain and the Harbor City Relief Drain. Several smaller storm drains also discharges into Machado Lake, including Project No. 643's Figueroa Street Outlet and a 72-inch storm drain outlet. Machado Lake discharges at the southern end by overflowing a concrete dam into the Machado Lake wetland. Water discharges from the wetland through the Harbor Outflow structure and into the West Basin of the Los Angeles Harbor.

The Walteria Lake, located within the City's boundaries, is owned and operated by LA County. It is approximately 1,005 acre-feet in capacity and receives raw stormwater mainly from Rolling Hills Estates and Palos Verdes Estates. Effluent from the lake is pumped at a maximum rate of 57 cubic feet per second (cfs) through a force main system into a 54-inch drain line that lies under Skypark Drive. The discharge eventually leaves the City near the intersection of Crenshaw Boulevard and Amsler Street.

Figure 2 shows the drainage basins and stormwater conveyance infrastructure in the City. The figure also shows nearby communities discharging stormwater into the City's drainage system.

1.2.3 Land Use

The City of Torrance is predominantly residential land use, with concentrations of industrial and commercial uses. This reflects the City's history as a "company town," where homes were built to house the local work force of industries. Residential development covered almost half of the City's land area. Industrial uses occupied the second largest land area, at 22 percent. Commercial and Public/Quasi-Public/Open Space uses represent the third largest land uses in the City, about 12 percent each. Torrance also had a limited supply of vacant land mostly within commercial and industrial areas. Given the built-out character of the community, only minor land use changes from baseline year 2010 conditions will occur over the long term.

Residential uses are located throughout Torrance at varying development densities. The highest residential densities occur along major streets and near major transportation corridors, in older neighborhoods, and in apartment or condominium developments and Planned Development communities around Sepulveda Boulevard and Plaza Del Amo between Hawthorne and Crenshaw Boulevards. The lowest residential densities are largely located in the western and southern portions of the City. Figure 3 identifies the land uses in Torrance.

1.2.4 Water Quality Issues

Machado Lake, located in the Dominguez Channel watershed in southern LA County, is identified on the 1998, 2002, 2006, and 2008 Clean Water Act 303(d) list of impaired water bodies as impaired due to chlordane, DDT, dieldrin, Chem A, and PCBs in tissue. As part of the Los Angeles County MS4 Permit Core Monitoring Program, the Dominguez Channel watershed data collected in 2008-2009 did not detect OC pesticides and PCBs in any of the samples (Los Angeles County Stormwater Monitoring Report, 2008-09). While these data were not collected from the Machado Lake subwatershed specifically, they are representative of contaminant loadings from the Dominguez Channel Watershed Management Area, which contains similar land uses and topography as the Machado Lake subwatershed. Based on these data, current stormwater discharge from the Machado Lake subwatershed appears to be a minimal source of contamination to the lake. However, it is possible for small amounts of contaminated sediment to accumulate to levels that cause impairment.

These data, however, document the presence of contaminated sediment residing in Wilmington Drain and Project 77 drain. The locations of these drains are shown on Figure 4. If sediment is transported downstream to Machado Lake it would be a significant source of contaminated sediment. Table 2 shows the mass of contaminant loaded from each sub-drainage area.

Machado Lake is located in the Ken Malloy Harbor Regional Park (KMHRP), which is a 231 acres LA City Park serving the Wilmington and Harbor City areas. As shown on Figure 4, the park is located west of the Harbor Freeway (110) and east of Vermont Avenue between the Tosco Refinery on the south and the Pacific Coast Highway on the North. Machado Lake is one of the last lake and wetland systems in LA; the area is approximately 103.5 acres in total

size. The upper portion, which includes the open water area, is approximately 40 acres and the lower wetland portion is about 63.5 acres. Machado Lake is a shallow polymictic lake; the depth is generally 0.5 to 1.5 meters; the *average* depth is approximately 1.0 meter. The lake was originally developed as part of Harbor Regional Park in 1971 and intended for boating and fishing. Over the years water quality generally declined; boating was stopped and signs were posted warning of the risk of eating fish from the lake.

Table 2 Total Annual Pesticides and PCBs Load Entering Machado Lake(1)

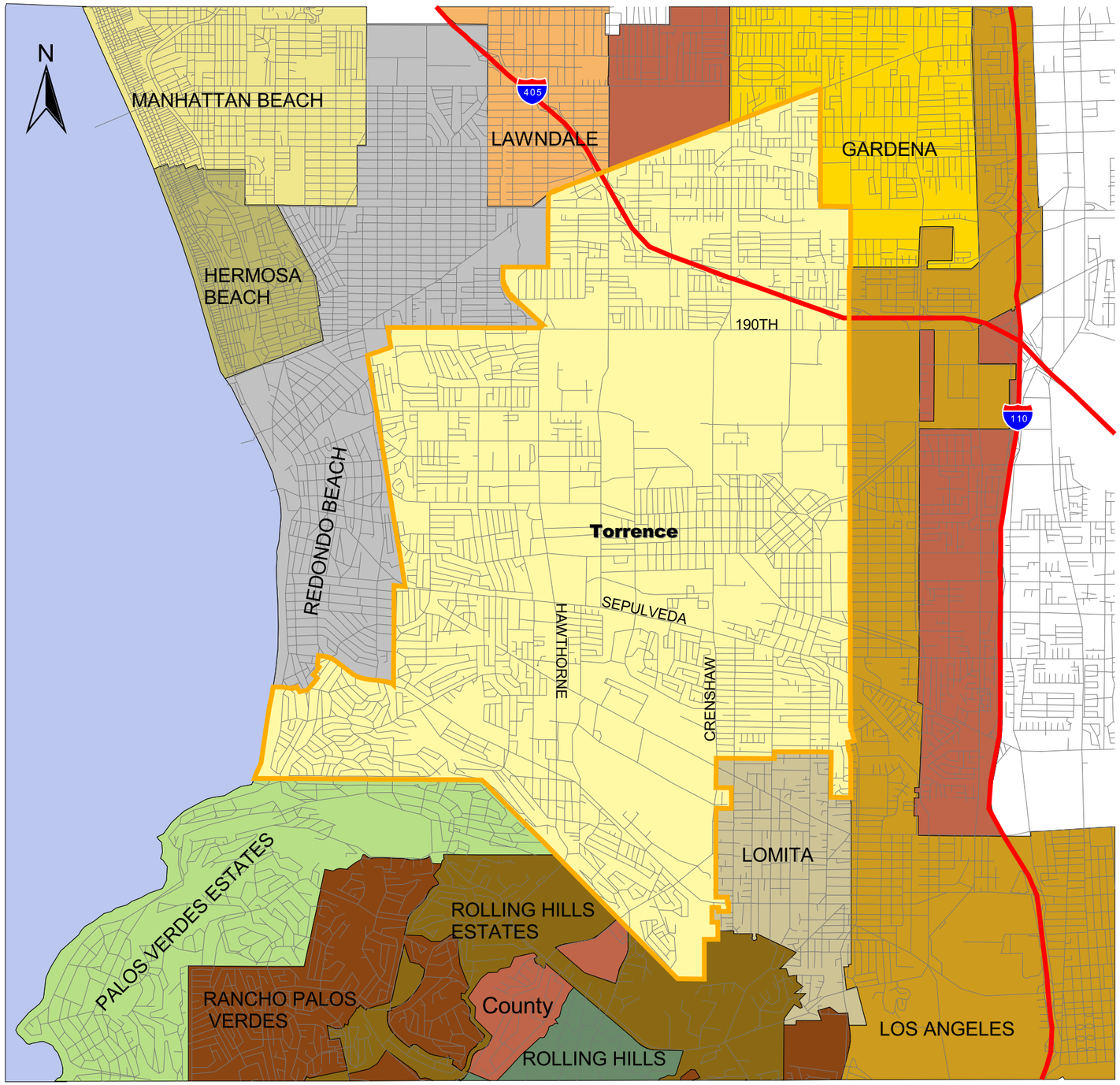
Pollutant	Annual Load (g/year)	
	Washington Drain	Project 77
Chlordane	26.2	6.9
Total DDT	19.0	1.5
PCBs	19.8	-

Notes:
1. Source: Machado Lake Pesticides and PCBs TMDL, Revised Draft – September 2, 2010.

The dominant land use in the Machado Lake Watershed is high-density single-family residential, accounting for approximately 45 percent of the land use. Industrial, vacant, retail/commercial, multi-family residential, transportation, and educational institutions each account for 5 to 7 percent of the land use, while "all other" accounts for the remaining 23 percent. Machado Lake is a receiving body of urban and stormwater runoff from a network of storm drains throughout the watershed. As indicated on Figure 4, there are three discharge points into Machado Lake from the following storm drain channels:

- Wilmington Drain.
- Project No. 77.
- Harbor City Relief Drain.

Approximately 88 percent of the Machado Lake Watershed drainage area flows through the Wilmington Drain into Machado Lake. Machado Lake is not the terminal point of the Machado Lake subwatershed. Machado Lake has the ability to overflow its dam into the lower wetlands, which discharge through a stormdrain to Los Angeles Harbor.



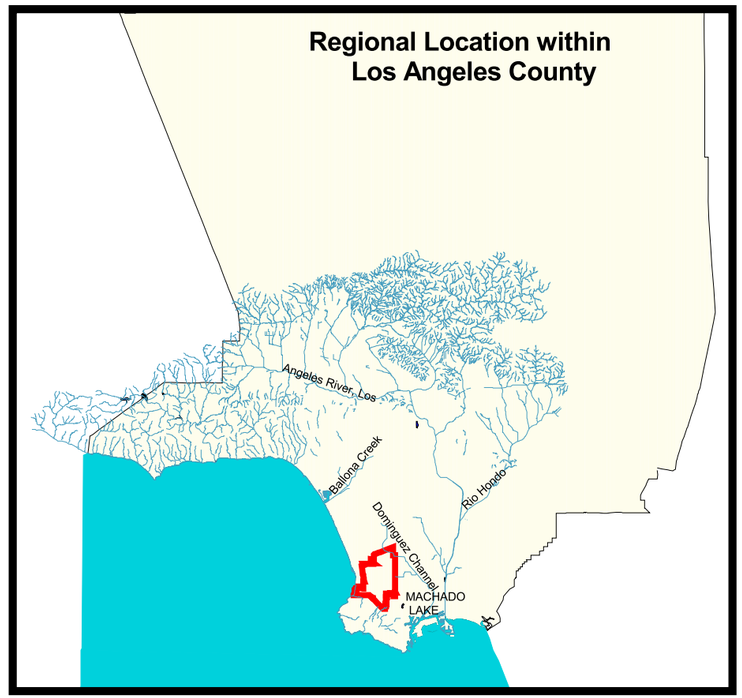


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Figure 1 Regional Map of Torrance

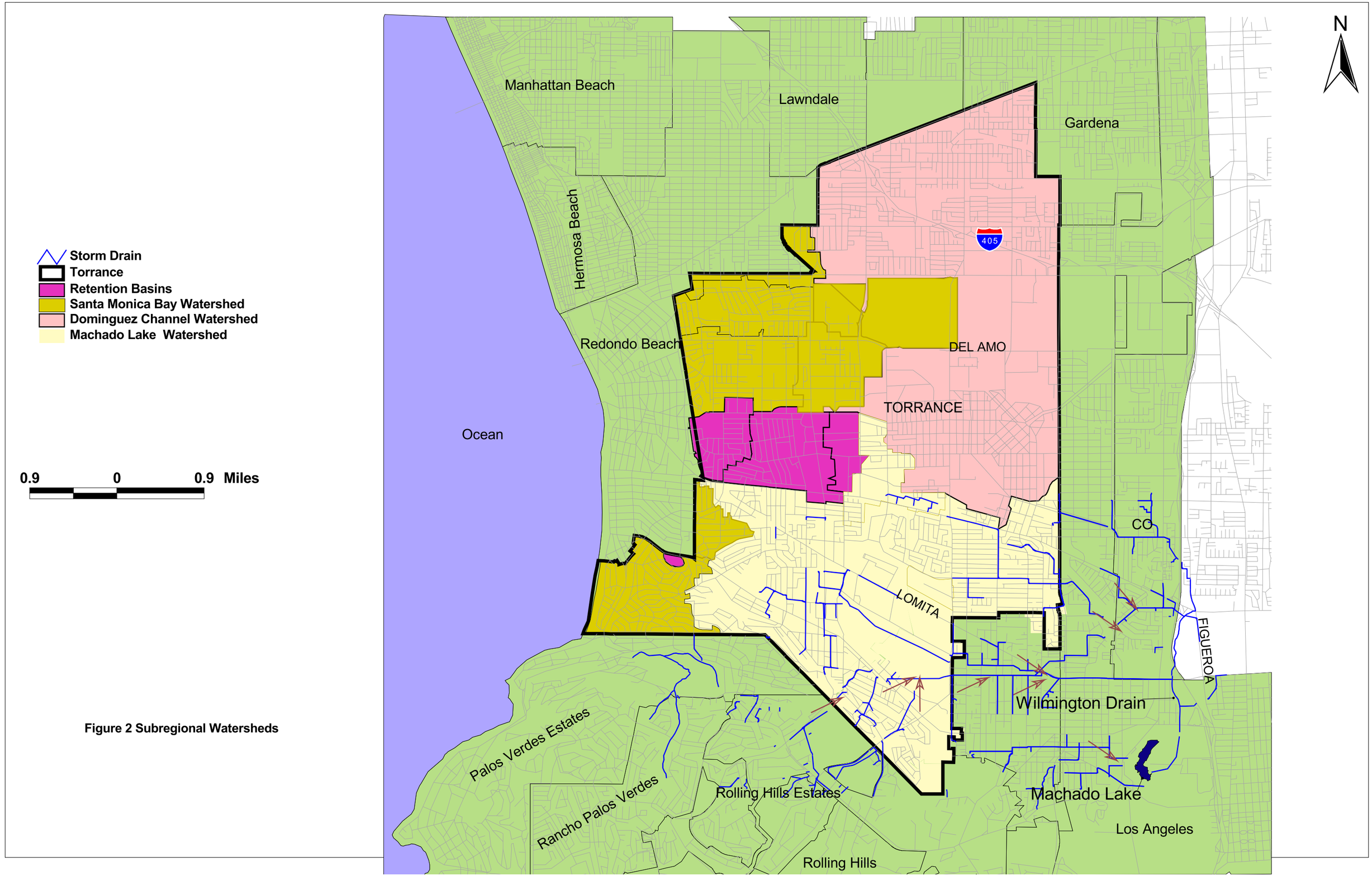


Figure 2 Subregional Watersheds

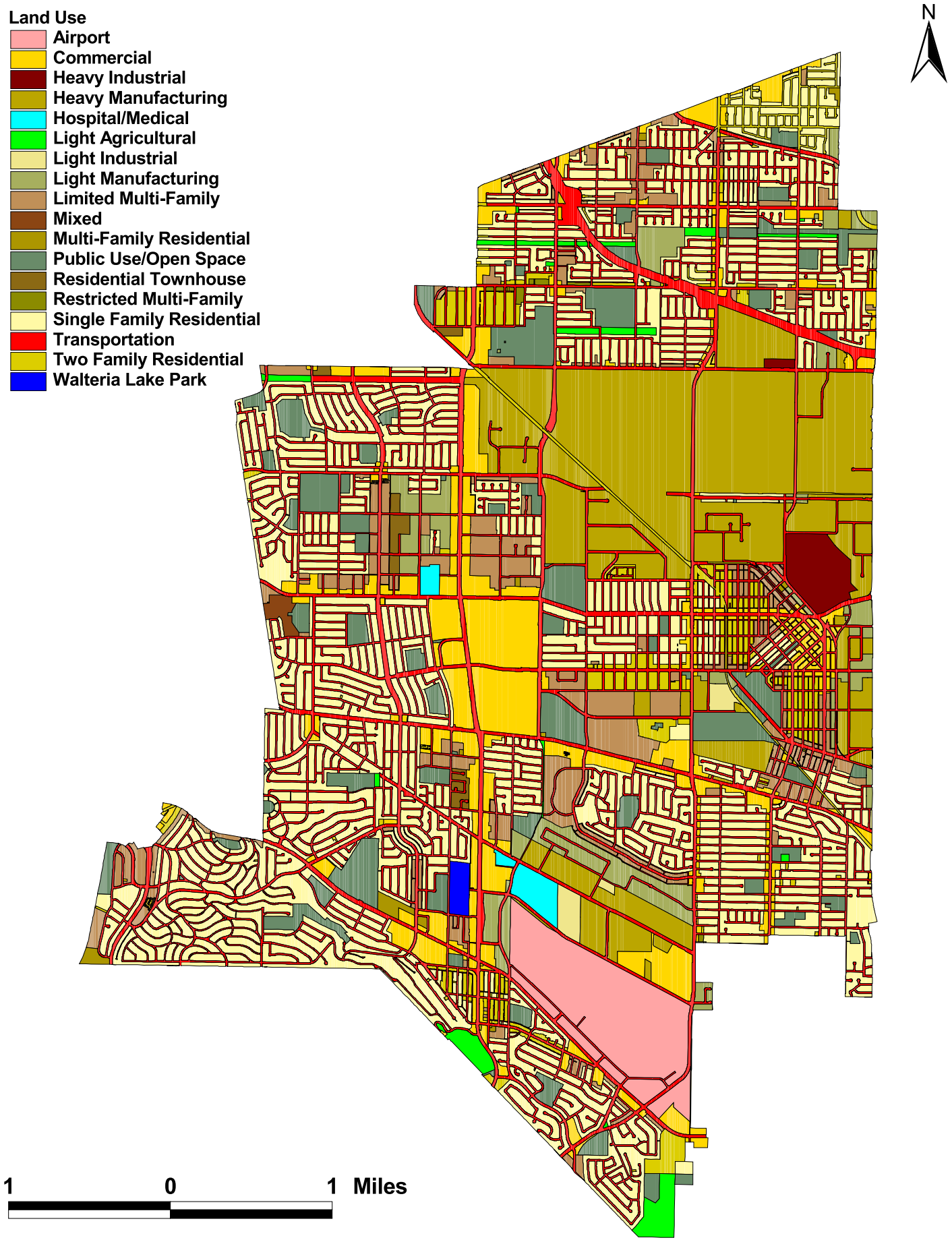


Figure 3 Existing Land Use of Torrance

Figure 4 2007 Satellite Imagery of Machado Lake and Ken Malloy Harbor Park Overview

1.3 Special Study Work Plan

This document provides the overall structure of the Special Study Work Plan with submittals to the Regional Board, as well as providing the initial Pre-BMP Implementation Study Plan (including a proposed field data collection and sampling plan). The Special Study Work Plan addresses the requirements of Optional Study No. 3 to assess compliance with WLAs for pesticides and PCBs originating from the City's watersheds. The scope of work for this plan includes the following:

- Pre-BMP Implementation Study Period - Includes three wet weather sampling each year for a period of two years.
- BMP Evaluation and Selection Study Report - This study report is to be submitted at a later date (see proposed schedule of work plan elements), and will summarize the collected field data. The field data will be used to assess compliance with WLAs under the TMDL. Based on the assessment of compliance, the BMP and Selection Study Report will identify and screen structural BMPs for mitigation to bring the City into compliance with the TMDL.
- Monitoring and Reporting Plan - Subsequent to acceptance by the Regional Board of the findings and conclusions of the City's BMP Evaluation and Selection Study Report, the City will submit an MRP specific to the needs for assessment of future compliance with the TMDL.
- BMP Implementation Report - This report will summarize the monitoring data collected after the of BMP implementation and will provide to the Regional Board an assessment of the success of the structural BMPs implemented by the City to support compliance with the TMDL. One wet weather sampling will be conducted each other year.

The actual start date for the sampling will be determined following the Regional Board's approval of this Special Study Work Plan. Other conditions that may affect the sampling schedule are weather and equipment conditions and availability. The schedule for the work plan is summarized in Table 3.

The Special Study Work Plan identifies the proposed tasks the City agrees to perform, their timelines, and the roles and responsibilities of various parties in completing the work. The purpose of this document is to serve as a starting point for work planning discussions between the City and the Regional Board.

Table 3	Schedule or Work Plan Elements	
ID	**Work Plan Element**	**Schedule**
1	Special Study Work Plan	January, 2012 (submittal)
2	Regional Board Review/Approval	Feb, 2012 (approval)
3	Pre-BMP Implementation Study	April, 2012 – March, 2013 (field sampling)
4	BMP Evaluation, Monitoring and Reporting Plan	September, 2013 (submittal - Draft) March, 2014 (Submittal – Final)
5	Regional Review/Approval	February, 2015 (approval)
6	BMP Implementation	April, 2015 (implementation)
7	BMP Implementation Report	September, 2019 (submittal)

2.0 PRE-BMP IMPLEMENTATION STUDY

2.1 Introduction

The Pre-BMP Implementation Study includes a 12-month FSP and evaluation of regional water quality models for wet weather conditions and Machado Lake to assess the City's current compliance with WLAs. The FSP covers sample collection methods, analytical procedures, data analysis and reporting, and health and safety aspects. The FSP will generate a variety of data including discharge rates and flow volumes, the concentrations of chemical parameters, and the measurement of physical parameters. Utilizing the mass balance approach, the data will be used to estimate the mass of pesticides and PCBs originating from the City as well as nearby agencies discharging stormwater into the City's storm drain system. The data will also be examined for patterns and trends, comparing stormwater quality between different sampling locations over time.

The Pre-BMP Implementation Study will be undertaken once approval is obtained from the Regional Board for the Special Study Work Plan.

The remaining sections of this document contain the FSP providing field sampling methods and analytical procedures that will be used to collect wet weather water quality data and continuous flow data.

2.2 Objectives of the Pre-BMP Implementation Study

The Pre-BMP Implementation Study will provide the City data needed to assess water quality impacts to the City's drainage network. The objective of this study is to support the City's compliance with the Machado Lake Pesticides and PCBs TMDL by performing Special Study No. 3. Data and information elements that are part of the Pre-BMP Implementation Study include:

1. Wet weather flow data including calculation of continuous volume data and water quality data obtained through field monitoring and sampling (data to be collected by implementing the FSP included within this document).
2. Estimates of wet weather stormwater quality impacts identified using an integrated water quality model developed by the City of Torrance. The water quality model is described in Section 2.2.1.
3. Identification of BMPs that will be implemented by the City to mitigate observed water quality impacts in the City's outflows to Machado Lake.

2.2.1 Pollutant Loading and Analysis Tool (PLAT)

In order to estimate wet weather stormwater quality impacts, the City has developed an integrated watershed modeling tool to simulate watershed hydrology, pesticides and PCBs, sediment, and contaminant dynamics. This tool called Pollutant Loading and Analysis Tool (PLAT), incorporates existing and commonly used watershed models. The main models used by PLAT are PLOAD, Program for Predicting Polluting Particle Passage thru Pits, Puddles, and Ponds (P8), and U.S EPA SUSTAIN model. PLAT is based on spatially distributed inputs derived from high resolution satellite imagery. PLAT has four main components: pollutant hot-spots characterization, BMP screening, continuous simulation, and BMP design, optimization, and placement. The SUSTAIN model provides an optimization routine that helps identify the appropriate size of BMPs for treating stormwater runoff from respective source areas to meet TMDL reduction goals. The tool has been validated with results from the LA County Watershed Management Model System (WMMS).

3.0 FIELD SAMPLING PLAN

The 12-month FSP is designed to collect continuous flow data and discrete wet weather water quality data to support the overall study objectives summarized in Section 2.

3.1 Sampling Locations and Access

Site selection is a major challenge, given the scarcity of funding for sampling and laboratory analysis. The number of locations to be sampled was decided based on the program objectives, regulatory requirements, and the size and complexity of the drainage sub-basins and conveyance system. In addition, the frequency of sampling at each location was considered.

As a first step in the selection process, the City's watersheds, sub-basins and drainage system network were reviewed. Based on this review, nine locations were identified that could be used to characterize the flows in and out of each subbasin. Four of these locations are needed at a minimum to characterize the flows conveyed to Machado Lake. The final selection of sample locations was based on factors such as site permission, access, clustering, personal safety, equipment safety, and the likelihood that stormwater would flow at the location. Table 4 summarizes the proposed stormwater sampling locations, types, and

characteristics. The general sampling locations are depicted on Figure 5. Appendix A shows detailed characteristics of each sampling location.

At a minimum, four sampling locations will meet the objectives of this program. However, the City will sample five additional locations, Tor-S3, Tor-S6, Tor-S7, Tor-S8, and Tor-S9 as shown on Figure 5 because the results will support critical decisions including identifying sources originating outside of the City's boundaries or sources not under the direct control of the City. The sampling locations Tor-S6, Tor-S7, Tor-S8, and Tor-S9 are discharge points for Rolling Hills and Palos Verdes Estates.

The sampling locations are described below.

Tor-S1

This site is located 40 ft north and 80 ft east of the intersection of Plaza Del Amo and Western Avenue. The total upstream drainage area is approximately 63 acres. The drainage area is mainly residential and commercial land use. Residential and commercial land uses represent 36 percent and 33 percent, respectively, of the drainage area. This site is easily accessible and safe for conducting sampling during both dry and wet weather conditions. The storm sewer conveying stormwater to this site is a 36-inch reinforced concrete pipe. This site is one of the four sites that will provide information on the amount of pollutants leaving the City limits.

Sampling Site: TOR-S1

Table 4 Sampling Location Characteristics

Sampling Location Name	Description	Land Use	GPS Coordinates	Associated Upstream Storm Drain Name	Diameter (in) and Material
Tor-S1	Located 40 ft north and 80 ft east of the intersection of Plaza Del Amo and Western Avenue. .	Residential/ commercial	33° 49.3572' 118° 18.5208'	City	36 RCP
Tor-S2	Approximately 50 ft west of 246th Place and Pennsylvania Avenue intersection.	Mixed	33°48.093' 118° 19.5252'	City	33 RCP
Tor-S3	Effluent of Walteria Lake, approximately 100 ft east of Madison St. and Skypark Drive intersection.	Mixed	33°48.6312 118° 20.8674'	Walteria Lake	54
Tor-S4	Approximately 210 ft north and 85 ft east of 236th Street and Western Avenue intersection.	Mostly residential	33° 48.7056' 118° 18.5196'	City	9'-2"Wx11'H RCB
Tor-S5	About 25 ft west of intersection of Bani Avenue and 250th Street (two pipes intersect from south and west).	Residential/ Airport	33° 47.8956' 118° 19.6872'	City	8'-9"Wx9'-7"H RCB
Tor-S6	Approximately 600 ft east of Estates Lane and Crenshaw Boulevard.	Mostly residential	33° 47.1822' 118° 20.43'	Rolling Hills Estates	36 RCP
Tor-S7	About 160 ft south and 280 ft east of Rolling Hills Road and Hawthorne Blvd. intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	Mostly residential	33° 47.6826 118° 20.9232'	Rolling Hills Estates	10'x10' RCB
Tor-S8	About 500 ft northwest of Paseo De Las Tortugas and Mesa St. intersection. Will monitor dry weather flow originating from Rolling Hills Estates.	Mostly residential	33° 48.0522' 118° 21.4254'	Rolling Hills Estates	24 RCP
Tor-S9	About 830 ft east and 120 ft south of Paseo de las Tortugas and Vista Montana intersection. Will monitor dry weather flow originating from Palos Verdes Estates.	Mostly residential	33° 48.2742' 118° 21.7776'	Palos Verdes Estates	42 RCP

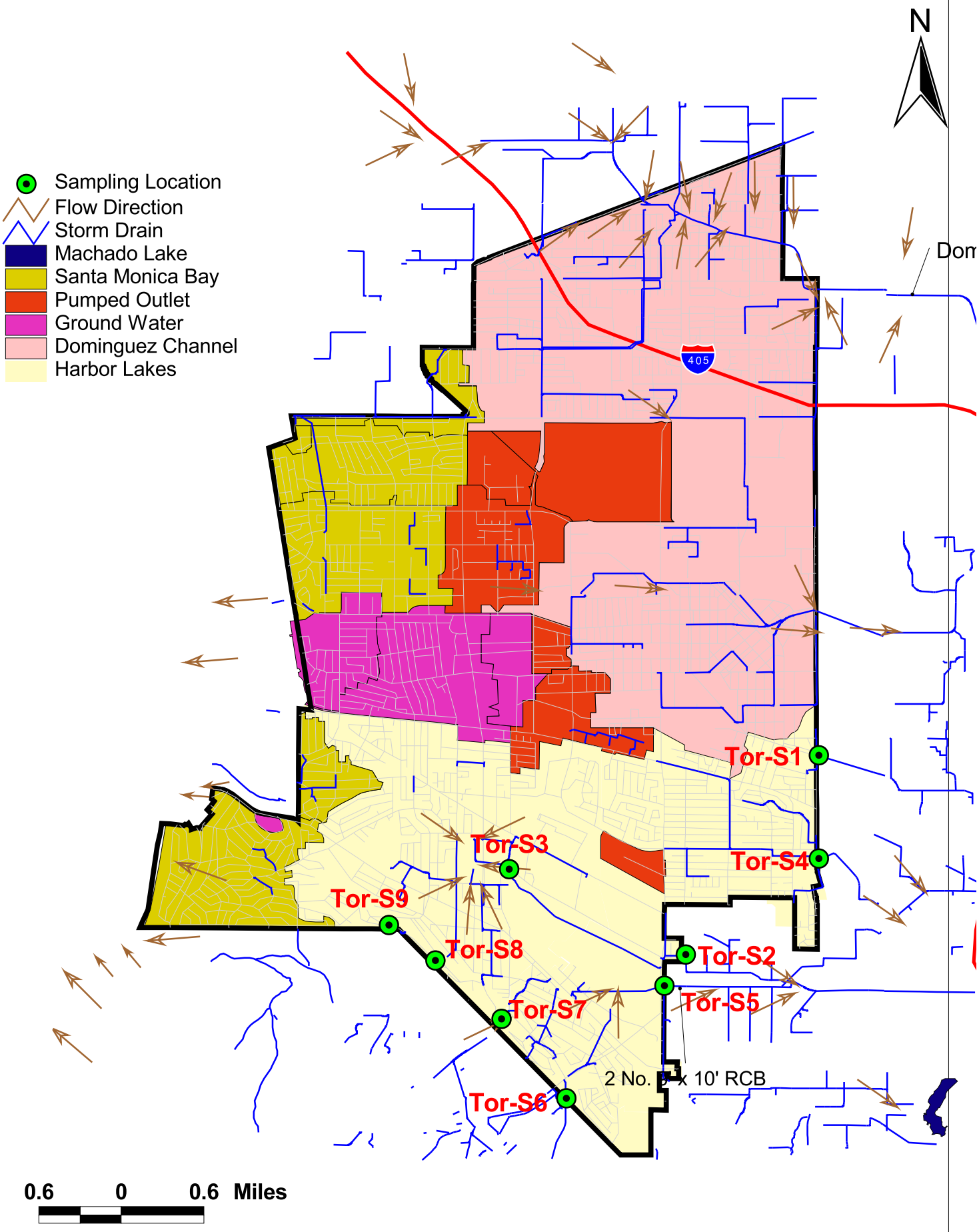


Figure 5 General Location Map of Sampling Locations

Tor-S2

Tor-S2 is approximately 50 ft west of the intersection of 246th Place and Pennsylvania Avenue. The total upstream drainage area is about 2,605 acres. The drainage area is a mixed land use, about 32 percent residential, 10 percent commercial and 11 percent industrial. The Torrance Airport accounts for 12 percent of the drainage area. Tor-S2 is easily accessible and safe for conducting sampling during both dry and wet weather conditions. Stormwater is conveyed to this site through an 8' x 7' reinforced concrete box. This site is one the four sites that will provide information to quantify the amount of pollutants leaving the City limits.

Sampling Site: TOR-S2

Tor-S3

This site, which is approximately 100 ft east of Madison St. and Skypark Drive intersection, will assist the City in characterizing discharges from Walteria Lake. The total upstream drainage area is approximately 2,285 acres. This site is upstream of Tor-S2. Land use is mixed with 37 percent residential, 10 percent commercial and 9 percent industrial. A 54-inch pipe conveys stormwater to this site. The site is easily accessible and safe for all weather sampling.

Sampling Site: TOR-S3

Tor-S4

Tor-S4 is approximately 210 ft north and 85 ft east of 236th Street and Western Avenue intersection. The total drainage area upstream of this sampling location is approximately 1,014 acres. Residential land use represents nearly 60 percent of the drainage area. Commercial and industrial land uses represent only 9 percent of the drainage area. The storm drain serving this site is a 9'-2" x 11' RCB. The site is safe for all weather sampling and it is easily accessible.

Sampling Site: TOR-S4

Tor-S5

This site is about 25 ft west of the intersection of Bani Avenue and 250th Street (two pipes intersect from south and west). This sampling site serves an upstream drainage area of approximately 661 acres. This site is mainly residential and airport land use; residential and airport land uses represent 43 and 24 percent of the drainage area, respectively. The storm drain discharging stormwater to this site is an 8'-9" x 9'-7' RCB. This site is easily accessible and safe for sampling activities.

Sampling Site: TOR-S5

Tor-S6

Tor-S6 is located at approximately 600 ft east of Estates Lane and Crenshaw Boulevard. This site will monitor flow entering the City's storm drain from Rolling Hills Estate. The sampling site is safe and easily accessible.

Sampling Site: TOR-S6

Tor-S7

This site is about 160 ft south and 280 ft east of Rolling Hills Road and Hawthorne Blvd. intersection. It will monitor dry weather flow originating from Rolling Hills Estates. The site is easily accessible and safe for sampling at all weather conditions.

Sampling Site: TOR-S7

Tor-S8

This site is located at about 500 ft northwest of Paseo De Las Tortugas and Mesa St. intersection. It will monitor dry weather flow originating from Rolling Hills Estates. The site is easily accessible and safe for sampling at all weather conditions.

Sampling Site: TOR-S8

Tor-S9

Tor-S9 is about 830 ft east and 120 ft south of Paseo de Las Tortugas and Vista Montana intersection. This site will monitor dry weather flow originating from Palos Verdes Estates. The site is accessible and safe for sampling activities.

Sampling Site: TOR-S9

Four types of measurements will be conducted each station. Each measurement type is discussed further in the following sections.

3.1.1 Stormwater Composite Samples

Flow-weighted composite samples of three storm events from each location will be collected to obtain Event Mean Concentrations (EMCs) of chemicals. Flow-weighted, whole water (unfiltered) sample will be collected over the course of the storm event with Isco 6712 automatic samplers. The samplers will be located either within the junction being sampled (above the expected water levels) or at secure sites, on the ground surface immediately adjacent to the junction access (e.g., manhole). The sampling tube will be placed inside the junction with the intake screen for the tube close to but not in contact with the bottom of the junction.

Sampling of composite water samples will be attempted whenever weather conditions present themselves in order to obtain three stormwater samples within the wet-weather season during storms that meet the acceptable target storm conditions. The target storm conditions for sampling are:

- Storms predicted to produce more than 0.2 inches rainfall over a minimum of a 3 hour period, not to exceed approximately 2.25 inches in a 24 hour period (equivalent to the 2-year event)
- And to have been preceded by at least a 24-hour dry period (less than 0.1 inches rainfall).

The objective is to get a composite sample that represents the water quality over the entire storm hydrograph. This is the primary reason to define the minimum and maximum of the target storm conditions. National Oceanic and Atmospheric Administration (NOAA) and California Climate Service storm forecasts will generally be used in the evaluation and identification of storms potentially meeting these criteria.

The described target storm conditions should be considered goals. Each event sampled will be evaluated relative to these goals but circumstances may arise where all these goals cannot be met. In that event, Regional Board will be contacted to discuss sampling or storm conditions that substantially do not meet the target storm conditions prior to analyzing the samples. The justification for accepting samples that deviate from these target storm conditions will be provided in the Field Report.

For each sampling location, drainage basins will be evaluated for basin area and runoff characteristics to facilitate calculation of expected discharge volumes for a variety of storm conditions meeting the storm criteria. The samplers will initially be setup with four programs to cover storm events from 0.2 inches to 0.5 inches, 0.5 inches to 1.0 inches, 1.0 inches to 1.5 inches, and 1.5 inches to 2.25 inches. Based on the forecast, the samplers will be called and the appropriate program will be run. Samplers will be pre-programmed to collect aliquots of stormwater in a uniform paced variable-volume manner following the calculated “trigger flow rate” or “trigger depth” depending on the individual site conditions. The objective is to collect a flow proportional composite sample that represents the entire storm hydrograph (aliquots will be collected into seven of the eight 1.8 liter bottles over the storm event, the

eighth bottle in the sampler will be used for a field blank for quality assurance/quality control [QA/QC]). However, this is only a guideline that will be considered in the evaluation of expected discharges and may be modified at one or more sampling locations. If storm volumes exceed expected volumes, the sampling period will be concluded when the sample bottles are full and thus in some cases, the falling limb of the storm hydrograph may not be sampled in its entirety.

3.1.2 Stormwater Grab Samples

During one storm event, discrete stormwater "grab" samples will be collected from all sampling locations. Because the purpose of the grab samples is to collect partitioning (chemical dissolved phase/suspended sediment) rather than loading data, samples will be collected during storm periods expected to have higher chemical concentrations (e.g., first flush or rising limb), to increase the likelihood of detecting these chemicals.

The sample teams will collect the stormwater from the automated samplers and transport it to the Laboratory, where it will be composited and one aliquot will be filtered and distributed appropriately to sample bottles for laboratory analyses and a second aliquot will be distributed directly to sample bottles for laboratory analysis. The analytical methods and concentration goals are the same as those discussed above for composite water samples. Target storm conditions for grab sampling are the same as for composite sampling described above, with grab samples taken sometime in the rising limb of the hydrograph of a continuous storm meeting the above requirements.

3.1.3 Sediment Trap Samples

Sediment traps will generally be installed at each sampling location as close to the target junction as possible and downstream of the automatic sampler intake tube, but this may vary at some locations. Figure 6 presents a photograph of a sediment trap of the type that will be deployed. For large pipes draining larger areas (i.e., land use based locations) the sediment traps will be placed at the bottom of the junction or adjacent outlet pipe. For smaller pipes, the opening of the collection bottle will be placed as close as possible to the same elevation as the invert of the junction or outfall outlet. Some sampling locations may require the use of sandbags or structural modifications to generate flow conditions conducive to sediment trap sampling. The sediment traps will be deployed at each location for a minimum target period of 3 months during the wet-weather period.

Sediment traps will be inspected at a minimum on a monthly basis. When inspected, if the collection bottle is more than half full of sediments, the bottle will be capped with screw closures, removed from the mounting brackets, packaged and placed on ice in coolers for transport to the Laboratory to be archived. A clean empty collection bottle will then be placed in the trap. If the collection bottle is less than one third full at the first monthly inspection, options for repositioning or relocating the equipment or adding additional traps to obtain a higher collection rate will be considered.

3.1.4 Flow Measurements

Isco Model 750 Area Velocity flow modules will be used in conjunction with the Isco automatic samplers to allow the collection of flow-weighted composites at each sampling

location. The flow modules will also continuously record flow data for the duration of sediment trap deployment.

Figure 6 Photo of Sediment Trap

3.2 Sample Collection Frequency

Samples will be collected on a storm event basis with the goal of three storm events per year. For each of the three storm events samples will be collected under the following conditions:

1. Sampling will occur during a storm event with at least 0.1 inch of precipitation (defined as a "measurable" event). Weather forecasts will be evaluated before deciding whether or not to sample a particular rain event. The monitoring manager will periodically establish a modem connection with each sampling unit to monitor rainfall, flow rates, and sampling activity. The monitoring manager will download stored data from the National Weather Service as needed.
2. Sampling will not occur at a frequency greater than once every 72 hours.
3. Sampling will not occur unless there has been at least 72 hours of continuous dry weather immediately preceding the "measurable" event.
4. Grab samples will be collected from all locations during approximately the first 30 minutes to 1 hour of stormwater discharge (first flush).

3.3 Selection of Analytical Parameters

The City proposes to use a mass based WLA compliance option to evaluate TMDL compliance. Samples submitted for pesticides and PCBswill be tested for total chlordane, DDT and Derivatives, total organic carbon, Dieldrin and total PCBs. In addition to TMDL constituents, general water chemistry (temperature, dissolved oxygen, pH, and electrical

conductivity) and a flow measurement will be required at each sampling event. General chemistry measurements will be taken in the laboratory immediately following sample collection, for the auto samplers or if weather conditions are unsuitable for field measurements. The constituents to be sampled are listed in Table 5.

Table 5 Monitoring Constituents		
Analyte	**Method of Analysis**	**Detection Limits**
Total Organ Carbon	EPA 414.1	1 mg/l
PCBs	EPA 8082	0.1 µg/l
DDT and Derivatives	EPA 8081A	0.1 µg/l
Dieldrin	EPA 8081A	0.1 µg/l
Total Chlordane	EPA 8081A	0.1 µg/l
TSS	EPA 160.2	0.5 mg/l

3.4 The Sampling Team

All samples from the nine sampling locations will be collected by a contract lab retained by the City. Pre-labeled sample bottles will be provided by the certified laboratory that will be conducting the analyses. The Sampling Team will be responsible for ensuring that all required equipment is ready for field operation. They are also responsible for performing the entire field sampling activities and most of the sampling preparation. Any member of the Sampling Team may recommend canceling sampling if the predicted conditions do not materialize or if health or safety of the team could be imperiled due to site conditions or extreme weather.

4.0 SAMPLE COLLECTION PROCEDURES

This section describes the sampling procedures, record keeping, sample handling, storage, and field quality control procedures that will be used during stormwater sampling.

4.1 Preparation for conducting the sampling

Several things will be done to prepare to conduct stormwater sampling. First, the laboratory to analyze the samples will be contacted. The following information will be sought from the lab:

- Type and size of bottles needed
- Procedures to filling the bottles
- Sample volume requirements
- Labels or additional forms required
- Explanation of the chain of custody form
- Sample preservation requirements and/or holding time restrictions
- Means of sample delivery to the lab
- Overnight delivery requirements
- Costs

Once a lab has been selected the sampling equipment (sampling bottles from a lab, sampling instruments, and personal safety equipment) will be made ready, as well as the

Once a lab has been selected the sampling equipment (sampling bottles from a lab, sampling instruments, and personal safety equipment) will be made ready, as well as the field sheet to document the required information. Table 6 lists constituents and sample container requirements.

Field personnel will complete a field condition data sheet. The following items will be listed on the field sampling sheet and included in the stormwater discharge monitoring report:

- Person who conducted the sampling
- Date and time of discharge
- Length of storm event
- Time between sampled storm event and previous storm event (at least 72 hrs)
- Total rainfall during storm event
- Photo documentation

A field data sheet is attached as Appendix B.

4.1.1 Sampling Equipment

The primary equipment to be maintained during the course of this sampling program is the Isco samplers and the sediment traps. Both types of samplers will remain in the field for the duration of the deployment period. The Isco samplers and sediment traps will be routinely inspected throughout the course of the deployment period on a frequency dictated by the need for Isco battery replacement. Upon each inspection the proper functioning of Isco samplers and sediment traps will be confirmed by visually inspecting the equipment both inside and outside of the junction or pipe (as relevant to the particular sampling location).

Sediment traps will be inspected to determine that the trap is still properly attached to the junction or pipe and that the bottles are properly seated within the sampler. Any debris will be cleared away from around the samplers.

For Isco samplers, the proper attachment and placement of the flow sensor and intake tube will be verified and any debris will be cleared from this equipment. Tubes will be inspected for bending or occlusions and cleared as necessary. The Isco sampler battery will be replaced as necessary and the proper power up and re-initialization of the sampler will be confirmed prior to leaving the site. The flow sensor will be calibrated as necessary. The flow log memory capacity will be checked and data will be downloaded to a laptop if the memory is near full. The sampler will be called to make sure the cell phone connection is properly working.

If either sediment traps or Isco samplers are damaged beyond field repair capability, they will be removed and replaced with a spare sampler. For Isco samplers, the sampler will be shipped to a company designated repair site and repaired as quickly as possible, so that it can be used as a potential spare in the future.

The following equipments will also be required for the sampling efforts:

- Field forms
- Waterproof pens

- Powder-free nitrile gloves
- Clear glass jar for visual examinations
- Sample containers
- Sample preservatives
- Sample container labels
- COC forms
- COC seals
- Ice chests
- Ice
- Foul-weather gear
- Manhole sampler

Table 6 Monitoring Constituents and Sample Container Requirements

Analyte	Container	Volume	Preservation	Holding Time
Water		*0 ml*		
Total Organ Carbon	Amber jar	500 ml	Cool 4 ± 2º	28 days
PCBs	Amber jar	1000 ml	Cool 4 ± 2º	7 days
DDT and Derivatives	Amber jar	800 ml	Cool 4 ± 2º	7 days
Dieldrin	Amber jar	800 ml	Cool 4 ± 2º	7 days
Total Chlordane	Amber jar	800 ml	Cool 4 ± 2º	7 days
TSS	Poly bottle	200 ml	Cool 4 ± 2º	7 days
Sediment				
PCBs	Sleeve	30 grams	Cool 4 ± 2º	14 days
Total Organ Carbon	EPA 414.1	30 grams	Cool 4 ± 2º	28 days
DDT and Derivatives	Sleeve	30 grams	Cool 4 ± 2º	14 days
Dieldrin	Sleeve	30 grams	Cool 4 ± 2º	14 days
Total Chlordane	Sleeve	30 grams	Cool 4 ± 2º	14 days

4.2 Sampling Method

Water and sediment samples will be collected from storm sewer manhole and outfall sites. All samples will be collected as individual grabs. Samples will be collected directly into sample containers or with a laboratory-supplied container attached to a pole with duct tape or other means. Sampling containers will be held with container openings facing upstream to prevent contamination during sampling. Field personnel will wear powder-free nitrile disposable gloves. Each sample will be given a field identification, tagged, and kept cool at 4 degrees C. Chain-of-custody (COC) procedures will be observed and samples delivered to the laboratory within the allowable holding times for each parameter.

It is assumed that sampling locations will have well-mixed conditions so that single grabs are representative of water quality. Field personnel will record the degree of turbulence or quiescence as well as the dimensions of the conveyance sampled and/or a description of water flowing in the conveyance. Field personnel will also record the date and time of sample collection and the flow rate.

Sampling containers for direct grabs (either by hand or with pole attached to laboratory supplied container) will be pre-cleaned by the laboratory. It will be made certain that if a sample is transferred (either for collection purposes or to form grab-composite samples), that only laboratory-supplied containers are permitted to come in contact with the sample.

4.3 Personal Safety

A Health and Safety Plan approved by the contract lab will be reviewed by the all field personnel before the sampling operations covered in this monitoring plan begin. Personal safety will be of primary concern while conducting all stormwater sampling related activities. All persons involved in the sampling operation will be made aware of the hazards associated with monitoring and should freely voice any concerns if potential hazards become apparent. The Occupational Safety and Health Administration (OSHA) provides regulations and guidance on occupational safety, many of which are directly applicable to the types of activities involved in stormwater monitoring. It is the direct responsibility of each person involved in the monitoring program to read the Health and Safety Plan and adhere to its requirements. The following list provides a few basic health and safety procedures that will help to create a safer sampling environment.

- Do not sample alone, a minimum of two-person field crews will be used for stormwater sampling.
- Do not enter a confined space without proper training, equipment, and surface support.
- Never remove or replace manhole covers with your bare hands or feet.
- Never leave an open manhole unattended.
- Do not start staging or sampling until traffic control has been established.

4.4 Clean Sampling Techniques

Clean sample collection techniques will be followed to minimize the potential for contamination of stormwater runoff samples. Care will be taken during all sampling

operations to avoid contamination of the water samples by human, atmospheric, or other potential sources of contamination. The monitoring team should prevent contamination of any of the following items: composite bottles, lids, sample, tubing, and strainers.

4.5 Sample Packing and Shipping

Monitoring personnel will deliver the samples to the laboratory. Sample bottles will be placed in coolers or some other package that is rigid enough to provide protection of the samples and is insulated to keep samples cold. During packing, the sample from one monitoring location will not be separated into separate shipping containers unless bottles of one size need to be shipped together because of container size. If samples from a location are separated a copy of the field-sampling sheet pertaining to the bottles will be enclosed in each shipping container. Prior to shipping, all sample bottles will be recorded on the packing lists, which will include the shipping date and the method of transporting the samples. Samples will be delivered to the analytical laboratory within 4 hours of sampling to ensure the maximum holding time for bacteria of 6 hours is not exceeded.

4.6 Chain of Custody

After samples have been obtained and the collection procedures properly documented, a written record of the COC of each sample will be made. This record ensures that samples will not be tampered with or inadvertently compromised in any way, and it also tracks the requested analysis for the analytical laboratory. COC refers to the documented account of changes in possession that occur for samples.

The COC record tracks the sampling path from origin through laboratory analysis. Information necessary in the COC includes:

- Name of the persons collecting the sample(s).
- Date and time of sample collection.
- Location of sample collection.
- Names and signatures of all persons handling the samples in the field and in the laboratory.
- Laboratory analysis requested and control information (e.g., duplicate or spiked samples etc.) and any special instructions (e.g., time sensitive analyses).

To ensure that all necessary information is documented a COC form will accompany each sample or set of samples. COC forms will be printed on multipart carbonless paper so that all personnel handling the samples may obtain a copy. A COC record should accompany all sample shipments and the sample originator will retain a copy of the forms. When transferring custody of samples the transferee will sign and record the date and time of each transfer. Each person who takes custody will complete the appropriate portion of the chain of custody documentation. A sample COC form to be used for this field sampling is attached as Appendix C.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

5.1 Data Quality Objective

The quality assurance/quality control (QA/QC) program will be implemented to satisfy the data quality objectives of the monitoring program. The primary data quality objectives are to obtain defensible data of acceptable sensitivity and quality to:

- Evaluate the stormwater management program.
- Evaluate stormwater quality.
- Evaluate of BMP as corrective measure.

The analytical laboratory selected for this study will evaluate the accuracy of its sample extraction and/or analytical procedures using spiked samples, which may include matrix spikes (MS), laboratory control samples (LCS) and surrogate spikes. Acceptable spike recoveries must fall within statistically derived laboratory "control limits." Precision is the agreement among a set a replicate measurements of the same parameter. The analytical laboratory will evaluate precision by performing matrix spike duplicate (MSD), laboratory control sample duplicate (LCSD) and duplicate stormwater sample analyses (typically performed for inorganic parameters only). The data quality objectives also include obtaining data that are comparable and representative of the water quality conditions at each monitoring location. Comparable data will be collected if comparable sampling, analysis, QA/QC and reporting procedures are implemented throughout the monitoring program. Representative samples will be collected by performing sampling activities compliant with the procedures described in this monitoring plan. Duplicate samples will be collected and the results will be used to evaluate representativeness. Comparability expresses the confidence with which one data set can be compared to another. Data are comparable if collection techniques, measurement procedures, methods, and reporting are equivalent for the samples within a sample set. Data quality assurance objectives are summarized in Table 7.

Analyte	Units	Precision	Accuracy	Completeness
Total Organ Carbon	µg/l	±20%	±30%	90%
PCBs	µg/l	±20%	±30%	90%
DDT and Derivatives	µg/l	±20%	±30%	90%
Dieldrin	µg/l	±20%	±30%	90%
Total Chlordane	µg/l	±20%	±30%	90%
TSS	mg/l	±20%	±30%	90%

5.1.1 Field Quality Control Samples

Field quality control samples will be collected at a 10% frequency in order to provide quality performance information for the sampling program. One in ten samples submitted for analysis will be one of three field QC sample types: field blank; field duplicate; and/or performance evaluation blank. Table 8 lists the quality performance goals that each of the three types of field QC sample types is intended to address.

Table 8 Field Quality Control Sample Types

Quality Performance Goal	Field Blank	Field Duplicate	Performance Evaluation Blank
Minimize false positive results	X		X
Sample bottles free of contamination	X		
No contamination introduced by sampling process	X		
Measurement error attributable to sample inhomogeneity		X	

5.2 Field Quality Assurance/Quality Control

This section summarizes the QA/QC procedures that will be implemented by field personnel to evaluate sample contamination, sampling precision, and matrix interference.

5.2.1 Equipment Blanks

After the intermediate sample container or scoop is cleaned, an equipment blank will be collected by pouring reagent-grade water into the apparatus. The water will be transferred into sample bottles and analyzed for the full analytical suite.

5.2.2 Field Duplicate Samples

Field duplicate samples will be collected to evaluate the precision and representativeness of the sample collection procedures as well as sample homogeneity. The duplicate sample will be collected using the specified manual grab sampling techniques. Twice the volume required for the analytical suite will be collected with each duplicate sample. For grab samples, intermediate sample containers will be used, and the volume collected will be apportioned equally between the intermediate containers. The water in each intermediate container will be poured into a discrete set of sample bottles. One set of bottles will be labeled with fictitious sample identification and submitted “blind” to the laboratory.

5.2.3 Matrix Spike Samples

MS and MSD analyses will be performed by the laboratory using project samples. Field crews will submit twice the required sample volume for the sample selected as the matrix spike sample. Field personnel will identify the MS/MSD sample on the COC form.

5.3 Laboratory Quality Control

This sub-section summarizes the QC procedures the laboratory will perform and report with the analytical data packages. These procedures are not inclusive of the QA/QC that is required for compliance with the analytical method.

5.3.1 Method Blanks

A method blank is prepared using reagent-grade water, and is extracted and analyzed with each sample batch (typically 20 samples extracted and/or analyzed on a given day). Method blank results are used to identify potential sources of sample contamination resulting from laboratory procedures. Target analytes should not be detected in the method blank above the practical quantitative limit.

5.3.2 Matrix Spike and Laboratory Control Samples

MS, MSDs, LCS, and LCSDs will be performed by the laboratory to evaluate the accuracy of the sample extraction and analysis procedures. MS/MSDs will also be performed to evaluate matrix interference. Matrix interference is the effect of the sample matrix on the analysis, which may partially or completely mask the response of the analytical instrumentation to the target analyte(s). Matrix interference may affect the accuracy of the extraction and/or analysis procedures to varying degrees, and may bias the sample results high or low. The MS/MSD is prepared by adding known quantities of target analytes to a sample. The sample is then extracted and/or analyzed as a typical environmental sample, and the results are reported as percent recovery.

6.0 DATA MANAGEMENT AND REPORTING

The sampling results will be reported by the laboratory as hard copy and as electronic files. Hard copy data will be entered into an electronic format, and checked at least once by a different person. Electronic submittal of results will be discussed with the analytical laboratory in advance of delivery and its format arranged. A separate record will be generated for each sample analysis.

In addition, the key information such as station ID, sample date and time, name of sampler, name of constituent, all results, units, detection limits, methods used, name of the laboratory, and any field notes will be entered into the database. Additional information, such as compositing of multiple samples, or the use of grab will also be included.

When reporting the laboratory results for each stormwater sample the following information will be provided:

- Sample site.
- Sample date and time.
- Sample number (or identification).
- Sampling technician(s).
- Detection limit and reliability limit of analytical procedure(s).

- Sample results with clearly specified units.

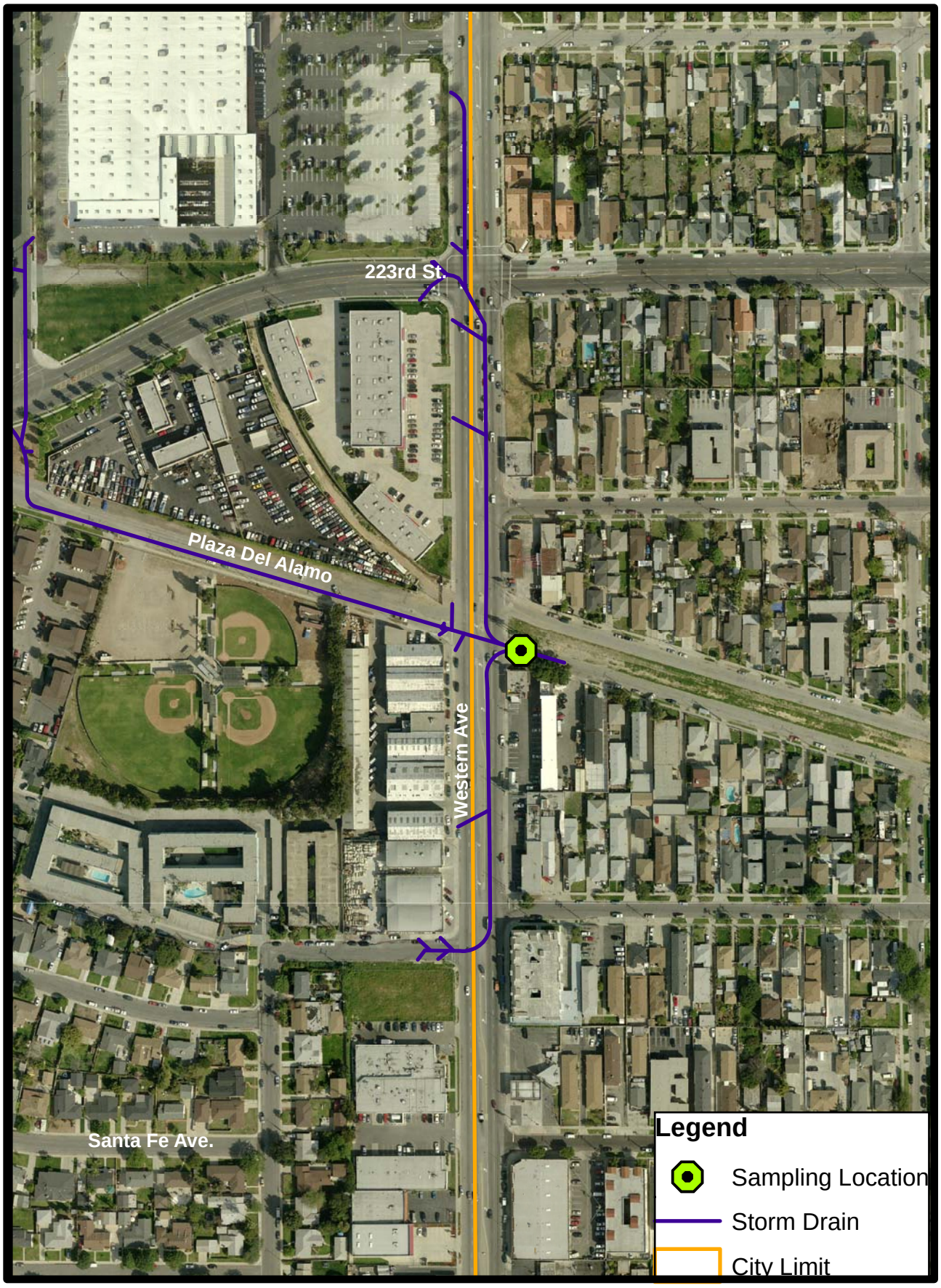
The results of all samples collected under this plan will be submitted to Regional Board in a monitoring report. Monitoring report will include:

- Introduction and background information
- Documentation and summary of each sampling event, including photos
- Electronic copies of field conditions data sheets
- Summary discussion of results
- Tabular results of all samples, including quality assurance quality control samples, in electronic format, (Excel)
- Evaluation data quality based on QAPP requirements.

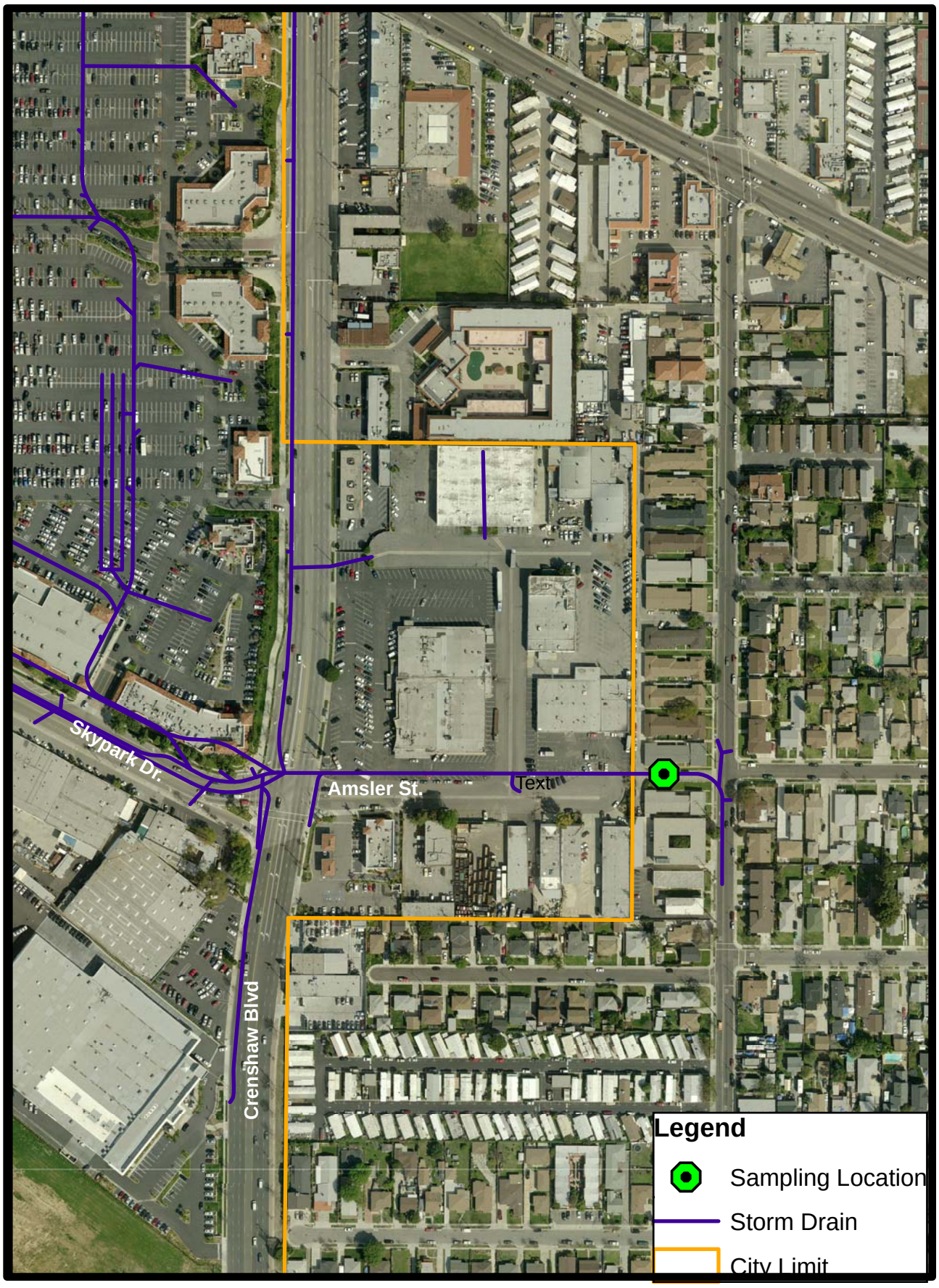
APPENDIX A

Detailed Maps of Sampling Locations

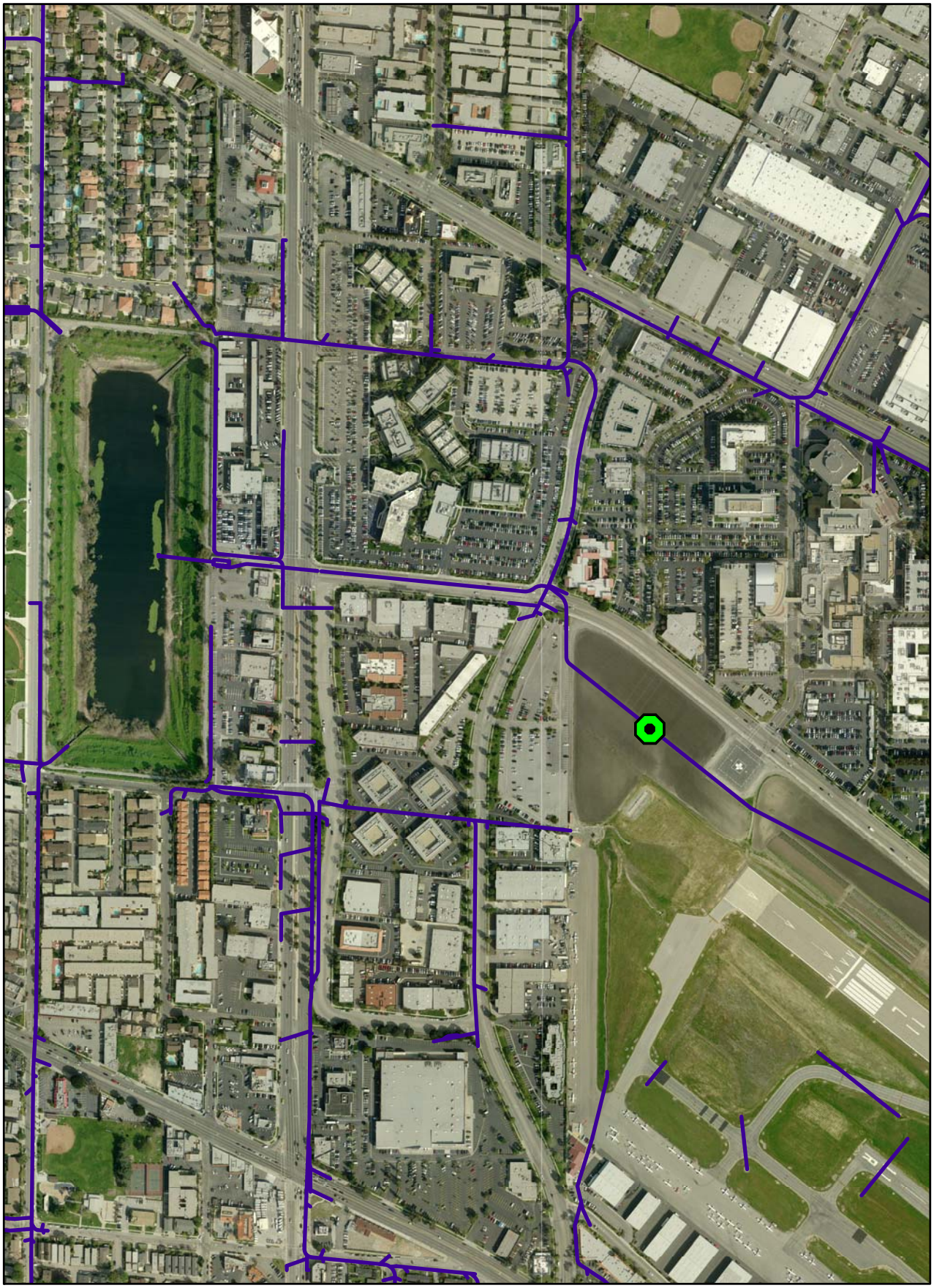
Stormwater Sampling Location - Tor-S1



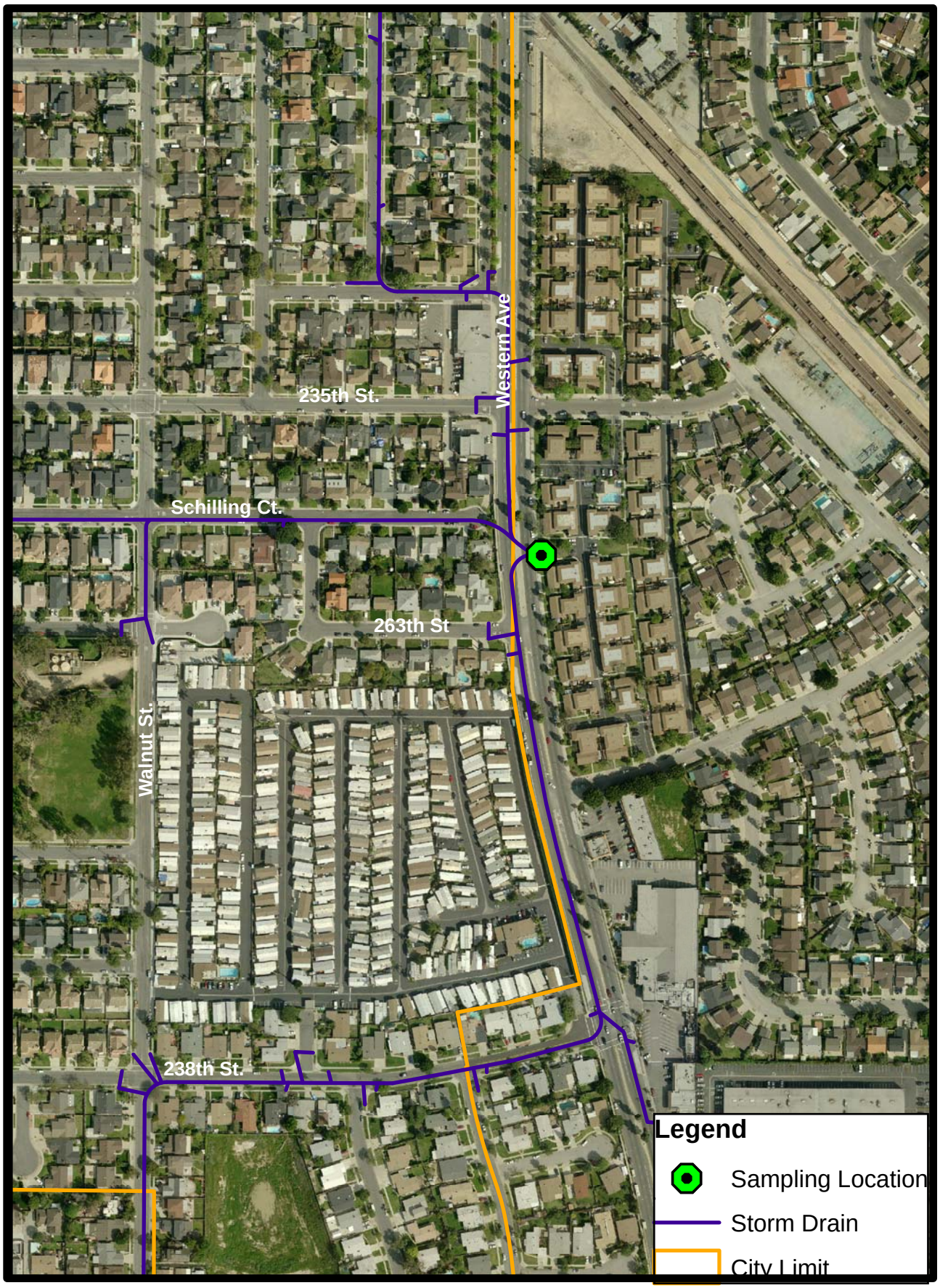
Stormwater Sampling Location - Tor-S2



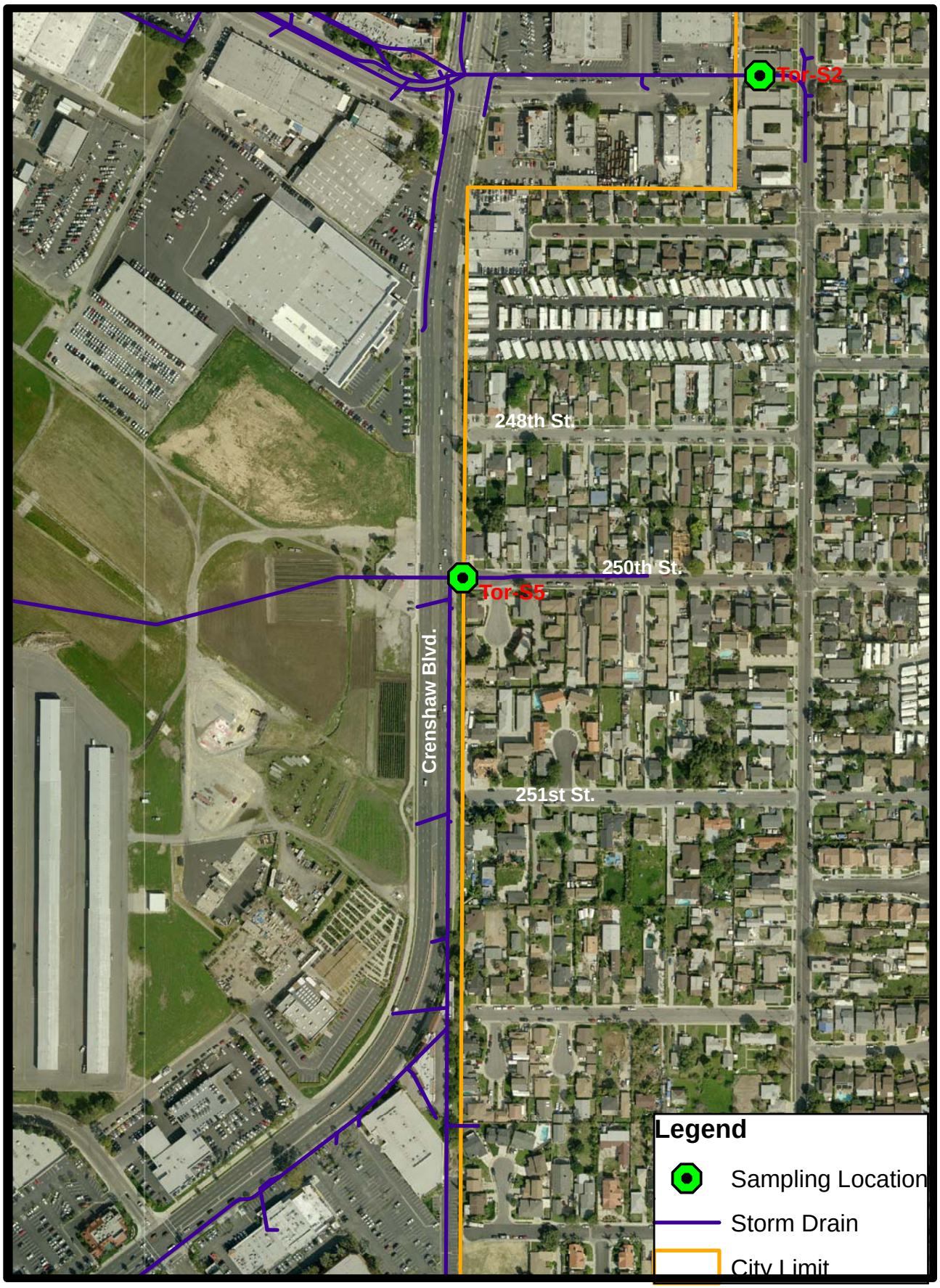
Stormwater Sampling Location: Tor-S3



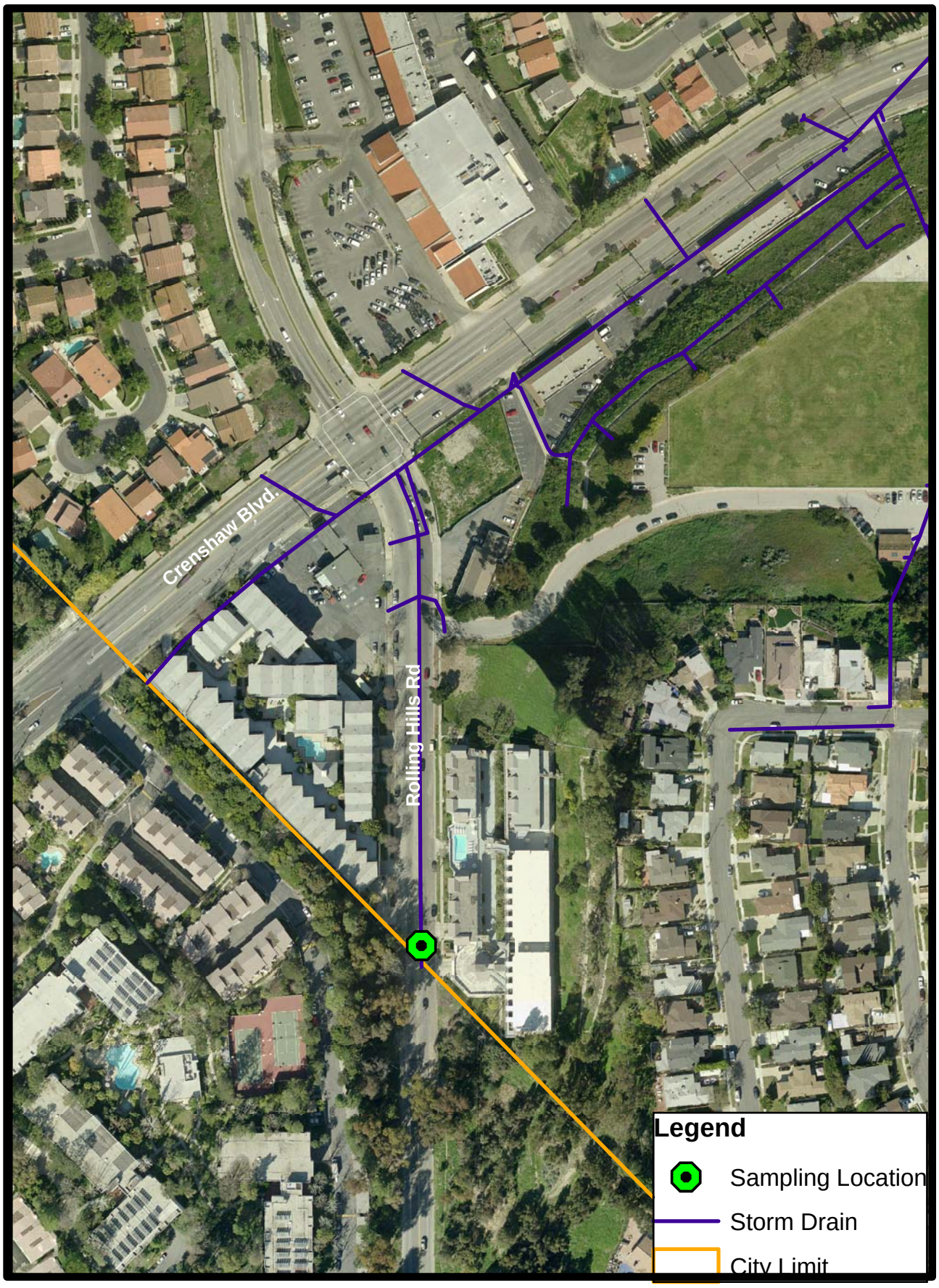
Stormwater Sampling Location - Tor-S4



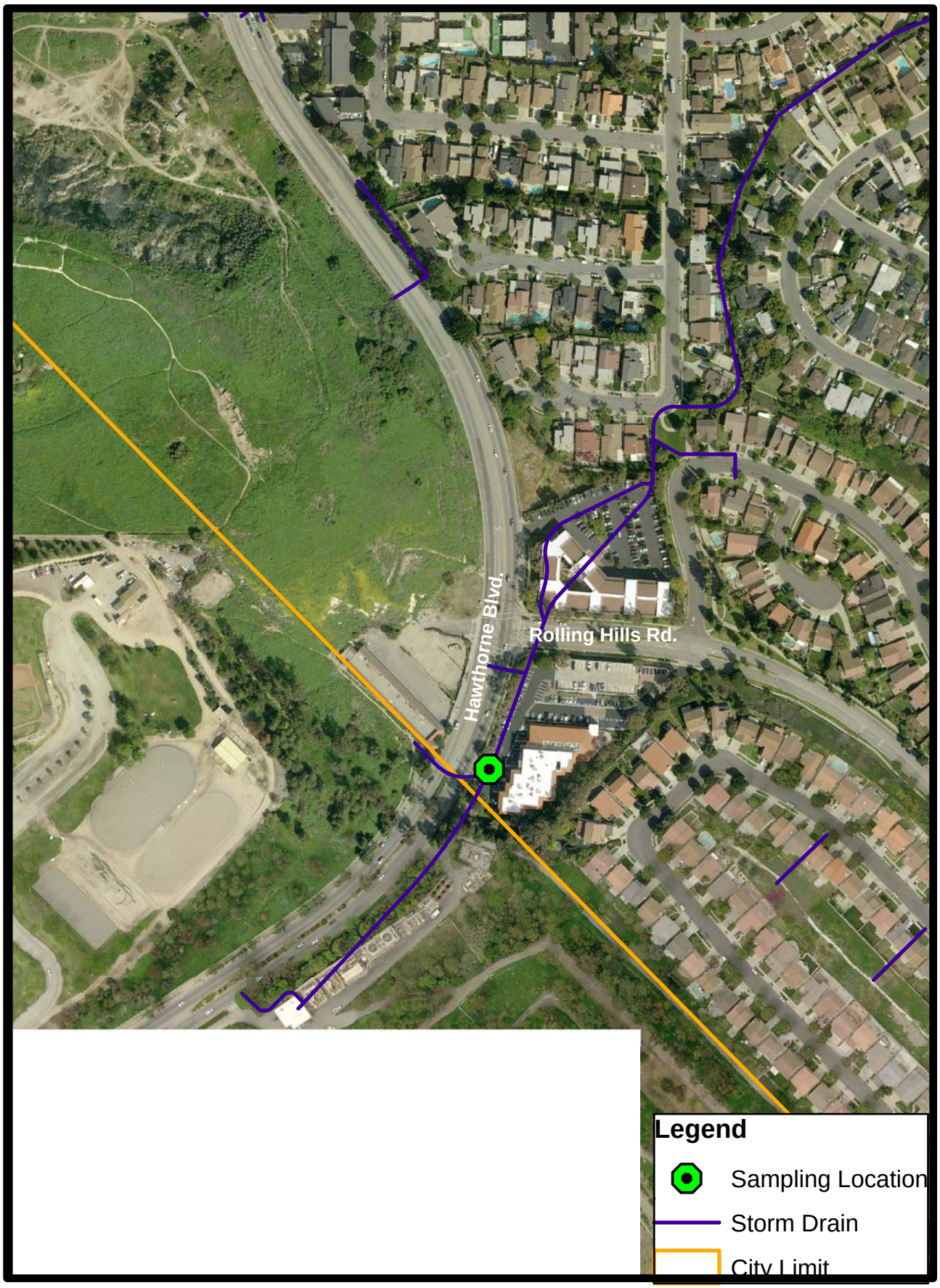
Stormwater Sampling Location - Tor-S5



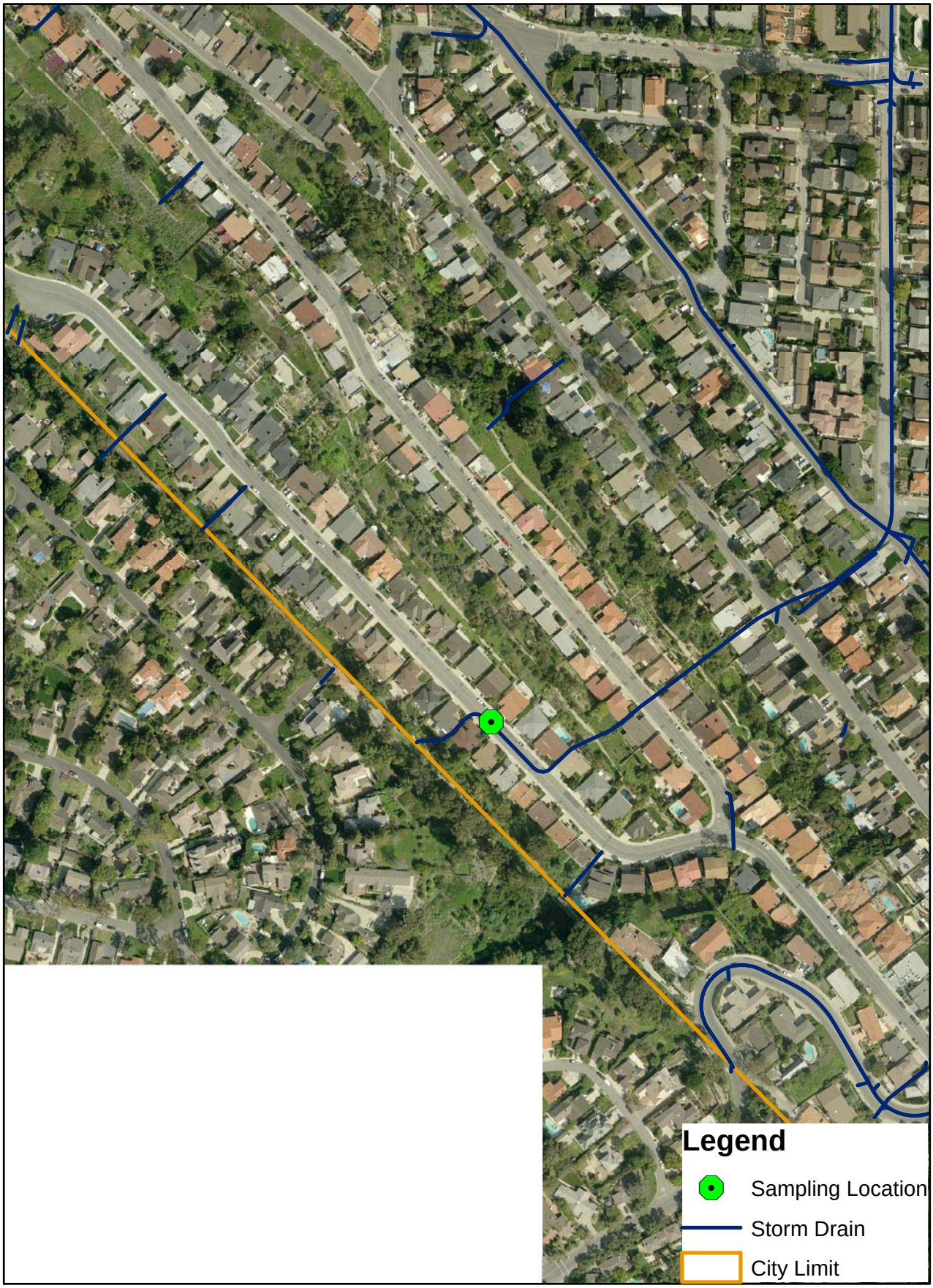
Stormwater Sampling Location - Tor-S6



Stormwater Sampling Location - Tor-S7



Stormwater Sampling Location - Tor-S8



Stormwater Sampling Location - Tor-S9

APPENDIX B

Field Data Sheet

Sampling Field Data

City of Torrance, California

Page_____ of_____

Area Letter & Name or Run #: _____

Run: Scheduled / Makeup / Reopen / Extra

Collected by: _____ **Initiated by:** _____

Date Collected: _____ **Date/time Initiated:** _____

Missed Station	Area Letter	Station #	Military Time	Boat /Land/ Clams/Mussels	Temp °C	Random / Adverse/ Extra	Condition or Adversity	Open or Closed	Wind	Salinity ‰	A-1 MPN/100 ml MF CFU/100ml EC MPN/100 ml	Comments

Remarks:

CHAIN OF CUSTODY:

Relinquished by:	Date, Time & Temp°C	# Samples	Relinquished to:	Received by:	Date, Time & Temp°C	# Samples

Circle Water Quality Lab: Boothbay or Lamoine | **WQ Lab Staff Acceptance:**

Entered by: _____ **Date:** _____

APPENDIX C

Chain of Custody

GENERAL CHAIN-OF-CUSTODY FORM

EVIDENCE/PROPERTY CUSTODY	Tracking Number Investigation ID Number	
NAME OF RECIPIENT FACILITY	LOCATION	
NAME, TITLE AND CONTACT NUMBER OF PERSON FROM WHOM RECEIVED	ADDRESS	
LOCATION FROM WHERE OBTAINED	REASON OBTAINED	DATE/TIME OBTAINED

ITEM NO	QUANTITY	DESCRIPTION OF ARTICLES (Include model, serial number, condition and unusual marks or scratches)

		CHAIN OF CUSTODY		
ITEM NO.	DATE	RELEASES BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	

Chain-of-Custody (continued)

ITEM NO.	DATE	RELEASES BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	
		PRINTED NAME & CONTACT INFORMATION	PRINTED NAME & CONTACT INFORMATION	
		SIGNATURE	SIGNATURE	

FINAL DISPOSAL ACTION
RELEASE TO OWNER OR OTHER (NAME/ORGANIZATION)
DESTROY
OTHER (Specify)
FINAL DISPOSAL AUTHORITY
ON THIS DOCUMENT PERTAINING TO THE INQUIRY/INVESTIGATION INVOLVING;
ITEM(S) (IS)(ARE) NO LONGER REQUIRED AS EVIDENCE AND MAY BE DOSPOSED AS INDICATED ABOVE. *If articles must be retained do not sign, but explain in separate correspondence.*
(Typed or Printed Name & Organization) (Signature) (Date)
WITNESS TO DESTRUCTION EVIDENCE
THE ARTICLES LISTED AT ITEM NUMBERS (WAS)(WERE) DESTROYED BY THE EVIDENCE CUSTODIAN IN MY PRESENCE, ON THE DATE INDICATED ABOVE
(Typed or Printed Name & Organization) (Signature) (pole)

LOS ANGELES COUNTY GUIDELINES

This appendix contains the following documents from LACDPW:

- LACDPW Low Impact Development Standards Manual, January 2009
- LACDPW Stormwater Best Management Practice, Design and Maintenance Manual

These documents, along with LACDPW's Hydrology Manual, Hydraulic Design Manual and Standard Plans, can be found on the LACDPW website at:
http://ladpw.org/services/publications.cfm

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County of Los Angeles Low Impact Development Standards Manual January 2009

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CHAPTER 1: INTRODUCTION

Urbanization has the potential to impact the water resources in the County of Los Angeles. As land is developed, impervious area and surface runoff increase. Less water is percolated into the groundwater basins and runoff may collect and transport pollutants to the downstream receiving waters, including beaches, streams, and the flood control and water conservation systems of the County of Los Angeles. Low-Impact Development (LID) practices are one means to mitigate the impacts of development and urbanization.

WHAT IS LID?

LID is a new approach to managing rainfall and stormwater runoff. LID practices are designed to protect surface and groundwater quality, maintain the integrity of ecosystems, and preserve the physical integrity of receiving waters by controlling rainfall and stormwater runoff at or close to the source.

Use of these techniques helps reduce off-site runoff and ensure adequate groundwater recharge. LID techniques focus mainly on site-specific hydrology since every aspect of site development affects the hydrologic response of the site. Thus, the primary goal of LID methods is to mimic the undeveloped site hydrology using site-design techniques that store, infiltrate, evaporate, and detain runoff.

HOW DOES LID WORK?

The concept of LID is to distribute small, cost-effective landscape features throughout the project site. The source control concept is quite different from conventional regional treatment (pipe and large stormwater management basin design).

LID incorporates multifunctional site design elements or Best Management Practices (BMPs) for stormwater detention and water quality improvements. These multifunctional site design elements include the use of bioretention/filtration landscape areas, disconnected hydrologic flowpaths, reduced impervious surfaces, functional landscaping, and functional grading to maintain hydrologic functions that existed prior to development, such as infiltration, frequency and volume of discharges, and groundwater recharge.

BMPs are placed throughout the site in many small, discrete units and are distributed in a small portion of each lot or site near the source of impacts, virtually eliminating the need for a centralized facility, such as a regional stormwater management basin. By this process, a developed site can be designed as an integral part of the environment, maintaining undeveloped hydrologic functions through the careful use of LID BMPs. BMPs are defined and described in Chapter 5, Low-Impact Development Best Management Practices.

BMPs and the use of LID practices is most efficient and cost-effective when they are designed to capture and treat the most frequently occurring storm events as well as the first flush portion of runoff producing storm events. Numerous studies have shown that small storms, which occur more frequently than relatively large storms in Southern California, typically transport the greatest load of pollutants to local water bodies. The majority of pollutants are typically transported during the first flush portion of a runoff event, which is often considered to be the first 3/4 inch of a storm event.

CHANGE TO IMPROVE QUALITY OF LIFE

Historically, urban development and storm drain system design have consisted of streets, driveways, sidewalks, and structures constructed out of impervious materials that directly convey runoff to curb and gutter systems, the storm drain system, and downstream receiving waters. Until recently, conventional storm drainage and flood control systems have been designed to convey stormwater away from developed areas as quickly as possible without thoroughly addressing stormwater quality and/or groundwater recharge enhancement.

The natural absorption and infiltration abilities of the land are lost when natural vegetated pervious ground cover is converted to impervious surfaces, such as paved highways, streets, rooftops, and parking lots in conventional development. This can result in postdevelopment runoff with greater volume, velocity, and peak-flow rate than undeveloped runoff from the same area. Increased volume, velocity, rate, and duration of runoff can accelerate the erosion or sedimentation of downstream natural channels. Significant declines in the biological integrity and physical habitat of streams and other receiving waters may occur with a conversion from natural to impervious surfaces. Furthermore, ephemeral and intermittent streams, as found in the semiarid regions in Southern California, may be even more sensitive where a small increase of total impervious area can have impacts to stream morphology. Runoff durations can also increase as a result of flood control and other efforts to control peak-flow rates. See Table 1-1 for a listing of the potential impacts to a watershed due to conventional urban/suburban development.

Table 1-1 Degradation of watershed conditions and stream response.

Change in Watershed Condition	**Stream Response**
Increased pollutant loads	Metals, bacteria, and synthetic organic compounds: some acutely toxic, negative health effects in fish, altered spawning and migration of fish in presence of metals
	Nutrients: excessive aquatic plant growth; excessive diurnal oxygen fluctuations
Increased imperviousness	Increased storm flow volume and frequency
	Channel erosion
	Increased fine sediment and urban water pollutant loads
	Increased fish passage barriers

Increased fine sediment deposition	Reduced intergravel dissolved oxygen levels in streambed
	Loss of macroinvertebrate habitat
Loss of fragmentation of riparian areas	Reduced delivery of woody debris
	Reduced bank stability and loss of bank habitat structure and complexity
	Reduced shading and temperature control

Studies have shown that the collective discharge of untreated runoff from large areas of conventional residential, commercial, industrial, and municipal development often results in significant environmental impacts to local water resources. Until recently, conventional development has used existing storm drain system design methods that do not provide stormwater quality benefits.

Improvements in stormwater management have been made in the County of Los Angeles, but additional stormwater improvements are now required. With the addition of about 2.5 million new residents in the Los Angeles region by 2030, development in Los Angeles will continue to present challenges for stormwater treatment and management. Stormwater quality management techniques must be reconsidered in the design of new development and redevelopment. New and effective management through LID that improve the quantity and quality of stormwater is vital to the long-term economic growth and quality of life in the County of Los Angeles.

BENEFITS THROUGH THE USE OF LID

ENVIRONMENTAL BENEFITS

Pollution Abatement

LID practices can reduce both the volume of runoff and the pollutant loadings discharged into receiving waters. LID practices result in pollutant removal through settling, filtration, adsorption, and biological uptake. Reductions in pollutant loadings to receiving waters can improve habitat for aquatic and terrestrial wildlife and enhance recreational uses.

Protection of Downstream Water Resources

The use of LID practices can help prevent or reduce hydrologic impacts on receiving waters, reduce stream channel degradation from erosion and sedimentation, improve water quality, increase water supply, and enhance the recreational and aesthetic value of our natural resources. LID practices can be used to protect water resources that are downstream in the watershed. Other potential benefits include reduced incidence of illness from contact recreation activities, such as swimming and wading, more robust and safer seafood supplies, and reduced medical treatment costs.

Groundwater Recharge

LID practices can also be used to infiltrate runoff to recharge groundwater. Growing water shortages nationwide increasingly indicate the need for water resource management strategies designed to integrate stormwater, drinking water, and wastewater programs to maximize benefits and minimize costs. Development typically results in increases in the amount of impervious surface and volume of runoff.

Water Quality Improvements/Reduced Treatment Costs

It is almost always less expensive to keep water clean than it is to clean it up. A study of 27 water suppliers, conducted by the Trust for Public Land and the American Water Works Association, found a direct relationship between natural cover in a watershed and water supply treatment costs. In other words, communities with higher percentages of natural cover had lower treatment costs. According to the study approximately 50 to 55 percent of the variation in treatment costs can be explained by the percentage of forest cover in the source area.

Habitat Improvements

Innovative stormwater management techniques like LID or conservation design can be used to improve natural resources and wildlife habitat, maintain or increase land value, or avoid expensive mitigation costs.

LAND VALUE AND QUALITY OF LIFE BENEFITS

Reduced Downstream Flooding and Property Damage

LID practices can be used to reduce downstream impacts through the reduction of peak flows and the total volume of runoff. This can reduce property damage, the initial capital costs, and the operation and maintenance costs of flood control infrastructure. Strategies designed to manage runoff at the site, or as close as possible to its point of generation, can reduce erosion and sediment transport and reduce downstream impacts. As a result, the costs for clean ups and stream bank restoration can be reduced or avoided altogether. The use of LID techniques can also help protect or restore floodplains, which can be used as park space or wildlife habitat.

Real Estate Value/Property Tax Revenue

Various LID projects and smart growth studies have shown that people are willing to pay more for clustered homes than conventionally designed subdivisions. Clustered housing with open space is appreciated at a higher rate than conventionally designed subdivisions. The Environmental Protection Agency's *Economic Benefits of Runoff Controls* describes numerous examples where

developers and subsequent homeowners have received premiums for proximity to attractive stormwater management practices. These designs should be visually attractive, safe for the residents, and should be considered an integral part of planning the development.

Aesthetic Value

LID techniques are usually attractive features because landscaping is an integral part of the designs. Designs that enhance a property's aesthetics using trees, shrubs, and flowering plants that complement other landscaping features can be selected. The use of these designs may increase property values or result in faster sale of the property due to the perceived value of the extra landscaping.

Quality of Life/Public Participation

Placing water quality practices on individual lots provides opportunities to involve homeowners in stormwater management and enhances public awareness of water quality issues. An American Lives, Inc., real estate study found that 77.7 percent of potential homeowners rated natural open space as essential or very important in planned communities.

LID GOALS

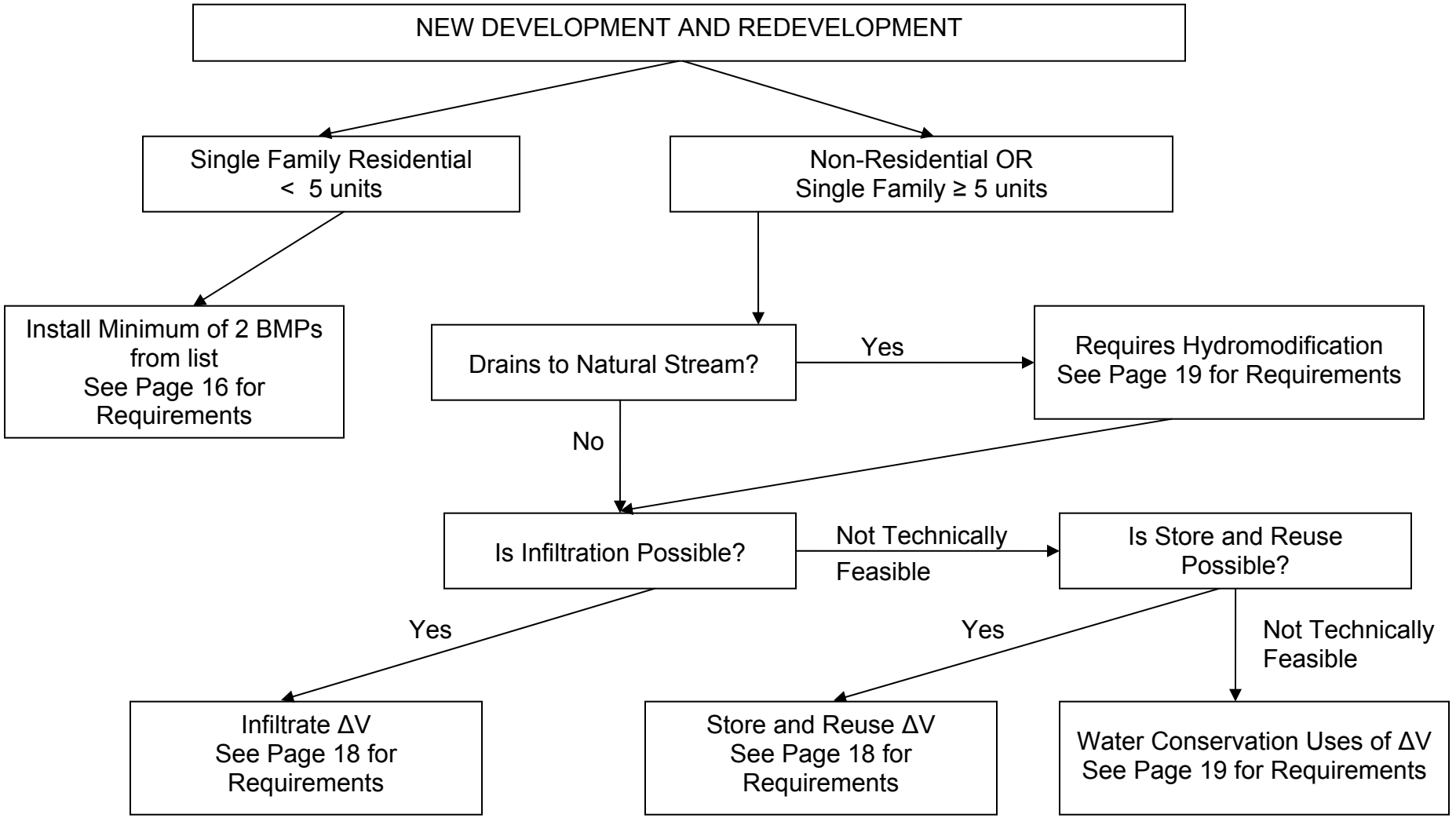
The goals of LID are discussed and demonstrated throughout the manual. The list below highlights some of the main goals and principles of LID:

- Provide an improved technology for water quality improvements of receiving waters and for additional groundwater recharge.
- Introduce new concepts, technologies, and objectives for stormwater management, such as micromanagement and multifunctional landscape features (bioretention areas, swales, and conservation areas), to mimic or replicate hydrologic functions and maintain the ecological/biological integrity of receiving streams.
- Encourage flexibility in regulations that allows innovative engineering and site planning to promote smart growth principles.
- Encourage environmentally sensitive development.
- Encourage public education and participation in environmental protection.

HOW TO USE THIS MANUAL

LID allows the site planner/engineer to use a wide array of simple cost-effective techniques that focus on site-level hydrologic control. This manual describes those techniques and provides examples and descriptions of how they work, and also contains BMP fact sheets. For ease of use and understanding, this document has been divided into 7 chapters. Figure 1-1 summarizes the major components of the LID approach. Compliance with the existing regulations is required by the County of Los Angeles Ordinance 22.52.2210.

LID DESIGN REQUIREMENTS



CHAPTER 2: SITE PLANNING AND SITE DESIGN

INTRODUCTION

A significant element in the implementation of LID, and one that should be incorporated at the earliest possible stage of a project, is the design and layout of the development site. Good LID site design takes advantage of the services provided by the site's natural systems. The natural systems that LID seeks to preserve and even restore are an undeveloped site's hydrologic functions, vegetation, and soils. LID site planning and design practices approach stormwater as a resource that should be conserved.

According to the National Association of Home Builders[1]:

> "LID (LID) strategies strive to allow natural infiltration to occur as close as possible to the original area of rainfall. By engineering terrain, vegetation, and soil features to perform this function, costly conveyance systems can be avoided, and the landscape can retain more of its natural hydrological function. LID practices dovetail with green building practices that incorporate environmental considerations into all phases of the development process. Builders can often use green building and LID to lower actual development costs. Although most effective when implemented on a community-wide basis, using LID practices on a smaller scale, i.e., on a small development, can also have an impact."

HYDROLOGIC FUNCTIONS

Natural hydrologic functions provide the following services in a watershed:

- Rainfall interception: In a vegetated watershed, the surfaces of trees, shrubs, and grasses catch initial light rainfall before it reaches the ground. Interception can delay the start and lower the volume of runoff.

- Shallow surface storage: The shallow pockets present in natural terrain store rainfall and runoff, filtering and allowing infiltration, and delaying the start of runoff.

- Evaporation and transpiration: Evaporation occurs when water changes from a liquid to a vapor and moves into the air. Transpiration occurs when vegetation releases water vapor into the atmosphere. Both processes reduce the volume of runoff, locally return moisture to the atmosphere, and provide local cooling effects. Collectively, this process is called evapotranspiration.

[1] National Association of Home Builders Research Center, *Low Impact Development (LID) Practices for Storm Water Management*, http://toolbase.org/Technology-Inventory/Sitework/low-impact-development, accessed April 7, 2008.

- Infiltration: Infiltration is the movement of surface water down through the soil into groundwater. Such movement filters and reduces the volume of runoff and replenishes groundwater supplies.

- Runoff: Runoff is the flow of water across the land surface that occurs after rainfall interception, surface storage, and infiltration reach capacity.

Hydrologic processes can be adversely impacted by land development through:

- Removing vegetation: The loss of vegetative canopy reduces the amount of rainfall intercepted. The loss of deep root systems allows soils to compress and lose storage and infiltration capacity. The loss of leaf litter and organic matter on the ground removes a number of beneficial physical, chemical, and biological processes that treat runoff.

- Covering porous soils with impervious surfaces: Rainfall that could have been stored or infiltrated is converted directly into runoff, carrying with it the pollution associated with the land use. Rainfall and runoff that could have recharged groundwater reservoirs for later reuse are lost.

- Replacing natural drainage paths with paved pathways, pipes, and channels: While efficiently removing water from a site, hardened conveyances collect the increased runoff with greater speed, causing higher flow rates, the loss of infiltration potential at the site, increased erosion in natural and soft-bottomed channels, and the loss of in-stream and streamside habitat.

VEGETATION

Vegetation provides the following services[2] in a watershed:

- Intercepts rainfall.

- Stores water in plant tissue.

- Filters air and water pollution.

- Provides erosion control.

- Keeps soil pore structure open for storage and infiltration of water.

- Pipes water along roots and into the soil.

- Provides water vapor through transpiration.

- Balances oxygen and carbon dioxide in the atmosphere by photosynthesis.

[2] American Society of Landscape Architects, et al., *Sustainable Sites Initiative, Preliminary Report on Standards & Guidelines*, November 1, 2007.

- Moderates the climate globally and locally by regulating greenhouse gasses and lowering heat island effects.

- Provides habitat for resident and migratory animals; provides connective habitat in urbanized areas.

Vegetation can be adversely impacted by land development through:

- Disturbance and removal: With the absence of vegetation, a site will lose its capacity to infiltrate, absorb, and filter runoff. Local heat island effects would be created. Soil health would suffer as soils become compacted. Erosion and sedimentation would increase.

- Inadequate space: Confined planting patterns, including cramped root zones, limit healthy plant growth, leading to increased maintenance and premature death of vegetation.

- Introduction of invasive plants: Some plants that are not native to the area can overtake the native or California friendly species, threatening native organisms.

SOILS

Healthy soils provide the following services[3] in a watershed:

- Regulate infiltration, runoff, erosion, sedimentation, and flooding.

- Increased capacity for the storage of water.

- Support growth of vegetation.

- Filter pollutants in runoff.

- Support production of food and raw materials.

- Support the nitrogen cycle.

- Lockup carbon.

- Provide biological habitats.

Soils can be adversely impacted by land development through:

- Compaction: Soil compaction disturbs native soil structure, reduces infiltration rates, and limits root growth and plant survivability. While soil compaction is necessary to provide structurally sound foundations, areas away from foundations are often excessively compacted by vehicle and foot traffic during construction.

[3] Ibid.

- Removal of vegetation: Removal of vegetation can expose soils to erosion and thus cause sedimentation and the modification of natural streams. Disturbance of soil can also release previously locked organic carbons into the atmosphere[4].

- Removal of topsoil: A common practice is the removal of topsoil before or during construction. This practice removes native seeds, removes soil organisms, impedes the reestablishment of healthy soils, and upsets the native soil structure even if the original soil is returned.

- Contamination: The application of pesticides and herbicides can introduce toxic organics and metals into the soil, which can bioaccumulate in higher organisms and possibly get into food sources. Broadly applied pesticides and herbicides could impact unintended species including those found in the soil. Such disruption can adversely affect resistance to pathogens, infiltration, and the filtering of pollutants.

SITE DESIGN PRACTICES[5] FOR LID

The goals of LID are to mimic undeveloped hydrology and control runoff at the source. These goals are accomplished with creative site planning and the incorporation of localized, naturally functioning BMPs into the site's design.

The first step in creating a LID design is site planning. The elements[6] that make up a successful low-impact site plan are:

1. Conserving natural areas, soils, and vegetation.

2. Minimizing disturbances to natural drainage patterns.

3. Minimizing and disconnecting impervious surfaces.

4. Minimizing soil compaction.

5. Directing runoff from impervious areas to pervious areas.

CONSERVING NATURAL AREAS, SOILS, AND VEGETATION

The conservation of natural areas, soils, and vegetation helps to retain numerous functions of predevelopment hydrology, including rainfall interception, infiltration, and evapotranspiration. Maximizing these functions will thereby reduce the amount of runoff that must be treated. Further, minimizing soil disturbance reduces the emission of

[4] Lal, R., "Soil Carbon Sequestration Impacts on Global Climate Change and Food Security," Science 304: 1623-7 (2004), in *Sustainable Sites Initiative*.
[5] American Society of Landscape Architects, et al., op cit.
[6] County of San Diego, *Low Impact Development Handbook*, December 31, 2007.

greenhouse gasses[7] and conserves natural habitat. For these reasons, site planning, design, and execution, where appropriate, should:

1. Conform to local watershed, conservation, and open space plans.

2. Preserve sensitive environmental areas.

3. Preserve historically undisturbed vegetated areas.

4. Build upon the least porous soils or limit construction activities and disturbances to areas with previously disturbed soils.

5. Protect healthy soils, reuse the top soils already on the site, and import soil only when on-site soils are exhausted.

6. Preserve the maximum surface area of undisturbed grades.

7. Preserve native trees and restrict disturbance of soils beneath tree canopies.

8. Avoid disturbing vegetation and soil on slopes and near surface waters.

9. Leave an undisturbed buffer along both sides of natural streams.

10. Avoid adding materials to the soil that decrease cation exchange capacity (CEC), such as sand, except where required for special water treatment needs.

Examples of conserving natural areas, soils, and vegetation:

- Avoid mass clearing and grading, and grade only those areas where structures are to be built.

- Protect existing streamside areas and habitat.

- Mulch tree and plant beds.

- Incorporate plants to suit existing soil and drainage conditions rather than changing soil and drainage conditions to suit a desired plant list.

- Create multilayered planting schemes that replicate natural sites with both canopy and vegetative ground cover.

- Incorporate compost to increase water retention and soil moisture and reduce the need for fertilizer.

- Use appropriate vegetative plantings and bioremediation techniques to remove or neutralize soil contaminants.

[7] Lal, R., op cit

- Cluster development to preserve porous soils, natural streams, and natural slopes.

MINIMIZING DISTURBANCES TO NATURAL DRAINAGE PATTERNS

Minimizing disturbances to natural drainage patterns preserves the predevelopment timing, rate, and duration of runoff as well as preserving streamside habitats. Preserving the predevelopment drainage characteristics will also minimize the physical impacts on a natural stream. For these reasons, site planning, design, and execution, where appropriate, should:

1. Maintain surface flow patterns of undeveloped sites.

2. Maintain existing water body alignments, sizes, and shapes.

3. Protect seasonal flooding patterns of wetlands.

4. Restore streams and drainage corridors to achieve the same characteristics of timing, flow, and habitat as the original drainage courses in the event that preservation of natural drainage patterns cannot be maintained.

   Examples of minimizing disturbances to natural drainage patterns:

   - Avoid burying, piping, or channelizing streams by carefully planning water crossings and considering alternatives to traditional culverts, even for small crossings.

   - Daylight piped stream systems and restore stream banks and channels to historic, healthy configurations.

   - Avoid the concentration of surface runoff.

   - Avoid large, shallow, and unshaded water features that can increase water temperatures in receiving waters.

   - Create or restore wetlands and riparian areas to absorb, filter, and attenuate runoff.

   - Restore organic matter levels in all root zones to levels consistent with similar soil types in undisturbed regional soils.

   - Minimize manicured lawns and annuals beds as the dominant site elements.

MINIMIZING AND DISCONNECTING IMPERVIOUS SURFACES

Minimizing and disconnecting impervious surfaces increase the chance for rainfall and runoff to infiltrate into the ground, thereby reducing, slowing, and filtering runoff, and

increasing groundwater supplies. For these reasons site planning, design, and execution, where appropriate, should:

1. Reduce overall impervious areas by maximizing landscaping and using pervious pavements.

2. Reduce the amount of impervious areas that are hydraulically connected to impervious conveyances, such as driveways, walkways, culverts, swales, streets, or storm drains.

   Examples of minimizing and disconnecting impervious surfaces:

   - Use porous pavements on private property for sidewalks and less traveled surfaces, such as driveways, fire lanes, bike lanes, parking lanes, overflow parking, and parking stalls.

   - Install shared driveways, flared driveways, and residential driveways with center vegetated strips.

   - Provide for shared parking in commercial areas.

   - Direct roof downspouts to vegetated areas, rain gardens, or planter boxes.

   - Isolate paved areas with buffers.

   - Modify curb and gutter and route runoff in vegetated swales.

   - Reduce a building's footprint by building upward rather than outward.

   - Install rain barrels and cisterns below roof downspouts.

   - Install a green roof.

MINIMIZING SOIL COMPACTION

Soil compaction damages soil structure, reduces infiltration rates, limits root growth and plant survivability, and destroys soil organisms. Reduced infiltration creates increased runoff volume. Uncompacted soils support vegetation, support organisms, and store and infiltrate water. For these reasons site planning, design, and execution, where appropriate, should:

1. Restrict grading and compaction to those areas that will support structures.

2. Protect soils, especially porous soils, against compaction and rutting in areas where traffic is unavoidable.

3. Minimize the size of construction easements and material storage areas.

4. Site stockpiles within the development envelope during the construction phase of a project.

5. Prohibit working on wet soils with heavy equipment.

6. Restore compacted open space areas with tilling and soil amendments.

   Examples of minimizing soil compaction:

   - Incorporate a soil noncompaction and restoration plan into the project's construction phase Storm Water Pollution Prevention Plan.

   - Till into compacted soils 3 inches of well-aged organic mulch to a depth of 12 inches after grading.

DIRECTING RUNOFF FROM IMPERVIOUS AREAS TO INFILTRATION AREAS

Runoff across impervious areas will flow faster and carry pollutants accumulating on the impervious surfaces. The prevention of surface infiltration will also create more runoff volume. Directing runoff to infiltration areas will slow the velocity, filter out pollutants, and replenish groundwater. Infiltration has been found to be a reasonable and practical method for reducing pollutant load provided there is suitable pretreatment[8]. For these reasons site planning, design, and execution, where appropriate, should:

1. Grade surfaces to drain toward open space, swales, or bioretention cells with infiltration capability.

2. Grade surfaces to drain through suitable pretreatment trains toward porous pavements with infiltration capability.

3. Use grassed or vegetated swales with infiltration capability to convey runoff rather than using conduit and lined conveyances.

   Examples of directing runoff from impervious areas to infiltration areas:

   - Design streets to drain to grassed or vegetated swales or bioretention cells with infiltration capability.

   - Grade parking areas to drain to grassed or vegetated swales, bioretention cells, and/or pervious pavements with infiltration capability.

   - Grade driveways to drain sideways to adjacent pervious areas with infiltration capability rather than to the street.

[8] Los Angeles/San Gabriel Rivers Watershed Council, *L. A. Basin Water Augmentation Study*, www.lasgrwc.org/WAS.htm, accessed March 31, 2008.

- Direct roof runoff to vegetated swales, planter boxes, or bioretention cells with infiltration capability.

- Raise stormwater inlets in planting areas to allow water to soak into the soil where it can infiltrate.

CHAPTER 3: DESIGN REQUIREMENTS

All new development and redevelopment under the jurisdiction of the County of Los Angeles is required to meet LID requirements. The goals of LID are to increase groundwater recharge, enhance water quality, and prevent degradation to downstream natural drainage courses.

REQUIREMENTS FOR SMALL SCALE RESIDENTIAL PROJECTS

Residential development and redevelopment of four units or less, or remodels affecting more than 50 percent of the original home footprint are not required to complete hydrologic analysis for the project site, but must include at least two of the following items into the site design:

- Porous pavement

  Install porous pavement that allows rainwater to infiltrate through it. Porous pavement includes, but is not limited to, porous asphalt, porous concrete, ungrouted paving blocks, and gravel. At least 50 percent of the pavement on the lot shall be porous.

- Downspout routing

  Each roof downspout shall be directed to one of the following BMPs. The sum of the capacity of the downspout BMPs shall be at least 200 gallons.

  a. Cistern/rain barrel

     Direct roof downspouts to rain barrels or cisterns. The stored stormwater can then be used for irrigation or other nonpotable uses.

  b. Rain garden/planter box

     Direct roof downspouts to rain gardens or planter boxes that provide retention and treatment of stormwater.

- Disconnect impervious surfaces

  Slope driveways and other impervious surfaces to drain toward pervious surfaces. If possible, runoff should be directed toward vegetated areas or water quality BMPs. Limit the total area not directed toward vegetated areas or water quality BMPs to 10 percent or less of the area of the lot.

- Dry well

  Install a dry well to infiltrate stormwater. The dry well shall be sized to hold at least 200 gallons of stormwater.

- Landscaping and landscape irrigation

  Plant trees near impervious surfaces to intercept rainfall in their leaves. Trees planted adjacent to impervious surfaces can intercept water that otherwise would have become runoff. Two trees shall be planted on each parcel so that they overhang impervious surfaces. Install irrigation systems that minimize water usage and eliminate dry-weather urban runoff.

- Green roof

  Install a green roof to retain and treat stormwater on the rooftop. A green roof shall cover at least 50 percent of the total rooftop area.

REQUIREMENTS FOR LARGE SCALE DEVELOPMENT

All residential developments of five units or greater and all nonresidential developments shall follow the LID Hydrologic Analysis techniques outlined in the Hydrologic Analysis Section of this manual.

LID Requirements

Large scale residential and nonresidential development projects shall prioritize the selection of BMPs to treat stormwater pollutants, reduce stormwater runoff volume, and promote groundwater infiltration and stormwater reuse in an integrated approach to protecting water quality and managing water resources. BMPs shall be implemented in the following order of preference:

1. BMPs that promote infiltration.

2. BMPs that store and beneficially use stormwater runoff.

3. BMPs that utilize the runoff for other water conservation uses including, but not limited to, BMPs that incorporate vegetation to promote pollutant removal and runoff volume reduction and integrate multiple uses, and BMPs that percolate runoff through engineered soil and allow it to discharge downstream slowly.

4. If the Director of Public Works determines that compliance with the above (No. 3) LID requirements is technically infeasible, in whole or in part, in response to an applicant's submittal, the Director shall require the applicant to submit a proposal for approval by the Director that incorporates design features demonstrating compliance with the LID requirements to the maximum extent practicable.

The LID goals of increasing groundwater recharge, enhancing water quality, and preventing degradation to downstream natural drainage courses shall be used in the evaluation, approval, and implementation of LID BMPs, as well as any determination of infeasibility.

On-site Infiltration Requirements

The excess volume (ΔV) determined by the hydrologic analysis in Chapter 4 shall be infiltrated throughout the project site whenever possible. This can be accomplished on a lot-by-lot or on a subregional scale provided that equivalent benefit can be demonstrated. The following requirements apply:

- Infiltrate the ΔV from each lot at the lot level, or
- Infiltrate the ΔV from the entire project site including streets and public right of way in subregional facilities. The tributary area of a subregional facility shall generally be limited to 5 acres, but may be exceeded per the Director of Public Works.

Infiltration may not be possible in all development scenarios. Exceptions may include, but are not limited to, the following technical feasibility and implementation parameters:

- Locations where seasonal high groundwater is within 10 feet of the surface.
- Within 100 feet of a groundwater well used for drinking water.
- Brownfield development sites or other locations where pollutant mobilization is a documented concern.
- Locations with potential geotechnical hazards as outlined in a report prepared and stamped by a licensed geotechnical engineer.
- Locations with natural, undisturbed soil infiltration rates of less than 0.5 inches per hour that do not support infiltration-based BMPs.
- Locations where infiltration could cause adverse impacts to biological resources.
- Development projects in which the use of infiltration BMPs would conflict with local, State or Federal ordinances or building codes.
- Locations where infiltration would cause health and safety concerns

On-site Storage and Reuse Requirements

When infiltration is not possible, on-site storage and reuse of the ΔV is the next preferred LID BMP option. Storage and reuse of the ΔV may not be possible in all development scenarios. Exceptions may include, but are not limited to, the following technical feasibility and implementation parameters:

- Projects that would not provide sufficient irrigation or (where permitted) domestic grey water demand for use of stored runoff due to limited landscaping or extensive use of low water use plant palettes in landscaped areas.
- Projects that are required to use reclaimed water for irrigation of landscaping.

- Development projects in which the storage and reuse of stormwater runoff would conflict with local, State or Federal ordinances or building codes.

- Locations where storage facilities would cause potential geotechnical hazards as outlined in a report prepared and stamped by a licensed geotechnical engineer.

- Locations where storage facilities would cause health and safety concerns.

Water Conservation Requirements

When infiltration or storage and reuse of the ΔV is not possible, LID BMPs that incorporate vegetation to promote pollutant removal and runoff volume reduction, integrate multiple uses and/or BMPs that percolate runoff through engineered soil and allow it to discharge downstream slowly shall be implemented. These LID BMPs shall be sized to detain and treat the ΔV.

Infeasibility

Compliance with the LID requirements in this manual in whole or in part may not be feasible in all development scenarios. In these situations, the applicant shall demonstrate the infeasibility of compliance with the LID requirements and submit a proposal for approval by the Director that incorporates design features demonstrating compliance with the LID requirements to the maximum extent practicable.

Water Quality Treatment Requirements

The runoff from the water quality design storm event associated with the developed site hydrology described in Chapter 4 must be treated before discharge in compliance with the National Pollutant Discharge Elimination System Municipal Stormwater Permit for the County of Los Angeles.

Hydromodification Requirements

California Drainage Law is a complicated and complex area with respect to the rights of upper and lower landowners. Therefore, it is in everyone's best interest to require developments to analyze all the factors that may contribute to changed drainage characteristics, which may contribute to downstream drainage impacts (increased flooding and erosion). Below is an outline of the procedure required to analyze drainage impacts on off-site property.

1. All projects are required to conduct hydrology and hydraulic analysis for SUSMP, LID, 2-, 5-, 10-, 25-, and 50-year storm events per the Los Angeles County Department of Public Works Hydraulic and Hydrology manuals.

2. HEC-RAS is required as the standard for analyzing changes in flow velocity, flow volume, and depth/width of flow for all natural drainage courses.

3. Sediment transport analysis using HEC-RAS, SAMS, and HEC-6 is required to determine long-term impacts of streambed accretion and degradation for major drainage courses with Capital Storm flow rates (Q) greater than 5,000 cubic feet per second.

4. All projects are required to fully mitigate off-site drainage impacts caused by hydromodification and changes in water quality, flow velocity, flow volume, and depth/width of flow under all 7 hydrologic scenarios above.

5. If not fully mitigated, the developer is required to obtain Drainage Acceptance letters from impacted downstream property owners. If Drainage Acceptance letters cannot be obtained and mitigation is not feasible, the developer must recommend to Regional Planning that a Statement of Overriding Consideration be included in the California Environmental Quality Act document to disclose that there will be significant unmitigated downstream drainage impacts.

Hydromodification Exemptions

All projects that comply with one or more of the following conditions are exempt from conducting a full analysis for hydromodification impacts. Applicants must still demonstrate that the project mitigates for hydromodification impacts to the satisfaction of the Director of Public Works.

- Projects that disturb less than one acre.

- Less than 10,000 square feet of new impervious area.

- Projects that do not increase impervious area or decrease the infiltration capacity of pervious areas compared to preproject conditions.

- Projects that are replacement, maintenance, or repair of an existing permitted flood control facility.

- Projects within a watershed or subwatershed where a geomorphically-based watershed study has been prepared that establishes that the potential for hydromodification impacts is not present based on appropriate assessment and evaluation of relevant factors, including: runoff characteristics, soil conditions, watershed size and conditions, channel conditions, and proposed levels of development within the watershed.

- Projects that discharge directly or via a storm drain into concrete or significantly hardened channels, which in turn discharge into a sump area under tidal influence, or other receiving water that is not susceptible to hydromodification impacts.

- Projects that have hydrologic control measures that include sufficient subregional, regional, in-stream control measures, or a combination thereof such that hydromodification will not occur.

CHAPTER 4: LID HYDROLOGIC ANALYSIS

INTRODUCTION

Southern California has a relatively dry climate with long periods of very little rainfall often followed by intense storm events. The County of Los Angeles Department of Public Works uses the Modified Rational Method of hydrologic analysis. A detailed discussion of the methodology is included in the Los Angeles County Department of Public Works Hydrology Manual. The most recent version is available online at http://www.ladpw.org/wrd/publication/index.cfm.

LID GOALS

The primary benefits expected from implementation of LID are: (1) increased groundwater recharge, (2) enhanced water quality, and (3) stability of downstream natural reaches.

The main benefits of LID can be achieved with relatively simple analysis using tools that are currently available and consistent with approved methods, such as Los Angeles County's Tc calculator available online at http://www.ladpw.org/wrd/publication/Engineering/hydrology/tc_calculator_files.zip.

METHODOLOGY

LID Hydrologic Analysis Steps

Step 1: Determine hydrologic parameters

Determine drainage area of proposed development site (for sites larger than 40 acres use multiple subareas). Calculate slope and length of flow path and identify soil type.

Step 2 Identify design storm

There are several options for an LID design storm. This accounts for regional differences in rainfall and is consistent with existing SUSMP design criteria.

A. The 85th percentile 24-hour runoff event determined, as the maximized capture stormwater volume for the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/SCE Manual of Practice No. 87, (1998), or

B. The volume of annual runoff, based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbook – Industrial/Commercial, (1993), or

C. The volume of runoff produced from a 0.75-inch storm event prior to its discharge to a stormwater conveyance system, or

D. The volume of runoff produced from a historical record based reference 24-hour rainfall criterion for treatment 0.75 inch average for the County of Los Angeles area) that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event.

Step 3: Calculate undeveloped runoff volume

Using an approved hydrologic analysis tool consistent with the Los Angeles County Department of Public Works Hydrology Manual, determine the volume associated with the selected design storm assuming clear flows and undeveloped site conditions (0 percent impervious surfaces).

Step 4: Calculate developed runoff volume

Using the same design storm, determine the runoff volume associated with the proposed development. The impervious values shall be consistent with the hydrology manual recommendations based on land-use type.

Step 5: Calculate the excess volume (ΔV)

Subtract the undeveloped runoff volume from the developed runoff volume. This quantity is required to be infiltrated wherever possible at the site level and the BMPs used to accomplish this requirement shall be distributed throughout the project site.

Step 6: Determine water quality treatment volume or flow rate

The entire volume identified in Step 4 must be treated or infiltrated or one of the following flow rate based events can be used to determine the flow rate of runoff that must be treated:

A. The flow of runoff produced from a rain event equal to at least 0.2 inches per hour intensity; or

B. The flow of runoff produced from a rain event equal to at least 2 times the 85th percentile hourly rainfall intensity for the County of Los Angeles; or

C. The flow of runoff produced from a rain event that will result in treatment of the same portion of runoff as treated using volumetric standards above.

CHAPTER 5: LOW-IMPACT DEVELOPMENT BEST MANAGEMENT PRACTICES

BIORETENTION

POLLUTANT REMOVAL	
Sediment	High
Nutrients	High
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

Bioretention areas are vegetated shallow depressions that provide storage, infiltration, and evapotranspiration. Bioretention areas also remove pollutants by filtering stormwater through plants adapted to the local climate, soil moisture conditions, and an engineered soil mix. In bioretention areas, pore spaces, microbes, and organic material in the engineered soils help retain water in the form of soil moisture and promote the adsorption of pollutants (such as dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants utilize soil moisture and promote the drying of the soil through transpiration. If no underdrain is provided, outflow of the device's stored water into the underlying soils occurs over a period of days. For areas with low permeability, native soils, or steep slopes, bioretention areas can be designed with an underdrain system that routes the treated runoff to a more suitable infiltration area, a cistern for later reuse, or to the storm drain system. In this situation, treatment is achieved mainly through filtration and adsorption in the vegetation and engineered soils.

ADVANTAGES	LIMITATIONS
• Provides shade and windbreaks, and improves aesthetics • Enhances water quality through treatment and gradual infiltration	• Not appropriate for industrial sites or locations where spills may occur • Not suitable for areas where water table is within 10 feet of ground and surface stratum unstable • Not recommended where tree removal would be required • May pose vector control problem

GENERAL CONSTRAINTS AND SITE CONCERNS

Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and downstream of swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system. The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated. In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention should only be used in stabilized drainage areas. Design considerations include:

- Native soil infiltration rate - Underdrain is required in low permeability soils.
- Vertical relief and proximity to storm drain - Site must have adequate relief between land surface and storm drain to permit vertical percolation through the soil media if collected and conveyed in underdrain to storm drain system.
- Depth to groundwater - Shallow groundwater table may not permit complete drawdown between storms.
- Availability of pervious area - Bioretention areas typically occupy between 2 to 10 percent of the drainage area.

MULTIUSE OPPORTUNITIES

Bioretention areas can be applied in various settings, including:

- Individual lots for rooftop, driveway, and other on-lot impervious surface infiltration.
- Shared facilities located in common areas for individual lots.
- Areas within loop roads or cul-de-sacs.
- Landscaped parking lot islands.

- Within parkways and other right of ways along roads.
- Common landscaped areas in apartment complexes or other multifamily housing designs.
- In parks and along open space edges.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

CISTERNS/RAIN BARRELS

POLLUTANT REMOVAL	
Sediment	High
Nutrients	High
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

Cisterns and rain barrels are containers, which capture stormwater runoff as it comes down through the roof gutter system. Rain barrels are placed outside of a building at roof downspouts to store rooftop runoff for later reuse in lawn and garden watering. Cisterns also collect rooftop runoff, but store the water in significantly larger volumes in manufactured tanks or built underground storage areas. Both cisterns and rain barrels can be implemented without the use of pumping devices, instead relying on gravity flow. The collection of this stormwater reduces the amount of stormwater runoff and assists in the reduction of potential pollutants entering the stormwater conveyance system. Reducing the water used from the municipal water system can reduce a site's water bill.

ADVANTAGES	LIMITATIONS
• Low installation cost • Requires little space for installation • Reduces amount of stormwater runoff • Conserves water usage • Reduction in the discharge of pollutants due to reduction of overall off-site flow volume	• Limited amount of stormwater runoff can be captured • Restricted to structure runoff

GENERAL CONSTRAINTS AND SITE CONCERNS

The following rain barrel and cistern technical and operational features should be considered:

- Screens on gutters and downspouts to remove sediment and particles as the water enters the barrel or cistern.
- Removable child-resistant covers and mosquito screening on water entry holes.
- The option of draining the system completely for maintenance.
- Drain spigots that have garden hose threading, suitable for connection to a drip irrigation system.
- Aesthetic features that are compatible with the lot's landscaping plan or landscaping that provides visual screening.
- Private stormwater maintenance agreements met between the property owner and any potential second and third parties.
- Adequate storage capacity.
- Should be located for easy maintenance or replacement.

DESIGN SPECIFICATIONS

The required capacity of a cistern and rain barrel is a function of the rooftop surface area that drains to it, the inches of rainfall required to fill the vessel, and water losses due mainly to evaporation. Cisterns should be designed to prevent mosquito access.

OPERATIONS AND MAINTENANCE

Maintenance requirements for rain barrels are minimal and consist only of regular inspection of the unit as a whole and any of its constituent parts and accessories. All components should be inspected at least twice a year and repaired or replaced as needed. Cisterns, along with all their components and accessories, should undergo regular inspection at least twice a year. Replacement or repair of the unit as a whole and any of its constituent parts and accessories should be completed as necessary.

During the wet season, cisterns and rain barrels should be inspected periodically for mosquitos.

Note: For more information, please visit the American Rain Catchment Systems Association website at www.arcsa.org.

DRY PONDS

POLLUTANT REMOVAL	
Sediment	Medium
Nutrients	Low
Trash	High
Metals	Medium
Bacteria	Medium
Oil and Grease	Medium
Organics	Medium

DESCRIPTION

Dry extended detention (ED) basins are basins whose outlets have been designed to detain the runoff from a water quality design storm for 36 to 48 hours to allow sediment particles and associated pollutants to settle and be removed. Dry ED basins do not have a permanent pool; they are designed to drain completely between storm events. They can also be used to provide hydromodification and/or flood control by modifying the outlet control structure design and including additional detention storage. The slopes, bottom, and forebay of ED basins are typically vegetated.

Dry ED basins can be located either online or offline. For offline basins, a flow diversion structure is used to divert the design storm volume to the basin from the storm drain. For online basins, all storm drain flows are routed through the basin; storm events exceeding the water quality design capacity will pass through the basin and will discharge over a primary overflow untreated or, during extreme events, over an emergency spillway. In both types of basins, influent flows enter a sediment forebay. Here coarse solids are first removed prior to flowing into the main cell of the basin where finer sediment and associated pollutants settle as stormwater is detained and slowly released through a controlled outlet structure. Dry-weather flows and very low storm flows are often infiltrated within the basin.

ADVANTAGES	LIMITATIONS
• Inexpensive and easy to construct and operate due to simplicity • Provide significant removal of sediments and associated toxics • Provides erosion control • Provides flood control	• Only moderate pollutant removal • Ponded water may cause vector control problem

GENERAL CONSTRAINTS AND SITE CONCERNS

- Surface space availability - typically 0.5 to 2 percent of the total tributary development area required.
- Depth to groundwater - bottom of basin should be higher than the water table.
- Steep slopes - basins placed on slopes greater than 15 percent or within 200 feet from the top of a hazardous slope or landslide area require a geotechnical investigation.
- Compatibility with flood control - basins must not interfere with flood control functions of existing conveyance and detention structures.
- Dry ED basins shall never be placed within a blue-line stream.

MULTIUSE OPPORTUNITIES

A dry ED basin can sometimes be retrofitted into an existing flood control basin or integrated into the design of a park or playfield. Perforated risers, multiple orifice plate outlets, or similar multistage outlets are required for flood control retrofit applications to ensure adequate detention time for small storms while still providing peak-flow attenuation for the flood design storm. Recreational multiuse facilities must be inspected after every storm and may require a greater maintenance frequency than dedicated water quality basins to ensure aesthetics and public safety are not compromised. Any planned multiuse facility must obtain special approval by the County of Los Angeles Department of Public Works.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

DRY WELLS

POLLUTANT REMOVAL	
Sediment	High
Nutrients	High
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

Commonly known as sumps, french drains, drain fields, and shallow injection wells; dry wells simply use gravity to infiltrate stormwater into the subsurface. A dry well is constructed by digging a hole in the ground and filling it with an open graded aggregate or plastic infill devices. Stormwater runoff is diverted to the dry well for infiltration into the ground, allowing it to be stored in the voids. While it may seem harmless and cost-effective at first glance to use these dry wells to infiltrate stormwater into the ground, in reality, the impact to groundwater quality from these devices varies and is highly dependent upon many factors.

ADVANTAGES	LIMITATIONS
• Requires minimal space to install • Low installation costs • Reduces amount of runoff • Provides groundwater recharge • Can serve small impervious areas like rooftops • Helps to disconnect impervious surfaces	• Offers little pretreatment, which may cause clogging • Risk of groundwater contamination in very coarse soils may require groundwater monitoring • Dry wells service a limited drainage area, typically only rooftop runoff • Loss of infiltrative capacity and high maintenance cost in fine soils • Low removal of dissolved pollutants in very coarse soils • Not recommended for use with commercial rooftops unless adequacy of pretreatment is assured

GENERAL CONSTRAINTS AND SITE CONCERNS

Constraints for dry wells are similar to those associated with many infiltration BMPs:

- Soils must be permeable.
- Dry wells should not be installed where hazardous or toxic materials are used, handled, stored, or where a spill of such materials would drain into the dry well.
- Must have a minimum of 10 feet between the bottom of the dry well and the seasonal high-0water table.
- Dry wells must be located at least 10 feet away, on the down slope side of the structure, from building foundations to prevent seepage.
- Not suitable on fill sites or steep slopes.
- Generally, dry wells that are deeper than their widest surface dimension are classified as Class V Injection Wells and are regulated by the Environmental Protection Agency. These wells must comply with the requirements of the Federal Underground Injection Control Program.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

ENGINEERED WETLANDS

POLLUTANT REMOVAL	
Sediment	High
Nutrients	Medium
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

Constructed wetlands are constructed pools that retain water throughout the year. They are shallower than wet ponds, but have a greater vegetative cover. It is important to note that natural wetlands are not recommended for stormwater treatment as natural wetlands should be conserved.

Constructed wetlands are developed for the purpose of stormwater management. Additionally, constructed wetlands provide habitat and are aesthetically pleasing, making them widely accepted in communities. Treatment occurs through sedimentation and biological uptake. Many different designs for constructed wetlands exist, however, one of the most often used includes an initial detention pond for settling and increased storage capacity.

ADVANTAGES	LIMITATIONS
• Provides wildlife habitat • Provides removal of wide range of constituents • Provides erosion control • Provides flood control	• Safety concerns when constructed where there is public access • Not suitable for steep, unstable slopes • May have vector control problems • May need base flow to maintain water level • Requires fairly large open space • May require State Division of Safety of Dams approval depending on size

GENERAL CONSTRAINTS AND SITE CONCERNS

- Availability of base flows - stormwater wetlands require a regular source of water to support wetland biota.
- Slope stability - stormwater wetlands are not permitted near steep slope hazard areas.
- Surface space availability - large footprint required.
- Compatibility with flood control - basins must not interfere with flood control functions of existing conveyance and detention structures.

MULTIUSE OPPORTUNITIES

Provided adequate surcharge storage, a stormwater wetland may be combined with a flood control basin to provide both water quality control and peak-flow control. Wetlands can also be designed with wildlife viewing areas and walking trails around the perimeter to provide passive recreation. Any planned multiuse facility must obtain special approval by the County of Los Angeles Department of Public Works.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

GREEN ROOFS

POLLUTANT REMOVAL	
Sediment	High
Nutrients	Medium
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

A green roof is a heavy weight roof system of waterproofing material with a thick soil/vegetation protective cover. The green roof can be used in place of a traditional roof to limit impervious site area. The green roof captures and then evapotranspirates 50 to 100 percent of precipitation depending on the season. Green roofs attempt to mimic predeveloped hydrology, thereby reducing postdeveloped peak-runoff rates to near predeveloped rates. They help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in warm seasons. Green roofs should not be used on slopes greater than 10 percent. A drain system and overflow to an approved conveyance and destination/disposal method will be required.

There are two types of green roofs: extensive and intensive systems. Intensive green roofs have larger depths of soil and require more maintenance and irrigation. Extensive green roofs feature very thin planting mediums and require little maintenance.

ADVANTAGES	LIMITATIONS
• Requires no additional space • Reduces overall volume of stormwater • Reduces pollutant discharge due to microbial processes and plant uptake	• Requires drought-tolerant vegetation • Increased roof loading • Requires maintenance to the same extent as any landscaped area • Need to be watered regularly in first year after construction until vegetation is established

GENERAL CONSTRAINTS AND SITE CONCERNS

Green roofs can be installed during initial construction or placed on buildings as part of a retrofit. The amount of stormwater that a green roof mitigates is directly proportional to the area it covers, the depth and type of the growing medium, slope, and the type of plants selected. The larger the green roof area, the more stormwater mitigated. Green roofs are appropriate for industrial and commercial facilities and large residential buildings such as condominiums or apartment complexes. Green roofs can also prove useful for small residential buildings under some circumstances. For instance, green roofs are commonly used on single-family residential structures in Germany and other European countries. Single-family residential structures, like all buildings with green roofs, must be able to support the loading from a saturated roof. Furthermore, the green roofs should be easily accessible; and residents should understand the maintenance requirements necessary to keep the roof functional.

A building must be able to support the loading of green roof materials under fully saturated conditions. These materials include a waterproofing layer, a soil or substrate layer, and a plant layer. Plants selected need to be suited for local climatic conditions and can range from sedums, grasses, and wildflowers on extensive roofs to shrubs and small trees on intensive roofs.

DESIGN SPECIFICATIONS

GENERAL SPECIFICATIONS

Proprietary green roof applications must comply with the vendor's guidelines for installation and maintenance. In the case of a conflict between vendor guidelines and County requirements, the stricter shall apply. Good quality waterproofing material must be used on the roof surface. Soil of adequate fertility and drainage capacity at depths of 2 to 6 inches and weight of 10 to 30 pounds per square foot shall be applied for an extensive green roof. For an intensive green roof, a minimum soil depth of 8 inches and weight of 60 pounds per square foot should be used. The building structure must be shown to be adequate to hold the additional weight. Vegetation shall be self-sustaining plants without the need for fertilizers or pesticides. Soil coverage to prevent erosion

shall be established immediately upon installation by using mulch, vegetation mats, or other approved protection method. Ninety percent plant coverage shall be achieved within two years. Temporary irrigation to establish plants is recommended. A permanent irrigation system using potable water may be used, but an alternative means of irrigation such as air conditioning condensate or other nonpotable sources is recommended. Alternative sources should be analyzed to determine if the source has chemicals that might harm or kill the vegetation. Maximum roof slope shall be 10 percent, unless the applicant can provide documentation for runoff control on steeper slopes.

STRUCTURAL ROOF SUPPORT

The structural roof support must be sufficient to hold the additional weight of the green roof. For retrofit projects, check with an architect, structural engineer, or roof consultant to determine the condition of the existing building structure and what might be needed to support a green roof. This might include additional decking; roof trusses; joists, columns, and/or foundations. Generally, the building structure must be adequate to hold an additional 10 to 25 pounds per square foot (psf) saturated weight, depending on the vegetation and growth medium that will be used. (This is in addition to snow load requirements.) An existing rock ballast roof may be structurally sufficient to hold a 10 to 12 psf green roof. (Ballast typically weighs 10 to 12 psf.)

For new construction, the project architects and structural engineers shall address the structural requirements of the green roof during the design process. Greater flexibility and options are available for new buildings than for reroofing. The procedures for the remaining components are the same for both reroofing and new construction.

WATERPROOF MEMBRANE

Waterproof membranes are made of various materials, such as modified asphalts (bitumens), synthetic rubber ethylene propylene diene monomer (EPDM), hypolan chlorosulfonated polyethylene (CSPE), and reinforced polyvinyl chloride (PVC). Some of the materials come in sheets or rolls and some are in liquid form. They have different strengths and functional characteristics. Some of these products require root inhibitors and other materials to protect the membrane. Numerous companies manufacture waterproofing materials appropriate for green roofs.

PROTECTION BOARDS OR MATERIALS

These materials protect the waterproof membrane from damage during construction and over the life of the system, usually made of soft fibrous materials.

ROOF BARRIER

Root barriers are made of dense materials that inhibit root penetration. The need for a root barrier depends on the waterproof membrane selected. Modified asphalts usually require a root barrier while synthetic rubber (EPDM) and reinforced PVC generally do

not. Check with the manufacturer to determine if a root barrier is required for a particular product. Membranes impregnated with pesticides are not allowed. Manufacturers must provide the County of Los Angeles Department of Public Works with evidence that membranes impregnated with copper will not leach out at concentrations of concern.

DRAINAGE LAYER

There are numerous ways to provide drainage. Products range from manufactured perforated plastic sheets to a thin layer of gravel. Some green roof designs do not require any drainage layer other than the growth medium itself, depending on roof slope and size (e.g., pitched roofs and small flat roofs).

GROWTH MEDIUM

The growth medium is generally 2 to 6 inches thick and well drained. It weighs from 10 to 25 pounds per square foot when saturated. A simple mix of 1/4 topsoil, 1/4 compost, and 1/2 pumice perlite may be sufficient for many applications. Some companies have their own growth medium specifications. Other components could include digested fiber, expanded clay or shale, or coir.

VEGETATION

Green roof vegetation should have the following attributes:

- Drought tolerant, requiring little or no irrigation after establishment.
- A growth pattern that allows the plant to thoroughly cover the soil. At least 90 percent of the overall surface shall be covered.
- Self-sustaining, without the need for fertilizers, pesticides, or herbicides.

  Able to withstand heat, cold, and high winds
- Very low maintenance, needing little or no mowing or trimming.
- Perennial or self-sowing.
- Fire resistant.

A mix of sedum/succulent plant communities is recommended because they possess many of these attributes. Herbs, forbs, grasses, and other low ground covers can also be used to provide additional benefits and aesthetics; however, these plants may need more watering and maintenance to survive and keep their appearance.

Installation: Four methods (or combinations of them) are generally used to install the vegetation; vegetation mats, plugs/potted plants, sprigs, and seeds.

1. Vegetation mats are sod-like, pregerminated mats that achieve immediate full-plant coverage. They provide immediate erosion control, do not need mulch, and minimize weed intrusion. They also need minimal maintenance during the establishment period and little ongoing watering and weeding.

2. Plugs or potted plants may provide more design flexibility than mats. However, they take longer to achieve full coverage, are more prone to erosion, need more watering during establishment, require mulching, and more weeding.

3. Sprigs are hand broadcast. They require more weeding, erosion control, and watering than mats.

4. Seeds can be either hand broadcast or hydraseeded. Like sprigs, they require more weeding, erosion control, and watering than mats.

GRAVEL BALLAST

Gravel ballast is sometimes placed along the perimeter of the roof and at air vents or other vertical elements. The need for ballast depends on operational and structural design issues. It is sometimes used to provide maintenance access, especially to vertical elements requiring periodic maintenance. In many cases very little, if any, ballast is needed. In some situations a header or separation board may be placed between the gravel ballast and adjacent elements (such as soil or drains). If a root barrier is used, it must extend under the gravel ballast and growth medium and up the side of the vertical elements.

DRAIN

As with a conventional roof, a green roof must safely drain runoff from the roof to an approved stormwater destination.

OPERATIONS AND MAINTENANCE

GENERAL REQUIREMENTS

- Soil Substrate/Growth Medium - soil shall be inspected for evidence of erosion from wind or water. If erosion channels are evident, they shall be stabilized with additional soil substrate/growth medium and covered with additional plants.

- Green Roof System Structural Components - Structural components shall be operated and maintained in accordance with manufacturers' requirements. Drain inlets shall be kept unrestricted. Inlet pipe shall be cleared when soil substrate, vegetation, debris, or other materials clog the drain inlet. Sources of sediment and

debris shall be identified and corrected. Determine if drain inlet pipe is in good condition and correct as needed.

- Debris and Litter: Debris shall be removed to prevent clogging of inlet drains and interference with plant growth.

- Vegetation: Vegetation shall be maintained to provide 90 percent plant cover. During the establishment period, plants shall be replaced once per month as needed. During the long-term period, dead plants shall generally be replaced as needed. Fallen leaves and debris from deciduous plant foliage shall be removed. Nuisance and prohibited vegetation shall be removed when discovered. Dead vegetation shall be removed and replaced with new plants. Weeding shall be manual with no herbicides or pesticides used. Weeds shall be removed regularly and not allowed to accumulate. Fertilization is not necessary and fertilizers shall not be applied. During drought conditions, mulch or shade cloth may be applied to prevent excess solar damage and water loss. Mowing of grasses shall occur as needed. Clippings shall be removed.

- Irrigation can be accomplished either through hand watering or automatic sprinkler systems. If automatic sprinklers are used, manufacturers' instructions for operations and maintenance shall be followed. During the establishment period (1 to 3 years), water sufficient to assure plant establishment shall be applied. During the long-term period (3 plus years), water sufficient to maintain plant cover shall be applied.

- Spill prevention measures from mechanical systems located on roofs shall be exercised when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

- Training and/or written guidance information for operating and maintaining green roofs shall be provided to all property owners and tenants. A copy of the operations and maintenance plan shall be provided to all property owners and tenants.

- Access and safety to the green roof shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Walkways shall be clear of obstructions and maintained to design standards.

- Aesthetics of the green roof shall be maintained as an asset to the property owner and community. Evidence of damage or vandalism shall be repaired and accumulation of trash or debris shall be removed upon discovery.

- Insects shall not be harbored at the green roof. Standing water creating an environment for development of insect larvae shall be eliminated by manual means. Chemical sprays shall not be used.

Note: Please visit www.greenroofs.org for more information on green roofs.

INFILTRATION BASIN

POLLUTANT REMOVAL	
Sediment	High
Nutrients	High
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

An infiltration basin is a shallow surface pond that is designed to infiltrate stormwater through permeable soils. Infiltration basins retain runoff until it gradually infiltrates through the soil and eventually into the groundwater. Vegetation is used to avoid erosion of the basin bottom and slopes. The vegetation provides pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Pollutant removal takes place through a combination of filtration, adsorption, and biological processes.

Infiltration basins are effective in reducing the pollutants of concern listed above; however, coarser sediments can clog and render the basin ineffective. An evaluation of the soils at the site is required to determine if an infiltration basin is an appropriate BMP to use.

As opposed to infiltration trenches, an infiltration basin creates a visible surface pond because it is not backfilled with rocks or stones. Infiltration basins are generally used for drainage areas between 5 and 50 acres. For drainage areas less than 5 acres, an infiltration trench or other BMP may be more appropriate. For drainage areas greater than 50 acres, maintenance of an infiltration basin would be burdensome and an extended/dry detention basin or wet pond may be more appropriate.

Infiltration basins are generally dry except immediately following storms. A low-flow channel may be necessary if a constant base flow is present.

ADVANTAGES	LIMITATIONS
• Avoids discharge to surface waters • Good pollutant removal capabilities • Controls runoff volume • Provides erosion and flood control • Provides groundwater recharge • Provides more habitat value than other infiltration systems • It replicates pre-development hydrology • Can fulfill an area's landscape requirement	• Dependent upon soil and subsurface conditions • High failure rates due to clogging and high maintenance burden • Sediment forebay or pretreatment required • Not recommended to treat industrial sites or sites where hazardous spills may occur • Minimum soil infiltration rate of 0.5 inches/hour • Soil infiltration rates greater than 2.4 inches/hour require full treatment of water prior to infiltration, due to risk of groundwater contamination • Not appropriate for sites with Hydrologic Soil Types C and D • In coarse soil types there is risk of groundwater contamination • Requires complete stabilization of upstream drainage areas prior to construction • Not suitable for fill areas or steep slopes • Once basin becomes clogged it is difficult to restore function • Accumulation of metals and petroleum hydrocarbons may reach toxic level

GENERAL CONSTRAINTS AND SITE CONCERNS

The use of an infiltration basin may be limited by a number of factors, including type of native soils, climate, and location of groundwater table. Site characteristics such as excessive slope of the drainage area, fine-grained soil types, and proximate location of the water table and bedrock may preclude the use of an infiltration basin. Generally, infiltration basins are not suitable for areas with relatively impermeable soils containing clay and silt or in areas with fill.

As with any infiltration BMP, the potential for groundwater contamination must be carefully considered, especially if the groundwater is used for human consumption or agricultural purposes. The infiltration basin is not suitable for sites that use or store chemicals or hazardous materials unless hazardous and toxic materials are prevented from entering the basin. In these areas, other BMPs that do not allow interaction with the groundwater should be considered. In addition, an appropriate erosion-control seed mix needs to be used for the basin.

An infiltration basin needs to be built without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide (low pressure) tires. Prior to any construction, the infiltration area needs to be enclosed with a top to stop entrance by unwanted equipment.

It is important to note that before construction begins, the entire drainage area needs to be stabilized. This can be done by implementing a temporary diversion berm around the perimeter of the construction site to prevent drainage and sediment buildup to this area. After construction is completed, the entire contributing drainage area needs to be stabilized and clean of construction material before runoff can be allowed into the infiltration basin.

It is also important to note that the use of treated wood or galvanized metal anywhere inside the facility is prohibited. The use of galvanized fencing is permitted only in accordance with County fencing requirements.

Evaluation of a particular site to determine if the use of an infiltration basin is appropriate includes:

- Determination of the soil type (ASTM D 3385-88 – Consider NRCS Soil Types A and B only) and consult USDA Soil Survey Tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30 percent clay or more than 40 percent of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.

- Groundwater separation should be at least 10 feet from the basin invert to the measured groundwater elevation and 100 feet away from groundwater wells. There is concern at the State and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.

- Placement should be away from buildings, slopes, and highway pavement (greater than 10 feet) and production wells and bridge structures (greater than 100 feet).

- Sites constructed of fill having a base flow or with a slope greater than 15 percent should not be considered.

- Ensure that adequate head is available to operate flow-splitter structures (to allow the basin to be off-line) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

INFILTRATION TRENCHES

POLLUTANT REMOVAL	
Sediment	High
Nutrients	High
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

An infiltration trench is a long and narrow excavated ditch over porous soils, backfilled with rocks or stones, and lined with filter fabric on the sides and bottom. Stormwater runoff is diverted into the infiltration trench. Since the trench has no outlet, runoff is stored in the void spaces between the stones or gravel. Stormwater infiltrates into the soil where pollutants are removed through a combination of filtration, adsorption, and biological processes.

Infiltration trenches are effective in reducing the pollutants of concern listed above. Pretreatment BMPs such as vegetative swales, buffer strips, or detention basins are typically required to remove coarser sediments that can clog and render the trench ineffective. An evaluation of the soils at the site is required to determine if an infiltration trench is an appropriate BMP to implement.

Infiltration trenches differ from infiltration basins in that the former is used for small drainage areas and stores runoff out of sight within the void spaces of rocks or stones underground. Infiltration basins are for larger drainage areas and runoff is stored within a visible surface pond.

ADVANTAGES

- Avoids discharge to surface waters
- Good pollutant removal capabilities
- Controls runoff volume
- Provides erosion and flood control
- Provides groundwater recharge
- Little aesthetic impact
- Fits in narrow areas and unused areas of a development site
- It replicates pre-development hydrology

LIMITATIONS

- Dependent upon soil and subsurface conditions
- High failure rates due to clogging and high maintenance burden
- Not recommended to treat industrial sites or sites where hazardous spills may occur
- Maximum drainage area should be less than 5 acres
- Minimum soil infiltration rate of 0.5 inch/hour
- Soil infiltration rates greater than 2.4 inches/hour require full treatment of water prior to infiltration due to risk of groundwater contamination
- Not appropriate for sites with Hydrologic Soil Types C and D
- In coarse soil types there is risk of groundwater contamination
- Requires complete stabilization of upstream drainage areas prior to construction
- Not suitable for fill areas or steep slopes
- Once trench becomes clogged it is difficult to restore function
- Accumulation of metals and petroleum hydrocarbons may reach toxic level

GENERAL CONSTRAINTS AND SITE CONCERNS

The use of infiltration trenches may be limited by a number of factors including type of native soil, climate, and location of groundwater table. Site characteristics such as excessive slope of the drainage area, fine-grained soil types, and proximate location of the water table and bedrock may preclude the use of infiltration trenches. Generally, infiltration trenches are not suitable for areas with relatively impermeable soils containing clay and silt or in areas with fill. As with any infiltration BMP, the potential for groundwater contamination must be carefully considered, especially if the groundwater is used for human consumption or agricultural purposes. The infiltration trench is not suitable for sites that use or store chemicals or hazardous materials unless hazardous and toxic materials are prevented from entering the trench. In these areas, other BMPs that do not allow interaction with the groundwater should be considered.

It is important to note that before construction begins, the entire drainage area needs to be stabilized. This can be done by implementing a temporary diversion berm around the perimeter of the construction site to prevent drainage and sediment buildup to this area. After construction is completed, the entire contributing drainage area needs to be stabilized and clean of construction material before runoff can be allowed into the infiltration trench.
To determine if the use of infiltration trenches is appropriate, the following factor must be considered:

- Determination of the soil type (ASTM D 3385-88 – Consider NRCS Soil Types A and B only) and consult USDA Soil Survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30 percent clay or more than 40 percent of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.

- Groundwater separation should be at least 10 feet from the basin invert to the measured groundwater elevation and 100 feet away from groundwater wells. There is concern at the State and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.

- Placement should be away from buildings, slopes, and highway pavement (greater than 10 feet) and production wells and bridge structures (greater than 100 feet).

- Sites constructed of fill, having a base flow, or with a slope greater than 15 percent should not be considered.

- Ensure that adequate head is available to operate flow-splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

LANDSCAPE IRRIGATION

DESCRIPTION

The majority of residential water usage is dedicated to landscape irrigation. Irrigation systems are often poorly designed and maintained, resulting in inefficient water usage and urban runoff. Urban runoff from irrigation often carries fertilizers, pesticides, herbicides, and other pollutants used on landscapes. Efficient irrigation design can minimize the amount of water used to irrigate a landscape and eliminate urban runoff from the site. Methods to increase irrigation efficiency include low-flow sprinkler heads, smart controllers that take into account local evapotranspiration rates, sensors that detect unfavorable weather conditions, and low-flow sprinkler heads.

DESIGN SPECIFICATIONS

SMART IRRIGATION CONTROLLERS

A smart irrigation controller is a device that automatically adjusts watering times in response to weather changes. Smart irrigation controllers use sensors and weather information to manage watering times and frequency. In order to comply with the landscape irrigation option for small scale residential projects, the applicant shall install a smart irrigation controller for any area of the lot that is either landscaped or designated for future landscaping.

PLANTER BOXES

POLLUTANT REMOVAL	
Sediment	High
Nutrients	High
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

There are two types of planter boxes: contained planters and infiltration planters. Contained planters are used for planting trees, shrubs, and ground cover to be placed over impervious surface. The planter may be a prefabricated pot of various dimensions or may be constructed in place and have an infinite variety of shapes and sizes. Contained planters are placed on impervious surfaces such as sidewalks, plazas, and rooftops. Drainage is allowed through the bottom of the planter.

Infiltration planters are structural landscaped reservoirs used to collect, filter, and infiltrate stormwater runoff allowing pollutants to settle and filter out as the water percolates through the planter soil and infiltrates into the ground. In addition to providing pollution reduction, flow rates and volumes can also be managed with infiltration planters. Planters can be used to reduce the total impervious area and should be integrated into the overall site design. Numerous design variations of shape, wall treatment, and planting scheme can be used to fit the character of a site. An overflow to an approved conveyance and disposal method will be required.

ADVANTAGES	LIMITATIONS
• Requires very little space • Aesthetically pleasing • Can provide water treatment or infiltration • Wide applicability • Useful for disconnecting downspouts	• Infiltration rate limited to infiltration capacity of underlying soil • A relatively limited volume of stormwater can be mitigated using planter boxes

GENERAL CONSTRAINTS AND SITE CONCERNS

Contained planter boxes are suitable for any location as they are placed over impervious surfaces. Planter boxes are ideal for urban infill environments where space is limited. For infiltration planters, the infiltration rate of the native soil is a key element in determining size.

DESIGN SPECIFICATIONS

DESIGN CONSIDERATIONS

Plants shall be relatively self-sustaining with little need for fertilizers or pesticides. Irrigation is optional, although plant viability must be maintained. Trees are encouraged for stormwater interception. Planter storage depth must be at least 12 inches unless a larger than --required planter square footage is used. Minimum planter width is 30 inches. Planters shall be constructed without slope.

SOIL SUITABILITY

Contained planters are appropriate for all soil types as they are placed over impervious surface. Topsoil shall be used within the top 12 to 18 inches of the facility. Infiltration planters are appropriate for soils with a minimum infiltration rate of 0.5 inch per hour. There shall be no less than 3 feet of undisturbed infiltration medium between the bottom of the facility and any impervious layer (i.e., hardpan, solid rock, high groundwater levels, etc.). Topsoil shall be used within the top 18 inches of the facility.

PLANTER WALLS

Planter walls shall be made of stone, concrete, brick, clay, plastic, wood, or other stable material. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

SIZING

Individual infiltration planters sized with the simplified approach shall be designed to receive less than 15,000 square feet of impervious area runoff. Planters shall be designed to pond water for less than 36 hours after each storm event.

LANDSCAPING

Contained planters shall be planted to cover at least 50 percent of the planter surface. Tree planting is not required in planters, but is encouraged where practical. Tree planting is also encouraged near planters.

CONSTRUCTION CONSIDERATIONS

Infiltration planter areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of planter areas.

OPERATIONS AND MAINTENANCE

INSPECTION AND MAINTENANCE ACTIVITIES SUMMARY	
ROUTINE MAINTENANCE	• Downspout from rooftop or sheet flow from paving allows unimpeded stormwater flow to the planter. Debris shall be removed routinely (e.g., no less than every 6 months) and upon discovery. Damaged pipe shall be repaired upon discovery. • Planter reservoir receives and detains stormwater prior to infiltration. Water should drain from reservoir within 3 to 4 hours of storm event. Sources of clogging shall be identified and corrected. Topsoil may need to be amended with sand or replaced all together. • Overflow pipe safely conveys flow exceeding reservoir capacity to an approved stormwater receiving system. Overflow pipe shall be cleared of sediment and debris when 50 percent of the conveyance capacity is plugged. Damaged pipe shall be repaired or replaced upon discovery. • Spill prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified. • Training and/or written guidance information for operating and maintaining stormwater planters shall be provided to all property owners and tenants. A copy of the Operations and Maintenance Plan shall be provided to all property owners and tenants.

ROUTINE MAINTENANCE	• Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Mulch shall be replenished at least annually. Vegetation, large shrubs, or trees that limit access or interfere with planter operation shall be pruned or removed. Fallen leaves and debris from deciduous plant foliage shall be raked and removed. Nuisance or prohibited vegetation shall be removed when discovered. Invasive vegetation contributing up to 25 percent of vegetation of all species shall be removed and replaced. Dead vegetation shall be removed to maintain less than 10 percent of area coverage or when planter function is impaired. Vegetation shall be replaced within a specific timeframe (e.g., 3 months) or immediately, if required, to maintain cover density and control erosion where soils are exposed. • Access to the stormwater planter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles if applicable. Obstacles preventing maintenance personnel and/or equipment access to the stormwater planter shall be removed. Gravel or ground cover shall be added if erosion occurs (e.g., due to vehicular or pedestrian traffic). • Insects and rodents shall not be harbored in the stormwater planter. Pest control measures shall be taken when insects/rodents are found to be present. If sprays are considered, then a mosquito larvicide such as Bacillus thurendensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor. Holes in the ground located in and around the stormwater planter shall be filled and compacted.
MAJOR MAINTENANCE	• Splash blocks prevent splashing against adjacent structures and convey water without disrupting media. Any deficiencies in structure such as cracking, rotting, and failure shall be repaired. • Planter shall contain filter media and vegetation. Structural deficiencies in the planter including rot, cracks, and failure shall be repaired. • Filter media consisting of sand, gravel, and topsoil shall allow stormwater to percolate uniformly through the planter. The planter shall be excavated and cleaned; and gravel or soil shall be replaced to correct low infiltration rates. Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged. Sediment accumulation shall be hand removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation. Litter and debris shall be removed routinely (e.g., no less than quarterly) and upon discovery.

POROUS PAVEMENT

POLLUTANT REMOVAL	
Sediment	Low
Nutrients	High
Trash	High
Metals	High
Bacteria	Low
Oil and Grease	High
Organics	Low

DESCRIPTION

There are many types of pervious pavement on the market today. Numerous products and design approaches are available including special asphalt paving; manufactured products of concrete, plastic, and gravel; paving stones; and brick. It may be used for walkways, patios, plazas, driveways, parking lots, and some portions of streets subject to compliance with building codes. The material must be installed and maintained to manufacturers' specifications. These materials may not be allowed in certain areas. A professional engineer must design pervious pavement systems that will be supporting vehicular traffic.

ADVANTAGES

- Provide significant reductions in surface runoff and pollutant loading
- Can be designed with an underdrain in situations where infiltration is not feasible
- Reduces pavement ponding

LIMITATIONS

- Only applicable for low traffic volume areas
- To maintain effectiveness, porous pavements require frequent maintenance
- Easily clogged by sediments if not situated properly
- Extended rain can reduce the pavement's load bearing capacity

GENERAL CONSTRAINTS AND SITE CONCERNS

When designing pervious pavement systems, the infiltration rate of the native soil is a key element in determining the depth of base rock for the storage of stormwater or for determining whether an underdrain system is appropriate. Traffic loading and design speed are important considerations in determining which type of pervious pavement is applicable. Pedestrian, Americans with Disabilities Act accessibility, aesthetics, and maintainability are also important considerations depending on pavement use.

Pervious pavements shall not be used on sites with a likelihood of high oil and grease concentrations. These site uses include vehicle wrecking or impound yards, fast food establishments, automotive repair and sales, and parking lots that receive a high number of average daily trips (> 1,000). Runoff from unpaved areas should not be directed toward pervious pavement due to the potential for sediment loads to clog the pavement.

MULTIUSE OPPORTUNITIES

Pervious pavement is highly versatile and can be used in replacement of impermeable asphalt in many situations.

DESIGN SPECIFICATIONS

CONSTRUCTION CONSIDERATIONS

Installation procedures are vital to the success of pervious pavement projects, particularly pervious asphalt and concrete pavement mixes. The subgrade cannot be overly compacted with the inclusion of fine particulates or the void ratio critical to providing storage for large storm events will be lost. Weather conditions at the time of installation can affect the final product. Extremely high or low temperatures should be avoided during construction of pervious asphalt and concrete pavements.

SOIL SUITABILITY

Pervious pavement systems are appropriate for all soil types, but will require underdrain systems for soils that do not infiltrate well (less than 0.5 inch per hour). There shall be no less than 3 feet of undisturbed infiltration medium between the bottom of the base rock and any impervious layer (i.e., hardpan, solid rock, high groundwater levels, etc.), unless an underdrain system is used.

DIMENSIONS AND SLOPES

Minimum/maximum dimensions and other specifications are product specific and shall comply with manufacturers' recommendations. Slopes shall be less than 10 percent in all cases.

SIZING

Porous pavement should be designed to capture at least the water quality design storm event for its tributary area. The remaining storm volume bypasses the BMP and can be routed to another treatment or infiltration BMP or to the conventional stormwater conveyance system.

1. The prediction of the rate of infiltration of water through natural soils is related to soil type, porosity, degree of compaction, moisture content, and field capacity. This complexity governs soil drain times and has made the development of a single comprehensive model to predict drain times in actual porous pavement applications difficult. However, determining drain time is the key element in designing the size of porous pavement systems. The depth of the subbase can be determined by:

$$H_d = E \times t_d / r$$

Where:

H_d = Depth of reservoir layer (in).

t_d = Detention time (hr).

E = Soil infiltration rate (in/hr).

r = Void ratio.

The required porous pavement surface area can then be computed by:

$$A_s = V / (r \times H_d)$$

Where:

A_s = Porous pavement surface area (ft^2).

V = Water quality volume (ft^3).

2. Specifications. The cross-section typically consists of four layers. A description of each layer is presented below.

3. Asphalt Layer. The surface asphalt layer consists of an open-graded asphalt mixture ranging from depths of 2 to 4 inches depending on required bearing strength and pavement design requirements. Porous pavements contain approximately 16 percent voids, compared to 3 to 5 percent for conventional pavements allowing runoff to quickly infiltrate.

4. Top Filter Layer. This layer consists of a 0.5-inch-diameter crushed stone to a depth of 1 to 2 inches. This layer serves to stabilize the porous asphalt layer.

5. Reservoir Layer. The reservoir subbase consists of 1.5 to 3-inches crushed stone. The depth of this layer depends on the desired storage volume, which is a function of the soil infiltration rate, void spaces, and in colder climates the depth of the frost line, but typically ranges from 2 to 4 feet. The reservoir layer should be designed to drain completely in 48 to 72 hours.

6. Bottom Filter Layer. This layer serves to stabilize the reservoir layer and is the interface between the reservoir layer and the filter fabric covering the underlying soil. It consists of a 2-inch-thick layer of 0.5-inch crushed stone.

7. Filter Fabric. It is very important to line the entire trench area, including the sides, with filter fabric prior to placement of the aggregate. The filter fabric serves a very important function by inhibiting soil from migrating into the reservoir layer and reducing storage capacity.

8. Underlying Soil. The underlying soil should have an infiltration capacity of at least 0.1 inch/hour, but preferably greater than 0.50 inch/hour. Soils at the lower end of this range may not be suited for a full infiltration system.

9. Construction Practices (adapted from Schueler, 1992).

    a. All adjacent areas should be stabilized to prevent any sediment from washing onto the pavement surface, leading to premature clogging.

    b. The subgrade shall be prepared as required while limiting undue compaction; permeability must be maintained. Equipment with tracks or over-sized rubber tires shall be used; DO NOT use vehicles with standard rubber tires.

    c. The reservoir base course shall be laid in lifts over the base filter course and lightly compacted. The base courses should be kept free of all dirt and debris during construction.

    d. The asphalt layer shall be laid directly over the top filter course in one lift. The laying temperature should be between 240 and 260 degrees. The ambient temperature should be above 50 degrees.

    e. Compaction should take place when the surface is cool enough to resist a 9-Mg roller (class equivalent of a 10-ton roller). One or 2 passes is all that is required for proper compaction. Any more may reduce porosity.

    f. Transporting of the mix to the site shall be in clean vehicles with smooth dump beds that have been sprayed with a nonpetroleum release agent. The mix should be covered during transport to limit cooling.

    g. After final rolling, no vehicular traffic of any kind should be permitted on the pavement until cooling and hardening has taken place; no sooner than 6 hours, but preferably a day or two.

INSPECTION AND MAINTENANCE ACTIVITIES SUMMARY	
ROUTINE MAINTENANCE	• Regular sweeping shall be implemented for porous asphalt or concrete systems. The surface shall be kept clean and free of leaves, debris, and sediment. The surface shall not be overlaid with an impermeable paving surface • Overflow devices shall be inspected for obstructions or debris, which shall be removed upon discovery. Overflow or emergency spillways shall be capable of transporting high flows of stormwater to an approved stormwater receiving system. • Vegetation and large shrubs/trees that limit access or interfere with porous pavement operation shall be pruned. • Fallen leaves and debris from deciduous plant foliage shall be raked and removed. • Poisonous, nuisance, dead, or odor producing vegetation shall be removed immediately. • Grass shall be mowed to less than 4 inches and grass clippings shall be bagged and removed. • Irrigation shall be provided as needed. • Spill prevention measures shall be exercised when handling substances that can contaminate stormwater. A spill prevention plan shall be implemented at all nonresidential sites and in areas where there is likelihood of spills from hazardous materials. • Access to the pervious pavement shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles if applicable. • Obstacles preventing maintenance personnel and/or equipment access to the porous pavement shall be removed. • Standing water creating an environment for development of insect larvae shall be eliminated. • Holes in the ground located in and around the pervious pavement shall be filled and compacted.
MAJOR MAINTENANCE	• Sources of erosion damage shall be identified and controlled when native soil is exposed near the overflow structure. • Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic. • Source control measures prevent pollutants from mixing with stormwater. Typical nonstructural control measures include raking and removing leaves, street sweeping, vacuum sweeping, limited and controlled application of pesticides and fertilizers, and other good housekeeping practices.

SAND FILTERS

POLLUTANT REMOVAL	
Sediment	High
Nutrients	Low
Trash	High
Metals	High
Bacteria	Medium
Oil and Grease	High
Organics	High

DESCRIPTION

Sand filters consist of a layer of sand in a structural box used to trap pollutants. The water filters through the sand and then flows into the surrounding soils or an underdrain system that conveys the filtered stormwater to a discharge point. Water that has percolated through the sand is collected via a perforated underdrain system before being conveyed to the downstream storm drainage system. As stormwater passes through the sand, pollutants are trapped in the small pore spaces between sand grains or are adsorbed to the sand surface. Over time bacteria can grow in the sand bed and provide some biological treatment. However, continuous dry-weather flows would be necessary to maintain the moisture required by the bacteria. Stormwater sand filters may also be two-chambered, including a pretreatment settling basin and a filter bed filled with sand. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media (sand) in the second chamber.

ADVANTAGES	LIMITATIONS
• Relatively high pollutant removal • Sufficient capture volume provides significant control of channel erosion and enlargement	• More expensive to construct than many other BMPs • May require more maintenance than some other BMPs depending on the size of the filter bed • High-solid loads will cause filter to clog • Does not work well in large watersheds • Certain designs maintain permanent sources of standing water where mosquito and midge breeding is likely to occur

GENERAL CONSTRAINTS AND SITE CONCERNS

In general, sand filters are preferred over infiltration practices, such as infiltration trenches, when contamination of groundwater with conventional pollutants is of concern. This usually occurs in areas where underlying soils alone cannot treat runoff adequately or groundwater tables are high. In addition, sand filters are the preferred treatment option in regions where evaporation exceeds rainfall since a wet pond would be unlikely to maintain the required permanent pool. Additionally, implementation of sand filters for stormwater management is ideal for relatively small impervious watersheds.

- High loading rates may clog quickly if flows are not adequately pretreated.
- Vertical relief and proximity to storm drain site must have adequate relief between land surface and storm drain to permit vertical percolation through the sand filter and collection and conveyance in underdrain to storm drain system.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

VEGETATED BUFFERS

POLLUTANT REMOVAL	
Sediment	High
Nutrients	Low
Trash	Medium
Metals	Medium
Bacteria	Low
Oil and Grease	High
Organics	Medium

DESCRIPTION

Vegetated buffers are vegetated areas designated to treat sheet flow runoff from adjacent impervious surfaces or intensive landscaped areas such as golf courses. Vegetated buffers use biological and chemical processes to filter stormwater runoff by slowing runoff velocities, filtering out sediment and other pollutants, and providing some infiltration into underlying soils. While some assimilation of dissolved constituents may occur, vegetated buffers are generally more effective in trapping sediments and particulate-bound metals, nutrients, and pesticides. Although vegetated buffers are not designed to attenuate peak stormwater flows, their use can be an effective water quality measure, and like many other LID techniques, vegetated buffers can add development aesthetic value and cost significantly less than hardscaped stormwater infrastructure.

A vegetated buffer is commonly operated as a pretreatment BMP located upstream of other BMPs capable of greater pollutant removal rates. If designed properly, vegetated buffers are able to provide relatively high pollutant removal. As a stand-alone BMP, vegetated buffers can only treat low-intensity rainfall events. While providing water quality treatment for small frequent storms, vegetated buffers operating as online facilities must still retain the ability to convey high runoff rates from the roadway when high-intensity storms occur. Vegetated buffers cannot treat high-velocity flows and do

not provide enough storage or infiltration to effectively reduce peak discharges to predevelopment levels.

ADVANTAGES	LIMITATIONS
• Simple to install (only planting and some earthwork) • Require minimal maintenance • Can provide reliable water quality by trapping, filtering, and infiltrating contaminants typically present in runoff • Can provide open space and recreation opportunities in residential areas • Can help to accent the natural landscape providing green space adjacent to parking lots and roadways	• Not recommended for arid areas where sustaining growth is difficult • Not appropriate for hilly or intensively paved areas due to high-velocity runoff • Not appropriate for industrial sites or locations where spills may occur • Thick vegetative cover must be maintained to work effectively • If improperly graded and designed this BMP can render an ineffective practice mainly due to erosion • Channelization and premature failure may result from poor design, imprecise construction, and lack of maintenance

GENERAL CONSTRAINTS AND SITE CONCERNS

The most important criteria for the selection of this BMP is soil, space, and slope.

- The effectiveness of a vegetated buffer depends heavily on having an evenly distributed sheet flow, the size of the contributing area, and the associated volume runoff to be treated. To prevent the formation of concentrated flows, it is advised to have each vegetated buffer serve a contributing area of 5 acres or less.

- Slopes should be less than 5 percent grade to avoid the formation of gullies and rills that can disrupt sheet flow. Vegetated buffers may have reduced effectiveness on slopes 6 to 15 percent and will not function at all on slopes 15 percent or greater. Limited site slope may cause ponding.

- The maximum length (in the direction of flow toward the buffer) of the tributary area should be 60 feet. The minimum length in direction of flow is 15 feet.

- A water table depth within 3 feet of the surface provides greater removal rate of soluble pollutants (i.e., within root zone).

- The effectiveness of vegetated buffers increases where the climate permits year-round dense vegetation and decreases in arid regions where vegetation in upland areas is scarce.

- Steep terrain and/or large tributary areas may cause concentrated erosive flow. A shallow, evenly distributed flow across entire width of strip is required. The maximum flow path from a contributory impervious surface should not exceed 150 feet. Sheet flow depth should be less than 0.5 inch for the design storm. Depending on the pollutant removal required, residence time should be at least 5 minutes preferably 9 minutes or more.

- A level spreader may be necessary to induce sheet flow over the vegetated buffer and avoid short-circuit caused by channelization of concentrated flows and sheet flow elimination. Level spreader options include porous pavement strip, stabilized turf strips, slotted spreader curbing, rock filled trench, concrete sills, or plastic-lined trench acting as a small detention pond.

- Vegetated buffers should be placed 3 to 4 feet from edge of pavement to accommodate a vegetation free zone.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

VEGETATED SWALES

POLLUTANT REMOVAL	
Sediment	Medium
Nutrients	Low
Trash	Low
Metals	Medium
Bacteria	Low
Oil and Grease	Medium
Organics	Medium

DESCRIPTION

Vegetated swales are open, shallow channels with low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the channels, provide the opportunity for volume reduction through infiltration and evapotranspiration, and reduce the flow velocity in addition to conveying stormwater runoff. An effective vegetated swale achieves uniform sheet flow over and through a densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location within a development project and is the choice of the designer depending on the functional criteria outlined below. Swales that are integrated within a project may use turf or other more intensive landscaping while swales that are located on the project perimeter, within a park, or close to an open space area may be planted with a more naturalistic plant palette.

ADVANTAGES	LIMITATIONS
• Potentially inexpensive • Significant collateral water quality benefits • Roadside ditches are easily converted to swales	• Can be difficult to avoid channelization • Cannot treat a large drainage area. Large areas may need to be divided and treated with several swales • Impractical in areas with steep topography • Not effective and may even erode when flow velocities are high if the grass cover is not properly maintained • In some places their use is restricted by law; many local municipalities require curb and gutter systems in residential areas • Swales are more susceptible to failure, if not properly maintained, than other treatment BMPs

GENERAL CONSTRAINTS AND SITE CONCERNS

- Steep terrain and/or large tributary areas may cause erosive flows.
- Limited site slope may cause ponding.
- Swales must not interfere with flood control functions of existing conveyance and detention structures.

MULTIUSE OPPORTUNITIES

Swales can easily be converted into roadside vegetated buffers or parking lot landscaping.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

WET PONDS

POLLUTANT REMOVAL	
Sediment	High
Nutrients	Medium
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High

DESCRIPTION

Wet ponds are constructed, naturalistic ponds with a permanent or seasonal pool of water (also called a wet pool or dead storage). Aquascape facilities, such as artificial lakes, are a special form of wet pool facility that can incorporate innovative design elements to allow them to function as a stormwater treatment facility in addition to an aesthetic water feature. However, stormwater lakes are generally more appropriate for maintenance by a homeowners' association or an agency other than the Los Angeles County of Los Angeles Department of Public Works. In certain circumstances, a stormwater lake may be a candidate for the County of Los Angeles Department of Public Works maintenance. In such circumstances, special approval is required by the County.

ADVANTAGES	LIMITATIONS
• If properly designed, constructed, and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetlands habitat • Ponds are often viewed as a public amenity when integrated into a park setting • Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvement across a relatively broad spectrum of constituents including dissolved nutrients • Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed	• Some concern about safety when constructed where there is public access • Mosquito and midge breeding is likely to occur in ponds • Cannot be placed on steep unstable slopes • Need for base flow or supplemental water if water level is to be maintained • Require a relatively large footprint • Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams

GENERAL CONSTRAINTS AND SITE CONCERNS

- Availability of base flows - wet ponds require a regular source of water if water level is to be maintained.
- Slope stability – wet ponds are not permitted near steep slope hazard areas.
- Surface space availability - large footprint required.
- Compatibility with flood control - basins must not interfere with flood control functions of existing conveyance and detention structures.

MULTIUSE OPPORTUNITIES

Provided adequate surcharge storage, a wet pond may be combined with a flood control basin to provide both water quality control and peak-flow control. Wet ponds can also be designed with wildlife viewing areas and walking trails around the perimeter to provide passive recreation. Any planned multiuse facility must obtain special approval by the County of Los Angeles Department of Public Works.

Note: Please refer to the *County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual* for the most up-to-date information on this BMP.

CHAPTER 6: EXAMPLE DESIGNS

LID EXAMPLE DESIGN NO. 1

DETERMINE REQUIREMENTS

For a single-family residential tract with more than 5 units, the following applies:

- Infiltrate or retain the increase in the volume of the runoff from the water quality storm on the parcel level.
- Treat the entire volume of the runoff from the water quality storm.

DETERMINE HYDROLOGIC PARAMETERS

The total area of the site is 25 acres. Of that, 10 acres is dedicated open space. The total area that must be mitigated for is 15 acres.

A = 15 acres

Soil 97

Assume 42% impervious

Flow path = 1080'

Average Slope = (1600-1580) / 1080 = 1.85%

IDENTIFY DESIGN STORM

Select a water quality storm from the menu of storm events. For this example, assume a 3/4-inch storm over 24 hours.

CALCULATE UNDEVELOPED RUNOFF VOLUME

The rate and volume of runoff can be calculated using the Tc Calculator utility (available at http://ladpw.org/wrd/publication/).

$Q_u = 0.29$ *cfs*
$V_u = 4000$ ft^3

CALCULATE DEVELOPED RUNOFF VOLUME

Using the same design storm and methodology, calculate the runoff rates and volumes that would occur after development.

$Q_d = 1.25$ cfs
$V_d = 17700$ ft^3

The developed volume V_d is the total volume that must be treated.

CALCULATE ΔV

$\Delta V = Q_d - Q_u = 17700 - 4000 = 13700$ ft^3

The increase in runoff volume ΔV is the amount that must be infiltrated on a parcel level.

CHOOSE BMPS

For this example, porous pavement driveways with underlying infiltration trenches have been selected as one method of infiltrating the ΔV.

There are 42 lots and it is assumed that each lot has a 15- x 15-foot driveway.

The depth of the infiltration trench under each driveway can then be calculated.

Assume a 0.4 void ratio for the underlying gravel.

D = 13700 ft^3 / (42 lots * 15' x 15' * .4) = 3.63 ft

LID EXAMPLE DESIGN NO. 2

DETERMINE REQUIREMENTS

For a commercial redevelopment project, the following applies:

- Infiltrate or retain the increase in the volume of the runoff from the water quality storm on the parcel level.
- Treat the entire volume of the runoff from the water quality storm.

DETERMINE HYDROLOGIC PARAMETERS

The total area of the site is 5 acres.

A = 5 acres

Soil 20

Assume 95 percent impervious.

Flow path = 680'

Average Slope = (1200-1170) / 680 = 4.4 percent.

Identify Design Storm

Select a water quality storm from the menu of storm events. For this example, assume a 3/4-inch storm over 24 hours.

CALCULATE UNDEVELOPED RUNOFF VOLUME

The rate and volume of runoff can be calculated using the Tc Calculator utility (available at http://ladpw.org/wrd/publication/).

$Q_u = 0.1$ *cfs*
$V_u = 1343$ *ft*^{3}

CALCULATE DEVELOPED RUNOFF VOLUME

Using the same design storm and methodology, calculate the runoff rates and volumes that would occur after development.

$Q_d = 0.86$ *cfs*
$V_d = 11550$ *ft*^{3}

The developed volume V_d is the total volume that must be treated.

CALCULATE ΔV

$$\Delta V = Q_d - Q_u = 11550 - 1343 = 10200\ ft^3$$

The increase in runoff volume ΔV is the amount that must be infiltrated on a parcel level.

CHOOSE BMPS

For this example, bioretention planters and porous pavement have been selected as the methods of infiltrating the ΔV.

Assuming a 3-foot depth and a 0.4 void ratio for gravel, 8500 ft^2 are necessary to infiltrate the total volume, or roughly 4 percent of the total area of the site.

The wasted space at the ends of parking spaces can be used for bioretention facilities.

$$175\ ft^2 \times 7 + 300\ ft^2 \times 5 = 2725\ ft^2$$

The remaining volume can be infiltrated using porous pavement.

$$8500 - 2725 = 5775\ ft^2$$

County of Los Angeles Department of Public Works

Stormwater Best Management Practice Design and Maintenance Manual

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For Publicly Maintained

Storm Drain Systems

August 2010

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1. INTRODUCTION

Purpose

Stormwater treatment best management practices (BMPs) are an integral part of stormwater management plans for new development and significant redevelopment projects. Certain new development and redevelopment projects are required to submit drainage concept and stormwater quality plans that show details of treatment facilities designed to mitigate potential impacts to surface water and groundwater quality. These treatment facilities can be either privately or publicly maintained. The purpose of this BMP design and maintenance manual is to provide design criteria and guidelines for developers, to assist the County in the review and approval of stormwater treatment BMP designs, and to provide guidance on BMP maintenance requirements for those devices that will be publicly maintained.

Other Stormwater BMP Selection and Design Manuals

Three previous stormwater BMP manuals have been published by the County of Los Angeles Department of Public Works:

1. Development Planning for Stormwater Management – A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), dated September 2002, prepared by the LACDPW; and

2. Technical Manual for Stormwater Best Management Practices in the County of Los Angeles, draft dated February 2004, prepared by the LACDPW.

3. Los Angeles County-Wide Structural BMP Prioritization Methodology, dated April 2006, prepared by Geosyntec Consultants and Heal the Bay.

These three manuals were designed to assist the development community in Los Angeles County in selecting and designing site-specific post-construction BMPs to minimize pollutant impacts from urban stormwater runoff. These manuals also describe the legal framework for the development planning program within the County of Los Angeles. In contrast, this manual does not provide information on plan submittal requirements, but instead provides detailed guidance on BMP sizing, design specifications, and maintenance requirements. The design specifications contained in this manual were based on and are consistent with the general design principles contained in the three previous LACDPW manuals.

California Stormwater Quality Association (CASQA) released four Stormwater Best Management Practice Handbooks in January 2003. The design guidance contained in the New Development and Redevelopment Best Management Practice Handbook was also used in the preparation of this manual.

Design specifications were also drawn from a number of other sources:

- King County Surface Water Design Manual, King County Department of Natural Resources, Seattle, Washington. August 2005.

- Technical Guidance Manual for Stormwater Quality Control Measures, Ventura Countywide Stormwater Quality Management Program. July 2002.

- Hydrology Manual, Los Angeles County Department of Public Works. January 2006.

- Design Manual - Debris Dams and Basins, Los Angeles County Flood Control District. October, 1979.

- Design Manual - Hydraulic, Los Angeles County Flood Control District. March 1982.

Content and Organization of this Manual

Chapter 1 serves as an introduction and summarizes available options for treatment of stormwater. Chapters 2 - 10 provide design specifications and maintenance guidance for specific types of treatment. The appendices include a glossary (Appendix A); sample worksheets for BMP sizing (Appendix B); design specifications for flow diversion structures (Appendix C); facility inspection procedures (Appendix D); facility inspection and maintenance checklists (Appendix E); and the Policy for New Percolation Basin Testing, Design, and Maintenance dated October 10, 2007 (Appendix F).

General Considerations

Runoff treatment facilities are designed to remove pollutants contained in stormwater runoff. The pollutants of concern, depending on the watershed, may include trash, debris, and sediment; metals such as copper, lead, and zinc; nutrients (e.g., nitrogen and phosphorous); certain bacteria and viruses; mineral salts such as chloride; and organic chemicals such as petroleum hydrocarbons and pesticides. Methods of pollutant removal include sedimentation/settling, filtration, plant uptake, ion exchange, adsorption, and microbially-mediated decomposition. Floatable pollutants such as oil, debris, and scum can be removed with separator structures. Runoff treatment facilities can also be designed to reduce runoff volume, thereby reducing pollutant loading to receiving waters. Runoff treatment facility types and common terms used in runoff treatment are discussed below.

Maintenance Responsibility

Maintenance is required for all types of runoff treatment facilities. Upon acceptance into the Flood Control District, LACDPW will assume operation and maintenance responsibilities for the BMPs contained in this manual. The devices shall be placed within public right-of-ways or Flood Control District easements.

The primary purpose of BMPs is water quality treatment. However, an ancillary benefit of certain BMPs is the provision of habitat for aquatic and terrestrial wildlife. The quality and extent of such habitat may be affected by maintenance activities required to ensure the continued water quality performance of the BMP. In situations where there is potential for habitat to attract threatened or endangered species, the project proponent must coordinate with and develop written agreements with the California Department of Fish and Game or the US Fish and Wildlife service. These agreements must ensure that the BMPs are considered treatment facilities and not waters of the United States, and that long term operation and maintenance requirements are acceptable to these agencies.

Pretreatment

Pretreatment must be provided for filtration and infiltration facilities, and other facilities whose function could be adversely affected by sediment or other pollutants. Pretreatment may also be provided for water quality detention basins and other BMPs to facilitate the routine removal of sediment, trash, and debris, and to increase the longevity of the downstream BMPs. Runoff from undeveloped hillsides and canyons should be routed to debris basins in compliance with County requirements and, where feasible, routed around downstream treatment BMPs.

Pretreatment may be provided by presettling basins or forebays (small detention basins), vegetated swales, filter strips, hydrodynamic separators, and catch basin inserts. Debris controls as described in the Los Angeles County Sedimentation Manual may also be appropriate for pretreatment. Source control activities, implemented per the SUSMP requirements, minimize the introduction of pollutants into stormwater runoff and also help to protect filtration and infiltration facilities. Effort should be made early in the site planning stages to minimize runoff from impervious areas by grading toward landscaped areas, disconnecting downspouts, and using pervious conveyances prior to discharging to the storm drain system. These low impact development (LID) practices can reduce the size and maintenance burden of downstream, end-of-pipe BMPs.

Infiltration

Infiltration refers to the use of the filtration, adsorption, and biological decomposition properties of soils to remove pollutants prior to the intentional routing of runoff to the subsurface for groundwater recharge. Infiltration BMPs include infiltration basins and trenches. Infiltration can provide multiple benefits, including pollutant removal, peak flow control, groundwater recharge, and flood control. However, conditions that can limit the use of infiltration include soil properties and potential adverse impacts on groundwater quality. To adequately address the protection of groundwater when evaluating infiltration, site soils must be determined to be suitable by conducting a geotechnical investigation that includes an in-situ percolation test, per the Policy for New Percolation Basin Testing, Design, and Maintenance (October 10, 2007, or as amended (provided in Appendix G)) and determination of minimum depth to groundwater. Soils must have sufficient organic content and sorption capacity to remove certain pollutants, but must be coarse enough to infiltrate runoff in a reasonable amount of time (e.g., < 72 hours). Examples of suitable soils are silty and sandy loams. Coarser soils, such as gravelly sands, have limited organic content and high permeability and therefore present a potential risk to groundwater from certain pollutants, especially in areas of shallow groundwater. NPDES permits often specify a water table distance separation of ten feet depth or more to protect groundwater quality. These permits also specify that infiltration BMPs are not allowed for areas of industrial activity or areas subject to high vehicular traffic (25,000 or greater average daily traffic (ADT) on the main roadway or 15,000 or more ADT on any intersecting roadway), nor are they allowed within 100 feet from any drinking water well unless appropriate pretreatment for the pollutants of concern is provided.

Incidental infiltration that occurs in other types of BMPs, such as dry extended detention basins, vegetation swales, filter strips, and bioretention areas, generally pose a lesser risk to groundwater quality as treatment is provided in the BMP prior to infiltration.

Biofiltration

Biofiltration utilizes vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As runoff passes through the vegetation, the combined effects of filtration, infiltration, adsorption, and biological uptake remove pollutants. Vegetation also decreases the velocity of flow and allows for particulates to settle. Biofiltration facilities include both vegetated swales, which are designed to convey and treat concentrated runoff flowing at shallow depths and slow velocities, and filter strips, which are broad areas of turf grasses or other vegetation designed for treating sheet flow runoff from adjacent impervious surfaces.

Bioretention

Bioretention areas are vegetated (i.e., landscaped) shallow depressions that provide storage, infiltration, and evapotranspiration, and also provide for pollutant removal (e.g. filtration, adsorption, nutrient uptake) by filtering stormwater through the vegetation and soils. In bioretention areas, as in biofiltration BMPs, pore spaces and organic material in the soils help to retain water in the form of soil moisture and to promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants utilize soil moisture, promote the drying of the soil through transpiration, and uptake pollutants in their roots and leaves. Plants with extensive root systems also help to maintain filtration rates. Where bioretention facilities are underlain by highly infiltrative soils, an underdrain is not necessary. Underdrains may be used where space is limited (underdrains allow for a smaller bioretention area footprint), where low infiltrative soils are present, or to minimize ponding.

Filtration

Various media, such as sand, perlite, zeolite, compost, and activated carbon, can be used to effectively remove total suspended solids (TSS) and associated pollutants such as organics (hydrocarbons and pesticides) and particulate metals in filtration BMPs. Filtration systems can be configured in the form of horizontal beds, trenches, or lastly, cartridge systems in underground vaults or catch basins.

Wetpools

A wetpool is a permanent pool of water incorporated into a wetpond, stormwater lake, or stormwater wetland BMP.[1] Wetpools provide runoff treatment by allowing settling of particulates (sedimentation), by biological uptake, and by vegetative filtration (if vegetation is present). Wetpool BMPs may be single-purpose facilities, providing only runoff treatment, or they may also provide flow control by providing additional detention storage with the use of a multi-stage outlet structure. If combined with detention, the wetpool volume can often be stacked under the detention volume with little further loss of development area.

[1] Wetponds are constructed, naturalistic ponds with a permanent or seasonal pool of water. Stormwater lakes are a special form of wetpond designed to provide stormwater quality management. Stormwater wetland basins are a treatment system consisting of a sediment forebay and a permanent micro-pool with aquatic vegetation covering a significant portion of the basin. Wetponds and lakes will not be publicly maintained; stormwater wetland basins will be publicly maintained (see Section 7).

Oil/Water Separation

Oil/water separators (also called "water quality inlets") remove floating oil from the surface of the water. There are two general types of separators - American Petroleum Institute (API) separators and coalescing plate (CP) separators. Both types use physical mechanisms to remove high concentrations of floating and dispersed oil. Oil/water separators are not suitable for the relatively low concentrations of petroleum hydrocarbons present in typical urban runoff, and should only be used in locations where higher concentrations of oil are expected to occur, such as retail fuel facilities, high volume roads, and petroleum-related industrial facilities. Oil/water separators must be located off-line from the primary conveyance system, as they function at low flow conditions and will wash out in high flow conditions. Other oil control devices/facilities that may be used for removal of slightly elevated concentrations of oil (i.e., typical of high use commercial parking lots) include catch basin inserts, hydrodynamic devices, and linear sand filters. Oil control devices/facilities should always be placed upstream of other treatment facilities and as close to the source of oil generation as possible.

"On-line" and "Off-line" Facilities

The location and configuration of control facilities can vary depending on the desired function. For example, debris basins are often located in a drainage channel so as to collect solids and wood debris from the upstream portion of the watershed prior to entering a storm drain system. Such facilities may be referred to as "in-stream" controls.

On the other hand, runoff treatment facilities cannot be located in Waters of the US, but rather are located upland to treat runoff prior to discharge into Waters of the US. Such facilities are generally located within the development as part of the storm drain system. If the facility is located in the storm drain system such that all the runoff passes through the facility, the facility is called an "on-line" system. If, on the other hand, the facility only receives lower flows (defined as those less than or equal to the water quality design flow) that are diverted from the main storm drain line, the facility is called an "off-line" system. Off-line systems therefore require a flow splitter or equivalent device to be installed in the main storm drain line. Generally treatment performance is better for off-line facilities because a larger percentage of the runoff is treated. Figure 1-1 illustrates the difference between on-line, off-line, and in-stream controls.

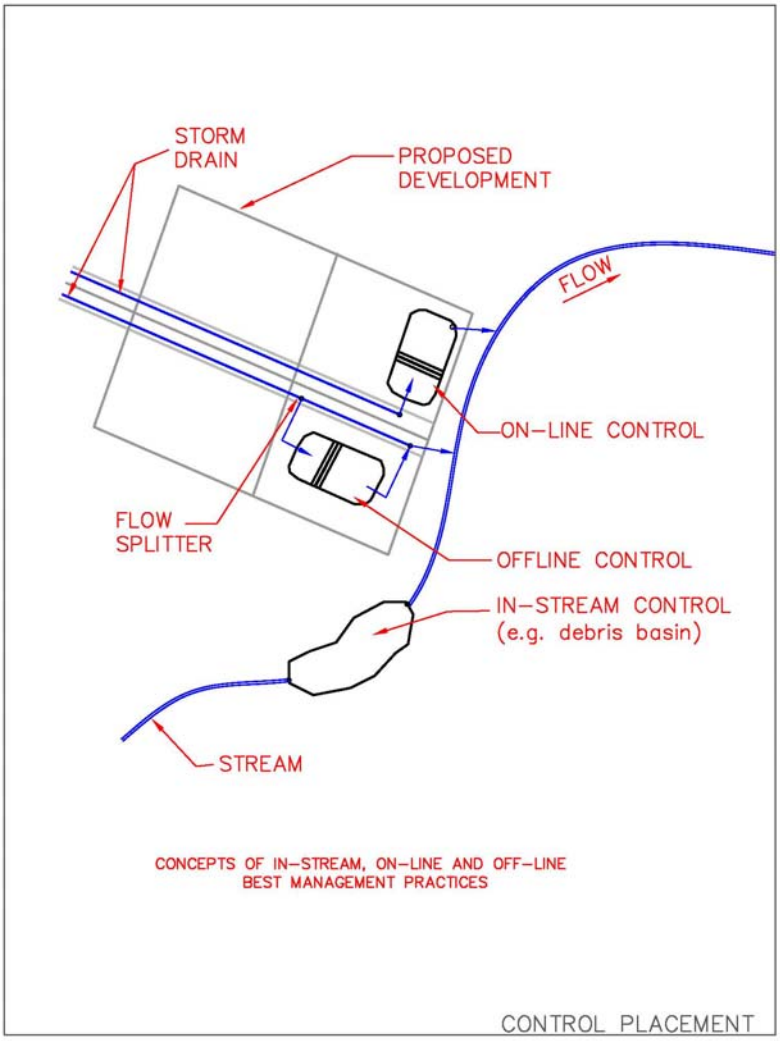


Figure 1-1: Difference Between On-line, Off-line, and In-stream Controls.

Hydromodification Control

As defined by the State Water Resources Control Board (2006), "hydromodification is the alteration of stream and river channels, installation of dams and water impoundments, and streambank and shoreline erosion." Urban development results in hydromodification by increasing runoff volume and the frequency and duration of flows. This alteration in the flow regime increases sediment transport capacity and, depending on sediment supply and channel conditions, can cause stream bank and stream bed erosion. Hydromodification control can be achieved through one or a combination of the following three approaches:

- Avoid, to the extent possible, the need to mitigate for hydromodification impacts by preserving natural hydrologic conditions and protecting sensitive hydrologic features, sediment sources, and sensitive habitats.

- Minimize the effects of development through site design practices (e.g., reducing connected impervious surfaces), implementation of stormwater volume-reducing BMPs (project-based hydrologic source control), and incorporation of flow duration control into water quality treatment BMPs such as extended detention basins and infiltration basins, as needed.

- Mitigate hydromodification impacts in-stream using geomorphically-based channel design.

Unit Process-Based BMP Selection and Design

As opposed to other design approaches that recommend the selection of typical BMPs based solely on documented performance factors, such as percent removal, effluent quality and/or percent capture, the design approach contained herein recommends the selection of the unit operations and processes (UOPs) that address the pollutants of concern and then selection of BMPs and/or BMP design components that incorporate those UOPs.

UOPs can be divided into four fundamental process categories: 1) hydrologic operations, 2) physical operations, 3) biological processes, and 4) chemical processes (Strecker et al., 2005). Hydrologic operations are essentially a subset of physical operations and include the principles of flow attenuation (e.g., peak shaving and detention) and volume reduction (e.g., infiltration and evapotranspiration). Physical operations, as referred to herein, include the principles of size separation and exclusion (e.g., screening and filtration), density separation (e.g., sedimentation and flotation), aeration and volatilization, and physical agent disinfection (e.g., ultra-violet light and heat). Biological processes include the principles of microbially-mediated transformations (e.g., redox reactions resulting from microbial respiration) and uptake and storage (e.g., bioassimilation). Chemical processes include the principles of sorption (e.g., ion exchange and surface complexation), coagulation and flocculation (e.g., particle agglomeration and precipitation), and chemical agent disinfection (e.g., chlorination and ozonination). The selection of any one of these UOPs should be based on the type and form (speciation) of the target pollutants in relation to specific stormwater management goals.

Most treatment facilities include more than one UOP. For example, dry extended detention basins may reduce the total runoff volume due to infiltration and evapotranspiration (ET), as well as attenuate peak flows, which causes particulates to settle out. Furthermore, some BMPs can be modified to include unit processes that are typically not incorporated in their design, such as including amended soils to promote infiltration in a vegetated swale. Consequently, several BMPs may include multiple unit processes, and in order to exploit the synergy amongst BMPs, the placement or order of BMPs and BMP components within a treatment system should be carefully considered. The recommended approach is to use the concept of the treatment train based on the following general progression:

1. Minimize flow rates and/or volume of runoff (site design practices and hydrological source control).
2. Remove bulk solids (> 5mm) (primary treatment)
3. Remove settleable solids (>75 µm) and liquid floatables (primary treatment)
4. Remove suspended (25-75 µm) and colloidal solids (> 0.1-25 µm) (secondary treatment)
5. Remove colloidal, dissolved, volatile, and pathogenic constituents (tertiary treatment)

It is important to note that some stormwater BMPs, such as vegetated swales, may be used as either primary and/or secondary components of a treatment train. Furthermore, tertiary treatment may be provided in BMPs that provide secondary treatment, such as constructed wetlands. Therefore, it may be more useful to categorize BMPs (and their components) according to the unit treatment processes that they provide. Table 1-1 provides a guide for linking unit treatment processes and target pollutants to stormwater BMPs. The choice of BMP should be driven by the target pollutants and the UOPs needed to address those pollutants.

Table 1-2 is a BMP practicability screening matrix that can be used to assist in the selection of BMPs for a particular site. The table briefly summarizes the critical design parameters, typical pollutants removed, major constraints, and maintenance requirements for the BMPs included in this manual. For detailed guidance on BMP selection and siting that considers pollutants of concerns, site conditions, and constraints refer to the following recent documents:

- Los Angeles County-Wide Structural BMP Prioritization Methodology (Geosyntec, 2006); http://labmpmethod.org/
- Critical Assessment of Stormwater Treatment and Control Selection Issues (Strecker et al., 2005); https://www.werf.us/products/products.cfm.

Table 1-1: Unit Operations and Processes Provided by Common BMPs and BMP Components.

Fundamental Process Category (FPC)	**Unit Operation or Process (UOP)** ***Target Pollutants***	**Common BMPs/BMP Components**
Hydrologic Operations	Flow and Volume Attenuation	Dry extended detention basins Wet ponds Stormwater wetland basins
	Volume Reduction *All pollutant loads*	Infiltration facilities Dry extended detention basins Bioretention Vegetated swales Filter strips
Physical Treatment Operations	Physical Sorption *Nutrients, metals, petroleum compounds*	Bioretention Infiltration facilities Sand filters Engineered media / granular activated carbon
	Size Separation and Exclusion (screening and filtration) *Coarse sediment, trash, debris*	Screens/bars/trash racks Bioretention Vegetated swales Filter strips Sand filters Infiltration facilities Proprietary filters Hydrodynamic separators Catch basin inserts (i.e., surficial filters)
	Density, Gravity, Inertial Separation (grit separation, sedimentation , flotation and skimming, and clarification) *Sediment, trash, debris, oil and grease*	Dry extended detention basins Wet ponds Wetland basins Settling basins Swales with check dams Oil-water separators Hydrodynamic separators
	Aeration and Volatilization *Oxygen demand, PAHs, VOCs*	Sprinklers Aerators
	Natural Disinfection *Pathogens*	Shallow detention ponds Ultra-violet systems
Biological Processes	Microbially Mediated Transformation (can include oxidation, reduction, or facultative processes) *Metals, nutrients, organic pollutants*	Wetland basins Bioretention Wet ponds Proprietary filters (e.g. compost)
	Uptake and Storage *Metals, nutrients, organic pollutants*	Wetlands basins Bioretention Wet ponds
Chemical Processes	Chemical Sorption Processes *Metals, nutrients, organic pollutants*	Infiltration facilities Sand filters Subsurface wetlands Proprietary filters (e.g. compost)
	Coagulation/Flocculation *Fine sediment, nutrients*	Dry extended detention basins Wet ponds Wetland basins Coagulant/flocculent injection systems
	Ion Exchange *Metals, nutrients, mineral salts*	Engineered media, zeolites, peats, surface complexation media
	Chemical Disinfection *Pathogens*	Custom devices for mixing chlorine or aerating with ozone Advanced treatment systems

Table 1-2: BMP Practicability Screening Matrix

BMP Type	Critical Design Parameters	Typical Pollutants Removed	Major Constraints	Maintenance Requirements
Extended Detention Basin	Stage-discharge relationship (outlet design); Storage capacity; Length to width ratio; Flow rate diversion for off-line facilities	High removal efficiency of coarse solids, trash and debris. Moderate removal of suspended sediment. Little to no predicted removal of dissolved metals and nutrients.	Surface space availability; Depth of excavation; Slope stability; Compatibility with flood control	Dredging of forebay required approximately every 5 years with reestablishment of pond bottom; Frequent mowing; Side slope upkeep; Trash and debris removal; Periodic inspections
Swale	Retention time; Minimum length; Maximum width; Flow rate, velocity, & depth; No. of check dams; Grass selection	High removal efficiency of coarse solids, trash, and debris. Moderate removal of suspended sediment. Variable removal of nutrients and metals.	Steep terrain; Availability of pervious area; Size of tributary area; High flows	Seasonal mowing and vegetation upkeep required; Sediment removal when exceeds 4 inches in any location; Periodic inspections
Filter Strip	Retention time; Minimum length; Longitudinal slope; Flow rate, velocity, & depth; Grass selection	High removal efficiency of coarse solids, trash, and debris. Moderate removal of suspended sediment. Limited removal of nutrients and metals.	Steep terrain; Availability of pervious area; Ability to maintain sheet flow; Size of tributary area; High flows	Seasonal mowing and vegetation upkeep required; Sediment removal when exceeds 4 inches in any location; Periodic regrading and reseeding; Periodic inspections
Bioretention	Soil characteristics and amendments; Depth to groundwater; Storage capacity; Plant selection	High removal efficiency of coarse solids, trash, and debris. Moderate removal of suspended sediment and metals. Variable removal of nutrients.	Field infiltration rate; Depth to groundwater; Contaminated soils; Proximity to storm drain; Vertical relief and proximity to storm drain; Surface space availability;	Semiannual, annual, and post-storm inspections; Vegetation upkeep; Periodic surface scarification and sediment removal
Infiltration Facilities	Min/Max infiltration rate; Depth to groundwater; Storage capacity	High removal efficiency of coarse solids, particulate and suspended sediment. Moderate removal of phosphorus/nitrogen. Dissolved metals and pathogen removal dependent on soil types.	Field infiltration rate; Depth to groundwater; Contaminated soils; Proximity to structures; Large drainage area	Semiannual/ annual and post-storm inspections; Vegetation upkeep; Periodic surface scarification and sediment removal;
Wetponds	Length to width ratio; Stage-discharge relationship; Permanent pool and surcharge capacity; Maximum depth; Base flow; Plant selection; Flow rate diversion for off-line facilities	High removal efficiency of coarse solids, suspended solids, trash, and debris. Some removal of dissolved solids, total phosphorus, soluble nutrients, trace metals, coliform and organics.	Surface space availability; Depth of excavation; Compatibility with flood control; Vector control	Dredging required approximately every 5 years with reestablishment of pond bottom; Side slope upkeep; Trash and debris removal; Periodic inspections; Removal of algal mats and control of fringe vegetation;
Stormwater Wetland	Volume of design storm; Length to width ratio; Depth distribution; Base flow; Plant selection; Flow rate diversion for off-line facilities	High removal efficiency of coarse solids, suspended sediment, trash and debris. Moderate removal of metals. Variable removal of phosphorus/nitrogen.	Surface space availability; soil type; System hydraulics; Vector control; Lack of base flow	Monthly inspections required until vegetation is established; Periodic removal of nuisance species and litter as required
Sand Filter	Maximum emptying time; Media depth; Particle size gradation; Depth to groundwater	High removal efficiency of coarse solids, suspended sediment, and metals. Some removal of nutrients and BOD.	Vertical relief and proximity to storm drain; Large drainage area; High sediment loadings; Aesthetics;	Seasonal surface scarification; Periodic removal of trash and debris and accumulated silt on bed surface (when >0.5" thick); Frequent inspection; Potential media replacement

2. DRY EXTENDED DETENTION BASINS

Definition

Dry extended detention (ED) basins (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain the SUSMP runoff volume (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)) for 36 to 48 hours to allow sediment particles and associated pollutants to settle and be removed. Dry ED basins do not have a permanent pool; they are designed to drain completely between storm events. They can also be used to provide hydromodification and/or flood control by modifying the outlet control structure design and including additional detention storage. The slopes, bottom, and forebay of ED basins are typically vegetated.

Dry ED basins can be located either on-line or off-line. For off-line basins, a flow diversion structure is used to divert the SUSMP volume to the basin from the storm drain. For on-line basins, all storm drain flows are routed through the basin; storm events exceeding the water quality design capacity will pass through the basin and will discharge over a primary overflow outlet untreated, or during extreme events, over an emergency spillway. In both types of basins, influent flows enter a sediment forebay where coarse solids are first removed prior to flowing into the main cell of the basin where finer sediment and associated pollutants settle as stormwater is detained and slowly released through a controlled outlet structure.

General Constraints and Siting Considerations

- Surface space availability - typically 0.5 to 2.0 percent of the total tributary development area required.
- Depth to groundwater - bottom of basin should be 2 feet higher than the seasonal high water table elevation.
- Steep slopes - basins placed above slopes greater than 15 percent or within 200 feet from the top of a hazardous slope or landslide area require a geotechnical investigation.
- Compatibility with flood control - basins must not interfere with flood control functions of existing conveyance and detention structures.

Multi-Use Opportunities

A dry ED basin can sometimes be retrofitted into an existing flood control basin or integrated into the design of a park or playfield. Perforated risers, multiple orifice plate outlets, or similar multi-stage outlets are required for flood control retrofit applications to ensure adequate detention time for small storms while still providing peak flow attenuation for the flood design storm. Recreational multi-use facilities must be inspected after every storm and may require a greater maintenance frequency than dedicated water quality basins to ensure aesthetics and public safety are not compromised. Any planned multi-use facility must obtain special approval by the LACDPW and any other jurisdictional agencies.

Dry Extended Detention Basin Design Specifications

Basin Sizing and Geometry

Dry extended detention basin geometry is illustrated in Figure 2-1.

1. Dry extended detention basins shall be sized to capture and treat the entire SUSMP volume with a 36 to 48 hour draw-down time.

2. The total basin volume shall be the SUSMP volume plus an additional 5% for total suspended solids (TSS) accumulation (105% of the SUSMP volume). Freeboard is in addition to the total basin volume.

3. The minimum freeboard shall be 2 feet above the maximum water surface elevation over the emergency spillway for online basins and 1 foot above the maximum water surface elevation over the emergency spillway for offline basins.

4. The length-to-width ratio at half basin depth shall be a minimum of 1.5:1. *Intent: a long flow length will improve TSS removal.*

5. The cross-sectional geometry across the width of the basin should be approximately trapezoidal with a maximum side slope of 3:1 unless otherwise permitted by the County (see Side Slopes below). Shallower side slopes are necessary if the basin is designed to have recreational uses during dry weather conditions.

6. A low flow channel shall be provided. A low flow channel is a narrow, shallow trench filled with pea gravel (or equivalent) that runs the length of the basin to drain dry weather flows. The low flow channel shall have a depth of 6 inches and a width of 1 foot, and shall tie into the outlet structure.

7. The basin bottom shall have a 1% longitudinal slope (direction of flow) in the forebay, and may range from 0 to 1% longitudinal slope in the main basin. The bottom of the basin shall slope 2% toward the center low flow channel.

8. A basin should be large enough to allow for equipment access. If the water quality design volume is such that the basin bottom would be less than 5 feet wide, an alternative BMP should be considered. See Maintenance Access below.

Soils Considerations

1. Extended detention basins can be used with almost all soils and geology, with minor design adjustments for rapidly percolating soils (sandy or gravelly soils with infiltration rate > 2.4 in/hr). If rapidly percolating soils are present, extended detention basins should be designed by a licensed soil engineer to include lower permeability soils in the subgrade to prevent rapid, untreated infiltration.

2. The slopes of the detention basin shall be analyzed for slope stability using rapid drawdown conditions and shall meet Los Angeles County minimum standards. A 1.5 static factor of

safety shall be used. Seismic analysis is not required due to the temporary inundation condition.

Energy Dissipation

1. Energy dissipation controls, constructed of sound materials such as stones, concrete, or proprietary devices that are rated to withstand the energy of the influent flow, shall be installed at the inlet to the forebay. Flow velocity into the basin forebay shall be controlled to 4 feet per second (fps) or less.

2. Energy dissipation controls must also be used at the outlet from the extended detention basin unless the basin discharges to a storm drain or hardened channel.

3. Consult the Los Angeles County Department of Public Works Design Division or Land Development Division for type and design of energy dissipation structure.

Forebay

As untreated stormwater enters the extended detention basin, it passes through a forebay for coarse solids removal. The forebay may be constructed using an internal berm constructed out of earthen embankment material, grouted riprap, or other structurally sound material.

1. The basin shall be sized so that 25% of the total basin volume is in the forebay and 75% of the total basin volume is in the main portion of the basin.

2. A gravity drain outlet from the forebay (4" minimum diameter) must extend the entire width of the internal berm.

3. The forebay outlet shall be offset from the inflow flowline to prevent short-circuiting.

4. Permanent steel post depth markers shall be placed in the forebay to define settled sediment removal limits at 50% and 100% of the forebay sediment storage depth.

Vegetation

Vegetation provides erosion protection from both wind and water and biofiltration of stormwater.

1. The bottom and slopes of the extended detention basin shall be vegetated. A mix of erosion-resistant plant species that effectively bind the soil should be used on the slopes and a diverse selection of plants that thrive under the specific site, climatic, and irrigation conditions should be specified for the basin bottom. The basin bottom should not be planted with trees, shrubs, or other large woody plants that may interfere with maintenance activities. Only native perennial grasses, forbs, or similar vegetation that can be replaced via seeding should be used on the basin bottom.

2. Only native or non-invasive plants should be used as approved by a licensed landscape architect. Suitable plant types for the specific BMP areas can be found by consulting an arborist, licensed landscape architect or referring to various online sources such as:

- CalFlora - a database of wild California plants that include plant characteristics and photos
  http://www.calflora.org
- The California Invasive Plant Council - a listing of invasive, non-native plants of California
  http://www.cal-ipc.org/
- Jepson Online Interchange For California Floristics - a database that provides information on identification, taxonomy, distribution, ecology, relationships, and diversity of California vascular plants.
  http://ucjeps.berkeley.edu/interchange.html
- L.A. River Master Plan Landscaping and Plant Palettes - a guidance document providing a listing of native plant communities in the Los Angeles area
  http://ladpw.org/wmd/watershed/LA/LAR_planting_guidelines_webversion.pdf
- VegSpec - a web-based decision support system that assists land managers in the planning and design of vegetative establishment practices
  http://ironwood.itc.nrcs.usda.gov/Netdynamics/Vegspec/pages/HomeVegspec.htm
- USDA Plants Database - an extensive database of native and non-native plants of the United States with over 100 plant characteristics
  http://plants.usda.gov/index.html

Outlet Structure and Drawdown Time

A total drawdown time of 36 to 48 hours shall be provided. The outlet structure shall be designed to release the bottom 50% of the detention volume (half-full to empty) over 24 to 32 hours, and the top half (full to half-full) in 12 to 16 hours. *Intent: Draw down schemes that detain low flows for longer periods than high flows have the following advantages over outlets that drain the pond evenly:*

- *Greater flood control capabilities*
- *Enhanced treatment of low flows which make up the bulk of incoming flows.*

There are two options that can be used for the outlet structure:

1. Uniformly perforated riser structures.
2. Multiple orifice structures (orifice plate).

The outlet structure can be placed in the pond with a debris screen (Figure 2-2) or housed in a standard manhole (Figure 2-3).

Note that a primary overflow (typically a riser pipe connected to the outlet works) should be sized to pass the peak flow rate from the developed capital design storm. The primary overflow is intended to protect against overtopping or breaching of the basin embankment.

Uniformly Perforated Riser Outlet Sizing Methodology (Figure 2-2)

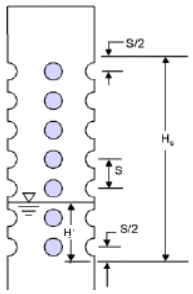
The following attributes influence the perforated riser outlet sizing calculations**:**

- Shape of the pond (e.g. trapezoidal)
- Depth and volume of the pond
- Elevation / depth of first row of holes
- Elevation / depth of last row of holes
- Size of holes
- Number of rows and number of holes per row
- Desired draw down time (e.g. 16 hour and 32 hour draw down for top half and bottom half respectively, 48 hour total draw down time)

The governing rate of discharge from a perforated riser structure having uniform holes at equal spacing can be calculated using Equation 2-1 below:

$$Q = C_p \frac{2A_p}{3H_s}\sqrt{2g}H^{3/2} \qquad \text{(Equation 2-1)}$$

Where:



Q = riser flow discharge (cfs)
C_p = discharge coefficient for perforations (use 0.61)
A_p = cross-sectional area of all the holes (ft^2)
s = center to center vertical spacing between perforations (ft)
H_s = distance from s/2 below the lowest row of holes to s/2 above the top row of holes (McEnroe 1988).
H = distance from s/2 below the lowest row of holes to the water surface elevation under consideration.

For the iterative computations needed to size the holes in the riser and determine the riser height a simplified version of Equation 2-1 may be used, as shown below in Equation 2-2:

$$Q = kH^{3/2} \qquad \text{(Equation 2-2)}$$

Where:

$$k = C_p \frac{2A_p}{3H_s}\sqrt{2g} \qquad \text{(Equation 2-3)}$$

Uniformly perforated riser designs are defined by the depth or elevation of the first row of perforations, the length of the perforated section of pipe, and the size or diameter of each perforation. The steps needed to size a perforated riser outlet are illustrated in Appendix C.

Multiple Orifice (Non-Uniform) Outlet Sizing Methodology

The following attributes influence multiple orifice outlet sizing calculations**:**

- Shape of the pond (e.g. trapezoidal)
- Depth and volume of the pond
- Elevation of each orifice
- Desired draw-down time (e.g., 16 hour and 32 hour draw down times for top half and bottom half respectively, 48 hour draw down time for whole pond)

The rate of discharge from a single orifice can be calculated using Equation 2-4 below:

$$Q = CA(2gH)^{0.5} \qquad \text{(Equation 2-4)}$$

Where:

Q = orifice flow discharge
C = discharge coefficient
A = cross-sectional area of orifice or pipe (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)
H = effective head on the orifice (measured from center of orifice to water surface)

Multiple orifice designs are defined by the depth (or elevation) and the size (or diameter) of each orifice (Figure 2-1). The steps needed to size a dual orifice outlet are outlined in Appendix C; multiple orifices may be provided and sized using a similar approach.

Emergency Spillway

A primary overflow outlet above the water quality outlet should be provided, as described above, to pass the developed capital design storm. An emergency overflow spillway in addition to the primary overflow outlet is required. Spillways shall meet the California Department of Water Resources, Division of Safety of Dams Guidelines for the Design and Construction of Small Embankment Dams (http://damsafety.water.ca.gov/docs/GuidelinesSmallDams.pdf). *Intent: Emergency overflow spillways are intended to control the location of pond overtopping and direct overflows back into the downstream conveyance system or other acceptable discharge point.*

Online Basins

1. If indicated by a downstream risk assessment, online basins must have an emergency overflow spillway to prevent overtopping of walls or berms should blockage of the primary outlet occur.

2. The overflow spillway must be sized to pass the capital developed peak flow.

3. The minimum freeboard shall be 2 feet above the maximum water surface elevation corresponding to flow over the emergency spillway.

Offline Basins

1. Offline basins must have either an emergency overflow spillway or an emergency overflow riser. The emergency overflow must be designed to pass the SUSMP storm peak flow directly to the downstream conveyance system or another acceptable discharge point.

2. The emergency overflow spillway shall be armored to withstand the energy of the spillway flows (Figure 2-4). The spillway shall be constructed of grouted rip-rap.

3. The minimum freeboard shall be 1 foot above the maximum water surface elevation corresponding to flow over the emergency spillway.

Side Slopes

1. Interior side slopes above the water quality design depth and up to the emergency overflow water surface shall be no steeper than 3H:1V, unless stabilization has been approved by a licensed geotechnical engineer.

2. Exterior side slopes shall be no steeper than 2H:1V, unless stabilization has been approved by a licensed geotechnical engineer.

3. For any slope (interior or exterior) greater than 2H:1V a geotechnical report must be submitted and approved by the County's Geotechnical and Materials Engineering Division.

4. Pond walls may be vertical retaining walls, provided: (a) they are constructed of reinforced concrete, (b) a fence is provided along the top of the wall (see fencing below) or further back, and (d) the design is stamped by a licensed civil engineer and approved by the County.

Embankments

1. Embankments are earthen slopes or berms used for detaining or redirecting the flow of water.

2. The minimum top width of all berm embankments shall be 20 feet, or as approved by the Geotechnical and Materials Division.

3. Basin berm embankments must be constructed on native consolidated soil (or adequately compacted and stable fill soils analyzed by a licensed geotechnical engineer) free of loose surface soil materials, roots, and other organic debris.

4. Earthworks shall be in accordance with Section 300-6 of the Standard Specifications for Public Works Construction, most recent edition.

5. Basin berm embankments greater than 4 feet in height must be constructed by excavating a key equal to 50% of the berm embankment cross-sectional height and width. This requirement may be waived if specifically approved by a licensed geotechnical engineer.

6. The berm embankment shall be constructed of compacted soil (95% minimum dry density, modified proctor method per ASTM D1557), placed in 6-inch lifts.

7. Low growing native or non-invasive perennial grasses shall be planted on downstream embankment slopes. See the Vegetation Management on Embankment Dams of Public Works' Debris Control Facilities, Attachment B, for a recommended plant list.

Fencing

Safety is provided by fencing of the facility.

1. Fences shall be designed and constructed in accordance with Title 11, Section 11.48 of the Los Angeles County Code and must be located at or above the overflow water surface elevation. Shrubs (County approved, California-adapted species) can be used to hide the fencing.

Right-of-Way

1. Detention basins and associated access roads to be maintained by the County shall be dedicated in fee or in an easement to Los Angeles County with appropriate access.

Maintenance Access

Maintenance access road(s) shall be provided to the control structure and other drainage structures associated with the basin (e.g., inlet, emergency overflow or bypass structures). Manhole and catch basin lids must be in or at the edge of the access road.

An access ramp is required for removal of accumulated sediment with a backhoe or loader and truck. The ramp must extend to the basin bottom to avoid damage to vegetation planted on the basin slope.

Access roads shall meet the following design criteria:

1. All access ramps and roads shall be paved with a minimum of 6 inches of concrete over 3 inches of crushed aggregate base material. This requirement may be modified depending on the soil conditions and intended use of the road at the discretion of the Department.

2. Maximum grade shall be 12% unless otherwise approved by the Department.

3. Centerline turning radius shall be 40 feet, minimum.

4. Access roads less than 500 feet long shall have 12-foot wide pavement within a minimum 15-foot wide bench. Access roads greater than 500 feet long shall have 16-foot wide pavement within a minimum 20-foot wide bench.

5. All access roads shall terminate with turnaround areas of 40 feet by 40 feet. A hammer type turn around area or a circle drive around the top of the pond is also acceptable.

6. Adequate double-drive gates and commercial driveways are required at street crossings. Gates should be located a minimum of 25 feet from the street curb except in residential areas where the gates may be located along the property line provided there is adequate site distance to see oncoming vehicles at the posted speed limit.

Landscaping

Landscaping outside of the basin is required for all dry extended detention basins and must adhere to the following criteria so as not to hinder maintenance operations:

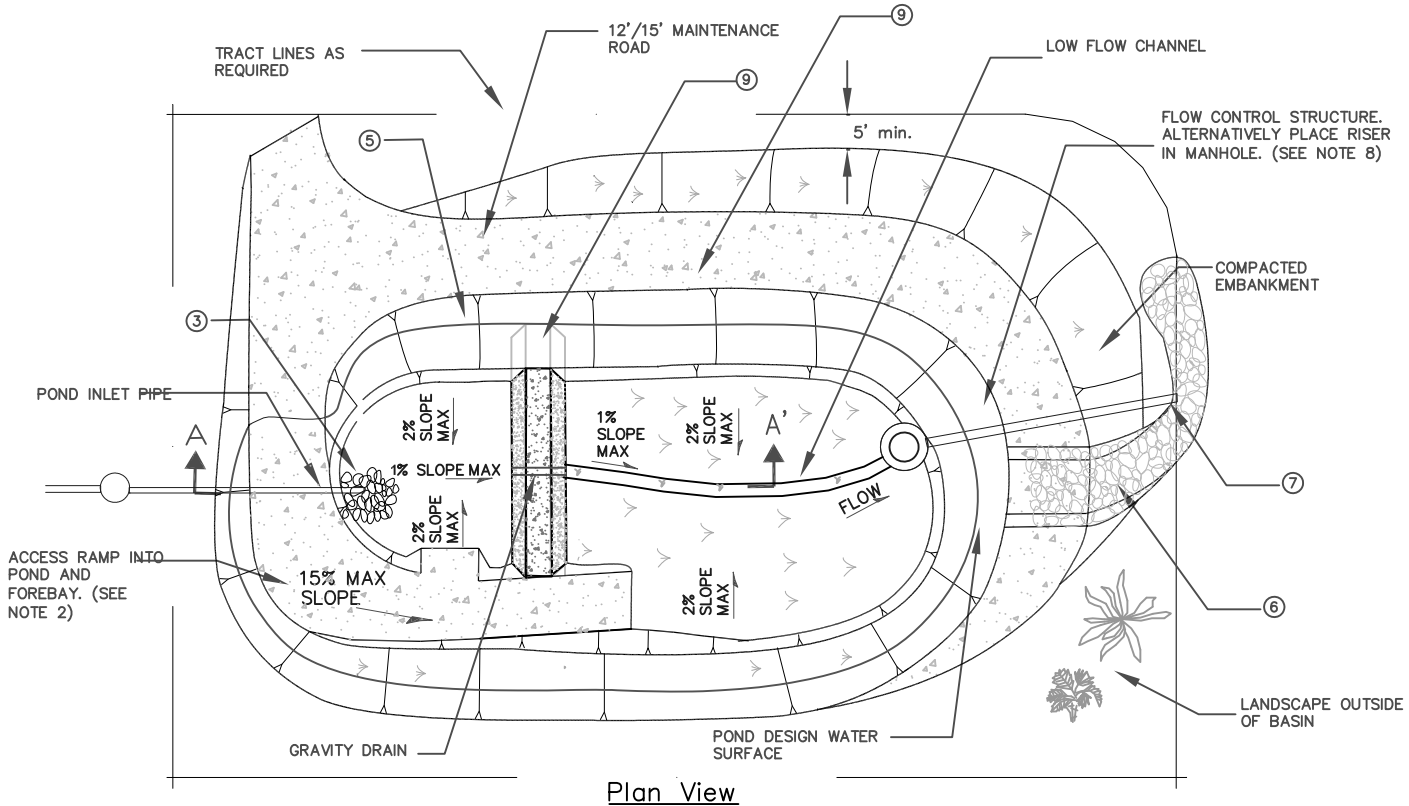
1. No trees or shrubs may be planted within 10 feet of inlet or outlet pipes or manmade drainage structures such as spillways, flow spreaders, or earthen embankments. Species with roots that seek water, such as willow or poplar, shall not be used within 50 feet of pipes or manmade structures. Weeping willow (*Salix babylonica*) should not be planted in or near detention basins.

2. The use of prohibited non-native plant species is not permitted. For more information on prohibited non-native plant species and invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist.

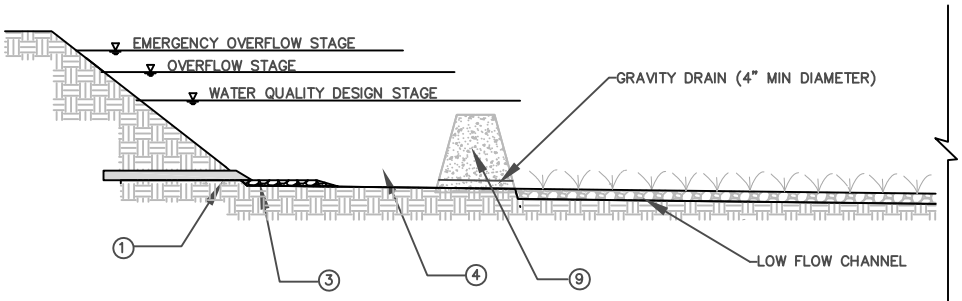
3. Other resources for identifying suitable plant types for specific BMP areas can be found by consulting a nurseryman, arborist, landscape architect or referring to various online sources such as:
    - CalFlora - a database of wild California plants that include plant characteristics and photos
      http://www.calflora.org
    - L.A. River Master Plan Landscaping and Plant Palettes - a guidance document providing a listing of native plant communities in the Los Angeles area
      http://ladpw.org/wmd/watershed/LA/LAR_planting_guidelines_webversion.pdf
    - Jepson Online Interchange For California Floristics - a database that provides information on identification, taxonomy, distribution, ecology, relationships, and diversity of California vascular plants.
      http://ucjeps.berkeley.edu/interchange.html
    - VegSpec - a web-based decision support system that assists land managers in the planning and design of vegetative establishment practices
      http://ironwood.itc.nrcs.usda.gov/Netdynamics/Vegspec/pages/HomeVegspec.htm
    - USDA Plants Database - an extensive database of native and non-native plants of the United States with over 100 plant characteristics
      http://plants.usda.gov/index.html

Restricted Construction Materials

The use of treated wood or galvanized metal anywhere inside the facility is prohibited. The use of galvanized fencing is permitted if in accordance with the fencing requirement above.



Plan View
(Not to Scale)



Section A – A'
(Not to Scale)

NOTES:

① INLET PIPE SHALL BE DESIGNED AND LOCATED SO THAT NON–EROSIVE VELOCITIES OCCUR IN THE FOREBAY

② MAINTENANCE RAMP SHOULD BE PAVED. SLOPE SHOULD NOT EXCEED 12%. MAINTENANCE RAMP SHOULD PROVIDE ACCESS TO BOTH THE FOREBAY AND MAIN BASIN.

③ RIP RAP APRON OR OTHER INLET ENERGY DISSIPATION SHALL BE PROVIDED SUCH THAT VELOCITIES IN THE FOREBAY ARE < 4 FT/S.

④ SEDIMENT FOREBAY SHOULD BE SIZED TO PROVIDE 25% OF THE TOTAL BASIN VOLUME.

⑤ SIDE SLOPES SHOULD NOT EXCEED 3:1 UNLESS APPROVED BY AN ENGINEER. SIDE SLOPES SHALL NOT EXCEED 2:1 WITHOUT A SUPPORTING GEOTECHNICAL REPORT.

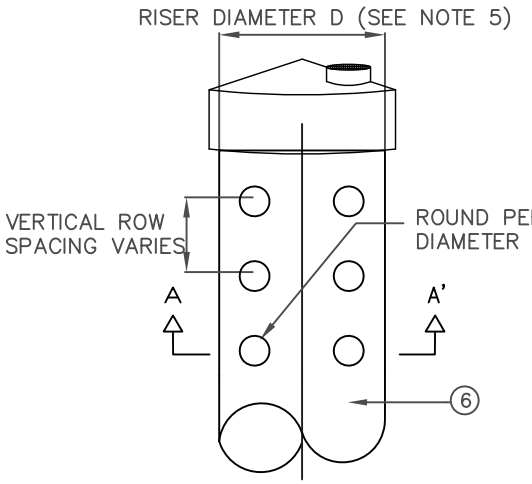
⑥ EMERGENCY SPILLWAY MUST BE SIZED TO PASS CAPITAL DEVELOPMENT PEAK FLOW FOR ON–LINE BASINS, AND WATER QUALITY DESIGN FLOW FOR OFF–LINE BASINS.

⑦ OUTLET PIPE. ENERGY DISSIPATION SHALL BE PROVIDED UNLESS DISCHARGE IS TO PIPE OR HARDENED CHANNEL.

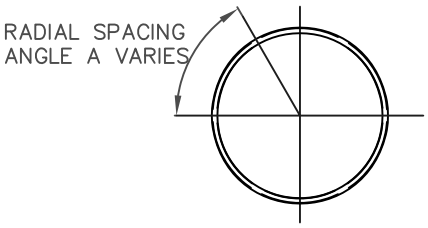
⑧ OUTLET STRUCTURE SHOULD BE SIZED TO DRAIN WATER QUALITY VOLUME IN 36 – 48 HOURS (SEE FIGURE 2–2 FOR PERFORATED RISER DETAILS). ALTERNATIVELY PLACE RISER STRUCTURE IN A MANHOLE (SEE FIGURE 2–3).

⑨ INSTALL EARTHEN BERM OR EQUIVALENT. TOP OF BERM SHALL BE 2' MINIMUM BELOW DESIGN WATER QUALITY STAGE. BERM SHALL BE KEYED INTO EMBANKMENT A MINIMUM OF 1' ON BOTH SIDES.

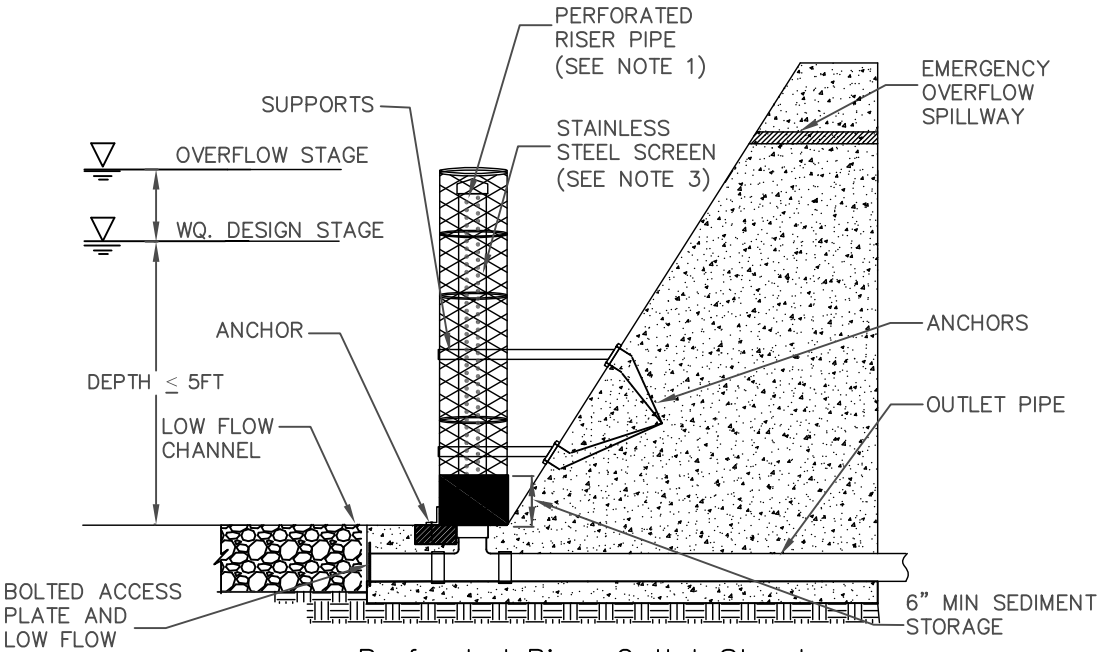
Figure 2–1
DETENTION POND



Perforated Riser Detail
(Not to Scale)



Section A – A'
(Not to Scale)

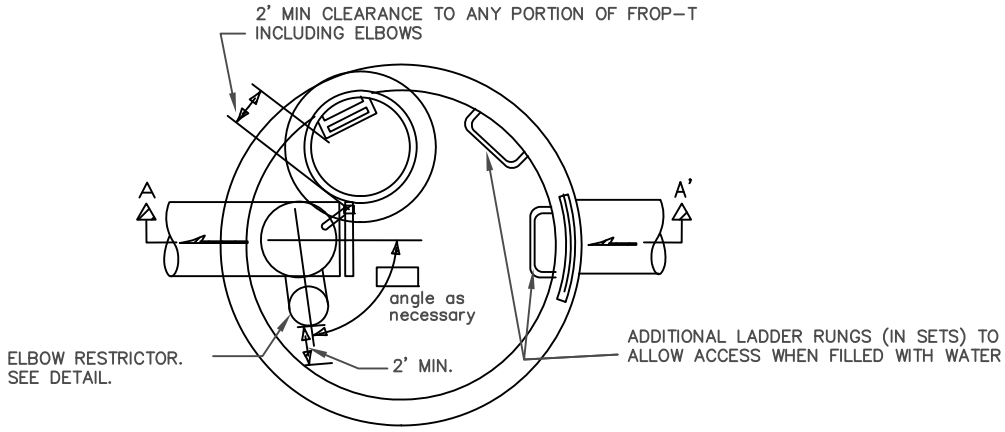


Perforated Riser Outlet Structure
(Not to Scale)

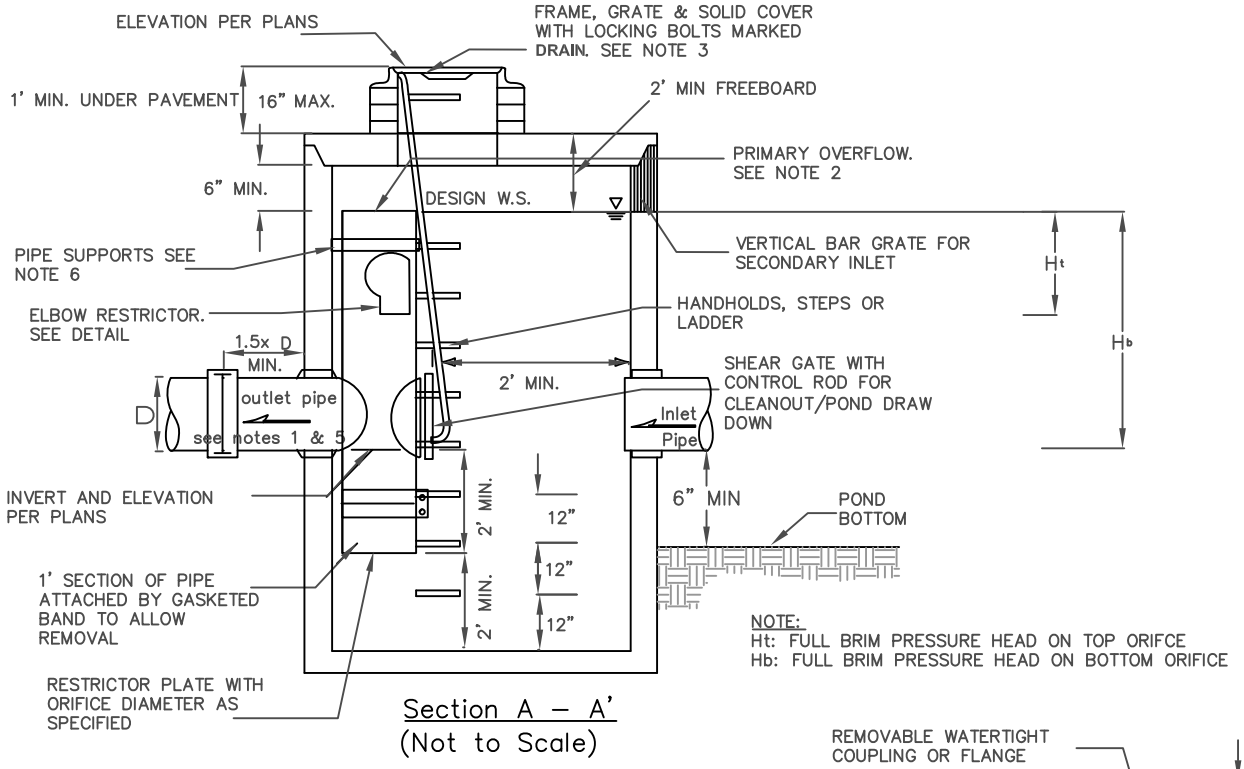
NOTES:

1. RISER PIPE SHALL BE SIZED TO PROVIDE 36 TO 48–HOUR FULL BRIM DRAW DOWN TIME.
2. TOTAL OUTLET CAPACITY: CAPITAL DEVELOPED PEAK FLOW FOR ON–LINE BASINS AND WATER QUALITY DESIGN FLOW FOR OFF–LINE BASINS.
3. SCREEN OPENINGS SHALL BE AT LEAST ¼" AND SHALL NOT EXCEED THE DIAMETER OF THE PERFORATIONS ON THE RISER.
4. RISER PIPE PERFORATION DIAMETER SHALL BE NO LESS THAN ½" AND NO MORE THAN 2"
5. MINIMUM PIPE DIAMETER (D) IS 2'
6. RISER PIPE MATERIAL IS CMP

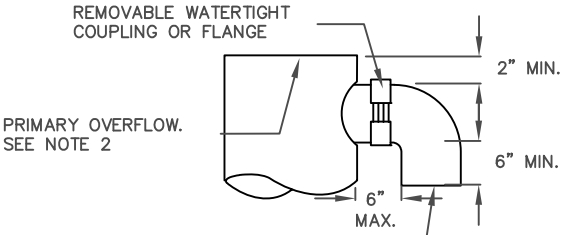
Figure 2–2
PERFORATED RISER STRUCTURE



Plan View
(Not to Scale)



Section A – A'
(Not to Scale)



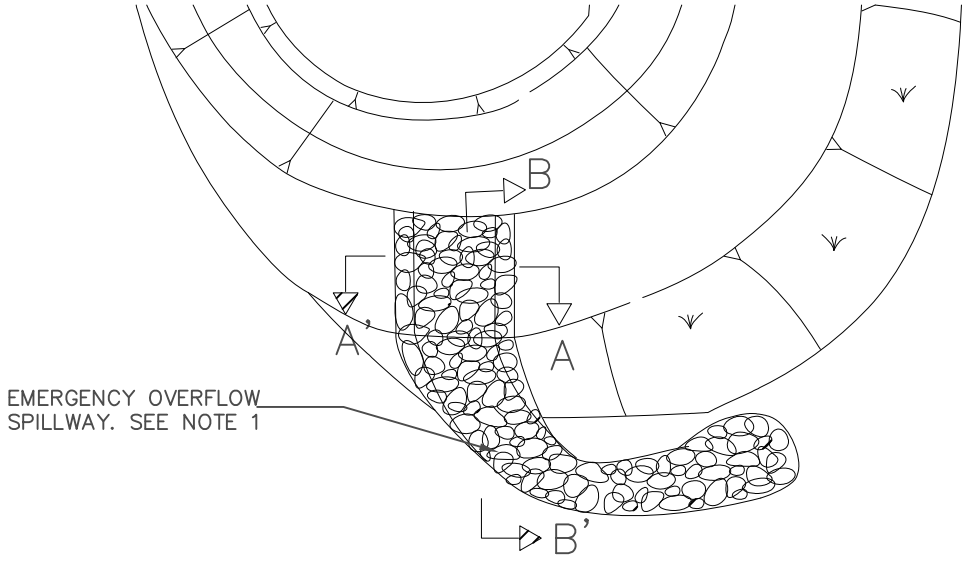
Detail
(Not to Scale)

NOTES:

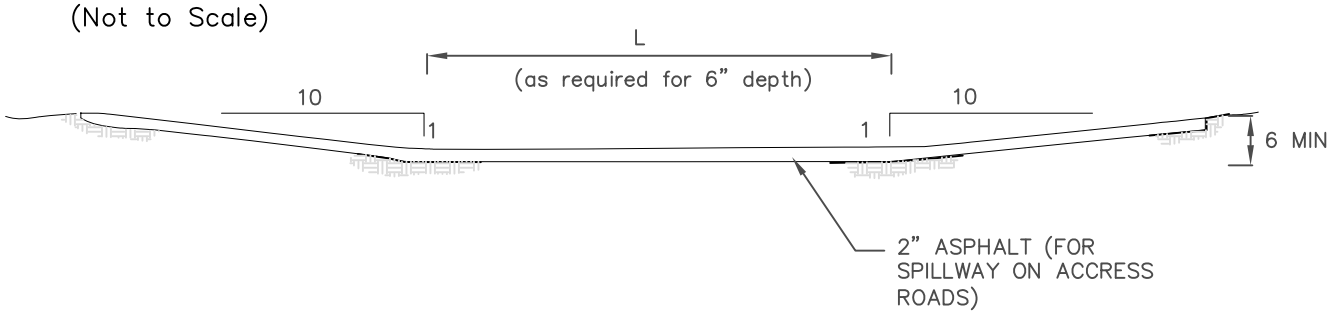
1. USE A MINIMUM OF A 54" DIA TYPE 2 CATCH BASIN
2. OUTLET CAPACITY: CAPITAL DEVELOPED PEAK FLOW FOR ON-LINE BASINS.
3. METAL PARTS: CORROSION RESISTANT. NON-GALVANIZED PARTS PERFERRED. GALVANIZED PIPE PARTS TO HAVE ASPHALT TREATMENT.
4. FRAME AND LADDER OR STEPS OFFSET SO:
   A. CLEANOUT GATE IS VISIBLE FROM TOP.
   B. CLIMB-DOWN SPACE IS CLEAR OF RISER AND
   C. FRAME IS CLEAR OF CURB.
5. IF METAL OUTLET PIPE CONNECTS TO CEMENT CONCRETE PIPE: OUTLET PIPE TO HAVE SMOOTH O.D. EQUAL TO CONCRETE PIPE I.D. LESS ¼"
6. PROVIDE AT LEAST ONE 3 X .090 GAGE SUPPORT BRACKET ANCHORED TO CONCRETE WALL. (MAXIMUM 3' VERTICAL SPACING)
7. LOCATE ADDITIONAL LADDER RUNGS IN STRUCTURES USED AS ACCESS TO TANKS OR VAULTS TO ALLOW ACCESS WHEN CATCH BASIN IS FILLED WITH WATER

Figure 2-3
MULTIPLE ORIFICE OUTLET

Plan View
(Not to Scale)



Section A – A' Option 1
(Not to Scale)



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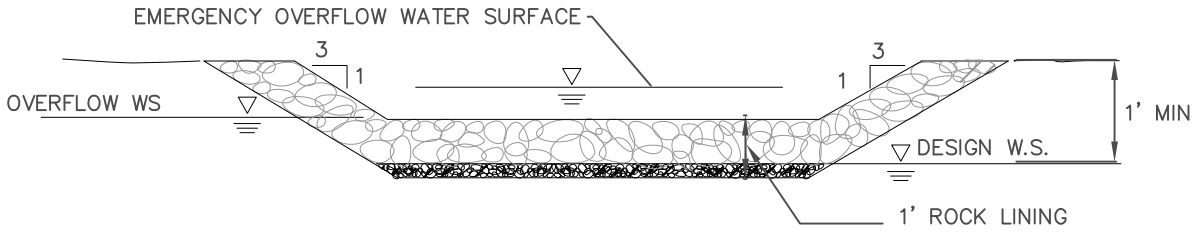
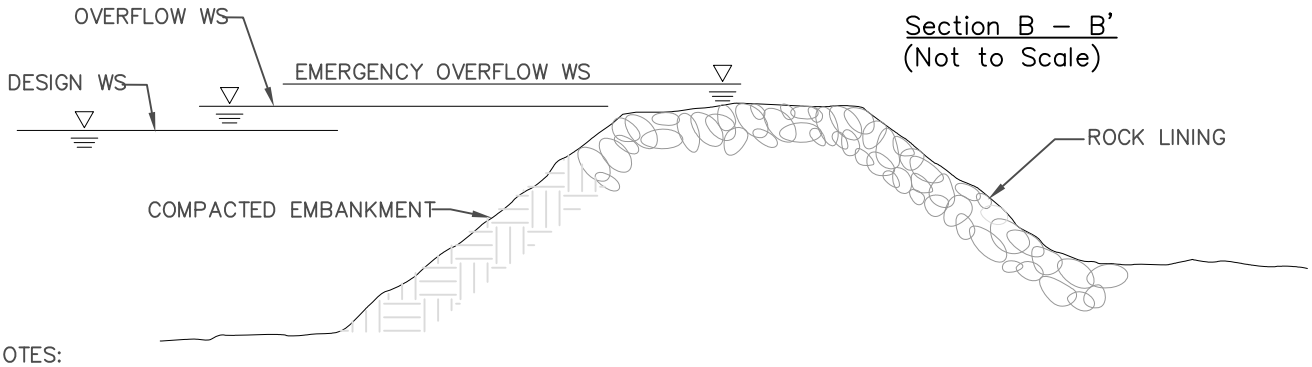




Section B – B'
(Not to Scale)

NOTES:

1. ALTERNATIVE SPILLWAY DESIGNS BASED ON THE CALIFORNIA DEPARTMENT OF WATER RESOURCES' GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SMALL EMBANKMENT DAMS OR AT THE DISCRETION OF THE DEPARTMENT

Figure 2–4
SPILLWAY

Dry Extended Detention Basins Maintenance Standards

General Requirements

Maintenance is critical for extended detention basins to continue to function as originally designed. A specific maintenance plan shall be formulated for each facility outlining the schedule and scope of maintenance operations, as well as documentation and reporting requirements. The following are general maintenance requirements:

1. The basin should be inspected annually and inspections after major storm events are encouraged (see Appendix E for guidance on BMP inspection). Trash and debris should be removed as needed, but at least annually prior to the beginning of the wet season (see Appendix F for dry extended detention basin inspection and maintenance checklist).

2. Site vegetation should be maintained as follows:

   - Vegetation, large shrubs, or trees that limit access or interfere with basin operation should be pruned or removed.
   - Slope areas that have become bare should be revegetated and eroded areas should be regraded prior to being revegetated.
   - Grass should be mowed to 4"-9" high and grass clippings should be removed.
   - Fallen leaves and debris from deciduous plant foliage should be raked and removed.
   - Invasive vegetation, such as Alligatorweed (*Alternanthera philoxeroides*), Halogeton (*Halogeton glomeratus*), Spotted Knapweed (*Centaurea maculosa*), Giant Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Perennial Pepperweed (*Lepidium latifolium*), and Yellow Starthistle (*Centaurea solstitalis*) must be removed and replaced with non-invasive species. Invasive species should never contribute more than 25% of the vegetated area. For more information on invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist.
   - Dead vegetation should be removed if it exceeds 10% of area coverage. Vegetation should be replaced immediately to maintain cover density and control erosion where soils are exposed.
   - No herbicides or other chemicals shall be used to control vegetation.

3. Accumulation of sediment exceeding 50% of the sediment storage capacity in the forebay, as indicated on the permanent steel post depth markers, should be removed. Sediment from the remainder of the basin should be removed when 6 inches of sediment accumulates. Sediment should be tested for toxic substance accumulation in compliance with current disposal requirements if visual or olfactory indications of pollution are noticed. If toxic substances are encountered at concentrations exceeding thresholds of Title 22, Section 66261 of the California Code of Regulations, the removed sediment must be disposed of in a hazardous waste landfill.

4. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for dry extended detention ponds is shown in Table 2-1. The routine and major maintenance standards listed in Tables 2-2 and 2-3 are intended to be measures to determine if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections.

Table 2-1: Dry Extended Detention Pond Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Removal trash and debris • Remove any evidence of visual contamination from floatables such as oil and grease • Remove minor sediment accumulation near inlet and outlet structures • Stabilize/repair eroded banks and fill in animal burrows if present • Make minor structural repairs to inlet/outlet structures, valves, sluice gates, pumps, fences, locks, access hatches should be inspected and kept functional • Eliminate pests and conditions that promote breeding of pests • Periodically observe function under wet weather conditions • Take photographs before and after maintenance (encouraged)
Major Maintenance	• Remove dead, diseased, or dying trees and woody vegetation that interfere with facility maintenance • Clean-out underdrains • Correct problems associated with berm settlement • Repair berm/dike breaches and stabilize eroded parts of the berm • Repair and rebuild spillway as needed to reverse the effects of severe erosion • Remove sediment build up in forebay and main pond area to restore original sediment holding capacity • Regrade main pond bottom to restore bottom slope and eliminate the incidence of standing pools • Aerate compacted areas to promote infiltration if volume reductions are desired • Repair or replace gates, fences, flow control structures, and inlet/outlet structures as needed to maintain full functionality

Table 2-2: Routine Maintenance Standards - Extended Detention Basins

Defect	**Conditions When Maintenance Is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Trash & Debris	Any trash and debris which exceed 5 cubic feet per 1,000 sf of basin area (one standard garbage can). In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.	Annually prior to wet season After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs
Inlet / outlet sediment accumulation	Minor sediment accumulation that affects flow through the facility.	Sediment cleaned out.	
Erosion of banks and channels	Rilling over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.	
Visual contaminants and pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No visual evidence of contaminants or pollutants present.	
Noxious pests	Visual observations or receipt of complaints of numbers of pests that would not be naturally occurring and could pose a threat to human or aquatic health.	Vectors controlled per LACDPW standards.	
Aesthetics	Minor vegetation removal and thinning. Mowing berms and surroundings	Facility is visually pleasing.	Monthly (or as dictated by agreement between County and landscape contractor)
Noxious Weeds	Any evidence of noxious weeds.	Eradicate all noxious weeds; control and prevent the spread of all noxious weeds. Use Integrated Pest Management techniques, if applicable. See http://www.ipm.ucdavis.edu/ for more information.	

Table 2-3: Major Maintenance Standards - Extended Detention Basins

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Tree Growth	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering, do not remove. Dead, diseased, or dying trees should be removed.	Trees do not hinder maintenance activities. Remove dead, diseased, or dying trees. (Use a certified Arborist to determine health of tree or removal requirements)	Annual or as needed (infrequent) After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs.
Settling of berm	If settlement is apparent. Settling can be an indication of more severe problems with the berm or outlet works. A geotechnical engineer should be consulted to determine the source of the settlement if the dike/berm is serving as a dam.	Berm is built back to the design elevation.	
Piping through berm	Discernable water flow through basin berm. Ongoing erosion with potential for erosion to continue. A licensed geotechnical engineer should be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved and berm stability achieved. Report of annual burrows.	
Tree and large shrub growth on downstream slope of embankments	Tree and large shrub growth on downstream slopes of embankments may prevent inspection and provide habitat for burrowing rodents.	Trees and large shrubs should be removed. All dead roots should be removed if practical. Otherwise, dead roots should be removed to a minimum of 36 inches below grade and replaced with cement grout to 12 inches below grade. The top 12 inches of the root holes should be filled with compacted, in-situ soils. The area facility engineer may require additional root removal if necessary for dam safety or maintenance purposes.	

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Erosion on Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks and pad depth are restored to design standards.	
Sediment accumulation	Sediment buildup exceeding 50% of the forebay sediment storage capacity. Six inches or more of accumulated sediment across basin bottom.	Basin capacity restored.	
Standing water	Low flow channel is not draining, standing pools of water are observed.	No standing pools of water in low flow channel.	
Gate/Fence Damage	Damage to gate/fence, including missing locks and hinges	Gate/Fence repaired.	

3. VEGETATED SWALES

Definition

Vegetated swales are open, shallow channels with low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the channels, provide the opportunity for stormwater volume reduction through infiltration and evapotranspiration, and reduce the flow velocity in addition to conveying stormwater runoff. An effective vegetated swale achieves uniform sheet flow over and through a densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location within a development project and is the choice of the designer, depending on the design criteria outlined below.

Vegetated swales can be designed to be either on-line or off-line. On-line vegetated swales are used for conveying high flows as well as providing treatment of the water quality design flow, and can replace curbs, gutters, and storm drain systems. On-line swales are sized so that the low flow portion of the swale meets the treatment BMP design criteria, and the upper portion of the swale conveys high flows up to the capital storm (e.g. flood conveyance), with a set freeboard (per the LACFCD "Design Manual Hydraulics"). Flow velocities are limited to prevent reentrainment of sediment and associated pollutants. Off-line swales have flows up to the water quality design flow diverted to them from the conveyance system. Freeboard for off-line swales is 8 inches.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 50 foot increments along their length. These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. The incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

General Constraints and Siting Considerations

- High flow velocity - steep terrain and/or large tributary area may cause erosive flows
- Shallow grades - limited site slope may cause ponding
- Compatibility with flood control - swales must not interfere with flood control functions of existing conveyance and detention structures
- Appropriate selection of vegetation based on irrigation requirements and exposure (shady versus sunny areas).

Multi-Use Opportunities

Swales can be easily integrated into roadside vegetated buffers or parking lot landscaping.

Vegetated Swale Design Specifications

Geotechnical Considerations

Vegetated swales can be used wherever the local climate and soils permit the establishment and maintenance of an appropriate vegetative cover, and slopes are low or can be engineered to swale specifications. They are impractical in areas with steep topography (slopes in excess of approximately 10%).

Sizing

The flow capacity of a vegetated swale is a function of the longitudinal slope (parallel to flow), the resistance to flow (i.e. Manning's roughness), and the cross sectional area. The cross section is normally approximately trapezoidal and the area is a function of the bottom width and side slopes. The flow capacity of vegetated swales should be such that the design water quality flow rate will not exceed a flow depth of 2/3 the height of the vegetation within the swale or 4 inches at the SUSMP design intensity. Once design criteria have been selected, the resulting flow depth for the design water quality flow rate is checked. If the depth restriction is exceeded, swale parameters (e.g. longitudinal slope, width) are adjusted to reduce the flow depth.

Procedures for sizing swales are summarized below and illustrated in Figure 3-1.

Step 1: Select design flows

The swale sizing is based on the SUSMP design flow Q_{wq} (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)).

Step 2: Calculate swale bottom width.

The swale bottom width is calculated based on Manning's equation for open-channel flow. This equation can be used to calculate discharges as follows:

$$Q = 1.49 / nAR^{1.67} S^{0.5} \qquad \text{(Equation 3-1)}$$

where:

- Q = flow rate (cfs)
- n = Manning's roughness coefficient (unitless)
- A = cross-sectional area of flow (ft^2)
- R = hydraulic radius (ft) = area divided by wetted perimeter
- S = longitudinal slope (ft/ft)

For shallow flow depths in swales, channel side slopes are ignored in the calculation of bottom width. Use the following equation (a simplified form of Manning's formula) to estimate the swale bottom width:

$$b = Q_{wq} n_{wq} / 1.49 y^{1.67} s^{0.5} \qquad \text{(Equation 3-2)}$$

Where:

b = bottom width of swale (ft)
Q_{wq} = water quality design flow (cfs)
n_{wq} = Manning's roughness coefficient for shallow flow conditions = 0.2 (unitless)
y = design flow depth (ft)
s = longitudinal slope (along direction of flow) (ft/ft)

Proceed to Step 3 if the bottom width is calculated to be between 2 and 10 feet. A minimum 2-foot bottom width is required. Therefore, if the calculated bottom width is less than 2 feet, increase the width to 2 feet and recalculate the design flow depth y using the Equation 3-2 where Q_{wq}, n_{wq}, and s are the same values as used above, but b = 2 feet.

The maximum allowable bottom width is 10 feet; therefore if the calculated bottom width exceeds 10 feet, then one of the following steps is necessary to reduce the design bottom width:

- Increase the longitudinal slope (s) to a maximum of 6 feet in 100 feet (0.06 feet per foot).
- Increase the design flow depth (y) to a maximum of 4 inches.
- Place a divider lengthwise along the swale bottom (Figure 3-1) at least three-quarters of the swale length (beginning at the inlet), without compromising the design flow depth and swale lateral slope requirements. Swale width can be increased to an absolute maximum of 16 feet if a divider is provided.

Step 3: Determine design flow velocity

To calculate the design flow velocity through the swale, use the flow continuity equation:

$$V_{wq} = Q_{wq} / A_{wq} \qquad \text{(Equation 3-3)}$$

where:

V_{wq} = design flow velocity (fps)
A_{wq} = $by + Zy^2$ = cross-sectional area (ft^2) of flow at design depth, where Z = side slope length per unit height (e.g., Z = 3 if side slopes are 3H:1V)

If the design flow velocity exceeds 1 foot per second, go back to Step 2 and modify one or more of the design parameters (longitudinal slope, bottom width, or flow depth) to reduce the design flow velocity to 1 foot per second or less. If the design flow velocity is calculated to be less than 1 foot per second, proceed to Step 4. *Note: It is desirable to have the design velocity as low as possible, both to improve treatment effectiveness and to reduce swale length requirements.*

Step 4: Calculate swale length

Use the following equation to determine the necessary swale length to achieve a hydraulic residence time of at least 10 minutes (600 seconds):

$$L = 60 t_{hr} V_{wq} \quad \text{(Equation 3-4)}$$

Where:

L = minimum allowable swale length (ft)
t_{hr} = hydraulic residence time (s)
V_{wq} = design flow velocity (fps)

The minimum swale length is 100 feet; therefore, if the swale length is calculated to be less than 100 feet, increase the length to a minimum of 100 feet, leaving the bottom width unchanged. If a larger swale can be fitted on the site, consider using a greater length to increase the hydraulic residence time and improve the swale's pollutant removal capability. If the calculated length is too long for the site, or if it would cause layout problems, such as encroachment into shaded areas, proceed to Step 5 to further modify the layout. If the swale length can be accommodated on the site, proceed to Step 6.

Step 5: Adjust swale layout to fit on site

If the swale length calculated in Step 4 is too long for the site, the length can be reduced (to a minimum of 100 feet) by increasing the bottom width up to a maximum of 16 feet, as long as the 10 minute retention time is retained. However, the length cannot be increased in order to reduce the bottom width because Manning's depth-velocity-flow rate relationships would not be preserved. If the bottom width is increased to greater than 10 feet, a low flow dividing berm is needed to split the swale cross section in half to prevent channelization.

Length can be adjusted by calculating the top area of the swale and providing an equivalent top area with the adjusted dimensions.

a) Calculate the swale treatment top area based on the swale length calculated in Step 4:

$$A_{top} = (b_i + b_{slope}) L_i \quad \text{(Equation 3-5)}$$

Where:

A_{top} = top area (ft^2) at the design treatment depth
b_i = bottom width (ft) calculated in Step 2
b_{slope} = the additional top width (ft) above the side slope for the design water depth (for 3:1 side slopes and a 4-inch water depth, b_{slope} = 2 feet)
L_i = initial length (ft) calculated in Step 4.

b) Use the swale top area and a reduced swale length L_f to increase the bottom width, using the following equation:

$$L_f = A_{top} / (b_f + b_{slope}) \quad \text{(Equation 3-6)}$$

where:

L_f = reduced swale length (ft)
b_f = increased bottom width (ft).

c) Recalculate V_{wq} according to Step 3 using the revised cross-sectional area A_{wq} based on the increased bottom width b_f. Revise the design as necessary if the design flow velocity exceeds 1 foot per second.

d) Recalculate to assure that the 10 minute retention time is retained.

Step 6: Provide conveyance capacity for flows higher than Q_{wq}

Vegetated swales may be designed as flow-through channels that convey flows higher than the water quality design flow rate, or they may be designed to incorporate a high-flow bypass upstream of the swale inlet. A high-flow bypass usually results in a smaller swale size. If a high-flow bypass is provided, this step is not needed. If no high-flow bypass is provided, proceed with the procedure below. Flow diversion structure design is described in Appendix D.

a) Check the swale size to determine whether the swale can convey the capital storm peak flows (Refer to Design Manual - Hydraulic, Section C, "Criteria for Hydraulic Design Open Channels" and "Hydrology Manual" LACDPW).

b) The capital storm peak flow velocity must be less than 3.0 feet per second. If this velocity exceeds 3.0 feet per second, return to Step 2 and increase the bottom width or flatten the longitudinal slope as necessary to reduce the capital storm peak flow velocity to 3.0 feet per second or less. If the longitudinal slope is flattened, the swale bottom width must be recalculated (Step 2) and must meet all design criteria.

Swale Geometry

1. In general, trapezoidal channel shape should be assumed for sizing calculations above, but a more naturalistic channel cross-section is preferred.

2. Swales designed for water quality treatment purposes only are anticipated to be fairly shallow, generally less than 1-foot. Therefore, a side slope of 2:1 (H:V) can be used and is acceptable. Milder slopes are necessary for mowed turf swales (3H:1V max).

3. Overall depth from the top of the side walls to the swale bottom shall be at least 12 inches.

4. Swale length shall be greater than 100 linear feet. Regardless of the recommended detention time, the swale should be not less than 100 feet in length. Length can be increased by meandering the swale.

5. The minimum swale bottom width shall be 2 feet to allow for ease of mowing.

6. The maximum swale bottom width shall be limited to 10 feet, unless a dividing berm is provided, then maximum bottom width can be 16 feet. Swale width is calculated without the dividing berm. *Intent: Experience shows that when the width exceeds about 10 feet, it*

is difficult to keep the water from concentrating in low-flow channels. It is also difficult to construct the bottom level and without sloping to one side. Vegetated swales are best constructed by leveling the bottom after excavating. A single-width pass with a front-end loader produces a better result than a multiple-width pass.

7. Swales that are required to convey flood as well as SUSMP flows should be sized to convey the capital storm and include 2 feet of freeboard.

8. Gradual meandering bends in the swale are desirable for aesthetic purposes and to promote slower flow.

Bottom Slope

1. The longitudinal slope (along the direction of flow) shall be between 1% and 6%.

2. If longitudinal slopes are less than 1.5% and the soils are poorly drained (e.g., silts and clays), then underdrains shall be provided. A soils report to verify soils properties shall be provided for swales less than 1.5%.

3. If longitudinal slope exceeds 6%, check dams with vertical drops of 12 inches or less shall be provided to achieve a bottom slope of 6% or less between the drop structures.

4. The lateral (horizontal) slope at the bottom of the swale shall be zero (flat) to discourage channeling.

Water Depth and Dry Weather Flow Drain

1. Water depth should not exceed 4 inches (or 2/3 of expected vegetation height), except for frequently mowed turf swales, for which the depth should not exceed 2 inches.

2. The swale length must provide a minimum hydraulic residence time of 10 minutes.

3. A low flow drain shall be provided for dry weather flows extending the entire length of the swale. The drain shall have a minimum depth of 6 inches, and a width no more than 5% of the calculated bottom swale width; the width of the drain shall be in addition to the required bottom width. If an anchored plate is used for flow spreading at the swale inlet, the plate wall shall have v-notches (maximum top width = 5% of swale width) or holes to allow preferential exit of low flows into the drain. If an underdrain is installed as required below, the low flow drain shall be omitted.

Energy Dissipation

1. Vegetated swales may be designed either on-line or off-line. If the facility is on-line, velocities shall be maintained below the maximum flow design velocity of 3 feet per second to prevent scour and resuspension of deposited sediments.

2. The maximum SUSMP flow velocity shall not exceed 1.0 foot per second. *Intent: This maximum SUSMP flow velocity promotes settling and keeps vegetation upright.*

3. This velocity limitation combined with a maximum depth of 4 inches and bottom width of 10 feet results in a recommended maximum flow capacity of about 3.3 cfs, after accounting for the side slopes. The contributory drainage area to each swale is limited so as not to exceed this recommended maximum flow capacity.

4. The maximum flow velocity during the capital storm shall not exceed 3.0 foot per second. This can be accomplished by:

    a. splitting roadside swales near high points in the road so that flows drain in opposite directions, mimicking flow patterns on the road surface.

    b. limiting contributory drainage areas to long swales by diverting flows throughout the length of the swale at regular intervals, to the downstream stormwater conveyance system.

5. A flow spreader (see "Flow Spreaders" below and detail in Figure 3-2) shall be used at the inlet so that the entrance velocity is quickly dissipated and the flow is uniformly distributed across the whole swale. Energy dissipation controls shall be constructed of sound materials such as stones, concrete, or proprietary devices that are rated to withstand the energy of the influent flows.

6. If check dams are used to reduce the longitudinal slope, a flow spreader shall be provided at the toe of each vertical drop, with specifications described below.

7. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

Flow Spreaders

1. An anchored plate flow spreader shall be provided at the inlet to the swale. Equivalent methods for spreading flows evenly throughout the width the swale are acceptable.

2. The top surface of the flow spreader plate shall be level, projecting a minimum of 2 inches above the ground surface of the water quality facility, or v-notched with notches 6 to 10 inches on center and 1 to 4 inches deep (use shallower notches with closer spacing).

3. A flow spreader plate shall extend horizontally beyond the bottom width of the facility to prevent water from eroding the side slope. The horizontal extent should be such that the bank is protected for all flows up to the capital design flow (on-line swales) or the maximum flow that will enter the WQ facility (off-line swales).

4. Flow spreader plates shall be securely fixed in place.

5. Flow spreader plates may be made of either concrete, stainless steel, or other durable material.

6. Anchor posts shall be 4-inch square concrete, tubular stainless steel, or other material resistant to decay.

Check Dams

If check dams are required, they can be designed out of a number of different materials, including riprap, earthen berms, or removal stop logs. Check dams must be placed as to achieve the desired slope (<6%), and desired velocity (not to exceed 3 fps during the capital storm or 1 fps during the SUSMP storm), at a maximum of 50 feet apart. If rip rap is used, the material should consist of well-graded stone consisting of a mixture of rock sizes. The following is an example of an acceptable gradation:

Particle Size	% Passing
24"	100
15"	75
9"	50
4"	10

Underdrains

If underdrains (not to be confused with a dry weather flow drain (see page 3-25 above)) are required, then they must meet the following criteria:

1. Underdrains must be made of slotted, polyvinyl chloride (PVC) pipe conforming to ASTM D 3034 or equivalent or corrugated high density polyethylene (HDPE) pipe conforming to AASHTO 252M or equivalent. *Intent: As compared to round-hole perforated pipe, slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.*

2. Slotted pipe shall have 2 to 4 rows of slots cut perpendicular to the axis of the pipe or at right angles to the pitch of corrugations. Slots shall have a width of 0.04-inch to 0.1-inch and shall have a length of 1-inch to 1.25-inch. Slots shall be spaced such that the pipe has a minimum of one square inch per lineal foot.

3. The pipe must be 6 inches or greater in diameter, so it can be cleaned without damage to the pipe. Clean-out risers with diameters equal to the underdrain pipe must be placed at the terminal ends of the underdrain and can be incorporated into the flow spreader and outlet structure to minimize maintenance obstacles in the swale. Intermediate clean-out risers may also be placed in the check dams or grade control structures. The cleanout risers shall be capped with a lockable screw cap.

4. The underdrain shall be placed parallel to the swale bottom and backfilled and bedded with six inches of drain rock. The following aggregate shall be used to provide a gravel blanket and bedding for the underdrain pipe to provide a 1-foot minimum depth around the top and sides of the slotted pipe.

Sieve size	Percent Passing
¾ inch	100
¼ inch	30-60
US No. 8	20-50
US No. 50	3-12
US No. 200	0-1

5. The drain rock must be wrapped in a geotextile fabric meeting the following minimum materials requirements.

Geotextile Property	Value	Test Method
Trapezoidal Tear (lbs)	40 (min)	ASTM D4533
Permeability (cm/sec)	0.2 (min)	ASTM D4491
AOS (sieve size)	#60 - #70 (min)	ASTM D4751
Ultraviolet resistance	70% or greater	ASTM D4355

6. The underdrain must infiltrate into the subsurface or drain freely to an acceptable discharge point.

Swale Divider

1. If a swale divider is used, the divider should be constructed of a firm material that will resist weathering and not erode, such as concrete or compacted soil seeded with grass. Treated timber should not be used. Selection of divider material must take into account maintenance activities, such as mowing.

2. The divider must have a minimum height of 1 inch greater than the water quality design water depth.

3. Earthen berms should be no steeper than 2H:1V.

4. Material other than earth shall be embedded to a depth sufficient to be stable.

Soils

1. Turf swale soils shall be amended with 2 inches of well-rotted compost, unless the organic content is already greater than 10%. The compost shall be mixed into the native soils to a depth of 6 inches to prevent soil layering and washout of compost. The compost will contain no sawdust, green or under-composted material, or any other toxic or harmful substance. It should contain no un-sterilized manure which can lead to high levels of pathogen indicators (coliform bacteria) in the runoff.

Vegetation

Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface.

1. The swale area should be appropriately vegetated with a mix of erosion-resistant plant species that effectively bind the soil. A diverse selection of low growing plants that thrive under the specific site, climatic, and watering conditions should be specified. A mixture of dry-area and wet-area grass species that can continue to grow through silt deposits is most effective. Native or adapted grasses are preferred because they generally require less fertilizer, limited maintenance, and are more drought resistant than exotic plants. Consultation with a landscape or erosion control specialist is recommended for project-

specific recommendations on grass seed, fertilizer, and mulching applications to ensure healthy grass growth. Suitable plant types can also be found by referring to various online sources such as:

- CalFlora - a database of wild California plants that include plant characteristics and photos
  http://www.calflora.org
- The California Invasive Plant Council - a listing of invasive, non-native plants of California
  http://www.cal-ipc.org/
- L.A. River Master Plan Landscaping and Plant Palettes - a guidance document providing a listing of native plant communities in the Los Angeles area
  http://ladpw.org/wmd/watershed/LA/LAR_planting_guidelines_webversion.pdf
- Jepson Online Interchange For California Floristics - a database that provides information on identification, taxonomy, distribution, ecology, relationships, and diversity of California vascular plants.
  http://ucjeps.berkeley.edu/interchange.html
- VegSpec - a web-based decision support system that assists land managers in the planning and design of vegetative establishment practices
  http://ironwood.itc.nrcs.usda.gov/Netdynamics/Vegspec/pages/HomeVegspec.htm
- USDA Plants Database - an extensive database of native and non-native plants of the United States with over 100 plant characteristics
  http://plants.usda.gov/index.html

2. Trees or shrubs may be used in the surrounding landscape as long as they do not excessively shade the swale.

3. Above the design treatment elevation, a typical lawn mix or landscape plants can be used provided they do not shade the swale vegetation.

4. Irrigation is required if the seed is planted in spring or summer. Use of a permanent irrigation system may help provide maximal water quality performance. Drought-tolerant grasses should be specified to minimize irrigation requirements.

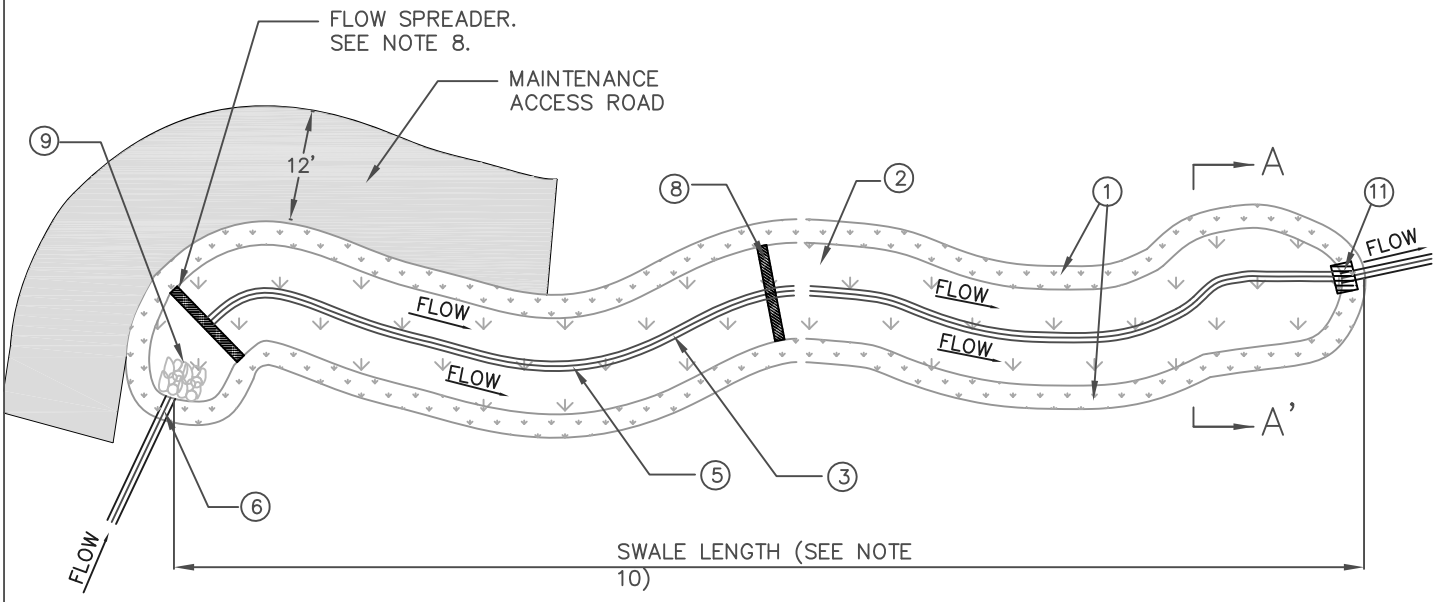
5. Vegetative cover should be at least 4 inches in height, ideally 6 inches. Swale water depth should ideally be 2 inches below the height of the shortest plant species and should not exceed 4 inches.

6. Locate the swale in an area without excessive shade to avoid poor vegetative growth. For moderately shaded areas, shade tolerant plants should be used.

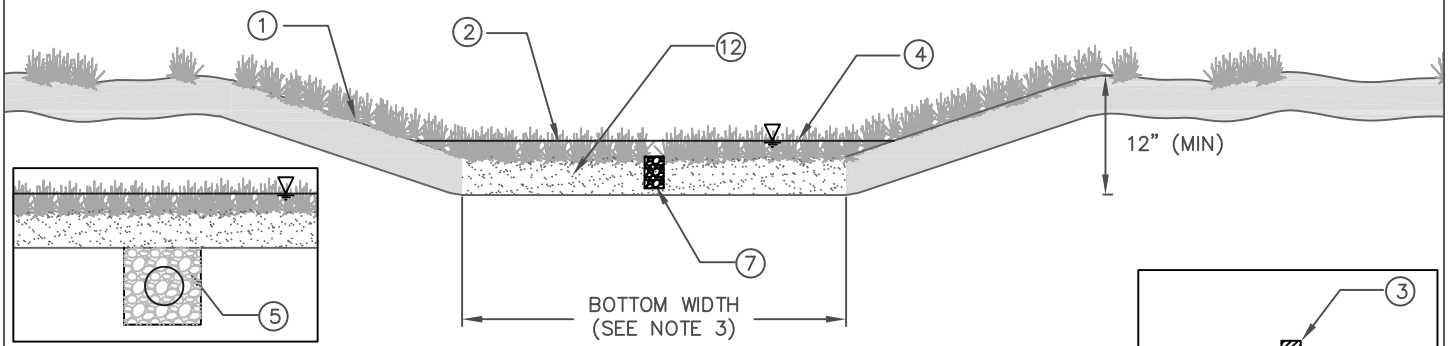
7. Locate the swale away from large trees that may drop leaves or needles. Excessive tree debris may smother the grass or impede the flow through the swale. Landscape planter beds should be designed and located so that soil does not erode from the beds and enter a nearby swale.

Restricted Construction Materials

The use of treated wood or galvanized metal within the vegetated swale is prohibited.



Plan View
(Not to Scale)



Underdrain
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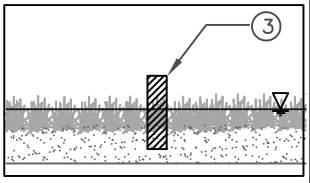
Section A – A'
(Not to Scale)

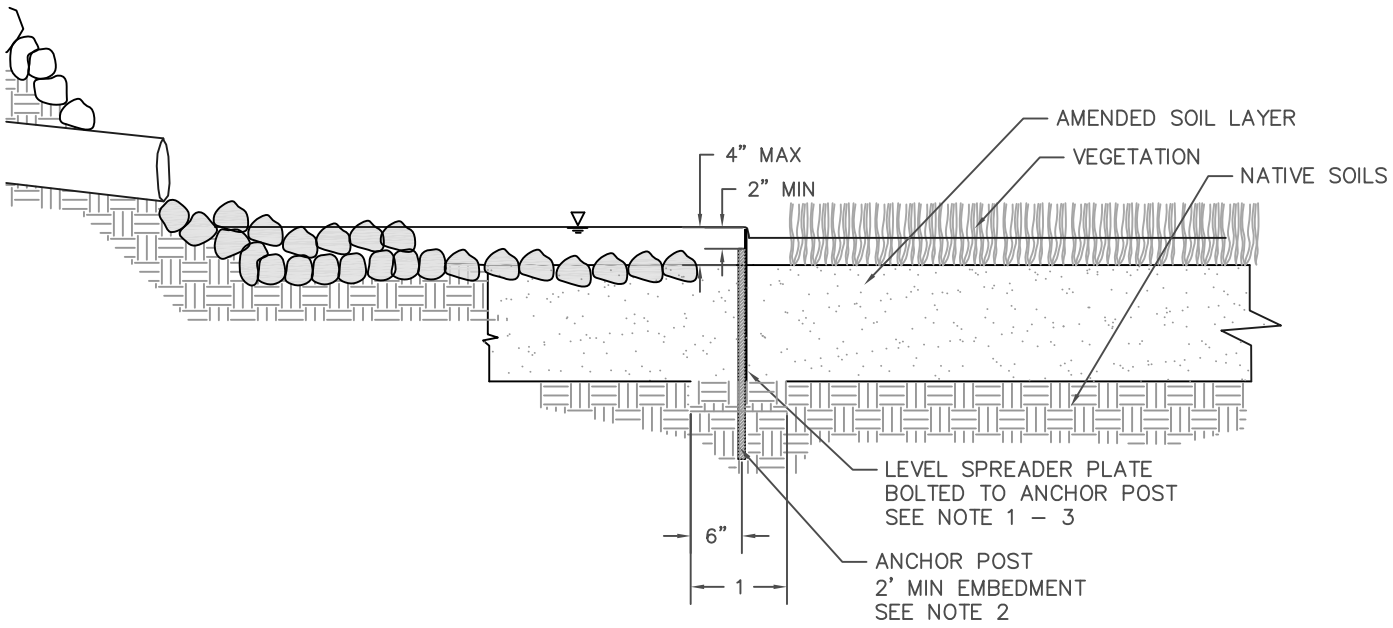


Swale Divider
(Not to Scale)

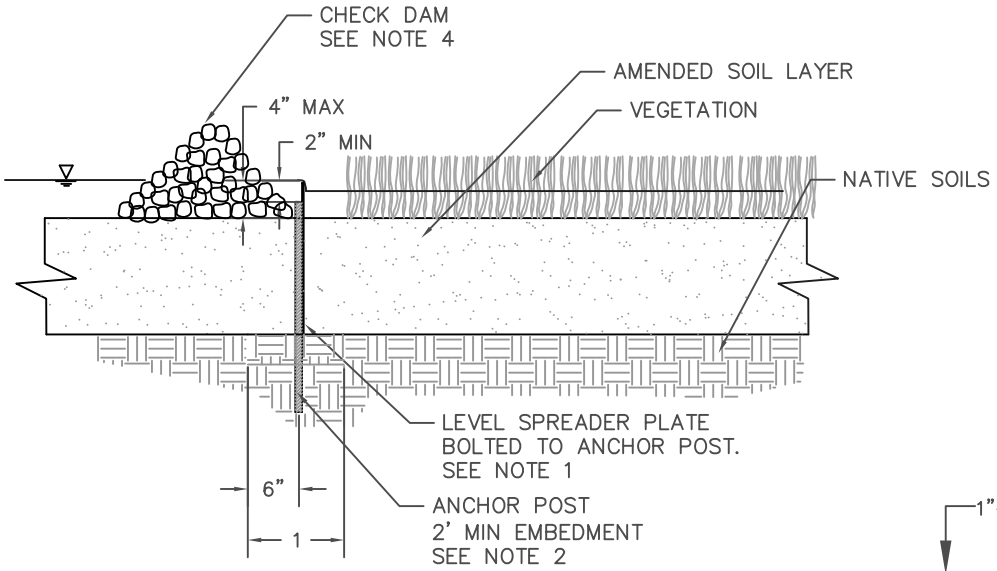
NOTES:

1. VEGETATED SIDE SLOPES AT 2H:1V MAXIMUM SLOPE. MOWED TURF SWALES AT 3H:1V MAXIMUM.
2. GRASS HEIGHT SHALL BE 4" – 6" HIGH.
3. SWALE DIVIDER REQUIRED FOR BOTTOM WIDTHS > 10'. MINIMUM REQUIRED BOTTOM WIDTH IS 2' EXCLUDING WIDTH OF LOW FLOW CHANNEL. MAXIMUM BOTTOM WIDTH WITH DIVIDER IS 16'.
4. DEPTH OF FLOW FOR WATER QUALITY TREATMENT MUST NOT EXCEED TWO–THIRDS OF THE GRASS HEIGHT AND NOT GREATER THAN 4" (INFREQUENTLY MOWED) OR 2" (FREQUENTLY MOWED).
5. 6" PERFORATED UNDERDRAIN IN 9" DEEP COARSE AGGREGATE BED CONNECTED TO STORM DRAIN. REQUIRED FOR SLOPES < 1.5% OR AS NEEDED.
6. INLET PIPE WITH INLET PROTECTION.
7. IF NO UNDERDRAIN, LOW FLOW DRAIN SHALL EXTEND ENTIRE LENGTH OF SWALE AND SHALL HAVE A DEPTH OF 6" MINIMUM AND WIDTH NO MORE THAN 5% SWALE BOTTOM WIDTH. ANCHORED PLATE FLOW SPREADER IF USED, SHALL HAVE V–NOTCHES (MAX TOP WIDTH = 5% OF SWALE WIDTH) OR HOLES TO ALLOW PREFERENTIAL EXIT OF LOW FLOWS.
8. INSTALL CHECK DAMS OR GRADE CONTROL STRUCTURES FOR SLOPES > 6% AT 50' MAXIMUM SPACING TO ACHIEVE A MAXIMUM EFFECTIVE LONGITUDINAL SLOPE OF 6%. FLOW SPREADERS SHALL BE PROVIDED AT INLET AND AT THE BASE OF EACH CHECK DAM SEE FIGURE 3–2.
9. INSTALL ENERGY DISSIPATOR AT THE INLET OF VEGETATED SWALE.
10. SWALE LENGTH SHALL BE 100' OR LENGTH REQUIRED TO PROVIDE 10 MINUTES RESIDENCE TIME, WHICH EVER IS GREATER.
11. INSTALL APPROPRIATE OUTLET STRUCTURE. ACCOMODATE LOW FLOW CHANNEL AND/OR UNDERDRAIN (IF PRESENT).
12. AMEND SOILS WITH 2" OF COMPOST TILLED INTO 6" OF NATIVE SOIL UNLESS NATIVE SOIL ORGANIC CONTENT > 10%.

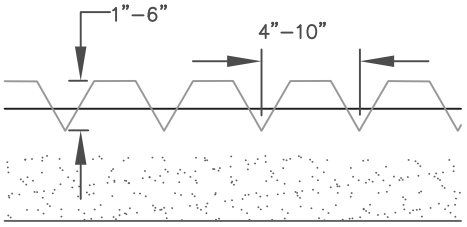
Figure 3–1
VEGETATED SWALE FILTER



Inlet Flow Spreader Detail
(Not to Scale)



Check Dam and Flow Spreader Detail
(Not to Scale)



V–Notched Flow Spreader Detail
(Not to Scale)

NOTES:

1. TOP SURFACE OF FLOW SPREADER SHALL BE LEVEL AND SHALL PROJECT 2" MINIMUM ABOVE GROUND. V–NOTCHES AT 6 TO 10 INCHES ON CENTER AND 1 TO 4 INCHES DEEP SHALL BE ACCEPTABLE.
2. FLOW SPREADER ANCHOR POSTS SHALL BE 4–INCH SQUARE CONCRETE , TUBULAR STEEL OR OTHER MATERIAL RESISTANT TO DECAY.
3. FLOW SPREADER PLATES SHALL HAVE A ROW OF PERFORATIONS AT THE BASE OF THE PLATE TO PREVENT PONDING FOR LONG DURATIONS.
4. CHECK DAM SHALL BE NO HIGHER THAN 12". CHECK DAM SPACING SHALL BE NO GREATER THAN 50 FEET APART.

Figure 3–2
FLOW SPREADER AND CHECK DAM

Vegetated Swale Maintenance Standards

General Requirements

1. Inspect vegetated swales for erosion or damage to vegetation after every storm greater than 0.75" for on-line swales and at least twice annually for off-line swales, preferably at the end of the wet season to schedule summer maintenance and in the fall to ensure readiness for winter (see Appendix E for guidance on facility inspection). Additional inspection after periods of heavy runoff is recommended. Each swale should be checked for debris and litter and areas of sediment accumulation (see Appendix F for a vegetated swale inspection and maintenance checklist).

2. Swale inlets (curb cuts or pipes) should maintain a calm flow of water entering the swale. Remove sediment as needed at the inlet if vegetation growth is inhibited in greater than 10% of the swale or if the sediment is blocking even distribution and entry of the water. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

3. Flow spreaders should provide even dispersion of flows across the swale. Sediments and debris should be removed from the flow spreader if blocking flows. Splash pads should be repaired if needed to prevent erosion. Spreader level should be checked and releveled if necessary.

4. Side slopes should be maintained to prevent erosion that introduces sediment into the swale. Slopes should be stabilized and planted using appropriate erosion control measures when native soil is exposed or erosion channels are forming.

5. Swales should drain within 48 hours of the end of a storm. Till the swale if compaction or clogging occurs and revegetate. The perforated underdrain pipe, if present, should be cleaned if necessary.

6. Vegetation should be healthy and dense enough to provide filtering while protecting underlying soils from erosion:

    - Mulch should be replenished as needed to ensure survival of vegetation.
    - Vegetation, large shrubs or trees that interfere with landscape swale operation should be pruned.
    - Fallen leaves and debris from deciduous plant foliage should be removed.
    - Grassy swales should be mowed to keep grass 4" to 6" in height. Grass clippings shall be removed.
    - Invasive vegetation, such as Alligatorweed (*Alternanthera philoxeroides*), Halogeton (*Halogeton glomeratus*), Spotted Knapweed (*Centaurea maculosa*), Giant Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Perennial Pepperweed (*Lepidium latifolium*), and Yellow Starthistle (*Centaurea solstitalis*) must be removed and replaced with non-invasive species. Invasive species should never contribute more than 10% of the vegetated area. For more information on invasive weeds, including biology and control

of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist.

- Dead vegetation should be removed if greater than 10% of area coverage or when swale function is impaired. Vegetation should be replaced and established before the wet season to maintain cover density and control erosion where soils are exposed.

7. Check dams (if present) should control and distribute flow across the swale. Causes for altered water flow and/or channelization should be identified and obstructions cleared. Check dams and swale should be repaired if damaged.

8. The vegetated swale should be well maintained; trash and debris, sediment, visual contamination (e.g., oils), noxious or nuisance weeds, should all be removed.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for vegetated swales is shown in Table 3-1. Detailed routine and major maintenance standards are listed in Tables 3-2 and 3-3.

Table 3-1: Vegetated Swale Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Remove excess sediment as needed • Removal trash and debris • Clean underdrain (where applicable) and/or unclog outlet to eliminate standing water • Clean and reset flow spreaders as needed to restore original function • Restore sunlight access to shaded regions. Remove overhanging tree branches as needed to prevent excessive shading. • Remove any evidence of visual contamination from floatables such as oil and grease • Mow routinely to maintain ideal grass height and to suppress weeds • Replace invasive vegetation with non-invasive species • Remove sediment and debris accumulation near inlet and outlet structures • Stabilize/repair minor erosion and scouring with gravel • Take photographs before and after maintenance (encouraged)
Major Maintenance	• Regrade swale bottom and reseed to mitigate ponding of water between storms or excessive erosion and scouring • Install or replace low flow channel using pea gravel media to better convey nuisance flows • Revegetate bare exposed portions of the swale to restore vegetation to original level of coverage • De-thatch grass to remove accumulated sediment and aerate compacted areas to promote infiltration

Table 3-2: Routine Maintenance Standards - Vegetated Swales

Defect or Problem	**Condition When Maintenance is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Sediment Accumulation	Sediment depth exceeds 2 inches or covers vegetation.	Sediment deposits on grass treatment area of the vegetated swale removed without significant disturbance of the vegetation. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.	Annually prior to wet season After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs
Trash and Debris Accumulation	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (one standard garbage can).	Trash and debris removed from vegetated swale.	
Standing Water	When water stands in the swale between storms and does not drain freely.	There should be no areas of standing water once inflow has ceased. Outlet structures and underdrain (if installed) shall drain freely.	
Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Spreader leveled and cleaned such that flows are distributed evenly over entire swale width.	
Excessive Shading	Vegetation growth is poor because sunlight does not reach swale.	Over-hanging limbs and brushy vegetation on side slopes are trimmed back.	
Erosion/ Scouring	Eroded or scoured swale bottom due to flow channelization or higher flows.	No erosion or scouring in swale bottom. For ruts or bare areas less than 12 inches wide, damaged areas repaired by filling with crushed gravel. Over time, the grass will have started to cover the rock.	
Visual Contaminants and Pollution	Any visual evidence of oil, gasoline, contaminants or other pollutants.	No visual contaminants or pollutants present.	
Vegetation Length	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Vegetation mowed or nuisance vegetation removed so that flow is not impeded. Grass should be mowed to a height of 4 to 6 inches (depending on landscape requirements). Grass clippings removed.	Monthly (or as dictated by agreement between County and landscape contractor

Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed	Frequency
Inlet/Outlet Blockage	Inlet/outlet areas clogged with sediment and/or debris.	Material removed so that there is no clogging or blockage in the inlet and outlet area.	
Low Flow Channel Overflow	Nuisance flows are ponding, swale is continually wet.	Low flow channel media is renewed to adequately convey nuisance flows.	

Table 3-3: Major Maintenance Standards - Vegetated Swales

Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed	Frequency
Standing Water	When water stands in the swale between storms and does not drain freely.	There should be no areas of standing water once inflow has ceased. Any of the following may apply: improved grade from head to foot of swale, removed clogged check dams, added underdrains or converted to a wet biofiltration swale.	Annual – preferably at end of wet season or as needed (infrequent) After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs
Erosion/ Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	No erosion or scouring in swale bottom. Bare areas greater than 12 inches wide are regraded and reseeded.	
Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks and an eroded, muddy channel has formed in the swale bottom	No eroded, muddy channel on the bottom. A low-flow pea-gravel drain added to the length of the swale, or an underdrain installed.	
Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Vegetation coverage in more than 90% of the swale bottom. Poorly vegetated areas are replanted with plugs of grass from the upper slope and reseeded there, plugs planted in the swale bottom with no gaps, or reseeded into loosened, fertile soil.	Semiannual – at beginning and end of wet season

4. FILTER STRIPS

Definition

Filter strips are vegetated areas designed to treat sheet flow runoff from adjacent impervious surfaces or intensive landscaped areas such as golf courses. Filter strips decrease runoff velocity, filter out TSS and associated pollutants, and provide some infiltration into underlying soils. While some assimilation of dissolved constituents may occur, filter strips are generally more effective in trapping sediment and particulate-bound metals, nutrients, and pesticides. Nutrients that bind to sediment include phosphorus and ammonium; soluble nutrients include nitrate. Filter strips are more effective when the runoff passes through the vegetation and thatch layer in the form of shallow, uniform flow. Biological and chemical processes may help break down pesticides, uptake metals, and utilize nutrients that are trapped in the filter.

Filter strips rely on dense turf vegetation with a thick thatch, growing on a moderately permeable soil and are well suited to treat runoff from roads and highways, driveways, roof downspouts, small parking lots, and other impervious surfaces. They are also good for use as vegetated buffers between developed areas and natural drainages.

General Constraints and Siting Considerations

- High flow velocity - steep terrain and/or large tributary area may cause concentrated, erosive flows
- Sheet flow - shallow, evenly-distributed flow across entire width of strip required. The maximum flow path from a contributory impervious surface should not exceed 150 feet.
- Shallow grades - limited site slope may cause ponding
- Availability of pervious area adjacent to impervious area - filter strips require sheet flow from impervious areas

Multi-Use Opportunities

Filter strips can be easily integrated into roadside vegetated buffers or parking lot landscaping.

Filter Strip Design Specifications

The main challenge associated with filter strips is maintaining sheet flow, which is critical to performance of this BMP. If flows are concentrated then little or no treatment of stormwater runoff is achieved and erosive rilling is likely. The use of a level spreading device (e.g., gravel trench) to deliver shallow, evenly-distributed sheet flow to the strip is required. A filter strip is illustrated schematically in Figure 4-1.

Location

1. The use of filter strips is limited to gently sloping areas where the vegetative cover is robust and diffuse, and where shallow flow characteristics are possible.

2. The filter strip shall be located away from building or tree shadows to avoid poor plant growth.

3. Groundwater levels should be at least 2 ft lower than the strip surface to ensure that the filter strip does not remain wet between storms.

Tributary Area Length

1. Maximum length (in the direction of flow towards the filter strip) of the tributary area shall be 150 feet.

2. The lateral slope of the contributing area (parallel to the edge of the pavement) shall be 4% or less.

3. The longitudinal slope of the contributing area (parallel to the flow) should be 5% or less.

Sizing

Step 1: Calculate the design flow

The design flow is calculated as described in *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended).

Step 2: Calculate the design flow depth

The design flow depth (d) is calculated based on the width and the slope (parallel to the flow path) using a modified Manning's equation as follows:

$$d_f = [Q_{wq} n_{wq} / 1.49 W s^{0.5}]^{0.6} \qquad \text{(Equation 4-1)}$$

where:

d_f = design flow depth (ft)
Q_{wq} = design flow (cfs)
W = width (perpendicular to flow = width of impervious surface contributing area (ft)
s = slope (ft/ft) of strip parallel to flow, average over the whole width
n_{wq} = Manning's roughness coefficient (0.25-0.3)

If d_f is greater than 1 inch, then a smaller slope is required, or a filter strip cannot be used.

Step 3: Calculate the design velocity

The design flow velocity is based on the design flow, design flow depth, and width of the strip:

$$V_{wq} = Q_{wq} / d_f W \qquad \text{(Equation 4-2)}$$

Step 4: Calculate the desired length of the filter strip

Determine the required length (L) to achieve a desired minimum residence time of 10 minutes using:

$$L = 60 t_{hr} V_{wq} \qquad \text{(Equation 4-3)}$$

Where:

L = minimum allowable strip length (ft)
t_{hr} = hydraulic residence time (s)
V_{wq} = design flow velocity (fps)

Geometry

1. The width of the filter strip vegetative surface should extend across the full width of the tributary area. The upstream boundary of the filter should be located contiguous to the developed area.

2. The filter strip should be at least 4 feet long (in direction of flow) to provide adequate water quality treatment.

3. Filter strips should be designed on slopes (parallel to the direction of flow) between 2% and 15%; steeper slopes tend to result in concentrated flow. Slopes less than 2% could pond runoff, and in poorly permeable soils, create a mosquito breeding habitat.

4. The lateral slope of strip (parallel to the edge of the pavement, perpendicular to the direction of flow) shall be 4% or less.

5. Grading should be even: a filter strip with uneven grading perpendicular to the flow path will develop flow channels over time.

6. The top of the strip should be installed 2 to 5 inches below the adjacent pavement to allow for vegetation and sediment accumulation at the edge of the strip. A beveled transition is acceptable and may be required per roadside design specifications.

7. Both the top and toe of the slope should be as flat as possible to encourage sheet flow and prevent channeling and erosion. For engineered vegetative strips, the facility surface should be graded flat prior to placement of vegetation.

Energy Dissipation / Level Spreading

Runoff entering a filter strip must not be concentrated. A flow spreader shall be installed at the edge of the pavement to uniformly distribute the flow along the entire width of the filter strip.

1. At a minimum, a gravel flow spreader (gravel-filled trench) shall be placed between the impervious area contributing flows and the filter strip, and meet the following requirements:

   a) The gravel flow spreader shall be a minimum of 6 inches deep and shall be 12 inches wide.

b) The gravel shall be a minimum of 1 inch below the pavement surface. *Intent: This allows sediment from the paved surface to be accommodated without blocking drainage onto the strip.*

c) Where the ground surface is not level, the gravel spreader must be installed so that the bottom of the gravel trench and the outlet lip are level.

d) Along roadways, gravel flow spreaders must be placed and designed in accordance with County road design specifications for compacted road shoulders.

2. A notched curb spreader and through-curb port spreader may only be used in conjunction with a gravel spreader to better ensure that water sheet-flows onto the strip, provided:

   a. Curb ports use fabricated openings that allow concrete curbing to be poured or extruded while still providing an opening through the curb to admit water to the filter strip. Openings in the curb shall be at regular intervals but at least every 6 feet. The width of each curb port opening shall be a minimum of 11 inches. Approximately 15 percent or more of the curb section length should be in open ports, and no port should discharge more than about 10 percent of the flow.

   b. Interrupted curbs are sections of curb placed to have gaps spaced at regular intervals along the total width of the treatment area. At a minimum, gaps shall be every 6 feet to allow distribution of flows into the treatment facility before they become too concentrated. The opening shall be a minimum of 11 inches. As a general rule, no opening should discharge more than 10 percent of the overall flow entering the facility.

3. Energy dissipaters are needed in a filter strip if sudden slope drops occur, such as locations where flows in a filter strip pass over a rockery or retaining wall aligned perpendicular to the direction of flow. Adequate energy dissipation at the base of a drop section can be provided by a riprap pad.

Access

Access shall be provided at the upper edge of a filter strip to enable maintenance of the inflow spreader throughout the strip width and allow access for mowing equipment.

Water depth and Velocity

1. The design water depth should not exceed 1 inch.

2. Runoff flow velocities should not exceed approximately 1 foot per second across the vegetated surface.

Soils

1. Filter strip soils shall be amended with 2 inches of well-rotted compost, unless the organic content is already greater than 10%. The compost shall be mixed into the native soils to a depth of 6 inches to prevent soil layering and washout of compost. The compost will contain no sawdust, green or under-composted material, or any other toxic or harmful

substance. It should contain no un-sterilized manure which can lead to high levels of pathogen indictors (coliform bacteria) in the runoff.

Vegetation

1. The filter area should be densely vegetated with a mix of erosion-resistant plant species that effectively bind the soil. Native or adapted grasses are preferred because they generally require less fertilizer and are more drought resistant than exotic plants.

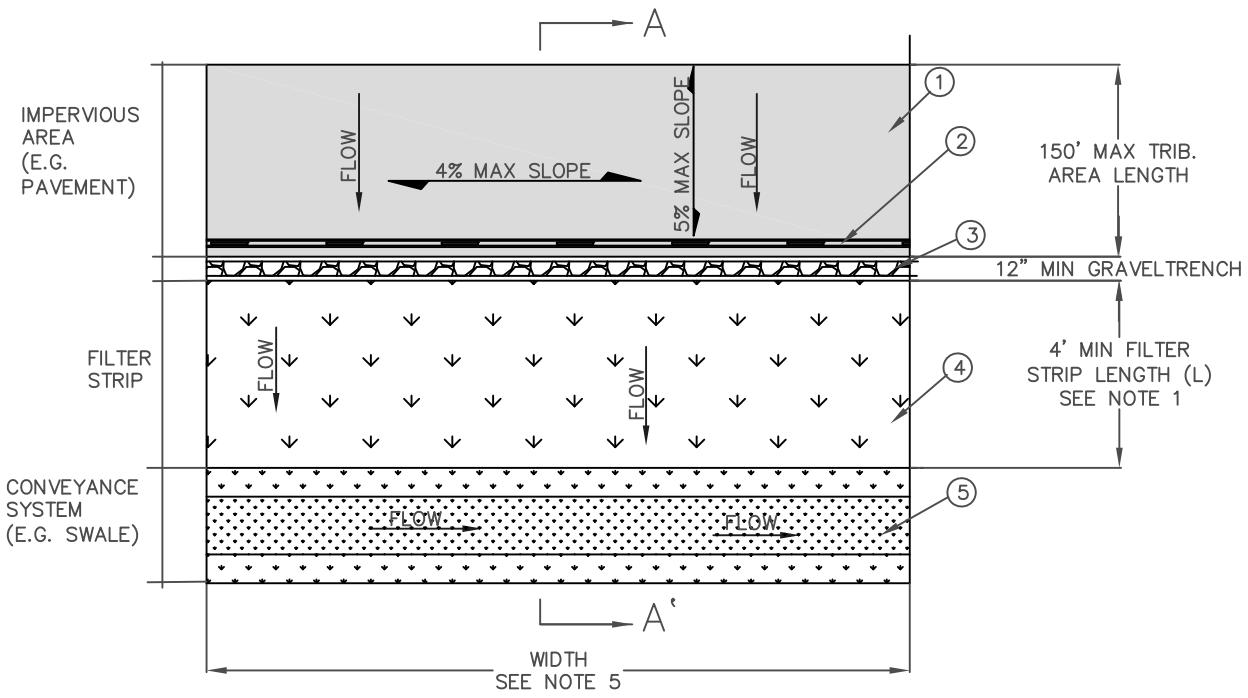
2. Sod can be used instead of grass seed, as long as there is complete coverage.

3. Irrigation shall be provided to establish the grass.

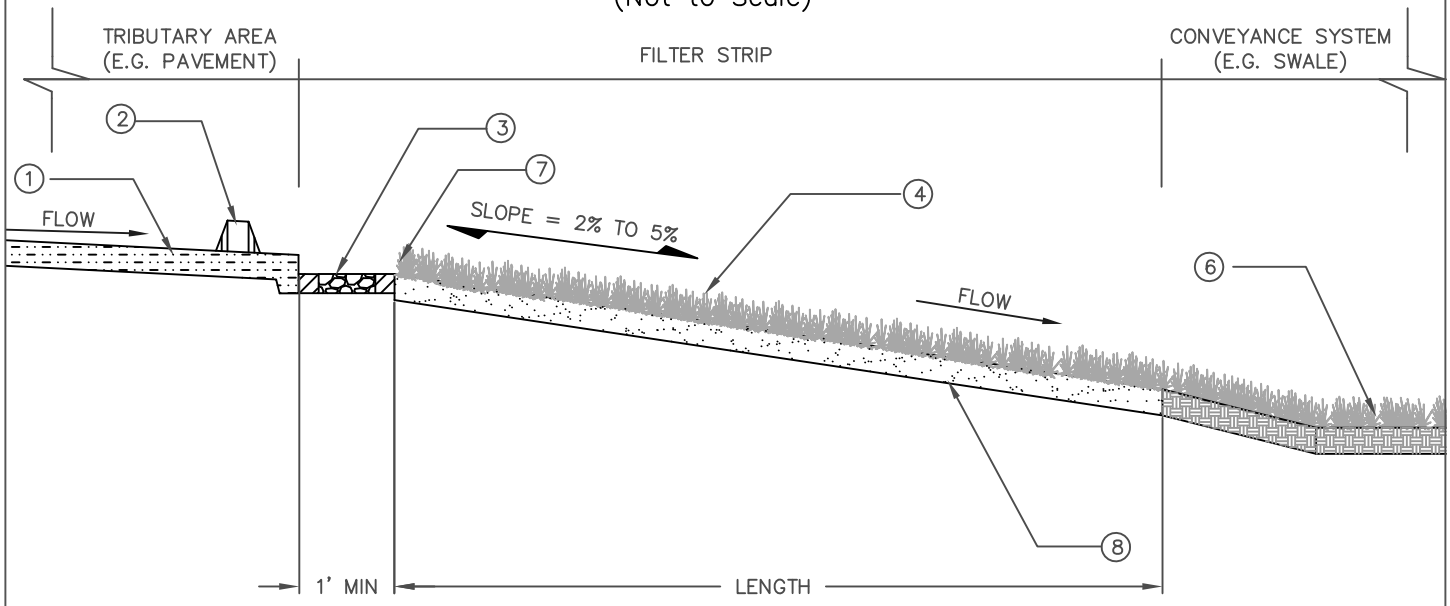
Trees or shrubs shall not be used because they shade the turf.

Restricted Construction Materials

The use of treated wood or galvanized metal anywhere inside the facility is prohibited.



Plan View
(Not to Scale)



Section A – A'
(Not to Scale)

NOTES:

1. MAXIMUM LENGTH OF IMPERVIOUS TRIBUTARY AREA SHALL BE 150'.
2. OPTIONAL SLOTTED WHEEL STOPS MAY BE USED.
3. GRAVEL TRENCH 6" DEEP BY 12" WIDE MIN SHALL BE PROVIDED.
4. VEGETATED FILTER STRIP SURFACE. SLOPE SHALL BE BETWEEN 2% TO 5%. WIDTH MUST BE EQUAL OR GREATER THAN THE WIDTH OF THE TRIBUTARY AREA.
5. CONVEYANCE SYSTEM WIDTH MUST BE EQUAL OR GREATER THAN THE WIDTH OF THE TRIBUTARY AREA.
6. INSTALL SWALE OR OTHER CONVEYANCE SYSTEM DOWNSTREAM OF FILTER STRIP.
7. TOP OF FILTER STRIP SHALL BE 2" – 5" BELOW TOP OF ADJACENT PAVEMENT.
8. AMEND SOILS WITH 2" OF COMPOST TILLED INTO 6" OF NATIVE SOIL UNLESS NATIVE SOIL ORGANIC CONTENT > 10%.

Figure 4–1
VEGETATED STRIP FILTER

Filter Strip Operations and Maintenance

General Requirements

Filter strips mainly require vegetation management; therefore little special training is needed for maintenance crews. Typical maintenance activities and frequencies include:

1. Inspect strips at least twice annually for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and in the fall to ensure the strip is ready for winter (see Appendix E for guidance on facility inspection). However, additional inspection after periods of heavy runoff is most desirable. The strip should be checked for debris and litter and areas of sediment accumulation (see Appendix F for dry extended detention basin inspection and maintenance checklist).

2. Mow as frequently as necessary (at least twice a year) for safety and aesthetics or to suppress weeds and woody vegetation.

3. Trash tends to accumulate in strip areas, particularly along roadways. The need for litter removal should be determined through periodic inspection. Litter should always be removed prior to mowing.

4. Regularly inspect vegetated buffer strips for pools of standing water. Vegetated filter strips can become a nuisance due to mosquito breeding in level spreaders (unless designed to dewater completely in less than 72 hours), in pools of standing water if obstructions develop (e.g. debris accumulation, invasive vegetation), and/or if proper drainage slopes are not implemented and maintained.

5. Activities that lead to ruts or depressions on the surface of the filter strip shall be prevented or the integrity of the strip shall be restored by leveling and reseeding. Examples are vehicle tracks, utility maintenance, and pedestrian (short-cut) tracks.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for filter strips is shown in Table 4-1. Detailed Routine and major maintenance standards are listed in Tables 4-2 and 4-3.

Table 4-1: Filter Strip Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Remove excess sediment as needed • Stabilize/repair minor erosion and scouring with crushed gravel • Remove trash and debris • Remove any evidence of visual contamination from floatables such as oil and grease • Mow routinely to maintain ideal grass height and to suppress weeds • Remove invasive vegetation and revegetate with non-invasive species • Take photographs before and after maintenance (encouraged)
Major Maintenance	• Regrade and revegetate to repair damage from severe erosion/scour channelization and to restore sheet flow • Clean and reset flow spreaders as needed to restore original function

Table 4-2: Routine Maintenance – Filter Strips

Defect	**Conditions When Maintenance Is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Sediment Accumulation	Sediment depth exceeds 2 inches or covers vegetation.	Sediment deposits removed, releveled so slope is even and flows pass evenly through strip.	Semi-annually, prior to wet season and after the wet season After major storm events (>0.75 in/24 hrs) if spot checks indicate widespread damage/ maintenance needs
Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	No erosion or scouring evident. For ruts or bare areas less than 12 inches wide, damaged areas repaired by filling with crushed gravel. The grass will creep in over the rock in time.	
Flow Spreader Clogged/Uneven	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Spreader leveled and cleaned so that flows are spread evenly over entire filter width.	
Visual Contaminants and Pollution	Any visual evidence of oil, gasoline, contaminants or other pollutants.	No visual contaminants or pollutants present.	

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Aesthetics	Minor vegetation removal and thinning. Mowing berms and surroundings	Facility is well kept.	Semi-annually (or as dictated by agreement between County and landscape contractor) Litter removal and mowing frequency is dependent on site conditions and desired aesthetics and should be done at a frequency to meet those objectives
Vegetation Length, Nuisance Weeds	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Grass mowed, nuisance vegetation controlled, such that flow is not impeded. Grass mowed to a height between 2-4 inches and clippings removed.	
Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Trash and debris removed from filter.	
Noxious Weeds	Any evidence of noxious weeds.	All noxious weeds eradicated and future establishment controlled with use of Integrated Pest Management (IPM) techniques, if applicable. See http://www.ipm.ucdavis.edu/ for more information.	

Table 4-3: Major Maintenance – Filter Strips

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Erosion/Scouring	Bare spots greater than 12 inches	No erosion visible. Large, bare areas greater than 12 inches wide regraded and reseeded.	As needed

5. BIORETENTION

Definition

Bioretention areas are vegetated (i.e., landscaped) shallow depressions that provide storage, infiltration, and evapotranspiration. Bioretention areas also remove pollutants by filtering stormwater through plants adapted to the local climate and soil moisture conditions and an engineered soil mix. In bioretention areas, pore spaces, microbes, and organic material in the engineered soils help to retain water in the form of soil moisture and to promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants utilize soil moisture and promote the drying of the soil through transpiration. If no underdrain is provided, exfiltration of the stored water in the bioretention area engineered soil into the underlying soils occurs over a period of days. For areas with low permeability native soils or steep slopes, bioretention areas can be designed with an underdrain system that routes the treated runoff to the storm drain system rather than depending on infiltration. In this situation, treatment is achieved mainly through filtration and adsorption in the vegetation and engineered soils in the biofiltration area.

General Constraints and Siting Considerations

- Native soil infiltration rate - underdrain is required in low permeability soils
- Vertical relief and proximity to storm drain - site must have adequate relief between land surface and storm drain to permit vertical percolation through the soil media and collection and conveyance in underdrain to storm drain system
- Depth to groundwater - shallow groundwater table may not permit complete drawdown between storms

Multi-Use Opportunities

Bioretention areas can be applied in various settings, including:

- Individual lots for rooftop, driveway, and other on-lot impervious surface infiltration.
- Shared facilities located in common areas for individual lots.
- Areas within loop roads or cul-de-sacs.
- Landscaped parking lot islands.
- Within right-of-ways along roads.
- Common landscaped areas in apartment complexes or other multifamily housing designs.
- In parks and along open space edges.

Bioretention Design Specifications

Geotechnical and Landscape Considerations

1. Bioretention areas located within 50 feet of a sensitive steep slope shall incorporate an underdrain. A geotechnical report must be provided to address the potential effects of

infiltration on the steep slope if a bioretention area without an underdrain is sited within 200 feet of the slope or hazardous landslide area.

2. An underdrain should be provided for the bioretention area when native soils permeability is less than 0.5 inches/hour, as determined by an in-situ percolation test.

Pretreatment

1. Bioretention areas shall use a filter strip to pretreat and spread incoming flows from roadways. Bioretention areas that treat runoff from residential roofs, sidewalks, driveways, or other "cleaner" surfaces do not require pretreatment.

2. If sheet flow is conveyed to the treatment area over stabilized grassed areas, the site must be graded in such a way that minimizes erosive conditions. Sheet flow velocities shall not exceed 1 foot per second.

Sizing Criteria

Bioretention areas can be sized using one of two methods: a simple sizing method or a routing method. The simple sizing procedure is summarized below. Continuous simulation modeling, routing spreadsheets, and/or other forms of routing modeling that incorporate rainfall-runoff relationships and infiltrative (flow) capacities of bioretention may be used to size facilities. Alternative sizing methodologies should be prepared with good engineering practices. For the routing modeling method, refer to Section 10 - Sand Filters. A bioretention sizing worksheet and example are provided in Appendix B.

With either method, the runoff entering the facility must completely drain the ponding area and the planting soil within 48 hours. Bioretention provides storage above ground, in the voids of the planting soil, and (if used) in the voids of gravel drainage layer. Bioretention is to be sized, with or without underdrains, such that the SUSMP volume will fill the available ponding depth, the void spaces in the planting soil, and (if provided) the gravel drainage layer.

Step 1: Calculate the design volume

Bioretention areas should be sized to capture and treat the SUSMP volume (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)).

Step 2: Determine the design percolation rate

The design percolation rate, P_{design}, will differ depending on whether the native soil percolation rate falls above or below a rate of 0.5 in/hr. Sites where the native soil percolation rate is equal to or exceeds 0.5 in/hr, measured per the Policy for New Percolation Basin Testing, Design, and Maintenance (see Appendix G), do not require the use of an underdrain, while sites where native soil percolation rates are less than 0.5 in/hr require the use of an underdrain.

Option 1: Determining the design percolation rate, P_{design}, with an underdrain
If the bioretention includes an underdrain, then the design percolation rate will be that of the planting soil. The planting soil design specifications listed below are assumed to have a design percolation rate of 2.5 in/hr.

Option 2: Determining the design percolation rate, P_{design}, of the native subsoil (no underdrain)
If the bioretention area does not include an underdrain, then the design percolation rate will be the limiting percolation rate (slowest) of the native subsoil, using in-situ tests described in Appendix G, and the planting soil. In most cases, the limiting percolation rate will be that of the native subsoil. It is important that adequate conservatism is incorporated in the selection of design percolation rates. The design percolation rate discussed here is the percolation rate of the underlying subsoil and not the percolation rate of the planting soil.

The design percolation rate may be calculated by applying correction factors to the field-measured percolation rate. A percolation testing correction factor applied to bioretention sizing of 0.25 (providing a safety factor of 4) should be applied to results of the percolation testing conducted per Appendix G.

$$P_{design} = P_{measured} \times F_{testing} \qquad \text{(Equation 5-1)}$$

Where:

P_{design} = design percolation rate (in/hr)
$P_{measured}$ = field measured percolation rate (in/hr)
$F_{testing}$ = correction factor for testing method; use 0.25

Step 3: Calculate the bioretention surface area

Determine the bottom surface area of the bioretention (surface area at the base of sideslopes, not at the top of sideslopes) using the following equation:

$$A = \frac{(V_{design})(l)}{(t)(P_{design}/12)(d+l)} \qquad \text{(Equation 5-2)}$$

Where:

V_{design} = SUSMP volume (ft^3)
P_{design} = design percolation rate (in/hr)
d = ponding depth (ft) [max 1.5 ft]
l = depth of planting media (ft) [min 2 ft]
t = required drawdown time (hr) [max 48 hrs]

Gravel Drainage Layer. A gravel drainage layer should be provided where underlying native soil permeability is greater than 0.5 in/hr and percolation is allowed. The base of the drainage layer should have zero slope (level). The drawdown time for the gravel drainage layer should not exceed 72 hours. The planting soil and gravel layers should be separated with a thin, 2- to 4-inch layer of sand and a thin layer (nominally two inches) of #8 stone.

Determine the maximum depth of runoff that can be infiltrated within the required drain time (72 hr) as follows:

$$d_{\max} = \frac{P_{design}}{12} * t \qquad \text{(Equation 5-3)}$$

Where:

- d_{max} = the maximum depth of water that can be infiltrated within the required drain time (ft)
- P_{design} = native subsoil design percolation rate (in/hr) [measured percolation rate x 0.25]
- t = required drain time (hrs) [72 hours]

Choose the gravel drainage layer depth (l) such that:

$$d_{\max} \geq n * l \qquad \text{(Equation 5-4)}$$

Where:

- d_{max} = the maximum depth of water that can be infiltrated within the required drain time (ft)
- n = gravel drainage layer porosity (unitless)
- l = depth of gravel drainage layer (ft)

Calculate the infiltrating surface area (filter bottom area) required:

$$A = \frac{V_{design}}{\frac{TP_{design}}{12} + nl} \qquad \text{(Equation 5-5)}$$

Where:

- V_{design} = SUSMP volume (ft^3)
- n = gravel drainage layer porosity (unitless)
- P_{design} = native subsoil design percolation rate (in/hr) [measured percolation rate x 0.25]
- l = depth of gravel drainage layer (ft)
- T = fill time (time to fill bioretention area with water) (hrs) [use 2 hours for most designs]
- A = surface area of gravel drainage layer (ft^2)

Geometry

1. Bioretention areas shall be sized to capture and treat the SUSMP volume (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)) with an 18-inch maximum ponding depth.

2. Planting soil depth shall be a minimum of 2 feet, although 3 feet is preferred. *Intent: The planting soil depth should provide a beneficial root zone for the chosen plant palette and adequate water storage for the water quality design volume. A deeper planting soil depth will provide a smaller surface area footprint.*

3. Bioretention areas shall be designed to drain in less than 48 hours. Intent: Soils must be *allowed to dry out periodically in order to restore hydraulic capacity to receive flows from subsequent storms, maintain percolation rates, maintain adequate soil oxygen levels for healthy soil biota and vegetation, and to provide proper soil conditions for biodegradation and retention of pollutants.*

Flow Entrance and Energy Dissipation

The following types of flow entrance can be used for bioretention cells:

1. Dispersed, low velocity flow across a landscape area. Dispersed flow may not be possible given space limitations or if the facility is controlling roadway or parking lot flows where curbs are mandatory.

2. Dispersed flow across pavement or gravel and past wheel stops for parking areas.

3. Flow spreading trench around perimeter of bioretention area. May be filled with pea gravel or vegetated with 3:1 side slopes similar to a swale. A vertical-walled open trench may also be used at the discretion of the County.

4. Curb cuts for roadside or parking lot areas: curb cuts should include rock or other erosion protection material in the channel entrance to dissipate energy. Flow entrance should drop 2 to 3 inches from curb line and provide an area for settling and periodic removal of sediment and coarse material before flow dissipates to the remainder of the cell.

5. Pipe flow entrance: Piped entrances, such as roof downspouts, should include rock, splash blocks, or other erosion protection material at the entrance to dissipate energy and disperse flows.

6. Woody plants (trees, shrubs, etc.) can restrict or concentrate flows and can be damaged by erosion around the root ball and shall not be placed directly in the entrance flow path.

Underdrains

If underdrains are required, then they must meet the following criteria:

1. 6-inch minimum diameter.

2. Underdrains must be made of slotted, polyvinyl chloride (PVC) pipe (PVC SDR 35 or approved equivalent). *Intent: As compared to round-hole perforated pipe, slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.*

3. Slotted pipe shall have 2 to 4 rows of slots cut perpendicular to the axis of the pipe or at right angles to the pitch of corrugations. Slots shall be 0.04 to 0.1-inch and shall have a length of 1-inch to 1.25-inch. Slots shall be longitudinally spaced such that the pipe has a minimum of one square inch per lineal foot.

4. Underdrains shall be sloped at a minimum of 0.5%.

5. Rigid non-perforated observation pipes with a diameter equal to the underdrain diameter shall be connected to the underdrain every 250 to 300 feet to provide a clean-out port as well as an observation well to monitor dewatering rates. The wells/cleanouts shall be connected to the perforated underdrain with the appropriate manufactured connections. The wells/cleanouts shall extend 6 inches above the top elevation of the bioretention facility mulch, and shall be capped with a lockable screw cap. The ends of underdrain pipes not terminating in an observation well/cleanout shall also be capped.

6. The following aggregate shall be used to provide a gravel blanket and bedding for the underdrain pipe. Place the underdrain on a bed of washed aggregate at a minimum thickness of 6 inches and cover with the same aggregate to provide a 1-foot minimum depth around the top and sides of the slotted pipe.

Sieve size	Percent Passing
¾ inch	100
¼ inch	30-60
US No. 8	20-50
US No. 50	3-12
US No. 200	0-1

7. At the option of the designer/geotechnical engineer, a geotextile fabric may be placed between the planting media and the drain rock. If a geotextile fabric is used it must meet the following minimum materials requirements.

Geotextile Property	**Value**	**Test Method**
Trapezoidal Tear (lbs)	40 (min)	ASTM D4533
Permeability (cm/sec)	0.2 (min)	ASTM D4491
AOS (sieve size)	#60 - #70 (min)	ASTM D4751
Ultraviolet resistance	70% or greater	ASTM D4355

Preferably, aggregate should be used in place of filter fabric to reduce the potential for clogging. This aggregate layer should consist of 2 - 4 inches of washed sand underlain with 2 inches of Choking Stone (Typically #8 or #89 washed).

8. The underdrain shall be elevated from the bottom of the bioretention facility by 6 inches within the gravel blanket to create a fluctuating anaerobic/aerobic zone below the drain

pipe. *Intent: denitrification within the anaerobic/anoxic zone is facilitated by microbes using forms of nitrogen (NO2 and NO3) instead of oxygen for respiration.*

9. The underdrain must drain freely to an acceptable discharge point. The underdrain can be connected to a downstream open conveyance (vegetated swale), to another bioretention cell as part of a connected treatment system, daylight to a vegetated dispersion area using an effective flow dispersion device, stored for reuse, or to a storm drain.

Overflow

An overflow device is required at the 18-inch ponding depth. The following, or equivalent, should be provided:

1. A vertical PVC pipe (SDR 35) shall be connected to the underdrain.

2. The overflow riser(s) should be 6 inches or greater in diameter, so it can be cleaned without damage to the pipe. The vertical pipe will provide access to cleaning the underdrains.

3. The inlet to the riser should be 6 inches above the planting media, and be capped with a spider cap to exclude floating mulch and debris.

Hydraulic Restriction Layers

Infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner may be placed along the vertical walls to reduce lateral flows. This liner shall have a minimum thickness of 30 mils.

Planting/Storage Media

1. The planting media placed in the cell shall be highly permeable and high in organic matter (e.g., loamy sand mixed thoroughly with compost amendment) and a surface mulch layer.

2. Planting media shall consist of 60 to 70% sand, 15 to 25% compost, and 10 to 20% clean topsoil. The organic content of the soil mixture should be 8% to 12%; the pH range should be 5.5 to 7.5.

3. Sand should be free of stones, stumps, roots or other similar objects larger than 5 millimeters, and have the following gradation:

Particle Size (ASTM D422)	% Passing
#4	100
#6	88-100
#8	79-97
#50	11-35
#200	5-15

4. Compost should be free of stones, stumps, roots or other similar objects larger than ¾ inches; have a particle size of 98% passing through ¾" screen or smaller; and meet the following characteristics:

    - Soluble Salt Concentration: < 10 mmhos/cm (dS/m)
    - pH: 5.0-8.5
    - Moisture: 30-60% wet weight basis
    - Organic Matter: 30-65% dry weight basis
    - Stability (Carbon Dioxide evolution rate): >80% relative to positive control
    - Maturity (Seed emergence and seedling vigor): >80% relative to positive control
    - Physical contaminants: < 1% dry weight basis

5. Topsoil shall be free of stones, stumps, roots or other similar objects larger than 2 inches, and have the following characteristics:

    - Soluble salts: < 4.0 mmhos/cm (dS/m)
    - pH range: 5.5 to 7.0
    - Organic matter: > 5%
    - Carbon to Nitrogen Ratio: < 20:1
    - Moisture content: 25-55%

Particle Size (ASTM D422, D1140)	% Passing
3/4"	98
Sand (0.05 - 2.0 mm)	50-75
Silt (0.002 - 0.05 mm)	15-40
Clay	< 5

6. The bioretention area shall be covered with 2 – 4 inches (average 3 inches) of mulch at the start and an annual placement of 1-2 inches of mulch beneath plants. *Intent: this will help sustain nutrient levels, suppress weeds, and maintain infiltrative capacity.* Mulch shall be:

    - Well-aged, shredded or chipped woody debris or plant material. Well-aged mulch is defined as mulch that has been stockpiled or stored for at least twelve (12) months. Compost meeting the requirements above may also be used (compost is less likely to float and is a better source for organic materials).

    - Free of weed seeds, soil, roots and other material that is not bole or branch wood and bark.

    - A maximum of 2 to 3 inches thick (*intent: thicker applications can inhibit proper oxygen and carbon dioxide cycling between the soil and atmosphere*).

    - Grass clippings or pure bark shall not be used as mulch.

7. Planting media design height shall be marked appropriately, such as a collar on the vertical riser (if installed), or with a stake inserted 2 feet into the planting media and notched to show bioretention surface level and ponding level.

8. The bioretention soil mix shall be tested and meet the following criteria:

Item	Criteria	Test Method
Corrected pH	5.5 – 7.5	ASTM D4972
Magnesium	Minimum 32 ppm	*
Phosphorus (Phosphate - P_2O_5)	Not to exceed 69 ppm	*
Potassium (K_2O)	Minimum 78 ppm	*
Soluble Salts	Not to exceed 500 ppm	*

* Use authorized soil test procedures.

Should the pH fall outside of the acceptable range, it may be modified with lime (to raise) or iron sulfate plus sulfur (to lower). The lime or iron sulfate must be mixed uniformly into the soil mix prior to use in bioretention facilities.

Should the soil mix not meet the minimum requirement for magnesium, it may be modified with magnesium sulfate. Likewise, should the soil mix not meet the minimum requirement for potassium, it may be modified with potash. Magnesium sulfate and potash must be mixed uniformly into the soil mix prior to use in bioretention facilities.

Limestone. Limestone shall contain not less than 85 percent calcium and magnesium carbonates. Dolomitic (magnesium) limestone shall contain at least 10 percent magnesium as magnesium oxide and 85 percent calcium and magnesium carbonates.

Limestone shall conform to the following gradation:

Sieve Size	Minimum Percent Passing By Weight
No. 10	100
No. 20	98
No. 100	50

Iron Sulfate. Iron sulfate shall be a constituent of an approved horticultural product produced as a fertilizer for supplying iron and as a soil acidifier.

Magnesium Sulfate. Magnesium sulfate shall be a constituent of an approved horticultural product produced as a fertilizer.

Potash. Potash (potassium oxide) shall be a constituent of an approved horticultural product produced as a fertilizer.

Plants

1. Prior to installation, a licensed landscape architect shall certify that all plants, unless otherwise specifically permitted, conform to the standards of the current edition of American Standard for Nursery Stock as approved by the American Standards Institute, Inc. All plant grades shall be those established in the current edition of American Standards for Nursery Stock.

2. Shade trees shall have a single main trunk. Trunks shall be free of branches below the following heights:

CALIPER (in)	HEIGHT (ft)
1-1/2 to 2-1/2	5
3	6

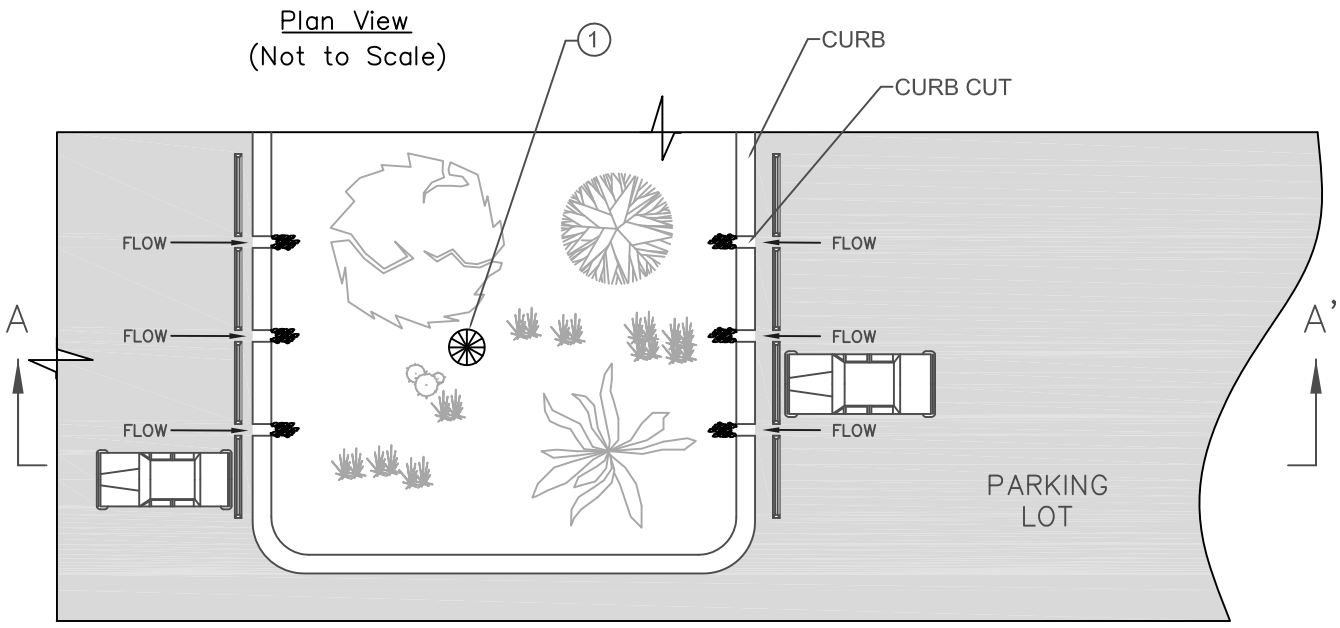
- Plant materials shall be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 48 hours.

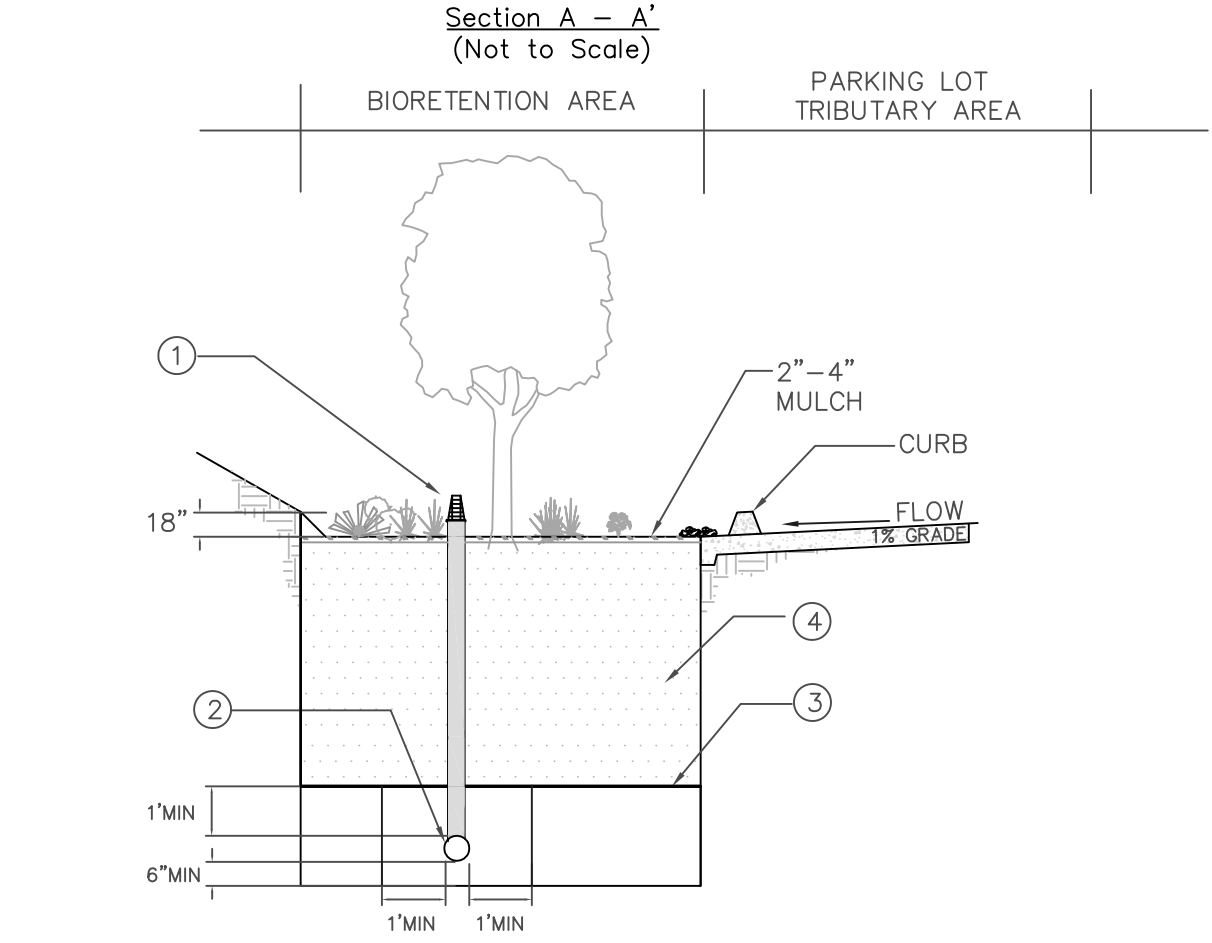
- It is recommended that a minimum of three tree, three shrubs, and three herbaceous groundcover species be incorporated to protect against facility failure due to disease and insect infestations of a single species. Plant rooting depths shall not damage underdrain if present. Slotted or perforated underdrain pipe should be more than 5 feet from tree locations (if space allows).

- Native plant species and/or hardy cultivars that are not invasive and do not require chemical inputs shall be used to the maximum extent practicable.

Restricted Construction Materials

The use of treated wood or galvanized metal anywhere inside the facility is prohibited.





NOTES

① OVERFLOW DEVICE: VERTICAL RISER OR EQUIVALENT.

② PERFORATED 6" MIN PVC PIPE UNDERDRAIN SYSTEM (AS NEEDED). WHERE SOIL CONDITIONS ALLOW, OMIT THE UNDERDRAIN AND INSTALL AN APPROPRIATELY SIZED GRAVEL DRAINAGE LAYER (TYPICALLY A WASHED 57 STONE) BENEATH THE PLANTING MEDIA FOR ENHANCED INFILTRATION.

③ OPTIONAL CHOKING GRAVEL LAYER.

④ 2' MIN PLANTING MIX; 3' PREFERRED.

Figure 5–1
BIORETENTION

Bioretention Operations and Maintenance

General Requirements

Bioretention areas require annual plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. In general, bioretention maintenance requirements are typical landscape care procedures and include:

1. Watering: Plants should be selected to be drought tolerant and not require watering after establishment (2 to 3 years). Watering may be required during prolonged dry periods after plants are established.

2. Erosion control: Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred (see Appendix E for guidance on facility inspection and Appendix F for a bioretention inspection and maintenance checklist). Properly designed facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems occur the following should be reassessed: (1) flow velocities and gradients within the cell, and (2) flow dissipation and erosion protection strategies in the pretreatment area and flow entrance. If sediment is deposited in the bioretention area, immediately determine the source within the contributing area, stabilize, and remove excess surface deposits.

3. Plant material: Depending on aesthetic requirements, occasional pruning and removing of dead plant material may be necessary. Replace all dead plants and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species. Periodic weeding is necessary until plants are established. The weeding schedule should become less frequent if the appropriate plant species and planting density have been used and, as a result, undesirable plants excluded.

4. Nutrient and pesticides: The soil mix and plants are selected for optimum fertility, plant establishment, and growth. Nutrient and pesticide inputs should not be required and may degrade the pollutant processing capability of the bioretention area, as well as contribute pollutant loads to receiving waters. By design, bioretention facilities are located in areas where phosphorous and nitrogen levels are often elevated and these should not be limiting nutrients. If in question, have soil analyzed for fertility.

5. Mulch: Replace mulch annually in bioretention facilities where heavy metal deposition is likely (e.g., contributing areas that include industrial and auto dealer/repair parking lots and roads). In residential lots or other areas where metal deposition is not a concern, replace or add mulch as needed to maintain a 2 to 3 inch depth at least once every two years.

6. Soil: Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems. Replacing mulch in bioretention facilities where heavy metal

deposition is likely provides an additional level of protection for prolonged performance. If in question, have soil analyzed for fertility and pollutant levels.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for bioretention areas is shown in Table 5-1. Detailed Routine and major maintenance standards are listed in Tables 5-2 and 5-3.

Table 5-1: Bioretention Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Repair small eroded areas and ruts by filling with gravel. Overseed bare areas to reestablish vegetation • Remove trash and debris and rake surface soils to mitigate ponding • Remove accumulated fine sediments, dead leaves and trash to restore surface permeability • Remove any evidence of visual contamination from floatables such as oil and grease • Eradicate weeds and prune back excess plant growth that interferes with facility operation. Remove invasive vegetation and replace with non-invasive species • Remove sediment and debris accumulation near inlet and outlet structures to alleviate clogging • Clean and reset flow spreaders (if present) as needed to restore original function • Mow routinely to maintain ideal grass height and to suppress weeds • Periodically observe function under wet weather conditions
Major Maintenance	• Repair structural damage to flow control structures including inlet, outlet and overflow structures • Clean out under-drain, if present, to alleviate ponding. Replace media if ponding or loss of infiltrative capacity persists and revegetate • Regrade and revegetate to repair damage from severe erosion/scour channelization and to restore sheet flow • Take photographs before and after major maintenance (encouraged)

Table 5-2: Routine Maintenance – Bioretention

Defect or Problem	**Condition When Maintenance is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Erosion	Splash pads or spreader incorrectly placed; eroded or scoured areas due to flow channelization, or higher flows.	No erosion on surface of basin. No erosion or scouring evident. For ruts or bare areas less than 12 inches wide, damaged areas repaired by filling with crushed gravel. The grass will creep in over the rock in time.	Annually prior to wet season. After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs
Standing Water	When water stands in the basin between storms and does not drain freely (with 36- 48 hours after storm event).	Water drains completely from basin as designed and surface is clear of trash and debris. Underdrains (if installed) are cleared.	
Loss of Surface Permeability	Accumulation of fine sediments, dead leaves, trash and other debris on surface	Surface permeability restored. Surface layer removed and replaced with fresh mulch.	
Visual Contaminants and Pollution	Any visual evidence of oil, gasoline, contaminants or other pollutants.	No visual contaminants or pollutants present.	Monthly (or as dictated by agreement between County and landscape contractor
Vegetation	Weeds, excessive plant growth, plants interfering with basin operation, plants diseased or dying	Basin tidy, plants healthy and pruned. Any plants that interfere with function are removed. Invasive or non-acclimated plants replaced.	
Inlet/Overflow	Inlet/outlet areas clogged with sediment and/or debris.	Material removed so that there is no clogging or blockage of the inlet or overflow area.	
Trash and Debris	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (one standard garbage can).	Trash and debris removed and facility looks well kept.	

Table 5-3: Major Maintenance – Bioretention

Defect or Problem	**Condition When Maintenance is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Standing water	When water stands in the basin between storms and does not drain freely (with 36- 48 hours after storm event).	Filter media (sand, gravel, and topsoil) and vegetation removed and replaced.	Annually prior to wet season
Erosion/ Scouring	Bare spots greater than 12 inches	No erosion on surface of basin. Large bare areas are regraded and reseeded/replanted.	As needed

6. INFILTRATION FACILITIES

Definition

Infiltration facilities included in this manual include infiltration basins and infiltration trenches. In general, infiltration facilities are similar to stormwater detention systems but are constructed with a highly permeable base that is specifically designed to infiltrate runoff. It is usually not practical to infiltrate runoff at the same rate that it is generated; therefore, these facilities generally include both a storage component and a drainage component.

Infiltration basins are usually shallow with flat, vegetated bottoms and side slopes and can be incised by excavating a depression below the existing grade or constructed above grade by constructing a perimeter berm.

Infiltration trenches are long, narrow, rock-filled trenches that receive stormwater runoff from small drainage areas. These facilities may include a shallow depression at the surface, but the majority of runoff is stored in the void space between the stones and infiltrates through the sides and bottom of the trench.

Pretreatment BMPs such as swales, filter strips, and sediment forebays/basins/manholes that minimize sediment loads to infiltration facilities are recommended to increase longevity and reduce the maintenance burden of infiltration facilities.

Infiltration facilities are ideal for hydromodification control, where surface runoff volume reductions are desired. Infiltration facilities are also good candidates for the removal of fine sediment, particulate bound pollutants, and bacteria. The primary pollutant removal processes in infiltration facilities include volume and associated pollutant load reduction, sedimentation, filtration, and adsorption. Sedimentation of coarse particles should, however, be minimized in infiltration facilities through the use of appropriate pretreatment devices to prevent clogging. Infiltration facilities can be used to provide complete reduction of pollutant loads to downstream receiving water systems. Ideal sites for infiltration facilities are areas with permeable soils and depth to seasonally high groundwater levels that is at least 10 feet below the existing ground surface. Infiltration facilities should not be used for industrial sites or locations where hazardous materials spills may occur.

General Constraints and Siting Considerations

- Slope stability - infiltration facilities are not permitted near steep slope hazard areas
- Setbacks - a minimum setback from structures or leach fields is required for infiltration facilities
- Native soil infiltration rate - performance can be limited by the permeability of native soils
- Depth to groundwater - a vertical separation is required between the infiltration surface and the shallow groundwater table to ensure that the facility will completely drain between storms and that infiltrating water will receive adequate treatment though the soils before it reaches the groundwater

- Depth to bedrock or impervious soil layer - a shallow confining layer may inhibit complete infiltration of SUSMP volume
- Contaminated soils - infiltration facilities are not permitted at sites with existing soil contamination
- Surface space availability - large footprint required
- High sediment loading rates - may clog quickly if sediment loads are high (e.g., unstabilized site) or flows are not adequately pretreated

Multi-Use Opportunities

Under special circumstances an infiltration basin may be combined with a detention basin to provide both water quality control and peak flow control. However, this practice is not recommended at sites receiving high sediment loadings due to the potential for clogging and the associated maintenance burden. Infiltration basins may also be integrated into the design of a park or playfield. Recreational multi-use facilities must be inspected after every storm and may require a greater maintenance frequency than dedicated water quality basins as to ensure aesthetics and public safety are not compromised. Any planned multi-use facility must obtain approval by the affected County department(s).

Infiltration Facility Design Specifications

Geotechnical Considerations

Due to the potential to contaminate groundwater, cause slope instability, impact surrounding structures, and potential for insufficient infiltration capacity, an extensive geotechnical site investigation must be undertaken early in the site planning process to verify site suitability for the installation of infiltration facilities. Soil infiltration rates and the water table depth should be evaluated to ensure that conditions are satisfactory for proper operation of an infiltration facility. See Appendix G, Policy for New Percolation Basin Testing, Design, and Maintenance.

The applicant must demonstrate through infiltration testing, soil logs, and the written opinion of a licensed civil engineer that sufficiently permeable soils exist on site to allow the construction of a properly functioning infiltration facility.

1. Infiltration facilities require a minimum soil infiltration rate of 0.5 inches/hour. If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated in an upstream BMP prior to infiltration to protect groundwater quality. Pretreatment for coarse sediment removal is required in all instances.

2. Groundwater separation must be at least 10 feet from the basin or trench bottom to the measured groundwater elevation and at least 100 horizontal feet from any drinking water wells. Measurements of groundwater levels must be made during the time when water level is expected to be at a maximum (i.e., toward the end of the wet season).

3. Infiltration facilities are not suitable to collect runoff from sites that use or store chemicals or hazardous materials outside. [*Note: Infiltration facilities are not suitable for industrial*

sites or locations where spills can occur. In these areas, one of the other BMPs in this manual should be used].

4. Infiltration facilities are not suitable for un-remediated "brownfield sites" where there is known groundwater or soil contamination.

5. Sites with a slope greater than 25% (4:1) shall be excluded. A geotechnical analysis and report addressing slope stability are required if located on slopes greater than 15%.

6. An infiltration facility must not be located within 15 feet of a 2:1 or greater slope. The geotechnical report must address the potential effects of infiltration on the stability of the slope if the facility is sited within 200 feet of the slope or a mapped landslide.

Site Geotechnical Investigation

1. A geotechnical report shall state whether the site is suitable for the proposed infiltration basin, and shall recommend a design infiltration rate (see "Design Infiltration Rate" under the "Sizing Criteria" section). The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Setbacks

1. Infiltration facilities shall be setback a minimum of 100 feet from proposed or existing septic system drain fields and drinking water wells.

2. Infiltration facilities shall be setback a minimum of 15 feet from any 2:1 or steeper slope.

3. Infiltration facilities shall be setback 8 feet from any structural foundation. The 8-foot setback may be reduced to a minimum of 5 feet if geotechnical evaluations address the potential impacts of the facility's phreatic surface on adjacent structural foundations.

Pretreatment

Pretreatment is provided for infiltration facilities in order to reduce the sediment load entering the facility and maintain the infiltration rate of the basin. Pretreatment refers to design features that provide settling of large particles before runoff reaches a management practice; easing the long-term maintenance burden. Pretreatment is important for all structural stormwater management practices, but it is particularly important for infiltration practices. To ensure that pretreatment mechanisms are effective, designers shall incorporate sediment reduction practices. Sediment reductions BMPs may include vegetated swales, vegetated filter strips, sedimentation basins or forebays, sedimentation manholes and hydrodynamic separation devices. The use of at least two pretreatment devices is highly recommended for infiltration facilities.

For design specification of selected pre-treatment devices, refer to:

- Filter Strip (Section 4)

- Vegetated Swales (Section 3)
- Proprietary Devices (Section 11)

Sizing Criteria

As with sand filters, infiltration facilities can be sized using one of two methods: a simple sizing method or a routing modeling method. With either method the SUSMP volume must be completely infiltrated within 72 hours. Infiltration basins provide the majority of storage above ground while infiltration trenches provide the majority of storage in the voids of the rock fill. The simple sizing procedures provided below can be used for either infiltration basins or trenches. For the routing modeling method, refer to Section 10 - Sand Filters.

Step 1: Calculate the design volume

Infiltration facilities shall be sized to capture and infiltrate the SUSMP volume (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)).

Step 2: Determine the design percolation rate

The percolation rate will decline between maintenance cycles as the surface becomes occluded and particulates accumulate in the infiltrative layer. Monitoring of actual facility performance has shown that the full-scale infiltration rate is far lower than the rate measured by small-scale testing. It is important that adequate conservatism is incorporated in the selection of design percolation rates. For infiltration trenches, the design percolation rate discussed here is the percolation rate of the underlying soils and not the percolation rate of the filter media bed (refer to the "Facility Geometry" section for the recommended composition of the filter media bed for infiltration trenches).

A simplified method may be used to determine the design percolation rate by applying correction factors to the field measured percolation rate. These factors take into account uncertainty in measurement procedure, depth to water table or impermeable strata, infiltration facility geometry, and long term reductions in permeability due to biofouling and accumulation of fines.

$$P_{design} = P_{measured} \times F_{testing} \times F_{plugging} \times F_{geometry} \qquad \text{(Equation 6-1)}$$

Where:

P_{design}	=	design percolation rate (in/hr)
$P_{measured}$	=	measured percolation rate (per Policy for New Percolation Basin Testing, Design, and Maintenance, Appendix G or as amended) (in/hr)
F	=	correction factor

$F_{testing}$ takes into account uncertainties in the testing method and is 0.5.

$F_{plugging}$ accounts for reductions in infiltration rates over the long term caused by plugging of soils. The factor is:

- 0.7 for loams and sandy loams
- 0.8 for fine sands and loamy sands
- 0.9 for medium sands
- 1.0 for coarse sands or cobbles or for any facility preceded by a full specification filter strip or vegetated swale.

$F_{geometry}$ accounts for the influence of facility geometry and depth to the water table or impervious strata on the actual infiltration rate. $F_{geometry}$ must be between 0.25 and 1.0 as determined by the following equation:

$$F_{geometry} = 4\ D/W + 0.05 \qquad \text{(Equation 6-2)}$$

Where:

D = depth from the bottom of the facility to the maximum wet-season water table elevation or nearest impervious layer, whichever is less (ft)
W = width of the facility (ft)

Note that adjusted percolation rate (P_{design}) may be different for basins and trenches installed in the same location due to differences in dimension.

Step 3: Calculate the surface area

Determine the size of the required infiltrating surface by assuming the SUSMP volume will fill the available ponding depth plus the void spaces based on the computed porosity of the filter media (normally about 32%).

1. Determine the maximum depth of runoff that can be infiltrated within the required drain time (72 hr) as follows:

$$d_{\max} = \frac{P_{design}}{12} t \qquad \text{(Equation 6-3)}$$

Where:

t = required drain time (hrs) [Use 72 hours]
P_{design} = design percolation rate of underlying soils (in/hr)
d_{max} = the maximum depth of water that can be infiltrated within the required drain time (ft)

2. Choose the ponding depth (d_p) and/or trench depth (d_t) such that:

$$d_{\max} \geq d_p \qquad \text{For Infiltration Basins} \qquad \text{(Equation 6-4)}$$

$$d_{\max} \geq n_t d_t + d_p \qquad \text{For Infiltration Trenches} \qquad \text{(Equation 6-5)}$$

Where:

d_p = ponding depth (ft)
n_t = trench fill aggregate porosity (unitless)
d_t = depth of trench fill (ft)
d_{max} = the maximum depth of water that can be infiltrated within the required drain time (ft)

3. Calculate infiltrating surface area (filter bottom area) required:

$$A = \frac{WQ_v}{((TP_{design}/12)+d_p)}$$ For Infiltration Basins (Equation 6-6)

$$A = \frac{WQ_v}{((\ TP_{design}/12\ )+n_t d_t + d_p)}$$ For Infiltration Trenches (Equation 6-7)

(Adapted from Georgia Stormwater Manual: http://www.georgiastormwater.com/vol2/3-2-5.pdf)

Where:

WQ_v = design water quality volume (ft^3)
n_t = trench fill aggregate porosity (unitless)
P_{design} = design percolation rate (in/hr)
d_p = ponding depth (ft)
d_t = depth of trench fill (ft)
T = fill time (time to fill to max ponding depth with water) (hrs) [use 2 hours for most designs]

Facility Geometry

Infiltration Basins

1. Infiltration basins shall be designed and constructed with the flattest bottom slope possible to promote uniform ponding and infiltration across the facility.

2. A sediment forebay is required unless adequate pretreatment is provided in a separate pretreatment unit (e.g. upstream hydrodynamic device or vegetated swale) to address sediment loads, or the tributary catchment is mostly impervious. The sediment forebay, if present, shall have a volume equal to 25% of the total infiltration basin volume.

3. The forebay shall be designed with a minimum length to width ratio of 2:1 and must completely drain to the main basin through an 8-inch minimum low-flow outlet.

4. All inlets shall enter the sediment forebay. If there are multiple inlets into the forebay, the length-to-width ratio shall be based on the average flowpath length for all inlets.

5. Side-slopes shall be no steeper than 3H:1V.

Infiltration Trench

1. Infiltration trenches shall be at least 24 inches wide and 3 to 5 feet deep.

2. The longitudinal slope of the trench should not exceed 3%

3. The filter bed media layers shall have the following composition and thickness:

    - Top layer (top 2 inches of pea gravel)
    - Middle layer (3-5 feet of washed 2 to 6-inch gravel). Void space should be in the range of 30 percent to 40 percent.
    - Bottom layer (6 inches of sand or fabric equivalent)

4. An observation well should be installed at the lower end of the infiltration trench to check for water levels and drawdown time. A typical observation well consists of a slotted PVC well screen, 4 to 6 inches in diameter, capped with a lockable, above-ground lid. Ensure that the screened interval is short and placed near the bottom of the trench to avoid piping.

Embankments

1. Embankments are earthen slopes or berms used to detain or redirect the flow of water.

2. The minimum top width of all berm embankments shall be 20 feet, or as approved by the Geotechnical and Materials Division.

3. Basin berm embankments must be constructed on native consolidated soil (or adequately compacted and stable fill soils analyzed by a licensed geotechnical engineer) free of loose surface soil materials, roots, and other organic debris.

4. Earthworks shall be in accordance with Section 300-6 of the Standard Specifications for Public Works Construction, most recent edition.

5. Basin berm embankments greater than 4 feet in height must be constructed by excavating a key equal to 50% of the berm embankment cross-sectional height and width. This requirement may be waived if specifically recommended by a licensed geotechnical engineer.

6. The berm embankment shall be constructed of compacted soil (95% minimum dry density, modified proctor method per ASTM D1557), placed in 6-inch lifts.

7. Low growing native or non-invasive perennial grasses shall be planted on downstream embankment slopes. See the Vegetation Management on Embankment Dams of Public Works' Debris Control Facilities, Attachment B, for a recommended plant list.

Additional Control Functions

Infiltration basins can be designed to provide channel protection, and/or flood control by providing storage capacity in excess of that provided for water quality and incorporating outlet controls. The additional storage and outlet structure should be provided per the requirements

outlined in the Extended Detention Basins section of this document (see Section 2). Note that the selected outlet structure shall not be designed to drain the water quality volume and shall be similar to outlet structures that maintain a permanent pool (see Section 8 - Wetponds and Lakes).

Drainage

1. The bottom of infiltration bed must be native soil, over-excavated to at least one foot in depth and the soil replaced uniformly without compaction. Amending the excavated soil with 2-4 inches (~15-30%) of coarse sand is recommended.

2. The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

3. The hydraulic conductivity of the subsurface layers should be sufficient to ensure a maximum 72-hr drawdown time. An observation well shall be incorporated to allow observation of drain time.

4. For infiltration basins, an underdrain shall be installed within the bottom layer to provide drainage in case of standing water. The underdrain shall be operated by opening a valve, which shall be closed during normal operation. Cleanouts shall be provided for the underdrain.

Emergency Overflow

There must be an overflow route for stormwater flows that overtop the facility or in case the infiltration facility becomes clogged.

1. For online facilities, the overflow channel must be able to safely convey flows from the capital storm to the downstream conveyance system or other acceptable discharge point. Sizing is based on the LACDPW Hydraulics and Hydrology/Sedimentation manuals.

Vegetation

<u>Infiltration Basin</u>

1. A thick mat of drought tolerant grass should be established on the basin floor and side-slopes following construction. Grasses can help prevent erosion and increase evapotranspiration and their rhizomes discourage compaction within the root zone helping to maintain the surface infiltration rates. Additionally, the active growing vegetation can help break up surface crusts that accumulate from sedimentation of fine particulates.

2. Grass may need to be irrigated during establishment.

3. Facility will not be accepted by the County/Flood Control District until vegetation is well established and functioning.

Infiltration Trench

1. Infiltration trenches shall be kept free of vegetation.

2. Trees and other large vegetation should be planted away from trenches such that drip lines do not overhang infiltration beds.

Maintenance Access

Infiltration Basin

Infiltration basins require access provisions similar to dry extended detention basins (Section 2).

A maintenance access road(s) shall be provided to the drainage structures associated with the basin (e.g., inlet, emergency overflow or bypass structures). Manhole and catch basin lids must be in or at the edge of the access road.

An access ramp to the basin bottom is required to facilitate the entry of sediment removal and vegetation maintenance equipment without compaction of the basin bottom and side slopes.

Access roads shall meet the following design criteria:

1. All access ramps and roads shall be paved with a minimum of 6 inches of concrete over 3 inches of crushed aggregate base material. This requirement may be modified depending on the soil conditions and intended use of the road at the discretion of the Department.

2. Maximum grade shall be 12% unless otherwise approved by the Department.

3. Centerline turning radius shall be 40 feet, minimum.

4. Access roads less than 500 ft long shall have 12 feet wide pavement within a minimum 15 feet wide bench. Access roads greater than 500 feet long shall have 16 feet wide pavement within a minimum 20 feet wide bench.

5. All access roads shall terminate with turnaround areas of 40 feet by 40 feet. A hammer type turn around area or a circle drive around the top of the facility is also acceptable.

6. Adequate double-drive gates and commercial driveways are required at street crossings. Gates should be located a minimum of 25 feet from the street curb except in residential areas where the gates may be located along the property line provided there is adequate site distance to see oncoming vehicles at the posted speed limit.

Infiltration Trench

1. The facility and outlet structures must all be safely accessible during wet and dry weather conditions.

2. An access road along the entire length of the trench is required unless the trench is located along an existing road or parking lot that can be safely used for maintenance access.

3. If the infiltration facility becomes plugged and fails, then access is needed to excavate the facility to remove and replace the filter bed media, as well as to increase all dimensions of the facility by 2 inches to provide a fresh surface for infiltration. To prevent damage and compaction, access must be able to accommodate a backhoe working at "arms length" from the berm.

Construction

1. Infiltration facilities shall not be hydraulically connected to the storm drain system until all contributing drainage areas are stabilized (e.g., with vegetation or pavement) as shown on the Contract Plans and to the satisfaction of the Engineer. Infiltration facilities shall not be used as sediment control facilities.

2. To preserve and avoid the loss of infiltration capacity, the following construction guidelines must be specified:

    - The entire area draining to the facility must be stabilized before construction begins. If this is infeasible, a diversion berm must be placed around the perimeter of the infiltration site to prevent sediment entrance during construction and landscape establishment.

    - Compaction of the subgrade with heavy equipment should be minimized to the maximum extent possible. If the use of heavy equipment on the base of the facility cannot be avoided, the infiltrative capacity should be restored by tilling or aerating prior to placing the infiltrative bed.

    - The exposed soils must be inspected by a soil engineer after excavation to confirm that soil conditions are suitable.

Landscaping

Landscaping outside of the basin, but within the easement/right-of-way, is required for infiltration basins and must adhere to the following criteria so as not to hinder maintenance operations:

1. No trees or shrubs may be planted within 10 feet of inlet or outlet pipes or manmade drainage structures such as spillways, flow spreaders, or earthen embankments. Species with roots that seek water, such as willow or poplar, shall not be used within 50 feet of pipes or manmade structures. Weeping willow (*Salix babylonica*) should not be planted in or near detention basins.

2. Prohibited non-native plant species will not be permitted. For more information on invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist.

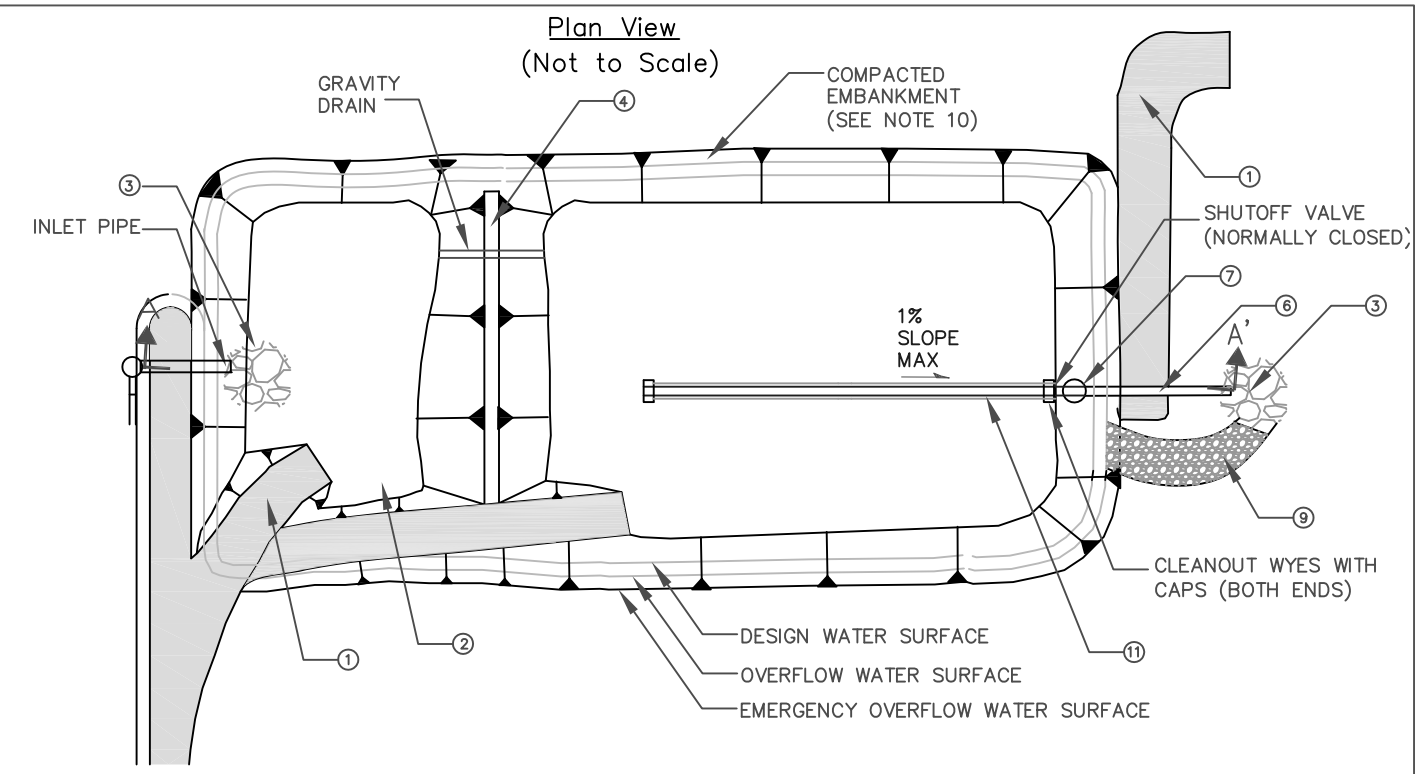
3. Other resources for identifying suitable plant types for specific BMP areas can be found by consulting a nurseryman, arborist, landscape architect or referring to various online sources such as:
    - CalFlora - a database of wild California plants that include plant characteristics and photos
      http://www.calflora.org
    - L.A. River Master Plan Landscaping and Plant Palettes - a guidance document providing a listing of native plant communities in the Los Angeles area
      http://ladpw.org/wmd/watershed/LA/LAR_planting_guidelines_webversion.pdf

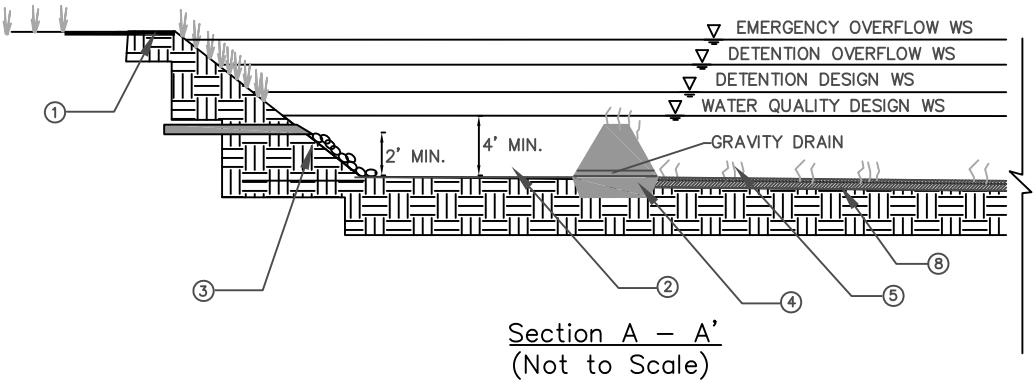
    a. Jepson Online Interchange For California Floristics - a database that provides information on identification, taxonomy, distribution, ecology, relationships, and diversity of California vascular plants.
       http://ucjeps.berkeley.edu/interchange.html

    - VegSpec - a web-based decision support system that assists land managers in the planning and design of vegetative establishment practices
      http://ironwood.itc.nrcs.usda.gov/Netdynamics/Vegspec/pages/HomeVegspec.htm
    - USDA Plants Database - an extensive database of native and non-native plants of the United States with over 100 plant characteristics
      http://plants.usda.gov/index.html

Restricted Construction Materials

The use of treated wood or galvanized metal anywhere inside the facility is prohibited.





Section A – A'
(Not to Scale)

NOTES:

(1) MAINTENANCE RAMP SHOULD BE PAVED. SLOPE SHOULD NOT EXCEED 12%. MAINTENANCE RAMP SHOULD PROVIDE ACCESS TO BOTH THE FIRST CELL AND MAIN BASIN.

(2) UPSTREAM PRETREATMENT SHALL BE PROVIDED. SEDIMENT FOREBAY WITH VOLUME EQUAL TO 25% OF TOTAL INFILTRATION BASIN VOLUME MAY BE USED IN LIEU OF UPSTREAM PRETREATMENT. DEPTH SHALL BE 4' MIN TO 8' MAX PLUS AN ADDITIONAL 1 FOOT MIN SEDIMENT STORAGE DEPTH.

(3) RIP RAP APRON OR OTHER ENERGY DISSIPATION.

(4) EXTEND EARTHEN BERM ACROSS ENTIRE WIDTH OF THE INFILTRATION BASIN.

(5) INFILTRATION BASIN BOTTOM AND SIDE SLOPES SHALL BE PLANTED WITH DROUGHT TOLERANT VEGETATION. DEEP ROOTED VEGETATION PREFERRED FOR BASIN BOTTOM. NO TOPSOIL SHALL BE ADDED TO INFILTRATION BASIN BED.

(6) SIZE OUTLET PIPE TO PASS CAPITAL DESIGN PEAK FLOW FOR ON–LINE INFILTRATION BASINS AND WATER QUALITY PEAK FLOW FOR OFF–LINE INFILTRATION BASINS.

(7) WATER QUALITY OUTLET STRUCTURE. SEE FIGURE 7–2 AND FIGURE 7–3 FOR DETAILS.

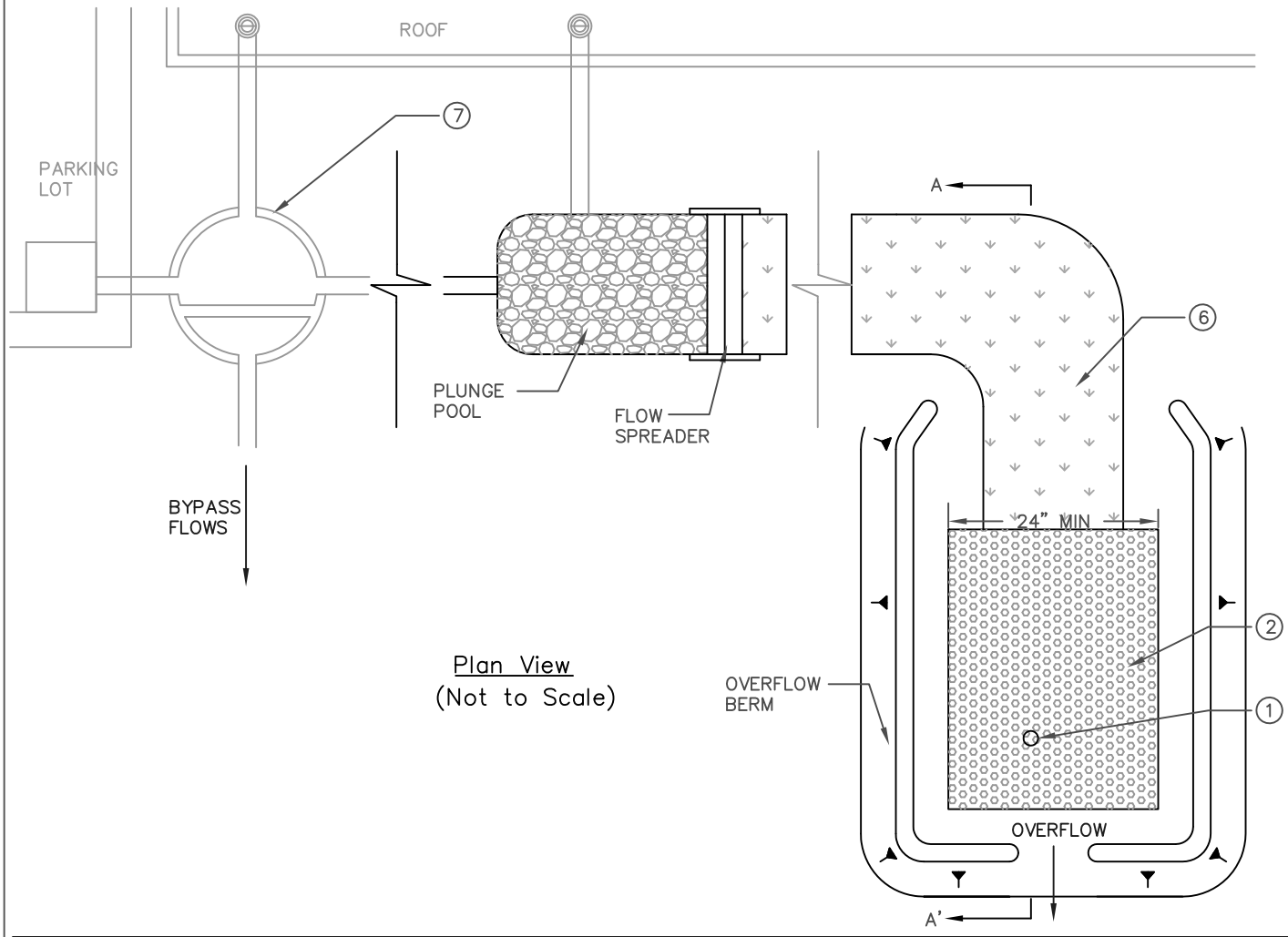
(8) OVER EXCAVATE BASIN BOTTOM 1 FOOT. RE–PLACE EXCAVATED MATERIAL UNIFORMLY WITHOUT COMPACTION. AMENDING EXCAVATED MATERIAL WITH 2" – 4" OF COARSE SAND IS RECOMMENDED FOR SOILS WITH BORDER LINE INFILTRATION CAPACITY.

(9) INSTALL EMERGENCY OVERFLOW SPILLWAY AS NEEDED. SEE FIGURE 2–4 FOR DETAILS

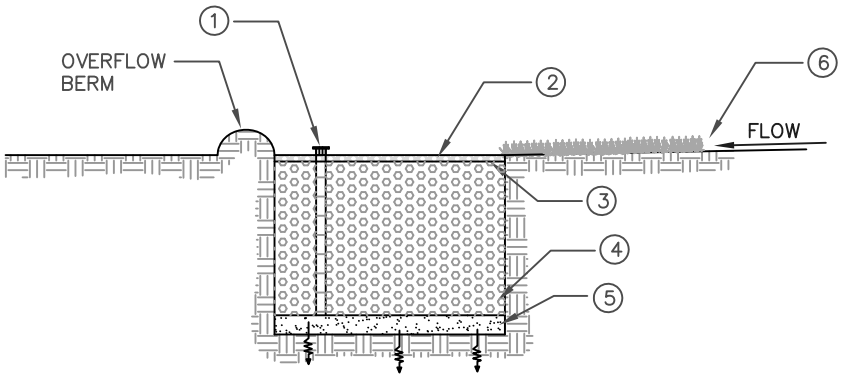
(10) EMBANKMENT SIDE SLOPES SHALL BE NO STEEPER THAN 3H:1V BOTH OUTSIDE AND INSIDE.

(11) INSTALL OPTIONAL 6" MINIMUM DIAMETER PERFORATED PIPE UNDERDRAIN. INSTALL AT 0.5% MINIMUM SLOPE.

Figure 6–1
INFILTRATION BASIN



Plan View
(Not to Scale)



Section A – A'
(Not to Scale)

NOTES:

(1) OBSERVATION WELL WITH LOCKABLE ABOVE-GROUND CAP

(2) 2" PEA GRAVEL FILTER LAYER

(3) PROVIDE FILTER FABRIC IF NO PRETREATMENT IS PROVIDED

(4) 3' – 5' DEEP TRENCH FILLED WITH 2" – 6" DIAMETER CLEAN STONE WITH 30% – 40% VOIDS

(5) 6" DEEP SAND FILTER LAYER (OR FABRIC EQUIVALENT)

(6) RUNOFF FILTERS THROUGH GRASS FILTER STRIP OR VEGETATED SWALE

(7) OPTIONAL FLOW CONTROL DEVICE FOR OFF-LINE CONFIGURATIONS

Figure 6-2
INFILTRATION TRENCH

Infiltration Facility Operations and Maintenance

General Requirements

Infiltration facility maintenance should include frequent inspections to ensure that water infiltrates into the subsurface completely within the recommended infiltration time of 72 hours or less after a storm (see Appendix E for guidance on facility inspection and Appendix F for an infiltration inspection and maintenance checklist).

Maintenance and regular inspections are of primary importance if infiltration basins and trenches are to continue to function as originally designed. A specific maintenance plan shall be developed specific to each facility outlining the schedule and scope of maintenance operations, as well as the documentation and reporting requirements. The following are general maintenance requirements:

1. Regular inspection should determine if the sediment pretreatment structures require routine maintenance.

2. If water is noticed in the basin more than 72 hours after a major storm or in the observation well of the infiltration trench more than 48 hours after a major storm, the infiltration facility may be clogged. Maintenance activities triggered by a potentially clogged facility include:

    - Check for debris/sediment accumulation, rake surface and remove sediment (if any) and evaluate potential sources of sediment and vegetative or other debris (e.g., embankment erosion, channel scour, overhanging trees, etc). If suspected upland sources are outside of the County's jurisdiction, additional pretreatment operations (e.g., trash racks, vegetated swales, etc.) may be necessary.

    - For basins, removal of the top layer of native soil may be required to restore infiltrative capacity.

    - For trenches, assess the condition of the top aggregate layer for sediment buildup and crusting. Remove top layer of pea gravel and replace. If slow draining conditions persist, entire trench may need to be excavated and replaced.

3. Any debris or algae growth located on top of the infiltration facility should be removed and disposed of properly.

4. Facilities should be inspected annually. Trash and debris should be removed as needed, but at least annually prior to the beginning of the wet season.

5. Site vegetation should be maintained as frequently as necessary to maintain the aesthetic appearance of the site, and as follows:

    - Vegetation, large shrubs, or trees that limit access or interfere with basin operation should be pruned or removed.

- Slope areas that have become bare should be revegetated and eroded areas should be regraded prior to being revegetated.
- Grass should be mowed to 4"-9" high and grass clippings should be removed.
- Fallen leaves and debris from deciduous plant foliage should be raked and removed.
- Invasive vegetation, such as Alligatorweed (*Alternanthera philoxeroides*), Halogeton (*Halogeton glomeratus*), Spotted Knapweed (*Centaurea maculosa*), Giant Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Perennial Pepperweed (*Lepidium latifolium*), and Yellow Starthistle (*Centaurea solstitalis*) must be removed and replaced with non-invasive species. Invasive species should never contribute more than 25% of the vegetated area. For more information on invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist. .
- Dead vegetation should be removed if it exceeds 10% of area coverage. Vegetation should be replaced immediately to maintain cover density and control erosion where soils are exposed.

6. For infiltration basins, sediment buildup exceeding 50% of the forebay sediment storage capacity, as indicated by the steel markers, should be removed. Sediment from the remainder of the basin should be removed when 6 inches of sediment accumulates. Sediments should be tested for toxic substance accumulation in compliance with current disposal requirements if visual or olfactory indications of pollution are noticed. If toxic substances are encountered at concentrations exceeding thresholds of Title 22, Section 66261 of the California Code of Regulations, the sediment must be disposed of in a hazardous waste landfill and the source of the contaminated sediments should be investigated and mitigated to the extent possible.

7. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for infiltration facilities is shown in Table 6-1. Detailed routine and major maintenance standards are listed in Tables 6-2 and 6-3.

Table 6-1: Infiltration Facility Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Remove trash and debris as required • Repair and reseed erosion near inlet if necessary • Remove any visual evidence of contamination from floatables such as oil and grease • Clean under-drain (if present) and outlet piping to alleviate ponding and restore infiltrative capacity. • Remove minor sediment accumulation, debris and obstructions near inlet and outlet structures as needed • Mow routinely to maintain ideal grass height and to suppress weeds • Periodically observe function under wet weather conditions • Take photographs before and after maintenance (encouraged)
Major Maintenance	• Clean out under-drains if present to alleviate ponding. Replace media if ponding or loss of infiltrative capacity persists and revegetate • Repair structural damage to flow control structures including inlet, outlet and overflow structures • De-thatch grass to remove accumulated sediment and aerate compacted areas to promote infiltration

Table 6-2: Routine Maintenance – Infiltration Facilities

Defect	**Conditions When Maintenance Is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Trash & Debris	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (one standard garbage can). In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.	Annually prior to wet season. After major storm events (>0.75 in/24 hrs) if spot checks indicate widespread damage/ maintenance needs. Litter removal is dependent on site conditions and desired aesthetics and should be done at a frequency to meet those objectives.
Inlet Erosion	Visible evidence of erosion occurring near inlet structures.	Eroded areas repaired/reseeded	
Visual Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present.	
Slow Drain Time	Standing water long after storm has passed (after 48 to 72 hours), or visual inspection of wells (if available) indicates that design drain times are not being achieved.	Water drains within 48 to 72 hours. Drainage pipe is cleared, accumulated litter on surface is removed, and top 1-2" of soil is raked or replaced.	
Inlets Blocked	Trash and debris or sediment blocking inlet structures.	Inlets clear and free of trash and debris.	
Appearance of Poisonous, Noxious or Nuisance Vegetation	Excessive grass and weed growth. Noxious weeds, woody vegetation establishing, Turf growing over rock filter.	Vegetation is mowed or trimmed to restore function. Weeds are removed to prevent noxious and nuisance plants from becoming established.	Monthly (or as dictated by agreement between County and landscape contractor).

Table 6-3: Major Maintenance – Infiltration Facilities

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Standing Water	Standing water long after storm has passed (after 24 to 48 hours), or visual inspection of wells (if available) indicates that design drain times are not being achieved	Design infiltration rate restored, either through excavation and filter media replacement or surface sediment removal. If applicable, underdrain cleaned, reset or replaced.	As needed

7. STORMWATER WETLAND BASINS

Definition

A stormwater wetland basin is a treatment system consisting of a sediment forebay and a permanent micro-pool with aquatic vegetation covering a significant portion of the basin. Stormwater wetland basins typically include components such as an inlet with energy dissipation, a sediment forebay for settling out coarse solids, and to facilitate maintenance, a base with shallow sections (1 to 2 feet deep) planted with emergent vegetation, deeper areas or micro pools (3 to 5 feet deep) , and a water quality outlet structure. The aquatic vegetation and the associated biological unit processes are a fundamental part of stormwater wetland basins. Therefore, it is critical that dry weather base flows exceed evaporation and infiltration losses to prevent loss of aquatic vegetation and to avoid stagnation and vector problems. In situations where dry weather flows are inadequate to support a wetland basin sized for the entire water quality design volume, an additional source of water may be needed during summer months. Otherwise, the wetland should be sized based on the available flow and the design should incorporate extended detention up to the water quality storm volume.

It is important to note the difference between stormwater wetlands and wetlands that are constructed as part of mitigation requirements. Constructed mitigation wetlands are intended to provide fully functional habitat similar to the habitat they replace. Stormwater wetlands are a treatment BMP designed to capture and treat pollutants to protect receiving waters, including natural wetlands and other ecologically significant habitat. The accumulation of pollutants in sediment and vegetation of stormwater wetlands may impact the health of aquatic biota. As such, periodic sediment and vegetation removal within stormwater wetlands may be required. These maintenance activities may temporarily interrupt the use of stormwater wetlands by wildlife.

The applications for stormwater wetlands include peak flow attenuation, volume reduction, and pollutant removal. The pollutant removal processes that occur in wetlands include sedimentation, filtration, plant uptake and storage, and microbially-mediated transformations. Other benefits provided by stormwater wetlands include opportunities for education and aesthetics. In theory, there are no limitations to the size of the tributary area to a stormwater wetland; however, stormwater wetlands are typically used for treating areas larger than 10 acres.

Factors that favor the selection of stormwater wetlands over other kinds of BMPs include enhanced treatment capability (including dry-weather flow treatment), aesthetics, and the ability to mitigate large tributary areas. Factors that may limit the use of stormwater wetland basins include overly permeable soils and/or non-existent base flows, public acceptance with regards to the potential for vector infestation, large footprint to treated area ratios (up to 12% percent of tributary area, dependant on overall imperviousness of the tributary area) and high initial capital cost of implementation.

General Constraints and Siting Considerations

- Availability of base flows - stormwater wetlands require a regular source of water to support wetland biota

- Slope stability - stormwater wetlands are not permitted near 2:1 (H:V) slopes
- Surface space availability - large footprint required
- Compatibility with flood control - basins must not interfere with flood control functions of existing conveyance and detention structures

Multi-Use Opportunities

Provided adequate surcharge storage, a stormwater wetland may be combined with a flood control basin to provide both water quality control and peak flow control. Stormwater wetlands can also be designed with wildlife viewing areas and walking trails around the perimeter to provide passive recreation. Any planned multi-use facility must obtain special approval by the LACDPW.

Stormwater Wetland Basin Design Specifications

Basin Sizing and Geometry

1. Stormwater wetland basins shall be sized to capture and treat the SUSMP volume (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)). If extended detention is included, then the extended detention volume must provide at least 12 hours detention of 20% of the water quality storm.

2. Stormwater wetlands should consist of at least two cells including a sediment forebay and a wetland basin (see Figure 7-1).

3. The sediment forebay must contain between 10 and 20 percent of the total basin volume.

4. The depth of the sediment forebay should be between 4 and 8 feet.

5. One foot of sediment storage shall be provided in the sediment forebay.

6. The "berm" separating the two cells shall be uniform in cross-section and shaped such that its downstream side gradually slopes to the main wetland basin.

7. The top of the berm shall be either at the water quality design water surface or submerged 1 foot below the water quality design water surface, as with wetponds. Correspondingly, the side slopes of the berm must meet the following criteria:

   a) If the top of the berm is at the water quality design water surface, the berm side slopes shall be no steeper than 3:1 (H:V).
   b) If the top of berm is submerged 1 foot, the upstream side slope may be a max of 2:1 (H:V).

8. The wetland basin should be designed with a "naturalistic" shape and a range of depths intermixed throughout the wetland basin to a maximum of 5 feet. See Table 7-1 for a recommended depth distribution.

Table 7-1: Recommended Distribution of Depths in Wetland Basin

Depth Range (feet)	Percent by Area
0.1 to 1	15
1 to 3	55
3 to 5	30

9. The flowpath length-to-width ratio should be a minimum of 3:1, but preferably at least 4:1 or greater. *Intent: a high flow path length to width ratio will maximize fine sediment removal.*

10. The minimum freeboard shall be 2 feet above the maximum water surface elevation for online basins and 1 foot above the maximum water surface elevation for offline basins.

11. Wetland pools should be designed such that the residence time for dry weather flows is no greater than 7 days. *Intent: Minimize vector and stagnation issues.*

Water Supply

1. Water balance calculations shall be provided to demonstrate that adequate water supply will be present to maintain a permanent pool of water during a drought year when precipitation is 50% of average for the site. Water balance calculations shall include evapotranspiration, infiltration, precipitation, spillway discharge, and nuisance flow (where appropriate).

2. Where water balance indicates that losses will exceed inputs, a source of water shall be provided to maintain the basin water surface elevation throughout the year. The water supply shall be of sufficient quantity and quality to not have an adverse impact on the stormwater wetland water quality.

Soils Considerations

1. Stormwater wetland implementation in areas with high permeability soils (>0.1 in/hr) requires liners to increase the chances of maintaining permanent pools and/or micro-pools in the basin. Liners can be either synthetic materials or imported lower permeability soils (i.e., clays). The water balance assessment should determine whether a liner is required. The following conditions can be used as a guideline.

   a) The wetland basin must retain water for at least 10 months of the year.
   b) The sediment forebay must retain at least 3 feet of water year-round.

   Many wetland plants can adapt to periods of summer drought, so a limited drought period is allowed in the wetland basin. This may allow for a soil liner rather than a geosynthetic liner. The sediment forebay must retain water year-round for presettling to be effective.

2. If low permeability soils are used for the liner, a minimum of 18 inches of native soil amended with good topsoil or compost (one part compost mixed with 3 parts native soil) must be placed over the liner. If a synthetic material is used, a soil depth of 2 feet is recommended to prevent damage to the liner during planting.

Buffer Zone

1. A minimum of 25 feet buffer shall be provided around the top perimeter of the stormwater wetland.

Energy Dissipation

1. The inlet to the stormwater wetland shall be submerged with the inlet pipe invert a minimum of 2 feet from the pond bottom (not including sediment storage). The top of the inlet pipe should be submerged at least 1 foot, if possible. *Intent: The inlet is submerged to dissipate energy of the incoming flow. The distance from the bottom is set to minimize resuspension of settled sediments. Alternative inlet designs that accomplish these objectives are acceptable.*

2. Energy dissipation controls must also be used at the outlet from the stormwater wetland unless the basin discharges to a storm drain or hardened channel.

3. Consult the LACDPW Design Division or Land Development Division for type and design of energy dissipation structure.

Vegetation

The wetland cell shall be planted with emergent wetland plants following the recommendations of a wetlands specialist.

Outlet Structure and Spillway

1. An outlet pipe and outlet structure shall be provided. The outlet pipe may be a perforated riser strapped to a manhole (see Figure 7-2) or placed in an embankment, suitable for extended detention, or may be back-sloped to a catch basin with a grated opening (jail house window) or manhole with a cone grate (birdcage) (see Figure 7-3). The grate or birdcage openings provide an overflow route should the basin outlet pipe become clogged.

2. The wetland outlet pipe shall be sized, at a minimum, to pass flows above the water quality design peak flow for off-line basins or flow from the capital storm for on-line basins.

3. Spillways shall meet the California Department of Water Resources, Division of Safety of Dams *Guidelines for the Design and Construction of Small Embankment Dams (http://damsafety.water.ca.gov/docs/GuidelinesSmallDams.pdf)*.

<u>Online Basins</u>

1. Online basins must have an emergency overflow spillway to prevent overtopping of the walls or berms should blockage of the riser occur based on a downstream risk assessment.

2. The overflow spillway must be sized to pass flow from the capital storm.

Offline Basins

1. An emergency overflow spillway or an emergency overflow riser must be provided. The emergency overflow must be designed to pass the SUSMP peak flow, with a minimum of 2 feet of freeboard, directly to the downstream conveyance system or another acceptable discharge point. Where an emergency overflow spillway would discharge to a steep slope, an emergency overflow riser, *in addition* to the spillway shall be provided.

2. The emergency overflow spillway shall be armored to withstand the energy of the spillway flows (Figure 2-4). The spillway shall be armored full width, beginning at a point midway across the berm embankment and extending downstream to where emergency overflows reenters the conveyance system.

Side Slopes

1. Interior side slopes up to the emergency overflow water surface shall be no steeper than 3:1 (H:V), unless stabilization has been approved by a licensed geotechnical engineer.

2. Exterior side slopes shall be no steeper than 2:1 (H:V), unless stabilization has been approved by a licensed geotechnical engineer.

3. For any slope (interior or exterior) greater than 2:1 (H:V) a geotechnical report must be submitted and approved by the County's Geotechnical and Materials Engineering Division.

Embankments

1. Embankments are earthen slopes or berms used for detaining or redirecting the flow of water.

2. The minimum top width of all berm embankments shall be 20 feet, or as approved by the geotechnical engineer and the LACDPW Materials Division.

3. Basin berm embankments must be constructed on native consolidated soil (or adequately compacted and stable fill soils analyzed by a licensed geotechnical engineer) free of loose surface soil materials, roots, and other organic debris.

4. Earthworks shall be in accordance with Section 300-6 of the Standard Specifications for Public Works Construction, most recent edition.

5. Basin berm embankments greater than 4 feet in height must be constructed by excavating a key equal to 50% of the berm embankment cross-sectional height and width. This requirement may be waived if specifically recommended by a licensed geotechnical engineer.

6. The berm embankment shall be constructed of compacted soil (95% minimum dry density, modified proctor method per ASTM D1557), placed in 6-inch lifts.

7. Low growing native perennial grasses shall be planted on downstream embankment slopes. See the Vegetation Management on Embankment Dams of Public Works' Debris Control Facilities, Attachment B, for a recommended plant list.

Fencing

Safety is provided by fencing of the facility.

1. Fences shall be designed and constructed in accordance with Title 11, Section 11.48 of the Los Angeles County Code and must be located at or above the overflow water surface elevation. Shrubs (County approved, California-adapted species) can be used to hide the fencing.

Right-of-Way

1. Wetland basins and associated access roads to be maintained by the County shall be dedicated in fee to Los Angeles County with appropriate access.

Maintenance Access

Maintenance access road(s) shall be provided to the control structure and other drainage structures associated with the basin (e.g., inlet, emergency overflow or bypass structures). Manhole and catch basin lids must be in or at the edge of the access road.

An access ramp is required for removal of sediment with a backhoe or loader and truck. The ramp must extend to the basin bottom to avoid damage to vegetation planted on the basin slope.

Access roads shall meet the following design criteria:

1. All access ramps and roads shall be paved with a minimum of 3 inches of concrete over 4 inches of crushed aggregate base material. This requirement may be modified depending on the soil conditions and intended use of the road at the discretion of the Department.

2. Maximum grade shall be 125% unless otherwise approved by the Department.

3. Centerline turning radius shall be 40 feet, minimum.

4. Access roads less than 500 ft long shall have 12 feet wide pavement within a minimum 15 feet wide bench. Access roads greater than 500 feet long shall have 16 feet wide pavement within a minimum 20 feet wide bench.

5. All access roads shall terminate with turnaround areas of 40 feet by 40 feet. A hammer type turn around area or a circle drive around the top of the facility is also acceptable

6. Adequate double-drive gates and commercial driveways are required at street crossings. Gates should be located a minimum of 25 feet from the street curb except in residential areas where the gates may be located along the property line provided there is adequate site distance to see oncoming vehicles at the posted speed limit.

Landscaping Outside of the Facility

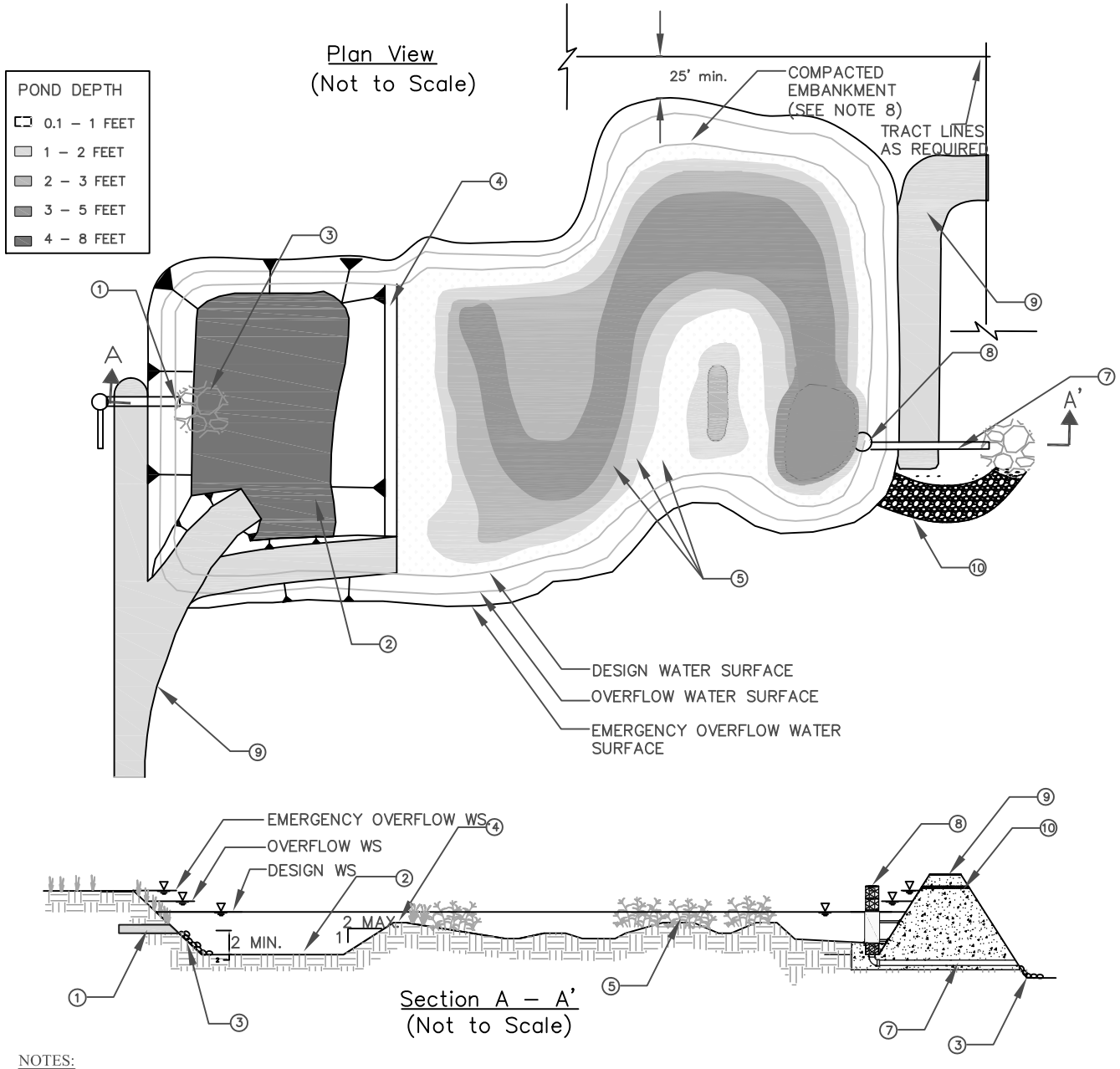
Site landscaping is required and must adhere to the following criteria so as not to hinder maintenance operations:

1. No trees or shrubs may be planted within 10 feet of inlet or outlet pipes or man-made drainage structures such as spillways, flow spreaders, or earthen embankments. Species with roots that seek water, such as willow or poplar, shall not be used within 50 feet of pipes or manmade structures. Weeping willow (*Salix babylonica*) should not be planted in or near detention basins.

2. Prohibited non-native plant species will not be permitted. For more information on invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist.

Restricted Construction Materials

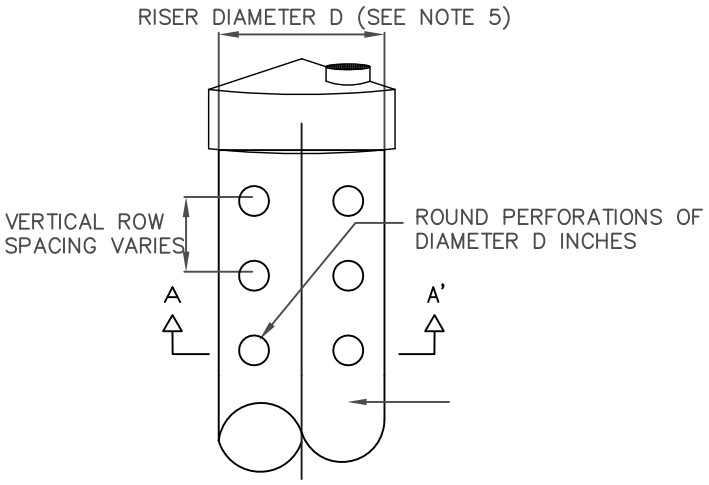
The use of treated wood or galvanized metal anywhere inside the facility is prohibited. The use of galvanized fencing is permitted if in accordance with the fencing requirement above.



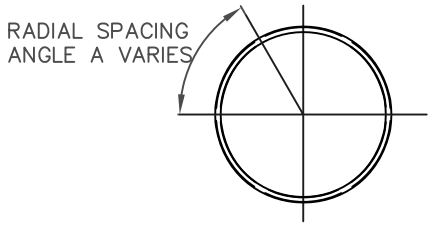
NOTES:

1. INLET PIPE SHOULD BE SUBMERGED WITH A MINIMUM OF 2' DISTANCE FROM THE BOTTOM
2. SEDIMENT FOREBAY. FORE BAY VOLUME SHALL EQUAL 10% TO 20% OF TOTAL WETLAND VOLUME. FOREBAY DEPTH SHALL BE 4' MIN TO 8' MAX PLUS AN ADDITIONAL I' MIN SEDIMENT STORAGE DEPTH.
3. RIP RAP APRON OR OTHER INLET ENERGY DISSIPATION.
4. BERM AT DESIGN WATER SURFACE ELEVATION OR SUBMERGED 1' BELOW DESIGN WATER SURFACE ELEVAVTION. EXTEND BERM ACROSS ENTIRE WIDTH OF THE WETLAND.
5. WETLAND VEGETATION. PLANTING SCHEME MUST BE DESIGNED BY A WETLAND ECOLOGIST.
6. EMBANKMENT SIDE SLOPES SHALL BE NO STEEPER THAN 2H:1V OUTSIDE AND 3H:1V INSIDE
7. SIZE OUTLET PIPE TO PASS CAPITAL DESIGN PEAK FLOW FOR ONLINE AND WATER QUALTIY PEAK FLOW FOR OFFLINE BASINS.
8. WATER QUALITY OUTLET STRUCTURE. SEE FIGURE 7–2 AND FIGURE 7–3 FOR DETAILS.
9. MAINTENANCE RAMP SHOULD BE PAVED. SLOPE SHOULD NOT EXCEED 12%. MAINTENANCE RAMP SHOULD PROVIDE ACCESS TO BOTH THE FOREBAY AND MAIN BASIN.
10.

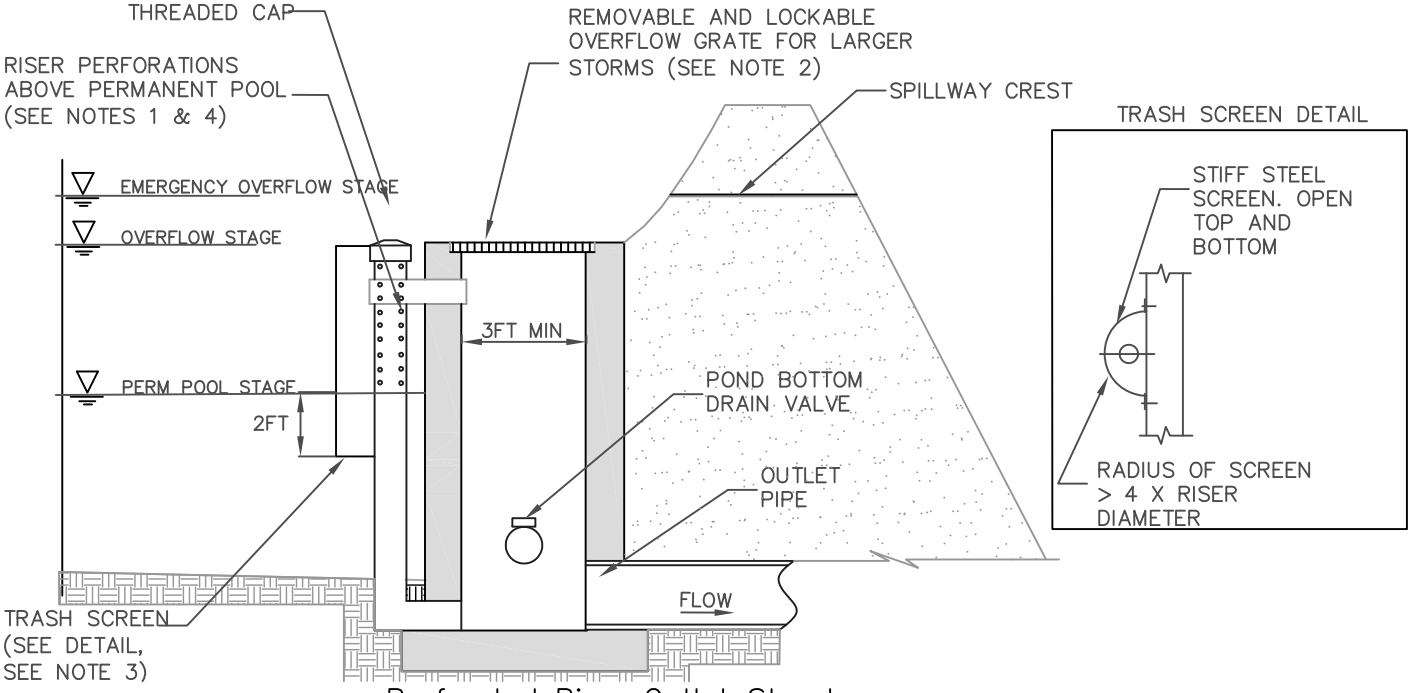
Figure 7–1
STORMWATER WETLAND BASIN



Perforated Riser Detail
(Not to Scale)



Section A – A'
(Not to Scale)

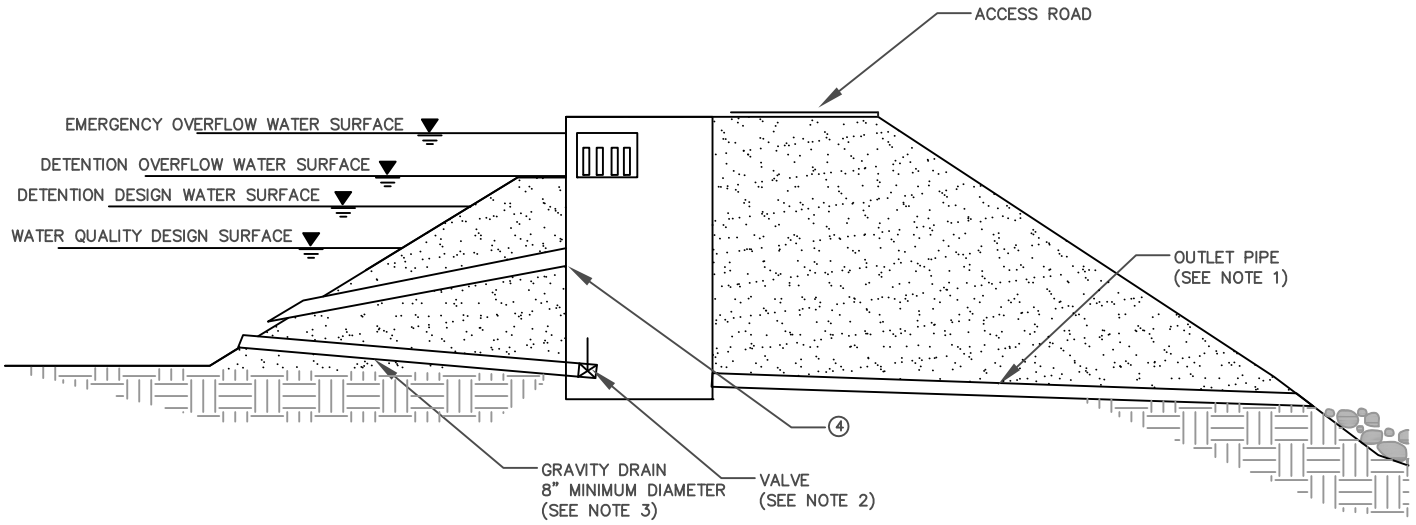


Perforated Riser Outlet Structure
(Not to Scale)

NOTES:

1. RISER PIPE SHALL BE SIZED TO PROVIDE 36 TO 48–HOUR FULL BRIM DRAW DOWN TIME.
2. TOTAL OUTLET CAPACITY: CAPITAL DEVELOPED PEAK FLOW FOR ON–LINE BASINS AND WATER QUALITY DESIGN FLOW FOR OFF–LINE BASINS.
3. SCREEN OPENINGS SHALL BE AT LEAST ¼" AND SHALL NOT EXCEED THE DIAMETER OF THE PERFORATIONS ON THE RISER.
4. RISER PIPE PERFORATION DIAMETER SHALL BE NO LESS THAN ½" AND NO MORE THAN 2"
5. MINIMUM PIPE DIAMETER (D) IS 2'
6. RISER PIPE MATERIAL IS CMP

Figure 7–2
RISER OUTLET



Inverted Pipe Outlet Structure
(Not to Scale)

NOTES:

① SIZE OUTLET PIPE SYSTEM TO PASS CAPITAL PEAK FLOW FOR ON-LINE PONDS AND WATER QUALITY PEAK FLOW FOR OFF-LINE PONDS.

② VALVE MAY BE LOCATED INSIDE MANHOLE OR OUTSIDE WITH APPROVED OPERATIONAL ACCESS

③ INVERT OF DRAIN SHALL BE 6" MINIMUM BELOW TOP OF INTERNAL BERM. LOWER PLACEMENT IS DESIRABLE. INVERT SHALL BE 6" MINIMUM ABOVE BOTTOM OF POND.

④ OUTLET PIPE INVERT SHALL BE AT WETPOOL WATER SURFACE ELEVATION

Figure 7-3
INVERTED PIPE OUTLET

Stormwater Wetland Basin Maintenance Standards

General Requirements

Maintenance is critical if stormwater wetland basins are to function as originally designed. A specific maintenance plan shall be developed for each facility outlining the schedule and scope of maintenance operations, as well as the documentation and reporting requirements. The following are general maintenance requirements:

1. The stormwater wetland basin should be inspected annually and inspections after major storm events are encouraged (see Appendix E for guidance on BMP facility inspection and Appendix F for a wetland basin inspection and maintenance checklist). Trash and debris should be removed as needed, but at least annually prior to the beginning of the wet season.

2. Site vegetation should be maintained as frequently as necessary to maintain the aesthetic appearance of the site and to prevent clogging of outlets, creation of dead volumes, and barriers to mosquito fish to access pooled areas, and as follows:

    - Vegetation, large shrubs, or trees that limit access or interfere with basin operation should be pruned or removed.
    - Slope areas that have become bare should be revegetated and eroded areas should be regraded prior to being revegetated.
    - Invasive vegetation, such as Alligatorweed (*Alternanthera philoxeroides*), Halogeton (*Halogeton glomeratus*), Spotted Knapweed (*Centaurea maculosa*), Giant Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Perennial Pepperweed (*Lepidium latifolium*), and Yellow Starthistle (*Centaurea solstitalis*) must be removed and replaced with non-invasive species. Invasive species should never contribute more than 25% of the vegetated area. For more information on invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist.
    - Dead vegetation should be removed if it exceeds 10% of area coverage. This does not include seasonal die-back where roots would grow back later in colder areas. Vegetation should be replaced immediately to maintain cover density and control erosion where soils are exposed.

3. Sediment buildup exceeding 6 inches over the storage capacity in the first cell should be removed. Sediments should be tested for toxic substance accumulation in compliance with current disposal requirements visual or olfactory indications of pollution are noticed. If toxic substances are encountered at concentrations exceeding thresholds of Title 22, Section 66261 of the California Code of Regulations, the sediment must be disposed of in a hazardous waste landfill.

4. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for wetland basins is shown in Table 7-2. Detailed routine and major maintenance standards listed in Tables 7-3 and 7-4 are intended to be measures to determine if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections.

Table 7-2: Wetland Basin Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Removal trash and debris • Remove minor sediment accumulation near inlet and outlet structures • Stabilize/Repair eroded banks and fill in animal burrows if present • Remove any evidence of visual contamination from floatables such as oil and grease • Eliminate pests and conditions suitable for creating ideal breeding habitat • Install or repair pond liner to ensure that first cell maintains a permanent pool • Remove algae mats as often as needed to prevent coverage of more than 20% of pond surface • Mow berms routinely if applicable to maintain aesthetic appeal and to suppress weeds
Major Maintenance	• Remove dead, diseased, or dying trees and woody vegetation that interfere with facility maintenance. • Correct problems associated with berm settlement • Repair berm/dike breaches and stabilize eroded parts of the berm • Repair and rebuild spillway as needed to reverse the effects of severe erosion • Remove sediment build up in forebay and main basin area to restore original sediment holding capacity • Regrade main basin bottom to restore bottom slope and eliminate the incidence of standing pools • Aerate compacted areas to promote infiltration if volume reductions are desired • Repair or replace gates, fences, flow control structures, and inlet/outlet structures as needed to maintain full functionality

Table 7-3: Routine Maintenance Standards – Stormwater Wetland Basins

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Trash & Debris	Any trash and debris which exceed 5 cubic feet per 1,000 sf of pond area (one standard garbage can). In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance. If trash and debris is observed blocking or partially blocking an outlet structure or inhibiting flows between cells, it should be removed quickly	Trash and debris cleared from site.	Annually prior to wet season After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs
Sediment Accumulation	Sediment accumulation in basin bottom that exceeds the depth of sediment zone plus 6 inches in the sediment forebay. If sediment is blocking an inlet or outlet, it should be removed.	Sediment cleaned out.	
Erosion	Erosion of basin side slopes and/or scouring of basin bottom.	Slopes should be stabilized using appropriate erosion control measure(s) and repair methods.	
Oil Sheen on Water	Prevalent and visible oil sheen.	No oil sheen present.	
Noxious Pests	Visual observations or receipt of complaints of numbers of pests that would not be naturally occurring and could pose a threat to human or aquatic health.	Vectors controlled per LACDPW standards.	
Water Level	First cell empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. The first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.	

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Aesthetics	Minor vegetation removal and thinning. Mowing berms and surroundings	Facility is well kept.	Monthly (or as dictated by agreement between County and landscape contractor)
Noxious Weeds	Any evidence of noxious weeds.	Eradicate all noxious weeds; control and prevent the spread of all noxious weeds. Use Integrated Pest Management techniques, if applicable. See http://www.ipm.ucdavis.edu/ for more information.	

Table 7-4: Major Maintenance Standards – Stormwater Wetland Basins

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Tree Growth	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering, do not remove. Dead, diseased, or dying trees should be removed.	Trees do not hinder maintenance activities. Remove dead, diseased, or dying trees. (Use a certified Arborist to determine health of tree or removal requirements)	Annual or as needed (infrequent) After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs.
Settling of Berm	If settlement is apparent. Settling can be an indication of more severe problems with the berm or outlet works. A geotechnical engineer should be consulted to determine the source of the settlement if the dike/berm is serving as a dam.	Dike is built back to the design elevation.	
Piping through Berm	Discernable water flow through basin berm. Ongoing erosion with potential for erosion to continue. A licensed geotechnical engineer should be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved and berm stability achieved.	

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Tree and Large Shrub Growth on Downstream Slope of Embankments	Tree and large shrub growth on downstream slopes of embankments may prevent inspection and provide habitat for burrowing rodents.	Trees and large shrubs should be removed. All dead roots should be removed if practical. Otherwise, dead roots should be removed to a minimum of 36 inches below grade and replaced with cement grout to 12 inches below grade. The top 12 inches of the root holes should be filled with compacted, in-situ soils. The area facility engineer may require additional root removal if necessary for dam safety or maintenance purposes.	
Erosion on Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks and pad depth are restored to design standards.	
Gate/Fence Damage	Damage to gate/fence, including missing locks and hinges	Gate/Fence repaired.	

8. SAND FILTERS

Definition

A sand filter operates much like a bioretention facility; however, instead of filtering stormwater through engineered soils, stormwater is filtered through a constructed sand bed with an underdrain system. Runoff enters the filter and spreads over the surface. As flows increase, water backs up on the surface of the filter where it is held until it can percolate through the sand. The treatment pathway is vertical (downward through the sand). High flows in excess of the design volume are bypassed. Water that has percolated through the sand is collected via a perforated underdrain system before being conveyed to the downstream storm drainage system or to an infiltration facility. As stormwater passes through the sand, pollutants are trapped in the small pore spaces between sand grains or are adsorbed to the sand surface. Over time, bacteria can grow in the sand bed and provide some biological treatment. However, continuous dry weather flows would be required to maintain the moisture required by the bacteria.

A sand filter may be used in nearly all developments where site characteristics provide adequate hydraulic head to effectively operate the filter. Approximately 4 ft of elevation difference is recommended between the inlet and outlet of the filter. Landscape uses of sand filters are limited due to the small numbers of plant species that can survive in sand. Large trees and shrubs that generate leaf litter should not be located near a sand filter, as the leaves tend to clog the surface of the filter and reduce infiltrative capacity.

Sand filters are designed to prevent water backup in the sand layer, as saturated sands can lead to anoxic conditions where metals and phosphorus can be mobilized. The underdrain system must flow freely. In areas with high groundwater tables that could potentially flood the underdrain system, an impermeable liner must be provided.

Sand filters have a propensity to clog under high sediment loads; therefore, in areas with high predicted sediment load, pretreatment must be provided.

General Constraints and Siting Considerations

- High loading rates - may clog quickly if flows are not adequately pretreated
- Vertical relief and proximity to storm drain - site must have adequate relief between land surface and storm drain to permit vertical percolation through the sand filter and collection and conveyance in underdrain to storm drain system

Sand Filter Design Specifications

Basin Sizing and Geometry

1. Sand Filters shall be sized to capture and infiltrate the SUSMP volume (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)).

2. Sand filters may be designed in any geometric configuration, but rectangular with a 1.5:1 length-to-width ratio or greater is preferred (See Figure 8-1).

3. Sand depth must be at least 24 inches, but 36 inches is preferred.

4. Depth of storage over the sand bed shall be 6 feet maximum.

5. Sand filters should be placed off-line to prevent scouring of the filter bed by high flows. The overflow structure must be designed to pass the SUSMP peak flow rate.

Sizing Methodology

A sand filter is designed with two parts: (1) a temporary storage reservoir to store runoff, and (2) a sand filter bed through which the stored runoff must percolate. Usually the storage reservoir is simply placed directly above the filter, and the floor of the reservoir pond is the top of the sand bed. For this case, the storage volume also determines the hydraulic head over the filter surface, which increases the rate of flow through the sand.

Two methods are available for sizing sand filters: a simple method and a routing modeling method. The simple method uses standard values to define filter hydraulic characteristics for determining the sand surface area. This method is useful for planning purposes, for a first approximation to begin iterations in the detailed method, or when use of the detailed computer model is not desired or not available. The simple method very often results in a larger filter than the routing method.

Background

Sand filter design is based on Darcy's law:

$$Q = KiA \qquad \text{(Equation 8-1)}$$

Where,

- Q = the water quality design flow (cfs)
- K = hydraulic conductivity (fps)
- A = surface area perpendicular to the direction of flow (sf)
- i = hydraulic gradient (ft/ft) for a constant head and constant media depth, computed as follows:

$$i = \frac{h + l}{l} \qquad \text{(Equation 8-2)}$$

Where,

- h = average depth of water above the filter (ft), defined for this design as $d/2$
- d = maximum storage depth above the filter (ft)
- l = thickness of sand media (ft)

Darcy's law underlies both the simple and the routing methods of design. The filtration rate V, or more correctly, $1/V$, is the direct input in the sand filter design. The relationship between

the filtration rate V and hydraulic conductivity K is revealed by equating Darcy's law and the equation of continuity, $Q = VA$. Specifically:

$Q = KiA$ and $Q = VA$ So, $VA = KiA$ or:

$$V = Ki \qquad \text{(Equation 8-3)}$$

Where,

V = filtration rate (ft/s)

Note that $V \neq K$. That is, the filtration rate is not the same as the hydraulic conductivity, but they do have the same units (distance per time). K can be equated to V by dividing V by the hydraulic gradient i, which is defined above.

The hydraulic conductivity K does not change with head nor is it dependent on the thickness of the media, only on the characteristics of the media and the fluid. A design hydraulic conductivity of 1 inch per hour (2 feet per day) used in this simple sizing method is based on bench-scale tests of conditioned rather than clean sand (KCSWDM, 2005) and represents the average sand bed condition as silt is captured and held in the sand bed.

Unlike the hydraulic conductivity, the filtration rate V changes with head and media thickness, although the media thickness is constant in the sand filter design.

Simple Sizing Method

The simple sizing method does not route flows through the filter. It determines the size of the filter based on the simple assumption that inflow is immediately discharged through the filter as if there were no storage volume. An adjustment factor (0.7) is applied to compensate for the greater filter size resulting from this method. Even with the adjustment factor, the simple method generally produces a larger filter size than the routing method.

Step 1: Determine maximum storage depth of water

Determine the maximum water storage depth (d) above the sand filter. This depth is defined as the depth at which water begins to overflow the reservoir pond, and it depends on the site topography and hydraulic constraints. The depth is chosen by the designer, but shall be 6 feet or less.

Step 2: Calculate the design flow

Determine SUSMP volume (V_{wq}) (see *A Manual for the Standard Urban Storm Water Mitigation Plan*, LACDPW, September 2002 (or as amended)).

Step 3: Calculate the sand filter area

Determine the sand filter area using the following equation:

$$A_{sf} = \frac{V_{wq} RL}{Kt(h + L)} \qquad \text{(Equation 8-4)}$$

Where,

A_{sf} = surface area of the sand filter bed (ft^2)
V_{wq} = water quality design volume (ft^3)
R = routing adjustment factor (use $R = 0.7$)
L = sand bed depth (ft)
K = design hydraulic conductivity (use 2 ft/day)
t = drawdown time (use 1 day)
h = average depth of water above the filter (ft), (use $d/2$ with d from Step 1)

Routing Method

A continuous runoff model, such as US EPA's SWMM Model, can be used to optimally size a sand filter. A continuous simulation model consists of three components: a representative long term period of rainfall data (≈ 20 years or greater) as the primary model input; a model component representing the tributary area to the sand filter that takes into account the amount of impervious area, soil types of the pervious area, vegetation, evapotranspiration, etc.; and a component that simulates the sand filter. Using this method, the filter should be sized to capture and treat the WQ design volume from the post-development tributary area.

The continuous simulation model routes predicted tributary runoff to the sand filter, where treatment is simulated as a function of the infiltrative (flow) capacity of the sand filter and the available storage volume above the sand filter. In a continuous runoff model such as SWMM, the physical parameters of the sand filter are represented with stage-storage-discharge relationships. Due to the computational power of ordinary desktop computers, long-term continuous simulations generally take only minutes to run. This allows the modeler to run several simulations for a range of sand filter sizes, varying either the surface area of the filter (and resulting flow capacity) or the storage capacity above the sand filter, or both. Sufficient continuous model simulations should be completed so that results encompass the WQ design volume capture goal.

Model results should be plotted for both varying storage depths above the filter and for varying filter surface area (and resulting flow capacity) while keeping all other parameters constant. The resulting relationship of percent capture as a function of sand filter flow and storage capacity can be used to optimally size a sand filter based on site conditions and restraints.

In addition to continuous simulation modeling, routing spreadsheets and/or other forms of routing modeling that incorporate rainfall-runoff relationships and infiltrative (flow) capacities of sand filters may be used to size facilities. Alternative sizing methodologies should be prepared with good engineering practices.

Sand Specification

Ideally the effective diameter of the sand, d10, should be just small enough to ensure a good quality effluent while preventing penetration of stormwater particles to such a depth that they cannot be removed by surface scraping (~2-3 inches). This effective diameter usually lies in the range 0.20-0.35 mm. In addition, the coefficient of uniformity, Cu = d60/d10, should be less than 3.

The sand in a filter should consist of a medium sand with very little fines meeting ASTM C 33 size gradation (by weight) or equivalent as given in the table below.

U.S. Sieve Size	Percent Passing
3/8 inch	100
U.S. No. 4	95 to 100
U.S. No. 8	80 to 100
U.S. No. 16	50 to 85
U.S. No. 30	25 to 60
U.S. No. 50	5 to 30
U.S. No. 100	Less than 10

Finally, the silica (SiO_2) content of the sand should be greater than 95% by weight.

Underdrains

1. Several underdrain systems can be used in a sand filter design:

    a. A central underdrain collection pipe with lateral collection pipes in an 8 inch minimum gravel backfill or drain rock bed.
    b. Longitudinal pipes in an 8 inch minimum gravel backfill or drain rock bed, with a collection pipe at the outfall.
    c. Small sand filters may utilize a single underdrain pipe in an 8 inch minimum gravel backfill or drain rock bed.

2. All underdrain pipes and connectors must be 6 inches or greater so they can be cleaned without damage to the pipe. Clean-out risers with diameters equal to the underdrain pipe must be placed at the terminal ends of all pipes and extend to the surface of the filter. A valve box should be provided for access to the cleanouts and the cleanout assembly must be water tight to prevent short circuiting of the sand filter.

3. The underdrain pipe must be sized and perforated as to ensure free draining of the sand filter bed. Round perforations must be at least 1/2-inch in diameter and the pipe must be laid with holes downward.

4. The maximum perpendicular distance between any two lateral collection pipes or from the edge of the filter and the collection pipes shall be 9 feet.

5. All pipes must be placed with a minimum slope of 0.5%.

6. The invert of the underdrain outlet must be above the seasonal high groundwater level.

7. At least 8 inches of gravel backfill must be maintained over all underdrain piping, and at least 6 inches must be maintained on both side and beneath the pipe to prevent damage by heavy equipment during maintenance. Either drain rock or gravel backfill may be used between pipes.

8. The bottom gravel layer should have a diameter at least 2X the size of the openings into the drainage system. The grains should be hard, preferably rounded, with a specific gravity of at least 2.5, and free of clay, debris and organic impurities.

9. Either a geotextile fabric or a two-inch transition gradation layer (preferred) must be placed between the sand layer and the drain rock or gravel backfill layer. If a geotextile is used, one inch of drain rock or gravel backfill should be place above the fabric. This allows for a transitional zone between sand and gravel and may reduce pooling of water at the liner interface. The geotextile must meet the following minimum materials requirements.

Geotextile Property	Value	Test Method
Trapezoidal Tear (lbs)	40 (min)	ASTM D4533
Permeability (cm/sec)	0.2 (min)	ASTM D4491
AOS (sieve size)	#60 - #70 (min)	ASTM D4751
Ultraviolet resistance	70% or greater	ASTM D4355

Pretreatment

Pretreatment must be provided for sand filters in order to reduce the sediment load entering the filter. Pretreatment refers to design features that provide settling of large particles before runoff reaches a management practice, easing the long-term maintenance burden. To ensure that pretreatment mechanisms are effective, designers shall incorporate practices such as vegetated swales, vegetated filter strips, or sediment forebays, or proprietary devices such as hydrodynamic separators.

For design specification of pre-treatment devices, refer to:

- Filter Strip (see Section 4)
- Vegetated Swales (see Section 3)
- Sediment Forebays (See Section 2 – Dry Extended Detention Basins)
- Hydrodynamic Separators (See Section 9 – Proprietary Devices)

Flow Spreading

1. A flow spreader shall be installed at the inlet along one side of the filter to evenly distribute incoming runoff across the filter and to prevent erosion of the filter surface.

    a. If the sand filter is curved or an irregular shape, a flow spreader shall be provided for a minimum of 20 percent of the filter perimeter.
    b. If the length-to-width ratio of the filter is 2:1 or greater, a flow spreader must be located on the longer side and for a minimum length of 20 percent of the facility perimeter.
    c. In other situations, use good engineering judgment in positioning the spreader.

2. Erosion protection shall be provided along the first foot of the sand bed adjacent to the flow spreader. Geotextile weighted with sand bags at 15-foot intervals may be used. Quarry spalls may also be used.

Vegetation

1. The use of vegetation in sand filters is optional. However, no top soil should be added to the sand filter bed because the fine-grained materials (silt and clay) reduce the hydraulic capacity of the filter.

2. Growing grass or other vegetation requires the selection of species that can tolerate the demanding environment of a sand filter bed. Plants not receiving sufficient dry weather flows must be able to withstand long periods of drought during summer periods, followed by periods of saturation during storm events. A horticultural specialist should be consulted for advice on species selection.

3. A sod grown in sand may be used on the sand surface as long as there is no clay in the sand substrate and the particle size gradation of the substrate meets the sand filter specifications. No other sod shall be used due to the high clay content in most sod soils.

4. To prevent uses that could compact and damage the filter surface, permanent structures are not permitted on sand filters (e.g. playground equipment).

Emergency Overflow Structure

Sand filters may only be placed off-line, but an emergency overflow must still be provided in the event the filter becomes clogged. The overflow structure must be able to safely convey flows from the SUSMP storm to the downstream conveyance system or other acceptable discharge point (Figure 2-4).

Side Slopes

1. Interior side slopes up to the emergency overflow water surface shall be no steeper than 3H:1V, unless stabilization has been approved by a licensed geotechnical engineer.

2. Exterior side slopes shall be no steeper than 2H:1V, unless stabilization has been approved by a licensed geotechnical engineer.

3. For any slope (interior or exterior) greater than 2H:1V a geotechnical report must be submitted and approved by the County's Geotechnical and Materials Engineering Division.

4. Pond walls may be vertical retaining walls, provided: (a) they are constructed of reinforced concrete, (b) a fence, which prevents access, is provided along the top of the wall (see fencing below) or further back, and (c) the design is stamped by a licensed civil engineer and approved by the County.

Embankments

1. Embankments are earthen slopes or berms used for detaining or redirecting the flow of water.

2. The minimum top width of all berm embankments shall be 20 feet, or as approved by the geotechnical engineer and the Los Angeles County Materials Division.

3. Basin berm embankments must be constructed on native consolidated soil (or adequately compacted and stable fill soils analyzed by a licensed geotechnical engineer) free of loose surface soil materials, roots, and other organic debris.

4. Earthworks shall be in accordance with Section 300-6 of the Standard Specifications for Public Works Construction, most recent edition.

5. Basin berm embankments greater than 4 feet in height must be constructed by excavating a key equal to 50% of the berm embankment cross-sectional height and width. This requirement may be waived if specifically recommended by a licensed geotechnical engineer.

6. The berm embankment shall be constructed of compacted soil (95% minimum dry density, modified proctor method per ASTM D1557), placed in 6-inch lifts.

Fencing

Safety is provided by fencing of the facility.

1. Fences shall be designed and constructed in accordance with Title 11, Section 11.48 of the Los Angeles County Code and must be located at or above the overflow water surface elevation. Shrubs (County approved, California-adapted species) can be used to hide the fencing.

Right-of-Way

1. Sand filters to be maintained by the County shall be in a lot or easement dedicated in fee to Los Angeles County with appropriate access.

Maintenance Access

Maintenance access road(s) shall be provided to the control structure and other drainage structures associated with the basin (e.g., inlet, emergency overflow or bypass structures). Manhole and catch basin lids must be in or at the edge of the access road.

An access ramp is required for removal of sediment with a backhoe or loader and truck. The ramp must extend to the bottom of the sand filter.

Access roads shall meet the following design criteria:

1. All access ramps and roads shall be paved with a minimum of 3 inches concrete over 4 inches of crushed aggregate base material. This requirement may be modified depending on the soil conditions and intended use of the road at the discretion of the Department.

2. Maximum grade shall be 12% unless otherwise approved by the Department.

3. Centerline turning radius shall be 40 feet, minimum.

4. Access roads less than 500 ft long shall have 12 feet wide pavement within a minimum 15 feet wide bench. Access roads greater than 500 feet long shall have 16 feet wide pavement within a minimum 20 feet wide bench.

5. All access roads shall terminate with turnaround areas of 40 feet by 40 feet. A hammer type turn around area or a circle drive around the top of the facility is also acceptable.

6. Adequate gates and commercial driveways are required at street crossings. Gates should be located a minimum of 25 feet from the street curb except in residential areas where the gates may be located along the property line provided there is adequate site distance to see oncoming vehicles at the posted speed limit.

Landscaping Outside of the Facility

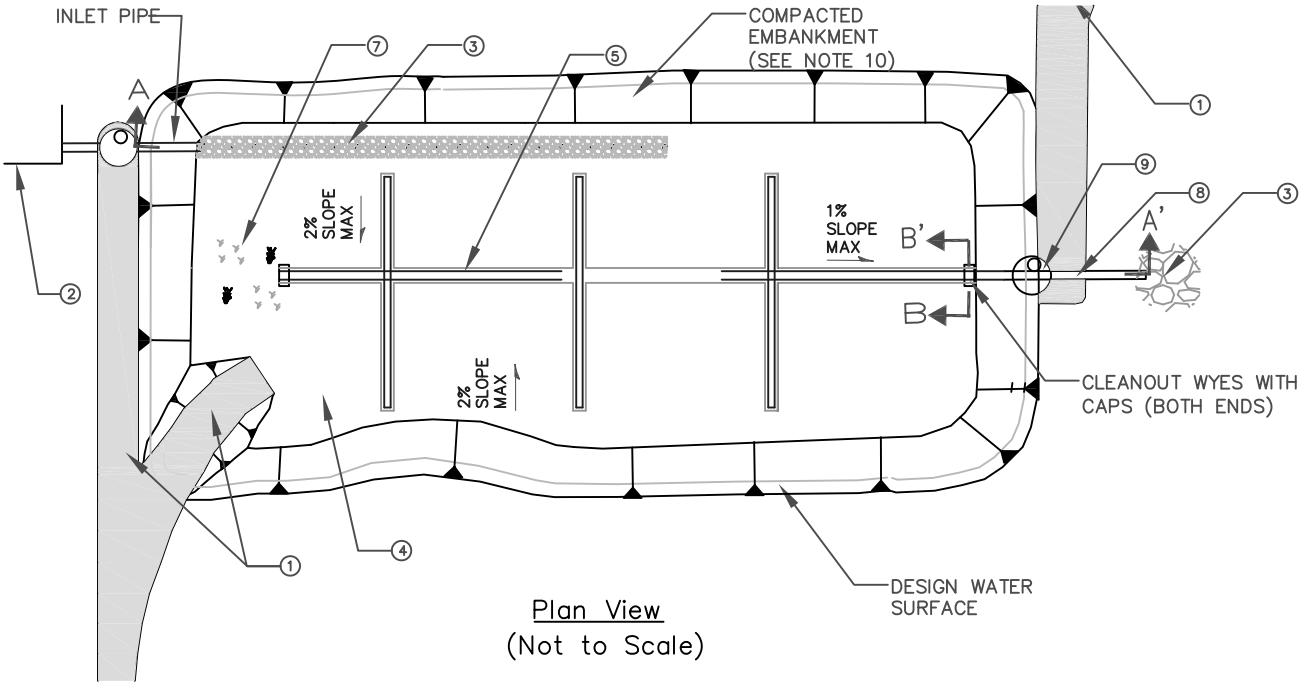
A sand filter can add aesthetics to a site and should be incorporated into a project's landscape design. Interior side slopes may be stepped with flat areas to provide informal seating with a game or play area below. Perennial beds may be planted above the overflow water surface elevation. Large shrubs and trees are not recommended, however, as shading limits evaporation and falling leaves can clog the filter surface. If a sand filter area is intended for recreational uses, such as a volleyball area, the interior side slopes of the filter embankment should be no steeper than 3:1 and may be stepped.

1. No trees or shrubs may be planted within 10 feet of inlet or outlet pipes or manmade drainage structures such as spillways, flow spreaders, or earthen embankments. Species with roots that seek water, such as willow or poplar, shall not be used within 50 feet of pipes or manmade structures.

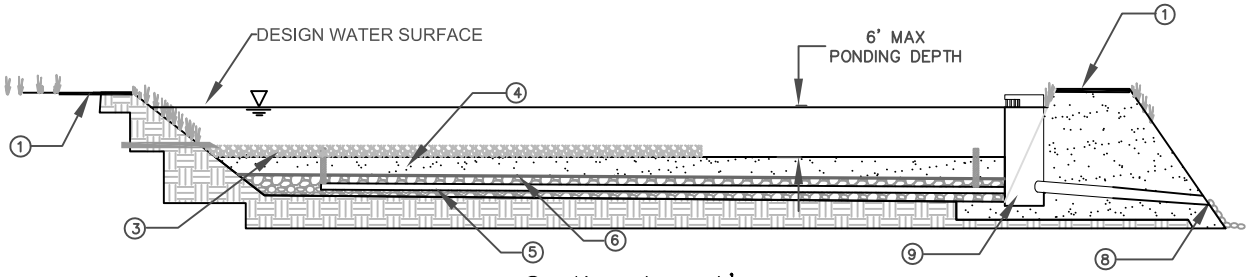
2. Prohibited non-native plant species will not be permitted. For more information on invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist.

Restricted Construction Materials

The use of treated wood or galvanized metal anywhere inside the facility is prohibited. The use of galvanized fencing is permitted if in accordance with the Fencing requirement above.



Plan View
(Not to Scale)



Section A – A'
(Not to Scale)

NOTES:

① INSTALL MAINTENANCE ACCESS ROAD AND RAMP TO BOTTOM OF SAND FILTER. MAINTENANCE RAMP SHOULD BE PAVED. SLOPE SHOULD NOT EXCEED 12%.

② UPSTREAM PRETREATMENT SHALL BE PROVIDED. RECOMMENDED PRETREATMENT OPTIONS INCLUDE SEDIMENTATION / HYDRODYNAMIC DEVICES AND VEGETATED BMPS. IN THE ABSENCE OF PRETREATMENT, INCLUDE SEDIMENT FOREBAY WITH VOLUME EQUAL TO 10–20% OF TOTAL SAND FILTER VOLUME.

③ FLOW SPREADER TO EVENLY DISTRIBUTE FLOWS ALONG AT LEAST 20% OF PERIMETER.

④ FILTER BED SHALL BE A 24" MINIMUM SAND LAYER ON TOP OF 8" MINIMUM GRAVEL OR DRAIN ROCK BACKFILL.

⑤ 6" MINIMUM DIAMETER PERFORATED PIPE UNDERDRAIN. INSTALL AT 0.5% MINIMUM SLOPE

⑥ INSTALL GEOTEXTILE FABRIC OR TRANSITIONALLY GRADED AGGREGRATE BETWEEN SAND AND GRAVEL LAYER.

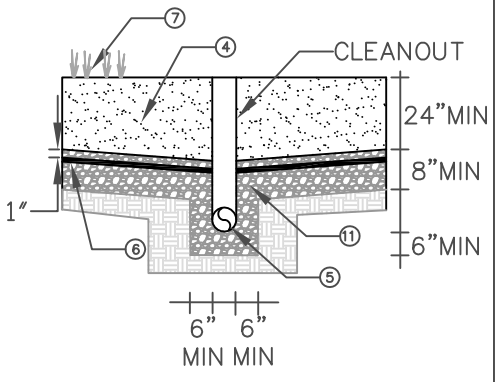
⑦ VEGETATION MAY BE PLANTED ON TOP OF FILTER BED. NO TOP SOIL SHALL BE ADDED TO FILTER BED.

⑧ SIZE OUTLET PIPE STRUCTURE TO PASS WATER QUALITY DESIGN STORM AND INCLUDE AN EMERGENCY OVERFLOW.

⑨ EMERGENCY OVERFLOW STRUCTURE.

⑩ SIDE SLOPES SHOULD NOT EXCEED 3:1 UNLESS APPROVED BY AN ENGINEER. SIDE SLOPES SHALL NOT EXCEED 2:1 WITHOUT A SUPPORTING GEOTECHNICAL REPORT.

⑪ ¾" – 1½" WASHED DRAIN ROCK OR GRAVEL LAYER.



Section B – B'
(Not to Scale)

Figure 8–1
SAND FILTER

Sand Filter Maintenance Standards

General Requirements

Sand filters are subject to clogging by fine sediment, oil and grease, and other debris (e.g., trash and organic matter such as leaves). Filters and pretreatment facilities should be inspected every 6 months during the first year of operation (see Appendix E for guidance on BMP facility inspection and Appendix F for a sand filter inspection and maintenance checklist). Inspection should also occur immediately following a storm event to assess the filtration capacity of the filter. Once the filter is performing as designed, the frequency of inspection may be reduced to once per year.

Most of the maintenance should be concentrated on the pretreatment practices, such as buffer strips and swales upstream of the trench to ensure that sediment does not reach the infiltration trench. Regular inspection should determine if the sediment removal structures require routine maintenance.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for sand filters is shown in Table 8-1. Detailed routine and major maintenance standards are listed in Tables 8-2 and 8-3.

Table 8-1: Sand filter Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Remove trash and debris • Repair and reseed erosion near inlet • Remove any evidence of visual contamination from floatables such as oil and grease • Clean under-drain and outlet piping to alleviate ponding and restore infiltrative capacity if needed • Clean and reset flow spreaders as needed to maintain even distribution of low flows • Remove minor sediment accumulation, debris and obstructions near inlet and outlet structures as needed • Mow, weed and trim routinely (where applicable) to maintain ideal grass height and to suppress weeds
Major Maintenance	• Scrape top 2 – 4 inches of sand and replace with clean sand to restore filtration rate • Clean out under-drains if present to alleviate ponding. Replace media if ponding or loss of infiltrative capacity persists and revegetate as needed • Reset settled piping, add fill material to maintain original pipe flow line elevations • Repair structural damage to flow control structures including inlet, outlet and overflow structures

Table 8-2: Routine Maintenance – Sand Filters

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Trash & Debris	Any trash and debris which exceed 5 cubic feet per 1,000 square feet of filter bed area (one standard garbage can). In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.	Annually prior to wet season After major storm events (>0.75 in/24 hrs) if spot checks indicate widespread damage/maintenance needs Litter removal is dependent on site conditions and desired aesthetics and should be done at a frequency to meet those objectives
Inlet Erosion	Visible evidence of erosion occurring near flow spreader outlets.	Eroded areas repaired/reseeded.	
Slow Drain Time	Standing water long after storm has passed (after 24 to 48 hours) and/or flow through the overflow pipes occurs frequently.	Water drains within 48 hours. This is achieved through removing accumulated litter on surface, removing and renewing top 2-4" of sand. If this does not cure the problem, backflush the drainage pipe. If this does not cure problem, then see major maintenance.	
Concentrated Flow	Flow spreader uneven or clogged so that flows are not uniformly distributed across the sand filter.	Level the spreader and clean so that flows are spread evenly over the sand filter bed.	
Appearance of Poisonous, Noxious or Nuisance Vegetation	Excessive grass and weed growth. Noxious weeds, woody vegetation establishing.	Mowing, weeding and trimming to restore function and prevent noxious and nuisance plants from establishing.	Monthly (or as dictated by agreement between County and landscape contractor)

Table 8-3: Major Maintenance – Sand Filters

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Standing Water	Standing water long after storm has passed (after 24 to 48 hours), and/or flow through the overflow pipes occurs frequently.	Design infiltration rate achieved, either through excavation and filter media replacement. If the underdrain is clogged, filter fabric must be removed and the pipe cleaned.	As needed
Pipe Settlement	If piping has visibly settled more than 1 inch.	Pipe is returned to original height. Add fill material to bring pipe back to grade. If erosion is evident around pipe, inspect for cracks or leaks.	

9. PROPRIETARY DEVICES

Definition

Proprietary devices are commercial products that typically aim at providing stormwater treatment in space-limited applications, often using patented innovative technologies. The most commonly encountered classes of proprietary stormwater management controls include hydrodynamic separation, catch basin insert technologies, cartridge filter-type controls, and proprietary biotreatment devices.

Hydrodynamic separation devices (alternatively, swirl concentrators) are devices that remove trash, debris, and coarse sediment from incoming flows using screening, gravity settling, and centrifugal forces generated by forcing the influent into a circular motion. By having the water move in a circular fashion, rather than a straight line, it is possible to obtain significant removal of suspended sediments and attached pollutants with less space as compared to wet vaults and other settling devices. Hydrodynamic devices were originally developed for combined sewer overflows (CSOs), where they were used primarily to remove coarse inorganic solids. Hydrodynamic separation has been adapted for stormwater treatment by several manufacturers and is currently used to remove trash, debris, and other coarse solids down to sand-sized particles. Several types of hydrodynamic separation devices are also designed to remove floating oils and grease using sorbent media. For more information on specific hydrodynamic devices and their vendors refer to Table 9-1 or check the Yellow Pages link at www.BMPLA.org for vendor contact information.

Catch basin inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris and may include sorbent media to remove floating oils and grease. There are a multitude of inserts of various shapes and configurations, typically falling into one of three groups: socks, boxes, and trays. The sock-type filters are typically constructed of a fabric, usually polypropylene. The fabric may be attached to a frame or the grate of the inlet may hold the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box and the bag takes the form of the box. Most box products are one box; that is, settling and filtration through media occur in the same box. Other products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon. Inserts are an easy and inexpensive retrofitting option because drain inlets are already a component of most standard drainage systems. Inserts are usually only suitable for mitigating relatively small tributary areas (less than 1 acre). For more information on specific catch basin inserts and their vendors refer to Table 9-1 or check the Yellow Pages link at www.BMPLA.org for vendor contact information.

Cartridge filter–type controls typically consist of a series of vertical filters contained in a vault or catch basin that provide treatment through filtration and sedimentation. The vault may be divided into multiple chambers where the first chamber acts as a pre-settling basin for removal of coarse sediment while another chamber acts as the filter bay and houses the filter cartridges. The performance and capacity of a cartridge filter installation depends on the properties of the media contained in the cartridges. Cartridge filter manufacturers often provide an array of

media types each with varying properties, targeting various pollutants and a range of particle sizes. Commonly used media include media that target solids, such as perlite, and media that target both dissolved and non-dissolved constituents, such as compost leaf media, zeolite, and iron-infused polymers. Manufacturers try to distinguish their products through innovative designs that aim at providing self cleaning and draining, uniformly loaded, and clog resistant cartridges that functional properly over a wide range of hydraulic loadings and pollutant concentrations. For more information on specific cartridge filter models and their vendors refer to Table 9-1 or check the Yellow Pages link at www.BMPLA.org for vendor contact information.

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as wetlands by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or higher volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through natural media (mulch, compost, soil, plants, microbes, etc) and either infiltrated or collected by an underdrain and delivered to the storm system. Tributary areas for biotreatment devices tend to be limited to 0.5 to 1.0 acres.

The vendors of the various proprietary BMPs provide detailed documentation for device selection, sizing, and maintenance requirements. Tributary area sizes are limited to the capacities of the largest available model. The latest manufacturer supplied documentation must be used for sizing and selection of all proprietary devices. Links to the websites of a number of vendors of proprietary devices is included in Table 9-1 or check the Yellow Pages link at www.BMPLA.org for vendor contact information.

General Design Specifications

Proprietary BMP vendors are constantly updating and expanding their product lines, so refer to the latest design guidance from the vendors. General guidelines on the performance, sizing, and operation and maintenance of proprietary devices are provided through LACDPW Watershed Division.

Expected Performance

For hydrodynamic devices, it has been stated with respect to CSOs that the practical lower limit of hydrodynamic separation is a particle with a settling velocity of 12 to 16.5 feet per hour (0.10 to 0.14 cm/s). As such, the focus for hydrodynamic separation in CSOs has been with settleable solids generally 200 microns and larger, given the presence of the lighter organic solids. For inorganic sediment, the above settling velocity range represents a particle diameter of 50 to 100 microns. Thus hydrodynamic separation devices are effective for removal of course sediment, trash, and debris, and are useful as pretreatment in combination with other types of BMPs that target smaller particle sizes.

Catch basin inserts come in such a wide range of configurations that it is practically impossible to generalize the expected performance. Inserts should mainly be used for catching coarse sediments and floatable trash, and are effective as pretreatment in combination with other types of BMPs. Trash and large objects can greatly reduce the effectiveness of catch basin inserts with respect to sediment and hydrocarbon capture. Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.

Cartridge filters have been proven to provide efficient removals for both dissolved and non-dissolved constituents. Cartridge filters are, however, less adept at handling high flow rates as compared to catch basin inserts and hydrodynamic devices, mainly due to the enhanced treatment provided through the filtration mechanism.

Proprietary biotreatment devices are relatively new compared to the other types of proprietary treatment devices included in this document. Therefore, there are fewer third party studies on proprietary biotreatment devices and the available performance information is mostly vendor-supplied. According to the vendors, like their natural counterparts, proprietary biotreatment devices are highly efficient at mitigating dissolved metals, nutrients, and suspended solids.

More detailed performance information is available from the vendors of each class of proprietary device. The performance numbers are typically presented as percent removals rather than effluent quality measurements and can be found on the vendor websites using the links provide in Table 9-1.

Sizing

Hydrodynamic devices, catch basin inserts and cartridge filters are flow-based BMPs and therefore should be sized to capture and treat the SUSMP peak flow rate if used as a standalone BMP. Proprietary biotreatment devices on the other hand include both volume-based and flow-based BMPs. Volume-based proprietary devices should be sized to capture and treat the water quality design volume if used as a standalone BMP.

Auxiliary components of proprietary devices such as sorbent media, screens, baffles, and sumps are selected based on site specific conditions such as the loading that is expected and the desired frequency of maintenance. Sizing of proprietary devices is reduced to a simple process whereby a model can simply be selected from a table or a chart based on a few known quantities (tributary area, location, design flow rate, design volume, etc). A few of the manufacturers either size the devices for potential clients or offer calculators on their websites that simplify the design process even further and lessens the possibility of using obsolete design information.

For the latest sizing guidelines, refer to the manufacturer's website.

Operation and Maintenance

Hydrodynamic Separation Devices

Hydrodynamic separators do not have any moving parts and are consequently not maintenance intensive. Maintenance is important, however, to ensure that they are operating as efficiently as possible. Proper maintenance involves frequent inspections throughout the first year of installation, especially after major storm events. The systems are considered full when the sediment level is within one foot of the unit's top, at which point it must be cleaned out. Removal of sediment can be performed with a sump vac or vactor truck. Some hydrodynamic separator systems may contribute to mosquito breeding if they hold standing water between storms.

Refer to manufacturer's guidelines for inspection and maintenance activities.

Catch Basin Inserts

Catch basin inserts can be maintenance intensive due to their susceptibility for accumulating trash and debris. Regular maintenance activities include the cleanup and removal of accumulated trash and sediment, while major maintenance activities include replacing filter media (if used) and or repairing/replacing geotextile fabrics. There are a number of proprietary catch basin inserts and proper maintenance procedures should be determined based on manufacturer's recommendations for the selected catch-basin insert.

Cartridge filters

Maintenance activities include periodically removing captured trash, debris, and sediment from the vault floor, typically twice per year depending on the accumulation rate, using a sump vac or vactor truck. The media in media filters has to be replaced when it becomes saturated, typically about once every other year, also depending on the pollutant accumulation rate. The manufacturers of these devices typically provide contract operation and maintenance services.

All stormwater vaults that contain standing water can become a breeding area for mosquitoes. Manufacturers have developed systems to completely drain the vault, such as a perforated pipe installed in the bottom of the vault that is encased in a filter sock to prevent clogging.

Biotreatment Devices

Maintenance of biotreatment devices can be provided by the manufacturers and typically consists of routine inspection and hand removal of accumulated trash and debris. As opposed to other proprietary treatment devices, no vactor trucks or mechanical maintenance is needed.

Online Resources

Table 9-1 provides a list of links to the websites of several proprietary stormwater management controls manufactures current as of January 2009. Note that this is not an exclusive list of the proprietary products that are available. Also check the BMPLA Yellow Pages (www.BMPLA.org). The products listed in Table 9-1 and in the BMPLA Yellow Pages are proprietary and nonproprietary products that are meant to improve or eliminate pollution associated with urban runoff and stormwater. The phrase "Best Management Practice" is a common term used in Federal, State, and local regulations to label these types of products, activities, and services. Usage of the term does not imply that some products, activities, or services are better than others, or that the County of Los Angeles evaluates or decides which product, activity, or service should be listed. The inclusion of vendors, manufacturers, and products on this list in no way represents an endorsement or guarantee of effectiveness as a result of the use of these products, nor for any compliance issues regarding the Americans with Disabilities Act. Please contact the vendor and follow the manufacturers' specifications for preparation, installation, and maintenance of these products.

Table 9-1: Proprietary Device Manufacturer Websites

Category	Device	Manufacturer	Website
Catch Basin Insert	Curb Inlet Basket, Grate Inlet Skimmer	Suntree Technologies Inc.	www.suntreetech.com
Catch Basin Insert	Ultra-CurbGuard	UltraTech International, Inc.	www.Stormwater-Products.com
Catch Basin Insert	Hydro-Kleen	Hydro Compliance Management, Inc.	www.HydroCompliance.com
Catch Basin Insert	The Hydro-Cartridge®	Advanced Aquatic International, Inc.	www.hydro-cartridge.com
Catch Basin Insert	Streamguard™ Catch Basin Insert	B & B Marketing Corp	http://www.b-bmarketingcorp.com/streamguard.htm
Catch Basin Insert	Aqua-Guardian™ Catch Basin Insert	Aquashield, Inc.	http://aquashieldinc.com/aqua-guardian.htm
Catch Basin Insert	Ultra-Urban Filter	AbTech Industries	www.abtechindustries.com
Catch Basin Insert	FloGard+Plus, PerkFilter™ Percolation Filter	KriStar Enterprises, Inc.	www.kristar.com
Cartridge Filter	StormScreen™, StormFilter™	Stormwater 360º	http://www.contech-cpi.com/stormwater/products/filtration/stormfilter/15
Hydrodynamic Device	BaySaver Separation System	BaySaver Inc.	www.baysaver.com
Hydrodynamic Device	V2B1™ Stormwater Treatment System	Environment 21, LLC	http://www.env21.com/V2B1.html
Hydrodynamic Device	Aqua-Swirl™ Concentrator	Aquashield, Inc.	http://www.aquashieldinc.com/aqua-swirl.html
Hydrodynamic Device	Vortechs™ Stormwater Treatment System	Contech Construction Products Inc.	http://www.contech-cpi.com/stormwater/products/hydrodynamic_separation/vortechs/72
Hydrodynamic Device	Downstream Defender™	Hydro International	http://www.hydro-international.biz/stormwater/downstream.php
Hydrodynamic Device	Continuous Deflective Separation (CDS) Unit,	Contech Construction Products Inc.	http://www.contech-cpi.com/stormwater/products/hydrodynamic_separation/cds/558
Hydrodynamic Device	CrystalStream	CrystalStream Technologies	www.crystalstream.com
Proprietary Biotreatment	Filterra	Americast	http://www.americastusa.com/index.php/filterra/
Proprietary Biotreatment	StormTreat Systems	StormTreat Systems Inc	http://www.stormtreat.com/home.htm

Note: Web links last accessed in January 2009

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11. ACKNOWLEDGMENTS

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APPENDIX A GLOSSARY

Best Management Practice (BMP): Methods, measures, or practices designed and selected to reduce or eliminate the discharge of pollutants to surface waters from point and nonpoint source discharges including storm water. BMPs include structural and nonstructural controls, and operation and maintenance procedures, which can be applied before, during, and/or after pollution producing activities.

Bioretention Facility: A facility that utilizes soil infiltration and both woody and herbaceous plants to remove pollutants from stormwater runoff. Runoff is typically captured and infiltrated over a period of 24 to 48 hours.

Capacity: The capacity of a stormwater drainage facility is the flow volume or rate that the facility (e.g., pipe, pond, vault, swale, ditch, drywell, etc.) is designed to safely contain, receive, convey, reduce pollutants from, or infiltrate stormwater to meet a specific performance standard. There are different performance standards for pollution reduction, flow control, conveyance, and destination/ disposal, depending on location.

Catch Basin: A structural facility located just below the ground surface, used to collect stormwater runoff for conveyance purposes. Generally located in streets and parking lots, catch basins have grated lids, allowing stormwater from the surface to pass through for collection. Catch basins also include a sumped bottom and submerged outlet pipe (downturned 90 degree elbow, hood, or baffle board) to trap coarse sediment and oils.

Check Dam: Small temporary barrier, grade control structure, or dam constructed across a swale, drainage ditch, or area of concentrated flow with the intent to slow or stop runoff.

Control Device: A device used to hold back or direct a calculated amount of stormwater to or from a stormwater management facility. Typical control structures include vaults or manholes fitted with baffles, weirs, or orifices.

Conveyance: The transport of stormwater from one point to another.

Detention Facility: A facility designed to receive and hold stormwater and release it at a slower rate, usually over a number of hours. The full volume of stormwater that enters the facility is eventually released.

Detention Tank, Vault, or Oversized Pipe: A structural subsurface facility used to provide flow control for a particular drainage basin.

Drainage Basin: A specific area that contributes stormwater runoff to a particular point of interest, such as a stormwater management facility, drainageway, wetland, river, or pipe.

Embankment: A long artificial mound of stone or earth; built to hold back water.

Extended Detention Basin: A surface vegetated basin used to provide flow control for a particular drainage basin. Stormwater temporarily fills the extended detention pond during large storm events and is slowly released over a number of hours, reducing peak flow rates.

Filter Strip: A gently sloping, densely grassed area used to filter, slow, and infiltrate stormwater.

Flow Control Facility: Any structure or drainage device that is designed, constructed, and maintained to collect, retain, infiltrate, or detain surface water runoff during and after a storm event for the purpose of controlling post-development quantity leaving the site.

Flow Control: The practice of limiting the release of peak flow rates, flow durations, and volumes from a site. Flow control is intended to protect downstream properties, infrastructure, and natural resources from the increased stormwater runoff flow rates and volumes resulting from development.

Hydrodynamic Separation: Flow-through structures with a settling or separation unit to remove sediments and other pollutants in which no outside power source is required, because the energy of the flowing water allows the sediments to efficiently separate. Depending on the type of unit, this separation may be by means of swirl action or indirect filtration.

Impervious Surface / Area: A hard surface area which either prevents or retards the entry of water into the soil as under natural conditions prior to development. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater.

Infiltration Trench: A linear excavation, backfilled with gravel, used to filter pollutants and infiltrate stormwater.

Infiltration: The percolation of water into the ground.

Integrated Pest Management Plan (IPMP): A balanced approach to pest management which incorporates the many aspects of plant health care in ways that mitigate harmful environmental impacts and protect human health.

Landscaping: The vegetation (plantings), topsoil, rocks, and other surface elements associated with stormwater facility design.

Open Channel: A fluid passageway which allows part of the fluid to be exposed to the atmosphere.

Operations and Maintenance (O&M): The continuing activities required to keep stormwater management facilities and their components functioning in accordance with design objectives.

Outfall / Outlet: A location where collected and concentrated water is discharged. Outfalls can include discharge from stormwater management facilities, drainage pipe systems, and constructed open channels.

Planter Box: A structural facility filled with topsoil and gravel and planted with vegetation. The planter is completely sealed, and a perforated collection pipe is placed under the soil and gravel, along with an overflow provision, and directed to an acceptable destination point. The stormwater planter receives runoff from impervious surfaces, which is filtered and retained for a period of time.

Pollutant: An elemental or physical material that can be mobilized or dissolved by water or air and creates a negative impact to human health and/ or the environment. Pollutants include suspended solids (sediment), heavy metals (such as lead, copper, zinc, and cadmium), nutrients (such as nitrogen and phosphorus), bacteria and viruses, organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers), floatable debris, and increased temperature.

Pollutants of Concern: Pollutants that exhibit one or more of the following characteristics: current loadings or historic deposits of the pollutant are impacting the beneficial uses of a receiving water, elevated levels of the pollutant are found in sediments of a receiving water and/or have the potential to bioaccumulate in organisms therein, or the detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and/or flora and fauna.

Pollution Reduction: The practice of filtering, retaining, or detaining surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.

Practicable: Available and capable of being done, after taking into consideration cost, existing technology, and logistics in light of overall project purpose.

Public Facility: A street, right-of-way, sewer, drainage, stormwater management, or other facility that is either currently owned by the City/County or will be conveyed to the City/County for maintenance responsibility after construction.

Retention Facility: A facility designed to receive and hold stormwater runoff. Rather than storing and releasing the entire runoff volume, retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation. In this way, the full volume of stormwater that enters the facility is not released off-site.

Roadway: Any paved surface used to carry vehicular traffic (cars/trucks, forklifts, farm machinery, or any other large machinery).

Runoff: Stormwater flows across the ground surface during and after a rainfall event. Also simply referred to as stormwater.

Stormwater: Water runoff that originates as precipitation on a particular site, basin, or watershed. Also referred to as runoff.

Stormwater Management: The overall culmination of techniques used to reduce pollutants from, detain and/or retain, and provide a destination for stormwater to best preserve or mimic the natural hydrologic cycle, to accomplish goals of reducing combined sewer overflows or basement sewer backups, or to fit within the capacity of existing infrastructure.

Surface Conveyance: The transport of stormwater on the ground surface from one point to another.

Total Suspended Solids (TSS): Matter suspended in stormwater excluding litter, debris, and other gross solids exceeding 1 millimeter in diameter.

Underground Injection Control (UIC): A federal program under the Safe Drinking Water Act, which regulates the injection of water below ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination.

Vegetated Facilities: Stormwater management facilities that rely on plantings to enhance their performance. Plantings can provide wildlife habitat and enhance many facility functions, including infiltration, pollutant removal, water cooling, flow calming, and prevention of erosion.

Vegetated Swale: A long and narrow, trapezoidal or semicircular channel, planted with a variety of trees, shrubs, and grasses or with a dense mix of grasses. Stormwater runoff from impervious surfaces is directed through the swale, where it is slowed and in some cases infiltrated, allowing pollutants to settle out. Check dams are often used to create small ponded areas to facilitate infiltration.

Water Body: Water bodies include coastal waters, rivers, sloughs, continuous and intermittent streams and seeps, ponds, lakes, aquifers, and wetlands.

Watercourse: A channel in which a flow of water occurs, either continuously or intermittently, with some degree of regularity. Watercourses may be either natural or artificial.

APPENDIX B BMP Sizing Worksheets

Dry Extended Detention Basin Worksheet

Step 1: Determine SUSMP volume		
1-1. Enter drainage area, A	A =	acres
1-2. Enter impervious fraction, Imp	Imp =	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended)), P_i	P_i =	in
1-5. Calculate rainfall depth, $P = P_i/12$	P =	ft
1-6. Calculate SUSMP volume, $V_{wq} = 43560 \cdot P^*A^*C$	V_{wq} =	ft^3
Step 2: Calculate the volume of the active basin		
2-1. Calculate basin active volume (includes SUSMP volume + sediment storage volume), $V_a = 1.05V_{wq}$	V_a =	ft^3
Step 3: Determine Detention Basin Location and Preliminary Geometry Based on Site Constraints		
3-1. Based on site constraints, determine the basin geometry and the storage available by developing an elevation-storage relationship for the basin. For this simple example, assume a trapezoidal geometry for cell 1 (forebay) and cell 2.		
3-2. Enter the total surface area of the basin footprint based on site constraints, A_{tot}	A_{tot} =	ft^2
3-3. Enter the length of the basin footprint based on site constraints, L_{tot} (L:W = 1.5:1 min)	L_{tot} =	ft
3-4. Calculate the width of the basin footprint, $W_{tot} = A_{tot} / L_{tot}$	W_{tot} =	ft
3-5. Enter interior side slope as length per unit height (min = 3), Z	Z =	
3-6. Enter desired freeboard depth, d_{fb} (min: 2 ft on-line; 1 ft offline)	d_{fb} =	ft
3-7. Calculate the length of the active volume surface area including the internal berm but excluding freeboard, $L_{av\text{-}tot} = L_{tot} - 2Zd_{fb}$	$L_{av\text{-}tot}$ =	ft
3-8. Calculate the width of the active volume surface area including the internal berm but excluding freeboard, $W_{av\text{-}tot} = W_{tot} - 2Zd_{fb}$	$W_{av\text{-}tot}$ =	ft
3-9. Calculate the total active volume surface area including the internal berm and excluding freeboard, $A_{av\text{-}tot} = L_{av\text{-}tot} \bullet W_{av\text{-}tot}$	$A_{av\text{-}tot}$ =	ft^2
3-10. Enter the width of the internal berm (6 ft min), W_{berm}	W_{berm} =	ft
3-11. Enter the length of the internal berm, $L_{berm} = W_{av\text{-}tot}$	L_{berm} =	ft
3-12. Calculate the area of the berm, $A_{berm} = W_{berm} \bullet L_{berm}$	A_{berm} =	ft^2
3-13. Calculate the SUSMP surface area excluding the internal berm and freeboard, $A_{av} = A_{av\text{-}tot} - A_{berm}$	A_{av} =	ft^2

Step 4: Determine Dimensions of Cell 1		
4-1. Enter the percent of V_a in Cell 1 (25% required), $\%V_1$	$\%V_1$ =	%
4-2. Calculate the active volume of Cell 1, $V_1 = (V_a \bullet \%V_1)/100$	V_1 =	ft^3
4-3. Enter a desired average depth for the active volume of Cell 1, d_1	d_1 =	ft
4-4. Calculate the surface area for the active volume of Cell 1, $A_1 = V_1 / d_1$	A_1 =	ft^2
4-5. Enter the width of Cell 1, $W_1 = W_{wq\text{-}tot} = L_{berm}$	W_1 =	ft
4-6. Calculate the length of Cell 1 (Note: inlet and outlet should be configured to maximize the residence time), $L_1 = A_1 / W1$	L_1 =	ft
Step 5: Determine Dimensions of Cell 2		
5-1. Calculate the active volume of Cell 2, $V_2 = V_a - V_1$	V_2 =	ft^3
5-2. Calculate the surface area of the active volume of Cell 2, $A_2 = A_{av} - A_1$	A_2 =	ft^2
5-3. Calculate the average depth for the active volume of Cell 2, $d_2 = V_2 / A_2$	d_2 =	ft
5-4. Enter the width of Cell 2, $W_2 = W_1 = W_{av\text{-}tot} = L_{berm}$	W_2 =	ft
5-5. Calculate the length of Cell 2, $L_2 = A_2 / W_2$	L_2 =	ft
5-6. Calculate the width of Cell 2 at half of d_2, $W_{mid2} = W_2 - Zd_2$	W_{mid2} =	ft
5-7. Calculate the length of Cell 2 at half of d_2, $L_{mid2} = W_2 - Zd_2$	L_{mid2} =	ft
5-8. Verify that the length-to-width ratio of Cell 2 at half of d_2 is at least 1.5:1 with ≥ 2:1 preferred. If the length-to-width ratio is less than 1.5:1, modify input parameters until a ratio of at least 1.5:1 is achieved. If the input parameters cannot be modified as a result of site constraints, another site for the basin should be chosen, $LW_{mid2} = L_{mid2} / W_{mid2}$	LW_{mid2} =	
Step 6: Ensure Design Requirements and Site Constraints are Achieved		
6-1. Check design requirements and site constraints. Modify design geometry until requirements are met. If the chosen site for the basin is inadequate to meet the design requirements, choose a new location or alternative treatment BMP.		
Step 7: Size Outlet Structure		
7-1. Refer to Appendix C for pond outlet structure sizing methodologies and examples. The total drawdown time for the basin should be 36-48 hours. The outlet structure shall be designed to release the bottom 50% of the detention volume (half-full to empty) over 24-32 hours, and the top half (full to half-full) in 12-16 hours. A primary overflow should be sized to pass the peak flow rate from the developed capital design storm.		

Step 8: Determine Emergency Spillway Requirements

8-1. For online basins, an emergency overflow spillway should be sized to pass the capital design storm in order to prevent overtopping of the walls or berms in the event that a blockage of the riser occurs. For offline basins, an emergency spillway or riser should be sized to pass the SUSMP storm. For sites where the emergency spillway discharges to a steep slope, an emergency overflow riser, in addition to the spillway should be provided.

Dry Extended Detention Basin Design Example

Step 1: Determine SUSMP Volume

For this design example, a 10-acre residential development with a 60% total impervious area is considered.

Step 1: Determine SUSMP volume			
1-1. Enter drainage area, A	A =	10	acres
1-2. Enter impervious fraction, Imp	Imp =	0.60	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	0.59	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended)), P_i	P_i =	1.2	in
1-5. Calculate rainfall depth, P = P_i/12	P =	0.10	ft
1-6. Calculate SUSMP volume, V_{wq} = 43560•P*A*C	V_{wq} =	25,700	ft^3

Step 2: Calculate Volume of the Active Basin and the Forebay Basin

Step 2: Calculate the design volume of the active basin			
2-1. Calculate basin active design volume (includes SUSMP + sediment storage volume), $V_a = 1.05V_{wq}$	V_a =	26,985	ft^3

Step 3: Determine Detention Basin Location and Preliminary Geometry Based on Site Constraints

The detention basin in this example has an internal berm separating the forebay (Cell 1) and the main basin (Cell 2). The internal berm elevation is 2 ft below the elevation of the SUSMP volume within the entire basin. The berm length is equal to the width of the basin when filled to the active design volume.

Step 3: Determine Detention Basin Location and Preliminary Geometry Based on Site Constraints			
3-1. Based on site constraints, determine the basin geometry and the storage available by developing an elevation-storage relationship for the basin. For this simple example, assume a trapezoidal geometry for cell 1 (forebay) and cell 2.			
3-2. Enter the total surface area of the basin footprint based on site constraints, A_{tot}	A_{tot} =	11,000	ft^2
3-3. Enter the length of the basin footprint based on site constraints, L_{tot} (L:W = 1.5:1 min)	L_{tot} =	200	ft
3-4. Calculate the width of the basin footprint, $W_{tot} = A_{tot} / L_{tot}$	W_{tot} =	55	ft
3-5. Enter interior side slope as length per unit height (min = 3), Z	Z =	3	

Step 3: Determine Detention Basin Location and Preliminary Geometry Based on Site Constraints			
3-6. Enter desired freeboard depth, d_{fb} (min: 2 ft on-line; 1 ft offline)	d_{fb} =	2	ft
3-7. Calculate the length of the active volume surface area including the internal berm but excluding freeboard, $L_{av\text{-}tot} = L_{tot} - 2Zd_{fb}$	$L_{av\text{-}tot}$ =	188	ft
3-8. Calculate the width of the active volume surface area including the internal berm but excluding freeboard, $W_{av\text{-}tot} = W_{tot} - 2Zd_{fb}$	$W_{av\text{-}tot}$ =	43	ft
3-9. Calculate the total active volume surface area including the internal berm and excluding freeboard, $A_{av\text{-}tot} = L_{av\text{-}tot} \bullet W_{av\text{-}tot}$	$A_{av\text{-}tot}$ =	8,084	ft^2
3-10. Enter the width of the internal berm (6 ft min), W_{berm}	W_{berm} =	6	ft
3-11. Enter the length of the internal berm, $L_{berm} = W_{av\text{-}tot}$	L_{berm} =	43	ft
3-12. Calculate the area of the berm, $A_{berm} = W_{berm} \bullet L_{berm}$	A_{berm} =	258	ft^2
3-13. Calculate the SUSMP surface area excluding the internal berm and freeboard, $A_{av} = A_{av\text{-}tot} - A_{berm}$	A_{av} =	7,826	ft^2

Step 4: Calculate Dimensions of Cell 1

Calculate the dimensions of the forebay (Cell 1) based on the active design volume for Cell 1 (25% of V_a) and a desired average depth, d_1. The width of the forebay, W_1, is equivalent to the length of the berm, L_{berm}, and the width of Cell 2, W_2.

Step 4: Determine Dimensions of Cell 1			
4-1. Enter the percent of V_a in Cell 1 (25% required), $\%V_1$	$\%V_1$ =	25	%
4-2. Calculate the active volume of Cell 1 (including sediment storage), $V_1 = (V_a \bullet \%V_1)/100$	V_1 =	6,746	ft^3
4-3. Enter a desired average depth for the active volume of Cell 1, d_1	d_1 =	5	ft
4-4. Calculate the surface area for the active volume of Cell 1, $A_1 = V_1 / d_1$	A_1 =	1,349	ft^2
4-5. Enter the width of Cell 1, $W_1 = W_{wq\text{-}tot} = L_{berm}$	W_1 =	43	ft
4-6. Calculate the length of Cell 1 (Note: inlet and outlet should be configured to maximize the residence time), $L_1 = A_1 / W1$	L_1 =	31	ft

Step 5: Calculate the Dimensions of Cell 2

Calculate the dimensions of the main basin (Cell 2) based on the active design volume for Cell 2 and a desired average depth, d_2. A calculation of the length, L_{mid2}, and width, W_{mid2}, at half basin depth, d_2, is conducted in order to verify that the length-to-width ratio at half d_2 is greater than 1.5:1.

Step 5: Calculate the dimensions of Cell 2			
5-1. Calculate the active volume of Cell 2, $V_2 = V_a - V_1$	$V_2 =$	20,239	ft^3
5-2. Calculate the surface area of the active volume of Cell 2, $A_2 = A_{av} - A_1$	$A_2 =$	6,477	ft^2
5-3. Calculate the average depth of the active volume of Cell 2, $d_2 = V_2 / A_2$	$d_2 =$	3	ft
5-4. Enter the width of Cell 2, $W_2 = W_1 = W_{av\text{-}tot} = L_{berm}$	$W_2 =$	43	ft
5-5. Calculate the length of Cell 2, $L_2 = A_2 / W_2$	$L_2 =$	151	ft
5-6. Calculate the width of Cell 2 at half of d_2, $W_{mid2} = W_2 - Zd_2$	$W_{mid2} =$	34	ft
5-7. Calculate the length of Cell 2 at half of d_2, $L_{mid2} = W_2 - Zd_2$	$L_{mid2} =$	52	ft
5-8. Verify that the length-to-width ratio of Cell 2 at half of d_2 is at least 1.5:1 with ≥ 2:1 preferred. If the length-to-width ratio is less than 1.5:1, modify input parameters until a ratio of at least 1.5:1 is achieved. If the input parameters cannot be modified as a result of site constraints, another site for the basin should be chosen, $LW_{mid2} = L_{mid2} / W_{mid2}$	$LW_{mid2} =$	1.6	

Step 6: Ensure Design Requirements and Site Constraints are Achieved

Check design requirements and site constraints. Modify design geometry until requirements are met. If the chosen site for the basin is inadequate to meet the design requirements, choose a new location or an alternative treatment BMP.

Step 7: Size Outlet Structure

Refer to Appendix C for basin outlet structure sizing methodologies and examples. The total drawdown time for the basin should be 36-48 hours. The outlet structure shall be designed to release the bottom 50% of the detention volume (half-full to empty) over 24-32 hours, and the top half (full to half-full) in 12-16 hours. A primary overflow should be sized to pass the peak flow rate from the developed capital design storm.

Step 8: Determine Emergency Spillway Requirements

For online basins, an emergency overflow spillway should be sized to pass the capital design storm in order to prevent overtopping of the walls or berms in the event that a blockage of the riser occurs. For offline basins, an emergency spillway or riser should be sized to pass the SUSMP storm. For sites where the emergency spillway discharges to a steep slope, an emergency overflow riser, in addition to the spillway should be provided.

Vegetated Swale Worksheet

Step 1: Determine SUSMP flow		
1-1. Enter drainage area, A (acres)	A =	acres
1-2. Enter impervious fraction, Imp (eg. 60% = 0.60)	Imp =	
1-3. Calculate runoff coefficient, C = 0.9 • Imp + 0.05	C =	
1-4. Enter design rainfall intensity, i (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for sizing methods for flow-based controls)	i =	in/hr
1-5. Calculate SUSMP flow, $Q_{wq} = C \cdot i \cdot A$	Q_{wq} =	cfs
Step 2: Calculate swale bottom width		
2-1. Enter Manning's roughness coefficient for shallow flow conditions (use 0.2), n_{wq}	n_{wq} =	
2-2. Enter expected vegetation height, y_g	y_g =	ft
2-3. Calculate design flow depth, $y = 2/3y_g$ (0.17 for mowed turf)	y =	ft
2-4. Enter longitudinal slope (along direction of flow), s_f	s_f =	ft/ft
2-5. Calculate bottom width of swale, $b = Q_{wq}n_{wq} / 1.49y^{1.67}s_f^{0.5}$	b =	ft
2-6. If b is between 2 and 10 feet, go to Step 3		
2-7. If b is less than 2 ft, assume b = 2 ft and recalculate flow depth, $y = (Q_{wq}n_{wq} / 2.98s_f^{0.5})^{0.6}$	y =	ft
2-8. If b is greater than 10 ft, one of the following design adjustments must be made: 1) increase the longitudinal slope to a maximum of 0.06 ft/ft (check dams may be used to achieve this), and repeat steps 2-3 to 2-5 above. 2) increase the design flow depth to a maximum of 4 in (0.33 ft) and repeat steps 2-2 to 2-5 above. 3) include a flow splitter longitudinally along the swale bottom (Figure 3-1) that extends at least three-quarters of the swale length (beginning at the inlet).		
Step 3: Determine design flow velocity		
3-1. Enter side slope length per unit height (e.g. 3 if side slope are 3H :1V), Z	Z =	
3-2. Calculate the cross-sectional area of flow at design depth, $A_{wq} = b \cdot y + Z \cdot y^2$	A_{wq} =	ft^2
3-3. Calculate design flow velocity, $V_{wq} = Q_{wq} / A_{wq}$	V_{wq} =	ft/s

Step 4: Calculate swale length		
4-1. Enter target residence time (10 minutes minimum)	t_{HR} =	s
4-2. Calculate swale length, $L = 60t_{HR}V_{wq}$	L =	ft
4-3. If L is too long for the site, proceed to Step 5 to adjust the swale layout		
4-4. If L is greater than 100 ft and will fit within the constraints of the site skip to Step 6		
4-5. If L is less than 100 ft, increase the length to a minimum of 100 ft leaving the bottom width unchanged, skip to Step 6		
Step 5: Adjust swale layout to fit within site constraints		
5-1. Choose a reduced swale length, L_f	L_f =	ft
5-2. Recalculate flow velocity, $V_{wq} = L_f / (60t_{HR})$	V_{wq} =	ft/s
5-3. Recalculate cross-sectional area, $A_{wq} = Q_{wq} / V_{wq}$	A_{wq} =	ft^2
5-4. Calculate an increased bottom width $b_f = Q / (V_{wq}y)$	b_f =	ft
5-5. Recalculate longitudinal slope, $s_f = [Q_{wq}n_{wq} / (1.49A_{wq}y^{2/3})]^2$	s_f =	%
5-6. If s_f is between 1.5% and 6%, the swale design is acceptable for water quality, proceed to Step 6		
5-7. If s_f is between 1% and 1.5%, the swale design is acceptable for water quality with underdrains (see design requirements). Proceed to Step 6. 2. If longitudinal slopes are less than 1.5% and the soils are poorly drained (e.g., silts and clays), then underdrains shall be provided. A soils report to verify soils properties shall be provided for swales less than 1.5%.		
5-8. If s_f is <1%, the swale design is unacceptable. Consider subdividing drainage area and repeat all above steps, or choose a different BMP for the site.		
Step 6: Provide conveyance capacity for flows higher than Q_{wq} (if swale is on-line)		
6-1. If the swale already includes a high-flow bypass to convey flows higher than the SUSMP flow rate, skip this step and **verify that all parameters meet design requirements** to complete sizing		
6-2. If swale does not include a high-flow bypass, check the swale size for capital storm peak flow conveyance (Refer to Design Manual Hydraulic, Section C, "Criteria for Hydraulic Design: Open Channels". Calculate the capital peak flow velocity, V_p	V_p =	ft/s
6-3. If V_p > 3.0 feet per second, return to Step 2 and increase the bottom width or flatten the longitudinal slope as necessary to reduce the capital storm peak flow velocity to 3.0 feet per second or less. If the longitudinal slope is flattened, the swale bottom width must be recalculated (Step 2) and must meet all design criteria.		

Vegetated Swale Design Example

Step 1: Determine SUSMP Flow

For this design example, a 10-acre residential development with a 60% total impervious area is considered. Flow-based sizing Method 1 as described in A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) is assumed. Therefore, the design intensity is 0.2 in/hr.

Step 1: Determine SUSMP flow			
1-1. Enter drainage area, A (acres)	A =	10	acres
1-2. Enter impervious fraction, Imp	Imp =	0.60	
1-3. Calculate runoff coefficient, C = 0.9 • Imp + 0.05	C =	0.59	
1-4. Enter design rainfall intensity, i (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for sizing methods for flow-based controls)	i =	0.2	in/hr
1-5. Calculate SUSMP flow, Q_{wq} = C•i•A	Q_{wq} =	1.18	cfs

Step 2: Calculate Swale Bottom Width

The swale bottom width is calculated based on Manning's equation. The grass height in the swale will be maintained at 4-inches. Therefore, the design depth is assumed to be 2/3 of 4 inches, or 2.7 inches (0.22 ft). The default Manning's roughness coefficient is assumed appropriate for expected vegetation density and design depth.

Step 2: Calculate swale bottom width			
2-1. Enter Manning's roughness coefficient for shallow flow conditions (0.2 typical), n_{wq}	n_{wq} =	0.2	
2-2. Enter expected vegetation height, y_g	y_g =	0.5	ft
2-3. Calculate design flow depth, y = 2/3y_g (0.33 ft for mowed turf)	y =	0.33	ft
2-4. Enter longitudinal slope (along direction of flow), s_f	s_f =	0.04	ft/ft
2-5. Calculate bottom width of swale, b = $Q_{wq}n_{wq}$ / 1.49$y^{1.67}s_f^{0.5}$	b =	5.0	ft
2-6. If b is between 2 and 10 feet, go to Step 3			

Step 3: Determine Design Flow Velocity

The side slopes are will be designed as 3H :1V, so Z = 3.

Step 3: Determine design flow velocity			
3-1. Enter side slope length per unit height (e.g. 3 if side slope are 3H :1V), Z	Z =	3	
3-2. Calculate the cross-sectional area of flow at design depth, $A_{wq} = b \cdot y + Z \cdot y^2$	A_{wq} =	2.0	ft^2
3-3. Calculate design flow velocity, $V_{wq} = Q_{wq} / A_{wq}$	V_{wq} =	0.6	ft/s

Step 4: Calculate Swale Length

Using the design flow velocity and a minimum residence time of 10 minutes, the length of the swale is calculated as follows. The swale length must be a minimum of 100 ft.

Step 4: Calculate swale length			
4-1. Enter target residence time (10 minutes minimum), t_{HR}	t_{HR} =	10	min
4-2. Calculate swale length, $L = 60 \cdot t_{HR} \cdot V_{wq}$	L =	360	ft
4-3. If L is too long for the site, proceed to step 5 to adjust the swale layout			
4-4. If L is greater than 100 ft and will fit within the constraints of the site skip to Step 6			
4-5. If L is less than 100 ft, increase the length to a minimum of 100 ft leaving the bottom width unchanged, skip to Step 6			

Site constraints only allow a swale length of 250 feet. Therefore proceed to Step 5 to adjust the swale length.

Step 5: Adjust Swale Layout to Fit Within Site Constraints

To adjust swale length to 250 feet, the bottom width needs to be increased (up to a maximum of 16 ft if a divider is provided).

Step 5: Adjust swale layout to fit within site constraints			
5-1. Choose a reduced swale length, L_f	L_f =	250	ft
5-2. Recalculate flow velocity, $V_{wq} = L_f / (60 t_{HR})$	V_{wq} =	0.42	ft/s
5-3. Recalculate cross-sectional area, $A_{wq} = Q_{wq} / V_{wq}$	A_{wq} =	2.8	ft2
5-4. Calculate an increased bottom width $b_f = Q_{wq} / (V_{wq} \cdot y)$	b_f =	8.5	ft
5-5. Recalculate longitudinal slope, $s_f = [Q_{wq} n_{wq} / (1.49 A_{wq} y^{2/3})]^2$	s_f =	1.4	%
5-6. If s_f is between 1.0% and 6%, the swale design is acceptable for water quality, proceed to Step 6			

Since longitudinal slopes are less than 1.5%, if the soils are poorly drained (e.g., silts and clays), then an underdrains should be provided. A soils report to verify soils properties should be provided for swales less than 1.5%.

Step 6: Provide Conveyance Capacity for Flows Higher than Q_{wq}

The swale will be offline such that all flows greater than Q_{wq} will be bypassed

Filter Strip Worksheet

Step 1: Calculate the design flow		
1-1. Enter drainage area, A	A =	acres
1-2. Enter impervious fraction, Imp	Imp =	
1-3. Calculate runoff coefficient, C = (0.9•Imp + 0.05)	C =	
1-4. Enter design rainfall intensity, i (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for flow-based controls sizing Method 1)	i =	in/hr
1-5. Calculate SUSMP flow, Q_{wq} = CiA	Q_{wq} =	cfs
Step 2: Calculate the design flow depth		
2-1. Enter filter strip longitudinal slope, s	s =	
2-2. Enter Manning roughness coefficient (0.25-.3), n_{wq}	n_{wq} =	
2-3. Enter width of impervious surface contributing area, W	W =	ft
2-4. Calculate average depth of water using Manning eq, $d_f = 12[Q_{wq}n_{wq}/1.49Ws^{0.5}]^{0.6}$	d_f =	in
2-5. If d_f > 1", go step 2-1 and decrease the slope		
2-6. If the slope cannot be changed due to construction constraints, go to step 2-3 and increase the width perpendicular to flow		
Step 3: Calculate the design velocity		
3-1. Calculate design flow velocity, $V_{wq} = Q_{wq}/d_fW$	V_{wq} =	ft/s
3-2. If the V_{wq} >1 ft/s go to step 2-1 and decrease the slope		
Step 4: Calculate the length of the filter strip		
4-1. Enter residence time (10 minutes, min.), t	t =	min
4-2. Calculate length of the filter strip, $L = 60tV_{wq}$	L =	ft
4-3. If L < 4 ft, go to step 2-1 and increase the slope		

Filter Strip Design Example

Step 1: Calculate the Design Flow

For this design example, a 10-acre residential development with a 60% total impervious area is considered. Flow-based sizing Method 1, as described in A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended), is assumed. Therefore, the design rainfall intensity is assumed to be 0.2 in.

Step 1: Calculate the design flow			
1-1. Enter drainage area, A	A =	10	acres
1-2. Enter impervious fraction, Imp	Imp =	0.60	
1-3. Calculate runoff coefficient, C = (0.9 x Imp + 0.05)	C =	0.59	
1-4. Enter design rainfall intensity, i (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for flow-based controls sizing Method 1)	i =	0.2	in/hr
1-5. Calculate SUSMP flow, Q_{wq} = CiA	Q_{wq} =	1.18	cfs

Step 2: Calculate the Design Flow Depth

Based on the site constraints we choose the width of the filter strip 150 ft and the filter strip longitudinal slope as 3%. The design water depth should not exceed 1 inch.

Step 2: Calculate the design flow depth			
2-1. Enter filter strip longitudinal slope , s	s =	0.03	
2-2. Enter Manning roughness coefficient (0.25-.3), n_{wq}	n_{wq} =	0.27	
2-3. Enter width of impervious surface contributing area , W	W =	150	ft
2-4. Calculate average depth of water using Manning eq, $d_t = 12[Q_{wq}n_{wq}/1.49Ws^{0.5}]^{0.6}$	d_f =	0.67	in
2-5. If d_f > 1" , go step 2-1 and decrease the slope			
2-6. If the slope cannot be changed due to construction constraints, go to step 2-3 and increase the width perpendicular to flow			

Step 3: Calculate the Design Velocity

The designed flow velocity should not exceed 1 foot/second across the filter strip.

Step 3: Calculate the design velocity			
3-1. Calculate design flow velocity, $V_{wq} = Q_{wq}/d_fW$	V_{wq} =	0.1401	ft/s
3-2. If the design flow velocity is higher than 1ft/s go to step 2-1 and decrease the slope			

Step 4: Calculate the Length of the Filter Strip

The filter strip should be at least 4 feet long (in the direction of flow) and accommodate a minimum residence time of 10 minutes to provide adequate water quality treatment.

Step 4: Calculate the length of the filter strip			
4-1. Enter residence time(10 minutes, min.), t	t =	10	min
4-2. Calculate length of the filter strip, $L = 60tV_{wq}$	L =	84.1	ft
4-3. If L < 4 ft, go to step 2-1 and increase the slope			

Bioretention Area Worksheet

Step 1: Determine SUSMP volume		
1-1. Enter drainage area, A	A =	acres
1-2. Enter impervious fraction, Imp	Imp =	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	in
1-5. Calculate rainfall depth, P = P_i/12	P =	ft
1-6. Calculate SUSMP volume, V_{wq}=43560•P*A*C	V_{WQ} =	ft^3
Step 2: Pretreatment		
2-1. If required please go to filter strips worksheet		
Step 3: Calculate bioretention area		
3-1. Enter thickness of planting mix (min. 24"), l	l =	in
3-2. Enter storage depth (max. 18") above the filter, d	d =	in
3-3. Enter design percolation rate (with an underdrain, assume 0.375"/hr min.; without an underdrain, use measured percolation rate x 0.25), P_{design}	P_{design} =	in/hr
3-4. Enter drawdown time (48 hrs, max.), t	t =	hr
3-5. Calculate bioretention area necessary, $A = \frac{(V_{design})(l)}{(t)(P_{design}/12)(d+l)}$	A_{sf} =	ft^2
Step 4: Calculate underdrain system or size gravel layer		
4-1. Calculated filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f = P_{design} \bullet A_{sf}/43200$ (note: for this example, step 4-1 is equivalent to step 5-1 of the Sand Filter Worksheet).	Q_f =	cfs
4-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet to calculate the underdrain system capacity.		
4-3. If no underdrain, size a gravel layer. Calculate the maximum depth of runoff that can be infiltrated within the required drain time (max. 72 hr), $d_{max} = \frac{P_{design}}{12} * t$	d_{max} =	ft
4-4. Choose the gravel drainage layer porosity *n* (typically	n =	
4-5. Choose the gravel drainage layer depth (l) such that $d_{max} \geq n * l$	l =	ft

Step 4: Calculate underdrain system or size gravel layer (cont)	
4-6. Choose the fill time T (time to fill bioretention area with water) (hrs) [use 2 hours for most designs]	T = hrs
4-6. Calculate the infiltrating surface area (filter bottom area) required: $A = \frac{V_{design}}{\frac{TP_{design}}{12} + nl}$	A = ft^2
Step 5: Provide Conveyance Capacity for Flows Higher than Q_{wq}	
5-1. An emergency overflow must still be provided in the event that the surface area becomes clogged or the bioretention area is placed online.	

Bioretention Area Design Example

Bioretention areas have several components that allow the pretreatment, spreading, filtration, collection and discharge of the incoming flows.

Step 1: Determine SUSMP Volume

For this design example, a 10-acre residential development with a 60% total impervious area is considered.

Step 1: Determine SUSMP volume			
1-1. Enter drainage area, A	A =	10	acres
1-2. Enter impervious fraction, Imp	Imp =	0.60	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	0.59	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	1.2	in
1-5. Calculate rainfall depth, P = P_i/12	P =	0.10	ft
1-6. Calculate SUSMP volume, V_{wq} = 43560•P*A*C	V_{wq} =	25,700	ft^3

Step 2: Pretreatment

The bioretention areas that collect runoff from residential roofs, sidewalks, driveways, or other "cleaner" surfaces do not require pretreatment. If the runoff originates from locations other than "clean" surfaces, then pretreatment is required. Please refer to Filter Strips Worksheet for detailed calculations.

Step 3: Determine bioretention area footprint area

A bioretention area is designed with two components: (1) temporary storage reservoir to store runoff, and (2) a plant mix filter bed (planting soil mixed with sand content = 70%) through which the stored runoff must percolate to obtain treatment.

The simple sizing method does not route flows through the filter which would allow a more accurate sizing of the facility. The size of the filter is determined based on the simple assumption that inflow is immediately discharged through the filter at a rate not less than 0.375 in/hr which is equivalent to drawing down the maximum 18" storage depth over 48 hours (0.375 in/hr = 18 in/48 hr).

Step 3: Calculate bioretention footprint area			
3-1. Enter thickness of planting mix (min. 24"), l	l =	24	in
3-2. Enter storage depth (18" max.) above the filter, d	d =	18	in
3-3. Enter percolation rate (0.375"/hr min.), P_{design}	P_{design} =	0.375	in/hr
3-4. Enter drawdown time (48 hrs max.), t	t =	48	hr
3-5. Calculate bioretention area, $A = \frac{(V_{design})(l)}{(t)(P_{design}/12)(d+l)}$	A_{sf} =	9,790	ft^2

Step 4: Calculate Filter Longitudinal Underdrain Collection Pipe

If an underdrain is required, please see the sand filter underdrain calculation. All underdrain pipes must be 6 inches or greater to facilitate cleaning.

Step 4: Calculate filter underdrain system			
4-1. Calculated filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f = P_{design} \cdot A_{sf}/43200$ (note: for this example, step 4-1 is equivalent to step 5-1 of the Sand Filter Worksheet.	Q_f =	0.1	cfs
4-2. Please follow steps 5-2 through 5-7 of the Sand Filter Worksheet to calculate the underdrain system capacity.			

Step 5: Provide Conveyance Capacity for Flows Higher than Q_{WQ}

Provide conveyance capacity for flows higher than Q_{wq}, SUSMP flow rate, to bypass the bioretention area. An emergency overflow must also be provided in the event that the surface area becomes clogged or the bioretention area is placed online.

Infiltration Facilities Worksheet

Step 1: Determine SUSMP volume		
1-1. Enter drainage area, A	A =	acres
1-2. Enter impervious fraction, Imp	Imp =	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	in
1-5. Calculate rainfall depth, P = P_i/12	P =	ft
1-6. Calculate SUSMP volume, V_{wq} = 43560•P*A*C	V_{wq} =	ft^3
Step 2: Calculate design infiltration rate		
2-1. Enter measured soil percolation rate (0.5 in/hr min.), $P_{measured}$	$P_{measured}$ =	in/hr
2-2. Enter correction factor for testing (0.5), F_t	F_t =	
2-3. Enter correction factor for plugging, (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sands-cobbles), F_p	F_p =	
2-4. Calculate $F_{geometry}$ (must be between 0.25 and 1.0), $F_{geometry}$ = 4 D/W + 0.05 , where D=depth from the bottom of the facility to the maximum wet-season water table elevation or nearest impervious layer, whichever is less (ft) and W = width of the facility (ft)	$F_{geometry}$ =	
2-5. Calculate the design percolation rate, $P_{design} = P_{measured}\ F_t F_p F_{geometry}$	P_{design} =	in/hr
Step 3: Determine facility size		
3-1. Enter drawdown time (72 hrs max.), t_d	t_d =	hrs
3-2. Calculate max.depth of runoff that can be infiltrated within the t_d, $d_{max} = P_{design}\ t_d/12$	d_{max} =	ft
3-3. For basins, select ponding depth d_p such that $d_p \le d_{max}$	d_p =	ft
3-4. For trenches, enter trench fill aggregate porosity, n_t	n_t =	
3-5. Enter depth of trench fill, d_t	d_t =	in
3-5. Select trench ponding depth d_p such that $d_p \le d_{max} - n_t d_t$	d_p=	ft
Step 4: Determine infiltrating surface area (filter bottom area)		
4-1. Enter the time to fill infiltration basin or trench with water (Use 2 hours for most designs), T	T =	hrs
4-2. Calculate infiltrating surface area for infiltration basin: $A_b = V_{wq}/(T\ P_{design}/12+d_p)$	A_b =	ft^2

4-3. Calculate infiltrating surface area for infiltration trenches: $A_t = V_{wq}/(T\ P_{design}\ /12+n_t d_t+dp)$	A_t = ft^2
Step 5: Provide conveyance capacity for filter clogging	
5-1.The infiltration facility should be placed off-line, but an emergency overflow must still be provided in the event the filter becomes clogged.	

Infiltration Facility Design Example

Step 1: Determine SUSMP Volume

For this design example, an infiltration basin and trench are sized for a 10-acre residential development with a 60% total impervious area.

Step 1: Determine SUSMP volume			
1-1. Enter drainage area, A	A =	10	acres
1-2. Enter impervious fraction, Imp	Imp =	0.60	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	0.59	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	1.2	in
1-5. Calculate rainfall depth, P = P_i/12	P =	0.10	ft
1-6. Calculate SUSMP volume, V_{wq} = 43560•P*A*C	V_{wq} =	25,700	ft^3

Step 2: Calculate Design Infiltration Rate

Infiltration facilities require a minimum soil infiltration rate of 0.5 in/hr. If the rate exceeds 2.4 in/hr as in this example, then the runoff should be fully treated in an upstream BMP prior to infiltration to protect the groundwater quality.

Step 2: Calculate design infiltration rate			
2-1. Enter measured soil percolation rate (0.5 in/hr min.), $P_{measured}$	$P_{measured}$ =	4	in/hr
2-2. Enter correction factor for testing (0.5), F_t	F_t =	0.5	ft
2-3. Enter correction factor for plugging, (0.7 loams-sandy loams, 0.8 fine-loamy sands, 0.9 medium sands, 1.0 coarse sands-cobbles), F_p	F_p =	0.8	
2-4. Calculate $F_{geometry}$ (must be between 0.25 and 1.0), $F_{geometry}$ = 4 D/W + 0.05 , where D=depth from the bottom of the facility to the maximum wet-season water table elevation or nearest impervious layer, whichever is less (ft) and W = width of the facility (ft)	$F_{geometry}$ =	0.25	
2-5. Calculate the design percolation rate, $P_{design} = P_{measured} F_t F_p F_{geometry}$	P_{design} =	0.4	in/hr

Step 3: Determine Facility Size

The simple sizing method requires that the SUSMP volume must be completely infiltrated within 72 hours. The size of the infiltration trench is determined based on the simple assumption that inflow is immediately discharged through the trench.

Step 3: Determine facility size			
3-1. Enter drawdown time (72 hrs max.), t_d	t_d =	72	hrs
3-2. Calculate max. depth of runoff that can be infiltrated within the t_d, $d_{max} = P_{design}\ t_d/12$	d_{max}=	2.4	ft
3-3. Enter trench fill aggregate porosity, n_t	n_t=	0.32	
3-4. Enter depth of trench fill, d_t	d_t =	4	ft
3-5. Select trench ponding depth d_p such that $d_p \leq d_{max} - n_t d_t$	d_p=	1.1	ft

Step 4: Determine Infiltrating Surface Area

The size of the infiltrating surface is determined by assuming the SUSMP volume will fill the available ponding depth (plus the void spaces of the computed porosity (usually about 32%) of the gravel in the trench).

Step 4: Determine infiltrating surface area (filter bottom area)			
4-1. Enter the time to fill infiltration basin or trench with water (Use 2 hours for most designs), T	T =	2	hrs
4-2. Calculate infiltrating surface area for infiltration basin: $A_b = V_{wq}/[(T\ P_{design}\ /12)+d_p]$	A_b =	10,420	ft^2
4-3. Calculate infiltrating surface area for infiltration trenches: $A_t = V_{wq}/(T\ P_{design}\ /12+n_t d_t+d_p)$	A_t =	10,500	ft^2

Step 5: Provide Conveyance Capacity for Flows Higher than Q_{wq}

5-1.The infiltration facility should be placed off-line, but an emergency overflow for flows greater than the SUSMP peak flow rate, Q_{wq}, must still be provided in the event the filter becomes clogged.

Stormwater Wetland Worksheet

Step 1: Determine SUSMP Volume		
1-1. Enter drainage area, A	A =	acres
1-2. Enter impervious fraction, Imp	Imp =	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	
1-4. Enter the design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	in
1-5. Calculate rainfall depth, $P = P_i/12$	P =	ft
1-6. Calculate SUSMP volume, $V_{wq} = 43560 \cdot P^*A^*C$	V_{wq} =	ft^3
Step 2: Determine Wetland Location, Wetland Type and Preliminary Geometry Based on Site Constraints		
2-1. Based on site constraints, determine the wetland geometry and the storage available by developing an elevation-storage relationship for the wetland. For this simple example, assume a trapezoidal geometry for cell 1 (forebay) and cell 2. The wetland does not have extended detention.		
2-2. Enter the total surface area of the wetland footprint based on site constraints, A_{tot}	A_{tot} =	ft^2
2-3. Enter the length of the wetland footprint based on site constraints, L_{tot}	L_{tot} =	ft
2-4. Calculate the width of the wetland footprint, $W_{tot} = A_{tot} / L_{tot}$	W_{tot} =	ft
2-5. Enter interior side slope as length per unit height (min = 3), Z	Z =	
2-6. Enter desired freeboard depth, d_{fb}	d_{fb} =	ft
2-7. Calculate the length of the SUSMP surface area including the internal berm but excluding freeboard, $L_{wq\text{-}tot} = L_{tot} - 2Zd_{fb}$	$L_{wq\text{-}tot}$ =	ft
2-8. Calculate the width of the SUSMP surface area including the internal berm but excluding freeboard, $W_{wq\text{-}tot} = W_{tot} - 2Zd_{fb}$	$W_{wq\text{-}tot}$ =	ft
2-9. Calculate the total SUSMP surface area including the internal berm and excluding freeboard, $A_{wq\text{-}tot} = L_{wq\text{-}tot} \cdot W_{wq\text{-}tot}$	$A_{wq\text{-}tot}$ =	ft^2
2-10. Enter the width of the internal berm (6 ft min), W_{berm}	W_{berm} =	ft
2-11. Enter the length of the internal berm, $L_{berm} = W_{wq\text{-}tot}$	L_{berm} =	ft
2-12. Calculate the area of the berm, $A_{berm} = W_{berm} \cdot L_{berm}$	A_{berm} =	ft^2
2-13. Calculate the SUSMP volume surface area excluding the internal berm and freeboard, $A_{wq} = A_{wq\text{-}tot} - A_{berm}$	A_{wq} =	ft^2

Step 3: Determine Dimensions of Cell 1 (forebay)		
3-1. Enter the percent of V_{wq} in Cell 1 (10-20% required), $\%V_1$	$\%V_1$ =	%
3-2. Calculate the active volume of Cell 1 (includes SUSMP + sediment storage volume), $V_1 = (V_{wq} \bullet \%V_1)/100$	V_1 =	ft^3
3-3. Enter desired average depth of Cell 1 (5-9 ft including sediment storage of 1 ft), d_1	d_1 =	ft
3-4. Calculate the surface area for the SUSMP volume of Cell 1, $A_1 = V_1 / d_1$	A_1 =	ft^2
3-5. Enter the width of Cell 1, $W_1 = W_{av\text{-}tot} = L_{berm}$	W_1 =	ft
3-6. Calculate the length of Cell 1 (Note: inlet and outlet should be configured to maximize the residence time), $L_1 = A_1 / W1$	L_1 =	ft
Step 4: Determine Dimensions of Cell 2		
4-1. Calculate the active volume of Cell 2, $V_2 = V_{wq} - V_1$	V_2 =	ft^3
4-2. Calculate surface area of Cell 2, $A_2 = A_{wq} - A_1$	A_2 =	ft^2
4-3. Enter width of Cell 2, $W_2 = W_1 = W_{wq\text{-}tot} = L_{berm}$	W_2 =	ft
4-4. Calculate top length of Cell 2, $L_2 = A_2 / W_2$	L_2 =	ft
4-5. Verify that the length-to-width ratio of Cell 2 is at least 3:1 with ≥ 4:1 preferred. If the length-to-width ratio is less than 3:1, modify input parameters until a ratio of at least 3:1 is achieved. If the input parameters cannot be modified as a result of site constraints, another site for the pond should be chosen, $LW_2 = L_2 / W_2$	LW_2 =	
4-6. Enter percent of surface area of very shallow zone, $\%A_{vs}$ (see recommended distribution of depths, pg. 7-3)	$\%A_{vs}$ =	%
4-7. Calculate very shallow zone surface area, $A_{vs} = (A_2 \bullet \%A_{vs})/100$	A_{vs} =	ft^2
4-8. Enter average depth of very shallow zone (0.1 - 1 ft), d_{vs}	d_{vs} =	ft
4-9. Calculate volume of very shallow zone, $V_{vs} = A_{vs} \bullet d_{vs}$	V_{vs} =	ft^3
4-10. Enter width of very shallow zone, $W_{vs} = W_2$	W_{vs} =	ft
4-11. Calculate length of very shallow zone, $L_{vs} = A_{vs} / W_{vs}$	L_{vs} =	ft
4-12. Enter percent of surface area of shallow zone, $\%A_s$	$\%A_s$ =	%
4-13. Calculate surface area of shallow zone, $A_s = (A_2 \bullet \%A_s)/100$	A_s =	ft^2
4-14. Enter average depth of shallow zone (1 - 3 ft), d_s	d_s =	ft
4-15. Calculate volume of shallow zone, $V_s = A_s \bullet d_s$	V_s =	ft^3
4-16. Enter width of shallow zone, $W_s = W_2$	W_s =	ft
4-17. Calculate length of shallow zone, $L_s = A_s / W_s$	L_s =	ft
4-18. Calculate surface area of deep zone, $A_{deep} = A_2 - A_{vs} - A_s$	A_{deep} =	ft^2
4-19. Calculate volume of deep zone, $V_{deep} = V_2 - V_{vs} - V_s$	V_{deep} =	ft^3

Step 4: Determine Dimensions of Cell 2		
4-20. Calculate average depth of deep zone (3 - 5 ft), $d_{deep} = V_{deep} / A_{deep}$	d_{deep} =	ft
4-21. Enter width of deep zone, $W_{deep} = W_2$	W_{deep} =	ft
4-22. Calculate length of deep zone, $L_{deep} = A_{deep} / W_{deeo}$	L_{deep} =	ft

Step 5: Ensure Design Requirements and Site Constraints are Achieved

5-1. Check design requirements and site constraints. Modify design geometry until requirements are met. If the chosen site for the wetland is inadequate to meet the design requirements, choose a new location for the wetland or select an alternative treatment BMP.

Step 6: Size Outlet Structure

6-1. Please refer to Appendix C for wetland outlet structure sizing methodologies and examples. The wetland outlet pipe shall be sized, at a minimum, to pass flows greater than the SUSMP peak flow for off-line basins or flow from the capital storm for on-line basins.

Step 7: Determine Emergency Spillway Requirements

7-1. For online basins, an emergency overflow spillway should be sized to pass the capital design storm to prevent overtopping of the walls or berms in the event that a blockage of the riser occurs. For offline basins, an emergency spillway or riser should be sized to pass the SUSMP storm. For sites where the emergency spillway discharges to a steep slope, an emergency overflow riser, in addition to the spillway should be provided.

Stormwater Wetland Design Example

Wetland siting requires the following considerations prior to construction: (1) availability of base flow – stormwater wetlands require a regular source of water to support wetland biota, (2) slope stability – stormwater wetlands are not permitted near steep slope hazard areas, (3) surface space availability – large footprint area is required, and (4) compatibility with flood control – basins must not interfere with flood control functions of existing conveyance and detention structures.

The wetland in this example does not have extended detention. An internal berm separates the forebay (Cell 1) and the main basin (Cell 2). The berm is at the elevation of the active volume (SUSMP plus sediment storage volume) design surface which is also the permanent wetpool elevation.

Step 1: Determine SUSMP Volume

For this design example, a 10-acre residential development with a 60% total impervious area is considered.

Step 1: Determine SUSMP Volume			
1-1. Enter drainage area, A	A =	10	acres
1-2. Enter impervious fraction, Imp	Imp =	0.60	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	0.59	
1-4. Enter the design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	1.20	in
1-5. Calculate rainfall depth, P = P_i/12	P =	0.10	ft
1-6. Calculate SUSMP volume, V_{wq} = 43560•P*A*C	V_{wq} =	25,700	ft^3

Step 2: Determine Pond Location and Preliminary Geometry Based on Site Constraints

A total footprint area and total length available for the wetland is provided. This step calculates the total active volume surface area which is equivalent to the permanent wetpool surface area. This step also calculates the dimensions of the internal berm.

Step 2: Determine Wetland Location, Wetland Type and Preliminary Geometry Based on Site Constraints	
2-1. Based on site constraints, determine the wetland geometry and the storage available by developing an elevation-storage relationship for the wetland. For this simple example, assume a trapezoidal geometry for cell 1 (forebay) and cell 2. The wetland does not have extended detention.	

Step 2: Determine Wetland Location, Wetland Type and Preliminary Geometry Based on Site Constraints			
2-2. Enter the total surface area of the wetland footprint based on site constraints, A_{tot}	A_{tot} =	11,000	ft^2
2-3. Enter the length of the wetland footprint based on site constraints, L_{tot}	L_{tot} =	200	ft
2-4. Calculate the width of the wetland footprint, $W_{tot} = A_{tot} / L_{tot}$	W_{tot} =	55	ft
2-5. Enter interior side slope as length per unit height (min = 3), Z	Z =	3	
2-6. Enter desired freeboard depth, d_{fb}	d_{fb} =	2	ft
2-7. Calculate the length of the SUSMP surface area including the internal berm but excluding freeboard, $L_{wq\text{-}tot} = L_{tot} - 2Zd_{fb}$	$L_{wq\text{-}tot}$ =	188	ft
2-8. Calculate the width of the SUSMP surface area including the internal berm but excluding freeboard, $W_{wq\text{-}tot} = W_{tot} - 2Zd_{fb}$	$W_{wq\text{-}tot}$ =	43	ft
2-9. Calculate the total SUSMP surface area including the internal berm and excluding freeboard, $A_{wq\text{-}tot} = L_{wq\text{-}tot} \bullet W_{wq\text{-}tot}$	$A_{wq\text{-}tot}$ =	8,084	ft^2
2-10. Enter the width of the internal berm (6 ft min), W_{berm}	W_{berm} =	6	ft
2-11. Enter the length of the internal berm, $L_{berm} = W_{wq\text{-}tot}$	L_{berm} =	43	ft
2-12. Calculate the area of the berm, $A_{berm} = W_{berm} \bullet L_{berm}$	A_{berm} =	258	ft^2
2-13. Calculate the active volume surface area excluding the internal berm and freeboard, $A_{wq} = A_{wq\text{-}tot} - A_{berm}$	A_{wq} =	7,826	ft^2

Step 3: Determine Dimensions of Cell 1

It should be assumed that cell 1 (the forebay) should be 15% of the SUSMP volume, V_{wq}.

Step 3: Determine Dimensions of Cell 1			
3-1. Enter the percent of V_{wq} in Cell 1 (10-20% required), $\%V_1$	$\%V_1$ =	15	%
3-2. Calculate the active volume of Cell 1 (including sediment storage), $V_1 = (V_{wq} \bullet \%V_1)/100$	V_1 =	3,855	ft^3
3-3. Enter desired average depth of Cell 1 (5-9 ft including sediment storage of 1 ft), d_1	d_1 =	5	ft
3-4. Calculate the surface area for the SUSMP volume of Cell 1, $A_1 = V_1 / d_1$	A_1 =	771	ft^2
3-5. Enter the width of Cell 1, $W_1 = W_{av\text{-}tot} = L_{berm}$	W_1 =	43	ft
3-6. Calculate the length of Cell 1 (Note: inlet and outlet should be configured to maximize the residence time), $L_1 = A_1 / W1$	L_1 =	18	ft

Step 4: Determine Dimensions of Cell 2

Verify that the surface area and length-to-width ratio of Cell 2 meet the design criteria. Calculate volumes, depths and surface areas for the very shallow, shallow and deep zones.

Step 4: Determine Dimensions of Cell 2			
4-1. Calculate the active volume of Cell 2, $V_2 = V_{wq} - V_1$	$V_2 =$	21,845	ft^3
4-2. Calculate surface area of Cell 2, $A_2 = A_{wq} - A_1$	$A_2 =$	7,055	ft^2
4-3. Enter width of Cell 2, $W_2 = W_1 = W_{wq\text{-}tot} = L_{berm}$	$W_2 =$	43	ft
4-4. Calculate top length of Cell 2, $L_2 = A_2 / W_2$	$L_2 =$	164	ft
4-5. Verify that the length-to-width ratio of Cell 2 is at least 3:1 with ≥ 4:1 preferred. If the length-to-width ratio is less than 3:1, modify input parameters until a ratio of at least 3:1 is achieved. If the input parameters cannot be modified as a result of site constraints, another site for the pond should be chosen, $LW_2 = L_2 / W_2$	$LW_2 =$	4	
4-6. Enter percent of surface area of very shallow zone, $\%A_{vs}$	$\%A_{vs} =$	15	ft^2
4-7. Calculate very shallow zone surface area, $A_{vs} = (A_2 \bullet \%A_{vs})/100$	$A_{vs} =$	1,058	ft^2
4-8. Enter average depth of very shallow zone (0.1 - 1 ft), d_{vs}	$d_{vs} =$	1	ft
4-9. Calculate volume of very shallow zone, $V_{vs} = A_{vs} \bullet d_{vs}$	$V_{vs} =$	1,058	ft^3
4-10. Enter width of very shallow zone, $W_{vs} = W_2$	$W_{vs} =$	43	ft
4-11. Calculate length of very shallow zone, $L_{vs} = A_{vs} / W_{vs}$	$L_{vs} =$	25	ft
4-12. Enter percent of surface area of shallow zone, $\%A_s$	$\%A_s =$	55	
4-13. Calculate surface area of shallow zone, $A_s = (A_2 \bullet \%A_s)/100$	$A_s =$	3,880	ft^2
4-14. Enter average depth of shallow zone (1 - 3 ft), d_s	$d_s =$	3	ft
4-15. Calculate volume of shallow zone, $V_s = A_s \bullet d_s$	$V_s =$	11,641	ft^3
4-16. Enter width of shallow zone, $W_s = W_2$	$W_s =$	43	ft
4-17. Calculate length of shallow zone, $L_s = A_s / W_s$	$L_s =$	90	ft
4-18. Calculate surface area of deep zone, $A_{deep} = A_2 - A_{vs} - A_s$	$A_{deep} =$	2,116	ft^2
4-19. Calculate volume of deep zone, $V_{deep} = V_2 - V_{vs} - V_s$	$V_{deep} =$	9,146	ft^3
4-20. Calculate average depth of deep zone (3 - 5 ft), $d_{deep} = V_{deep} / A_{deep}$	$d_{deep} =$	4	ft
4-21. Enter width of deep zone, $W_{deep} = W_2$	$W_{deep} =$	43	ft
4-22. Calculate length of deep zone, $L_{deep} = A_{deep} / W_{deeo}$	$L_{deep} =$	49	ft

Step 5: Ensure Design Requirements and Site Conditions are Achieved

Check design requirements and site constraints. Modify design geometry until requirements are met. If the chosen site for the wetland is inadequate to meet the design requirements, choose a new location for the wetland or select and alternative treatment BMP.

Step 6: Size Outlet Structure

Please refer to Appendix C for wetland outlet structure sizing methodologies and examples. The wetland outlet pipe shall be sized, at a minimum, to pass flows greater than the SUSMP peak flow for off-line basins or flow from the capital storm for on-line basins.

Step 7: Determine Emergency Spillway Requirements

For online basins, an emergency overflow spillway should be sized to pass the capital design storm to prevent overtopping of the walls or berms in the event that a blockage of the riser occurs. For offline basins, an emergency spillway or riser should be sized to pass the SUSMP storm. For sites where the emergency spillway discharges to a steep slope, an emergency overflow riser, in addition to the spillway should be provided.

Sand Filters Worksheet

Step 1: Determine SUSMP volume		
1-1. Enter drainage area, A	A =	acres
1-2. Enter impervious fraction, Imp	Imp =	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	in
1-5. Calculate rainfall depth, P = P_i/12	P =	ft
1-6. Calculate SUSMP volume, V_{wq}=43560•P*A*C	V_{wq} =	ft^3
Step 2: Calculate sand filter area		
2-1. Enter thickness of sand filter (min. 2 ft, 3 ft preferred), L	L =	ft
2-2. Enter maximum storage depth (6 feet) above the filter, d	d =	ft
2-3. Enter routing adjustment factor, R	R =	
2-4. Calculate average depth of water above the filter, h = d/2	h =	ft
2-5. Enter hydraulic conductivity (1"/hr), K_i	K_i =	in/hr
2-6. Calculate hydraulic conductivity (ft/day), $K_{day} = 2K_i$	K_{day} =	ft/day
2-7. Calculate hydraulic gradient, i = (h+L)/L	i =	ft/ft
2-8. Enter drawdown time, t	t =	day
2-9. Calculate sand filter area, $A_{sf} = (V_{wq}RL)/(K_{day}t(h+L))$	A_{sf} =	ft^2
Step 3: Determine filter dimensions		
3-1. Sand filter area, A_{sf}	A_{sf} =	ft^2
3-2. Enter geometric configuration, L_R:W ratio (2:1), L_R	L_R =	
3-3. Calculate the width of the sand filter, W	W =	ft
3-4. Calculate the length of the sand filter, L	L =	ft
3-5. Calculate rate of filtration, $r_{wq} = K_{day}i$	r_{wq} =	$ft/d/ft^2$
Step 4: Calculate storage volume		
4-1. Enter interior side slopes, 3H:1V(max), Z	Z =	
4-2. Calculate top length, L_t = L + 2Zd	L_t =	ft
4-3. Calculate top width, W_t = W +2Zd	W_t =	ft
4-4. Calculate filter storage volume, $V_s = 1/3•d(A_{sf}+A_t+(A_{sf}A_t)^{0.5})$ Where $A_t = L_t*W_t$	V_s =	ft^3

Step 5: Calculate filter longitudinal underdrain collection pipe		
5-1. Calculated filtered flow rate, $Q_f = r_{wq}A_{sf}$	Q_f =	cfs
5-2. Enter minimum slope for energy gradient, S_e	S_e =	
5-3. Enter Hazen-Williams coefficient for plastic, C	C =	
5-4. Enter pipe diameter, D	D =	in
5-5. Calculate pipe hydraulic radius, R_h =D/48	R_h =	ft
5-6. Calculate velocity at the outlet of the pipe, $V_p = 1.318CR_h^{0.63}S_e^{0.54}$	V_p =	ft/s
5-7. Calculate pipe capacity, $Q_{cap} = 0.25\Pi(D/12)^{\wedge 2}V_p$	Q_{cap} =	cfs
Step 6: Provide conveyance capacity for filter clogging		
6-1. The sand filters should be placed off-line, but an emergency overflow must still be provided in the event the filter becomes clogged and **verify that all parameters meet design requirements** to complete sizing.		

Sand Filter Design Example

Step 1: Determine SUSMP Volume

For this design example, a 10-acre residential development with a 60% total impervious area is considered.

Step 1: Determine SUSMP volume			
1-1. Enter drainage area, A	A =	10	acres
1-2. Enter impervious fraction, Imp	Imp =	0.60	
1-3. Calculate runoff coefficient, C = 0.9•Imp + 0.05	C =	0.59	
1-4. Enter design rainfall depth of the storm, (see A Manual for the Standard Urban Storm Water Mitigation Plan, LACDPW, September 2002 (or as amended) for volume-based controls sizing methods), P_i	P_i =	1.2	in
1-5. Calculate rainfall depth, P = P_i/12	P =	0.10	ft
1-6. Calculate SUSMP volume, V_{wq} = 43560•P*A*C	V_{wq} =	25,700	ft^3

Step 2: Calculate Sand Filter Area

A sand filter is designed with two components: (1) temporary storage reservoir to store runoff, and (2) a sand filter bed through which the stored runoff must percolate getting treatment. The simple sizing method does not rout flows through the filter. The size of the filter is determined based on the simple assumption that inflow is immediately discharged through the filter. The adjustment factor, R, is applied to compensate for the greater filter size resulting from this method.

Step 2: Calculate sand filter area			
2-1. Enter thickness of sand filter (min. 24" or 2'), l	l =	2	ft
2-2. Enter storage depth (6' max.) above the filter, d	d =	6	ft
2-3. Enter routing adjustment factor, R	R =	0.7	
2-4. Calculate average depth of water above the filter, h = d/2	h =	3	ft
2-5. Enter hydraulic conductivity (1"/hr), K_i	K_i =	1	in/hr
2-6. Calculate hydraulic conductivity (ft/day), K_{day} = 2K_i	K_{day} =	2	ft/day
2-7. Calculate hydraulic gradient, i = (h+l)/l	i =	2.5	ft/ft
2-8. Enter drawdown time, t	t =	2	day
2-9. Calculate sand filter area, A_{sf} = (V_{wq}Rl)/(K_{day}t(h+l))	A_{sf} =	1,799	ft^2

Step 3: Determine Filter Dimensions

Step 3: Determine filter dimensions			
3-1. Sand filter area, A_{sf}	A_{sf} =	1,799	ft^2

Step 3: Determine filter dimensions			
3-2. Enter geometric configuration, L_R:W ratio (2:1 min.), L_R	L_R =	2	
3-3. Calculate the width of the sand filter, W	W =	30.0	ft
3-4. Calculate the length of the sand filter, L	L =	60.0	ft
3-5. Calculate rate of filtration, $r_{wq} = K_{day}i$	r_{wq} =	5.0	$ft/d/ft^2$

Step 4: Calculate Storage Volume

The side slopes are will be designed as 3H:1V, so Z = 3.

Step 4: Calculate storage volume			
4-1. Enter interior side slopes, 3H:1V(max), Z	Z =	3	
4-2. Calculate top length, $L_t = L + 2Zd$	L_t =	96.0	ft
4-3. Calculate top width, $W_t = W + 2Zd$	W_t =	66.0	ft
4-4. Calculate filter storage volume, $V_s = 1/3 \cdot d(A_{sf}+A_t+(A_{sf}A_t)^{0.5})$, where $A_t = L_t \cdot W_t$	V_s =	23,018	ft^3

Step 5: Calculate Filter Longitudinal Underdrain Collection Pipe

All underdrain pipes must be 6 inches or greater to facilitate cleaning.

Step 5: Calculate filter longitudinal underdrain collection pipe			
5-1. Calculated filtered flow rate, $Q_f = r_{wq}A_{sf}$	Q_f =	0.10	cfs
5-2. Enter minimum slope for energy gradient, S_e	S_e =	0.005	
5-3. Enter Hazen-Williams coefficient for plastic, C	C =	140	
5-4. Enter pipe diameter, D	D =	6	in
5-5. Calculate pipe hydraulic radius, R_h =D/48	R_h =	0.13	
5-6. Calculate velocity at the outlet of the pipe, $V_p = 1.318CR_h^{0.63}S_e^{0.54}$	V_p =	2.8	ft/s
5-7. Calculate pipe capacity, $Q_{cap} = 0.25\Pi(D/12)^{\wedge 2}V_p$	Q_{cap} =	0.6	cfs

Step 6: Provide Conveyance Capacity for Filter Clogging

The sand filters should be placed off-line, but an emergency overflow must still be provided in the event the filter becomes clogged and **verify that all parameters meet design requirements** to complete sizing.

APPENDIX C POND OUTLET SIZING EXAMPLES

Perforated Risers Outlet Sizing Methodology (Figure 2-2)

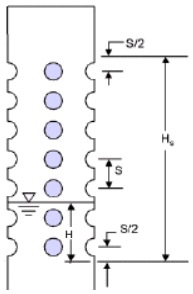
The following factors are inputs to the perforated riser outlet sizing calculations**:**

- Shape of the pond (e.g. trapezoidal)
- Depth and volume of the pond
- Elevation / depth of first row of holes
- Elevation / depth of last row of holes
- Size of perforations
- Number of rows or perforations and number of perforations per row
- Desired draw down time (e.g. 16 hour and 32 hour draw down for top half and bottom half respectively, 48 hour total draw down time)

The governing the rate of discharge from a perforated riser structure can be calculated using Equation C-1 below:

$$Q = C_p \frac{2A_p}{3H_s}\sqrt{2g}H^{3/2} \qquad \text{(Equation C-1)}$$

Where:



Q = riser flow discharge (cfs)
C_p = discharge coefficient for perforations (use 0.61)
A_p = cross-sectional area of all the holes (ft^2)
s = center to center vertical spacing between perforations (ft)
H_s = distance from s/2 below the lowest row of holes to s/2 above the top row of holes (McEnroe 1988).
H = distance from s/2 below the lowest row of holes to the water surface elevation under consideration.

For the iterative computations needed to size the perforations in the riser and determine the riser height a simplified version of Equation C-1 may be used, as shown below in Equation C-2:

$$Q = kH^{3/2} \qquad \text{(Equation C-2)}$$

Where:

$$k = C_p \frac{2A_p}{3H_s}\sqrt{2g} \qquad \text{(Equation C-3)}$$

Uniformly perforated riser designs are defined by the depth or elevation of the first row of perforations, the length of the perforated section of pipe, and the size or diameter of each perforation. The steps needed to size a perforated riser outlet are outlined below.

Step 1: Determine riser elevation or depth in the pond

Set the riser elevation at 6" above the pond bottom to provide for sediment storage. Select a riser height such that the last row of perforations is inline with the top of the SUSMP pool elevation.

Step 2: Determine pond and riser attributes and constants for computations

Parameters examined at this step include pond geometry such as pond shape, pond bottom length and width, and pond side slopes. Organize the attributes obtained in this step in a table such as Table C-1.

Step 3: Determine constant *k*

Determine the value of the constant *k* (Equations C-2 and C-3) that provides the desired draw down time.

a. Set up a computation table such as Table C-3. Note that the table must have at least 19 height slices or the bottom 5% of the pond should be combined in the computations. The formulas for each column of the computation table are provided in Table C-2.

b. Using the pond depth, partition the pond into equal height horizontal slices to be stored as entries in Table C-3. At each elevation E_n (or table entry), complete the following:

   i. Determine the change in elevation H_n (ft) [$H_n = (E_o - E_{n+1})$]
   ii. Calculate the average discharge Q_n (cfs) [$Q_n = k(H_n)^{3/2}$] *Eqn 3*
   iii. Calculate the pond surface area A_n (ft^2) [A_n = L x W for rectangular ponds]
   iv. Compute the available storage V_n (ft^3) [$V_n = A_n \times H_n$]
   v. Determine the average drain time T_n (hrs) [$T_n = (V_n / Q_n) \times 3600$]

c. Sum up the drain times at each height slice to determine the total drain time for the pond. If the value obtained is smaller or greater than the desired value, increase or decrease the *k* value and repeat the computations in step b until the desired drain time is achieved.

Step 4: Determine the size and number of rows of perforations

Determine the size and number of rows of perforations that yield a *k* value equal to the *k* value used in the previous step. Follow the steps below to obtain riser attributes:

a. Select an initial number of rows, number or holes per row and an initial hole diameter.

b. Obtain flow area per row values from Table C-4 or compute flow area.

c. Select a value for H_s and C_p and compute *k*.

d. Repeat the above steps varying the number of rows, hole diameter, number of holes per row and H_s until the desired value of *k* is obtained or it is determined that *k* is too small to be matched by any realistic combination of inputs. Hole diameter should not be less than 1/4" to minimize the potential for clogging.

Step 5: Verify the design

The design is completed by verifying that the drain time for the both the top half and the bottom half are acceptable and the total drain time is equivalent to the desired value. Note that the drain time for the top half can be obtained by summing the drain times for the top half of the entries in the computation Table C-3. The drain time for the bottom half can similarly be obtained by summing values for the drain times for the bottom half of the entries in the computation Table C-3.

Table C-1: Constants Used in Example Computations

Constant	Values	Units
Orifice coefficient (C_p)	0.6	-
Perforation diameter (d)	0.0468	ft
Combined area of holes (A_p)	0.0399	ft^2
Acceleration due to gravity (g)	32.2	ft/s^2
Pond bottom length (L)	40	ft
Pond bottom width (W)	20	ft
Side slopes (z)	3	-
Pond bottom surface area (A)	800	ft^2
k	0.02791	$ft^{3/2}/s$

Table C-2: Pond Draw Down Time Calculation

Line No.	Elev. (ft)	Change in Elevation (ft)	Average Discharge (cfs)	**Pond Surface Area (ft^2)	Storage Volume (ft^3)	Average Drain Time (hrs)
1	E_o	$H_o = (E_o - E_1)$	$Q_0 = k(H_o)^{3/2}$	$A_0 = L \times W$	$V_o = A_o \times H_o$	$T_0 = V_0 / Q_0$
2	E_1	$H_1 = (E_1 - E_2)$	$Q_1 = k(H_o)^{3/2}$	$A_1 = L \times W$	$V_1 = A_1 \times H_1$	$T_1 = V_1 / Q1$
3	E_2	$H_2 = (E_2 - E_1)$	$Q_2 = k(H_o)^{3/2}$	$A_2 = L \times W$	$V_2 = A_2 \times H_2$	$T_2 = V_2 / Q_2$
…	…	…	…	…	…	…

* q_{add} is the additional flow from any additional orifices below the current elevation
** Pond surface area can be calculated or measured. Non rectangular cross sections must use the appropriate formulas for calculating cross-sectional areas.

Table C-3: Sample Spread Sheet for Perforated Riser Outlet Sizing Calculations

Line No.	Elevation	Change in height	Average Flow at Elev. (top orifice only)	Pond Surface Area	Storage Volume	Time to Drain Unit at Current Flow
	$[E_n]$	$[E_1 - E_2]$	[See Eqn 3]	A_n	$[A_n \times dH]$	$[V_{nv} / Q_n]$
	(ft)	H_n (ft)	Q_n (cfs)	(ft^2)	V_n (ft^3)	T (hrs)
1	6	0.3	0.4102	4256	1419	1.0
2	5.7	0.3	0.3765	3996	1332	1.0
3	5.3	0.3	0.3438	3744	1248	1.0
4	5.0	0.3	0.3120	3500	1167	1.0
5	4.7	0.3	0.2814	3264	1088	1.1
6	4.3	0.3	0.2518	3036	1012	1.1
7	4.0	0.3	0.2233	2816	939	1.2
8	3.7	0.3	0.1960	2604	868	1.2
9	3.3	0.3	0.1699	2400	800	1.3
10	3.0	0.3	0.1450	2204	735	1.4
11	2.7	0.3	0.1215	2016	672	1.5
12	2.3	0.3	0.0995	1836	612	1.7
13	2.0	0.3	0.0789	1664	555	2.0
14	1.7	0.3	0.0601	1500	500	2.3
15	1.3	0.3	0.0430	1344	448	2.9
16	1.0	0.3	0.0279	1196	399	4.0
17	0.7	0.3	0.0152	1056	352	6.4
18	0.3	0.3	0.0054	924	308	15.9
19	0.0	0.0	0.0000	800	0	0.0
					Total Draw Down Time	48

Table C-4: Circular Perforation Sizing for Perforated Riser.

Hole Dia (in) *	Hole Dia (in)	Min. S_c (in)	Area per Row (sq in)		
			n=1	n=2	n=3
1/4	0.250	1	0.05	0.10	0.15
5/16	0.313	2	0.08	0.15	0.23
3/8	0.375	2	0.11	0.22	0.33
7/16	0.438	2	0.15	0.30	0.45
1/2	0.500	2	0.20	0.39	0.59
9/16	0.563	3	0.25	0.50	0.75
5/8	0.625	3	0.31	0.61	0.92
11/16	0.688	3	0.37	0.74	1.11
3/4	0.750	3	0.44	0.88	1.33
13/16	0.813	3	0.52	1.04	1.56
7/8	0.875	3	0.60	1.20	1.80
15/16	0.938	3	0.69	1.38	2.07
1	1.000	4	0.79	1.57	2.36
1 1/16	1.063	4	0.89	1.77	2.66
1 1/8	1.125	4	0.99	1.99	2.98
1 3/16	1.188	4	1.11	2.22	3.32
1 1/4	1.250	4	1.23	2.45	3.68
1 5/16	1.313	4	1.35	2.71	4.06
1 3/8	1.375	4	1.48	2.97	4.45
1 7/16	1.438	4	1.62	3.25	4.87
1 1/2	1.500	4	1.77	3.53	5.30
1 9/16	1.563	4	1.92	3.83	5.75
1 5/8	1.625	4	2.07	4.15	6.22
1 11/16	1.688	4	2.24	4.47	6.71
1 3/4	1.750	4	2.41	4.81	7.22
1 13/16	1.813	4	2.58	5.16	7.74
1 7/8	1.875	4	2.76	5.52	8.28
1 15/16	1.938	4	2.95	5.90	8.84
2	2.000	4	3.14	6.28	9.42
n = Number of columns of perforations					

Source: UDFCD, 1999

Multiple Orifice Outlet Sizing Methodology

The following attributes influence multiple orifice outlet sizing calculations**:**

- Shape of the pond (e.g. trapezoidal)
- Depth and volume of the pond
- Elevation of each orifice
- Desired draw-down time (e.g., 16 hour and 32 hour draw down times for top half and bottom half respectively, 48 hour draw down time for whole pond)

The rate of discharge from a single orifice can be calculated using Equation C-4 below:

$$Q = CA(2gH)^{0.5} \qquad \text{(Equation C-4)}$$

Where:

Q = orifice flow discharge
C = discharge coefficient
A = cross-sectional area of orifice or pipe (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)
H = effective head on the orifice (measured from center of orifice to water surface)

Multiple orifice designs are defined by the depth (or elevation) and the size (or diameter) of each orifice (Figure 2-1). The steps needed to size a dual orifice outlet are outlined below; multiple orifices may be provided and sized using a similar approach.

Step 1: Determine orifice elevations

a. For the bottom orifice, set the orifice elevation (H_b) at a maximum of 6" above the pond bottom. If the bottom orifice is below the invert of the outlet pipe, then use the outlet pipe invert elevation for orifice calculations.

b. For the top orifice, set the orifice elevation (H_t) at half way to the top of the SUSMP pool.

Step 2: Determine pond and orifice attributes and constants for computations

Parameters examined at this step include pond geometry such as pond shape, pond bottom length and bottom width and pond side slopes. Organize the attributes obtained in this step in a table such as Table C-5.

Step 3: Determine the required size of the bottom orifice

a. Set up a computation table such as Table C-6. The formulas for each column of the computation table are provided in Table C-7.

b. Using the pond depth, partition the pond into equal height horizontal slices to be stored as entries in Table C-6. At each elevation E_n (or table entry), complete the following:

i. Determine the change in elevation H_n (ft) [$H_n = (E_o - E_{n+1})$]
ii. Calculate the average discharge Q_n (cfs) [$Q_n = CA(2gH_n)^{0.5}$] *Eqn 1*
iii. Calculate the pond surface area A_n (ft2) [A_n = L x W for rectangular ponds]
iv. Compute the available storage V_n (ft3). [$V_n = A_n \times H_n$]
v. Determine the average drain time T_n (hrs) [$T_n = (V_n / Q_n) \times 3600$]

c. Sum up the drain times at each height slice to determine the total drain time for the bottom half of the pond. If the value obtained is smaller or greater than the desired value, increase or decrease the orifice diameter and repeat the computations in step b above until the desired drain time is achieved

Step 4: Determine the required size of the top orifice

a. Set up a Table such as Table C-8. The formulas for each column of the computation tables are provided in Table C-7.

b. At each elevation E_n complete the following:

i. Determine the change in elevation H_n (ft) [$H_n = (E_n - E_{n+1})$]
ii. Calculate the average discharge Q_n (cfs) [$q_n = CA(2gH_n)^{0.5}$] *Eqn 1*
iii. Calculate the combine average discharge Q_0 [$Q_n = q_n + q_{add}$]
iv. Calculate the pond surface area A_n (ft^2) [A_n = L x W for rectangular ponds]
v. Compute the available storage V_n (ft^3) [$V_n = A_n \times H_n$]
vi. Determine the average drain time T_n (hrs) [$T_n = V_n / Q_n$]
vii. Note that q_{add} is the maximum discharge from the bottom orifice.

c. Sum up the drain times at each height slice to determine the total drain time for the top half of the pond. If the value obtained is smaller than the desired value, increase or decrease the orifice diameter and repeat the computations in step 4b until the desired drain time is achieved.

Step 5: Verify the design

The design is completed by verifying that the sum of the detention times for the top half of the pond and the bottom half of the pond add up to the total desired detention time (36 to 48 hours).

Table C-5: Constants Used in Example Computations

Constant	Lower Orifice Values	Upper Orifice Values	Units
Orifice coefficient (C_p)	0.6	0.6	-
Orifice diameter (d)	0.0633	0.0675	ft
Orifice cross-sectional area (a)	0.003	0.004	ft^2
Acceleration due to gravity (g)	32.2	32.2	ft/s^2
Pond bottom length (L)	40	40	ft
Pond bottom width (W)	20	20	ft
Side slopes (z)	3	3	-
Pond bottom surface area (A)	800	800	ft^2

Table C-6: Sample Spreadsheet for Dual Orifice Pond Outlet Sizing Calculations: Bottom Half of Pond

Line Number	Elevation [E]	Change in height	Average Flow at Elev. (top orifice only)	Pond Surface Area	Storage Volume	Time to Drain Unit at Current Flow Rate
		$[E_1-E_2]$	[See Eqn 1]	A_{elev}	$[A_{elev} \times dH]$	$[V_{elev} / Q_{elev}]$
	(ft)	H (ft)	q_{top} (cfs)	(ft^2)	V_{elev} (ft^3)	T (hrs)
1	3.0	3.0	0.0567	2204	735	3.6
2	2.7	2.7	0.0534	2016	672	3.5
3	2.3	2.3	0.0500	1836	612	3.4
4	2.0	2.0	0.0463	1664	555	3.3
5	1.7	1.7	0.0422	1500	500	3.3
6	1.3	1.3	0.0378	1344	448	3.3
7	1.0	1.0	0.0327	1196	399	3.4
8	0.7	0.7	0.0267	1056	352	3.7
9	0.3	0.3	0.0189	924	308	4.5
10	0.0	0.0	0.0000	800	0	0.0
					Subtotal Draw Down Time	32.0

Table C-7: Pond Draw Down Time Calculation

Line No.	Elev. (ft)	Change in Elevation (ft)	Average Discharge (cfs)	*Combined Average Discharge (cfs)	**Pond Surface Area (ft^2)	Storage Volume (ft^3)	Average Drain Time (hrs)
1	E_o	$H_o = (E_o - E_1)$	$q_0 = CA(2gH_o)^{0.5}$	$Q_1 = q_1 + q_{add}$	$A_0 = L \times W$	$V_o = A_o \times H_o$	$T_0 = V_0 / Q_0$
2	E_1	$H_1 = (E_1 - E_2)$	$q_1 = CA(2gH_o)^{0.5}$	$Q_2 = q_2 + q_{add}$	$A_1 = L \times W$	$V_1 = A_1 \times H_1$	$T_1 = V_1 / Q_1$
3	E_2	$H_2 = (E_2 - E_1)$	$q_2 = CA(2gH_o)^{0.5}$	$Q_3 = q_3 + q_{add}$	$A_2 = L \times W$	$V_2 = A_2 \times H_2$	$T_2 = V_2 / Q_2$
…	…	…	…	…	…	…	…

* q_{add} is the additional flow from any additional orifices below the current elevation

** Pond surface area can be calculated or measured. Non-rectangular cross sections must use the appropriate formulas for calculating cross-sectional areas.

Table C-8: Sample Spreadsheet for Dual Orifice Pond Outlet Sizing Calculations: Top Half of Pond

Line Number	Elevation	Change in height	Average Flow at Elev. (top orifice only)	Combined Average Discharge	Pond Surface Area	Storage Volume	Time to Drain Unit at Current Flow
	[E]	[E_1 - E_2]	[See Eqn 1]	[q_{top} + q_{bot}]	A_{elev}	[A_{elev} x dH]	[V_{elev} / Q_{elev}]
	(ft)	H (ft)	q_{top} (cfs)	Q_{elev} (cfs)	(ft^2)	V_{elev} (ft^3)	T (hrs)
1	6.0	3.0	0.1615	0.2181	4256	1419	1.8
2	5.7	2.7	0.1522	0.2089	3996	1332	1.8
3	5.3	2.3	0.1424	0.1990	3744	1248	1.7
4	5.0	2.0	0.1318	0.1885	3500	1167	1.7
5	4.7	1.7	0.1203	0.1770	3264	1088	1.7
6	4.3	1.3	0.1076	0.1643	3036	1012	1.7
7	4.0	1.0	0.0932	0.1499	2816	939	1.7
8	3.7	0.7	0.0761	0.1328	2604	868	1.8
9	3.3	0.3	0.0538	0.1105	2400	800	2.0
10	3.0	0.0	0.0000	0.0567	2204	0	0.0
						Subtotal Draw Down Time	16.0
						Total Draw Down Time	48.0

APPENDIX D FLOW SPLITTER DESIGN SPECIFICATION

Flow splitters must be provided for off-line facilities to divert the SUSMP flow to the BMP and bypass higher flows. In most cases, it is a designer's choice whether stormwater treatment BMPs described in this manual are designed as on-line or off-line; an exception are filter strips and planter boxes which are always designed on-line.

A crucial factor in designing flow splitters is to ensure that low flows are delivered to the treatment facility up to the SUSMP flow rate. Above this rate, additional flows remain in the storm drain or are diverted to a bypass drain with minimal increase in head at the flow splitter structure to avoid surcharging the SUSMP facility under high flow conditions.

Flow splitters are typically manholes or vaults with weirs. In place of weirs, the splitter mechanism may be a half tee section with a solid top and an orifice in the bottom of the tee section. A full tee option may also be used (see "Design Criteria" below). Two possible design options for flow splitters are shown in Figures D1 and D2. Other equivalent designs that achieve the result of splitting low flows, up to the SUSMP design flow, into the treatment facility and divert higher flows around the facility are also acceptable.

Flow splitters may be modeled using standard level pool routing techniques, as described in the Handbook of Applied Hydrology (Chow, Ven Te, 1964) and elsewhere. The stage/discharge relationship of the outflow pipes should be determined using backwater analysis techniques. Orifices, if used, may be designed using the approach outlined in "Outlet Structure and Drawdown Time" in Chapter 2, Extended Detention Basins. Weirs should be analyzed as sharp-crested weirs.

Design Criteria

1. A flow splitter shall be designed to deliver the required SUSMP flow rate to the stormwater treatment facility.

2. The top of the weir shall be located at the water surface corresponding to the design flow. Higher flows enter the bypass line.

3. Capital storm flows to the treatment facility shall not increase the design SUSMP flow by more than 10%.

4. Example designs are shown in Figure D1 and Figure D2. Equivalent designs are also acceptable.

5. Special applications, such as roads, may require the use of a modified flow splitter. The weir wall may be fitted with a notch and adjustable weir plate to proportion runoff volumes other than high flows.

6. For ponding facilities, backwater effects must be included in designing the height of the standpipe in the manhole/vault (Option B).

7. Ladder or step and handhold access shall be provided. If the weir wall is higher than 36 inches, two ladders, on the either side of the wall, are required.

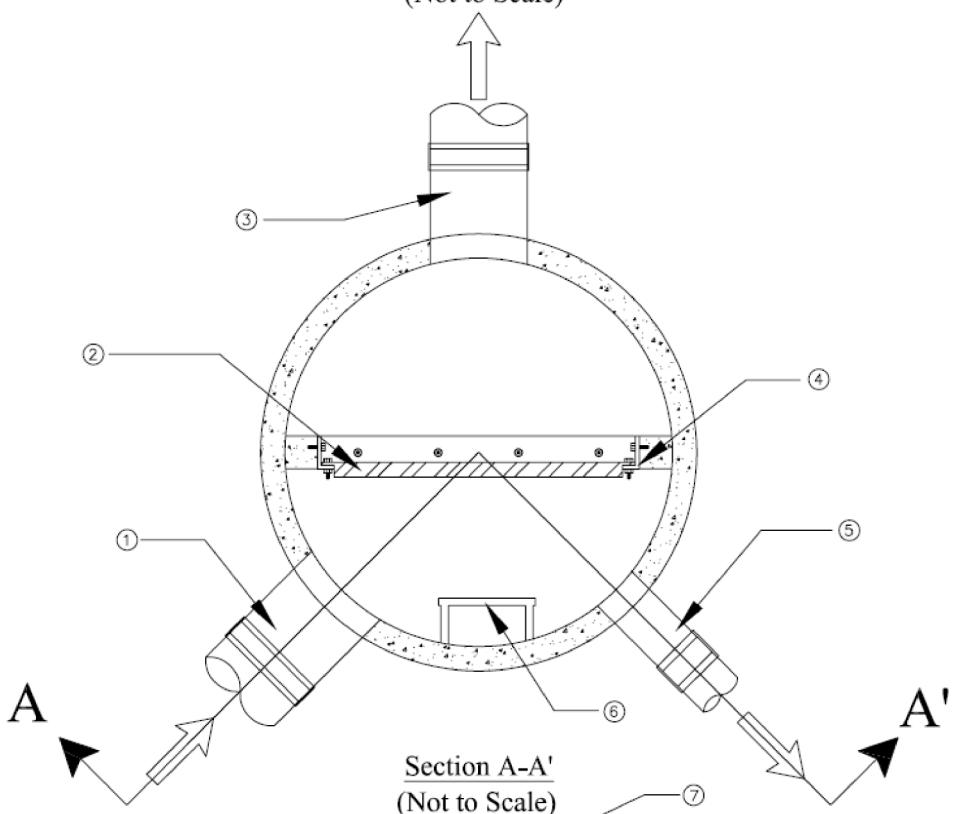
Material Requirements

1. The splitter baffle shall be installed in a standard manhole or vault. The baffle wall shall be made of material resistant to corrosion (minimum 4-inch thick reinforced concrete, Type 302 or Type 316 stainless steel plate, or equivalent).

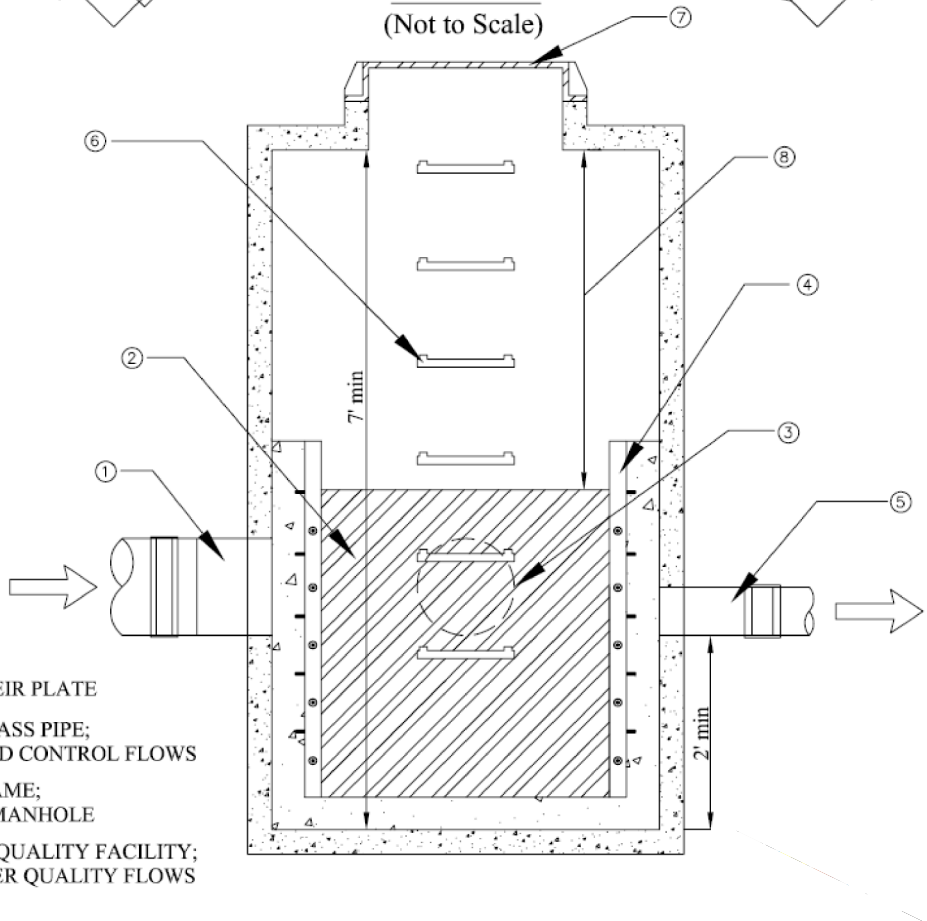
2. The minimum clearance between the top of the weir wall and the bottom of the manhole or vault cover shall be 4 feet; otherwise, dual access points shall be provided.

3. All metal parts shall be corrosion resistant. Examples of preferred materials include aluminum, stainless steel, and plastic. Copper, zinc and galvanized materials are not permitted because of aquatic toxicity. Painting metal parts shall not be allowed because of poor longevity.

Plan View
(Not to Scale)



Section A-A'
(Not to Scale)



NOTES:

① INLET PIPE

② ADJUSTABLE WEIR PLATE

③ HIGH FLOW BYPASS PIPE;
SIZED FOR FLOOD CONTROL FLOWS

④ WEIR PLATE FRAME;
ANCHORED TO MANHOLE

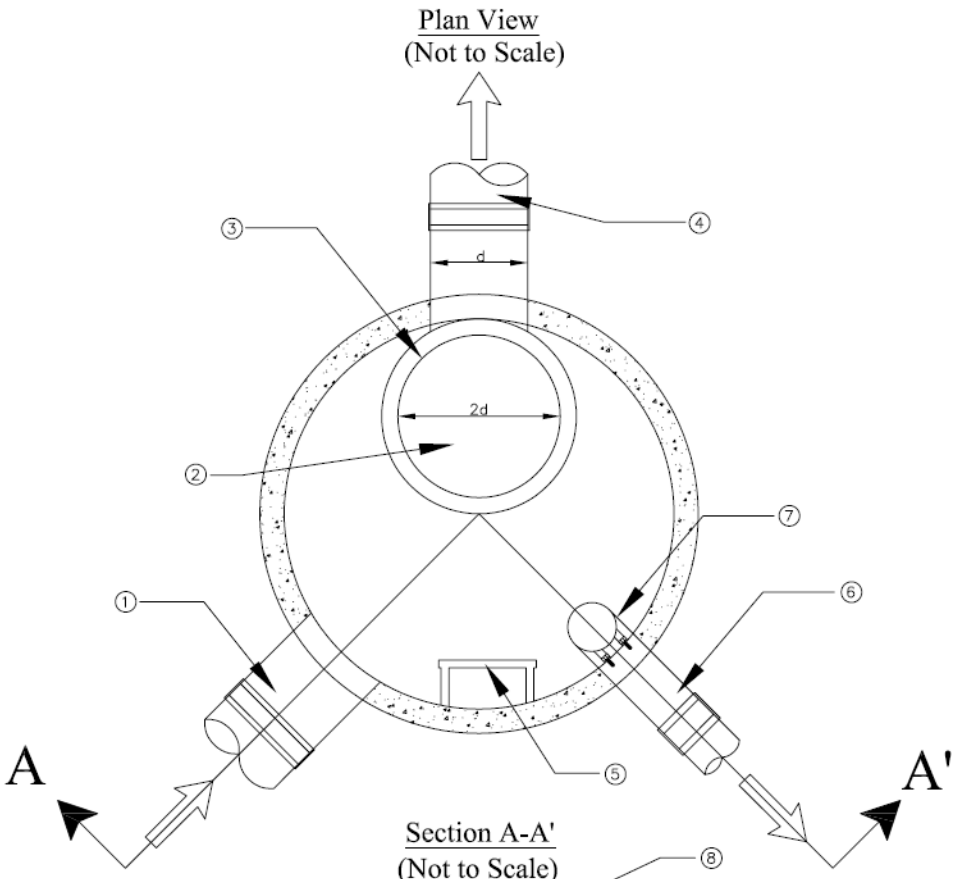
⑤ PIPE TO WATER QUALITY FACILITY;
SIZED FOR WATER QUALITY FLOWS

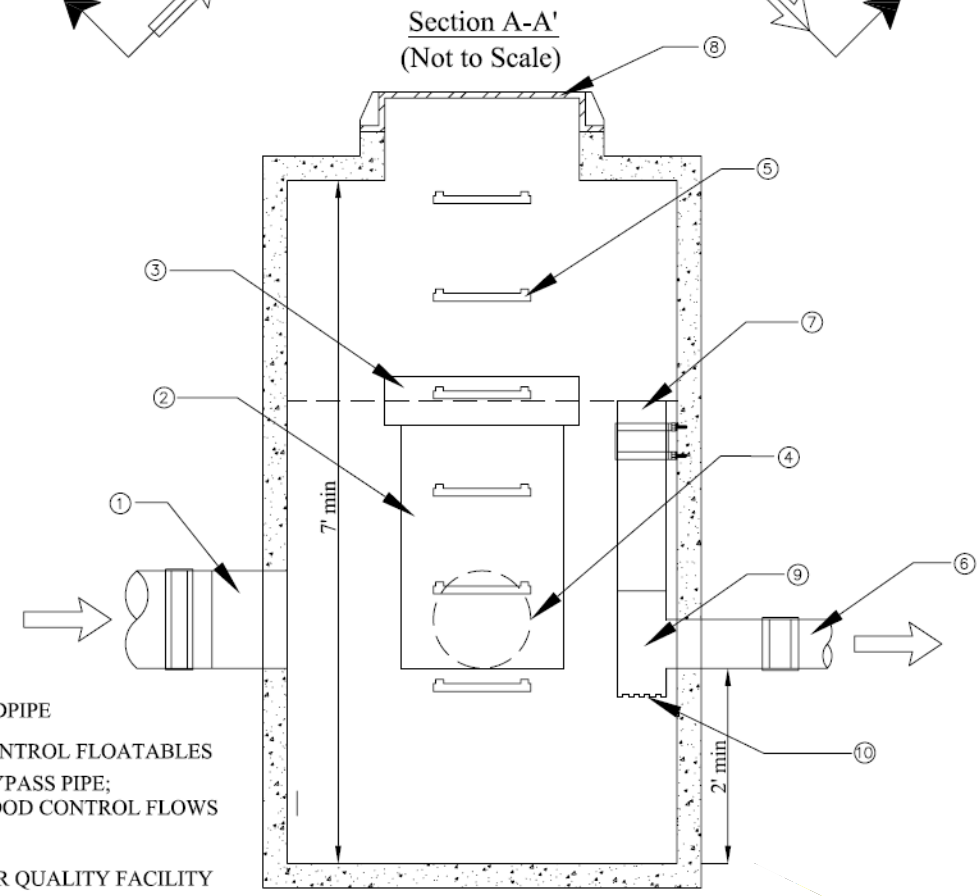
⑥ ACCESS STEPS

⑦ 24" ROUND FRAME AND SOLID LID

⑧ 4' MIN DISTANCE OR PROVIDE SEPARATE
ACCESS ON BOTH SIDES OF WEIR

Figure D–1
FLOW SPLITTER– OPTION A





NOTES:

① INLET PIPE

② BYPASS STANDPIPE

③ BAFFLE TO CONTROL FLOATABLES

④ HIGH FLOW BYPASS PIPE; SIZED FOR FLOOD CONTROL FLOWS

⑤ ACCESS STEPS

⑥ PIPE TO WATER QUALITY FACILITY

⑦ RISER PIPE; TOP OF PIPE AT DESIGN ELEVATION FOR WATER QUALITY FLOWS

⑧ 24" ROUND FRAME AND SOLID LID

⑨ REMOVABLE "TEE" SECTION FOR CLEANOUT

⑩ RISER PIPE ORIFICE SIZED FOR WATER QUALITY FLOWS

Figure D–2
FLOW SPLITTER–OPTION B

APPENDIX E FACILITY INSPECTION

Introduction

To ensure high-quality, long-term performance, BMPs need to be inspected on a regular basis. These inspections help the stormwater manager monitor the safety, longevity, and effectiveness of these practices over time. BMP maintenance inspections are intended to do the following:

- Ensure the facilities are generally safe
- Maintain the proper stormwater management capacity and cost-effectiveness
- Comply with reporting to regulatory agencies
- Provide BMP tracking data
- Follow standard engineering practices

Inspection Types and Frequency

Inspection types range in detail from a low level (e.g., drive by) to a high level (e.g., rigorous professional inspection). Inspection frequency depends on many factors including the type of facility, accessibility to the public, likelihood of vandalism, and major storm events. Regular inspections include observations on general appearance, damage by water or vandalism, erosion, plant loss, trash and debris accumulation, standing water (where there shouldn't be), obvious (visual) loss of functionality, and vegetation condition. Such inspections should occur at:

- regular intervals for aesthetics, vegetation maintenance and checking for vandal damage,
- after large storms and at the end of the rainfall season for possible flow damage, and
- before winter storms to ensure the facility is properly prepared to handle the coming runoff events.

Annual or semi-annual inspections would include these and other more rigorous evaluations.

The instructions for operations and maintenance in this Manual include suggested inspection frequencies for each BMP type.

Procedures

Pre-Inspection Preparation

Prior to BMP inspection, the inspector(s) will have to gather a number of materials and equipment that fall under three categories:

Public Communications Materials

General educational materials as well as jurisdiction program and contact information may be used to help address questions or comments raised by inquisitive residential or commercial property owners encountered during the inspection.

BMP Background Information

Historical information on each BMP to be inspected will ease the inspection process and help to ensure that past maintenance or structural problems have been addressed. As-builts drawings are particularly helpful if available.

Inspection Checklists

Standard inspection checklists are used to record the condition of all facilities, and particularly those that need frequent maintenance. It will also be easier to track maintenance electronically, using either a database or spreadsheet, rather than relying on paper files.

Well-designed checklists can be integrated with these systems to prioritize maintenance, track performance over time, and relate design characteristics to particular problems. To effectively achieve these goals, the checklist should:

- Be quantitative, so that maintenance can be easily prioritized.
- Be very specific about possible problems to reduce subjectivity.
- Limit the use of text, particularly if integrated with a database.
- Link problems to specific actions.
- Where possible, track the function of the facility over time for future research and design.

Inspection checklists should also be grouped in the order the inspector would inspect the practice. For example, ponds should typically be inspected from downstream to upstream, so the investigation begins with the outfall channel. Checklists are presented in Appendix F.

Inspection Equipment

A range of equipment is necessary to perform a comprehensive, safe inspection of a facility. A list of the materials and equipment that could potentially accompany any inspector is presented in Table E-1 below. Actual equipment needed for inspection is determined by the type of facility being inspected and the level of detail of the inspection.

Table E-1: Inspection Equipment

BMP Inspection Equipment/Materials	Quantity	Required for
Public communications materials		
Jurisdiction permission letter (for 3rd party inspectors)	multiple	All BMPs
Jurisdiction contact list multiple	All	BMPs
BMP-Specific Information		
Blank inspection checklists	multiple	All BMPs
Site plans/as-built drawings	per facility	All BMPs
Facility type and outfall pipe size	per facility	All BMPs
Facility location	per facility	All BMPs
Previous inspection results (reports, redlines and photos)	per facility	All BMPs
Confined space entry permit (as needed)	per facility	Underground Confined Space Entry (CSE)

Inspection Equipment		
Clipboard w/forms, pencil and compass	1	All BMPs
Area map	1	All BMPs
Mobile telephone	1	All BMPs
Two-way radio w/charged batteries	2	All BMPs
100' measuring tape	1	All BMPs
25' retractable scale	1	All BMPs
Bolt cutters	1	All BMPs
Cans of orange spray paint	2	All BMPs
Crow bar	1	All BMPs
Digital camera	1	All BMPs
First aid kit	1	All BMPs
Flashlight w/charged batteries	1	All BMPs
Goggles or safety glasses	2	All BMPs
Hardhats	2	All BMPs
Leather gloves	2	All BMPs
Manhole cover tool / puller	1	All BMPs
Pair of hard sole boots (wear)	2	All BMPs
Pair of rubber boots (as-needed)	2	All BMPs
Roll of orange tie-off tape	1	All BMPs
Std. size bolt locks and keys (for gates)	2	All BMPs
Waterproof carrying bag	1	All BMPs
Machete or pruning sheers	1	Above ground
Monkey wrench	1	Above ground
Standard shovel	1	Above ground
Observation well cap wrenches	1/Size	Infiltration facilities only
Small size bolt lock and key (for well caps)	1	Infiltration facilities only
100' rope	1	Underground CSE
Air monitor/meter w/charged batteries	1	Underground CSE
Orange pylons/traffic cones	4	Underground CSE
Spot light	1	Underground CSE
5 minute air supply	1	Underground CSE
Full face respirator	1	Underground CSE
Recalibration kit	1	Underground CSE
Ventilation/forced air blower	1	Underground CSE

Pre-Inspection Notification

Inspection and maintenance of BMPs is often the responsibility of two separate entities. Since the local government is accountable for ensuring the region's stormwater management system is operating within State and Federal regulations, inspections are typically conducted by either government personnel or a private contractor under government authority. However, the duty of maintaining the site frequently falls to the hands of a private homeowner, homeowner association or commercial property owner. Communication between the local government and the BMP manager/owner is key to ensuring long-term and effective BMP operation.

All correspondence should provide detailed information about what the BMP manager/owner can expect. This will allow the BMP manager/owner to better understand and be prepared for the role he/she or the community plays during the entire process. Effective communication can eliminate unnecessary concerns and confusion on the part of the BMP owner and provide a

base for legal action for the enforcing agency. The greater the clarity, the smoother the process will be for all involved.

Prior to inspection, a Notification of Inspection Letter should be sent to the BMP manager/owner. An example of this letter is included in Appendix G. This letter serves several purposes:

1. Informs the manager that he/she should expect someone to be on their property.
2. Encourages routine maintenance to be performed.
3. Notifies the manager of any special pre-inspection actions that must be completed.
4. Secures the name of the person who oversees the maintenance of the BMP.

A Notification of Inspection Letter should include the basic information listed above, along with all of the following information:

Date of Future Inspection

This could either be a specific day or a period, such as a week, that the BMP manager/owner would expect a local government inspector to be on the property.

Request for current maintenance manager contact information

Finding this information ahead of time will save time later when trying to ensure the repairs are completed.

Special Instructions

For example, the BMP manager/owner may be responsible for pumping out and pressure washing underground facilities prior to inspection.

Outline of Inspection Process

Provide as much detail as possible, such as, "The inspection will be sometime in the morning during the second week in August by Inspector. Within 14 days of inspection, you will be notified of any repairs that are required. You will then have 30 days to fix any deficiencies..."

In summary, all correspondence should include the following basic information:

1. Facility address and BMP owner's address are both essential because it possible that the owner is in charge of multiple sites.
2. Facility identification number provides an internal reference for the inspecting unit and for BMP owners that may have more than one BMP at the same address.
3. BMP owner name and title. Since homeowners, homeowner associations, and property managers can change without notice it is critical to include both the name and title, such as "John Doe or Current Property Manager/Owner," to ensure the letter reaches the appropriate person.
4. Description of Authority tells the manager by which regulation/code the local government gains authority to inspect the site and require repairs.

5. Deadline by which a response or repair should be made.
6. Consequences if response or repairs are not made.
7. Contact information for the person to whom the manager/owner can speak for assistance.

Health and Safety

Safety is a critical element of any operations and maintenance plan. Potential hazards associated with operating and maintaining BMP facilities include physical hazards that may develop as a result of automobile traffic, inclement weather conditions, high flow conditions, and steep or difficult terrain; electrical/mechanical hazards from motorized-valves and controls, atmospheric hazards resulting from poor ventilation in confined spaces, and chemical hazards from materials that may be present in urban runoff or in products used to clean/maintain various equipment.

A Health and Safety Plan approved by the County's Health and Safety Coordinator should be reviewed by the all field personnel before inspections begin. All persons involved in inspections should be made aware of the hazards associated with inspection and should freely voice any concerns if potential hazards become apparent. The Occupational Safety and Health Administration (OSHA) provides regulations and guidance on occupational safety, many of which are directly applicable to the types of activities involved in inspection. It is the direct responsibility of each person involved in the inspection program to read the Health and Safety Plan and adhere to its requirements.

Operation and maintenance personnel are responsible for assessing the individual site conditions to identify possible hazards, selecting safety equipment, and implementing appropriate safety precautions. Under no circumstances should inspection and/or maintenance activities be conducted if there is a significant safety concern that cannot be adequately addressed.

The following list provides a few basic health and safety procedures that can help to create a safer sampling environment:

- Do not enter a confined space (e.g., StormFilter™ vault) without proper training, equipment, and surface support.
- Never remove or replace manhole covers with your bare hands or feet.
- Never leave an open manhole unattended.
- Do not start staging or sampling until traffic control has been established.
- Follow manufacturer's instructions when operating mechanical equipment.
- Standard precautions should be taken when operating electrical equipment due to the moist conditions that will prevail at many of the installations (e.g., outdoor equipment panels).

Maintenance operations will normally be conducted under dry conditions when the facility is more accessible and the potential for many physical hazards is low. However, inspection activities may be conducted during storm events to evaluate how the system is operating. When working near open water it is important to be aware of and avoid drowning hazards. High stormwater flows often carry branches and other debris that can entangle a person or pin them beneath submerged obstacles. Creek banks can be unstable or slippery during wet weather and caution should be observed when walking on wet unstable surfaces.

Problem Identification

Inspectors should clearly identify the extent and location of problems identified during inspection. In addition to clearly describing problem areas on the checklists, inspectors should help repair crews locate repairs both at the site and on design plans.

Immediate Concerns

While all maintenance and inspection items are important, some maintenance concerns actually pose an immediate safety concern. Many of these are caused by missing or damaged elements that would prevent access by the public. Examples include missing manhole covers or trash racks, missing or damaged fencing when that fence prevents access to a pond with steep side slopes, or a missing or damaged grate at a large inflow or outfall pipe. Another set of immediate pond and wetland repairs involve dam safety or flooding hazards. If a practice shows signs of embankment failure, or if an inspector is unsure, an appropriately qualified person or engineer should be called in to investigate the situation immediately. Similarly, cracks in a concrete riser that drains a large area may pose a dam safety threat

As-built Drawings

The inspector should bring a copy of the as-built plan of the facility to mark potential corrections and problem areas on this plan. The marked up as-built plan should be stored either digitally or in a paper file system so that it can be brought out to confirm that maintenance was performed correctly on the follow-up inspection.

Photographs

Inspectors should take a core set of documentation photographs of practices being inspected. In addition, specific problem areas should be photo documented. A recommended set of core photographs include:

- Vehicle access points.
- Overview of the facility.
- Overview of principal intake structure.
- Inlet to facility and downstream outfall from facility.
- Emergency spillway (if applicable).

In addition, because of the large number of photographs that will likely be generated, a digital camera should be used to allow photographs to be stored electronically. (In advanced database programs, these photographs can be retrieved digitally). Finally, photographs should be named using a standard convention. The photograph name should indicate the practice identification number, feature (or problem) being photographed, and date of photograph.

Field Marking

Inspectors can highlight key areas of concern with spray paint or other marker. This is particularly useful for problems that may otherwise be difficult to find by others. Marking should be used as discretely as possible. For example, only dots sprayed at the base of trees should be used to mark limits of clearing for vegetation removal.

Post Inspection Follow Up and Maintenance Request Procedure

Once the BMP has been inspected, the BMP manager/owner should be informed of the BMP status and any repairs that need to be made through a Maintenance Notification Letter if privately owned, or through a Maintenance Request Order if the facility is maintained by the County. An example of the Maintenance Notification Letter is included in Appendix G. This letter should include the basic inspection information with the additional information below.

List of Repairs

This list should be detailed enough so it cannot be misinterpreted. For example, avoid ambiguous phrases such as "clear the bank." Instead, the list should specify "clear the bank of dead vegetation."

Outline of the Repair Process

This can expedite the repairs, particularly if the BMP manager/owner does not have previous experience with BMPs. In most cases it is worthwhile to suggest the use of a contractor to dissuade unqualified persons from performing the repairs. For example, "You will have 30 days to complete the repairs. The first step is to get bids from contractors. Next, your contractor should contact our inspector to discuss repairs. . ."

A facility inspection report should be attached for the BMP manager's/owner's records.

Educational material

Educational materials should also be attached to reinforce why properly maintaining BMPs is important not only for environmental reasons but also how good stormwater management serves their best interests.

Notification of Violation

In situations when a BMP manager/owner fails to comply with a Maintenance Notification Letter and/or other requests for compliance, a letter using strong language should be sent. These

notices are typically more formal than Maintenance Notification Letters and have a strong emphasis on the consequences if the manger/owner does not remedy the situation. Notices of Violation should include the basic information, plus:

1. Reference(s) to previous correspondence, which can provide a paper trail in cases when disagreement of roles arises.

2. List of repairs that should be detailed enough so it cannot be misinterpreted

3. List of violations the BMP manager/owner has accrued, including actions such as failing to comply with previous notices.

Copies of this letter may be sent to other agencies affected, e.g., such as those responsible for dam safety, etc. An example of this letter is included in Appendix G.

APPENDIX F FACILITY INSPECTION AND MAINTENANCE CHECKLIST

Included in this appendix are a series of checklists that can be used by both inspectors and maintenance personnel to ensure that observed deficiencies in BMPs are maintained appropriately. The checklists are ordered as follows:

1. Detention Basin Inspection/Maintenance Checklist
2. Vegetated Swale Inspection/Maintenance Checklist
3. Filter Strip Inspection/Maintenance Checklist
4. Bioretention Inspection/Maintenance Checklist
5. Planter Box Inspection/Maintenance Checklist
6. Infiltration Trench Inspection/Maintenance Checklist
7. Hydrodynamic Separation Device Inspection/Maintenance Checklist
8. Catch Basin Insert Inspection/Maintenance Checklist
9. Cartridge Media Filter Inspection/Maintenance Checklist

Extended Detention Basin Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1 or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
General				
Appearance	Untidy, un-mown (if applicable)			
Vegetation	Access problems or hazards; dead or dying trees			
	Poisonous or nuisance vegetation or noxious weeds			
Insects	Insects such as wasps and hornets interfere with maintenance activities.			
Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes			
Trash and Debris	Trash and debris > 5 cf/1,000 sf (one standard size garbage can).			
Pollutants	Any evidence of oil, gasoline, contaminants or other pollutants			
Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris. Basin not draining.			
Erosion	Erosion of the basin's side slopes and/or scouring of the basin bottom that exceeds 2-inches, or where continued erosion is prevalent.			
Piping	Evidence of or visible water flow through basin berm.			
Settlement of Basin Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.			
Overflow Spillway	Rock is missing and/or soil is exposed at top of spillway or outside slope.			
Sediment Accumulation in Basin Bottom	Sediment accumulations in basin bottom that exceeds the depth of sediment zone plus 6-inches.			
Tree or shrub growth	Trees > 4 ft in height with potential blockage of inlet, outlet or spillway; or potential future bank stability problems			
Debris Barriers (e.g., Trash Racks)				
Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1 or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Damaged/ Missing Bars	Bars are bent out of shape more than 3 inches.			
	Bars are missing or entire barrier missing.			
	Bars are loose and rust is causing 50% deterioration to any part of barrier.			
Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe.			
Fencing				
Missing or broken parts	Any defect in the fence that permits easy entry to a facility.			
Erosion	Erosion more than 4 inches high and 12-18 inches wide, creating an opening under the fence.			
Damaged Parts	Damage to gate/fence, posts out of plumb, or rails bent more than 6 inches.			
Deteriorating Paint or Protective Coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.			
Gates				
Damaged or missing member	Missing gate or locking devices, broken or missing hinges, out of plum more than 6 inches and more than 1 foot out of design alignment, or missing stretcher bar, stretcher bands, and ties.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Vegetated Swale Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash and debris accumulated in the swale.			
Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation start to take over.			
Excessive Shading	Vegetation growth is poor because sunlight does not reach swale. Evaluate vegetation suitability.			
Poor Vegetation Coverage	When vegetation is sparse or bare or eroded patches occur in more than 10% of the swale bottom. Evaluate vegetation suitability.			
Sediment Accumulation	Sediment depth exceeds 2 inches or covers more than 10% of design area.			
Standing Water	When water stands in the swale between storms and does not drain freely.			
Flow spreader or Check Dams	Flow spreader or check dams uneven or clogged so that flows are not uniformly distributed through entire swale width.			
Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks and an eroded, muddy channel has formed in the swale bottom.			
Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.			
Erosion/ Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows. Eroded or rilled side slopes.			
	Eroded or undercut inlet/outlet structures			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Filter Strip Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1 or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.			
Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.			
Excessive Shading	Grass growth is poor because sunlight does not reach swale. Evaluate grass species suitability.			
Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom. Evaluate grass species suitability.			
Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.			
Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.			
Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Bioretention Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash, plant litter and dead leaves accumulated on surface.			
Vegetation	Unhealthy plants and appearance.			
Irrigation	Functioning incorrectly (if applicable).			
Inlet	Inlet pipe blocked or impeded.			
Splash Blocks	Blocks or pads correctly positioned to prevent erosion.			
Overflow	Overflow pipe blocked or broken.			
Filter media	Infiltration design rate is met (e.g., drains 36-48 hours after moderate - large storm event).			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Planter Box Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash, plant litter and dead leaves accumulated on surface.			
Vegetation	Unhealthy plants and appearance.			
	Vegetation interfering with planter operations.			
Irrigation	Functioning incorrectly (if applicable).			
Plant box	Structural defects, holes and gaps.			
Inlet	Inlet pipe blocked or impeded.			
Splash Blocks	Blocks or pads correctly positioned to prevent erosion.			
Overflow	Overflow pipe blocked or broken.			
Filter media	Infiltration design rate is met (e.g., drains 3-4 hours after moderate - large storm event).			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Infiltration Trench Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2) †	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance, vegetative health	Mowing and trimming vegetation is needed to prevent establishment of woody vegetation, and for aesthetic and vector reasons.			
Vegetation	Poisonous or nuisance vegetation or noxious weeds.			
	Excessive loss of turf or ground cover (if applicable).			
Trash & Debris	Trash and debris > 5 cf/1,000 sf (one standard size garbage can).			
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.			
Erosion	Undercut or eroded areas at inlet or outlet structures.			
Sediment and Debris	Accumulation of sediment, debris, and oil/grease on surface, inflow, outlet or overflow structures.			
Sediment and Debris	Accumulation of sediment and debris, in sediment forebay and pretreatment devices.			
Water drainage rate	Standing water, or by visual inspection of wells (if available), indicates design drain times are not being achieved (i.e., within 72 hours).			
Media clogging surface layer	Lift surface layer (and filter fabric if installed) and check for media clogging with sediment (function may be able to be restored by replacing surface aggregate/filter cloth).			
Media clogging	Lift surface layer (and filter fabric if installed) and check for media clogging with sediment (partial or complete clogging which may require full replacement).			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Hydrodynamic Device Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1 or 2) †	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Refer to the manufacturer's instructions for maintenance/inspection requirements, below are generic guidelines to supplement manufacturer's recommendations.				
General				
Trash and Debris Accumulation	Trash or debris is blocking inletting capacity of the facility by more than 10%.			
Trash and Debris Sediment Accumulation	Trash, debris and sediment have reached the unit's capacity			
Unit Cover				
Cover Not in Place	Cover is missing or only partially in place.			
Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.			
Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep cover from sealing off access to maintenance.)			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Catchbasin Insert Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Date: _____Work Order # _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Refer to the manufacturer's instructions for maintenance/inspection requirements, below are generic guidelines to supplement manufacturer's recommendations.				
Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.			
Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage or restriction.			
Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.			
Hydrocarbon removal type				
Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.			
Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.			
Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Filter Cartridge Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2) †	Date Maintenance Performed	Comments or Action(s) taken to resolve issue
Refer to the manufacturer's instructions for maintenance/inspection requirements, below are generic guidelines to supplement manufacturer's recommendations.				
Underground Vault				
Sediment Accumulation on Media	Sediment depth exceeds 0.25-inches.			
Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.			
Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.			
Sediment in Drain Pipes or Cleanouts	When drain pipes, clean-outs, become full with sediment and/or debris.			
Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.			
Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2) †	Date Maintenance Performed	Comments or Action(s) taken to resolve issue
Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.			
	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.			
Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.			
Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, or misaligned.			
Below Ground Cartridge Type				
Filter Media	Drawdown of water through the media takes longer than 1 hour and/or overflow occurs frequently.			
Short Circuiting	Flows do not properly enter filter cartridges.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

APPENDIX G POLICY FOR NEW PERCOLATION BASIN TESTING, DESIGN, AND MAINTENANCE

Approved _____
DDE Donald L. Wolfe

October 10, 2007

TO: Tom Hoagland
Deputy Director

FROM: Dennis Hunter
Land Development Division

MAPP GOAL NO. 4–FISCAL YEAR 2006-07
POLICY FOR NEW PERCOLATION BASIN TESTING, DESIGN, AND MAINTENANCE

Recommendation

Approve the testing, design, and maintenance procedures as outlined in the following attachments for percolation basins that are constructed as part of private development projects.

Background

On October 28, 1980, the Board of Supervisors adopted the Interim Drainage Policy for Quartz Hill, which included mitigation for increased runoff from proposed developments (portions included in Appendix). One mitigation measure mentioned in this policy is percolation basins that would detain the increased runoff caused by a development that may adversely affect downstream areas. Due to increased development in Acton, Antelope Valley, and other areas that lack adequate drainage conveyances and outlets, developers are utilizing percolation basins as their method of mitigation. The Interim Drainage Policy for Quartz Hill also required these basins to be designed to the County Engineer's requirements. However, Public Works' lack of minimum requirements resulted in nonstandardized testing methodologies and design procedures that provided less than satisfactory results (Photos 1 and 2).

This policy will identify minimum requirements and, therefore, allow development to occur that is free of flood hazard while not significantly exacerbating flooding conditions to adjacent properties. If the site soils are such that an onsite basin cannot be designed to ensure that it is empty within seven (7) days, Public Works will require an offsite storm drain to convey flows to a more suitable offsite basin location. The applicant will be required to obtain all easements prior to Tentative Map approval.

Discussion

A panel consisting of representatives from Land Development, Geotechnical and Materials Engineering, Flood Maintenance, and Road Maintenance Divisions was assembled to develop standardized testing, design, and maintenance procedures. The current procedures were revisited and it was determined that traditional percolation

testing fails to account for the long-term saturation of the basins. It was also determined that the maintenance procedures recommended by the various private consultants resulted in the need for various filter fabrics and mechanical devices to remove accumulated sediments. In addition to establishing testing, design, and maintenance standards the panel also formalized the roles and areas of responsibility for the various divisions involved.

A presentation and draft version of the policy was distributed at the August 14, 2007, Land Development Advisory Committee meeting. A few questions were asked and answered, but no comments were received that warranted any revision to the policy.

RGD:la
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Attach.

cc: Geotechnical and Materials Engineering (Kelley, Montgomery)
Flood Maintenance (Lee, Hildebrand)
Road Maintenance (Lehman, Caddick)

ATTACHMENT 1

PERCOLATION BASIN TESTING PROCEDURE

Pretesting Preparation:

- Drill at least one boring to a minimum depth of 30 feet below the planned bottom of each proposed percolation basin. Additional borings must be performed in the area to establish continuity of subsurface materials. Each exploratory boring must be logged by a certified Engineering Geologist or Soils Engineer by either downhole logging or via samples obtained through the use of a continuous sampler.

- Create an excavation bottoming at the invert of the proposed basin. The consultant shall test a limited area through the use of an open-ended standpipe. The standpipe must be a minimum of 5 feet in diameter. The outer edge of the standpipe must be sealed in order to eliminate water loss from around the base.

- Presaturate the excavation, via the standpipe, for at least one week prior to performing testing. Maintain a constant head of at least 18 inches of water in the standpipe at all times during the presoak period.

Testing:

- Perform percolation testing using sediment-laden water. A minimum sediment load of 1000 Nepthelometric Turbidity Units (NTU) is required. Sediment loading must be carried out by directly adding sediment to the standpipe based upon water usage and the amount of load required to produce the required NTU. This must be accomplished on a daily basis. The sediment shall be collected from a nearby source area and shall be screened to reflect the anticipated sediment load grain size distribution. Maintain a constant 18 inches of head in the standpipe and record usage utilizing a continuous data logger.

- Once the usage stabilizes, continue testing for a minimum of two weeks. Stabilization is defined as when the slope of the mean trend line of the readings is less than 2 percent, when graphing the time (days) vs. percolation rate (in/hr).

Retesting:

- Allow sediment water to percolate completely and perform the recommended annual maintenance procedures recommended by the Soils Engineer and in accordance with Attachment 3 on the test area.

- Perform a retest utilizing the same methodology as described in the testing above, once maintenance has been performed.

Post-Testing:

- Based on the results of testing, the consultant must recommend a long-term percolation rate (in inches per day) to be utilized in the design of the percolation basin. The recommendation shall not exceed the result of the retest utilizing maintenance.

- Prepare and submit a report, which discusses the testing procedures, includes conclusions, and provides recommendations for maintenance.

Additional Notes:

- Land Development Division must be notified at least three (3) working days prior to initiation of testing.

- Basins will not be approved in areas that will receive fill during grading operations.

- Land Development Division will be responsible for requesting testing of proposed percolation basins and acceptance of the recommended percolation rate.

- Geotechnical and Materials Engineering Division will be responsible for the review of the testing procedures and design parameters.

- Flood Maintenance Division will be responsible for the operation and maintenance of the basin upon transfer to the Flood Control District.

- Percolation basins must percolate completely within seven days.

ATTACHMENT 2

PERCOLATION BASIN DESIGN PARAMETERS

- The basin will be required to be completely in native material. The basin may not be constructed in compacted fill.
- The sides of the basin must be at 3:1 gradient or flatter.
- The basin shall not be planted.
- The basin shall be designed to have pretreatment facilities, such as a filter strip or grass swale, to aid in the removal of suspended particulate pollutants
- Concrete access road to the bottom of the basin is required. The section of this access road is 12-feet-wide, 6-inch Portland Cement Concrete on 4-inch Crushed Miscellaneous Base, and not steeper than 12 percent grade.
- Monumentation for cleanouts will be required. This can be pipe-markers at all four corners of the basin.
- Discharge of nuisance flow from the development into the basin must be minimized. This should be done by designing the project so that nuisance flows minimally occur (i.e., smart irrigation, etc).
- The basin must be designed in a manner that will not accept any natural drainage, only the differential runoff from the proposed development.
- The basin must be designed with a drain valve to release the water in emergency situations.
- The location of the basin will be per the Soils Engineer's recommendation.
- A Drainage Benefit Assessment Area (DBAA), or similar, will be required to be setup by the developer to finance the maintenance of these basins.
- The Geotechnical Engineer shall address the potential for hydroconsolidation and slope instability associated with the impoundment of water within the basin.

ATTACHMENT 3

PERCOLATION BASIN MAINTENANCE PROCEDURE

- Maintenance should consist of either periodic physical removal of accumulated silt or periodic spading of the soil on an annual basis before each storm season or sooner if recommended by the Geotechnical Engineer. Spading of soil should be done annually, in order to limit growth of vegetation in the basin.

- With either method, care should be taken to avoid smearing of the absorption layer.

- If physical removal is utilized, the absorption layer should be scarified after removal of silt.

- If spading is utilized, a device such as the Tortella Spader should be utilized in lieu of conventional rototilling or disking, which tend to smear at the blade-soil interface.

- Organic material should be spaded into the soil to improve soil structure.

- The maintenance interval will be determined by the consultant's recommendation utilizing both volume of flow as well as water quality in the basin (spading should be done annually, prior to the start of the rainy season).

PHOTOGRAPHS

PHOTO 1 – Existing Percolation Basin in Antelope Valley

PHOTO 2–Existing Percolation Basin in Antelope Valley

PHOTO 3–Test Basin Excavation

PHOTO 4–Five Foot Diameter Stand Pipe

APPENDIX

DEPARTMENT OF PUBLIC WORKS

M E M O R A N D U M

TO: Carl L. Blum
Assistant Deputy Director

October 24, 1986

FROM: Rod Kubomoto
Drainage & Grading Section

ANTELOPE VALLEY INTERIM DRAINAGE POLICY

Recommendation

Approve the attached interim drainage policies and design criteria and standards for implementation in the Antelope Valley.

Discussion

Interim drainage policies for the Antelope Valley are a practical approach to flood hazard mitigation until regional drainage improvements are installed. In lieu of a moratorium on new construction, the Board of Supervisors adopted an interim drainage policy on October 28, 1980 for the Quartz Hill area (see attached copy). This was necessary due to an increase in development proposals in this area which lacks drainage conveyances and adequate outlets. The desert topography, coupled with the lack of well defined drainage courses and existing improvements affecting flow patterns, compounded the problem. Regional drainage improvements will ultimately alleviate the unmet drainage needs. However, in the interim, the main concern was and is today to allow development to occur that is free of flood hazard while not significantly worsening flooding conditions to adjacent properties. The Quartz Hill policy essentially provided this goal by collecting and percolating the increased run-off due to development and requiring elevated building pads above the anticipated flood level. Development continues to increase throughout the Antelope Valley and similar drainage problems are now being experienced. The Quartz Hill drainage policy is a reasonable compromise for the entire valley floor until regional facilities are installed. Attached are guidelines relative to reviewing and imposing requirements at tentative map processing and design criteria and standards for proposed County maintained drainage facilities. Approval of the recommendation will assist staff in regulating reasonable flood plain management for this area and improve section plan review consistency.

TELOPE VALLEY MASTER DRAINAGE PLAN FEES

In order to provide a source of funding for regional drainage improvements, the Department has adopted drainage fee requirements for all new land divisions. The requirements are as follows:

$ 2,000 per lot for single family residential

$10,000 per acre for commercial, manufacturing, or industrial

$1,000 per multi-dwelling unit (condo and apartments)

$10,000 per acre for mobile home parks (conditioned at time of CUP review)

These fees are currently waived for conditional certificates of compliance and building permits. Lots within a proposed land division with existing dwellings or other permitted main use are also exempt from the fees.

The developers must enter into an agreement with the County and provide adequate surety for the fees when (a) they apply for occupancy, or (b) the County has indentified projects for construction which will use this money. Based on current construction scheduling of regional facilities, the fees shall be collected prior to land division recordation. The submission of appropriate security shall be in accordance with Government Code Section 66499 and approved by the County. Two signed originals of the agreement are required and the surety shall be in the form of cashiers check, letter of credit, or letter of assignment. Due to the lengthy process to exonerate bonds, the Division does not prefer this form of surety for fees. It is intended that the Antelope Valley Master Plan of Drainage Facilities be built as soon as funds become available. However, if the funds are not used for construction within 7 years, the funds, if collected, will be returned to the applicant.

DRAINAGE BENEFIT ASSESSMENT AREAS (DBAA)

Proposed County-maintained facilities outside of the Flood Control District boundaries require maintenance provisions in the form of drainage benefit assessment area administered by the County and funded by lot owner assessments. The formation of the assessment area is coordinated through the Planning Division. Due to the relatively long process to legally form the assessment area, the developer may elect to enter into an agreement with the County. This would allow him to record the land division prior to assessment formation provided that no lots change ownership (see attached copy).

The following data must be submitted to the County to begin processing the assessment:

1. $3,000 processing fee
2. Land division map
3. Copy of the private drain plans
4. Benefited are indentified
5. Anticipated annual maintenance cost
6. O & M manual for multi-use flood recreational type facilities
7. Agreement

DETAILED PROCEDURES ARE OUTLINED PER SEPARATE MEMORANDUM (SEE ATTACHED DRAFT COPY).

TENTATIVE MAP REQUIREMENTS

Tentative map reviews are to be evaluated per current guidelines and procedures consistent with the Subdivision Ordinance. However, the added conditions are:

Assessment of required master drainage plan fees.

2. Formation of a benefit assessment district to fund the maintenance of drainage improvements (P.D.) if the site is located north of Avenue "S", Township 5 North (Outside Flood Control District boundaries).

3. Execution of the necessary agreements for master plan fees and DBAA formation and deposits prior to land division recordation.

4. Dedication of right of ways indentified on the Antelope Valley master drainage plan. Market value of the right of way can be used to offset the drainage fees. Construction in "planned flow paths" will be restricted but right of way will not be dedicated to County.

DRAINAGE CONCEPTS

Review of drainage concepts are to be consistent with current requirements and guidelines. However, four key issues should be acknowledged by the consulting engineer to avoid future complications and possible significant expenditures.

1. A maximum of seven day soil percolation rate for delta-volume and/or full retention basins. A soils report should be submitted for soil section review.

2. Drainage solutions that not only mitigate the flood hazard to lots but are compatible with street safety drainage requirements (refer to Road Sewer and Water Section).

3. Location and approximate sizing of the percolation basin.

4. Need for drainage acceptance letters from affected adjacent property owners.

DESIGN CRITERIA

The interim drainage provisions for the valley floor require subdivisions to limit drainage outflow to the before developed condition quantities. This would include not only the change in peak Q but also the volume due to the incremental decrease in permeability associated with development. Facilities therefore must detain the change in peak Q and percolate the change in volume to satisfy the interim policy. Percolation basins are the preferred design concept. However, due to site topography, public opposition, and field design parameters, several design options may be considered acceptable.

1. Allow contributory drainage to flow essentially through the development and detain the peak Delta Q and percolate the Delta volume. Return discharge of flows to the predevelopment condition or obtain drainage release letters from all affected properties.

2. Allow contributory drainage to be collected into the basin with the developmental increase and regulate outflow to the before-development Q while still percolating the Delta volume. Return discharge of flows to the before-developed condition or obtain drainage release letters.

3. Allow only detention of the peak Delta Q provided there is a reasonable adequate outlet and drainage release letters obtained from all affected properties.

4. Provide full retention and percolation of flows.

Each site must be evaluated on a case-by-case basis and drainage release letters may be mandatory due to the particular circumstances. Existing public roads maintained by the County may be considered as acceptable drainage oultes provided Departmental approval is obtained.

Interior street patterns should be designed to accommodate existing drainage patterns and street sump conditions should be avoided. Local streets can be utilized to convey storm flows provided it complies with street safety drainage requirements (refer to Road Sewer & Water Section).

PERCOLATION BASINS

A. HYDROLOGIC CRITERIA

Basins are to be sized on a 25-year rainfall frequency, 4th day only, storm event plus one foot of freeboard. The volume analysis is deemed acceptable due to physical conditions that indicate that the area experiences high-intensity, short-duration (thundershower) storm events. Updated methodology and hydrologic criteria are being evaluated by Hydraulic and Water Conservation Division. Analysis procedures and updated data will be incorporated upon Department policy and implementation approval.

B. GENERAL DESIGN STANDARDS

Provide adequate energy dissipation for inflows to prevent scour and erosion of the basin invert and side slopes.

Provide standard protection barriers and trash racks for inlets and outlets.

Provide a secondary overflow path (i.e., acess road) to a paved public street as an auxiliary spillway.

Outflow lines (except true detention type basins) are to be elevated a minimum of one foot above the basin invert.

The basin floor is to be graded to drain away from the outflow line (1% typical). This is to be minimize basin maintenance by isolating and concentrating summer low flows.

No seepage pits in the basin floor to mitigate nuisance flows will be allowed due to their high maintenance and lack of reliability.

C. STRUCTURAL CRITERIA

Soils report should be submitted that addresses slope stability, effects of rapid drawdown, infiltration, potential seepage, and possible effects such as land settlement or increased lateral infiltration and groundwater recharges.

Provide maximum 3:1 side slopes unless the soils report can verify stability at steeper slopes.

Basins utilizing walls as a means of retaining water must be reinforced concrete and structurally designed for hydrostatic pressures.

D. ACCESS AND FENCING

Provide security fencing and a double drive gate per Standard Drawing No. 2-D 178 or provide Department approved blockwalls (Min. height of 5 feet).

Provide a 12-foot wide minimum concrete access ramp to the bottom of the basin. Maximum grade into the basin shall be 12 percent.

Provide a 5-foot setback from the fence line or wall to the top of the basin slope along the basin perimeter adjacent public streets.

Provide an 8-foot setback from the fence line or wall to the top of the basin slope along the basin perimeter adjacent private lots. Lesser setbacks must be approved by the Department's Soil Unit and Operation and Maintenance Division.

RIGHTS OF WAY

The rights of way shall be shown and properly labeled on the plans. Basin facilities located outside the Flood Control District boundaries shall have easements dedicated to the County of Los Angeles for Flood Control purposes. Basins within the District boundaries are to be dedicated to Los Angeles County Flood Control District for flood control purposes. Rights of way in fee simple is required for facilities within future right of way needs per the Antelope Valley Master Drainage Plan. Planned flow paths are to be considered flood hazard areas.

3/81

INTERIM STANDARDS FOR PERCOLATION BASINS

1. The basin capacity shall be the difference in volume of runoff between the undeveloped subdivision and the developed conditions for the fourth storm day using the modified rational method.

2. The basin's side slopes shall not exceed one foot vertical to four feet horizonal with a depth of ponding no greater than 2.5 feet. ← FOR MULTI-USE RECREATIONAL PROPOSALS

3. The development shall be designed to direct nuisance water to the basin.

4. Basins must be designed to totally percolate drainage within a seven day time interval after storms. Percolation tests will have to be provided and approved by County Engineer. A controlled discharge outlet will have to be designed if soil conditions do not allow adequate percolation.

5. The basin design should be such that it does not adversely affect the aesthetics of the area and all efforts should be made to preserve significant natural plants and trees.

6. The subdivider shall establish a houseowners association ← DBAA for the maintenance for all drainage facilities other then those accepted for maintenance by the County.

COUNTY ENGINEER-FACILITIES
ATTN: Pete Spanglan

File
Quartz Hill
Drainage

MOTION BY SUPERVISOR BAXTER WARD

October 28, 1980

Recommendation of Supervisor Ward for Interim Drainage Policy for Quartz Hill, as suggested by North County Citizens Planning Council.

ADOPTED
BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES

4

OCT 28 1980

JAMES S. MIZE
EXECUTIVE OFFICER

MOTION BY SUPERVISOR BAXTER WARD

October 28, 1980

The Quartz Hill area of Antelope Valley is located on a relatively flat gently sloping plain which can be identified with the large alluvial plains found at the bases of most mountain ranges. Typically, storm runoff over these areas take the form of sheet flow with few defined drainage courses. In recent years, however, the area has begun to develop into a residential community at an increasing pace with a corresponding increase in the total runoff. This runoff has been confined to unimproved shallow drainage paths or concentrated and channelized in the streets. These streets, particularly in the northsouth direction, have insufficient capacity to contain this runoff and adjacent properties have been subject to flooding. The area also has many unimproved dirt streets that not only erode in storm flow, but could become a problem with a constant flow of nuisance water crossing from new developments upstream.

The area has limited topographic data and the extent of the flood hazard area is difficult to determine as the terrain gradually flattens toward the valley. The area needs a comprehensive study outlining the problem areas and suggesting solutions. An interim policy must be established to allow development to continue until a detailed master plan for drainage is completed.

The proposed interim policy incorporates many of the recommendations by the North County Citizens Planning Council as presented in its letter dated September 18, 1980, to our Honorable Board.

THEREFORE, I MOVE THAT THIS BOARD:

1. Establish the attached interim policy for drainage of new development in the Quartz Hill area.

2. Instruct the County Engineer to determine the extent of the flood hazard and prepare permanent policy and master plan for drainage in the Quartz Hill area.

INTERIM DRAINAGE POLICY FOR

QUARTZ HILL AREA

Development will be permitted outside the flood plain. Developments within the flood plain may be allowed if the street design and development layout do not alter the natural drainage patterns or adversely affect adjacent property. Floodways or flood protection areas must be provided for the passage of storm waters.

Fully improved roads may be used for routing storm water runoff. When the design storm exceeds the carrying capacity of the street, in new developments, floodways, or flood protection district shall be established.

When it is determined by the County Engineer that the development will have a significant increase in runoff and that this increase will adversely affect downstream developed areas, percolation basins may be required to detain the increased runoff caused by the development. Requirements for these basins shall be established by the County Engineer.

PROCEDURES FOR
DBAA MAINTENANCE AND TRANSFER

During the past few years, the Land Development Division has been requiring measures be taken to provide for drainage in the Antelope Valley by on-site detention or retention of increased storm water developed by the new subdivisions. The method used has been minimal storm drain systems which outlet into a basin. These basins are designated to accept that portion of runoff attributed to increased development. This policy was adopted by the Board of Supervisors on October 28, 1980, as an interim policy for the Quartz Hill area of the North County. Since all of the Antelope Valley has similar drainage concerns in areas other than Quartz Hill, the policy has been expanded to include subdivisions throughout most of the Valley.

There have been several subdivisions with requirements to install percolation basins to provide for drainage. The developers have also been required to form a drainage district to maintain these systems since those formed are not within the Los Angeles County Flood Control District boundary. These districts are composed of the properties within a subdivision and are formed under a benefit assessment area with money to be collected with the individual tax bills. Maintenance is the developer's obligation until these facilities have been accepted by the County. Additionally, DBAAs are being formed for subsurface drainage systems to collect water in geological problem areas. These systems, called hydraugers, are located near Valencia.

Procedures are as follows:

> The Land Development Division, as part of the subdivision requirements, shall process the plans, collect bonds, help establish the BAA and determine when the work is complete. When the work is complete, the Land Development Division shall recommend acceptance of the work and provide Planning Division with the information necessary to set up a procedure so that maintenance may commence.

Among necessary procedures are the following:

1. Set up fiscal collections from the Auditor-Controller.
2. Recommend yearly adjustments of collections to the Board of Supervisors.
3. Develop standards and specifications of maintenance or modify those submitted.
4. Monitor facilities.
5. Develop maintenance schedule.
6. Develop a disbursal program in conjunction with Business and Finance Division.
7. Development of work contracting.

Business and Finance Division

1. Establish recordkeeping procedure for collections and disbursal of funds.

Flood Maintenance Division

1. Receive work assignment from Planning Division including:
   a. Copy of BAA Ordinance
   b. DBAA document
   c. Subdivision map
   d. Construction plans
   e. Operation and maintenance manual or specifications (as required)
2. Create work order.
3. Recordkeeping, function, time and cost.
4. Service contract development.
5. August budget estimate to Planning Division (each year).

Construction Division

1. Provide ongoing inspection during construction.
2. Provide final inspection prior to acceptance of construction.

The Drainage Benefit Assessment Area listing is attached.

KCM:acm
(8.1/3)

Land Development Division

1. Identify drainage needs on tentative map conditions.
2. Review construction plans.
3. Send construction plans to Flood Maintenance Division for review and maintenance estimate.
4. Collect deposit for DBAA formation.
5. Send material for DBAA formation to Planning Division.
6. Approve construction plans.
7. Construction inspection by Construction Division.
8. Notify Planning Division of completion of construction when Board of Supervisors' letter is prepared.
9. Recommend acceptance of completed construction by letter to Board of Supervisors after maintenance tax is collected.
10. Transfer maintenance "package" to Planning Division.

Planning Division

1. Accept DBAA formation material
    a. Job number access ($3,000.00±)
    b. Subdivision map
    c. Copy of private drain plans
    d. Benefited area boundary
    e. Maintenance cost estimate
    f. Operation and maintenance manual (as required)
2. Prepare report, EIR, Resolution Instituting Proceedings, and Notice of Hearing and Filing.
3. File necessary documents with Board of Supervisors.
4. Post Notice of Hearing and Filing.
5. Submit notification affidavits.
6. Prepare resolution determining assessments and submittal to voters.
7. File resolution determining assessment with Board.
8. Notify Land Development Division when DBAA is formed.
9. Accept transfer package from Land Development Division including:
    a. Copy of BAA Ordinance
    b. DBAA document
    c. Subdivision map and assessment roll
    d. Construction plans
    e. Operation and maintenance manuals or specifications (as required)
10. Records for each area.
11. Notices to Business and Finance Division.
12. Assign work and disbursements to Flood Maintenance Division.
13. Budgets each August for Board of Supervisors' approval.

DEPARTMENT OF PUBLIC WORKS

M E M O R A N D U M

TO: Mike Nagao
Planning Division

September 5, 1986

FROM: Carl L. Blum
Land Development Division

File No. 2-15.40
Transfer of Storm Drain Systems
Drainage Benefit Assessment Area No. _____
Private Drain No. _____

For your information, the above-referenced Retention/Detention Basin and Storm Drain System has been transferred to the District for operation and maintenance.

Date of Board of Supervisors' approval:

Date of Board Letter: _____ (copy attached)

Supervisorial District: 5

Designed by:

Basin Capacity: acre feet.

Main Line Storm Drain Length: feet more or less

Area:

Thomas Guide: page

Quad Sheet:

Operation and Maintenance Area: Hansen Yard

Rod H. Kubomoto
Head, Drainage and Grading Section

RHK:amc

Attachment

bc: Contract Administration Division, Operation and Maintenance (2), (Hansen Yard), Property Management (Permits), Land Development (D&G), Secretary of Nomenclature Committee, General Files.

DRAINAGE BENEFIT ASSESSMENT AREA

No.	Name	Location	Type of Maintenance	Constructed
1	Tract 38994 P.D. 1706	Avenue L-8 Street West	Sump/Landscape	20% Constructed Formed
2	Big Rock Mesa	Malibu	Hydraugers	No Construction Not Formed
3	Tract 36496	Canyon Country	Hydraugers	Construction completed-Formed
4	Tract 30114 P.D. 1248	Elizabeth Lake	Storm Drain	No Construction Formed
5	Tract 36395 P.D. 1853	Avenue M-8 and 60th Street West	Sump	Construction completed-Formed
6	Tract 43528	Canyon Country (Sierra Highway)	Hydraugers	Formed
7	P.M. 13213 P.D. 1809	Avenue M and 10th Street West	Dry S.D.	85% Constructed Voted
8	Tract 43545 P.D. 1937	Avenue K and 45th Street (W.)	Sump	No Construction Not Formed
9	Tract 44330	Quartz Hill	Sump	Formed
10	Tracts 36875 & 43087/P.D. 1990	Avenue R-12 and 47 Street E.	Sump	Abandoned
11	Tract 44370 P.D. 1980	Division Street and Avenue R-8	Detention Basin	Not Formed
12	Calle Del Barco	Malibu	Hydraugers	Voted
13	Tracts 43708, 44440, 44441, and 44442	40th Street W. and Avenue L-8	Sump	Not Formed

COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone: (818) 458-5100

THOMAS A. TIDEMANSON, Director
CECIL E. BUGH, Chief Deputy Director
MAS NAGAMI, Assistant Director

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

IN REPLY PLEASE
REFER TO FILE:

October 25, 1989

TO: Land Development Advisory
Committee Members

FROM: Donald L. Wolfe
Assistant Deputy Director
Land Development Division

INTERIM DRAINAGE POLICY

Attached is a draft interim drainage policy and guidelines for land development projects in the Acton area. Your comments are requested by December 1, 1989.

JEE:mg(M-2)IDP
L-0

DRAFT

ACTON INTERIM DRAINAGE POLICY AND GUIDELINES

The Interim Policy

Containment of the incremental increase of runoff and nuisance flows from land development proposals within the watershed for downtown Acton.

Tentative Map Requirements

Tentative map reviews are to be evaluated per current guidelines and procedures consistent with the Subdivision Ordinance. Drainage concepts will continue to be required and tentative subdivision maps held until the concepts are approved. The concept review will include an intensive evaluation of the lot layout and street patterns, as it affects drainage patterns and public safety. The reduction of proposed lots and/or redesign of street patterns may be necessary to mitigate the drainage concerns (and thereby avoid certain structural improvements).

Drainage Concepts

A drainage concept will be required for any division of land in Acton involving areas of known flood hazard and/or five acres or greater in total area. Delta Q basins shall be utilized to contain and percolate the incremental increase in runoff due to the development, similar to that used in the Antelope Valley.

Review of drainage concepts are to be consistent with current requirements and guidelines. However, several key issues should be acknowledged by the developer's engineer to avoid future complications and possible significant expenditures.

1. A maximum of seven-day soil percolation rate for delta-volume and/or full retention basins. A soils report should be submitted for soil section review.

2. Drainage solutions that not only mitigate the flood hazard to lots but are compatible with street safety drainage requirements.

3. Location and approximate sizing of the Delta Q basin.

4. Need for drainage acceptance letters from affected adjacent property owners.

5. The existance of multiple watercourses in the developed area necessitating multiple Delta Q basins.

6. Preliminary hydrology studies to evaluate before and after runoff conditions for the on-site areas as well the contributary off-site areas.

Drainage Concepts (Cont'd)

The drainage concepts will be coordinated and concurrently approved by both the Drainage and Grading and Road/Sewer and Water Sections.

Design Criteria

The interim drainage provisions require subdivisions to limit drainage outflow to the before developed condition quantities. This would include not only the change in peak Q but also the volume due to the incremental decrease in permeability associated with development. Facilities, therefore, must detain the change in peak Q and percolate the change in volume to satisfy this policy. No credit shall be permitted (in determining basin volume) for percolation during inflow.

Percolation basins are the preferred design concept. However, due to site topography, public input, and field design parameters, several design options may be considered acceptable including:

1. Allow contributory drainage (with debris) to flow essentially through the development and detain the peak Delta Q from the developed area and percolate the Delta volume. Return discharge of flows to the predevelopment condition or obtain drainage release letters from all affected properties.

2. Allow contributory, desilted drainage to be collected into the basin along with the developmental increase and regulate outflow to the before-development Q while still percolating the Delta volume. Return discharge of flows to the before-developed condition or obtain drainage release letters.

3. Allow only detention of the peak Delta Q provided there is a reasonable adequate outlet and drainage release letters obtained from all affected properties. Percolation of nuisance flows is still required.

4. Provide full retention and percolation of flows.

5. For subdivisions of five acres or less, provide drainage release letters in lieu of a Delta Q basin.

Each site must be evaluated on a case-by-case basis and drainage release letters may be mandatory due to the particular circumstances. Existing public roads maintained by the County may be considered as acceptable drainage outlets provided Departmental approval is obtained.

Interior street patterns should be designed to accommodate existing drainage patterns and street sump conditions should be avoided. Local streets can be utilized to convey storm flows provided it complies with street safety drainage requirements.

Basins are to be located at the downstream end of the developed area to maximize interception of nuisance flows and peak flow reduction.

DRAFT

Road Drainage Criteria

The attached charts depict the criteria for maintaining road drainage in the interim policy for Acton when storm drain solutions are not feasible. This policy permits flooding under certain conditions of all roadways up to a 25-year design frequency rainstorm.

Rights-Of-Way

The rights-of-way shall be shown and properly labeled on the plans. Retention and Delta Q basin easements are to be dedicated as flood control purposes to Los Angeles County Flood Control District.

Design Standards for Delta Q Basins

A. Hydrologic Criteria:

Basins are to be sized on a 25-year rainfall frequency, 4th day only, storm event plus one foot of freeboard. The volume shall be calculated based on hydrology before and after on the developed area without consideration for debris.

B. General Design Standards:

Provide adequate energy dissipation for inflows to prevent scour and erosion of the basin invert and side slopes.

Provide standard protection barriers and trash racks for inlets and outlets.

Provide a secondary overflow path (i.e., access road) to a paved public street as an auxiliary spillway.

Outflow lines (except true detention type basins) are to be elevated a minimum of one foot above the basin invert.

The basin floor is to be graded to drain away from the outflow line (3% typical). This is to be minimize basin maintenance by isolating and concentrating summer low flows.

C. Structural Criteria:

Soils report should be submitted that addresses slope stability, effects of rapid drawdown, infiltration, potential seepage, and possible effects such as land settlement or increased lateral infiltration and groundwater recharges.

Provide maximum 3:1 side slopes unless the soils report can verify stability at steeper slopes.

Basins utilizing walls as a means of retaining water must be reinforced concrete and structurally designed for hydrostatic pressures.

DRAFT

D. Access and Fencing:

Provide security fencing and a double drive gate per APWA Standard Drawing No. 600-0 or provide Department approved blockwalls (Min. height of 5 feet).

Provide a 12-foot wide minimum concrete access ramp to the bottom of the basin. Maximum grade into the basin shall be 12 percent.

Provide a 5-foot setback from the fence line or wall to the top of the basin slope along the basin perimeter adjacent public streets.

Provide an 8-foot setback from the fence line or wall to the top of the basin slope along basin perimeter adjacent private lots. Lesser setbacks must be approved by the Department in advance.

Drywell Alternatives

In smaller residential subdivisions (particularly with large rural lots) the use of a Delta Q basin and associated interceptor systems may be impractical. The Department will consider the use of a Maxwell Type IV drywell (or approved equal) on a case by case basis under the following conditions:

1. The subdivision is ten acres or less with minimum lot size of two acres and cannot be resubdivided into smaller lots.

2. Runoff and summer nuisance flows are properly intercepted and drywells are designed to handle potential debris laden flows.

3. Soils analysis supports the viability of operation, including in areas of proposed fill.

4. The drywells are located within public easements with paved vehicular access provided for maintenance and repair functions.

5. The use of these facilities have been adequately addressed in the environmental document for the tentative subdivision.

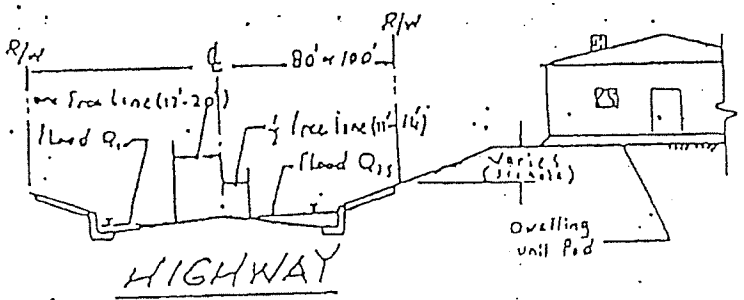
6. The approved hydrology study indicates a minimal increase in runoff due to development.

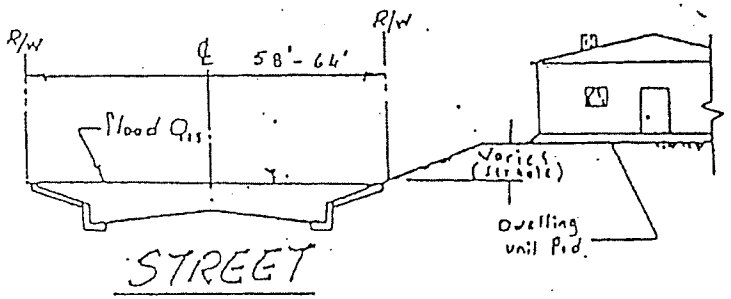
In certain situations, it may also be impractical to desilt all tributory flows and still pick up clear, developmental runoff for a Delta Q basin. The Department will consider, on site specific basis, the use of drywells to achieve percolation while allowing dilluted debris flows from the developed area to enter a Delta Q basin. It is the responsiblity of the engineering consultant to develop a basin facility that can operate in the dual capacity function.

Drywells will be considered in controlling summer nuisance flows wherein topographic features and other Department policies and standards do not allow the practicality of draining the flows into the Delta Q basin.

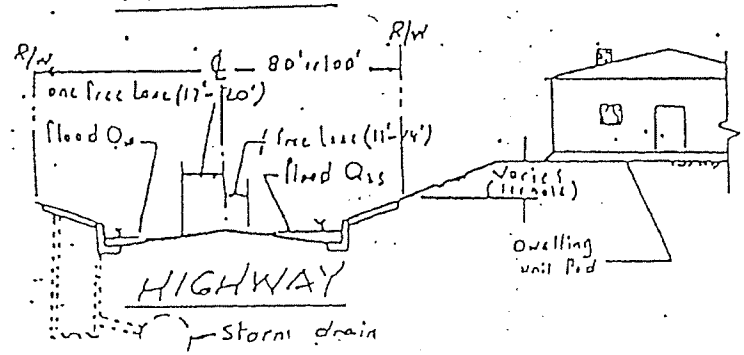
INTERIM ROAD DRAINAGE SAFETY FACTOR
ACTION

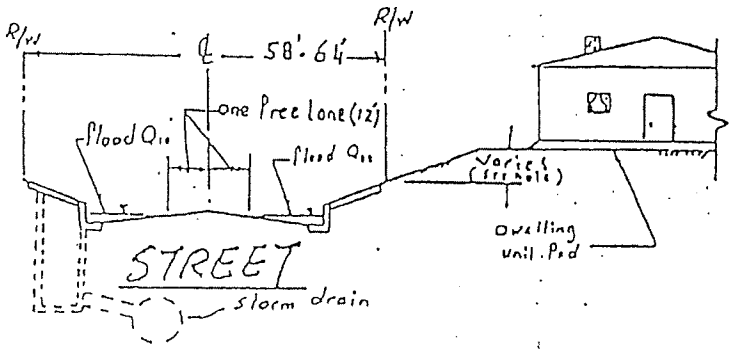
	FULL ROAD IMPROVEMENT ALTERNATIVES	DESIGN CRITERIA			ROAD FLOODING CONDITION		COMMENTS
		Q25	Q10	Within Gutter Area D X V	Highway	Street	
PRESENT CRITERIA	1. Without storm drain	X		Less than 6	½ free lane must be open in each direction	R/W to R/W or below either side of R/W	
			X	*	One free lane must be open in each direction	*	
	2. With storm drain	X		Less than 6	½ free lane must be open in each direction	Q10 Criteria governs	There are generally no existing acceptable outlets for concentrated flow.
			X	*	One free lane must be open in each direction		





* Q25 Criteria governs





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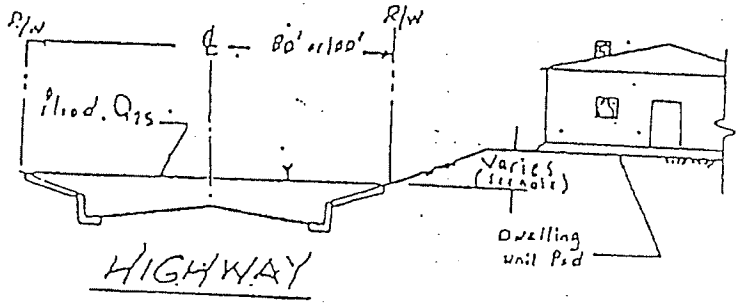
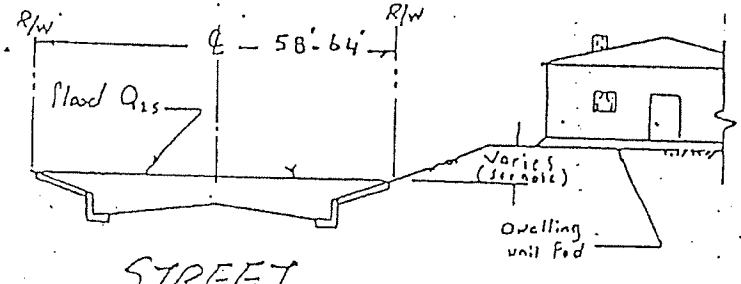
PROPOSED. TON

INTERIM ROAD DRAINAGE SAFETY POLICY

	FULL ROAD IMPROVEMENT ALTERNATIVES	DESIGN CRITERIA			ROAD FLOODING CONDITION		COMMENTS		
		Q25	Q10	Within Gutter Area D X V	Highway	Street	PROS	CONS	Additional Requirements
PROPOSED CRITERIA	3. Storm drain is not feasible. Allow flooding R/W to R/W.	X		A. New road improvements D X V must be less than 6. B. Widening existing improvements D X V must be less than existing conditions to a maximum of 9.	Allow highway flooding R/W to R/W but don't divert flow or increase the depth or the amount of flooding.	R/W to R/W	Roads are fully improved	1. Flooding R/W to R/W making road impassable during design storms. 2. Increase cost for road maintenance. 3. Conditions will not be improved until regional drainage facilities are available 4. Possible additional liabilities.	1. Drainage facilities to eliminate nuisance flows from highways.



HIGHWAY



STREET

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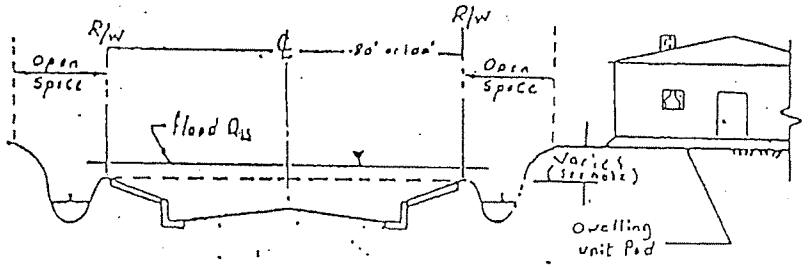
PROPOSED TION

INTERIM ROAD DRAINAGE SAFETY POLICY

	FULL ROAD IMPROVEMENT ALTERNATIVES	DESIGN CRITERIA			ROAD FLOODING CONDITION		COMMENTS		
		Q25	Q10	Within Gutter Area D X V	Highway	Street	PROS	CONS	Additional Requirements
PROPOSED CRITERIA	1. Storm drain is not feasible. Exceed flooding R/W to R/W.	X		A. New road improvements D X V must be less than 6. B. Widening existing road improvements D X V must be less than existing condition to a maximum of 9.	Allow highway flooding R/W to R/W but don't divert flow or increase the depth or amount of flooding. Provide ditch or drainage facilities outside R/W to carry flows exceeding surface capacity.	Not apply	Roads are fully improved	1. Flooding R/W to R/W making road impassable during design storms. 2. Increase cost for road maintenance. 3. Conditions will not be improved until regional drainage facilities are available. 4. Possible additional liabilities.	1. Drainage facilities to eliminate nuisance flows from highways. 2. Pipe or box culvert or Arizonal * type crossing with low flow pipes for road crossing. 3. Dedication of open space lots for drainage facilities outside R/W (private maintenance arrangement)

* Only if all other normal drainage solutions are not feasible, the Arizona type crossing with low flow pipes may be permissible on highways in flat natural drainage courses.



HIGHWAY

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Appendix D

MODEL DEVELOPMENT MAPS

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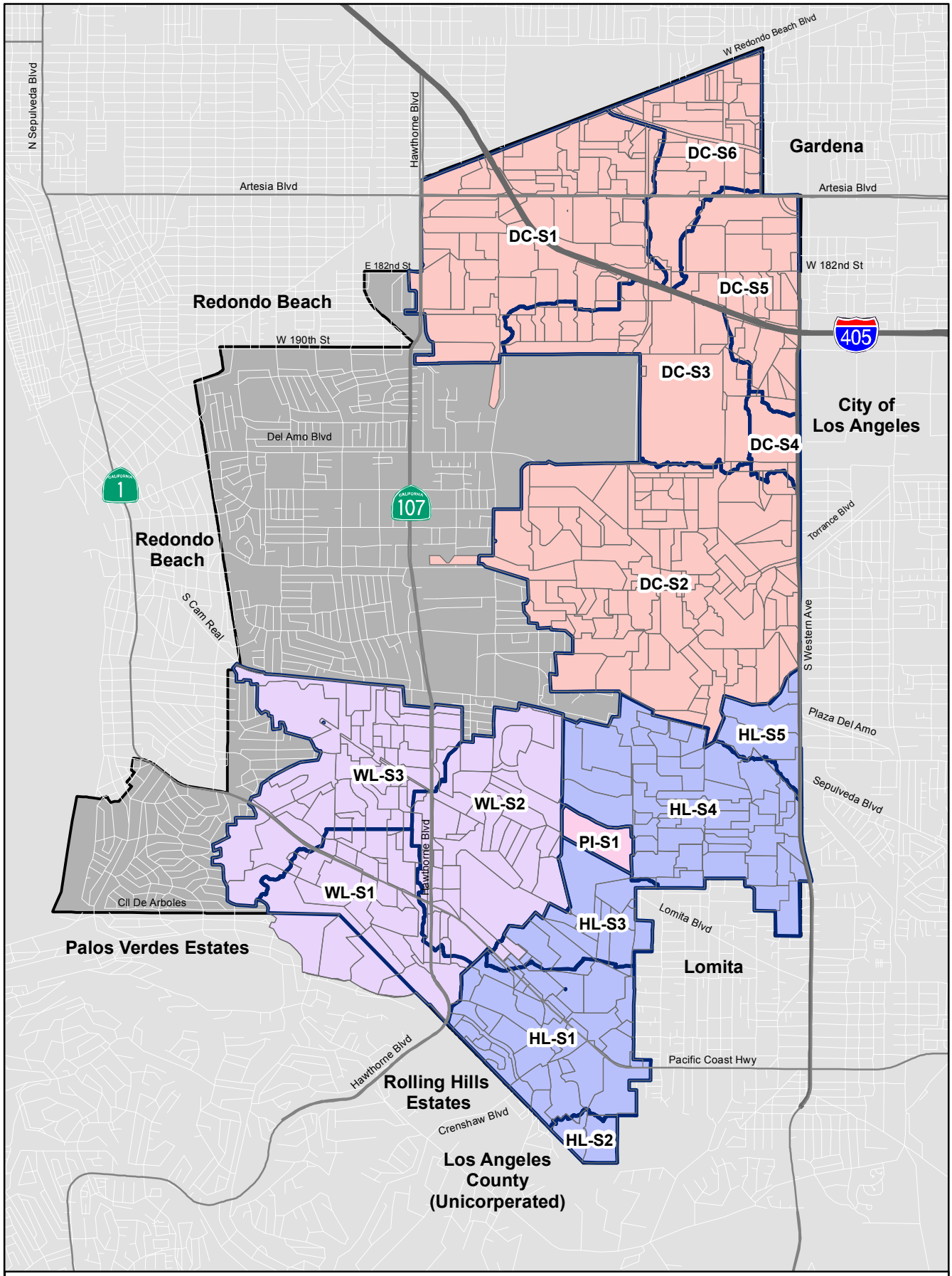

XPSWMM Subbasin by Watershed

- 237th St. Subarea
- Dominguez Channel Subarea
- Harbor Lakes Subarea
- Walteria Lake Subarea
- Not Calculated
- P8 Subarea Boundaries

N

0 0.25 0.5 1 Miles

Figure D.1
XPSWMM Subbasins
Stormwater Quality Master Plan
City of Torrance

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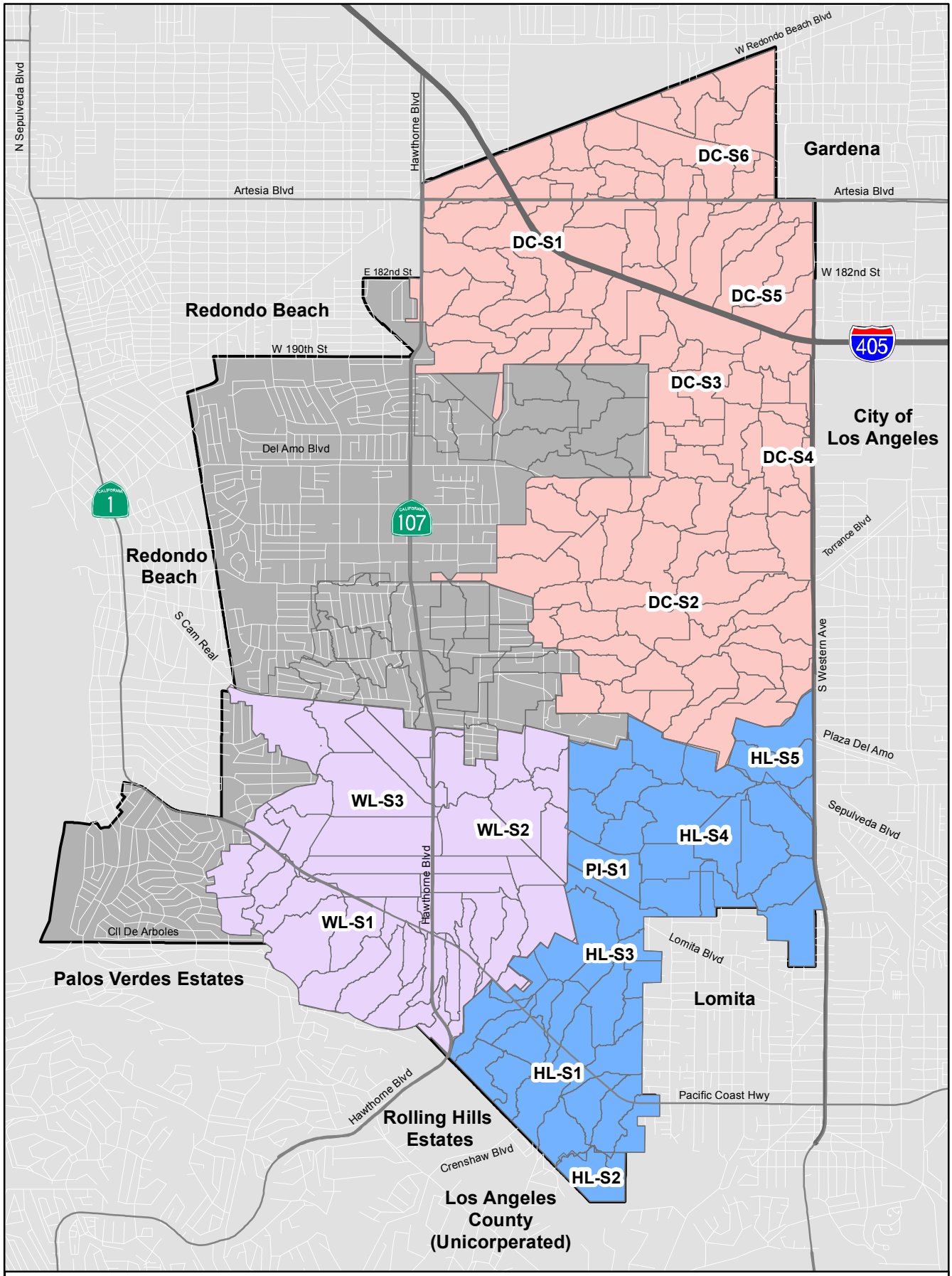


Figure D.2
Subbasins of PLOAD Model
Stormwater Quality Master Plan
City of Torrance

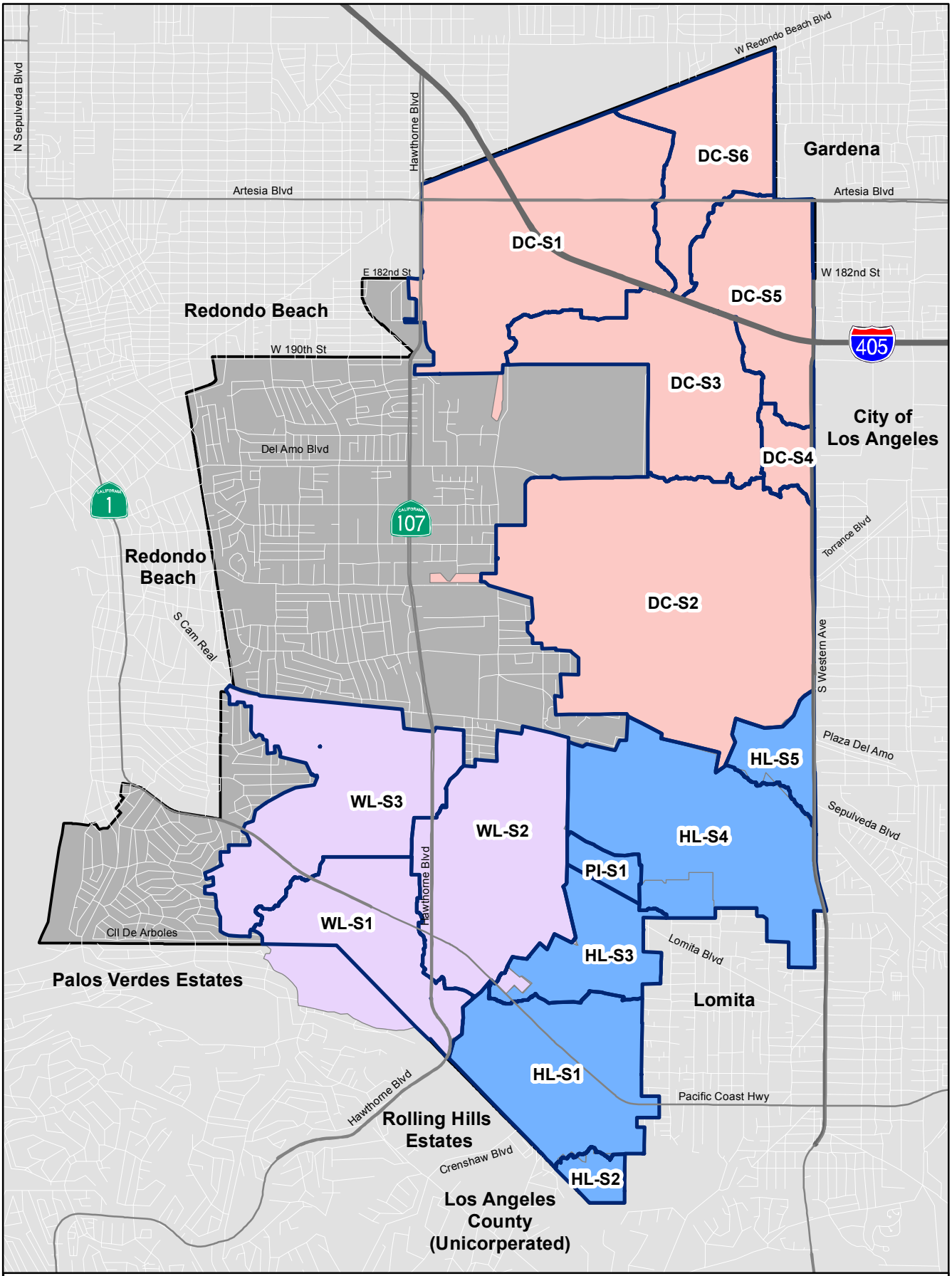
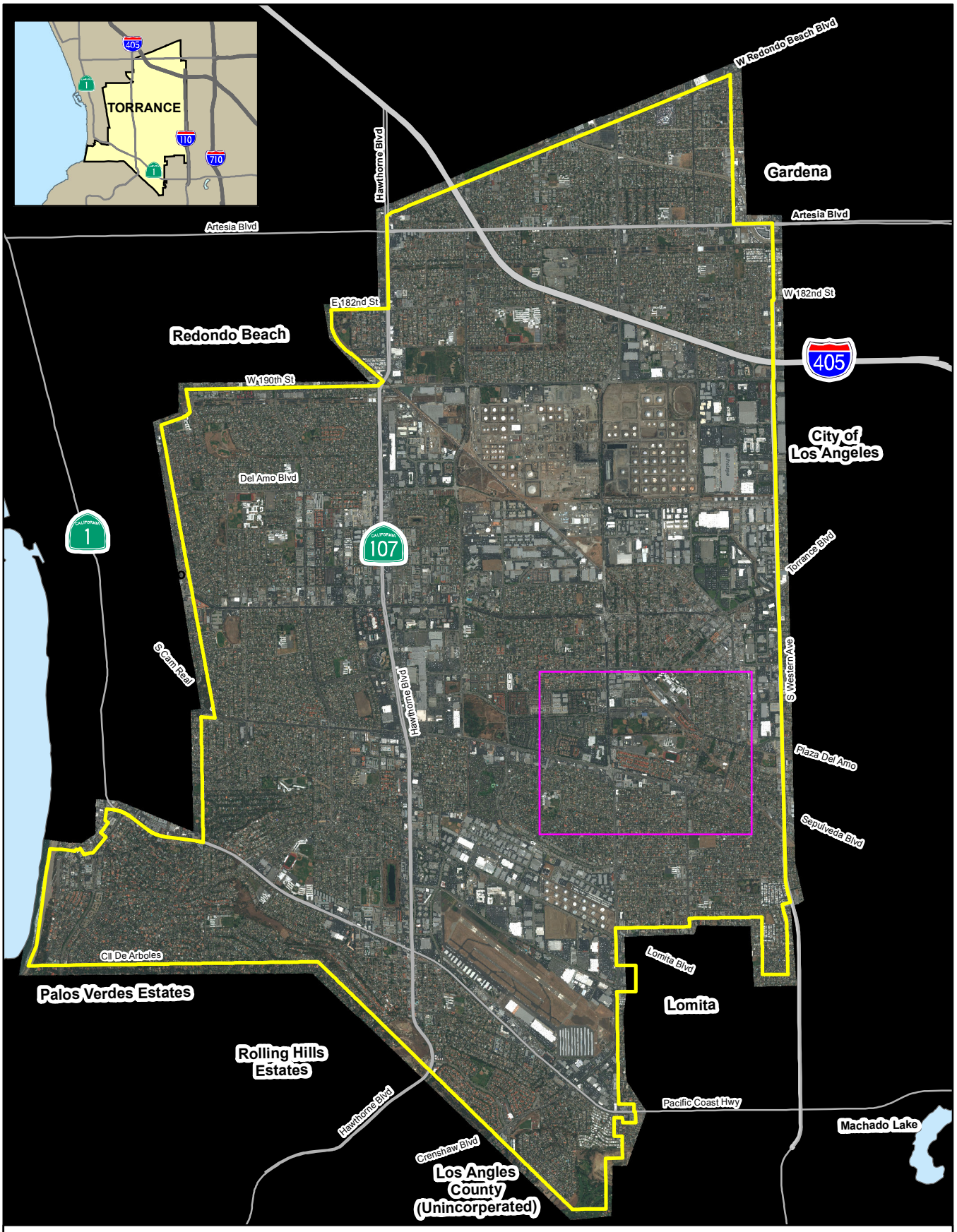


Figure D.3
Subareas of P8 Model
Stormwater Quality Master Plan
City of Torrance



Legend

- City Boundary
- Bodies of Water
- Comparison Area

0 0.25 0.5 1 Miles

Satellite Imagery from WorldView for July 10, 2010

Figure D.4
Satellite Image
Stormwater Quality Master Plan
City of Torrance

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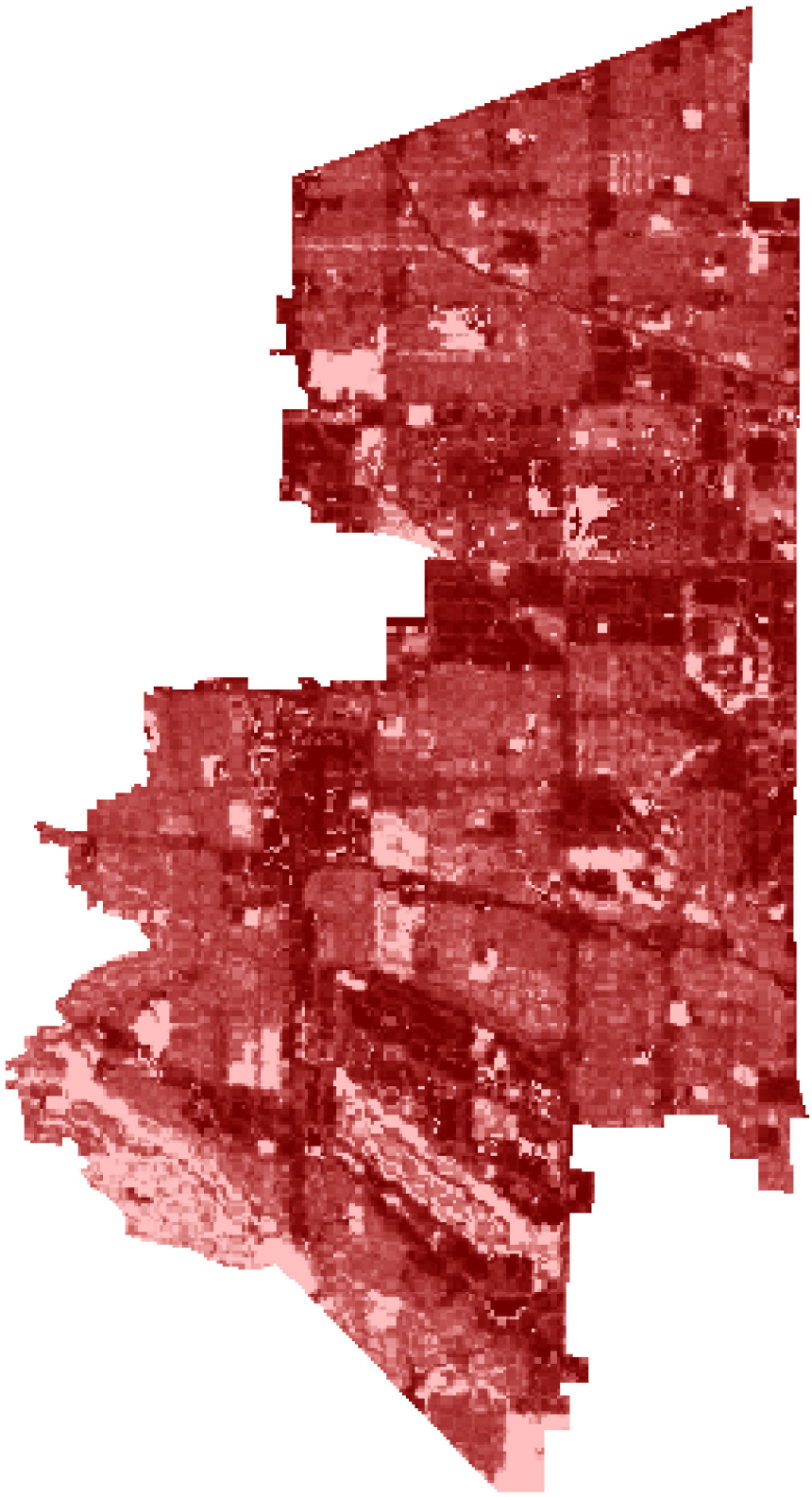

Imperviousness (%)

High : 100

Low : 0

Figure D.5
Imperviousness Derived from High Resolution Imagery
Stormwater Quality Master Plan
City of Torrance

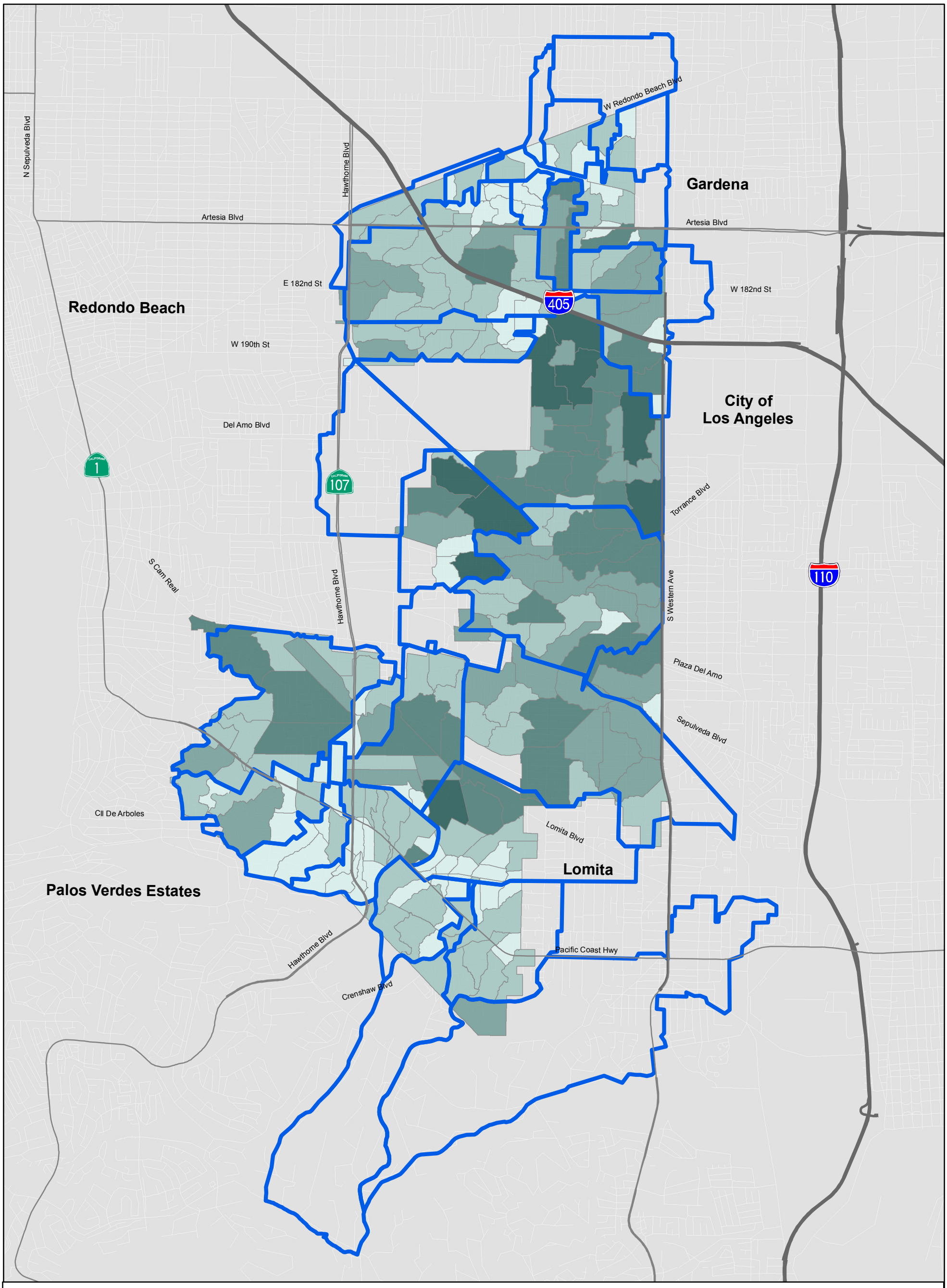

Figure D.6
Water Quality Calibration
City Model TSS Load
Stormwater Quality Master Plan
City of Torrance

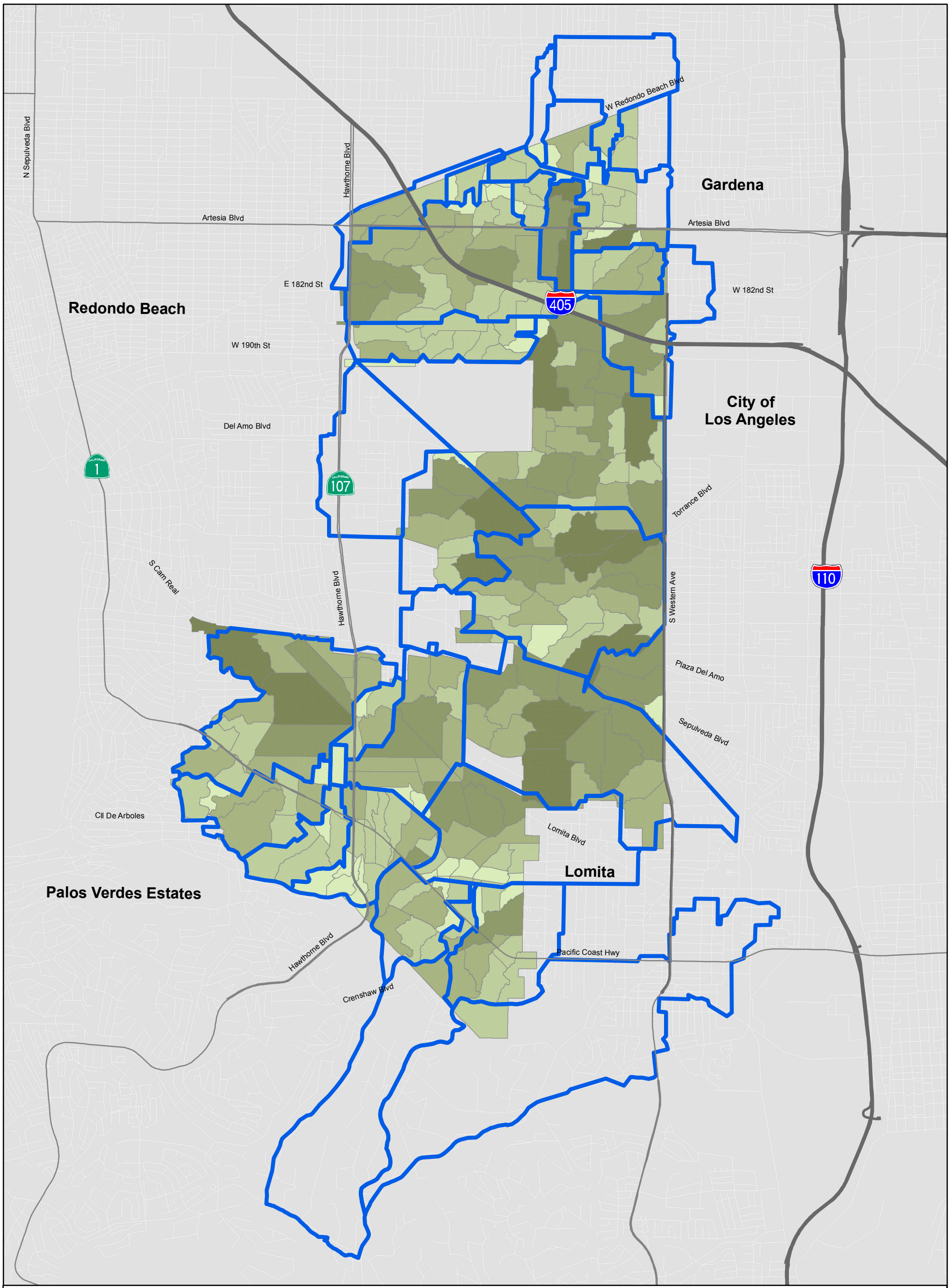

Figure D.7
Water Quality Calibration
City Model TP Load
Stormwater Quality Master Plan
City of Torrance

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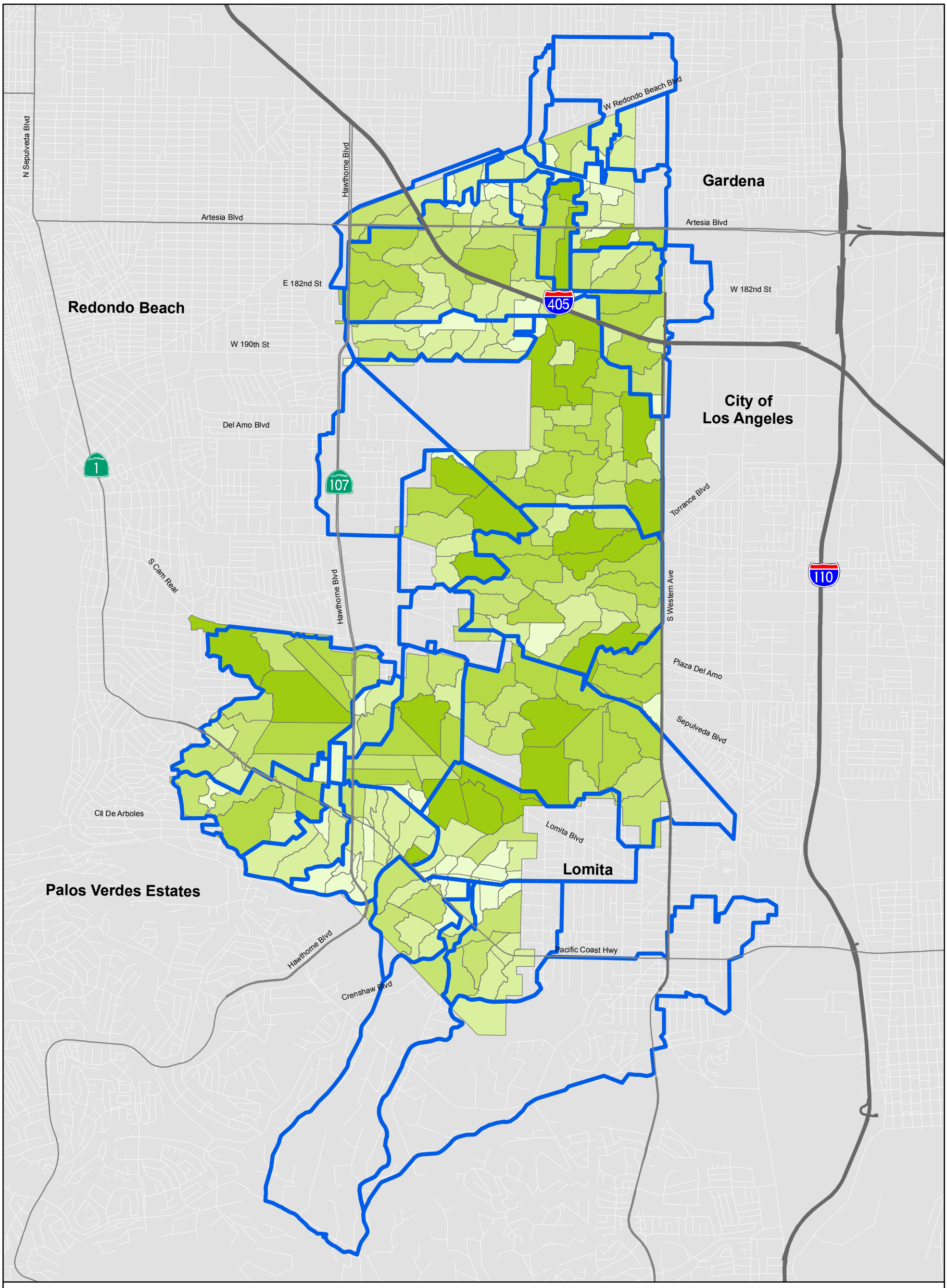

Figure D.8
Water Quality Calibration
City Model TN Load
Stormwater Quality Master Plan
City of Torrance

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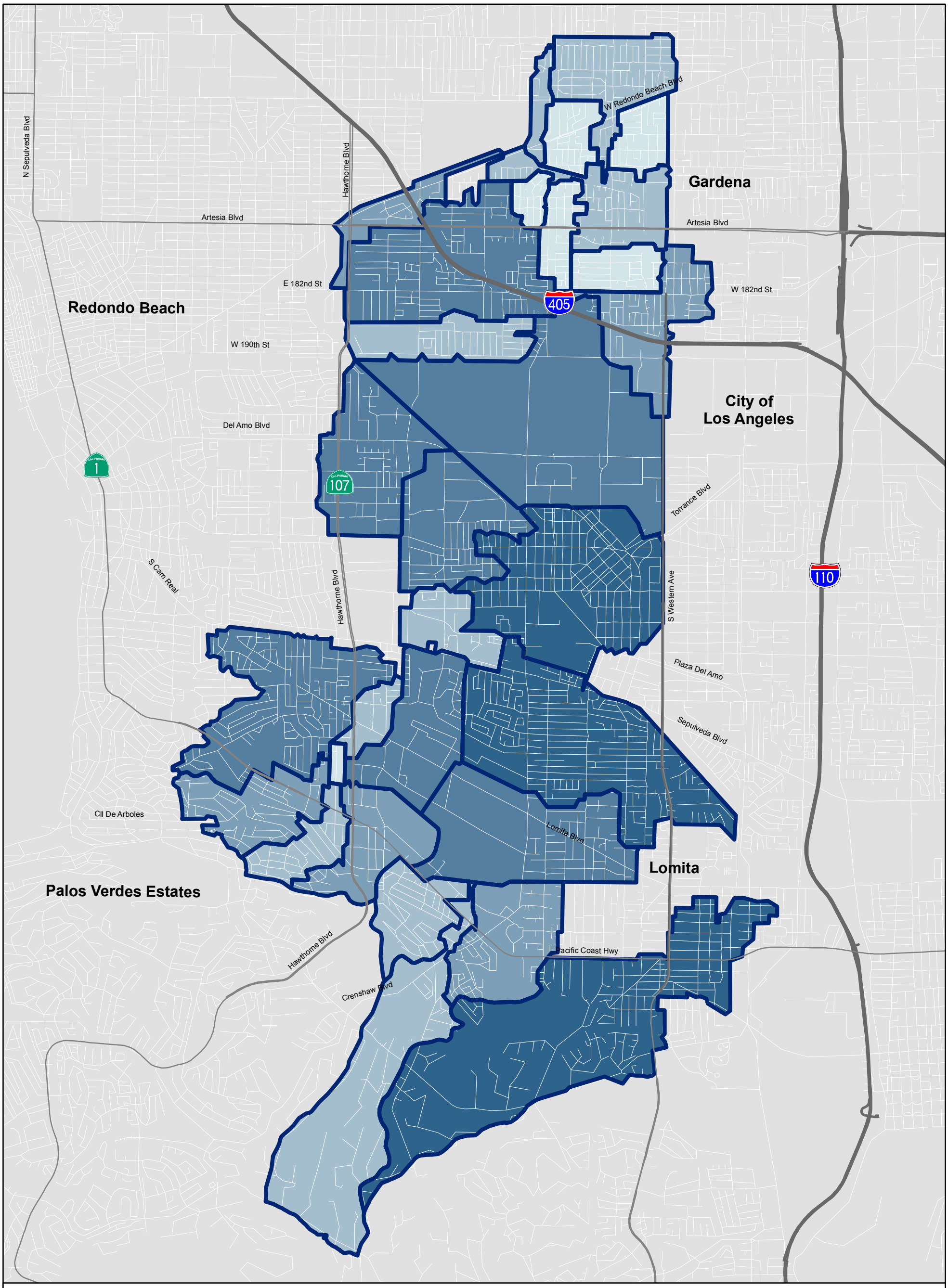

Predicted TSS Load by County Model (lb/yr)

- <5000
- 5000 - 10000
- 10000 - 20000
- 20000 - 45000
- >45000

- Freeway
- Major Roads
- Los Angeles County Model Subbasin Boundary

0 0.25 0.5 1 Miles

Figure D.9
Water Quality Calibration
Los Angeles County Model TSS Load
Stormwater Quality Master Plan
City of Torrance

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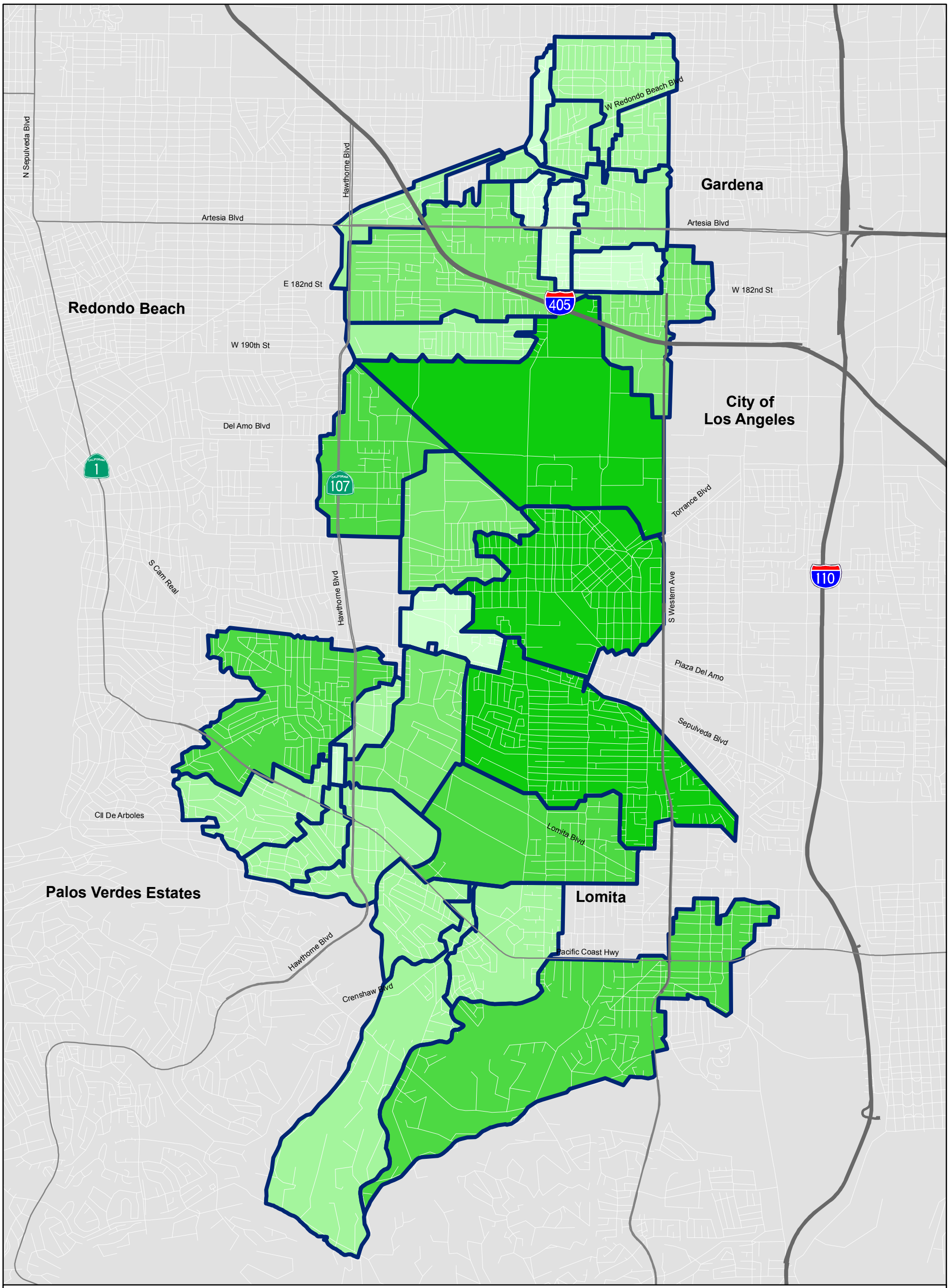

Figure D.10
Water Quality Calibration
Los Angeles County Model TP Load
Stormwater Quality Master Plan
City of Torrance

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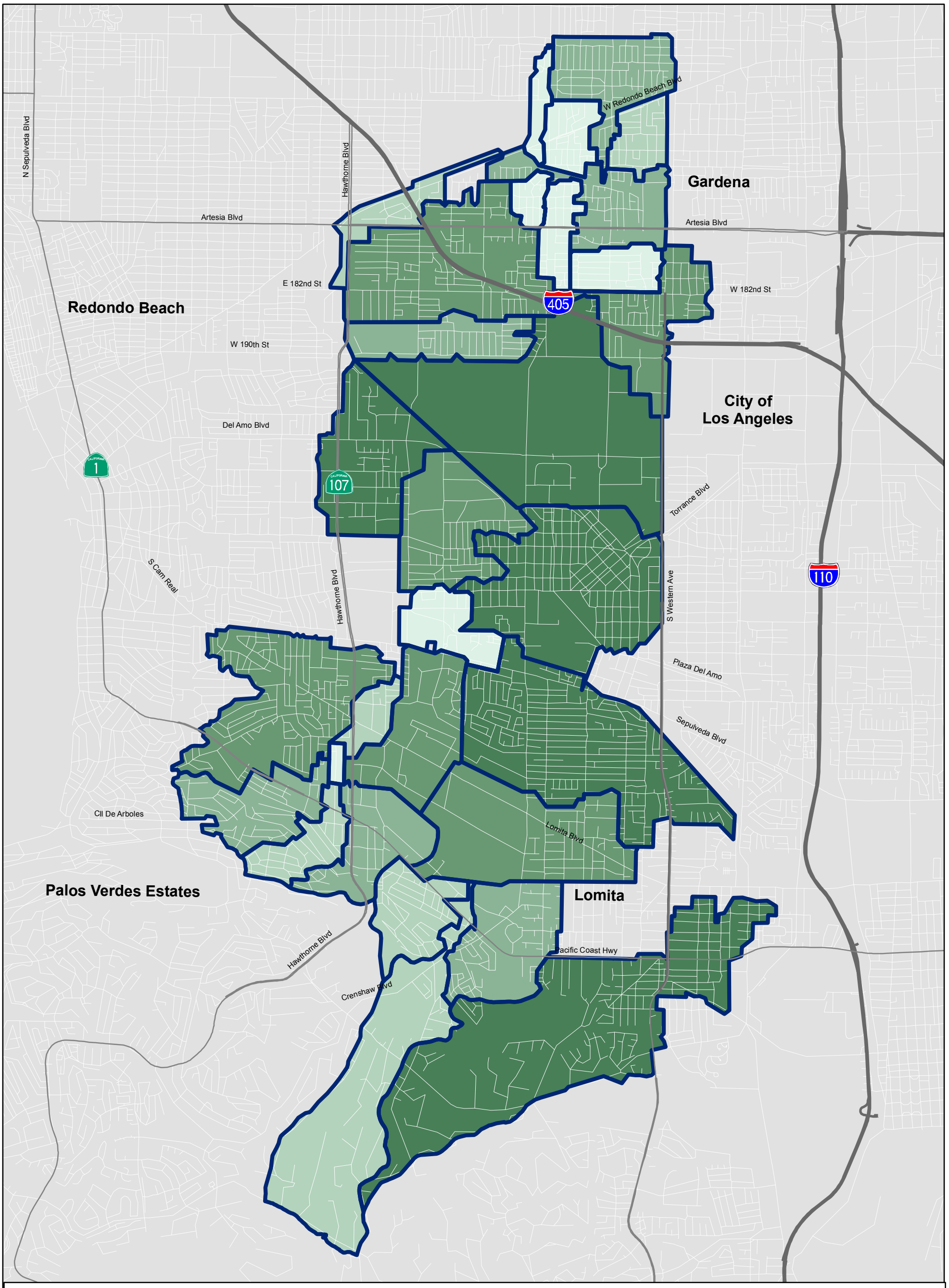

Predicted TN Load by County Model (lb/yr)

- <115
- 115 - 220
- 220 - 400
- 400 - 800
- >800

- Freeway
- Major Roads
- Los Angeles County Model Subbasin Boundary

0 0.25 0.5 1 Miles

Figure D.11
Water Quality Calibration
Los Angeles County Model TN Load
Stormwater Quality Master Plan
City of Torrance

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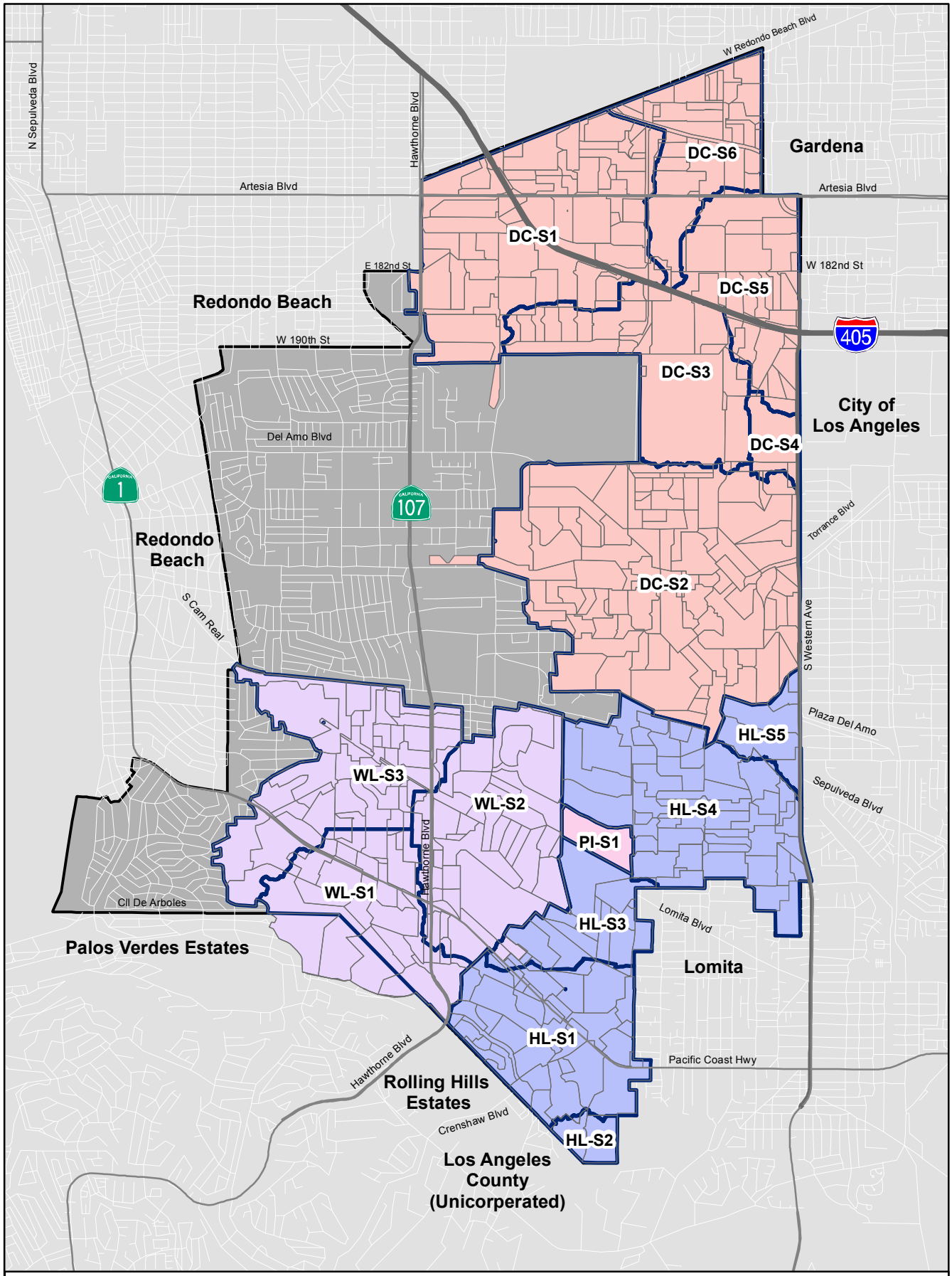

XPSWMM Subbasin by Watershed

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- Dominguez Channel Subarea
- Harbor Lakes Subarea
- Walteria Lake Subarea
- Not Calculated
- P8 Subarea Boundaries

N

0 0.25 0.5 1 Miles

Figure D.1
XPSWMM Subbasins
Stormwater Quality Master Plan
City of Torrance

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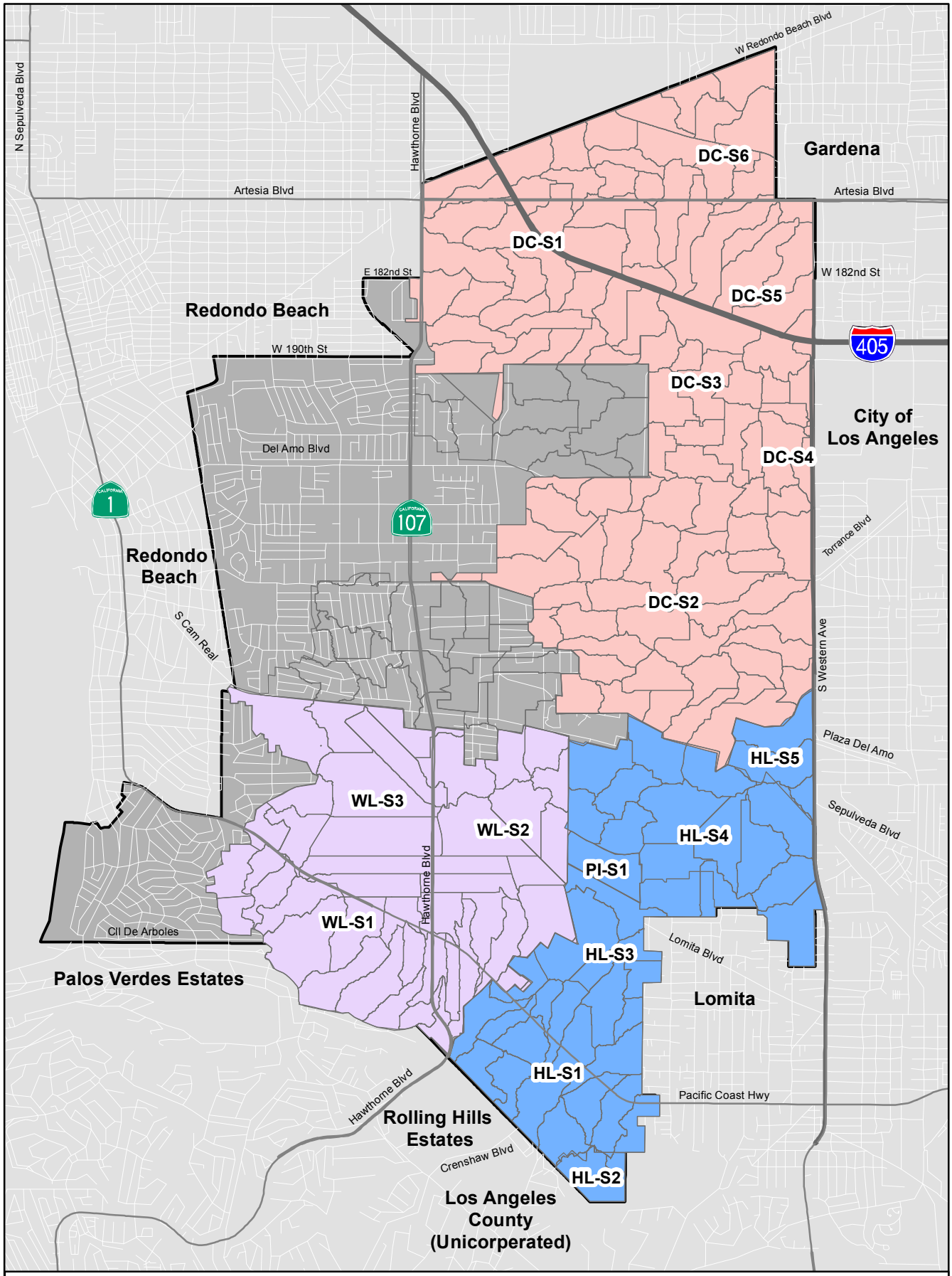


Figure D.2
Subbasins of PLOAD Model
Stormwater Quality Master Plan
City of Torrance

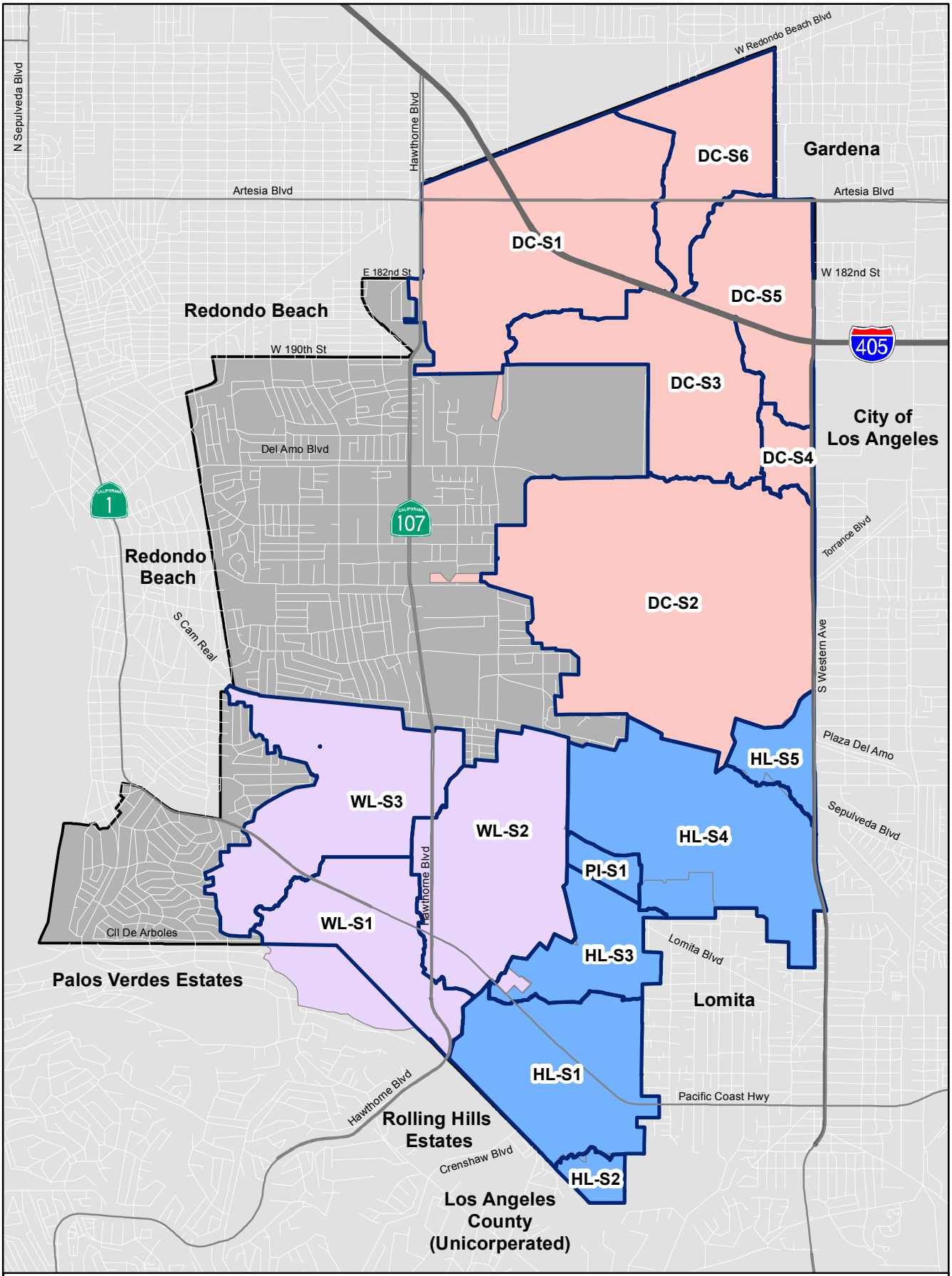
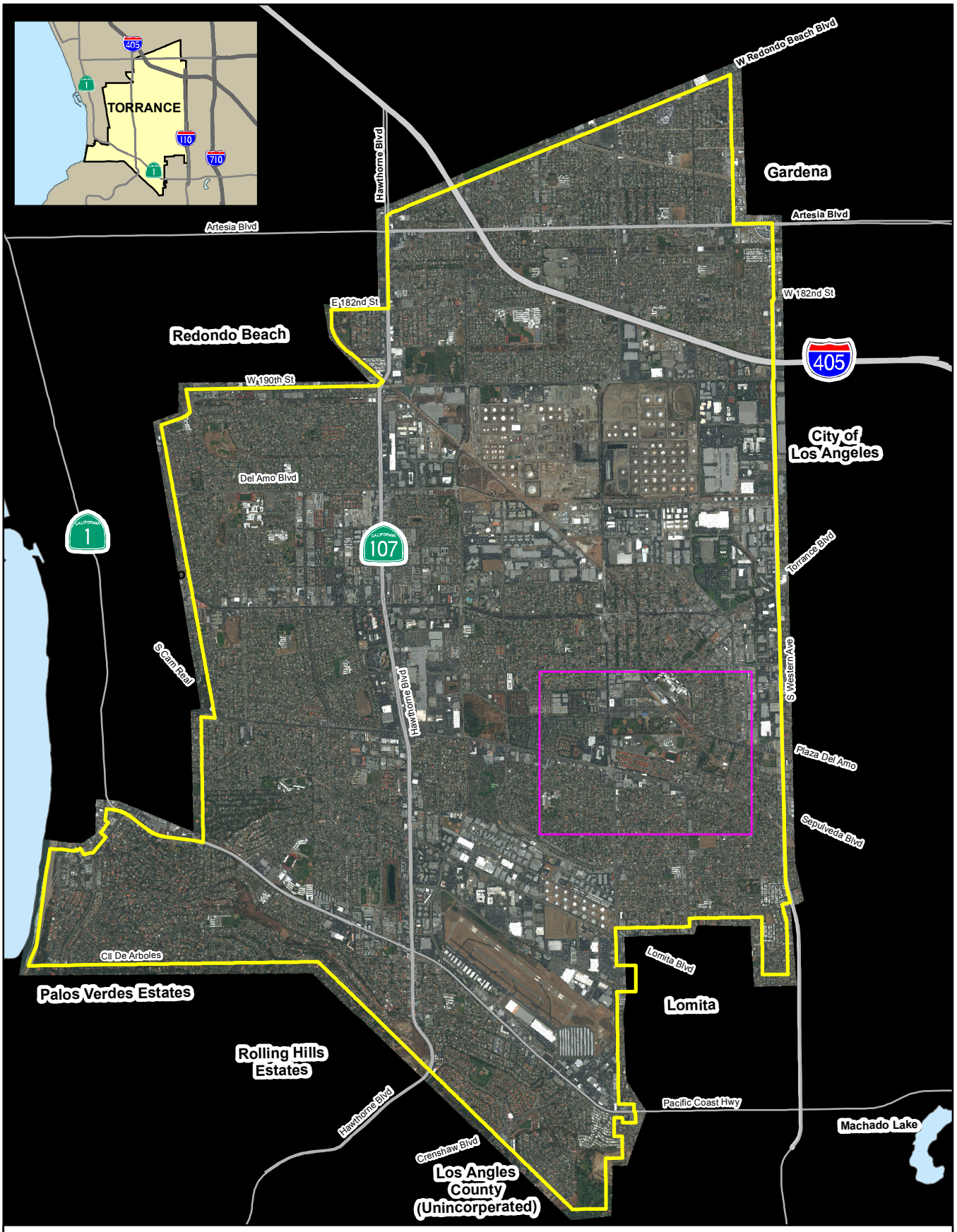


Figure D.3
Subareas of P8 Model
Stormwater Quality Master Plan
City of Torrance



Legend

- City Boundary
- Bodies of Water
- Comparison Area

0 0.25 0.5 1 Miles

Satellite Imagery from WorldView for July 10, 2010

Figure D.4
Satellite Image
Stormwater Quality Master Plan
City of Torrance

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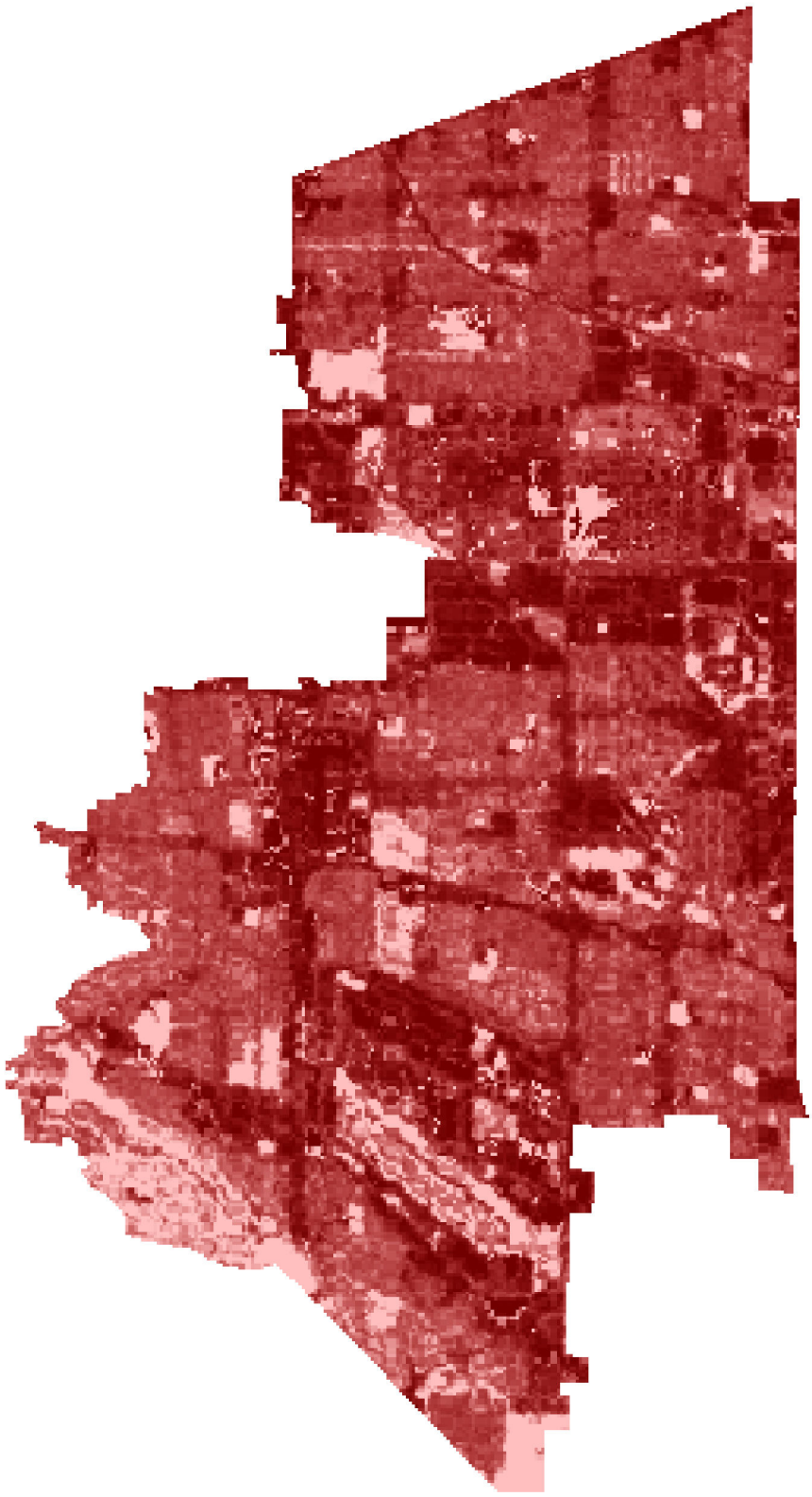

Imperviousness (%)

High : 100

Low : 0

Figure D.5
Imperviousness Derived from High Resolution Imagery
Stormwater Quality Master Plan
City of Torrance

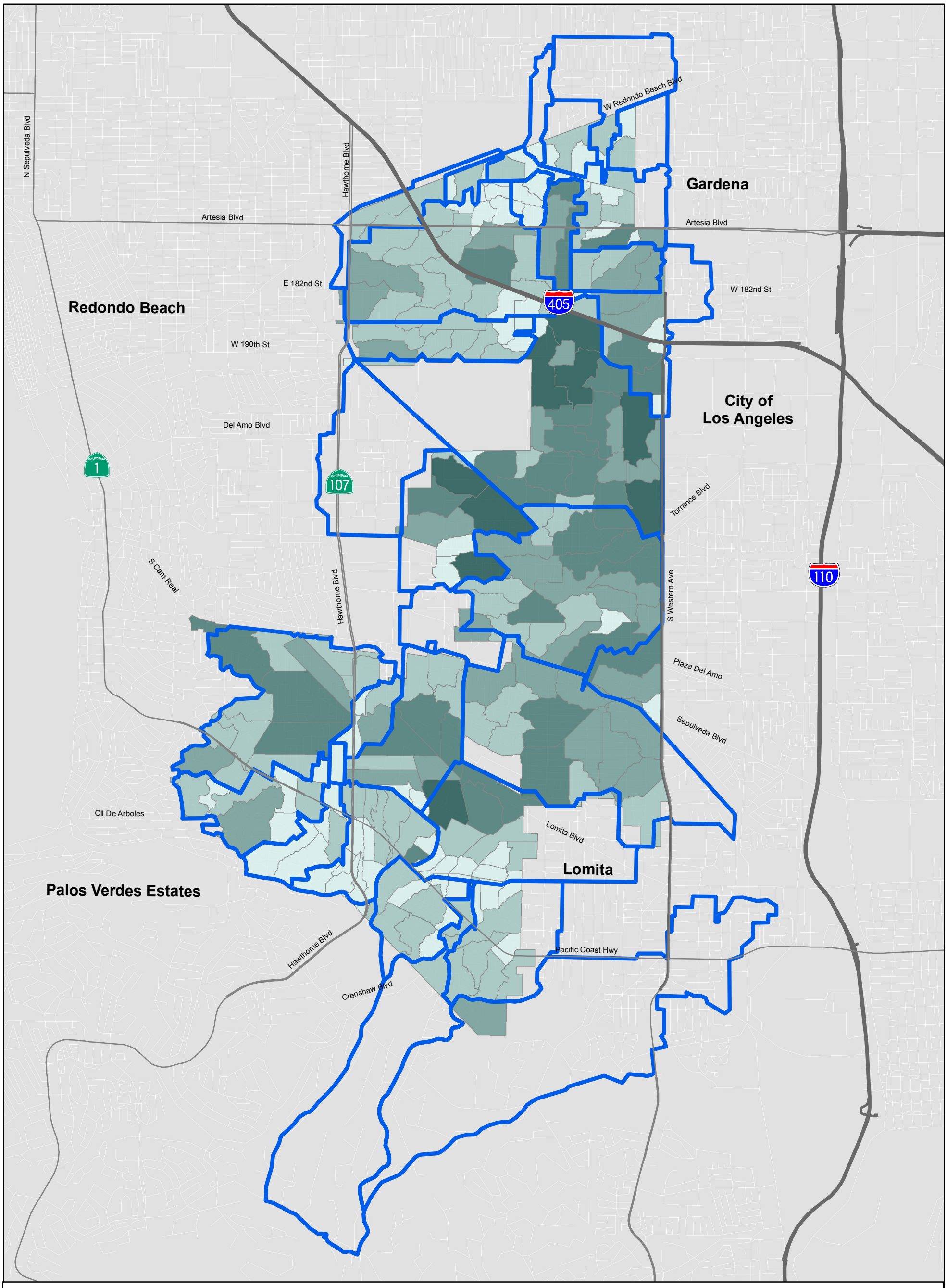

Figure D.6
Water Quality Calibration
City Model TSS Load
Stormwater Quality Master Plan
City of Torrance

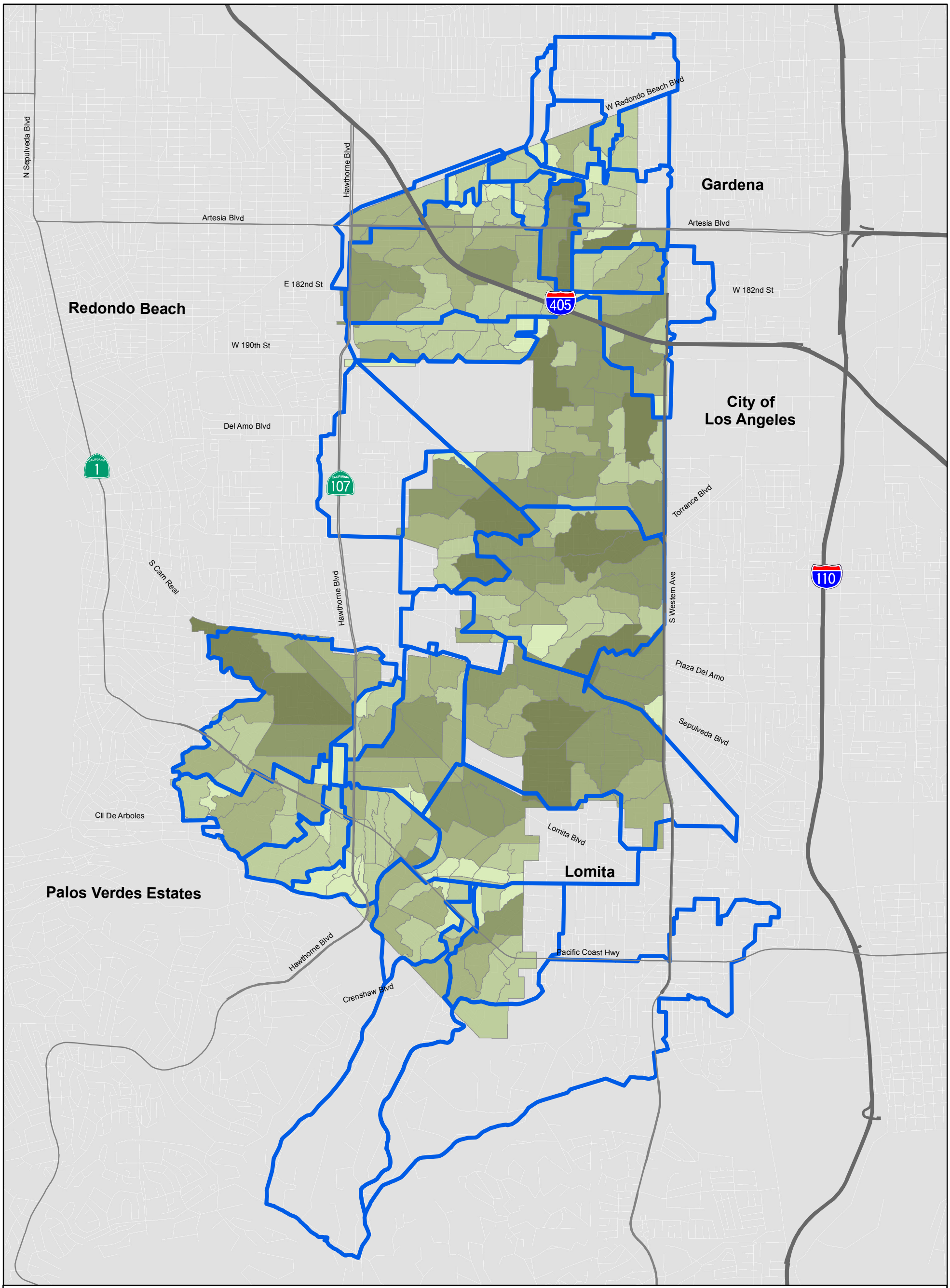

Figure D.7
Water Quality Calibration
City Model TP Load
Stormwater Quality Master Plan
City of Torrance

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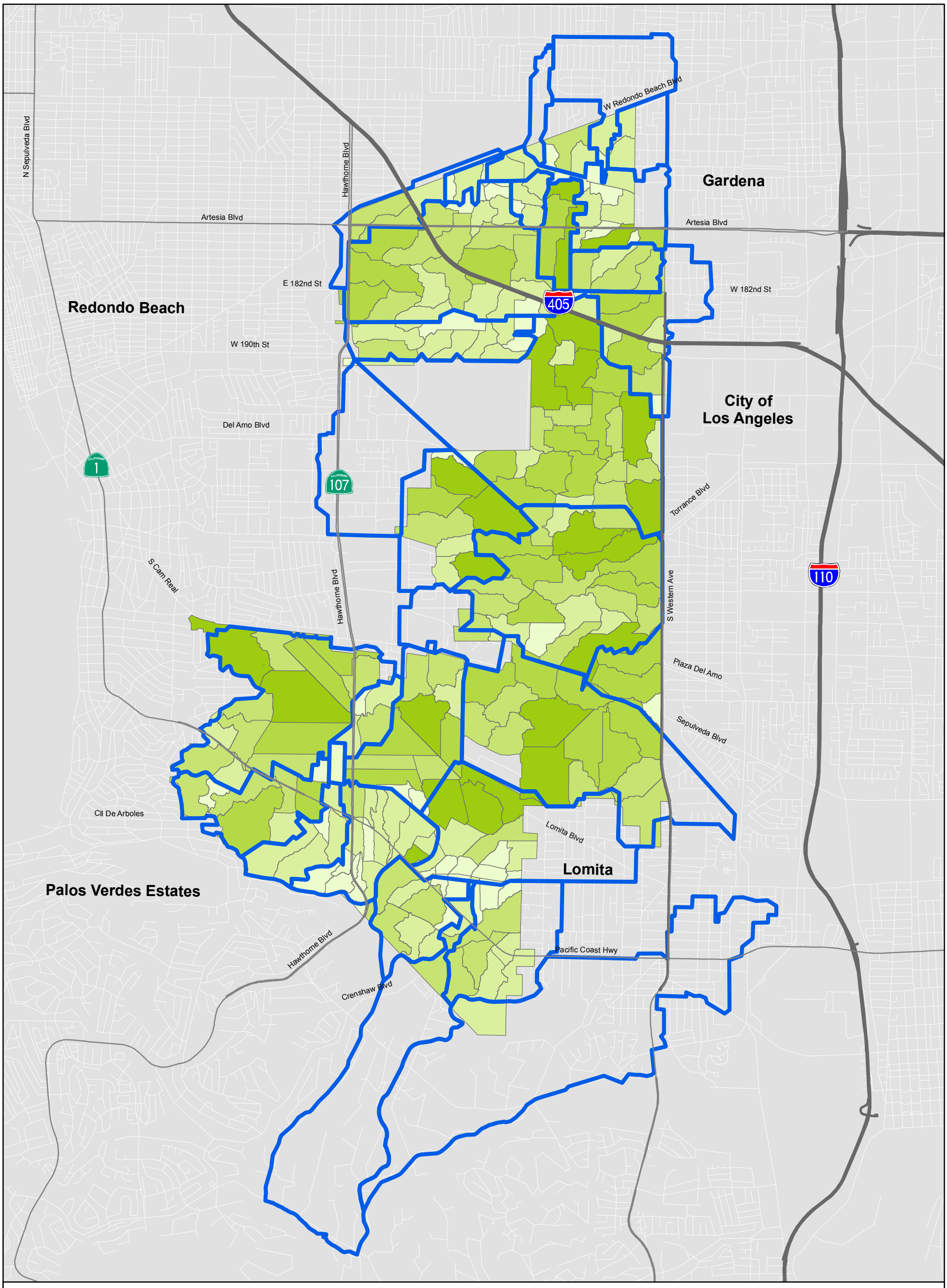

Figure D.8
Water Quality Calibration
City Model TN Load
Stormwater Quality Master Plan
City of Torrance

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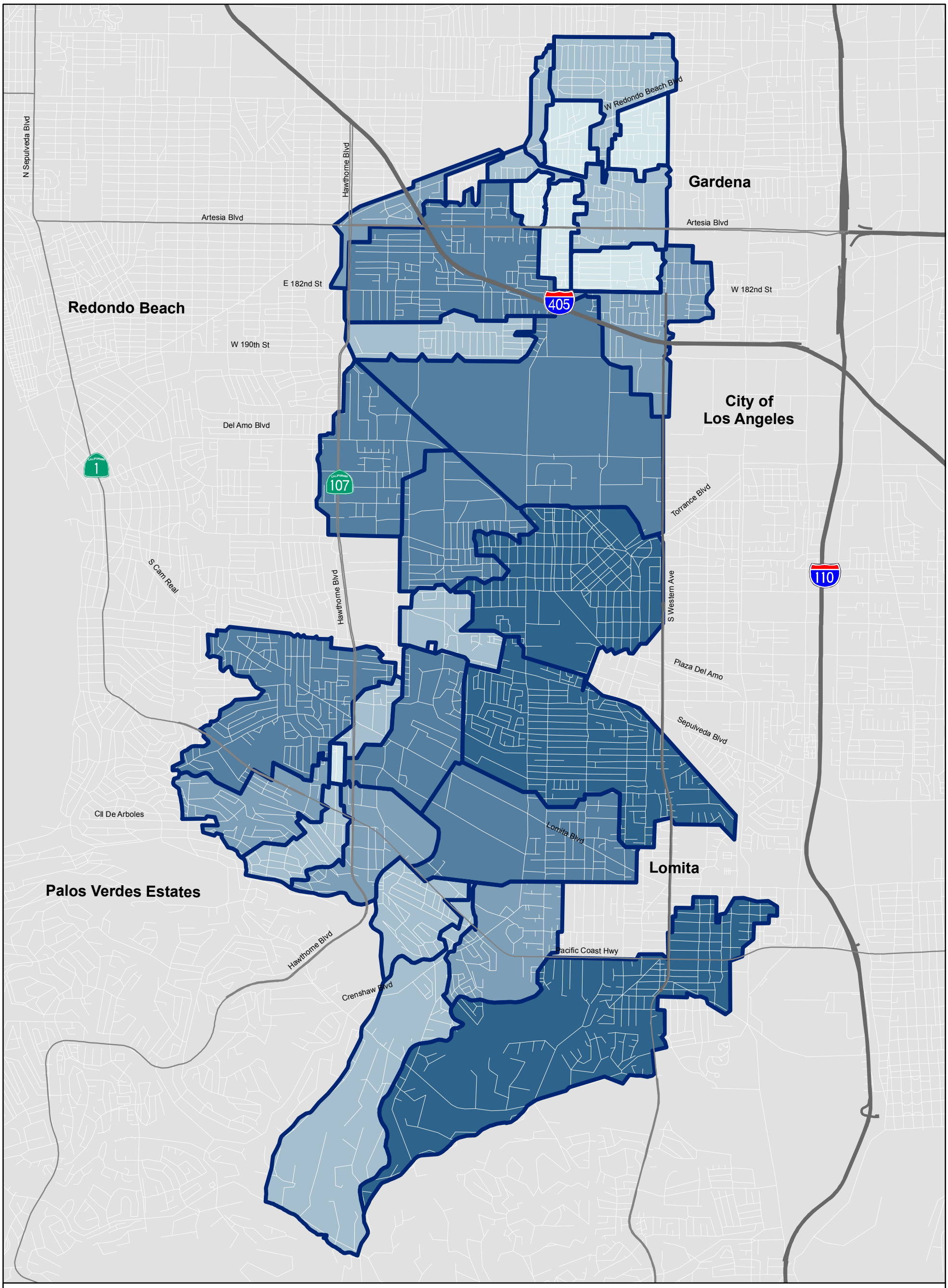

Predicted TSS Load by County Model (lb/yr)

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- >45000

- Freeway
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- Los Angeles County Model Subbasin Boundary

0 0.25 0.5 1 Miles

Figure D.9
Water Quality Calibration
Los Angeles County Model TSS Load
Stormwater Quality Master Plan
City of Torrance

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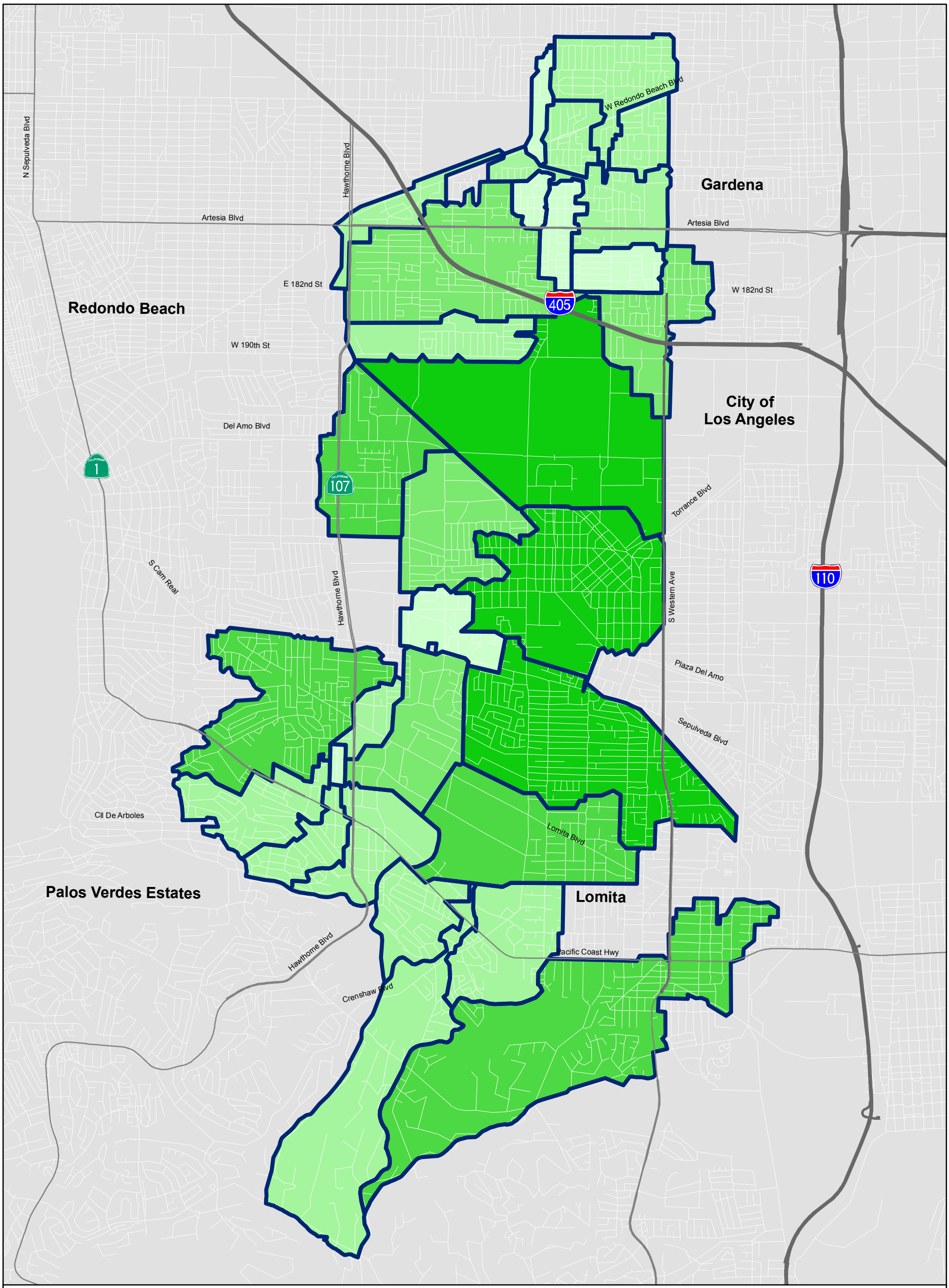

Figure D.10
Water Quality Calibration
Los Angeles County Model TP Load
Stormwater Quality Master Plan
City of Torrance

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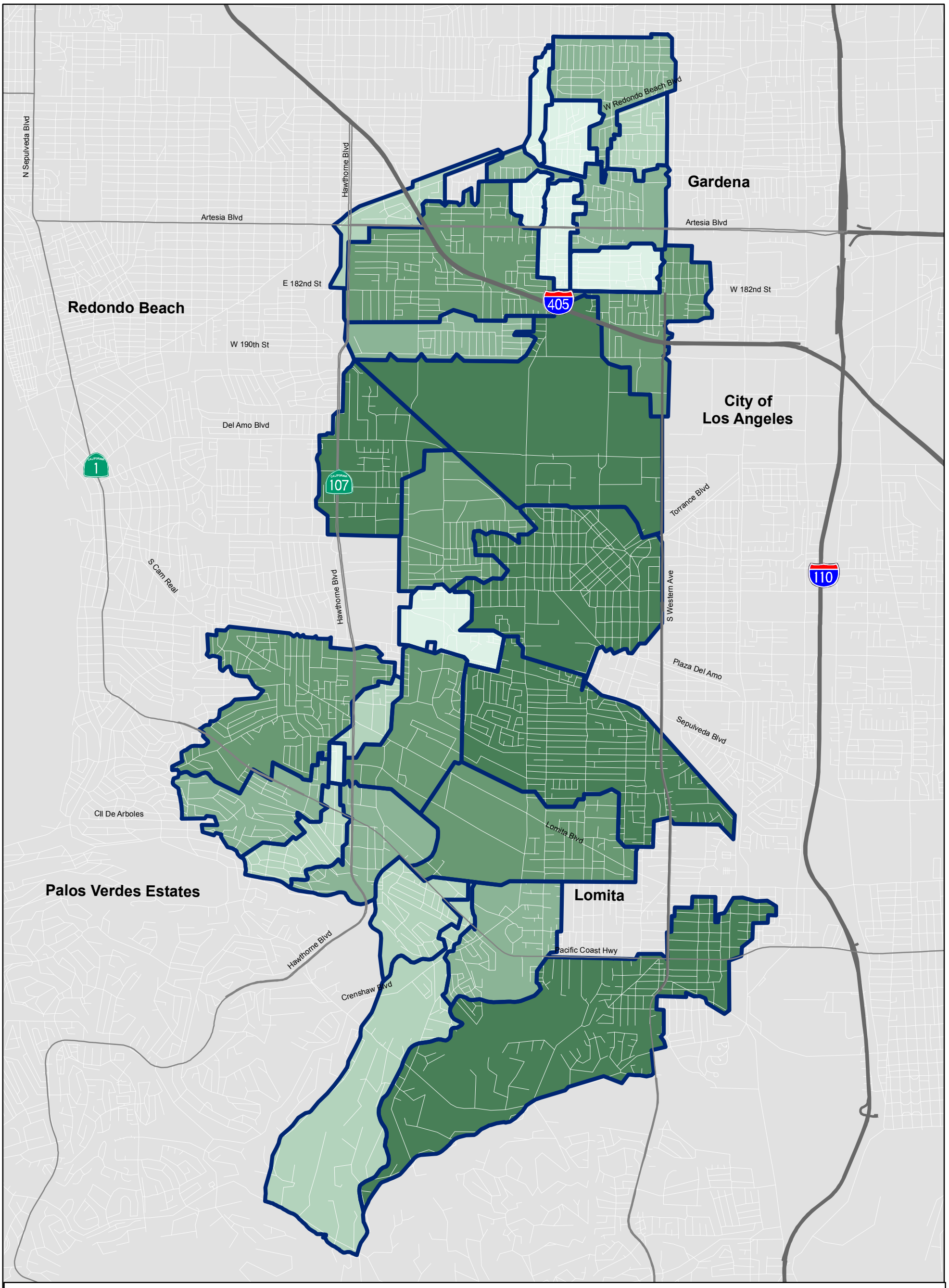

Predicted TN Load by County Model (lb/yr)

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- Freeway
- Major Roads
- Los Angeles County Model Subbasin Boundary

0 0.25 0.5 1 Miles

Figure D.11
Water Quality Calibration
Los Angeles County Model TN Load
Stormwater Quality Master Plan
City of Torrance

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Appendix E

MODEL DEVELOPMENT MAPS

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STREET DRAINAGE "HOT SPOTS"

AREAS WITH OBSERVED FLOODING

FREQUENTLY FLOODED AREAS WITH MINOR STORMS

MAJOR STORM FLOODED AREAS

CONTACT ENGINEERING DEPT. DRAINAGE TEAM AT 618-2820 TO INPUT INFORMATION REGARDING NEW "HOT SPOTS"

MAPPED BY:

GIS SECTION

TORRANCE COMMUNITY DEVELOPMENT GIS

COMMUNITY DEVELOPMENT DEPARTMENT

JEFFERY W. GIBSON

COMMUNITY DEPARTMENT DIRECTOR

Appendix G

Background Information on the LACFCD

This attachment provides background information pertaining to the Los Angeles County Flood Control District (LACFCD), and their involvement in the Beach Cities Enhanced Watershed Management Program (EWMP) Plan.

In 1915, the Los Angeles County Flood Control Act established the LACFCD and empowered it to manage flood risk and conserve stormwater for groundwater recharge. In coordination with the United States Army Corps of Engineers the LACFCD developed and constructed a comprehensive system that provides for the regulation and control of flood waters through the use of reservoirs and flood channels. The system also controls debris, collects surface storm water from streets, and replenishes groundwater with stormwater and imported and recycled waters. The LACFCD covers the 2,753 square-mile portion of Los Angeles County south of the east-west projection of Avenue S, excluding Catalina Island. It is a special district governed by the County of Los Angeles Board of Supervisors, and its functions are carried out by the Los Angeles County Department of Public Works. For the Beach Cities EWMP, the LACFCD service area is shown in Figure 1.

Unlike cities and counties, the LACFCD does not own or operate any municipal sanitary sewer systems, public streets, roads, or highways. The LACFCD operates and maintains storm drains and other appurtenant drainage infrastructure within its service area. The LACFCD has no planning, zoning, development permitting, or other land use authority within its service area. The Permittees that have such land use authority are responsible under the MS4 Permit for inspecting and controlling pollutants from industrial and commercial facilities, development projects, and development construction sites. (MS4 Permit, Part II.E, page 17.)

The MS4 Permit language clarifies the unique role of the LACFCD in storm water management programs: "[g]iven the LACFCD's limited land use authority, it is appropriate for the LACFCD to have a separate and uniquely-tailored storm water management program. Accordingly, the storm water management program minimum control measures imposed on the LACFCD in Part VI.D of this Order differ in some ways from the minimum control measures imposed on other Permittees. Namely, aside from its own properties and facilities, the LACFCD is not subject to the Industrial/Commercial Facilities Program, the Planning and Land Development Program, and the Development Construction Program. However, as a discharger of storm and non-storm water, the LACFCD remains subject to the Public Information and Participation Program and the Illicit Connections and Illicit Discharges Elimination Program. Further, as the owner and operator of certain properties, facilities and infrastructure, the LACFCD remains subject to requirements of a Public Agency Activities Program." (MS4 Permit, Part II.F, page 18).

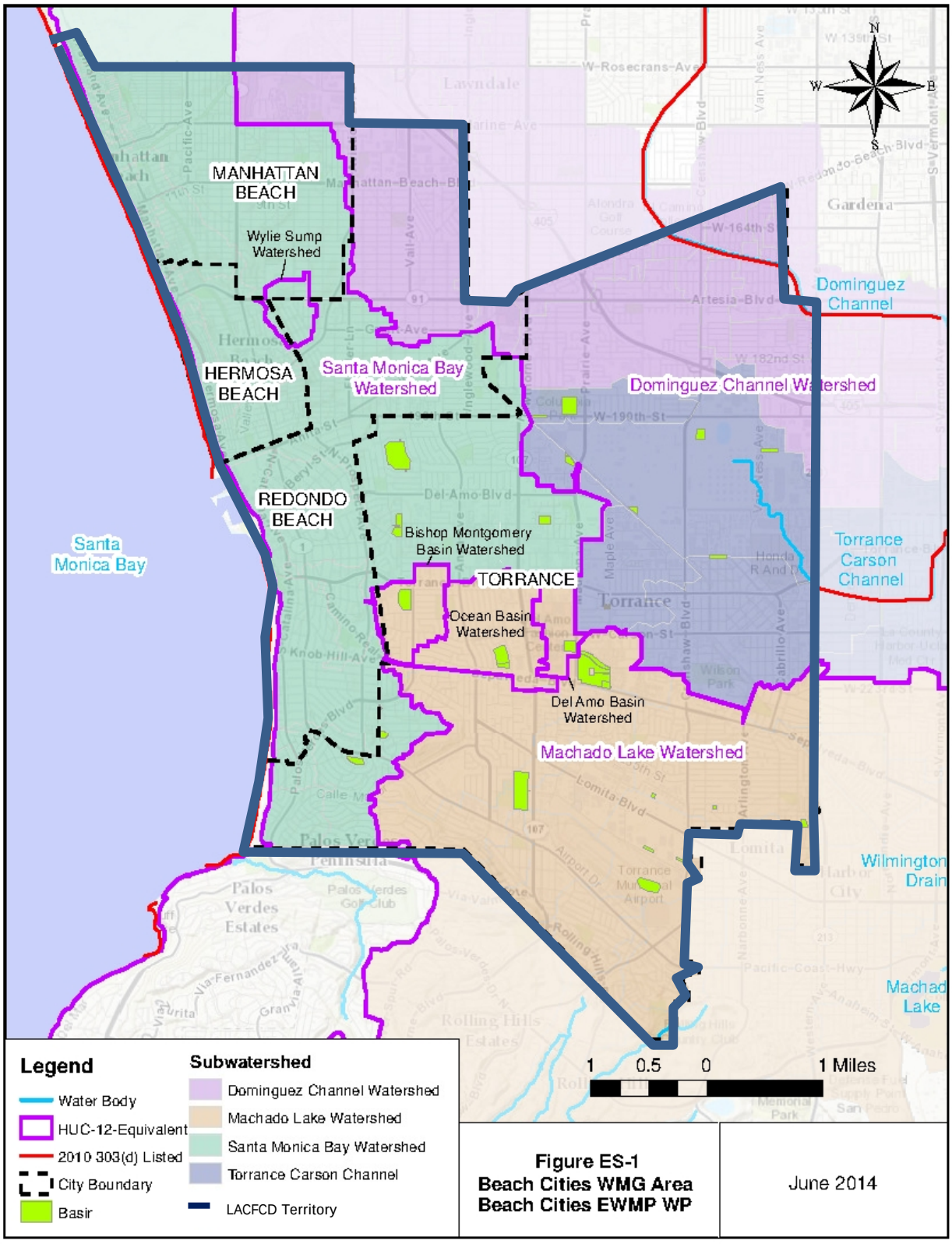
Consistent with the role and responsibilities of the LACFCD under the MS4 Permit, the EWMPs and Coordinated Integrated Monitoring Programs (CIMPs) reflect the opportunities that are available for the LACFCD to collaborate with Permittees having land use authority over the subject watershed area. In some instances, the opportunities are minimal, however the LACFCD remains responsible for compliance with certain aspects of the MS4 Permit as discussed above.

In some instances, in recognition of the increased efficiency of implementing certain programs regionally, the LACFCD has committed to responsibilities above and beyond its obligations under the 2012 MS4 Permit. For example, although under the 2012 MS4 Permit the Public Information and Participation Program (PIPP) is a responsibility of each Permittee, the LACFCD is committed to implementing certain regional elements of the PIPP on behalf of all Permittees at no cost to the Permittees. These regional elements include:

- Maintaining a countywide hotline (888-CLEAN-LA) and website (www.888cleanla.com) for public reporting and general stormwater management information at an estimated annual cost of $250,000. Each Permittee can utilize this hotline and website for public reporting within its jurisdiction.
- Broadcasting public service announcements and conducting regional advertising campaigns at an estimated annual cost of $750,000.
- Facilitating the dissemination of public education and activity specific stormwater pollution prevention materials at an estimated annual cost of $100,000.
- Maintaining a stormwater website at an estimated annual cost of $10,000.

The LACFCD will implement these elements on behalf of all Permittees starting July 2015 and through the MS4 Permit term. With the LACFCD handling these elements regionally, Permittees can better focus on implementing local or watershed-specific programs, including student education and community events, to fully satisfy the PIPP requirements of the 2012 MS4 Permit.

Similarly, although water quality monitoring is a responsibility of each Permittee under the 2012 MS4 Permit, the LACFCD is committed to implement certain regional elements of the monitoring program. Specifically, the LACFCD will continue to conduct monitoring at the seven existing mass emissions stations required under the previous Permit. The LACFCD will also participate in the Southern California Stormwater Monitoring Coalition's Regional Bioassessment Program on behalf of all Permittees. By taking on these additional responsibilities, the LACFCD wishes to increase the efficiency and effectiveness of these programs.


MANHATTAN BEACH
Wylie Sump Watershed
HERMOSA BEACH
Santa Monica Bay Watershed
REDONDO BEACH
Bishop Montgomery Basin Watershed
TORRANCE
Ocean Basin Watershed
Del Amo Basin Watershed
Dominguez Channel Watershed
Machado Lake Watershed
Santa Monica Bay
Dominguez Channel
Torrance Carson Channel
Wilmington Drain
Machado Lake
Gardena
Lawndale
Torrance
Palos Verdes Estates
Rolling Hills Estates
Lomita
Harbor City
W-Rosecrans-Ave
Artesia-Blvd
Del-Amo-Blvd
Lomita-Blvd
Pacific-Coast-Hwy
N
W
E
S
Legend
Water Body
HUC-12-Equivalent
2010 303(d) Listed
City Boundary
Basir
Subwatershed
Dominguez Channel Watershed
Machado Lake Watershed
Santa Monica Bay Watershed
Torrance Carson Channel
LACFCD Territory
1 0.5 0 1 Miles
Figure ES-1
Beach Cities WMG Area
Beach Cities EWMP WP
June 2014

Appendix H

Approach to Addressing Receiving Water Exceedances

APPROACH TO ADDRESSING RECEIVING WATER EXCEEDANCES

Sections VI.C.2 and VI.C.3 of the Permit describe how compliance with receiving water limits is attained for the various water body-pollutant combinations identified in a permittee's EWMP. Different actions are required for different types of receiving water limits. Specifically, the following classifications are addressed by the Permit:

- Water Body-Pollutant Combinations Addressed by a TMDL.
- 303(d)-listed Water Body-Pollutant Combinations: Pollutants in the same class as those identified in a TMDL and for which the water body is 303(d)-listed (Section VI.C.2.a.i), and pollutants not in the same class as those identified in a TMDL, but for which the water body is 303(d)-listed (Section VI.C.2.a.ii).
- Non 303(d)-listed Water Body-Pollutant Combinations: Pollutants for which there are exceedances of receiving water limitations, but for which the water body is not 303(d)-listed (Section VI.C.2.a.iii).

Figure H-1 illustrates this process.

Water Body-Pollutant Combinations Addressed by a TMDL

For water body-pollutant combinations addressed by a TMDL, adherence to all requirements and compliance dates as set forth in the approved EWMP will constitute compliance with applicable interim TMDL-based water quality based effluent limits and interim receiving water limits.

303(d)-listed Water Body-Pollutant Combinations

303(d)-listed water body-pollutant combinations are equivalent to the identified Category 2 combinations. Category 2 pollutants that will be addressed by the EWMP are limited to indicator bacteria in Dominguez Channel.[1] However, with the understanding that water body-pollutant combinations may be added to the Category 2 list based on future monitoring data, an approach to address both types of 303(d)-listed water body-pollutant combinations is provided below.

Pollutants in the same class as those identified in a TMDL

If in the future a water body within the Beach Cities EWMP Area is added to the State's 303(d) list and a direct linkage to MS4 discharges is shown, the requirements of Permit Section VI.C.2.a.i will apply to this water body-pollutant combination, and the following actions will be completed as part of the EWMP:

- Demonstrate that the BMPs selected to achieve the applicable TMDL provisions will also adequately address MS4 contributions of the pollutant(s) within the same class. Assumptions and requirements of the corresponding TMDL provisions must be applied to the additional pollutant(s), including interim and final requirements and deadlines for

[1] As detailed in this document, pollutants which have not been definitively tied to MS4 discharges are not included in the EWMP at this time, but will be evaluated as part of future monitoring under the CIMP.

their achievement, such that the MS4 discharges of the pollutant(s) will not cause or contribute to exceedances of receiving water limitations.
- Perform a RAA for this water body-pollutant combination.
- Identify milestones and dates for their achievement consistent with those in the applicable TMDL.

If outfall and receiving water monitoring under the CIMP indicate that such a listing is not linked to MS4 discharges, the Category 2 designation will be removed and further action for this water-body pollutant combination under the EWMP will cease.

Pollutants not in the same class as those identified in a TMDL

If in the future a water body within the Beach Cities EWMP Area is added to the State's 303(d) list and a direct linkage to MS4 discharges is shown, the requirements of Permit Section VI.C.2.a.ii will apply to this water body-pollutant combination. Currently, indicator bacteria in Dominguez Channel is the only 303(d)-listed pollutant that is not in the same class as any existing TMDL within the Dominguez Channel portion of the Beach Cities EWMP Area. Although the 303(d) source assessment only lists "point sources" and "nonpoint sources," and a definitive linkage to the Beach Cities has not been demonstrated, the MS4 system *may* cause or contribute to the bacteria impairment. Therefore, the following actions will be completed as part of the EWMP for indicator bacteria in Dominguez Channel, as well as in the future for any future applicable 303(d) listings:

- This water body-pollutant combination will be included in the RAA.
- If necessary, BMPs will be identified to address contributions of indicator bacteria from MS4 discharges to the receiving water, such that the MS4 discharges of bacteria will not cause or contribute to the exceedance of the receiving water limits.
- Enforceable milestones and dates for their achievement will be identified to control MS4 discharges such that they do not cause or contribute to exceedances of receiving water limitations within a timeframe that is as short as practicable, taking into account the technological, operational, and economic factors that affect the design, development, and implementation of the BMPs that are necessary. The time between dates will not exceed one year. Milestones will relate to a specific water quality endpoint (e.g., percent load reduction) and dates will relate either to taking a specific action or meeting a numeric water quality endpoint. If the identified dates are beyond the term of the Order, then Permit Section VI.C.2.a.ii(5) will apply.

If outfall and receiving water monitoring under the CIMP indicate that indicator bacteria is not an MS4-related pollutant, the Category 2 designation will be removed and further action for this water-body pollutant combination under the EWMP will cease.

Non 303(d)-listed Water Body-Pollutant Combinations

Permit Section C.2.a.iii discusses the requirements for pollutants for which there are exceedances of receiving water limitations, but for which the water body is *not* 303(d)-listed. As summarized previously, existing data indicate that cyanide, pH, selenium, mercury, and cadmium are all considered Category 3 pollutants for Dominguez Channel (including Torrance Lateral). However, at this time, due to an overall lack of data, these pollutants have not been definitively linked to MS4 discharges. As a result, these combinations (along with any potential future WBPCs) will

ultimately be identified based on data collected pursuant to the approved CIMP. If and when sufficient CIMP monitoring data suggest that MS4 discharges may[2] have caused or contributed, or have reasonable potential to cause or contribute, to the exceedance of receiving water limitations, then the EWMP will be modified as follows:

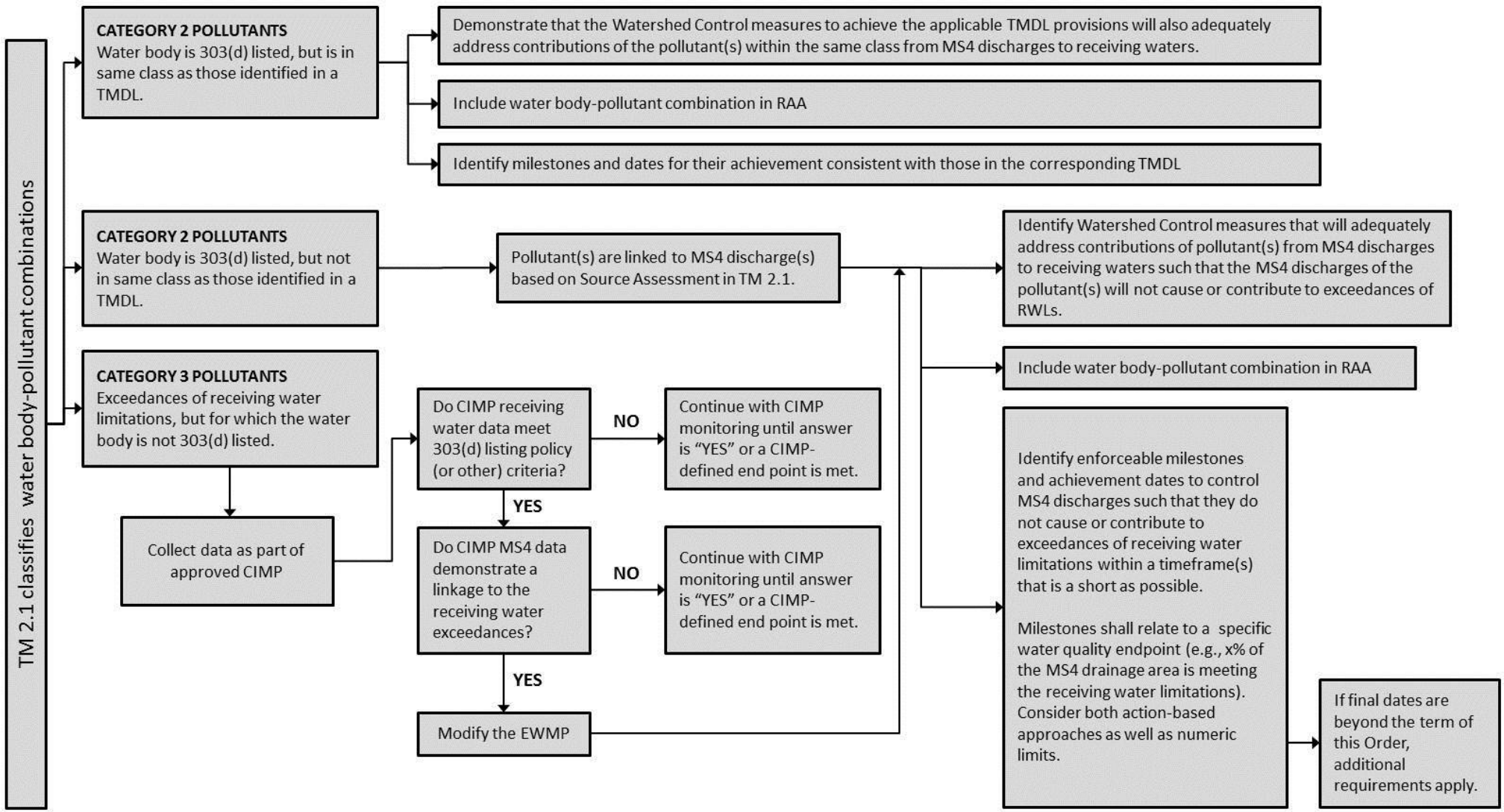
- BMPs will be identified to address contributions of the pollutant(s) from MS4 discharges to the receiving water(s), such that the MS4 discharges of the pollutant(s) will not cause or contribute to the exceedance of the receiving water limits.
- A RAA will be conducted for the water body-pollutant combination(s). In some instances this will require modeling of the identified pollutant.
- Enforceable milestones and dates for their achievement will be identified to control MS4 discharges such that they do not cause or contribute to exceedances of receiving water limitations within a timeframe(s) that is as short as practicable, taking into account the technological, operational, and economic factors that affect the design, development, and implementation of the BMPs that are necessary. The time between dates will not exceed one year. Milestones will relate to a specific water quality endpoint (e.g., percent load reduction) and dates will relate either to taking a specific action or meeting a milestone. If the identified dates are beyond the term of the Order, then Permit Section VI.C.2.a.iii(2)(d) will apply.

To evaluate if MS4 discharges may have caused or contributed to the exceedance of receiving water limitations, all of the following criteria will be applied:

- Receiving water samples exceed the applicable receiving water limitations at such frequency that they meet the listing criteria in Tables 3.1 and 3.2 in California's Water Control Policy (State Water Board, 2004);
- MS4 outfall samples (taken per the CIMP) exceed the applicable WQBELs or receiving water limits; and
- Data do not exist to demonstrate that the outfall exceedances were a result of other permitted discharges to the MS4 (e.g., permitted dewatering or groundwater treatment projects).

[2] Where CIMP monitoring data demonstrate that MS4 discharges may have caused or contributed to the exceedance of receiving water limitations, it should be noted that this does not constitute any admission of known contributions, but reflects uncertainty in linking datasets.

Figure H-1. Compliance with Receiving Water Limitations Not Otherwise Addressed by a TMDL



Appendix I

Land Use-Based Wet Weather Event Mean Concentrations

Table I-1. Proposed SBPAT EMCs for Beach Cities WMG Watersheds – Arithmetic Estimates of the Lognormal Summary Statistics (means with standard deviations in parentheses)[a]

Land Use	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	Diss Cu ug/L	Tot Cu ug/L	Tot Pb ug/L	Diss Zn ug/L	Tot Zn ug/L	Fecal Col. #/100mL
Single Family Residential	124.2 (184.9)	0.40 (0.30)	0.32 (0.21)	0.49 (0.64)	0.78 (1.77)	2.96 (2.74)	9.4 (9.0)	18.7 (13.4)	11.3 (16.6)	27.5 (56.2)	71.9 (62.4)	31,100[b] (94,200)
Commercial	67.0 (47.1)	0.40 (0.33)	0.29 (0.25)	1.21 (4.18)	0.55 (0.55)	3.44 (4.78)	12.3 (10.2)	31.4 (25.7)	12.4 (34.2)	153.4 (96.1)	237.1 (150.3)	51,600 (173,000)[c]
Industrial	219.2 (206.9)	0.39 (0.41)	0.26 (0.25)	0.6 (0.95)	0.87 (0.96)	2.87 (2.33)	15.2 (14.8)	34.5 (36.7)	16.4 (47.1)	422.1 (534.0)	537.4 (487.8)	3,760 (4,860)
Education (Municipal)	99.6 (122.7)	0.30 (0.17)	0.26 (0.2)	0.4 (0.99)	0.61 (0.67)	1.71 (1.13)	12.2 (11.0)	19.9 (13.6)	3.6 (4.9)	75.4 (52.3)	117.6 (83.1)	11,800[c] (23,700)
Transportation	77.8 (83.8)	0.68 (0.94)	0.56 (0.82)	0.37 (0.68)	0.74 (1.05)	1.84 (1.44)	32.40 (25.5)	52.2 (37.5)	9.2 (14.5)	222.0 (201.7)	292.9 (215.8)	1,680 (456)
Multi-Family Residential	39.9 (51.3)	0.23 (0.21)	0.20 (0.19)	0.50 (0.74)	1.51 (3.06)	1.80 (1.24)	7.40 (5.70)	12.1 (5.60)	4.5 (7.80)	77.5 (84.1)	125.1 (101.1)	11,800[d] (23,700)
Agriculture (row crop)	999.2 (648.2)	3.34 (1.53)	1.41 (1.04)	1.65 (1.67)	34.40 (116.30)	7.32 (3.44)	22.50 (17.50)	100.1 (74.8)	30.2 (34.3)	40.1 (49.1)	274.8 (147.3)	60,300 (153,000)
Vacant / Open Space	216.6 (1482.8)	0.12 (0.31)	0.09 (0.27)	0.11 (0.25)	1.17 (0.79)	0.96 (0.9)	0.60 (1.90)	10.6 (24.4)	3.0 (13.1)	28.1 (12.9)	26.3 (69.5)	484[e] (806)

[a] EMC statistics are calculated based on 1996-2000 data for Los Angeles County land use sites (Los Angeles County, 2000), except for agriculture which are based on Ventura County MS4 EMCs (Ventura County, 2003) and fecal coliform which are based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007b). These EMC datasets are summarized in the SBPAT User's Guide (Geosyntec, 2012).

[b] The fecal coliform EMC for the single-family residential land use is based on SCCWRP dataset for "low-density residential."

[c] The default log distribution best fit summary statistics for this land use-pollutant combination produced an unreasonably high deviation, therefore the arithmetic estimate of the log mean was held constant while the log summary statistics were recomputed based on the log CoV for SFR (SCCWRP's low-density residential EMC).

[c] Multi Family Residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

[d] The fecal coliform EMC for the multi-family residential land use is based on SCCWRP dataset for "high-density residential."

[e] Open space fecal coliform EMC statistics based on *E. coli* data (divided by 0.85 to adjust to fecal coliform) for Arroyo Sequit reference watershed, or 11 samples collected between December 2004 and April 2006. Data used by Regional Board for Santa Clara River Bacteria TMDL and taken from (SCCWRP, 2005) and (SCCWRP 2007a).

Appendix J

BMP Effluent Concentrations

Table J-1 summarizes the number of effluent data points (individual storm events) and percent non-detects for the pollutants and BMP types of interest for which sufficient data were available. A large percentage of non-detects can bias the effluent statistics derived from the dataset (e.g., total lead for bioretention shows a 60% non-detect ratio).

Table J-2 summarizes arithmetic averages and Table J-3 summarizes the arithmetic standard deviations of the BMP effluent concentrations that will be used in the RAA.

Consistent with IBD documentation (WWE and Geosyntec, 2007), BMP effluent concentrations are assumed to be limited by an "irreducible effluent concentration," or a minimum achievable concentration (Schuler, 1996). Lower limits are currently set at the 10th percentile effluent concentration of BMP data in the IBD for each modeled BMP type for which the BMP data show statistically significant reductions between influent and effluent means. If the differences are not statistically significant or there is a statistically significant increase, the 90th percentile is used as the minimum achievable effluent concentration, which essentially assumes no treatment except when influent to the BMP is very high. Table J-4 summarizes the irreducible effluent concentration estimates that are used in SBPAT to prevent treatment from occurring when influent concentrations are equal to or below these values.

Table J-1. Summary of Number of Data Points and Percent Non-Detects for BMP Effluent Concentration Data from the International BMP Database

BMP		TSS	TP	DP	NH3	NO3	TKN	DCu	TCu	TPb	DZn	TZn	FC
Bioretention	Count	193	249	164	184	259	201	NA	39	48	15	48	29
	%ND	10%	5%	4%	18%	3%	2%	NA	18%	60%	0%	35%	0%
Vegetated Swales (Bioswales)	Count	354	364	249	225	372	324	82	309	308	72	373	92
	%ND	1%	1%	0%	17%	1%	0%	4%	3%	39%	6%	23%	0%
Hydrodynamic Separators (not updated - original SBPAT analysis, 2008)	Count	199	170	58	69	59	77	89	99	95	99	174	31
	%ND	7%	3%	33%	28%	3%	5%	17%	0%	8%	18%	7%	3.2%
Media Filters	Count	409	403	244	215	391	374	186	361	341	221	433	185
	%ND	7%	6%	14%	24%	2%	6%	7%	12%	21%	19%	13%	0%
Detention Basins	Count	299	275	116	94	213	185	170	198	209	163	189	190
	%ND	1%	3%	16%	6%	7%	4%	32%	31%	50%	17%	15%	0%
Retention Ponds	Count	723	654	618	423	626	496	213	536	646	212	593	137
	%ND	4%	3%	6%	8%	6%	3%	26%	21%	30%	15%	7%	0%
Wetland Basins/Retention Ponds (combined)	Count	1028	932	862	681	872	680	228	684	767	227	770	158
	%ND	4%	3%	6%	7%	7%	2%	25%	20%	28%	14%	8%	0%

Table J-2 International BMP Database Arithmetic Mean Estimates of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu ug/L	TCu ug/L	TPb ug/L	DZn ug/L	TZn ug/L	FC #/100 mL
Constructed Wetland / Retention Pond (with Extended Detention)[1]	38.3	0.19	0.11	0.18	0.42	1.20	5.3	6.7	7.2	22.1	35.3	1.01E+04
Constructed Wetland / Retention Pond (without Extended Detention)[2]	32.9	0.17	0.09	0.17	0.38	1.20	5.3	6.2	12.0	22.6	38.0	9.89E+03
Dry Extended Detention Basin[3]	42.3	0.37	0.26	0.16	0.61	2.40	6.5	11.4	14.4	33.7	78.4	1.41E+04
Hydrodynamic Separator[4]	98.1	0.50	0.06	0.30	0.67	2.07	13.1	16.7	12.7	78.4	107.4	2.68E+04
Media Filter[5]	22.3	0.14	0.07	0.18	0.74	0.98	8.3	11.0	4.6	34.7	37.6	5.89E+03
Sub-surface Flow Wetland[6]	18.1	0.06	0.06	0.09	0.27	0.87	4.6	4.6	0.7	20.9	25.8	PR=90%
Treatment Plant[7]	2.0	0.00	0.00	0.00	0.27	0.01	1.0	1.0	4.4	5.0	5.0	2.00E+00
Vegetated Swale (Bioswale)[8]	27.1	0.28	0.17	0.09	0.43	0.87	9.6	10.1	6.4	33.3	33.3	8.00E+04
Bioretention[9]	18.1	0.14	0.07	0.18	0.37	0.98	8.3	8.8	4.2	34.7	37.6	5.89E+03
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

[1] Based on retention pond IBD category (basis per Geosyntec 2008)

[2] Based on combined wetland basin and retention pond IBD categories (basis per Geosyntec 2008)

[3] Strictly detention basin category from the IBD

[4] From Geosyntec, 2008

[5] Includes non-bio media filters (e.g., sand filters)

[6] Subsurface flow wetlands have not been extensively studied for stormwater treatment effectiveness and, though applied research exists, the International BMP database currently does not contain data with regard to their performance. As a result, the lowest effluent concentration of all IBD categories is used; except for Fecal Coliform, where 90% removal is used. The 90% removal is based on USEPA, 1993, which states that SSF wetlands are generally capable of a 1 to 2 log reduction in fecal coliforms.

[7] Secondary Drinking Water Standards or Minimum of all BMP types, whichever is less

[8] Strictly from vegetated swale category from the IBD

[9] Effluent quality assigned to treated underdrain discharge is based on the better performing characteristics of the "media filter" and "bioretention" categories for each pollutant.

Table J-3. International BMP Database Arithmetic Standard Deviations of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu ug/L	TCu ug/L	TPb ug/L	DZn ug/L	TZn ug/L	FC #/100 mL
Constructed Wetland / Wetpond (with Extended Detention)	76.80	0.253	0.357	0.234	0.787	0.688	4.288	9.710	12.96	42.46	61.96	3.23E+04
Constructed Wetland / Wetpond (without Extended Detention)	71.14	0.228	0.313	0.375	0.750	0.848	4.196	8.849	123.0	41.88	85.57	3.08E+04
Dry Extended Detention Basin	87.36	0.673	0.439	0.183	1.173	5.029	6.656	19.96	56.01	64.68	137.9	4.15E+04
Hydrodynamic Separator	236.5	1.237	0.093	0.880	1.198	3.737	11.98	11.98	25.70	137.4	137.4	2.16E+05
Media Filter	40.73	0.168	0.099	0.382	0.852	1.213	13.75	17.20	10.02	142.2	100.3	1.27E+04
Sub-surface Flow Wetland	30.66	0.145	0.088	0.145	0.552	0.594	3.504	3.504	1.845	12.84	17.16	5.37E+02
Treatment Plant	2.00	0.003	0.003	0.006	0.552	0.030	3.000	3.000	10.97	15.00	15.00	1.00E+00
Vegetated Swale (Bioswale)	35.12	0.311	0.239	0.145	0.905	0.872	7.749	9.429	15.36	28.49	34.86	1.19E+06
Bioretention	30.66	0.168	0.099	0.382	0.552	1.213	13.75	11.12	4.84	100.3	100.3	1.27E+04
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

Table J-4. International BMP Database Arithmetic Irreducible of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu ug/L	TCu ug/L	TPb ug/L	DZn ug/L	TZn ug/L	FC #/100 mL
Constructed Wetland / Wetpond (with Extended Detention)	1.358	0.034	0.010	0.019	0.011	0.499	1.387	1.387	0.429	1.000	2.933	4
Constructed Wetland / Wetpond (without Extended Detention)	1.300	0.030	0.009	0.012	0.010	0.520	1.267	1.267	0.400	1.075	3.000	5.4
Dry Extended Detention Basin	5.460	0.089	0.523	0.336	0.026	3.650	1.153	1.274	0.435	8.396	8.396	19.6
Hydrodynamic Separator	5.543	0.023	0.172	0.014	1.299	3.576	3.340	3.340	1.351	17.793	17.793	3295
Media Filter	1.487	0.026	0.010	0.013	0.064	0.210	0.995	1.298	0.372	1.000	2.000	13.1
Sub-surface Flow Wetland	1.268	0.025	0.006	0.009	0.008	0.141	1.000	1.000	0.089	1.000	2.933	4
Treatment Plant	0.500	0.001	0.001	0.001	0.008	0.001	0.100	0.100	0.255	0.500	0.500	1
Vegetated Swale (Bioswale)	2.000	0.079	0.040	0.009	0.056	0.141	2.708	2.708	0.434	5.720	5.720	9.53E+04
Bioretention	1.605	0.026	0.010	0.013	0.050	0.210	0.995	1.524	0.836	1.000	2.000	13.1
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

Appendix K

Sample TLR Calculations

Santa Monica Bay Watershed

Bacteria

To better illustrate the TLR calculation process, the following example scenario was developed for CML 5-02 for TMDL year 1995.

Steps 1-4: Calculate the exceedance frequency and allowable discharge days

The monitoring data in the receiving water of the analysis region draining to CML 5-02 was evaluated for exceedances of the TMDL FIB limits over all samples and only samples taken during days with precipitation greater than 0.1 inches. To determine the allowable discharge days for SMB-5-02, the 17 TMDL allowable exceedance days was divided by the exceedance frequency of samples taken during days with precipitation greater than 0.1 inches. The results of this analysis are shown in the table below.

Historical Exceedance Frequency (All events)	Historical Exceedance Frequency (Daily Rainfall > 0.10")	Allowable Discharge Days (Based on exceedance frequency with daily rainfall > 0.10")
50%	68%	25

Steps 5 - 6: Model the analysis region in SBPAT and size a retention BMP to only bypass during the allowable discharge days

The analysis region was modeled in SBPAT and resulted in 46 discharge days (i.e., midnight – midnight 24-hour periods where discharge occurred). To reduce the baseline 46 discharge days to the allowable 25 discharge days, the diversion flowrate to a hypothetical retention BMP was iteratively sized until these two numbers were equal. This process resulted in a retention BMP with a diversion flowrate of 54 cubic feet per second (cfs).

Steps 7: Model the hypothetical retention BMP and the baseline condition in SBPAT and compare the FC loads to determine the TLR

The baseline condition for the SMB-5-02 analysis region and the hypothetical retention BMP with a diversion flowrate of 54 cfs were modeled in SBPAT for the TMDL year 1995. The table below shows the results of this modeling.

Average MS4 Baseline FC Load (10^12 MPN)	Average FC Load assuming hypothetical retention BMP (10^12 MPN)	MS4 Baseline FC Load Reduced (10^12 MPN)	% MS4 Baseline FC Load Reduced
535	287	248	46%

Dominguez Channel Watershed

Bacteria

To better illustrate the bacteria TLR calculation process, the following provides a more detailed example of the calculations used for the Dominguez portion of for Beach Cities EWMP area in TMDL year 1995.

Steps 1-4: Calculate the exceedance frequency and allowable discharge days

A wet weather day is defined as a calendar day with precipitation greater than 0.1 inches, and the three days following such day. A high flow suspension (HFS) day is a day with greater than 0.5 inches of rain and the day following such a day. Because the allowable number of exceedance days is 10% of wet days, but high flow suspension days do not count as exceedances, the allowable number of exceedance days is calculated by multiplying the number of non-HFS wet weather days by 10%. The results of this analysis are shown in the table below.

Number of wet weather days in TMDL year 1995	Number of HFS days in TMDL year 1995	Number of non-HFS wet weather days in TMDL year 1995	Allowable Exceedance Days (Based on wet weather exceedance frequency of 10%)
73	19	54	5

Steps 5-6: Model the analysis region in SBPAT and size a retention BMP to only bypass during the allowable discharge days

The analysis region was modeled in SBPAT and resulted in 20 non-HFS discharge days (i.e., midnight – midnight 24-hour periods when discharge occurred), and the bacteria concentration in each one exceeded 4000 MPN/100mL. To reduce the baseline 20 non-HFS discharge days to the allowable 5 discharge days, the diversion flowrate to a hypothetical retention BMP was iteratively sized until 5 non-HFS discharge days occurred in the model. Note that discharges still occurred on HFS days, but these are not exceedances. This process resulted in a retention BMP with a diversion flow rate of 470 cubic feet per second (cfs).

Steps 7: Model the hypothetical retention BMP and the baseline condition in SBPAT and compare the FC loads to determine the TLR

The baseline condition analysis region and the hypothetical retention BMP with a diversion flow rate of 470 cfs were modeled in SBPAT for TMDL year 1995. The table below shows the results of this modeling.

Average baseline FC load (10^12 MPN)	Average FC load assuming hypothetical retention BMP (10^12 MPN)	Target Load Reduction (10^12 MPN)	Target Load Reduction (%)
1,523	721	802	53%

Metals - Copper

To better illustrate the metal TLR calculation process, the following example scenario was developed for the copper. The analysis was similar for all three metals.

Steps 1-2: Model the analysis region in SBPAT to estimate the baseline load

The analysis region was modeled in SBPAT from 11/1/2002 to 10/31/2012 to obtain daily flow, and loads for each wet day. Since SBPAT only includes wet weather flows, the days that SBPAT had any non-zero flow on were considered a wet day.

Steps 3: Find the 90th percentile load day and calculate allowable load

The 90th percentile load day was in that 10-year period was found and the load and volume on that day were recorded. The 90th percentile load day for copper was 11/30/2007. The allowable load was calculated by multiplying the WQBEL for copper (9.7 ug/L) by the runoff volume on that day. The runoff volume on 11/30/2007 was 301 acre feet.

Step 4: Compare the allowable load to the baseline load and compute TLR

The TLR is computed as the baseline load on the 90th percentile load day minus the allowable load. The table below shows the computation results:

Baseline Load (lb)	Allowable Load (lb)	Target Load Reduction (lb)	Target Load Reduction (%)
21.1	8.0	13.2	62%

Appendix L

MCM Customization Summary

Table L-1. Enhancements to MCMs

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
D.2 Progressive Enforcement (Applies D.6, D.7, D.8, and D.10)					
Develop and maintain a Progressive Enforcement Policy					Torrance Muni Code and City Charter Division 1 - Administration >> Chapter 1 - General provisions >> Article 2 - Penal Provisions and Division 1 - Administration >> Chapter 2 - Administration >> Article 3 - Environmental Quality Enforcement
Conduct follow-up inspection within 4 weeks of date of initial inspection					Yes
Take progressive enforcement					Any reported illicit discharges within the City will receive an incident number and the responsible party will receive a warning letter along with proper BMPs for the first offense. Second offense may receive a notice of violation and/or fines.
Retain records					Yes
Refer violations to LARWQCB					Yes
Investigate complaints from LARWQCB					Yes
Assist LARWQCB with Enforcement Actions					Yes
D.5 Public Information and Participation Program (PIPP)					
Participate in a Countywide PIPP, WMP PIPP, or individual PIPP that measurably increases knowledge and changes behavior, and involves a diversity of socio economic and ethnic communities					Attends quarterly Public Outreach Strategy meetings at LADPW or via webcast
Maintain reporting hotline					A resident or staff member can contact the City's Fire Prevention/NPDES Division who can provide general information, expedite the request by referring them to the appropriate department (i.e.: Fire if potentially hazardous illicit discharge, Public Works if a sewer overflow or to assist with clean-up of non-hazardous spill, or refer the caller to the countywide hotline, 888-CLEANLA).
Publish hotline info on web, telephone book					
ID staff/department that serve as the contact (publish this info)					

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Organize events (e.g., clean ups)		The Public Works Department coordinates and staffs an environmental booth at the 2013 two-day Hometown Fair and at the City's annual Earth Day festival. The community hosts the annual Coastal Cleanup Day event site at the Manhattan Beach Pier. The Roundhouse Aquarium co-sponsored the event, and coordinated approximately 300 volunteers.	Hosts annual Household Hazardous Waste Roundup, and annual compost giveaway events. The Public Works Department coordinates and staffs an environmental booth at the Public Safety Fair.	Hosts annual Household Hazardous Waste Roundup, and annual compost giveaway events. The City also hosts an annual Coastal Cleanup Day cleanup at Hermosa Pier.	Hosts Annual Environmental Fair, Hazardous Waste Roundups, Plastic Bag Exchange and Coastal Cleanup Day at Torrance Beach.
Residential Outreach (Individually or with group):	The Beach Cities promote and often host local Ocean Friendly Landscaping Workshops in cooperation with the South Bay Environmental Services Center (a non-profit center established by the South Bay Council of Governments), West Basin Municipal Water District and Surfrider Foundation.	The City has installed and maintains twenty-four (24) pet waste collection stations equipped with disposable bags for collecting and disposing of pet waste (Mutt Mitts®). These pet waste stations are located in municipal parks, along the Strand, and the linear greenbelt with a high frequency of use by residents with dogs. Three of the City's parks include off-leash dog runs equipped with pet waste stations. The City Newsletter is distributed quarterly to all residents in the City and is also available online--the newsletter provides environmental resource information and program updates to the community.	All City parks and the Esplanade are equipped with pet waste collection stations. The City Newsletter is distributed quarterly to residents in the City and is also available online--the newsletter provides various environmental resource information and program updates to the community.	All City parks and the linear greenbelt are equipped with pet waste collection stations and as well as along The Strand.	City Parks are equipped with pet waste collections stations. City participates in Ocean and Drought Friendly Landscaping Workshops. The City website provides environmental resource information and program updates to residents.
Public Service Announcements		Plastic bag ban effective in 2012. Ban on take-out/restaurant polystyrene food service ware became effective October 2013. Existing smoking ban was expanded/revised August 2014.	City has "Prohibition of smoking in beaches and recreational areas" Ordinance.	Ban on take-out/restaurant polystyrene food service ware became effective March 2013. Smoking Ban effective March 2012.	Smoking Ban effective 2012
(Develop) Public education materials on: vehicle fluids; household waste; construction waste; pesticides, fertilizers, and integrated pest management (IPM); green wastes; and animal wastes		Single and multi-family residents can participate in HHW collection as part of their base refuse rate (per household or unit), and receive unlimited scheduled pick-ups throughout the year at no additional charge. A free pharmaceutical drop off box is located in the Police/Fire lobby available for all residents to dispose controlled and uncontrolled pharmaceuticals. Battery recycling collection containers are located at 4 city facilities to provide residents with a convenient means for proper disposal of used batteries.		Project Pollution Prevention brochures on disposing of paint, oil, swimming pool chemicals and the like have been developed.	BMP brochures include automotive maintenance and car care, landscaping, roadwork and paving, general construction and brochures for proper disposal of paint & electrical items, cigarette waste, dog waste, oil, and pool chemicals have been developed and are made available at City outreach and environmental events and public counters.

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Distribute public education materials at points of purchase	Clean Bay Restaurant Program brochure distributed through participating restaurants to encourage public support for certified restaurants.		Project Pollution Prevention brochures are provided to residents and contractors at the public counter when they purchase permits.	Project Pollution Prevention brochures are provided to residents and contractors at the public counter when they purchase permits.	Clean Bay Restaurant Program brochure distributed through participating restaurants to encourage public support for certified restaurants. Pollution prevention brochures are made available at public counter for residents and contractors.
Maintain stormwater website	Jurisdictional Groups 5 & 6 as part of SMBBB TMDL Implementation established www.southbaystormwaterprogram.com	The City maintains an integrated environmental program "Going Green" web page that is accessible from the home page of the City's website. There, residents can stay abreast of local environmental initiatives and workshops (http://www.citymb.info/city-services/going-green). To specifically target measures to prevent runoff from residential properties, the City provides resources on Ocean-Friendly Gardens on its website: http://www.citymb.info/city-services/going-green/ocean-friendly-garden-sustainable-landscape, and continues to promote Sustainable Landscaping principles in its Green Code planning requirements for new projects or significant remodels. The Public Works Department frequently updates its webpage with environmental program information http://www.citymb.info/city-officials/public-works/environmental-programs and current issues of interest.		City has a Go Green Sustainability page on its website: http://www.hermosabch.org/index.aspx?page=332 Beach and Ocean Resources are featured on: http://www.hermosabch.org/index.aspx?page=477	City provides link to Jurisdictional 5 & 6 website, in addition to updates of environmental programs information and ocean/drought friendly landscaping workshops.
Provide schools with materials to educate children (K-12); can use state produced materials		Grades of Green program at Manhattan Beach elementary schools: http://www.gradesofgreen.org. The Roundhouse Marine Studies Lab and Aquarium located at the end of the Manhattan Beach Pier provides outreach to thousands of students through hands-on pollution and ocean awareness classes.		Grades of Green program at Hermosa Beach schools: http://www.gradesofgreen.org	The Stormwater Education Coordinator (Community Development), Waste Management Coordinator (Public Works) visit local schools to educate students at every age level regarding stormwater pollution prevention, recycling and conduct interactive, hands-on presentations and workshops. The students are also provided information and made aware of opportunities to volunteer or receive community service by attending a City sponsored cleanup event.
D.6 Industrial/ Commercial					

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Track Critical Sources - maintain inventory (watershed based or lat/long recorded)					Yes
Educate - notify critical sources of BMP requirements					Yes
Implement a Business Assistance Program for select sectors or small businesses - technical assistance, and distribute materials to specific sectors	Clean Bay Restaurant Program in partnership with Santa Monica Bay Restoration Commission	The City of Manhattan Beach and its franchise solid waste hauler successfully launched the Green Business Program to recognize businesses that incorporate sustainability into their daily business practices with the objective of reducing waste. The City's franchise solid waste hauler offers businesses free commercial waste audits to assess areas of improvement for the reduction of waste. Outreach to businesses continues via canvasing, program materials, flyers, FAQ, website updates, decals and press releases and green business audits. The City also offers a Green Business certification through the California Green Business Network for local businesses that meet certain criteria to reduce impacts on the environment. Businesses that participate in the City's program incorporate practices to reduce waste, save water, or reduce energy consumption. In 2014, eight (8) new businesses were added to the program.			Torrance distributes flyers, "Environmental Resources for Businesses and "Get Green" brochures to the local businesses. The Torrance Chamber of Commerce distributes the Clean Bay Certification program brochure to local restaurants and maintains a supply at their public counter, and features articles on ocean pollution prevention in their quarterly magazine. Clean Bay Restaurant Program in partnership with the Santa Monica Bay Restoration Commission.
Inspect Commercial Sources	Restaurants inspected annually instead of twice during 5-year permit. The food service establishments are inspected against a comprehensive 34-point storm water inspection checklist that requires 100% compliance in order for the facility to be awarded a Clean Bay Restaurant Certificate by the Santa Monica Bay Restoration Commission.				Commercial facilities including Nurseries, Automotive are inspected every other year instead of twice during 5-year permit. Food service establishments are inspected annually against a 26 point storm water inspection checklist that requires 100% compliance in order for the facility to be awarded a Clean Bay Restaurant Certificate by the Santa Monica Bay Restoration Commission.
Inspect Industrial Sources - Initial mandatory inspection		N/A -- No industrial facilities in Manhattan Beach		N/A -- No industrial facilities in Hermosa Beach	Industrial are inspected every other year instead of twice during 5-year permit.
Secondary mandatory inspection					Yes

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
No Exposure - evaluate and conduct 2nd inspection at 25% of facilities					
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)					Yes
D.7 Planning and Land Development					
Update ordinance/design standards to conform with new requirements (LID and Hydromod)				Hermosa LID ordinance requires all new development projects to implement LID, no minimum size threshold whereas MCM in permit has size threshold.	LID ordinance requires all new development projects to implement LID and Green Street Policy.
Optional: Establish alternative compliance for technical infeasibility, e.g., allow onsite biofiltration or offsite infiltration or gw replenishment or retrofit					
Optional if allowing offsite mitigation: Develop a prioritized list of offsite mitigation projects					
Optional if allowing offsite mitigation: Develop a schedule for completion of offsite projects (must be with 4 yrs of the Certificate of Occupancy of the first project that contributed funds)					
Optional if allowing offsite mitigation: Notice offsite projects to RB website					
Optional if allowing offsite mitigation: List of mitigation projects descriptions and estimated pollutant and flow reductions					
Optional if allowing offsite mitigation: Provide aggregated comparison of alternative compliance to results that would have been expected with on site retention of the SWQDv					
Optional: Submit documentation that a previously adopted LID ordinance provides equivalent pollutant loading and flow reduction					
Plan Review process - check LID and BMP sizing, etc.,			Any development in the Coastal Zone that requires a Coastal Development Permit is required to meet the LID standards.	Since 2010, the City has been requiring LID BMPs for residential projects through the plan review process.	City requires LID BMPs for development projects through the plan review process.
Establish internal agreements with structure for communication and authority for departments overseeing plan approval and project construction					
Require O&M plan for LID, treatment and hydromod BMPs					
Implement tracking and enforcement program for LID, treatment and hydromod BMPs					
Inspect all development sites upon completion and prior to occupancy certificates					
Verify O&M of BMPs operated by Permittee through inspection					
Develop maintenance inspection checklist					

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Require private parties that operate BMPs to submit verification of O&M; enforce as needed					
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)					
D.8 Development Construction Program					
Update erosion and sediment control ordinance/procedures to conform with new requirements				These requirements have been in place for years prior to adoption of the 2012 MS4 Permit: An Owner's Certification listing Minimum BMPs for All Construction Sites with signatures by Architect/Engineer of Record and Landowner are required for all building permits. Contractors are required to submit plans with appropriate construction BMPs identified. Standard notes incorporated into plans include provisions regarding Water Quality Requirements. Contractors are required to review the City's Storm Water Ordinance, guidelines for minimum construction BMPs and sign a statement acknowledging this and agreeing to comply with these rules and regulations. Projects disturbing one acre or more of soil must submit a Storm Water Pollution Prevention Plan (SWPPP) and obtain coverage under the statewide General Stormwater Permit for Construction Activities.	Projects disturbing one acre or more of soil must submit a Storm Water Pollution Prevention Plan (SWPPP) and obtain coverage under the statewide General Stormwater Permit for Construction Activities.
Sites < 1 acre; inspect based upon water quality threat				A building/grading site is inspected on average about 12 times and each time the inspector is on site, the condition of stormwater BMPs is noted by the inspector and, if necessary, corrections required.	
Establish priority inspection process					Inspection for compliance with construction BMPs are made in the course of every site visit during the construction. Building Inspectors thoroughly go through the site's BMP checklist at every inspection and spot checks are done before, during, and after storm events to ensure correct placement of erosion control measures where required.
Site < 1 acre; Require sites with soil disturbing activities to implement minimum BMPs					

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Require construction sites to prepare erosion sediment control plan(ESCP); review and approve (≥ 1 acre)					
Verify construction sites coverage under the CGP and 401 cert					
Develop/implement ESCP review checklist					
Require construction sites to adhere to standards and make standards readily available					
Conduct inspections at public and private sites (at least 1x/2 weeks for high threat sites (more frequently when rain is predicted or occurs; at least monthly for lower threat; also must inspect during all phases of construction - at least 3 times)					
Develop/implement SOPs/inspection checklist					
Track number of inspections for inventoried sites and verify minimum inspections are completed					
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)					
Train plan review staff and inspectors				City inspectors received CGP QSD/P training by a certified Trainer of Record, not simply "equivalent" training.	City Inspectors have or are required to get QSD/P training by a certified trainer.
Staff must be knowledgeable in QSD/P key objectives, local BMPs standards					
D.9 Public Agency Activities					
Require public construction sites to implement Planning and Land Development requirements, implement Erosion and Sediment Control BMPs, and obtain Construction General Permit coverage					The Building (Grading) and Development Review Divisions use a boilerplate during Plan Check and Construction design phase to make all developments aware of the BMP requirements
Maintain inventory of Permittee owned facilities (including parks and recreation faclities,)					Yes
Update inventory					Yes
Develop retrofit opportunity inventory; evaluate and rank		The City has retrofit 130,000 square feet of porous concrete paving on seven (7) municipal parking lots. The Manhattan Village Soccer Park is surfaced in synthetic turf which eliminates the need for fertilizer, pesticides or irrigation thereby reducing pollutant loads and nuisance flows from recreational areas. These playing surfaces are maintained via dry methods (vacuuming).			The Torrance Soccer Park is surfaced in synthetic turf which eliminates the need for fertilizer, pesticides or irrigation thereby reducing pollutant loads and nuisance flows from recreational areas. These playing surfaces are maintained via dry methods. The City is in the process of retrofitting all catch basins with automatic retractable grates which prevent trash from entering the stormwater system.

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Cooperate with private land owners to encourage site specific retrofitting; includes pilot projects and outreach					N/A
Obtain IGP coverage for public facilities where appropriate					N/A
Develop procedures to assess impact of flood mgt projects on water quality of receiving waters; evaluate to determine if retrofitting is feasible					N/A
Evaluate existing structural flood control facilities to determine if retrofitting facility to provide additional pollutant removal is feasible					N/A
Implement source control BMPs at Permittee owned facilities/activities					Yes
Require city-hired contractors to implement source control BMPs					Yes
Prevent vehicle/equipment washing discharges to the MS4, including fire fighting and emergency response vehicles					Departments receive targeted training in applying BMPs to prevent spills or runoff when washing vehicles and cleaning equipment. Fire Stations and City Facilities are equipped with clarifiers. The City Yard is equipped with an automated car washing system that is covered and contained.
Ensure new/redeveloped/replaced wash facilities are plumbed to the sanitary sewer or self contained.					Yes
Implement IPM program				Hermosa Beach has designated a pesticide free zone along the Valley Drive/Ardmore greenbelt and thus uses no pesticides in maintaining this swath of public recreational area which runs the length of the City.	Yes
Ordinances, policies, and procedures reflect IPM techniques and include commitments and schedules to reduce the use of pesticides that cause impairments					Non-pesticide remedies are considered and used prior to pesticide/fertilizer application.
Annually update in inventory of pesticides used by agency; quantify pesticides used by staff and contractors; demonstrate IPM alternatives to reduce pesticide use					Park Services maintains an inventory of pesticides, fertilizers, and chemicals used and is currently implementing greener, safer alternatives.

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Use SOPs for pesticide application					Public Works/Streetscape & Community Services/Parks Services protocol or "SOP" calls for impacted landscape maintenance personnel to: 1) Apply minimum amounts of each significant material 2) Avoid application during storm events or impending storm events 3) Use of pesticides and/or fertilizers allowed after inspection of area and/or plants.
Ensure no application of pesticides or fertilizers when two or more days with a 50% chance of rain is predicted by NOAA; within 48 hrs of 1/2 inch of rain; or when water is flowing off the site					Yes
Ensure staff applying pesticides are certified or working under supervision of a certified applicator in the appropriate category					Yes
Update catch basin map add GPS locations and update priority					Yes
Inspect/Clean catch basin in areas not subject to Trash TMDL- Priority A: 3x during wet season, 1x during dry 1x; Priority B: 1x during wet 1x and 1x during dry; Priority C: 1x per yr. Maintain records.				Only applies to Dominguez Channel areas and other areas prior to retrofit with trash excluders.	
Required trash management at public events				The City of Hermosa Beach has instituted a matrix of requirements for special events in the City. The requirements are phased in over three years and are tiered based on the size of the event. The requirements include measures to: 1) Reduce waste and single-use items, 2) Limit and reduce the size of handouts and flyers, 3) Control litter, contain wastes and prohibit hosing of surfaces 4) Increase recycling and solid waste diversion rates, and 5) Provide educational outreach to the public.	Provides both trash and recycling containers at City sponsored events, and provides educational outreach to the public to maximize recycling.
Place and maintain trash receptacles/capture devices at newly identified high trash generating areas		The City of Manhattan Beach maintains more than 450 trash receptacles in municipal parks and the public right-of-way. The City also maintains more than 125 additional receptacles for recyclable glass, plastic and aluminum beverage containers.	Redondo Beach maintains trash receptacles in public access areas throughout the City.	In addition to placement of refuse containers at transit stops and in parks, the City has placed over 100 recycling bins for beverage containers throughout the City, at all bus stops, in heavily-used pedestrian areas and parks.	In addition to placement of refuse containers at transit stops and in the parks, the City has placed recycling bins at bus stops and parks.

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Label storm drains					Inspects the legibility of the catch basin stencil or labels. Illegible stencils recorded and re-stenciled or re-labeled within 180 days of inspection
Inspect labels prior to each wet season					
Record and relabel illegible labels within 180 days of inspection					Yes
Post signs at access points to water bodies (open channels, creeks; lakes)					Yes
In areas not subject to the Trash TMDL, install trash excluders on catch basins or outfalls in areas defined as Priority A, or implement substantially equivalent BMPs		Ten (10) CDS® gross pollutant hydrodynamic separators have been installed on major storm drains within the City and has also installed approximately sixty (60) debris screens on catch basin openings that have historically required frequent cleaning (Priority A).	Redondo Beach has five CDS units in operation throughout the City removing trash and debris from entering the waterways.	Debris excluders are installed on 35 high priority catch basins owned by LACFCD within the City. The City has installed certified trash full capture exclusion devices on 14 City-owned catch basins in the City's commercial district along Hermosa Avenue and Pier Avenue--this was done years in advance of the Santa Monica Bay debris TMDL requirements.	Debris excluders are installed on high priority catch basins owned by LACFCD within the City--this was done years in advance of the Santa Monica Bay debris TMDL requirements.
Inspect and Remove trash and debris from open channels and other drainage structures 1x/yr before rainy season.					Yes
Eliminate discharge of contaminants during MS4 maintenance					Yes
Implement controls to limit infiltration of seepage from sanitary sewers to the storm drains					Yes
Implement routine preventative maintenance for both systems, survey sanitary sewer and MS4. May use SSO General WDR to fulfill this requirement.					Yes
Implement inspection and maintenance program for Permittee owned BMPs					Yes
Manage residual water in treatment control BMPs removed during maintenance					Yes
Street sweeping - Priority A: 2x/mo; B: 1x/mo; C: as needed, not less than 1x/yr		Streets are swept weekly and posted with no parking signs on street sweeping days.	Streets are swept weekly and posted with no parking signs on street sweeping days.	Streets are swept weekly and posted with no parking signs on street sweeping days--this exceeds the frequency even of Priority A areas in the permit for all areas in the City.	Streets are swept weekly and posted with no parking signs on street sweeping days.
Implement road construction maintenance BMPs (e.g., restrict paving activity to exclude periods of rain)					Yes

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Inspect and/or clean Permittee owned parking lots 2x/mo					Sweeping of City-owned parking lots twice a month. Trash receptacles in most City controlled public parking lots and at City sponsored events.
Train employees and contractors on stormwater requirements					All NPDES Municipal General Information Training is conducted in-house by the NPDES Analyst. In addition, NPDES training in trade specific and program specific areas is continuously conducted Citywide. Information to Training Resources is provided at these meetings. The Torrance Fire Department also conducts in-house training for staff regarding NPDES inspections, enforcement procedures and review of BMP's.
Train employees and contractors on pesticide use					Yes
D.10 Illicit Connections and Illicit Discharges Elimination					
Continue IC/ID program		Manhattan Beach adopted a strict water conservation ordinance that became effective July 2, 2009. The City of Manhattan Beach has also adopted the California Water Efficient Landscape ordinance applicable to new landscapes as well as CalGreen Code provisions for landscaping and irrigation.	Redondo Beach has a Landscape Regulations included in the Municipal Code, including water conservation.	Hermosa Beach adopted a Water Conservation and Drought Management Plan Ordinance and a Water Efficient Landscape Ordinance. The City enforces the water conservation ordinance as part of the Illicit Connections Illicit Discharge program.	The City is adopting a Water Conservation and Drought Management Program and has an ongoing Illicit Connections and Illicit Discharge Program.
Written procedures for conducting investigations and eliminations					Torrance Spill Procedure (Policy 10) and NPDES Ordinance posted on the City's website, detailing the progressive enforcement process.
Initiate investigation within 72 hours from becoming aware of the discharge					Fire Department is the first responder to spills, run-off and illicit discharges, and upon initial contact, responds to site within 15 minutes. Follow-up investigations are conducted within 48 hours.

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Implement solutions to eliminate discharge; conduct follow-up investigation to verify elimination; follow Progressive Enforcement Plan (see Part VI.D.2)		Three low flow diversions are operational within the City to eliminate dry weather discharge and divert to the sanitary sewer. The Greenbelt Infiltration Trench project utilizes the linear greenbelt parkland which runs through the City of Manhattan Beach (City) to intercept and infiltrate dry weather and wet weather low flows from 55 acres of existing residential development. Trash enclosures for new commercial facilities are required to be covered, enclosed and plumbed to the sanitary sewer.	A low flow diversion to a Filterra system with infiltration is operational at the Saphire stormdrain and a low flow and stormwater runoff diversion at the Alta Vista stormdrain is operational within the City, thereby eliminating polluted runoff from reaching our waterbodies.	Hermosa Strand Infiltration Trench diverts dry weather flows year-round from the 76-acre drainage area of the Pier Avenue Storm drain in the City's downtown commercial area. Pier Avenue Improvement Project is a "green" multi-benefit streetscape improvement which retrofits the City's main street to capture and treat stormwater/urban runoff in the downtown corridor (36-acre drainage area).The Public Works Department implements green street retrofits whenever the opportunity arises as part of capital improvement projects through installation of infiltration boxes within the public right-of-way along the curb-and-gutter. These infiltration boxes designed by the City's engineering staff intercept, filter, and infiltrate low flows prior to entry into catch basins.	The City has completed a Stormwater Basin Enhancement Project to maximize infiltration of dry weather and wet weather runoff and to reduce and biologically treat flows and pollutants to Santa Monica Bay.
When discharge originates upstream of jurisdiction, notify the upstream jurisdiction and LARWQCB within 30 days					
Initiate investigation within 21 days for illicit connection					
Permit or document illicit connection that only discharge stormwater or allowed non-stormwater					
Eliminate illicit connection within 180 days of investigation					
Facilitate public reporting via hotline					City of Torrance Community Development Department, 310-618-5990 City of Torrance Fire Prevention, 310- 618- 2973 during regular business hours, 24 hr contact Fire Dispatch for emergencies (911) (spills or discharges, complaints) at 310-781-7042. Complaints are entered into system and assigned case #.
Signage adjacent to open channels provide info re: public reporting					
Document calls and actions associated with hotline					Complaints are entered into system and assigned case # for staff follow up

2012 Permit Requirement	General Beach Cities MCM Enhancement (all agencies)	City-Specific MCM Enhancement			
		City of Manhattan Beach	City of Redondo Beach	City of Hermosa Beach	City of Torrance
Implement procedures on responding to complaints; evaluate and update procedures					**Fire/Hazardous Materials Division-** An incident number is assigned to every response. Staff can refer back to the incident number to track repeat illicit discharges.. The City's GIS system creates maps to document illicit discharges and spill locations. **CDD/PW-** illicit discharge or connection the information is recorded and maintained in a database. Each incident or case is given as tracking number and as enforcement actions are taken or inspections occur, the activity is documented in the system.
Implement a spill response plan					PW and Fire both maintain a spill prevention protocol to address illicit discharge control: "*Torrance Spill Policy & Procedure (Policy 10)".* The policy is posted on the City website.
Train staff and contractors on ID/IC					Annual training is provided to the respective departments and divisions that incorporates an ID/IC video and discussion. PW and Fire both maintain a spill prevention protocol to address illicit discharge control.
Create a list of positions and contractors that require ID/IC training					

Appendix M

LID Ordinances

ORDINANCE NO. _____

AN ORDINANCE RELATING TO LOW IMPACT DEVELOPMENT AND STORMWATER MANAGEMENT AND POLLUTION CONTROL AND AMENDING THE HERMOSA BEACH MUNICIPAL CODE AND REPEALING CONFLICTING OR REDUNDANT PROVISIONS OF THE GREEN BUILDING STANDARDS

The City Council of the City of Hermosa Beach does ordain as follows:

Section 1. Chapter 8.44 of Title 8 of the Hermosa Beach Municipal Code is amended in its entirety to read as follows:

Chapter 8.44
STORMWATER AND URBAN RUNOFF POLLLUTION CONTROL REGULATIONS

Sections:

8.44.010 Title
8.44.020 Findings
8.44.030 Purpose and Intent
8.44.040 Definitions
8.44.050 Construction and Application
8.44.060 Prohibited Activities
8.44.070 Exempted Discharges and Conditionally Exempted Discharges
8.44.080 Good Housekeeping Provisions
8.44.090 Requirements for Industrial/Commercial and Construction Activities
8.44.095 Low Impact Development Requirements for New Development and Redevelopment Projects
8.44.100 Inspection Authority
8.44.110 Violations of Storm Water and Dry Weather Runoff Pollution Control Regulations
8.44.120 No Taking

8.44.010 Title

This Chapter shall be known as the "City of Hermosa Beach Storm Water Management and Pollution Control Ordinance".

8.44.020 Findings

A. The Congress of the United States (hereinafter "Congress") has determined that pollutants contained in storm water and dry weather runoff are responsible for the environmental degradation of oceans, lakes, rivers, and other waters of the United States.

B. Congress, in 1987, amended the Clean Water Act of 1972 to reduce pollutants discharged into the waters of the United States by extending National Pollutant Discharge Elimination System (hereinafter "NPDES") requirements to regulate storm water and dry weather runoff discharge into municipal storm drain systems.

C. Storm water and dry weather runoff flows from individual properties onto streets, then through storm drains to coastal waters along the City of Hermosa Beach.

D. The City of Hermosa Beach is a co-permittee under the "Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating from the City of Long Beach MS4" (Order No. R4-2012-0175), NPDES Permit No. CAS004001, effective December 28, 2012, issued by the California Regional Water Quality Control Board - Los Angeles Region, which also serves as a NPDES permit under the Federal Clean Water Act. As a co-permittee, the City is required to maintain adequate legal authority within its respective jurisdiction to control pollutant discharges and to require the use of control measures to prevent or reduce the discharge of pollutants into the MS4 to achieve water quality standards.

E. In order to control, in a cost-effective manner, the quantity and quality of storm water and dry weather runoff to the maximum extent practicable, the adoption of reasonable regulations, as set forth herein, is essential.

F. It is the intent of this ordinance to simplify and streamline the Hermosa Beach municipal code with respect to stormwater low impact development provisions for new development and redevelopment projects by incorporating the substantive elements of the storm water provisions of Chapter 15.48 Green Building Standards of the Hermosa Beach Municipal Code into this Chapter.

G. The City of Hermosa Beach is small in geographic area, comprising 1.4 square miles. Accordingly, it is reasonable to simplify the determination of the storm water quality design volume for new development and redevelopment projects by adopting a single design storm depth applicable to all project sites within the city while meeting the intent of the Municipal NPDES Permit. The stormwater quality design volume is defined by the Municipal NPDES Permit as the greater of either the runoff from the 0.75 inch, 24-hour rain event or the 85th percentile, 24-hour storm as determined from the Los Angeles County 85th percentile precipitation isohyetal map. According to the referenced map, the largest 85th percentile, 24-hour rain event within the City of Hermosa Beach is approximately 0.77 inches. Thus to simplify regulatory requirements and streamline the project review process, the City of Hermosa Beach has determined to define the stormwater quality design volume as the runoff from the 0.8 inch, 24-hour rain event for all new development and redevelopment projects subject to low impact development requirements of Section 8.44.095 of this Chapter.

8.44.030 Purpose and Intent

A. The purpose of this Chapter is to comply with the Federal Clean Water Act, the California Porter-Cologne Water Quality Control Act, and the Municipal NPDES Permit where the City has jurisdictional authority by:

1. Reducing pollutants in storm water discharges to the maximum extent practicable;
2. Regulating illicit connections and illicit discharges and thereby reducing the level of contamination of storm water and dry weather runoff into the MS4; and
3. Regulating non-storm water discharges to the MS4.

B. This chapter is also intended to provide the City with the legal authority necessary to implement and enforce the requirements contained in 40 CFR § 122.26(d)(2)(i)(A-F) and in the Municipal NPDES Permit to the extent they are applicable in the City, to control discharges to and from

those portions of the MS4 over which it has jurisdiction as required by the Municipal NPDES Permit, and to hold dischargers to the MS4 accountable for their contributions of pollutants and flows.

C. This Chapter also sets forth requirements for the construction and operation of certain "commercial and industrial Facilities," "new development" and "redevelopment" projects, and other activities (as further defined herein), which are intended to ensure compliance with the storm water mitigation measures prescribed in the current version of the Municipal NPDES Permit, which is on file in the office of the City Clerk of this City. This Chapter authorizes the Authorized Enforcement Officer to define and adopt applicable Best Management Practices (BMPs) and other storm water pollution control measures, to grant emergency self-waivers from Municipal NPDES Permit requirements, as provided herein, to cite infractions, and to impose fines pursuant to this Chapter. Except as otherwise provided herein, an Authorized Enforcement Officer shall administer, implement, and enforce the provisions of this Chapter.

8.44. 040 Definitions

Except as specifically provided herein, any term used in this Chapter shall be defined as that term is defined in the current Municipal NPDES Permit, or if it is not specifically defined in the Municipal NPDES Permit, then as such term is defined in the Federal Clean Water Act, as amended, and/or the regulations promulgated thereunder. The following definitions apply to this Chapter only:

“Authorized Enforcement Officer" means the City Manager, Public Works Director, Community Development Director, Fire Chief or Police Chief, or the designees of those individuals.

"Automotive Service Facilities" means a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 5511, 7532-7534, or 7536-7539.

"Best Management Practices (BMPs)" means practices or physical devices or systems designed to prevent or reduce pollutant loading from storm water or non-storm water discharges to receiving waters, or designed to reduce the volume of storm water or non-storm water discharged to the receiving water. Examples of BMPs may include public education and outreach, proper planning of development projects, proper cleaning of catch basin inlets, and proper sludge or waste-handling and disposal, among others."

"City" means the City of Hermosa Beach.

"Commercial Development" means any development on private land that is not heavy industrial or residential. The category includes, but is not limited to: hospitals, laboratories and other medical facilities, government facilities, educational and religious institutions, recreational facilities, plant nurseries, multi-apartment buildings, car wash facilities, mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses and other light industrial complexes.

"Construction" means any construction or demolition activity, clearing, grading, grubbing, excavation, or any other activity that results in land disturbance. Construction does not include routine maintenance activities required to maintain the integrity of structures by performing minor repair and restoration work, original line and grade, hydraulic capacity, or original purpose of facility; emergency construction activities required to immediately protect public health and safety (including fire prevention); clearing and grubbing of vegetation for landscape maintenance which is not associated with a larger construction project; interior remodeling with no outside exposure of construction material or construction waste to storm water; mechanical permit work; or sign permit work. See “Routine Maintenance” definition below. Where clearing, grading, or excavating of underlying soil takes place during a repaving operation,

Construction General Permit coverage is required if one acre or more is disturbed or the activities are part of a larger plan of construction.

“Construction General Permit” means the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ (NPDES No. CAS000002), adopted September 2, 2009, and any successor permit to that permit.

"Control" means to minimize, reduce, eliminate, or prohibit by technological, legal, contractual or other means, the discharge of pollutants from an activity or activities.

"Development" means any construction, rehabilitation, redevelopment or reconstruction of any public or private residential project (whether single-family, multi-unit or planned unit development); industrial, commercial, retail and other non-residential projects, including public agency projects; or mass grading for future construction. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Directly Adjacent" means situated within 200 feet of the contiguous zone required for the continued maintenance, function, and structural stability of the environmentally sensitive area.

"Discharge" means when used without qualification the "discharge of a pollutant."

"Discharging Directly" means outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject property, development, subdivision, or industrial facility, and not commingled with the flows from adjacent lands.

"Discharge of a Pollutant" means any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source" or, any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. The term discharge includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

"Discretionary Project" is defined in the same manner as Section 15357 of the Guidelines For Implementation Of The California Environmental Quality Act contained in Title 14 of the California Code Of Regulations, as amended, and means a project which requires the exercise of judgment or deliberation when the City decides to approve or disapprove a particular activity, as distinguished from situations where the City merely has to determine whether there has been conformity with applicable statutes, ordinances, or regulations.

"Disturbed Area" means an area that is altered as a result of clearing, grading, and/or excavation.

"Dry Weather Runoff" means surface water flow produced by non-storm water resulting from residential, commercial, and industrial activities involving the use of potable and non-potable water.

"Environmentally Sensitive Area (ESA)” means an area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments (California Public Resources Code § 30107.5). Areas subject to storm water mitigation requirements are areas designated as Significant Ecological Areas by the Hermosa Beach Coastal Land Use Plan; an area designated as a Significant Natural Area by the California Department of Fish and Game's Significant Natural Areas Program, provided that area has been field verified by the Department of Fish and Game; an area listed in the Water Quality Control Plan - Los Angeles Region - Basin Plan for the Coastal Watersheds of Los

Angeles and Ventura Counties as supporting the Rare, Threatened, or Endangered Species (RARE) beneficial use; and an area identified by the City as environmentally sensitive.

"Good Housekeeping Practices" means common practices related to the storage, use, or cleanup of materials, performed in a manner that minimizes the discharge of pollutants. Examples include, but are not limited to, purchasing only the quantity of materials to be used at a given time, use of alternative and less environmentally harmful products, cleaning up spills and leaks, and storing materials in a manner that will contain any leaks or spills.

"Hillside" means property located in an area with known erosive soil conditions, where the development contemplates grading on any natural slope that is twenty-five percent or greater and where grading contemplates cut or fill slopes.

"Illicit Connection" means any human-made conveyance that is connected to the MS4 without a permit, excluding roof-drains and other similar type connections. Examples include channels, pipelines, conduits, inlets, or outlets that are connected directly to the storm drain system.

"Illicit Discharge" means any discharge into the MS4 or from the MS4 into a receiving water that is prohibited under local, state or federal statutes, ordinances, codes or regulations. The term illicit discharge includes all non-storm water discharge except authorized non-storm water discharges; conditionally exempt non-storm water discharges; and non-storm water discharges resulting from natural flows specifically identified in the Municipal NPDES Permit.

"Infiltration" means the downward entry of water into the surface of the soil.

"Inspection" means the entry and conducting of an on-site review of a facility and its operations, at reasonable times, to determine compliance with specific municipal or other legal requirements. The steps involved in performing an inspection, include, but are not limited to:

1) Pre-inspection documentation research;
2) Request for entry;
3) Interview of facility personnel;
4) Facility walk-through;
5) Visual observation of the condition of facility premises;
6) Examination and copying of records as required;
7) Sample collection (if necessary or required);
8) Exit conference (to discuss preliminary evaluation); and,
9) Report preparation, and if appropriate, recommendations for coming into compliance.

“Low Impact Development (LID)” means building or landscape features designed to retain or filter storm water runoff.

"Municipal NPDES Permit" means the "Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating from the City of Long Beach MS4" (Order No. R4-2012-0175), NPDES Permit No. CAS004001, effective December 28, 2012, issued by the California Regional Water Quality Control Board - Los Angeles Region, and any successor permit to that permit.

"Municipal Separate Storm Sewer System" or "MS4" means a conveyance or system of conveyances (consisting of roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

1) Owned or operated by a state, city, town borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the Clean Water Act that discharges to waters of the United States;

2) Designed or used for collecting or conveying storm water;

3) Which is not a combined sewer; and

4) Which is not part of a Publicly Owned Treatment Works (POTW) as defined in 40 Code of Federal Regulations122.2.

"New Development" means land disturbing activities; structural development, including construction or installation of a building or structure, demolition of existing development and construction of a new building or structure, creation of impervious surfaces; and land subdivision.

"Non-Storm Water Discharge" means any discharge to an MS4 or from the MS4 into a receiving water that is not composed entirely of storm water.

"NPDES permit" means any waste discharge requirements issued by the California Regional Water Quality Control Board - Los Angeles Region or the State Water Resources Control Board as an NPDES permit pursuant to California Water Code Section 13370 (other than the Municipal NPDES Permit).

"Parking Lot" means land area or a facility for the temporary parking or storage of motor vehicles used for business, for industry, for commerce, for government, for nonprofit enterprises or for personal use, with a parking lot size of five thousand (5,000) square feet or more, or with twenty-five (25) or more parking spaces.

"Pollutant" means those "pollutants" defined in Section 502(6) of the federal Clean Water Act (33 U.S.C. §1362(6)), or incorporated into California Water Code Section 13373. Examples of pollutants include, but are not limited to the following:

1) Commercial and industrial waste (such as fuels, solvents, detergents, plastic pellets, hazardous or toxic substances, fertilizers, pesticides, slag, ash, and sludge);

2) Metals such as cadmium, lead, zinc, copper, silver, nickel, chromium; and non-metals such as phosphorus and arsenic;

3) Petroleum hydrocarbons (such as fuels, lubricants, surfactants, waste oils, solvents, coolants and grease);

4) Excessive eroded soils, sediment and particulate materials in amounts which may adversely affect the beneficial use of the receiving waters, flora or fauna of the State;

5) Animal wastes (such as discharge from confinement facilities, kennels, pens, recreational facilities,);

6) Substances having characteristics such as pH less than 6 or greater than 9, or unusual coloration or turbidity, or excessive levels of fecal coliform, or fecal streptococcus, or enterococcus;

"Project" means all development, redevelopment, and land disturbing activities.

"Redevelopment" means the creation, addition, or replacement of impervious surfaces on an already developed site. Redevelopment includes, but is not limited to, the following activities that meet the minimum standards set forth in this definition: (1) the expansion of a building footprint, an addition, or replacement of a structure; (2) development of a structure, including an increase in impervious area (3) replacement of impervious surface that is not part of a routine maintenance activity; and (4) land disturbing activities related to structural or impervious surfaces. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of facility or emergency redevelopment activity required to protect public health safety.

"Regional Board" means the California Regional Water Quality Control Board-Los Angeles Region.

"Restaurant" means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption. (SIC code 5812 Establishments primarily engaged in the retail sale of prepared food and drinks for on-premise or immediate consumption. Caterers and industrial and institutional food service establishments are also included in this industry.).

"Retail Gasoline Outlet" means any facility engaged in selling gasoline and lubricating oils.

“Routine Maintenance” includes, but is not limited to, projects conducted to:

1) Maintain the original line and grade, hydraulic capacity, or original purpose of the facility;

2) Perform as needed restoration work to preserve the original design grade, integrity and hydraulic capacity of flood control facilities;

3) Includes road shoulder work, regrading dirt or gravel roadways and shoulders and performing ditch cleanouts;

4) Update existing lines (including replacing existing lines with new materials or pipes) and facilities to comply with applicable codes, standards, and regulations regardless if such projects result in increased capacity; and

5) Repair leaks.

Routine maintenance does not include construction of new lines or facilities resulting from compliance with applicable codes, standards and regulations. New lines are those that are not associated with existing facilities and are not part of a project to update or replace existing lines.

"Runoff" means any runoff including storm water and dry weather flows from a drainage area that reaches a receiving water body or subsurface. During dry weather it is typically comprised of base flow either contaminated with pollutants or uncontaminated, and nuisance flows.

“Significant Ecological Area” (SEA) means an area that is determined to possess an example of biotic resources that cumulatively represent biological diversity, for the purposes of protecting biotic diversity, as part of the Hermosa Beach Coastal Land Use Plan. Areas are designated as SEAs, if they possess one or more of the following criteria:

1) The habitat of rare, endangered, and threatened plant and animal species;

2) Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind, or are restricted in distribution on a regional basis;

3) Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind or are restricted in distribution in Los Angeles County;

4) Habitat that at some point in the life cycle of a species or group of species, serves as a concentrated breeding, feeding, resting, migrating grounds and is limited in availability either regionally or within Los Angeles County;

5) Biotic resources that are of scientific interest because they are either an extreme in physical/ geographical limitations, or represent an unusual variation in a population or community;

6) Areas important as game species habitat or as fisheries;

7) Areas that would provide for the preservation of relatively undisturbed examples of natural biotic communities in Los Angeles County; and

8) Sensitive coastal resource areas defined in California Public Resources Code Section 30116 as: “[s]pecial marine and land habitat areas, wetlands, lagoons, and estuaries as mapped and designated in Part 4 of the coastal plan.”

“Simple LID BMP” means a BMP constructed above ground on a single-family residential home that can be readily inspected by a homeowner or inspector. Simple LID BMPs do not require an operation and maintenance plan per the Municipal NPDES Permit. Examples of such BMPs include, but are not limited to, vegetated swales, rain barrels and above ground cisterns, rain gardens, and pervious pavement.

"Site" means the land or water area where any "facility or activity" is physically located or conducted, including adjacent land used in connection with the facility or activity.

"Source Control BMP" means any schedule of activities, prohibition of practices, maintenance procedures, managerial practices or operational practices that aim to prevent storm water pollution by reducing the potential for contamination at the source of pollution.

"Storm event" means a rainfall event that produces more than 0.1 inch of precipitation in 24 hours unless specifically stated otherwise.

"Storm water" means storm water runoff and surface runoff and drainage related to precipitation events (pursuant to 40 Code of Federal Regulations § 122.26(b)(13); 55 Federal Register 47990, 47996 (Nov. 16, 1990)).

"Storm Water Runoff" means that part of precipitation (rainfall or snowmelt) which travels via flow across a surface to the MS4 or receiving waters from impervious, semi-pervious or pervious surfaces. When all other factors are equal, runoff increases as the perviousness of a surface decreases.

"Structural BMP" means any structural facility designed and constructed to mitigate the adverse impacts of storm water and dry weather runoff pollution (e.g. canopy, structural enclosure). Structural BMPs may include both Treatment Control BMPs and Source Control BMPs.

"Treatment" means the application of engineered systems that use physical, chemical, or biological processes to remove pollutants. Such processes include, but are not limited to, filtration, gravity settling, media adsorption, biodegradation, biological uptake, chemical oxidation and UV radiation.

"Treatment Control BMP" means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media absorption or any other physical, biological, or chemical process.

8.44.050 Construction and Application

This Chapter shall be construed to assure consistency with the requirements of the federal Clean Water Act and the California Porter-Cologne Water Quality Control Act, and acts amendatory thereof or supplementary thereto, applicable implementing regulations, and the Municipal NPDES Permit, and any amendment, revision or reissuance thereof.

8.44.060 Prohibited Activities

A. Illicit Discharges and Connections. It is prohibited to establish, use, maintain, or continue illicit connections to the MS4, or to commence or continue any illicit discharges to the MS4. This prohibition against illicit connections is expressly retroactive and applies to connections made in the past but excludes permitted improvements to real property over which uncontaminated storm water runoff flows.

B. Littering. It is prohibited to throw, deposit, place, leave, maintain, keep, or permit to be thrown, deposited, placed, left, or maintained or kept, any refuse, rubbish, garbage, or any other discarded or abandoned objects, articles or accumulations, in or upon any street, alley, sidewalk, walk street, driveway, storm drain, inlet, catch basin conduit or drainage structure, business place, or upon any private plot of land in the City, so that the same might be or become a pollutant or be discharged to or through the MS4. No person shall throw or deposit litter in any fountain, pond, lake, stream, or other body of water within the City. This subsection shall not apply to refuse, rubbish, garbage or recyclables deposited in containers, bags, or other appropriate receptacles which are placed in designated locations for regular solid waste pick up and disposal.

C. Disposal of Landscape Debris. It is prohibited to intentionally dispose of leaves, dirt, or other landscape debris into the MS4.

D. Non-Storm Water Discharges. All non-storm water discharges into the MS4 are prohibited unless those flows are: in compliance with a separate NPDES permit; pursuant to a discharge exemption by the Regional Board, the Regional Board's Executive Officer, or the State Water Resources Control Board; associated with emergency firefighting activities (i.e., flows necessary for the protection of life or property); natural flows as defined in the Municipal NPDES Permit; conditionally exempt non-storm water discharges as defined in accordance with the Municipal NPDES Permit; or authorized as a temporary non-storm water discharge by U.S. Environmental Protection Agency (USEPA) pursuant to Sections 104(a) or 104(b) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Prohibited discharges include, but are not limited to:

   1. The discharge of wash waters to the MS4 when gas stations, auto repair garages, or other type of automotive service facilities (including those located at automotive dealerships) are cleaned;

   2. The discharge of wastewater to the MS4 from mobile auto washing, steam cleaning, mobile carpet cleaning, and other such mobile commercial and industrial operations;

   3. Discharges to the MS4 from areas where repair of machinery and equipment, including motor vehicles, which are visibly leaking oil, fluid or antifreeze, is undertaken;

4. Discharges of runoff to the MS4 from storage areas of materials containing grease, oil, or other hazardous substances (e.g. motor vehicle parts), and uncovered receptacles containing hazardous materials;
5. The discharge of chlorinated/brominated swimming pool water and filter backwash or swimming pool water discharges that contain any detergents, wastes, or algaecides, or any other chemicals including salts from pools commonly referred to as “salt water pools” in excess of applicable water quality objectives;
6. Discharges of runoff from the washing of toxic materials from paved or unpaved areas to the MS4;
7. Discharges to the MS4 from washing impervious surfaces in industrial/commercial areas which results in a discharge of runoff to the MS4, unless specifically required by the State's, or the City's, or Los Angeles County's health and safety codes and conducted utilizing BMPs specified in the Municipal NPDES Permit, or permitted under a separate NPDES permit;
8. Discharges from the washing out of concrete trucks, pumps, tools, and equipment into the MS4;
9. Discharges to the MS4 of any pesticide, fungicide, or herbicide, banned by the USEPA or the California Department of Pesticide Regulation;
10. The disposal of hazardous wastes into trash or recycling containers used for municipal solid waste disposal, or placed for removal by municipal solid waste disposal or permitted collector, where such disposal causes or threatens to cause a direct or indirect discharge to the MS4;
11. Discharge of any food or food processing wastes; and
12. Discharge of any fuel and chemical wastes, animal wastes, garbage, batteries, and other materials that have potential adverse impacts on water quality.

E. Discharges in Violation of the Municipal NPDES Permit. Any discharge that would result in or contribute to a violation of the Municipal NPDES Permit, either separately or in combination with other discharges, is prohibited. Liability for any such discharge shall be the responsibility of the person(s) causing or responsible for the discharge, and such person(s) shall defend, indemnify, and hold harmless the City from all losses, liabilities, claims, or causes of actions in any administrative or judicial action relating to such discharge.

F. Industrial Activities. No person shall conduct any industrial activity in the City without obtaining all permits required by state or federal law, including a NPDES general industrial activity storm water permit when required. Persons conducting industrial activities within the City shall refer to the most recent edition of the Industrial/Commercial Stormwater Best Management Practices Handbook, produced and published by the California Stormwater Quality Association, for specific guidance on selecting BMPs for reducing pollutants in storm water discharges from industrial activities.

8.44.070 Exempted Discharges and Conditionally Exempted Discharges

Discharges from those activities specifically identified in, or pursuant to the Municipal NPDES Permit as being Exempted Discharges or Conditionally Exempted Discharges shall not be considered a violation of this Chapter, provided that any applicable BMPs developed pursuant to the Municipal NPDES Permit are implemented to minimize any adverse impacts from such identified sources and that required conditions outlined in the Municipal NPDES Permit are met prior to discharge.

8.44.080 Good Housekeeping Provisions

Owners and occupants of property within the City shall implement Best Management Practices to prevent or reduce the discharge of pollutants to the MS4 to the maximum extent practicable. Treatment and structural BMPs shall be properly operated and maintained to prevent the breeding of vectors. Implementation includes, but is not limited to:

A. Septic Waste. No person shall leave, deposit, discharge, dump, or otherwise expose or create the potential to expose any chemical or septic waste to precipitation.

B. Use of Water. Runoff of water used for irrigation purposes shall be minimized to the maximum extent practicable. Runoff of water from the conditionally exempt washing down of paved areas shall be minimized to the maximum extent practicable utilizing BMPs specified in the Municipal NPDES Permit including sweeping and collection of debris for trash disposal. Conditionally exempt non-storm water discharges of roadway/driveway wash water only include those discharges resulting from use of high pressure, low volume spray washing using only potable water with no cleaning agents. Conditionally exempt non-storm water discharges of roadway/driveway wash water do not include hosing of any driveway or roadway with a garden hose with a pressure nozzle. Water used for irrigation purposes is also subject to Chapter 8.56 of this Code.

C. Storage of Materials, Machinery, and Equipment. Machinery or equipment that is to be repaired or maintained in areas susceptible to or exposed to storm water, shall be placed in a manner so that leaks, spills and other maintenance-related pollutants are not discharged to the MS4.

D. Removal and Disposal of Oil, Chemicals, Debris, or Other Pollutionable Materials from Industrial/Commercial Motor Vehicle Parking Lots. Industrial/commercial motor vehicle parking lots with more than twenty-five (25) parking spaces that are located in areas potentially exposed to storm water shall be swept regularly (including use of absorbent material if necessary) or other equally effective measures shall be utilized, to remove oil, chemicals, debris, or other pollutionable materials from such parking lots.

E. Food Wastes. Food wastes generated by non-residential food service and food distribution sources shall be properly disposed of and in a manner so such wastes are not discharged to the MS4.

F. Best Management Practices. BMPs shall be used in areas exposed to storm water for the removal and lawful disposal of all fuels, chemicals, fuel and chemical wastes, animal wastes, landscape debris, garbage, batteries, and hazardous, toxic, or other materials which have potential adverse impacts on water quality.

8.44.090 Requirements for Industrial/Commercial and Construction Activities

A. Each industrial discharger, discharger associated with construction activity, or other discharger described in any general storm water permit addressing such discharges, as may be issued by the U.S. Environmental Protection Agency, the State Water Resources Control Board, or the Regional Board, shall comply with all requirements of such permit. Each discharger identified in an individual NPDES permit shall comply with and undertake all activities required by such permit. Proof of compliance with any such permit may be required in a form acceptable to the Director of Community Development prior to the issuance of any grading, building, or occupancy permits, or any other type of permit or license issued by the City.

B. Storm water runoff containing sediment, construction materials, or other pollutants from the construction site and any adjacent staging, storage, or parking areas shall be reduced to the maximum extent practicable. The following shall apply to all construction projects within the City, regardless of project size, and shall be required from the time of land clearing, demolition, or commencement of construction until receipt of a Certificate of Occupancy:

   1. Sediment, construction wastes, trash and other pollutants from construction activities shall be reduced to the maximum extent practicable.

   2. Structural controls such as sediment barriers, plastic sheeting, detention ponds, filters, berms, and similar controls shall be utilized to the maximum extent practicable in order to minimize the escape of sediment and other pollutants from the site.

   3. All excavated soil shall be located on the site in a manner that minimizes the amount of sediment running onto the street, drainage facilities, or adjacent properties. Soil piles not actively in use shall be bermed or covered with plastic or similar materials until the soil is either used or removed from the site.

   4. No washing of construction or other vehicles is permitted adjacent to a construction site. No water from the washing of construction vehicles or equipment on the construction site is permitted to run off the construction site and enter the MS4.

   5. Solid waste receptacles must be situated at convenient locations on construction sites and must be maintained in such a manner that trash and litter and construction waste does not accumulate on the site nor migrate off site. Receptacles must be securely covered at the end of each business day and during rain events.

   6. Erosion from slopes and channels must be controlled through the effective combination of BMPs.

C. The owner or authorized representative of the owner must certify in a form acceptable to the Director of Community Development, or designee, that BMPs to control runoff from construction activity at all construction sites as required under this Chapter will be implemented prior to the issuance of any Demolition, Building or Grading Permit.

D. In addition to the provisions of Subsection B and C above, construction sites covering less than one acre must implement an effective combination of erosion and sediment control BMPs from the Municipal NPDES Permit to prevent erosion and sediment loss, and the discharge of construction wastes, to the satisfaction of the Community Development Director, or designee.

E. In addition to the provisions of Subsection B above, construction sites covering 1 (one) acre or more must adhere to the requirements set forth in the Municipal NPDES Permit and the Construction General Permit. A Storm Water Pollution Prevention Plan (SWPPP) shall be developed by a Qualified SWPPP Developer (QSD) for construction sites one acre or more consistent with the Municipal NPDES Permit. Such plans must be submitted to the Director of Community Development, or designee, for review and approval prior to the issuance of Building or Grading Permits. The SWPPP must include all elements required by the Construction General Permit. SWPPPs must be prepared in accordance with their calculated risk level per the Construction General Permit. BMPs selected for erosion and sediment control shall be detailed in the SWPPP. BMPs shall be selected from the Municipal NPDES Permit, as applicable, and, at a minimum, shall include those BMPs specified in Attachments A, C, D, and/or E of the Construction General Permit (or any equivalent attachments in a later amended permit) based on the project type or risk level. Selected BMPs must be selected, designed, implemented, and maintained in accordance with the BMP technical standards presented in the latest version of the

California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook for Construction; or Caltrans Stormwater Quality Handbook, Construction Site Best Management Practices Manual and addenda.

F. Roadway paving and repair projects must implement at a minimum the BMPs listed in the Municipal NPDES Permit for such projects. Roadway paving or repair projects 1 (one) acre or more in size shall also abide by the Construction General Permit, and implement all necessary BMPs as required for coverage under the Construction General Permit.

8.44.095 Low Impact Development Requirements for New Development and Redevelopment Projects

A. Projects Required to Comply. All new development and the following types of redevelopment projects are required to comply with the New Development and Redevelopment Project Performance Criteria set forth in the Municipal NPDES Permit:

1. All redevelopment projects, including single or multi-family residential projects, adding or replacing more than 5,000 square feet of impervious surface area;
2. Industrial parks or sites with 5,000 square feet or more of surface area;
3. Commercial malls or sites with 5,000 square feet or more of surface area;
4. Automotive Service facilities (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) with 5,000 square feet or more of surface area;
5. Retail gasoline outlets with 5,000 square feet or more of surface area;
6. Restaurants (SIC 5812) with 5,000 square feet or more of surface area;
7. Parking lots with five thousand (5,000) square feet or more of impervious surface area or with twenty-five (25) or more parking spaces (cumulative on the project site);
8. Any redevelopment project located in or directly adjacent to or discharging directly into a Significant Ecological Area (as defined herein), where the development will:

a. Discharge storm water and dry weather runoff that is likely to impact a sensitive biological species or habitat; and

b. Create 2,500 square feet or more of impervious surface area.

B. The following do not constitute new development or redevelopment and are not required to comply with the New Development and Redevelopment Project Performance Criteria set forth in the Municipal NPDES Permit:

1. Routine maintenance activities conducted to maintain original line and grade, hydraulic capacity, original purpose of facility, or emergency redevelopment activity required to protect public health and safety;
2. Discretionary permit projects or phased project applications which have been deemed complete by the effective date of this Chapter; and.
3. Discretionary permit projects with a valid vesting tentative map.

C. Where redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-development storm water quality control requirements, the entire Project must comply with the New Development/Redevelopment Project Performance Criteria in the Municipal NPDES Permit.

D. Where redevelopment results in an alteration to less than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-development storm water quality control requirements, only the alteration must comply with the New Development/Redevelopment Project Performance Criteria in the Municipal NPDES Permit, and not the entire development.

E. Street and road construction of 5,000 square feet or more of impervious surface area shall follow USEPA guidance regarding Managing Wet Weather with Green Infrastructure: Green Streets (December 2008 EPA-833-F-08-009) to the maximum extent practicable. Street and road construction applies to standalone streets, roads, alleys, and highways, and also applies to streets, roads and alleys within larger projects.

F. Incorporation of Low Impact Development Program Requirements into Project Plans.

1. New development and redevelopment projects are required to control pollutants and runoff volume from the project site by minimizing the impervious surface area through effective site design and use of water permeable surfaces (e.g., permeable paving or landscaping) to the extent it is technically feasible on not less than fifty percent of exterior surface areas excluding building footprints, and controlling runoff through infiltration, bio-retention, and/or rainfall harvest and use, in accordance with the standards set forth in the Municipal NPDES Permit.

2. An application for a new development or a redevelopment Project identified in paragraph A of this Section shall incorporate into the project plans a Storm Water Mitigation Plan ("SWMP"), which includes those BMPs necessary to control storm water pollution from the completed project. Structural or Treatment Control BMPs (including, as applicable, post-construction Treatment Control BMPs) set forth in project plans shall meet the design standards set forth in the Municipal NPDES Permit.

3. Hillside new development or redevelopment projects identified in paragraph A of this Section shall implement mitigation measures where applicable to:

    a. Conserve natural areas;

    b. Protect slopes and channels from erosion;

    c. Provide storm drain system stenciling and signage;

    d. Divert roof runoff to vegetated or other permeable areas before discharge unless the diversion would result in slope instability; and

    e. Direct surface flow to vegetated or other permeable areas before discharge unless the diversion would result in slope instability.

4. New Development/Redevelopment Project Performance Criteria: Post-construction Treatment Control BMPs are required for all new development and redevelopment projects identified in Paragraph A of this Section unless alternative measures are allowed as provided in the Municipal NPDES Permit. BMPs must be implemented to retain on-site the Stormwater Quality Design Volume (SWQDv), defined as runoff from the 0.80 inch, 24-hour rain event.

5. BMPs shall meet the design specifications and on-site retention potential described in the Municipal NPDES Permit.

    For projects unable to retain 100% of the SWQDv on-site due to technical infeasibility as defined in the Municipal NPDES Permit, the projects must implement alternative compliance measures in accordance with the Municipal NPDES Permit.

6. The following categories of projects which otherwise do not require compliance with this Section 8.44.095, but which the Director of Community Development, or designee, has determined may potentially have adverse impacts on post-development storm water quality, shall be designed to include post-construction Treatment Control BMPs to mitigate the adverse impacts on post-development storm water quality to the maximum extent practicable and must implement a site-specific plan to mitigate post-development storm water. Projects where one or more of the following project characteristics exist are deemed to potentially have adverse impacts on post-development storm water quality:

    a. Vehicle or equipment fueling areas;

    b. Vehicle or equipment maintenance areas, including washing and repair;

    c. Commercial or industrial waste handling or storage;

    d. Outdoor handling or storage of hazardous materials;

    e. Outdoor manufacturing areas;

    f. Outdoor food handling or processing;

    g. Outdoor animal care, confinement, or slaughter; or

    h. Outdoor horticulture activities.

G. Issuance of Discretionary Permits. No discretionary permit may be issued for any new development or redevelopment project identified in paragraph A of this Section or projects listed in Paragraph F.6 until the Director of Community Development, or designee, confirms that the project plans comply with the applicable storm water mitigation plans, BMP requirements and enumerated design criteria requirements set forth in this Chapter.

H. Issuance of Certificates of Occupancy. As a condition for issuing a Certificate of Occupancy for new development or redevelopment projects identified in paragraph A of this Section or projects listed in Paragraph F.6, the Director of Community Development, or designee, shall require facility operators and/or owners to build all the storm water pollution control BMPs and Structural or Treatment Control BMPs that are shown on the approved project plans and to submit a signed Certification Statement stating that the site and all Structural or Treatment Control BMPs will be maintained in compliance with the Municipal NPDES Permit and other applicable regulatory requirements.

Project owners shall provide an operation and maintenance plan, monitoring plan if required by the Director of Community Development, or designee, and verification of ongoing maintenance provisions for LID practices, Structural or Treatment Control BMPs, and Hydromodification Control BMPs including but not limited to: final map conditions, legal agreements, recorded covenants, conditions or restrictions, CEQA mitigation requirements, conditional use permits, and/ or other legally binding maintenance agreements to the satisfaction of the Director, or designee. These maintenance records must be kept on site for treatment BMPs implemented on single family residences.

B. Transfer of Properties Subject to Requirement for Maintenance of Structural and Treatment Control BMPs.

1. The transfer or lease of a property subject to a requirement for maintenance of Structural and/or Treatment Control BMPs shall include conditions requiring the transferee and its successors and assigns to either (a) assume responsibility for maintenance of any existing Structural or Treatment Control BMP, or (b) to replace an existing Structural or Treatment Control BMP with new control measures or BMPs meeting the then-current standards of the

City and the Municipal NPDES Permit. Such requirement shall be included in any sale or lease agreement or deed for such property. The condition of transfer shall include a provision that the successor property owner or lessee conduct maintenance inspections of all Structural or Treatment Control BMPs at least once a year and retain proof of inspection by the City for a minimum of five (5) years.

2. For residential properties where the Structural or Treatment Control BMPs are located within a common area which will be maintained by a homeowner's association, language regarding the responsibility for maintenance shall be included in the project's conditions, covenants, and restrictions (CC&Rs). Printed educational materials will be required to accompany the first deed transfer to highlight the existence of the requirement and to provide information on what storm water management facilities are present, signs that maintenance is needed, and how the necessary maintenance can be performed. The transfer of this information shall also be required with any subsequent sale of the property.

3. If Structural or Treatment Control BMPs are located within an area proposed for dedication to a public agency, they will be the responsibility of the developer until the dedication is accepted.

C. California Environmental Quality Act. Provisions of this Section shall be complimentary to, and shall not replace, any applicable requirements for storm water mitigation required under the California Environmental Quality Act (CEQA).

8.44.100 Inspection Authority

A. Authority to Enforce. The City's Authorized Enforcement Officers and designees thereof, are authorized and directed to enforce all provisions of this Chapter.

B. Right of Entry. Whenever necessary to make an inspection to enforce any of the provisions of this Chapter, or whenever an Authorized Enforcement Officer has reasonable cause to believe that there exists in any building or upon any premises any condition which constitutes a violation of the provision of this Chapter, an Authorized Enforcement Officer may enter such building or premises at all reasonable times to inspect the same or perform any duty imposed upon the officer by this Chapter; provided, that: (i) if such building or premises be occupied, he or she shall first present proper credentials and request entry; and (ii) if such building or premises be unoccupied, he or she shall first make a reasonable effort to locate the owner or other persons having charge or control of the building or premises and request entry. Any such request for entry shall state that the property owner or occupant has the right to refuse entry and that in the event such entry is refused, inspection may be made only upon issuance of an inspection warrant. In the event the owner and/or occupant refuses entry after such request has been made, the Officer may seek assistance from any court of competent jurisdiction in obtaining such entry.

C. Authority to Carry Out Inspections, Conduct Samplings, and Establishing Sampling Devices. An Authorized Enforcement Officer may carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with the Municipal NPDES Permit, including the prohibition of non-storm water discharges into the MS4 and receiving waters. With the consent of the owner or occupant or pursuant to an inspection warrant, any Authorized Enforcement Officer may establish on any property such devices as necessary to conduct sampling and monitoring activities necessary to determine the concentrations of pollutants in storm water and/or non-storm water runoff. The inspections provided for herein may include but are not limited to:

1. Inspecting efficiency or adequacy of construction or post construction BMPs;
2. Inspection, sampling, and testing any area runoff, soils in areas subject to runoff, and/or treatment system discharges;
3. Inspection of the integrity of all storm drain and sanitary sewer systems, including the use of smoke and dye tests and video survey of such pipes and conveyance systems;
4. Inspection of all records of the owner, contractor, developer or occupant of public or private property relating to BMP inspections conducted by the owner, contractor, developer or occupant and obtaining copies of such records as necessary;
5. Identifying points of storm water discharge from the premises whether surface or subsurface and locating any illicit connection or discharge.

D. Requirement to Sample or Monitor. Any Authorized Enforcement Officer may order that any person engaged in any activity and/or owning or operating any facility which may cause or contribute to storm water pollution or contamination, illicit discharges, and/or discharge of non-storm water to the MS4, undertake such monitoring activities and/or analyses and furnish such reports as the officer may specify. All costs incurred for such activity shall be borne by the party ordered to do the sampling. In the event the owner or operator of a facility subject to a monitoring and/or analyses order fails to conduct required monitoring and/or analyses and furnish the required reports in the form required, an Authorized Enforcement Officer may cause such monitoring and/or analyses and the cost, therefore, including the reasonable additional administrative costs incurred by the City shall be borne by the owner of the property and the cost thereof shall be invoiced to the owner of the property. If the invoice is not paid within sixty (60) days of the issuance thereof, the costs shall be a lien upon and against the property and continue in existence until the same shall be paid. If the lien is not satisfied by the owner of the property within three (3) months after the completion by an Authorized Enforcement Officer of the required monitoring and/or analyses and reports, the property may be sold in satisfaction thereof in a like manner as other real property is sold under execution.

E. Facility Inspections. The Director of Public Works, or designee, may periodically inspect every commercial and industrial facility as defined under the Municipal NPDES Permit at least twice during the term of the Municipal NPDES Permit and as often as necessary to insure compliance with this Chapter as the Director of Public Works, or designee, deems appropriate.

8.44.110 Violations of Storm Water and Dry Weather Runoff Pollution Control Regulations

A. Violations.
   1. Violations of the provisions of this Chapter are subject to the administrative penalty provisions of Chapter 1.10. Each day that a violation continues shall constitute a separate offense.
   2. Concealment. Causing, permitting, aiding, abetting, or concealing a violation of any provision of this Chapter shall constitute a violation of such provision

B. Public Nuisance
   1. In addition to being subject to the administrative penalty provisions:
      (a) Any action or inaction or condition caused or permitted to exist in violation of:
         (i) Any of the provisions of this Chapter; or

(ii) Any requirement of either the Municipal NPDES Permit, the Construction General Permit, an approved Storm Water Mitigation Plan, an approved SWPPP with respect to a property, the Industrial General Permit; or

(b) Any false certification or verification, or any failure to comply with a certification or verification provided by a project applicant or the applicant's successor in interest; or

(c) Any failure to properly operate and maintain any Structural or Treatment Control BMP on a property in accordance with an approved Storm Water Mitigation Plan or the Municipal NPDES Permit,

is hereby determined to be a threat to the public health, safety and welfare, is declared and deemed a public nuisance, and may be abated or restored by the Authorized Enforcement Officer, and a civil or criminal action to abate, enjoin or otherwise compel the cessation of such nuisance may be brought by the City. Nuisance abatement is government by Chapter 8.28 of this Code.

2. The cost of public nuisance abatement and restoration shall be assessed against the property, as set forth in Chapter 8.28 of this Code.

3. If any violation of this Chapter constitutes a seasonal or recurring nuisance, either the Community Development Director or Public Works Director, or their designee, shall so declare and provide notice to the address of the property via certified mail. The failure of any person to take appropriate annual or seasonal precautions required by the notice shall constitute a public nuisance and a violation of this Chapter.

C. Enforcement Procedure for Public Nuisance.

1. For the first failure to comply with any provision contained in this Chapter that will be prosecuted as a nuisance, rather than enforced pursuant to the City's administrative penalty provisions, an Authorized Enforcement Officer shall issue to the violator a written notice which includes the following information: (i) a description of the violation being committed; (ii) a specified time within which the violation must be corrected or within which the violator may file a written response to the Officer disputing the existence of a violation; and (iii) a description of the penalties which may be imposed for continued noncompliance.

2. If the violator demonstrates that the violation does not exist, or has been corrected, no further action need be taken. If, however, the violation exists and is not corrected within the prescribed time, the Authorized Enforcement Officer may thereafter pursue any of the enforcement remedies described below in this Section.

3. Notice is only required under this Section in the first instance for failure to comply with any provision of this Chapter and is not required for subsequent violations of the same or substantially similar activity.

4. Notice under this provision is not required before the City may pursue an administrative penalty under Chapter 1.10.

D. Civil Actions. In addition to any other remedies provided in this section, any violation of this Chapter may be enforced by civil action brought by the City. In any such action, the City may seek, as appropriate, any or all of the following remedies:

1. A temporary and/or permanent injunction.

2. Assessment of the violator for the costs of any investigation, inspection, or monitoring survey which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this subsection.
3. Costs incurred in removing, correcting, or terminating the adverse effects resulting from violation.
4. Compensatory damages for loss, damage or destruction of water quality, wildlife, fish, or aquatic life.

E. Administrative Enforcement Powers. In addition to the other enforcement powers and remedies established by this Chapter, the Authorized Enforcement Officers have the authority to utilize the following administrative remedies:

1. Cease and Desist Orders. When an Authorized Enforcement Officer finds that a violation of this Chapter has taken plan or is likely to take place, the Officer may issue an order to cease and desist such discharge, or practice, or operation likely to cause such violation and direct that those persons not complying shall: (i) comply with the requirement, (ii) comply with a time schedule for compliance, or (iii) take appropriate remedial or preventive action to prevent a specified violation from recurring.
2. Notice to Clean. Whenever an Authorized Enforcement Officer finds any oil, earth, debris, grass, weeds, dead trees, rubbish, refuse, waste, container or any other material of any kind, in or upon the sidewalk abutting or adjoining any parcel of land, or upon any parcel of land or grounds, which may result in pollutants entering the MS4 or a non-storm water discharge to the MS4, he or she may give notice to the owner or occupant of the adjacent property to remove such oil, earth, debris, grass, weeds, dead trees, rubbish, refuse, waste, container or other material, in any manner that the Officer may reasonably direct. The recipient of such notice shall undertake the activities as described in the notice.

F. Permit Revocation. To the extent the City makes a provision of this Chapter or any identified BMP a condition of approval to the issuance of a permit or license, any person in violation of such condition is subject to the permit revocation procedures set forth in this Code.

G. Remedies. Remedies specified in this Chapter are in addition to and do not supersede or limit any and all other remedies, civil, or criminal, including remedies under the Federal Clean Water Act and/or Porter-Cologne Act. The remedies provided for in this Section shall be cumulative and not exclusive.

H. Citizen Reporting. Members of the public are encouraged to report possible violations of this Chapter to the City's Public Works Department.

8.44. 120 No Taking

The provisions of this Chapter shall not be construed or operated to deprive any property owner of substantially all of the market value of such owner's property or otherwise constitute an unconstitutional taking without compensation.

Section 2. The following Sections modifying the CalGreen Code in Section 15.48.020 of Chapter 15.48 of Title 15 of the Hermosa Beach Municipal Code are repealed: Section A4.106.4; Section A5.106.2; Section A5.106.2.1; Section A5.106.2.2; Section A5.106.3; Section A5.106.3.1; and Section A.5.106.3.2.

PASSED, APPROVED AND ADOPTED this __day of _____, 2015.

_____
MAYOR

Attest:

_____
City Clerk

ORDINANCE NO. 15-0004

AN ORDINANCE OF THE CITY OF MANHATTAN BEACH AMENDING CHAPTER 5.84 REGARDING STORM WATER AND URBAN RUNOFF PROTECTION CONTROL

THE MANHATTAN BEACH CITY COUNCIL HEREBY ORDAINS AS FOLLOWS:

SECTION 1. The City Council hereby amends Manhattan Beach Municipal Code Chapter 5.84 (Storm Water and Urban Runoff Protection Control) to read as follows:

"Chapter 5.84
STORM WATER AND URBAN RUNOFF POLLUTION CONTROL

5.84.010 Purpose and intent.

5.84.020 Definitions.

5.84.030 Construction and application.

5.84.040 Prohibited activities.

5.84.050 Exempted discharges or conditionally exempted discharges.

5.84.060 Good housekeeping provisions.

5.84.070 Requirements for industrial/commercial and construction activities.

5.84.080 Inspection authority.

5.84.090 Enforcement.

5.84.100 Planning and Land Development Program requirements for New Development and Redevelopment projects.

5.84.010 Purpose and intent.

A. The purpose of this Chapter is to comply with the Federal Clean Water Act, the California Porter-Cologne Water Quality Control Act, and the Municipal National Pollutant Discharge Elimination System (NPDES) Permit by:

1. Reducing pollutants in storm water discharges to the maximum extent practicable;

2. Regulating illicit connections and illicit discharges, thereby reducing the level of contamination of storm water and urban runoff into the Municipal Separate Storm Sewer System (MS4) of the City of Manhattan Beach (City) and

3. Regulating non-storm water discharges to the MS4.

B. The intent of this Chapter is to ensure the future health, safety and general welfare of the citizens of the City and of the receiving waters of the County of Los Angeles and surrounding coastal areas to provide the City with the legal authority necessary to implement and enforce the requirements contained in 40 CFR § 122.26(d)(2)(i)(A-F) and in the Municipal NPDES Permit to the extent that they are applicable in the City, to control discharges to and from those portions of the municipal storm water system (MS4) over which the City has jurisdiction as required by the Municipal NPDES Permit, and to hold dischargers to the MS4 accountable for their contributions of pollutants and flows.

C. This Chapter authorizes the Authorized Enforcement Officer to define and adopt applicable Best Management Practices (BMPs) and other storm water pollution control measures, to cite infractions, to impose fines pursuant to this Chapter, and to grant emergency self-waivers from Municipal NPDES Permit requirements in order to conduct repairs of essential public service systems and infrastructure in emergency situations.

Except as otherwise provided herein, the Authorized Enforcement Officer shall administer, implement, and enforce the provisions of this Chapter.

D. This Chapter authorizes the Authorized Enforcement Officer to carry out inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with the provisions of this Chapter and the Municipal NPDES Permit, including the prohibition of non-storm water discharges into the MS4. This includes the authority to enter, monitor, inspect, take measurements, review and copy records, and require regular reports from entities discharging into the City's MS4.

5.84.020 Definitions

Except as specifically provided herein, any term used in this Chapter shall have the same meaning as that term is defined in the Municipal NPDES Permit; or, if it is not specifically defined in the Municipal NPDES Permit, then as such term is defined in the Federal Clean Water Act, as amended, and/or the regulations promulgated thereunder. The following words and phrases shall have the following meanings when used in this Chapter:

"Area susceptible to runoff" means any surface directly exposed to precipitation or in the path of runoff caused by precipitation.

"Authorized Enforcement Officer" means the City Manager or his or her designee and any City official authorized to issue citations under the municipal Code.

"Best Management Practices (BMPs)" means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

"City" means the City of Manhattan Beach.

"Construction" means any construction or demolition activity, clearing, grading, grubbing, excavation, or any other activities that result in soil disturbance. Construction includes structure teardown and demolition. It does not include routine maintenance activities required to maintain the integrity of structures by performing minor repair and restoration work, original line and grade, hydraulic capacity, or original purpose of facility; emergency construction activities required to immediately protect public health and safety; interior remodeling with no outside exposure of construction material or construction waste to storm water; mechanical permit work; or sign permit work. See "Routine Maintenance" definition below.

"Construction General Permit" means the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009- 0009-DWQ (NPDES No. CAS000002), adopted September 2, 2009, and any successor permit to that permit.

"Development" means any construction, rehabilitation, redevelopment, or reconstruction of any public or private residential project (whether single-family, multi-unit or planned unit development); industrial, commercial, retail and other non-residential projects, including public agency projects; or mass grading for future construction. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Directly Adjacent" means situated within two hundred feet of the contiguous zone required for the continued maintenance, function, and structural stability of the environmentally sensitive area.

"Discharging directly" means outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject, property, development, subdivision, or industrial facility, and not commingled with the flows from adjacent lands.

"Disturbed Area" means an area that is altered as a result of clearing, grading, and/or excavation.

"Environmentally Sensitive Area ("ESA") means an area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments (California Public Resources Code § 30107.5). Areas subject to storm water mitigation requirements are areas designated as Significant Ecological Areas by the County of Los Angeles (Los Angeles County Significant Areas Study, Los Angeles County Department of Regional Planning (1976) and amendments); an area designated as a Significant Natural Area by the California Department of Fish and Game's Significant Natural Areas Program, provided that area has been field verified by the Department of Fish and Game; an area listed in the Basin Plan as supporting the Rare, Threatened, or Endangered Species (RARE) beneficial use; and an area identified by the City as environmentally sensitive.

"Good housekeeping practices" means common practices related to the storage, use, or cleanup of pollutionable materials, performed in a manner that minimizes the discharge of pollutants. Examples include, but are not limited to, use of alternative and less environmentally harmful products, spill prevention, promptly cleaning up spills and leaks, and storing pollutionable materials in a manner that will contain any leaks or spills.

"Hillside" means property located in an area with known erosive soil conditions, where the development contemplates grading on any natural slope that is twenty-five percent or greater and where grading contemplates cut or fill slopes.

"Illicit connection" means any human-made conveyance that is connected to the storm drain system without a permit, excluding roof-drains and other similar type connections. Examples include channels, pipelines, conduits, inlets, or outlets that are connected directly to the storm drain system.

"Illicit discharge" means any discharge to the storm drain system that is prohibited under local, state, or federal statutes, ordinances, codes, or regulations. This includes all non-storm water discharges except discharges pursuant to a separate NPDES permit; discharges that are exempted or conditionally exempted in accordance with the Municipal NPDES Permit; and non-storm water discharges resulting from natural flows specifically identified in the Municipal NPDES Permit.

"Infiltration" means the downward entry of water into the surface of the soil.

"Inspection" means the entry and conduct of an on-site review of structures and devices on a property, at reasonable times, to determine compliance with specific municipal or other legal requirements. The steps involved in performing an inspection, include, but are not limited to:

1. Pre-inspection documentation research;

2. Request for entry;

3. Interview of property owner, resident and/or occupant(s);

4. Property walk-through;

5. Visual observation of the condition of property;

6. Examination and copying of records as required;

7. Sample collection (if necessary or required);

8. Exit discussion (to discuss preliminary evaluation) as appropriate; and

9. Report preparation, and if appropriate, recommendations for coming into compliance.

"Low Impact Development (LID)" means building or landscape features designed to retain or filter storm water runoff.

"Municipal NPDES Permit" means the "Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating from the City of Long Beach MS4" (Order No. R4-2012-0175), NPDES Permit No. CAS004001, effective December 28, 2012, issued by the California Regional Water Quality Control Board—Los Angeles Region, and any successor permit to that permit.

"Municipal separate storm sewer system (MS4)" means a conveyance or system of conveyances (consisting of roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

1. Owned or operated by a state, city, town borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the CWA that discharges to waters of the United States;

2. Designed or used for collecting or conveying storm water;

3. Which is not a combined sewer; and

4. Which not part of a Publicly Owned Treatment Works (POTW) is as defined in 40 CFR 122.2.

"New development" means land disturbing activities; structural development, including construction or installation of a building or structure, creation of impervious surfaces; and land subdivision.

"Non-storm water discharge" means any discharge to an MS4 that is not composed entirely of storm water.

"NPDES" means National Pollutant Discharge Elimination System.

"NPDES permit" means an authorization, license, or equivalent control document issued by U.S. Environmental Protection Agency (USEPA) or the State Water Resources Control Board or Regional Board to implement the requirements of Parts 122, 123 and 124 of the Code of Federal Regulations pursuant to Sections 318, 402, and 405 of the Clean Water Act, and includes any NPDES general permit. "Permit" does not include any permit which has not yet been the subject of final agency action, such as a "draft permit" or a "proposed permit".

"Pollutant" means those pollutants defined in Section 502(6) of the Federal Clean Water Act (33 U.S.C. Section 1362(6)), or incorporated into California Water Code Section 13373. Examples of pollutants include but are not limited to the following:

1. Commercial and industrial waste (such as fuels, solvents, detergents, plastic pellets, hazardous substances, fertilizers, pesticides, slag, ash, and sludge);

2. Metals such as cadmium, lead, zinc, copper, silver, nickel, chromium; and non- metals such as phosphorus and arsenic;

3. Petroleum hydrocarbons (such as fuels, lubricants, surfactants, waste oils, solvents, coolants and grease);

4. Excessive eroded soils, sediment and particulate materials in amounts which may adversely affect the beneficial use of the receiving waters, flora or fauna of the State;

5. Animal wastes (such as discharge from confinement facilities, kennels, pens, recreational facilities, stables, and show facilities); and

6. Substances having characteristics such as pH less than six (6) or greater than nine (9), or unusual coloration or turbidity, or excessive levels of fecal coliform, or fecal streptococcus, or enterococcus.

"Redevelopment" means land-disturbing activity those results in the creation, addition, or replacement of 5,000 square feet or more of impervious surface area on an

already developed site for all project categories except single family projects. For existing single family dwelling and accessory structures, redevelopment is the creation, addition, or replacement of 10,000 square feet or more of impervious surface. Redevelopment includes, but is not limited to: the expansion of a building footprint; addition or replacement of a structure; replacement of impervious surface area that is not part of a routine maintenance activity; and land disturbing activities related to structural or impervious surfaces. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Regional Board" means the California Regional Water Quality Control Board - Los Angeles Region.

"Routine Maintenance" includes, but is not limited to, projects conducted to:

1. Maintain the original line and grade, hydraulic capacity, or original purpose of the facility;

2. Perform as needed restoration work to preserve the original design grade, integrity, and hydraulic capacity of flood control facilities;

3. Carry out road shoulder work, regrading dirt or gravel roadways and shoulders, and performing ditch cleanouts;

4. Update existing lines and facilities, including the replacement of existing lines with new materials or pipes, to comply with applicable codes, standards, and regulations regardless if such projects result in increased capacity;

5. Repair leaks; and

6. Conduct landscaping activities without changing existing or natural grades.

Routine maintenance does not include construction of new lines or facilities resulting from compliance with applicable codes, standards, and regulations. New lines are those that are not associated with existing facilities and are not part of a project to update or replace existing lines.

"Significant Ecological Area" ("SEA") means an area that is determined to possess an example of biotic resources that cumulatively represent biological diversity, for the purposes of protecting biotic diversity, as part of the Los Angeles County General Plan.

Areas are designated as SEAs, if they possess one or more of the following criteria:

1. The habitat of rare, endangered, and threatened plant and animal species;

2. Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind, or are restricted in distribution on a regional basis;

3. Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind or are restricted in distribution in Los Angeles County;

4. Habitat that at some point in the life cycle of a species or group of species, serves as a concentrated breeding, feeding, resting, migrating grounds and is limited in availability either regionally or within Los Angeles County;

5. Biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or represent an unusual variation in a population or community;

6. Areas important as game species habitat or as fisheries;

7. Areas that would provide for the preservation of relatively undisturbed examples of natural biotic communities in Los Angeles County; and

8. Special areas.

"Simple LID BMP" means a BMP constructed above ground on a single-family residential home that can be readily inspected by a homeowner or inspector. Simple LID BMPs do not require an operation and maintenance plan per the Municipal NPDES Permit. Examples of such BMPs include, but are not limited to, vegetated swales, rain barrels and above ground cisterns, rain gardens, and pervious pavement.

"Site" means the land or water area where any "structure or activity" is physically located or conducted, including adjacent land used in connection with the structure or activity.

"Storm water runoff" means that part of precipitation (rainfall or snowmelt) which travels via flow across a surface to the MS4 or receiving waters from impervious, semi-pervious, or pervious surfaces. When all other factors are equal, runoff increases as the perviousness of a surface decreases.

"Structural BMP" means any structural facility designed and constructed to mitigate the adverse impacts of storm water and dry weather runoff pollution (e.g., canopy, structural enclosure). Structural BMPs may include both treatment control BMPs and source control BMPs.

"Treatment" means the application of engineered systems that use physical, chemical, or biological processes to remove pollutants. Such processes include, but

are not limited to, filtration, gravity settling, media adsorption, biodegradation, biological uptake, chemical oxidation, and UV radiation.

"Treatment control BMP" means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption, or any other physical, biological, or chemical process.

5.84.030 Construction and application.

This Chapter shall be construed to assure consistency with the requirements of the Federal Clean Water Act and acts amendatory thereof or supplementary thereto; applicable implementing regulations; and the Municipal NPDES Permit and any amendment, revision, or reissuance thereof.

5.84.040 Prohibited activities.

A. **Illicit Discharges and Connections.** It is a violation of this Chapter to commence, establish, use, maintain, or continue any illicit connections to the MS4 or any illicit discharges to the MS4. This prohibition against illicit connections applies to the use, maintenance, or continuation of any illicit connection, whether that connection was established prior to or after the effective date of this Chapter.

B. **Littering.** No person shall throw, deposit, place, leave, maintain, keep, or permit to be thrown, deposited, placed, left, maintained, or kept, any refuse, rubbish, garbage, or any other discarded or abandoned objects, articles, or accumulations, in or upon any street, alley, sidewalk, storm drain, inlet, catch basin conduit or drainage structure, business place, or upon any public or private plot of land in the City, so that the same might be or become a pollutant. No person shall throw or deposit litter in any fountain, pond, lake, stream, or other body of water within the City. This subsection shall not apply to refuse, rubbish, or garbage deposited in containers, bags, or other appropriate receptacles that are placed in designated locations for regular solid waste pick up and disposal.

C. **Disposal of Landscape Debris.** No person shall intentionally dispose of leaves, dirt, or other landscape debris into the MS4.

D. **Non-Storm Water Discharges.** All non-storm water discharges into the MS4 are prohibited unless those flows are: in compliance with a separate NPDES Permit; pursuant to a discharge exemption by the Regional Board, the Regional Board's executive officer, or the State Water Resources Control Board; associated with emergency firefighting activities (i.e., flows necessary for the protection of life or property); natural flows as defined in the Municipal NPDES Permit; conditionally exempt non-storm water discharges as defined in accordance with the Municipal NPDES Permit; or

authorized as a temporary non-storm water discharge by the USEPA pursuant to Sections 104(a) or 104(b) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Prohibited discharges include but are not limited to, but are not limited to:

1. The discharge of wash waters to the MS4 from commercial auto washing or when gas stations, auto repair garages, or other type of automotive service facilities are cleaned;

2. The discharge of wastewater to the MS4 from mobile auto washing, steam cleaning, mobile carpet cleaning, and other such mobile commercial and industrial operations;

3. Discharges to the MS4 from areas where repair of machinery and equipment, including motor vehicles, which are visibly leaking oil, fluid, or antifreeze, is undertaken;

4. Discharges of runoff to the MS4 from storage areas of materials containing grease, oil, or other hazardous substances, and uncovered receptacles containing hazardous materials;

5. Discharges of commercial/residential swimming pool filter backwash to the MS4;

6. Discharges of runoff from the washing of toxic materials from paved or unpaved areas to the MS4;

7. Discharges to the MS4 from washing impervious surfaces in industrial/commercial areas, unless specifically required by the State's, or the City's, or Los Angeles County's health and safety codes, or permitted under a separate NPDES permit;

8. Discharges to the MS4 from the washing out of concrete or cement laden wash water from concrete trucks, pumps, tools, and equipment;

9. Discharges to the MS4 of any pesticide, fungicide, or herbicide banned by the USEPA or the California Department of Pesticide Regulation or a product registered under the Federal Insecticide, Fungicide and Rodenticide Act to any waste stream that may ultimately be released to waters of the United States unless specifically authorized under an NPDES permit. This requirement is not applicable to products used for lawn and agricultural purposes; and

10. The disposal of hazardous wastes into trash containers used for municipal trash disposal where such disposal causes or threatens to cause a direct or indirect discharge to the MS4.

E. **Discharges in Violation of the Municipal NPDES Permit.** Any discharge that would cause or contribute to a violation of the Municipal NPDES Permit, either separately or in combination with other discharges, is prohibited. Liability for any such discharge shall be the responsibility of the person(s) causing or responsible for the discharge, and such person(s) shall defend, indemnify, and hold harmless the City from all losses, liabilities, claims, or causes of actions in any administrative or judicial action relating to such discharge.

5.84.050 Exempted discharges or conditionally exempted discharges.

Discharges from those activities specifically identified in or pursuant to the Municipal NPDES Permit as being exempted discharges, or conditionally exempted shall not be considered a violation of this Chapter, provided that all required conditions, including applicable BMPs pursuant to the Municipal NPDES Permit, are implemented prior to discharge to minimize any adverse impacts from such identified sources and that any required municipal permits are obtained prior to discharge.

5.84.060 Good housekeeping provisions.

Owners and occupants of property within the City shall comply with the following requirements:

A. **Septic Waste.** No person shall leave, deposit, discharge, dump, or otherwise expose any chemical or septic waste to precipitation.

B. **Use of Water.** Runoff of water used for irrigation purposes shall be minimized in accordance with the City's Water Conservation Ordinance as codified in Chapter 7.44 of the City's Municipal Code. Runoff of water from the conditionally exempt washing down of paved areas shall be minimized to the maximum extent practicable. Conditionally exempt non-storm water discharges of roadway/driveway wash water only include those discharges resulting from use of high pressure, low volume spray washing using only potable water with no cleaning agents. Sweeping and collection of debris for trash disposal instead of or prior to use of water should be utilized whenever possible.

C. **Storage of Materials, Machinery, and Equipment.** Machinery or equipment that is to be repaired or maintained in areas susceptible to or exposed to storm water, shall be placed in a manner so that leaks, spills, and other maintenance-related pollutants are not discharged to the MS4.

D. **Storage of Oil or Oily Material, Chemicals, Refuse, or Other Pollutionable Materials.** Oil or oily material, chemicals, refuse, or other pollutionable materials shall not be stored or deposited by any person in areas where they may be picked up by rainfall and carried off of the property and/or discharged to the MS4. Any such spill of such materials shall be contained and removed immediately.

E. **Removal and Disposal of Debris from Industrial/Commercial Motor Vehicle Parking Lots.** Industrial or commercial motor vehicle parking lots with more than twenty-five (25) parking spaces that are located in areas potentially exposed to storm water shall be swept regularly or other equally effective measures shall be utilized to remove oil, chemicals, debris, or other pollutionable materials from such parking lots, so as to prevent or minimize pollutants or debris from running off the parking lot into the MS4.

F. **Food Wastes.** Food wastes generated by non-residential food service and food distribution sources shall be properly disposed of and in a manner so such wastes are not discharged to the MS4. For example: restaurant kitchen mats may not be washed or rinsed into the street or alley.

G. **Best Management Practices.** BMPs shall be used in areas exposed to storm water for the removal and lawful disposal of all fuels, chemicals, fuel and chemical wastes, animal wastes, garbage, batteries, or other materials which have potential adverse impacts on water quality.

5.84.070 Requirements for industrial/commercial and construction activities.

A. Each industrial discharger, discharger associated with construction activity, or other discharger described in any general storm water permit addressing such discharges, as may be issued by the USEPA, the State Water Resources Control Board, or the Regional Board, shall comply with all requirements of such permit. Each discharger identified in an individual NPDES permit shall comply with and undertake all activities required by such permit. Proof of compliance with any such permit may be required in a form acceptable to the Authorized Enforcement Officer prior to the issuance of any grading, building, or occupancy permits, or any other type of permit or license issued by the City.

B. Non-storm water discharges to the MS4 from industrial, commercial, or construction activities are prohibited.

C. Industrial and commercial dischargers and dischargers associated with construction activities must implement effective BMPs, including source control BMPs, in accordance with the Municipal NPDES Permit to reduce

pollutants in storm water from such sites to the maximum extent practicable.

5.84.080 Inspection authority.

A. **Authority to Inspect.** The Authorized Enforcement Officer, City's Director of Public Works, building officials, community services officers, and any other representatives thereof, are authorized and directed to enforce all provisions of this Chapter.

B. **Right of Entry.** Whenever necessary to make an inspection to enforce any of the provisions of this Chapter, or whenever an Authorized Enforcement Officer has reasonable cause to believe that there exists in any building or upon any premises any condition which constitutes a violation of the provisions of this Chapter, the officer may enter such building or premises at all reasonable times to inspect the same or perform any duty imposed upon the officer by this Chapter; provided, that: (i) if such building or premises be occupied, he or she shall first present proper credentials and request entry; and (ii) if such building or premises be unoccupied, he or she shall first make a reasonable effort to locate the owner or other persons having charge or control of the building or premises and request entry. Any such request for entry shall state that the property owner or occupant has the right to refuse entry and that in the event such entry is refused, inspection may be made only upon issuance of an inspection warrant. In the event the owner and/or occupant refuses entry after such request has been made, the officer is hereby empowered to seek assistance from any court of competent jurisdiction in obtaining such entry.

C. **Authority to Conduct Samplings and Establishing Sampling Devices.** With the consent of the owner or occupant or pursuant to an inspection warrant, any Authorized Enforcement Officer may establish on any property such devices as necessary to conduct sampling and monitoring activities necessary to determine the concentrations of pollutants in storm water and/or non-storm water runoff. During the inspections as provided herein, the Authorized Enforcement Officer may take any samples deemed necessary.

D. **Requirement of Sample or Monitor.** Any Authorized Enforcement Officer may order that any person engaged in any activity and/or owning or operating any facility which may cause or contribute to storm water pollution or contamination, illicit discharges, and/or discharge of non-storm water to the storm water system, undertake such monitoring activities and/or analyses and furnish such reports as the officer may specify. All costs incurred for such activity shall be borne by the party ordered to do the sampling. In the event the owner or operator of a facility subject to a

monitoring and/or analyses order fails to conduct required monitoring and/or analyses and furnish the required reports in the form required, the Authorized Enforcement Officer may cause such monitoring and/or analyses to be conducted and the cost, therefore, including the reasonable additional administrative costs incurred by the City, shall be borne by the owner of the property and the cost thereof shall be, after notice and an opportunity for hearing, invoiced to the owner of the property. If the invoice is not paid within sixty (60) days of the issuance thereof, the costs shall be a lien upon and against the property and continue in existence until the same shall be paid. If the lien is not satisfied by the owner of the property within three (3) months after the completion by an Authorized Enforcement Officer of the required monitoring and/or analyses and reports, the property may be sold in satisfaction thereof in a like manner as other real property is sold under execution.

E. **Industrial and Commercial Inspections.** The Public Works Director, Authorized Enforcement Officer, or authorized staff or contractor, shall conduct industrial and commercial facility compliance inspections to confirm that storm water and non-storm water BMPs are effectively implemented in compliance with this Chapter and the Municipal NPDES Permit. These inspections shall be at a frequency sufficient to be in compliance with the Municipal NPDES Permit. Inspections shall be conducted no less than twice during the term of the Municipal NPDES Permit and as often as the Director of Public Works deems appropriate to verify compliance with this Chapter.

5.84.090 Enforcement.

A. **Enforcement Procedure.**

1. For the first failure to comply with any provision contained in this Chapter, the Director of Public Works or any Authorized Enforcement Officer shall issue to the violator a written notice which includes the following information: (i) a description of the violation being committed; (ii) a specified time within which the violation must be corrected or within which the violator may file a written response to the Director disputing the existence of a violation; and (iii) a description of the penalties which may be imposed for continued noncompliance.

2. If the violator demonstrates that the violation does not exist, or has been corrected, no further action need be taken. If, however, the violation exists and is not corrected within the prescribed time, the Director of Public Works may thereafter pursue any of the enforcement remedies described below in this Section.

B. **Violation a Misdemeanor.** Violation of this Chapter or the Municipal NPDES Permit shall be punishable as a misdemeanor, punishable as set forth in Section 1.04.010(A) of this Code; provided, however, that any or all of the first three violations of this Chapter or the Municipal NPDES Permit committed within any consecutive twelve (12) month period may be charged as an infraction at the discretion of the City Prosecutor. Each day that a violation continues shall constitute a separate offense.

C. **Violations Deemed a Public Nuisance.**

1. Any condition caused or permitted to exist in violation of any of the provisions of this Chapter or the Municipal NPDES Permit is hereby determined to be a threat to the public health, safety, and welfare; is declared and deemed a public nuisance and may be abated or restored by any Authorized Enforcement Officer; and a civil or criminal action to abate, enjoin, or otherwise compel the cessation of such nuisance may be brought by the City Attorney.

2. The cost of such abatement and restoration shall be borne by the owner of the property and the cost thereof shall be invoiced to the owner of the property, as provided by law or ordinance for the recovery of nuisance abatement costs.

3. If any violation of this Chapter constitutes a seasonal and recurrent nuisance, the City Manager shall so declare. The failure of any person to take appropriate annual precautions to prevent storm water pollution after written notice of a determination under this paragraph shall constitute a public nuisance and a violation of this Chapter.

D. **Concealment.** Causing, permitting, aiding, abetting, or concealing a violation of any provision of this Chapter shall constitute a separate violation of such provision.

E. **Civil Actions.** In addition to any other remedies provided in this Section, any violation of this Chapter may be enforced by civil action brought by the City. In any such action, the City may seek, as appropriate, any or all of the following remedies:

1. A temporary and/or permanent injunction;

2. Assessment of the violator for the costs of any investigation, inspection, or monitoring survey which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this subsection;

3. Costs incurred in removing, correcting, or terminating the adverse effects resulting from violation;

4. Compensatory damages for loss or destruction to water quality, wildlife, fish and aquatic life; and Attorney fees.

F. **Administrative Enforcement Powers.** In addition to the other enforcement powers and remedies established by this Chapter, the Authorized Enforcement Officer has the authority to utilize the following administrative remedies:

1. **Cease and Desist Orders.** When an Authorized Enforcement Officer finds that a discharge has taken place or is likely to take place in violation of this Chapter, the officer may issue an order to cease and desist such discharge, or practice, or operation likely to cause such discharge and direct that those persons not complying shall: (i) comply with the requirement, (ii) comply with a time schedule for compliance, and (iii) take appropriate remedial or preventive action to prevent the violation from recurring. Failure to comply with such an order shall constitute a separate violation of this Chapter.

2. **Notice to Clean.** Whenever an Authorized Enforcement Officer finds any oil, earth, debris, grass, weeds, dead trees, tin cans, rubbish, refuse, waste, or any other pollutionable material of any kind, in or upon the sidewalk abutting or adjoining any parcel of land, or upon any parcel of land or grounds, which may result in pollutants entering the MS4 or a non-storm water discharge to the MS4, he or she may give notice to the owner or occupant of the adjacent property to remove such oil, earth, debris, grass, weeds, dead trees, tin cans, rubbish, refuse, waste, or other pollutionable material, in any manner that he or she may reasonably provide. The recipient of such notice shall undertake the activities as described in the notice. Failure to comply with such a notice shall constitute a separate violation of this Chapter.

G. **Permit Revocation.** To the extent the City makes a provision of this Chapter or any identified BMP a condition of approval to the issuance of a permit or license, any person in violation of such condition is subject to the permit revocation procedures set forth in this Code.

H. **Remedies.** Remedies specified in this Chapter are in addition to and do not supersede or limit any and all other remedies, civil or criminal, including remedies under the Federal Clean Water Act and/or Porter-Cologne Act. The remedies provided for in this Section shall be cumulative and not exclusive.

I. **Citizen Reporting.** Members of the public are encouraged to report possible violations of this Chapter to the City's Public Works Department.

5.84.100 Planning and Land Development Program requirements for New Development and Redevelopment projects.

A. **Compliance with Municipal NPDES Permit.** The following New Development and Redevelopment projects are required to comply with the Municipal NPDES Permit:

1. All development projects equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet of impervious area;

2. Industrial parks with 10,000 square feet or more of surface area;

3. Commercial malls with 10,000 square feet or more surface area;

4. Retail gasoline outlets with 5,000 square feet or more of surface area;

5. Restaurants (SIC 5812) with 5,000 square feet or more of surface area;

6. Parking lots with 5,000 square feet or more of impervious area or with twenty-five or more parking spaces;

7. Single family hillside residential developments or redevelopments;

8. Street and road construction of 10,000 square feet or more of impervious surface area shall follow USEPA guidance regarding Managing Wet Weather with Green Infrastructure: Green Streets (December 2008 EPA-833-F-08-009) to the maximum extent practicable. Street and road construction applies to standalone streets, roads, highways, and freeway projects, and also applies to streets within larger projects;

9. Automotive service facilities (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536- 7539) with 5,000 square feet or more of surface area;

10. Projects located in or directly adjacent to, or discharging directly to a Significant Ecological Area (SEA), where the development will:

    a) Discharge storm water runoff that is likely to impact a sensitive biological species or habitat; and

b) Create 2,500 square feet or more of impervious surface area;

11. Projects in subject categories that meet Redevelopment thresholds (pursuant to the Municipal NPDES Permit), which include:

a) Land-disturbing activities which create, add, or replace 5,000 square feet or more of impervious surface area on an already developed site excluding single family dwellings and accessory structures.

b) Land-disturbing activities which create, add, or replace 10,000 square feet or more of impervious surface area on existing single family dwellings and accessory structures.

c) Where Redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-development storm water quality control requirements, the entire Project must be mitigated.

d) Where Redevelopment results in an alteration to less than 50% of impervious surfaces of a previously existing development, and the existing development was not subject to post-development storm water quality control requirements, only the alteration must be mitigated, and not the entire development.

EXCEPTIONS: The following do not constitute New Development or Redevelopment:

1. Routine maintenance activities conducted to maintain original line and grade, hydraulic capacity, original purpose of facility, or emergency redevelopment activity required to protect public health and safety. Impervious surface replacement, such as the reconstruction of parking lots and roadways which does not disturb additional area and maintains the original grade and alignment, is considered a routine maintenance activity.

2. Discretionary permit projects or phased project applications which have been deemed complete by June 28, 2015 and which have not received an extension of time.

3. Discretionary permit projects with a valid vesting tentative map.

B. **Incorporation of Planning and Land Development Program requirements Into Project Plans.**

1. New Development and Redevelopment projects are required to control pollutants and runoff volume from the project site by minimizing the impervious surface area and controlling runoff through infiltration, bioretention, and/or rainfall harvest and use, in accordance with the standards set forth in the Municipal NPDES Permit.

2. An applicant for a New Development or a Redevelopment Project identified in this Chapter shall incorporate into the applicant's project plans a Post Construction Storm Water Mitigation Plan which includes those Best Management Practices necessary to control storm water pollution from the completed project. Structural or treatment control BMPs (including, as applicable, post-construction treatment control BMPs) set forth in project plans shall meet the design standards set forth in the Municipal NPDES Permit.

3. To the extent that the City may lawfully impose conditions, mitigation measures, or other requirements on the development or construction of a single-family home in a hillside area, a single-family hillside home Development or Redevelopment project shall implement mitigation measures to:

   a) Conserve natural areas;

   b) Protect slopes and channels;

   c) Provide storm drain system stenciling and signage;

   d) Divert roof runoff to vegetated areas before discharge unless the diversion would result in slope instability; and

   e) Direct surface flow to vegetated areas before discharge unless the diversion would result in slope instability.

4. **New Development/Redevelopment Project Performance Criteria.** Post-construction BMPs to mitigate storm water pollution are required for all New Development and Redevelopment projects identified in this Chapter unless alternative measures are allowed as provided in the Municipal NPDES Permit. BMPs must be implemented to retain on-site the Storm Water Quality Design Volume (SWQDv), defined as runoff from either:

a) The 0.75 inch, 24-hour rain event; or

b) The 85th percentile, 24-hour event, as determined from the Los Angeles County 85th percentile precipitation isohyetal map, whichever is greater.

BMPs shall meet the design specifications and on-site retention potential outlined in the Municipal NPDES Permit. Projects unable to retain 100% of the SWQDv on-site due to technical infeasibility as defined in the Municipal NPDES Permit must implement alternative compliance measures in accordance with the Municipal NPDES Permit.

Single family hillside home development projects are exempt from the New Development/Redevelopment Project Performance Criteria of the Municipal NPDES Permit unless they create, add, or replace 10,000 square feet or more of impervious surface area.

Street and road construction projects of 10,000 square feet or more of impervious surface area are exempt from the New Development/Redevelopment Project Performance Criteria of the Municipal NPDES Permit but shall adhere to the City's Green Streets Policy and be consistent with USEPA guidance regarding Managing Wet Weather with Green Infrastructure: Green Streets (December 2008 EPA-833-F-08-009) to the maximum extent practicable.

C. **Issuance of Final Approval.** As a condition for issuing final approval for New Development or Redevelopment projects identified in this Chapter, the Authorized Enforcement Officer shall require property owners or their representative(s) to build all the storm water pollution control Best Management Practices and structural or treatment control BMPs that are shown on the approved project plans and to submit a signed certification statement stating that the site and all structural or treatment control BMPs will be maintained in compliance with the Municipal NPDES Permit and other applicable regulatory requirements.

With the exception of Simple LID BMPs (as defined in this Chapter) implemented on single family residences, project owners shall provide an operation and maintenance plan, monitoring plan where required, and verification of ongoing maintenance provisions for LID practices and treatment control BMPs including, but not limited to: final map conditions, legal agreements, covenants, conditions or restrictions, California Environmental Quality Act (CEQA), CEQA mitigation requirements, conditional use permits, and/or other legally binding maintenance

agreements. These maintenance records must be kept on site for treatment BMPs implemented on single family residences.

D. **Transfer of Properties Subject to Requirement for Maintenance of Structural and Treatment Control BMPs.**

1. The transfer or lease of a property subject to a requirement for maintenance of structural and treatment control BMP's shall include conditions requiring the transferee and its successors and assigns to either (a) assume responsibility for maintenance of any existing structural or treatment control BMP, or (b) to replace an existing structural or treatment control BMP with new control measures or BMPs meeting the current standards of the City and the Municipal NPDES Permit. Such requirement shall be included in any sale or lease agreement or deed for such property. The condition of transfer shall include a provision that the successor property owner or lessee conduct maintenance inspections of all structural or treatment control BMPs at least once a year and retain proof of inspection.

2. For residential properties where the structural or treatment control BMPs are located within a common area which will be maintained by the community association, appropriate arrangements shall be made with the association regarding the responsibility for maintenance.

3. If structural or treatment control BMPs are located within an area proposed for dedication to a public agency, they will be the responsibility of the developer until the dedication is accepted.

E. California Environmental Quality Act. CEQA. Provisions of this Section shall be complementary to, and shall not replace, any applicable requirements for storm water mitigation required under the CEQA."

SECTION 2. The City Clerk shall certify to the passage and adoption of this Ordinance and shall cause this Ordinance to be published within 15 days after its passage, in accordance with Section 36933 of the Government Code.

SECTION 3. This Ordinance shall go into effect and be in full force and effect at 12:01 a.m. on the 31st day after its passage.

PASSED, APPROVED AND ADOPTED this 21st day of April, 2015.

AYES: Howorth, Lesser, D'Errico, Burton and Mayor Powell
NOES: None
ABSENT: None
ABSTAIN: None

Wayne Powell
WAYNE POWELL
Mayor

ATTEST:

LIZA TAMURA
City Clerk

ORDINANCE NO.

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF REDONDO BEACH, CALIFORNIA AMENDING IN ITS ENTIRETY CHAPTER 7 OF TITLE 5 OF THE REDONDO BEACH MUNICIPAL CODE REGARDING STORMWATER AND URBAN RUNOFF POLLUTION CONTROL REGULATIONS AND MAKING A DETERMINATION OF EXEMPTION UNDER CEQA

WHEREAS, the federal Clean Water Act provides for the regulation and reduction of pollutants discharged into the waters of the United States by extending National Pollutant Discharge Elimination System ("NPDES") requirements to stormwater and urban runoff discharged into municipal storm drain systems.

WHEREAS, the City of Redondo Beach (the "City") is a co-permittee under the "Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Except those Discharges Originating from the City of Long Beach MS4, Order No. R4-2012-0175, NPDES Permit No. CAS00401" ("MS4 Permit") issued by the California Regional Water Quality Control Board—Los Angeles Region, and, as a co-permittee under the MS4 Permit, the City is required to adopt ordinances and implement procedures with respect to discharges into the municipal separate storm sewer system ("MS4").

WHEREAS, the City has previously adopted ordinances to ensure that it possesses the legal authority necessary to control discharges to and from those portions of the MS4 over which it has jurisdiction, in order to comply with the MS4 Permit, and to specifically prohibit certain discharges identified in the MS4 Permit.

WHEREAS, Chapter 7 of Title 5 of the Redondo Beach Municipal Code is being revised in order to comply with the current MS4 Permit.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF REDONDO BEACH, CALIFORNIA DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. Chapter 7 of Title 5 of the Redondo Beach Municipal Code is hereby amended in its entirety to read as follows:

"5-7.101 Title.

This chapter shall be known as the City of Redondo Beach Stormwater Management and Discharge Control Ordinance.

5-7.102 Findings.

A. The federal Clean Water Act (33 U.S.C. Section 1251, *et seq.*,) provides for the regulation and reduction of pollutants discharged into the waters of the United States by extending National Pollutant Discharge Elimination System ("NPDES")

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CITY ATTORNEY'S OFFICE
APPROVED BY LEGAL DEPARTMENT

requirements to stormwater and urban runoff discharge into municipal storm drain systems;

B. Stormwater and urban runoff flows from individual properties onto streets, then through storm drains passing through the City and finally into the waters of the United States;

C. The City is a co-permittee under the "Waste Discharge Requirements for Municipal Separate Storm Sewer System ("MS4") discharges within the Coastal Watersheds of Los Angeles County, except those discharges originating from the City of Long Beach MS4, which also serves as a NPDES Permit under the federal Clean Water Act (NPDES No. CAS614001), as well as waste discharge requirements under California law (the Municipal NPDES Permit") and, as a co-permittee under the Municipal NPDES Permit, the City is required to adopt ordinances and implement procedures with respect to the entry of non-stormwater discharges into the municipal stormwater system;

D. Part III, Section A of the Municipal NPDES Permit requires the City to effectively prohibit non-stormwater discharges from within its boundaries, into that portion of the MS4 which it owns or operates and into watercourses, except where such discharges are: (1) in compliance with a separate individual or general NPDES permit, or (2) identified and in compliance with Part III.A (non-stormwater discharges) of the Municipal NPDES Permit, or (3) originate from federal, state or other facilities which the City is preempted from regulating, and further provides that compliance with the terms of the Municipal NPDES Permit through the development and implementation of the programs described in the Municipal NPDES Permit will constitute compliance with the discharge prohibition in the Municipal NPDES Permit;

E. Part VI, Section A.2 of the Municipal NPDES Permit requires the City to establish and maintain the legal authority necessary to control discharges to and from those portions of the MS4 over which it has jurisdiction, so as to comply with the Municipal NPDES Permit and to specifically prohibit certain discharges identified in the Municipal NPDES Permit;

F. The Municipal NPDES Permit contemplates the development of an Enhanced Watershed Management Program in which the City will participate, which will in turn require the development and the implementation of programs for, among other things, the elimination of illicit connections and illicit discharges, development planning, development construction, and public information and education requirements, and which may require the later adoption of additional legal authority to implement such programs as they are developed by the permittees and approved by the Regional Board;

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G. In order to control, in a cost-effective manner, the quantity and quality of stormwater and urban runoff to the maximum extent practicable, the adoption of the ordinance codified in this chapter is essential.

5-7.103 Purpose and intent.

A. The purpose of this chapter is to ensure the future health, safety and general welfare of the citizens of the City and the water quality of the receiving waters of the County of Los Angeles and surrounding coastal areas by:

1. Reducing pollutants in stormwater discharges to the maximum extent practicable;

2. Regulating illicit connections and illicit discharges and reducing the level of contamination of stormwater and urban runoff in the municipal stormwater system; and

3. Regulating non-stormwater discharges to the municipal stormwater system.

B. The intent of this chapter is to protect and enhance the quality of watercourses, water bodies, and wetlands within the City in a manner consistent with the federal Clean Water Act, the California Porter-Cologne Water Quality Control Act and the Municipal NPDES Permit.

C. This chapter is also intended to provide the City with the legal authority necessary to control discharges to and from those portions of the municipal stormwater system over which it has jurisdiction as required by the Municipal NPDES Permit, and fully and timely comply with the terms of the Municipal NPDES Permit while the Enhanced Watershed Management Program is being developed by the City as part of the Beach Cities Watershed Management Group, and in contemplation of the subsequent amendment of this chapter or adoption by the City of additional provisions of this chapter to implement the subsequently adopted Enhanced Watershed Management Program, or other programs developed under the Municipal NPDES Permit.

D. This chapter also sets forth requirements for the construction and operation of certain commercial development, new development and redevelopment and other projects (as further defined herein) which are intended to ensure compliance with the stormwater mitigation measures prescribed in the current MS4 Permit. This chapter authorizes the Engineer to define and adopt applicable best management practices and other stormwater pollution control measures, as provided herein, to carry out all inspections including entering entities discharging to the MS4, conduct surveillance, conduct monitoring, cite infractions and to impose fines pursuant to this

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chapter. Except as otherwise provided herein, the Engineer shall administer, implement and enforce the provisions of this section.

E. The City Council shall approve and enter into interagency agreements as deemed necessary by the City Council to control the contribution of pollutants of the shared MS4.

5-7.104 Definitions.

Except as specifically provided herein, any term used in this chapter shall be defined as that term is defined in the current Municipal NPDES Permit, or if it is not specifically defined in the Municipal NPDES Permit, then as such term is defined in the Federal Clean Water Act, as amended, or the regulations promulgated thereunder. If the definition of any term contained in this section conflicts with the definition of the same term in the current Municipal NPDES Permit, then the definition contained in the Municipal NPDES Permit shall govern. The following words and phrases shall have the following meanings when used in this chapter:

"Area susceptible to runoff" means any surface directly exposed to precipitation or in the path of runoff caused by precipitation which path leads off the parcel on which the surface is located.

"Automotive service facilities" means a facility that is categorized in any one of the following Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes. For inspection purposes, Permittees need not inspect facilities with SIC codes 5013, 5014, 5511, 5541, 7532-7534, and 7536-7539 provided that these facilities have no outside activities or materials that may be exposed to stormwater.

"Basin Plan" means the Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, adopted by the Regional Water Board on June 13, 1994 and subsequent amendments.

"Best Management Practices (BMPs)" means practices or physical devices or systems designed to prevent or reduce pollutant loading from stormwater or non-stormwater discharges to receiving waters, or designed to reduce the volume of stormwater or non-stormwater discharged to the receiving water. Examples of BMPs may include public education and outreach, proper planning of development projects, proper cleaning of catch basin inlets, and proper sludge- or waste-handling and disposal, among others.

"Biofiltration" means a LID BMP that reduces stormwater pollutant discharges by intercepting rainfall on vegetative canopy, and through incidental infiltration and/or evapotranspiration, and filtration. Incidental infiltration is an important factor in achieving the required pollutant load reduction. Therefore, the term "biofiltration" as used in this

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chapter is defined to include only systems designed to facilitate incidental infiltration or achieve the equivalent pollutant reduction as biofiltration BMPs with an underdrain (subject to approval by the Regional Board's Executive Officer). Biofiltration BMPs include bioretention systems with an underdrain and bioswales.

"Bioretention" means a LID BMP that reduces stormwater runoff by intercepting rainfall on vegetative canopy, and through evapotranspiration and infiltration. The bioretention system typically includes a minimum 2-foot top layer of a specified soil and compost mixture underlain by a gravel-filled temporary storage pit dug into the in-situ soil. As defined in this Ordinance, a bioretention BMP may be designed with an overflow drain, but may not include an underdrain. When a bioretention BMP is designed or constructed with an underdrain it is regulated by the Municipal NPDES Permit as biofiltration.

"Bioswale" means a LID BMP consisting of a shallow channel lined with grass or other dense, low-growing vegetation. Bioswales are designed to collect stormwater runoff and to achieve a uniform sheet flow through the dense vegetation for a period of several minutes.

"City" means the City of Redondo Beach, California.

"Clean Water Act (CWA)" means the Federal Water Pollution Control Act enacted in 1972, by Public Law 92-500, and amended by the Water Quality Act of 1987. The Clean Water Act prohibits the discharge of pollutants to Waters of the United States unless the discharge is in accordance with an NPDES permit.

"Commercial development" means any development on private land that is not heavy industrial or residential. The category includes, but is not limited to: hospitals, laboratories and other medical facilities, educational institutions, recreational facilities, plant nurseries, car wash facilities, mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses and other light industrial complexes.

"Commercial Malls" means any development on private land comprised of one or more buildings forming a complex of stores which sells various merchandise, with interconnecting walkways enabling visitors to easily walk from store to store, along with parking area(s). A commercial mall includes, but is not limited to: mini-malls, strip malls, other retail complexes, and enclosed shopping malls or shopping centers

"Construction" means any construction or demolition activity, clearing, grading, grubbing, or excavation or any other activity that result in land disturbance. Construction does not include emergency construction activities required to immediately protect public health and safety or routine maintenance activities required to maintain the integrity of structures by performing minor repair and restoration work, maintain the original line and grade, hydraulic capacity, or original purposes of the facility. See "Routine Maintenance" definition for further explanation. Where clearing, grading or excavating of underlying soil takes place during a repaving operation, State General Construction Permit coverage by the State of California General Permit for Storm Water

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Discharges Associated with Industrial Activities or for Stormwater Discharges Associated with Construction Activities is required if more than one acre is disturbed or the activities are part of a larger plan

"Control" means to minimize, reduce, eliminate, or prohibit by technological, legal, contractual or other means, the discharge of pollutants from an activity or activities.

"Development" means any construction, rehabilitation, redevelopment or reconstruction of any public or private residential project (whether single family, multi-unit or planned unit development); industrial, commercial, retail and other nonresidential projects, including public agency projects; or mass grading for future construction. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Directly adjacent" means situated within two hundred (200) feet of the contiguous zone required for the continued maintenance, function, and structural stability of the environmentally sensitive area.

"Discharge" means when used without qualification the discharge of a pollutant.

"Discharge of a pollutant" means any addition of any pollutant or combination of pollutants to waters of the United States from any point source or, any addition of any pollutant or combination of pollutants to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. The term discharge includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by a state, municipality, or other person which do not lead to treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

"Discharging" directly means outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject, property, development, subdivision, or industrial facility, and not commingled with the flows from adjacent lands.

"Discretionary project" is defined in the same manner as Section 15357 of the Guidelines for Implementation of the California Environmental Quality Act contained in Title 14 of the California Code of Regulations, as amended, and means a project which requires the exercise of judgment or deliberation when the City decides to approve or disapprove a particular activity, as distinguished from situations where the City merely has to determine whether there has been conformity with applicable statutes, ordinances or regulations.

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"Disturbed area" means an area that is altered as a result of clearing, grading, and/or excavation.

"Engineer" means the City Engineer and persons directed by him or her and under the instruction and supervision of the City Engineer who are assigned to enforce this chapter.

"Environmentally sensitive area (ESA)" means an area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments (California Public Resources Code § 30107.5). Areas subject to storm water mitigation requirements are areas designated as Significant Ecological Areas by the County of Los Angeles (Los Angeles County Significant Areas Study, Los Angeles County Department of Regional Planning (1976) and amendments); an area designated as a Significant Natural Area by the California Department of Fish and Games Significant Natural Areas Program, provided that area has been field verified by the Department of Fish and Game; an area listed in the Basin Plan as supporting the Rare, Threatened, or Endangered Species (RARE) beneficial use; and an area identified by the City as environmentally sensitive.

"Flow-through treatment BMPs" means a modular, vault type "high flow biotreatment" devices contained within an impervious vault with an underdrain or designed with an impervious liner and an underdrain.

"Full Capture System" means any single device or series of devices, certified by the Executive Officer, that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate Q resulting from a one-year, one-hour storm in the sub-drainage area.

"Good housekeeping practices" means common practices related to the storage, use or cleanup of materials, performed in a manner that minimizes the discharge of pollutants. Examples include, but are not limited to, purchasing only the quantity of materials to be used at a given time, use of alternative and less environmentally harmful products, cleaning up spills and leaks, and storing materials in a manner that will contain any leaks or spills.

"General Construction Activities Storm Water Permit (GCASP)" means the general NPDES permit adopted by the State Board which authorizes the discharge of stormwater from construction activities under certain conditions.

"General Industrial Activities Storm Water Permit (GIASP)" means the general NPDES permit adopted by the State Board which authorizes the discharge of stormwater from certain industrial activities under certain conditions.

"Green Roof" means a LID BMP using planter boxes and vegetation to intercept rainfall on the roof surface. Rainfall is intercepted by vegetation leaves and through evapotranspiration. Green roofs may be designed as either a bioretention BMP or as a

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biofiltration BMP. To receive credit as a bioretention BMP, the green roof system planting medium shall be of sufficient depth to provide capacity within the pore space volume to contain the design storm depth and may not be designed or constructed with an underdrain.

"Hillside" means property located in an area with known erosive soil conditions, where the development contemplates grading on any natural slope that is twenty-five percent (25%) or greater and where grading contemplates cut or fill slopes.

"Illicit connection" means any human-made conveyance that is connected to the storm drain system without a permit, excluding gutters, roof-drains and other similar connections. Examples include channels, pipelines, conduits, inlets or outlets that are connected directly to the storm drain system.

"Illicit discharge" means any discharge to the storm drain system that is prohibited under local, state or federal statutes, ordinances, codes or regulations. This includes all non-stormwater discharges except discharges pursuant to a separate NPDES permit and discharges that are exempted or conditionally exempted in accordance with Part III the Municipal NPDES permit.

"Industrial/Commercial Facility" means any facility involved and/or used in the production, manufacture, storage, transportation, distribution, exchange or sale of goods and/or commodities, and any facility involved and/or used in providing professional and non-professional services. This category of facilities includes, but is not limited to, any facility defined by either the Standard Industrial Classifications (SIC) or the North American Industry Classification System (NAICS). Facility ownership (federal, state, municipal, private) and profit motive of the facility are not factors in this definition.

"Industrial Park" means land development that is set aside for industrial development. Industrial parks are usually located close to transport facilities, especially where more than one transport modalities coincide: highways, railroads, airports, and navigable rivers. It includes office parks, which have offices and light industry.

"Infiltration BMP" means a LID BMP that reduces stormwater runoff by capturing and infiltrating the runoff into in-situ soils or amended onsite soils. Examples of infiltration BMPs include infiltration basins, dry wells, and pervious pavement.

"Infiltration" means the downward entry of water into the surface of the soil.

"Low Impact Development" or "LID" consists of building and landscape features designed to retain or filter stormwater runoff.

"Material" means any substance including, but not limited to: garbage and debris; lawn clippings, leaves, and other vegetation; biological and fecal waste; sediment and

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sludge; oil and grease; gasoline; paints, solvents, cleaners, and any fluid or solid containing chemicals.

"Municipal NPDES Permit" means the Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities Therein, Except the City of Long Beach (Order No. R4-2012-0175), NPDES Permit No. CAS00401), issued by the California Regional Water Quality Control Board—Los Angeles Region, and any successor permit to that permit.

"Municipal Separate Storm Sewer System (MS4)" means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

1. Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States;

2. Designed or used for collecting or conveying stormwater;

3. Which is not a combined sewer; and

4. Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR Section 122.2.

"New development" means land-disturbing activities; structural development, including construction or installation of a building or structure, creation of impervious surfaces; and land subdivision.

"Non-stormwater discharge" means any discharge to a municipal stormwater system that is not composed entirely of stormwater.

"NPDES permit" means any waste discharge requirements issued by the Regional Board or the State Water Resources Control Board in the form of an NPDES permit pursuant to Water Code Section 13370 (other than the Municipal NPDES Permit).

"Outfall" means a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances with connect segments of the same stream or other waters of the United Sates and are used to convey waters of the United States. (40 CFR Section 122.26(b)(9))

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"Parking lot" means land area or a facility for the parking or storage of motor vehicles used for businesses, commerce, industry or personal use with a lot size of five thousand (5,000) square feet or more of surface area, or with twenty-five (25) or more parking spaces.

"Planning priority projects" means those projects specified in Section 18.04.105.C of this chapter that are required to incorporate appropriate storm water mitigation measures into the design plan for their respective projects.

"Pollutant" means those pollutants defined in Section 502(6) of the federal Clean Water Act (33 U.S.C. Section 1362(6)), or incorporated into California Water Code Section 13373. The term "pollutant" shall not include uncontaminated stormwater, potable water or reclaimed water generated by a lawfully permitted water treatment facility.

"Project" means all development, redevelopment, and land disturbing activities. The term is not limited to "Project" as defined under CEQA (California Public Resources Code Section 21065).

"Rainfall Harvest and Use" means a LID BMP system designed to capture runoff, typically from a roof but can also include runoff capture from elsewhere within the site, and to provide for temporary storage until the harvested water can be used for irrigation or non-potable uses. The harvested water may also be used for potable water uses if the system includes disinfection treatment and is approved for such use by the local building department (Order No. R4-2012-0175).

"Receiving Water" means "water of the United States" into which waste and/or pollutants are or may be discharged.

"Redevelopment" means land-disturbing activity that result in the creation, addition, or replacement of 5,000 square feet or more of impervious surface area on an already developed site. Redevelopment includes, but is not limited to: the expansion of a building footprint; addition or replacement of a structure; replacement of impervious surface area that is not part of routine maintenance activity; and land disturbing activity related to structural or impervious surfaces. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Regional Board" means the California Regional Water Quality Control Board—Los Angeles Region.

"Restaurant" means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption. (SIC Code 5812).

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"Retail gasoline outlet" means any facility engaged in selling gasoline and lubricating oils.

"Routine Maintenance" includes, but is not limited to projects conducted to:

1. Maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

2. Perform as needed restoration work to preserve the original design grade, integrity and hydraulic capacity of flood control facilities.

3. Includes road shoulder work, regrading dirt or gravel roadways and shoulders and performing ditch cleanouts.

4. Update existing lines and facilities, which include replacing existing lines with new materials or pipes, to comply with applicable codes, standards, and regulations regardless if such projects result in increased capacity.

5. Repair leaks.

Routine maintenance does not include construction of new lines or facilities resulting from compliance with applicable codes, standards and regulations. New lines are those that are not associated with existing facilities and are not part of a project to update or replace existing lines.

"Runoff" means any runoff including storm water and dry weather flows from a drainage area that reaches a receiving water body or subsurface. During dry weather it is typically comprised of base flow either contaminated with pollutants or uncontaminated, and nuisance flows.

"Significant Ecological Area" means an area that is determined to possess an example of biotic resources that cumulatively represent biological diversity, for the purposes of protecting biotic diversity, as part of the Los Angeles County General Plan. Areas are designated as SEAs, if they possess one or more of the following criteria:

1. The habitat of rare, endangered, and threatened plant and animal species.

2. Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind, or are restricted in distribution on a regional basis or within Los Angeles County.

3. Habitat that at some point in the life cycle of a species or group of species, serves as a concentrated breeding, feeding, resting, migrating grounds and is limited in availability either regionally or within Los Angeles County.

4. Biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or represent an unusual variation in a population or community.

5. Areas important as game species habitat or as fisheries.

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6. Areas that would provide for the preservation of relatively undisturbed examples of natural biotic communities in Los Angeles County.

7. Special areas.

"Site" means the land or water area where any facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

"Source control BMP" means any schedule of activities, prohibition of practices, maintenance procedures, managerial practices or operational practices that aim to prevent stormwater pollution by reducing the potential for contamination at the source of pollution.

"Standard urban stormwater mitigation plan" or "SUSMP" means a report submitted by an applicant for approval by the Engineer prior to issuance of a building, grading, planning or similar permit outlining the necessary LID requirements and BMPs which must be incorporated into design plans for development or redevelopment projects.

"Storm Drain System" means any facility or any parts of the facility, including streets, gutters, conduits, natural or artificial drains, channels and watercourse that are used for the purpose of collecting, storing, transporting or disposing of stormwater and are located within the City.

"Stormwater runoff" means that part of precipitation (rainfall) which travels via flow across a surface to the MS4 or receiving waters from impervious, semi-pervious or pervious surfaces. When all other factors are equal, runoff increases as the perviousness of a surface decreases.

"Structural BMP" means any structural facility designed and constructed to mitigate the adverse impacts of stormwater and urban runoff pollution (e.g. canopy, structural enclosure). Structural BMPs may include both treatment control BMPs and source control BMPs.

"Treatment" means the application of engineered systems that use physical, chemical or biological processes to remove pollutants. Such processes include, but are not limited to, filtration, gravity settling, media adsorption, biodegradation, biological uptake, chemical oxidation and UV radiation.

"Treatment control BMP" means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption or any other physical, biological or chemical process.

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"Urban runoff" means surface water flow produced by non-stormwater resulting from residential, commercial and industrial activities involving the use of potable and nonpotable water.

5-7.105 Construction and application.

This chapter shall be construed to assure consistency with the requirements of the federal Clean Water Act and acts amendatory or supplementary to the Federal Clean Water Act, applicable implementing regulations, and the Municipal NPDES Permit, and any amendment, revision or reissuance of the Municipal NPDES Permit.

5-7.106 Inspection.

The Engineer, or his representative, shall be authorized at any reasonable time to enter the premises of any property discharging to the MS4 to determine compliance with the provisions of this chapter; such inspection may include but not be limited to: sampling, monitoring, reviewing, photographing, videotaping and inspecting treatment facilities and discharge location.

5-7.107 Storm drain impact fees.

A. Every applicant for a permit pursuant to Section 9-1.02 of this Code for development construction shall pay a storm drain impact fee.

B. The proceeds of the storm drain impact fee shall be applied to offset the City's costs of enforcing the order as a result of development construction, and the amount of the storm drain impact fee shall not exceed the City's reasonable costs therefor.

C. The amount of the storm drain impact fee shall be established by resolution of the City Council, as amended from time to time, in accordance with the provisions of this section, as amended from time to time.

D. The City Engineer shall administer and collect the storm drain impact fee.

E. Permits issued pursuant to Section 9-1.02 for development construction shall not be issued until payment of the storm drain impact fee.

5-7.108 Critical source of pollution inspection fee.

A. Every person required to obtain a license pursuant to Redondo Beach Municipal Code Section 6-1.06 and also engaged in a business designated in the Municipal NPDES permit as a critical source of pollution shall pay an annual critical source of pollution inspection fee.

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B. The proceeds of the critical source of pollution inspection fee shall be applied to offset the City's costs of performing the inspections required by the Municipal NPDES permit and the amount of the critical source of pollution inspection fee shall not exceed the City's reasonable costs therefor.

C. The amount of the critical source of pollution inspection fee shall be established by resolution of the City Council as amended from time to time in accordance with provisions of this section.

D. The License Clerk and Collector shall administer and collect the critical source of pollution inspection fee.

E. No license issued pursuant to Redondo Beach Municipal Code Section 6-1.06 shall be issued or renewed until payment of the critical source of pollution inspection fee is received by the License Clerk and Collector.

5-7.109 Prohibited activities.

A. Illicit Discharges and Connections. It is prohibited to commence, establish, use, maintain or continue any illicit connections to the MS4 or any illicit discharges to the MS4. This prohibition against illicit connections applies to the use, maintenance or continuation of any illicit connection, whether that connection was established prior to or after the effective date of this chapter.

B. Littering. No person shall throw, deposit, place, leave, maintain, keep or permit to be thrown, deposited, placed, left or maintained or kept, any refuse, rubbish, garbage, or any other discarded or abandoned objects, articles or accumulations, in or upon any street, alley, sidewalk, storm drain, inlet, catch basin conduit or drainage structure, business place, or upon any or private plot of land in the City, so that the same might be or become a pollutant. No person shall throw or deposit litter in any fountain, pond, lake, stream, or other body of water within the City. This section shall not apply to refuse, rubbish or garbage deposited in containers, bags or other appropriate receptacles which are placed in designated locations for regular solid waste pick-up and disposal.

C. Disposal of Landscape Debris. No person shall dispose of leaves, dirt, or other landscape debris into the municipal separate stormwater system.

D. Non-stormwater Discharges. The following non-stormwater discharges into the MS4 are prohibited unless in compliance with a separate NPDES permit or pursuant to a discharge exemption by the Regional Board, the Regional Board's Executive Officer, or the State Water Resources Control Board:

1. The discharge of untreated wash waters to the MS4 when gas stations, auto repair garages, or other type of automotive service facilities are cleaned;

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2. The discharge of untreated wastewater to the MS4 from mobile auto washing, steam cleaning, mobile carpet cleaning, and other such mobile commercial and industrial operations;

3. To the maximum extent practicable, discharges to the MS4 from areas where repair of machinery and equipment, including motor vehicles, which are visibly leaking oil, fluid or antifreeze, is undertaken;

4. Discharges of untreated runoff to the MS4 from storage areas of materials containing grease, oil, or other hazardous substances, and uncovered receptacles containing hazardous materials;

5. Discharges of commercial/municipal swimming pool filter backwash to the MS4;

6. Discharges of untreated runoff from the washing of toxic materials from paved or unpaved areas to the MS4; provided, however, that nonindustrial and noncommercial activities which incidentally generate urban runoff, such as the hosing of sidewalks, shall be excluded from this prohibition;

7. To the maximum extent practicable, discharges to the MS4 from washing impervious surfaces in industrial/commercial areas which results in a discharge of untreated runoff to the MS4, unless specifically required by state law, or the City's Municipal code, or Los Angeles County's Health and Safety Codes, or permitted under a separate NPDES permit;

8. Discharges from the washing out of concrete trucks into the MS4;

9. Discharges to the MS4 of any pesticide, fungicide or herbicide, banned by the USEPA or the California Department of Pesticide Regulation; or

10. The disposal of hazardous wastes into trash containers used for municipal trash disposal where such disposal causes or threatens to cause a direct or indirect discharge to the MS4.

E. Car Washing. No motor vehicle, boat, trailer, or other type of mobile transportation may be washed, other than at a commercial carwash, unless such vehicle is being washed by:

1. A resident at their residence using a hand-held bucket or a water hose equipped with an automatic shutoff nozzle as long as water does not flow onto streets; or

2. A business that has an approved car wash facility for its fleet vehicles, provided that water does not flow onto streets.

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5-7.110 Exempted discharges, conditionally exempted discharges or designated discharges.

A. Discharges from those activities specifically identified in, or pursuant to, Part III.A.1-3 of the Municipal NPDES Permit as being exempted discharges, conditionally exempted discharges or designated discharges shall not be considered a violation of this chapter; provided that, consistent with Part III.A.1-3 of the Municipal NPDES Permit:

1. Any applicable BMPs developed pursuant to the Municipal NPDES Permit are implemented to minimize any adverse impacts from such identified sources;

2. The discharger meets all notification, reporting and recordkeeping requirements; and

3. The discharger has conducted all applicable monitoring requirements.

B. Discharges in Violation of the Municipal NPDES Permit. Any discharge that would result in or contribute to a violation of the Municipal NPDES Permit, either separately or in combination with other discharges, is prohibited. Liability for any such discharge shall be the responsibility of the person(s) causing or responsible for the discharge, and such person(s) shall defend, indemnify and hold harmless the City from all losses, liabilities, claims or causes of actions in any administrative or judicial action relating to such discharge.

5-7.111 Good housekeeping provisions.

Owners and occupants of property within the City shall comply with the following requirements:

A. Septic Waste. No person shall leave, deposit, discharge, dump, or otherwise expose any chemical or septic waste to precipitation in an area where a discharge to City streets or MS4 may or does occur.

B. Use of Water. Runoff of water used for irrigation purposes shall be minimized to the maximum extent practicable. Runoff of water from the permitted washing down of paved areas shall be minimized to the maximum extent practicable.

C. Storage of Materials, Machinery and Equipment. Machinery or equipment that is to be repaired or maintained in areas susceptible to or exposed to stormwater, shall be placed in a manner so that leaks, spills and other maintenance-related pollutants are not discharged to the MS4.

D. Removal and Disposal of Debris from Industrial/Commercial Motor Vehicle Parking Lots. Industrial/commercial motor vehicle parking lots with more than twenty-

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five (25) parking spaces that are located in areas potentially exposed to stormwater shall be swept regularly or other equally effective measures shall be utilized to remove debris from such parking lots.

E. Food Wastes. Food wastes generated by nonresidential food service and food distribution sources shall be properly disposed of and in a manner so such wastes are not discharged to the MS4.

F. Best Management Practices. Best management practices shall be used in areas exposed to stormwater for the removal and lawful disposal of all fuels, chemicals, fuel and chemical wastes, animal wastes, garbage, batteries, or other materials which have potential adverse impacts on water quality.

G. Maintenance of Structural BMPs. Structural BMPs shall be properly operated and maintained, consistent with the approved SUSMP. Records and documentation of such maintenance shall be provided to the Engineer upon request.

5-7.112 Requirements for industrial/commercial and construction activities.

A. Industrial/Commercial and Construction Related Dischargers Generally. Each discharger associated with industrial/commercial activity or construction activity, or other discharger described in any general NPDES permit addressing such discharges, as may be issued by the U.S. Environmental Protection Agency, the State Water Resources Control Board, or the Regional Board shall comply with all requirements of such NPDES permit and the City's development construction program. Each discharger identified in an individual NPDES permit shall comply with and undertake all activities required by such permit. Proof of compliance with any such NPDES permit and the City's development construction program may be required in a form acceptable to the Engineer prior to the issuance of any grading, building or occupancy permits, or any other type of permit or license issued by the City.

B. Non-stormwater discharges to the MS4 from industrial, commercial or construction activities in violation of any applicable NPDES permit or the City's development construction program are prohibited.

C. Source Control BMPs for Industrial/Commercial Facilities. Industrial/commercial facilities shall implement the effective source control BMPs listed in Table 10 of Part VI.D.6.f. of the Municipal NPDES Permit, unless a particular pollutant generating activity does not occur on a facility's site.

5-7.113 Standard urban stormwater mitigation plan (SUSMP) and low impact development (LID) requirements for new development and redevelopment projects.

CITY OF HUNTINGTON BEACH CITY ATTORNEY'S OFFICE APPROVED BY LEGAL DEPARTMENT

A. Objective. Pursuant to Part VI.D.7.b of the Municipal NPDES Permit, the provisions of this section establish requirements for construction activities and facility operations of development and redevelopment projects to comply with the current Municipal NPDES Permit to lessen the water quality impacts of development by using smart growth practices and integrate LID practices and standards for stormwater pollution mitigation through means of infiltration, evapotranspiration, biofiltration, and rainfall harvest and use. Except as otherwise provided herein, the City shall administer, implement and enforce the provisions of this section.

B. Scope. This section contains requirements for stormwater pollution control measures in development and redevelopment projects and authorizes the City to further define and adopt stormwater pollution control measures, and to develop LID principles and requirements, including but not limited to the objectives and specifications for integration of LID strategies. As specified in this section, certain Planning Priority Projects shall meet the requirements of this section through the preparation and submittal of a standard urban stormwater mitigation plan (SUSMP), which shall include the applicable LID requirements set forth in this section as an element of the SUSMP.

C. LID Standards Manual. The Engineer shall prepare, maintain, and update, as deemed necessary and appropriate, a manual ("LID Standards Manual"), which shall include urban and stormwater runoff quantity and quality control development principles and technologies for achieving compliance with the provisions of this section. The LID Standards Manual shall also include technical feasibility and implementation parameters, as well as other rules, requirements, and procedures as the Engineer deems necessary, for implementing the provisions of this Chapter.

D. Applicability – Planning Priority Projects. The following development and redevelopment projects shall be designated as Planning Priority Projects, which are subject to City conditioning and approval for the design and implementation of post-construction controls to mitigate storm water pollution prior to completion of the projects, and shall meet the requirements of this section:

1. New Development Projects.

a. All development projects equal to one (1) acre or greater of disturbed area that adds more than 10,000 square feet of impervious surface area.

b. Industrial parks 10,000 square feet or more of surface area.

c. Commercial malls 10,000 square feet or more of surface area.

d. Retail gasoline outlets with 5,000 square feet or more of surface area.

e. Restaurants (Standard Industrial Classification (SIC) of 5812) with 5,000 square feet or more of surface area.

f. Parking lots with 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces.

CITY OF FOUNTAIN VALLEY CITY ATTORNEY'S OFFICE APPROVED BY LEGAL DEPARTMENT

g. Streets and roads construction of 10,000 square feet or more of impervious surface area. Street and road construction applies to standalone streets, roads, highways, and freeway projects, and also applies to streets within larger projects.

h. Automotive service facilities (Standard Industrial Classification (SIC) of 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) 5,000 square feet or more of surface area.

i. Projects located in or directly adjacent to, or discharging directly to an Significant Ecological Area (SEA), where the development will:

(i) Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and

(ii) Create 2,500 square feet or more of impervious surface area.

j. Single-family hillside homes.

2. Redevelopment Projects

a. Land disturbing activity that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site on Planning Priority Project categories.

b. Where Redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-construction stormwater quality control requirements, the entire project must be mitigated.

c. Where Redevelopment results in an alteration of less than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-construction stormwater quality control requirements, only the alteration must be mitigated, and not the entire development.

d. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of facility or emergency redevelopment activity required to protect public health and safety. Impervious surface replacement, such as the reconstruction of parking lots and roadways which does not disturb additional area and maintains the original grade and alignment, is considered a routine maintenance activity. Redevelopment does not include the repaving of existing roads to maintain original line and grade.

e. Existing single-family dwelling and accessory structures are exempt from the Redevelopment requirements unless such projects create, add, or replace 10,000 square feet of impervious surface area.

E. Stormwater Pollution Control Requirements. The site for every Planning Priority Project shall be designed to control pollutants, pollutant loads, and runoff volume to the maximum extent feasible by minimizing impervious surface area and

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controlling runoff from impervious surfaces through infiltration, evapotranspiration, bioretention and/or rainfall harvest and use. In addition, the following specific requirements apply:

1. New Single-Family Hillside Homes. A new single-family hillside home development project shall include mitigation measures to:

a. Conserve natural areas;

b. Protect slopes and channels;

c. Provide storm drain system stenciling and signage;

d. Divert roof runoff to vegetated areas before discharge unless the diversion would result in slope instability; and

e. Direct surface flow to vegetated areas before discharge, unless the diversion would result in slope instability.

2. Street and Road Construction of 10,000 square feet or more. Street and road construction of 10,000 square feet or more of impervious surface shall follow the City's Green Street Manual developed by the Engineer and approved by City Council resolution. The City's Green Street Manual shall be based on the USEPA guidance regarding Managing Wet Weather with Green Infrastructure: Green Streets (December 2008 EPA-833-F-08-009).

3. Remainder of Planning Priority Projects Require a SUSMP. Except for the projects listed in paragraphs (1) and (2) of subsection D of this section, all other Planning Priority Projects shall prepare and submit to the Engineer for review and approval a SUSMP which shall also contain LID requirements consistent with Parts VI.D.7.c and VI.D.7.d(iii) of the Municipal NPDES Permit. In addition, Planning Priority Projects subject to this paragraph (3) shall do the following:

a. Incorporate the SUSMP into Project Plans. An applicant for a Planning Priority Project identified in paragraph (3) of subsection D of this section shall incorporate into the applicant's project plans a Storm Water Mitigation Plan (SWMP), which includes those BMPs necessary to control storm water pollution from construction activities and facility operations, as set forth in the SUSMP applicable to the applicant's project. Structural or Treatment Control BMPs (including, as applicable, post-construction treatment control BMPs) set forth in project plans shall meet the design standards set forth in the SUSMP and the current Municipal NPDES Permit.

b. Verify Maintenance of BMPs. If a project applicant has included or is required to include structural or treatment control BMPs in project plans, the applicant shall provide verification of maintenance provisions. The verification shall include the applicant's signed statement, as part of its project application, accepting responsibility for all structural and treatment control BMP maintenance until such time, if any, the property is transferred.

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E. Issuance of Discretionary Permits. No discretionary permit may be issued for any Planning Priority Project identified in this section until the Engineer confirms the project plans comply with the applicable requirements of this section.

F. Issuance of Certificates of Occupancy. As a condition for issuing a certificate of occupancy for a Planning Priority Project identified in this section, the Engineer shall require facility operators and/or owners to build all the stormwater pollution control BMPs and structural or treatment control BMPs that are shown on the approved project plans and to submit a signed certification statement stating that the site and all structural or treatment control BMPs will be maintained in compliance with the SUSMP and other applicable regulatory requirements.

G. Transfer of Properties Subject to Requirement for Maintenance of Structural and Treatment Control BMPs.

1. The transfer or lease of a property subject to a requirement for maintenance of structural and treatment control BMPs shall include conditions requiring the transferee and its successors and assigns to either (a) assume responsibility for maintenance of any existing structural or treatment control BMP or (b) to replace an existing structural or treatment control BMP with new control measures or BMPs meeting the then current standards of the City and the SUSMP. Such requirement shall be included in any sale or lease agreement or deed for such property. The condition of transfer shall include a provision that the successor property owner or lessee conduct maintenance inspections of all structural or treatment control BMPs at least once a year and retain proof of inspection.

2. For residential properties where the structural or treatment control BMPs are located within a common area which will be maintained by a homeowners association, language regarding the responsibility for maintenance shall be included in the projects conditions, covenants and restrictions (CC&Rs). Printed educational materials will be required to accompany the first deed transfer to highlight the existence of the requirement and to provide information on what stormwater management facilities are present, signs that maintenance is needed, and how the necessary maintenance can be performed. The transfer of this information shall also be required with any subsequent sale of the property.

3. If structural or treatment control BMPs are located within an area proposed for dedication to a public agency, said BMPs shall be the responsibility of the developer until the dedication is accepted by the public agency.

H. CEQA. Provisions of this section shall be complementary to, and shall not replace, any applicable requirements for stormwater mitigation required under the California Environmental Quality Act.

5-7.114 Enforcement.

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A. Violations Deemed a Public Nuisance.

1. The following violations shall be deemed a public nuisance:

a. Any condition caused or permitted to exist in violation of any of the provisions of this chapter; or

b. Any failure to comply with any applicable requirement of either the SUSMP or an approved stormwater mitigation plan with respect to a property; or

c. Any false certification or verification, or any failure to comply with a certification or verification provided by a project applicant or the applicant's successor in interest; or

d. Any failure to properly operate and maintain any structural or treatment control BMP on a property in accordance with an approved stormwater mitigation plan or the SUSMP, is determined to be a threat to the public health, safety and welfare, is declared and deemed a public nuisance, and may be abated or restored by any Engineer, and a civil or criminal action to abate, enjoin or otherwise compel the cessation of such nuisance may be brought by the City Attorney.

2. The cost of such abatement and restoration shall be borne by the owner of the property and the cost shall be billed to the owner of the property, as provided by law or ordinance for the recovery of nuisance abatement costs,

3. If any violation of this chapter constitutes a seasonal and recurrent nuisance, the Engineer shall so declare. The failure of any person to take appropriate annual precautions to prevent stormwater pollution after written notice of a determination under this section shall constitute a public nuisance and a violation of this chapter.

B. Concealment. Causing, permitting, aiding, abetting or concealing a violation of any provision of this chapter shall constitute a violation of such provision.

C. Civil Actions. In addition to any other remedies provided in this chapter, any violation of this chapter may be enforced by civil action brought by the City. In any such action, the City may seek any or all of the following remedies:

1. A temporary and/or permanent injunction;

2. Assessment of the violator for the costs of any investigation, inspection or monitoring survey which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this section;

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3. Costs incurred in removing, correcting or terminating the adverse effects resulting from violation;

4. Compensatory damages for loss or destruction to water quality, wildlife, fish and aquatic life.

D. Administrative Enforcement Powers. In addition to the other enforcement powers and remedies established by this chapter, the Engineer has the authority to utilize the following administrative remedies:

1. Cease and Desist Orders. When a discharge has taken place or is likely to take place in violation of this chapter, the Engineer may issue an order to cease and desist such discharge, or practice or operation likely to cause such discharge and direct that those persons not complying shall: (a) comply with the requirement; (b) comply with a time schedule for compliance; and (c) take appropriate remedial or preventive action to prevent the violation from recurring.

2. Notice to Clean. Whenever the Engineer finds any oil, earth, debris, grass, weeds, dead trees, tin cans, rubbish, refuse, waste or any other material of any kind, in or upon the sidewalk abutting or adjoining any parcel of land, or upon any parcel of land or grounds, which may result in pollutants entering the MS4 or a non-stormwater discharge to the MS4, he or she may give notice to the owner or occupant of the adjacent property to remove such oil earth, debris, grass, weeds, dead trees, tin cans, rubbish, refuse, waste or other material, in any manner that he or she may reasonably provide. The recipient of such notice shall undertake the activities as described in the notice.

E. Penalties. Violation of this chapter shall be punishable as provided in Chapter 1-2.01 of this Code. Each day that a violation continues shall constitute a separate offense.

F. Permit Revocation. To the extent the City makes a provision of this chapter or any identified BMP a condition of approval to the issuance of a permit or license, any person in violation of such condition is subject to the permit revocation procedures set forth in this code.

G. Burden of Proof. In an enforcement action, the burden of proof shall be on the person who is the subject of such action to establish that the reduction or elimination of the discharge to the maximum extent practicable has been accomplished through compliance with the best management practices available, including applicable monitoring, notifications and reporting requirements.

H. Remedies. Remedies under this chapter are in addition to and do not supersede or limit any and all other available remedies, civil or criminal. The remedies provided for in this chapter shall be cumulative and not exclusive.

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5-7.115 No taking.

The provisions of this chapter shall not operate to deprive any property owner of substantially all of the market value of such owner's property or otherwise constitute an unconstitutional taking without compensation."

Section 2. **Severability**. If any section, subsection, sentence, clause, phrase or portion of this ordinance for any reason is held to be invalid or unconstitutional by any court of competent jurisdiction, such decision shall not affect the validity or the remaining portions of this ordinance. The City Council of the City of Redondo Beach hereby declares that it would have adopted this ordinance and each section, subsection, sentence, clause, phrase or portion thereof irrespective of the fact that any one or more sections, subsections, sentences, clauses, phrases or portions were to be declared invalid or unconstitutional.

Section 3. **CEQA.** The City Council hereby finds, in the exercise of its independent judgment and analysis, that this ordinance is exempt from the California Environmental Quality Act ("CEQA") because the Low Impact Development requirements for new development and redevelopment projects of this Ordinance will not have a significant effect on the environment, and the adoption of this Ordinance and the timing thereof is mandated by the action of the Los Angeles Regional Water Quality Control Board ("LARWQCB"). In this case, the City is acting at the direction of the LARWQCB and federal law to protect, maintain, restore and enhance natural resources and the environment. To comply with the requirements of the LARWQCB, the City Council finds that the adoption of this Ordinance is categorically exempt from the requirements of the California Environmental Quality Act ("CEQA") pursuant to CEQA Guidelines Sections 15307 and 15308. Staff is hereby directed to prepare and post a notice of exemption pursuant to Guidelines Section 15062.

SECTION 4. INCONSISTENT PROVISIONS. Any provisions of the Redondo Beach Municipal Code, or appendices thereto, or any other ordinances of the City inconsistent herewith, to the extent of such inconsistencies and no further, are hereby repealed.

SECTION 5. SEVERANCE. If any section, subsection, sentence, clause, or phrase of this ordinance is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of the ordinance. The City Council hereby declares that it would have passed this ordinance and each section, subsection, sentence, clause and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, or phrases be declared invalid or unconstitutional.

SECTION 6. PUBLICATION AND EFFECTIVE DATE. This ordinance shall be published by one insertion in the official newspaper of the City, and the same shall go into effect and be in full force and operation from and after thirty (30) days after its final passage and adoption.

CITY OF REDONDO BEACH CITY ATTORNEY'S OFFICE APPROVED AS TO FORM

PASSED, APPROVED AND ADOPTED this ____ day of April, 2015.

Steve Aspel, Mayor

ATTEST:

STATE OF CALIFORNIA)
COUNTY OF LOS ANGELES) SS
CITY OF REONDO BEACH)

I, Eleanor Manzano, City Clerk of the City of Redondo Beach, California, do hereby certify that the foregoing Ordinance No. _____ was duly introduced at a regular meeting of the City Council held on the ___ day of _____, 2015, and was duly approved and adopted by the City Council at a regular meeting of said City Council held on the _____ day of , 2015, by the following vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

Eleanor Manzano, City Clerk

APPROVED AS TO FORM:

Michael W. Webb, City Attorney

ORDINANCE NO. ___

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF TORRANCE, CALIFORNIA AMENDING IN ITS ENTIRETY CHAPTER 7 OF TITLE 5 OF THE TORRANCE MUNICIPAL CODE REGARDING STORMWATER AND URBAN RUNOFF POLLUTION CONTROL REGULATIONS AND MAKING A DETERMINATION OF EXEMPTION UNDER CEQA

WHEREAS, the federal Clean Water Act provides for the regulation and reduction of pollutants discharged into the waters of the United States by extending National Pollutant Discharge Elimination System ("NPDES") requirements to stormwater and urban runoff discharged into municipal storm drain systems.

WHEREAS, the City of Torrance (the "City") is a co-permittee under the "Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Except those Discharges Originating from the City of Long Beach MS4, Order No. R4-2012-0175, NPDES Permit No. CAS00401" ("MS4 Permit") issued by the California Regional Water Quality Control Board—Los Angeles Region, and, as a co-permittee under the MS4 Permit, the City is required to adopt ordinances and implement procedures with respect to discharges into the municipal separate storm sewer system ("MS4").

WHEREAS, the City has previously adopted ordinances to ensure that it possesses the legal authority necessary to control discharges to and from those portions of the MS4 over which it has jurisdiction, in order to comply with the MS4 Permit, and to specifically prohibit certain discharges identified in the MS4 Permit.

WHEREAS, Chapter 7 of Title 5 of the Torrance Municipal Code is being revised in order to comply with the current MS4 Permit.

NOW, THEREFORE, the City Council of the City of Torrance, California does hereby ordain as follows:

Section 1. Chapter 7 of Title 5 of the Torrance Municipal Code is hereby amended in its entirety to read as follows:

"5-7.101 Title.

This chapter shall be known as the City of Torrance Stormwater Management and Discharge Control Ordinance.

5-7.102 Findings.

A. The federal Clean Water Act (33 U.S.C. Section 1251, *et seq.*,) provides for the regulation and reduction of pollutants discharged into the waters of the United States by

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extending National Pollutant Discharge Elimination System ("NPDES") requirements to stormwater and urban runoff discharge into municipal storm drain systems;

B. Stormwater and urban runoff flows from individual properties onto streets, then through storm drains passing through the City and finally into the waters of the United States;

C. The City is a co-permittee under the "Waste Discharge Requirements for Municipal Separate Storm Sewer System ("MS4") discharges within the Coastal Watersheds of Los Angeles County, except those discharges originating from the City of Long Beach MS4, which also serves as a NPDES Permit under the federal Clean Water Act (NPDES No. CAS614001), as well as waste discharge requirements under California law (the Municipal NPDES Permit") and, as a co-permittee under the Municipal NPDES Permit, the City is required to adopt ordinances and implement procedures with respect to the entry of non-stormwater discharges into the municipal stormwater system;

D. Part III, Section A of the Municipal NPDES Permit requires the City to effectively prohibit non-stormwater discharges from within its boundaries, into that portion of the MS4 which it owns or operates and into watercourses, except where such discharges are: (1) in compliance with a separate individual or general NPDES permit, or (2) identified and in compliance with Part III.A (non-stormwater discharges) of the Municipal NPDES Permit, or (3) originate from federal, state or other facilities which the City is preempted from regulating, and further provides that compliance with the terms of the Municipal NPDES Permit through the development and implementation of the programs described in the Municipal NPDES Permit will constitute compliance with the discharge prohibition in the Municipal NPDES Permit;

E. Part VI, Section A.2 of the Municipal NPDES Permit requires the City to establish and maintain the legal authority necessary to control discharges to and from those portions of the MS4 over which it has jurisdiction, so as to comply with the Municipal NPDES Permit and to specifically prohibit certain discharges identified in the Municipal NPDES Permit;

F. The Municipal NPDES Permit contemplates the development of an Enhanced Watershed Management Program in which the City will participate, which will in turn require the development and the implementation of programs for, among other things, the elimination of illicit connections and illicit discharges, development planning, development construction, and public information and education requirements, and which may require the later adoption of additional legal authority to implement such programs as they are developed by the permittees and approved by the Regional Board;

G. In order to control, in a cost-effective manner, the quantity and quality of stormwater and urban runoff to the maximum extent practicable, the adoption of the ordinance codified in this chapter is essential.

5-7.103 Purpose and intent.

A. The purpose of this chapter is to ensure the future health, safety and general welfare of the citizens of the City and the water quality of the receiving waters of the County of Los Angeles and surrounding coastal areas by:

1. Reducing pollutants in stormwater discharges to the maximum extent practicable;

2. Regulating illicit connections and illicit discharges and reducing the level of contamination of stormwater and urban runoff in the municipal stormwater system; and

3. Regulating non-stormwater discharges to the municipal stormwater system.

B. The intent of this chapter is to protect and enhance the quality of watercourses, water bodies, and wetlands within the City in a manner consistent with the federal Clean Water Act, the California Porter-Cologne Water Quality Control Act and the Municipal NPDES Permit.

C. This chapter is also intended to provide the City with the legal authority necessary to control discharges to and from those portions of the municipal stormwater system over which it has jurisdiction as required by the Municipal NPDES Permit, and fully and timely comply with the terms of the Municipal NPDES Permit while the Enhanced Watershed Management Program is being developed by the City as part of the Beach Cities Watershed Management Group, and in contemplation of the subsequent amendment of this chapter or adoption by the City of additional provisions of this chapter to implement the subsequently adopted Enhanced Watershed Management Program, or other programs developed under the Municipal NPDES Permit.

D. This chapter also sets forth requirements for the construction and operation of certain commercial development, new development and redevelopment and other projects (as further defined herein) which are intended to ensure compliance with the stormwater mitigation measures prescribed in the current MS4 Permit. This chapter authorizes the Engineer to define and adopt applicable best management practices and other stormwater pollution control measures, as provided herein, to carry out all inspections including entering entities discharging to the MS4, conduct surveillance, conduct monitoring, cite infractions and to impose fines pursuant to this chapter. Except as otherwise provided herein, the Engineer shall administer, implement and enforce the provisions of this section.

E. The City Council shall approve and enter into interagency agreements as deemed necessary by the City Council to control the contribution of pollutants of the shared MS4.

5-7.104 Definitions.

Except as specifically provided herein, any term used in this chapter shall be defined as that term is defined in the current Municipal NPDES Permit, or if it is not specifically defined in the Municipal NPDES Permit, then as such term is defined in the Federal Clean Water Act, as

amended, or the regulations promulgated thereunder. If the definition of any term contained in this section conflicts with the definition of the same term in the current Municipal NPDES Permit, then the definition contained in the Municipal NPDES Permit shall govern. The following words and phrases shall have the following meanings when used in this chapter:

"Area susceptible to runoff" means any surface directly exposed to precipitation or in the path of runoff caused by precipitation which path leads off the parcel on which the surface is located.

"Automotive service facilities" means a facility that is categorized in any one of the following Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes. For inspection purposes, Permittees need not inspect facilities with SIC codes 5013, 5014, 5511, 5541, 7532-7534, and 7536-7539 provided that these facilities have no outside activities or materials that may be exposed to stormwater.

"Basin Plan" means the Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, adopted by the Regional Water Board on June 13, 1994 and subsequent amendments.

"Best Management Practices (BMPs)" means practices or physical devices or systems designed to prevent or reduce pollutant loading from stormwater or non-stormwater discharges to receiving waters, or designed to reduce the volume of stormwater or non-stormwater discharged to the receiving water. Examples of BMPs may include public education and outreach, proper planning of development projects, proper cleaning of catch basin inlets, and proper sludge- or waste-handling and disposal, among others.

"Biofiltration" means a LID BMP that reduces stormwater pollutant discharges by intercepting rainfall on vegetative canopy, and through incidental infiltration and/or evapotranspiration, and filtration. Incidental infiltration is an important factor in achieving the required pollutant load reduction. Therefore, the term "biofiltration" as used in this chapter is defined to include only systems designed to facilitate incidental infiltration or achieve the equivalent pollutant reduction as biofiltration BMPs with an underdrain (subject to approval by the Regional Board's Executive Officer). Biofiltration BMPs include bioretention systems with an underdrain and bioswales.

"Bioretention" means a LID BMP that reduces stormwater runoff by intercepting rainfall on vegetative canopy, and through evapotranspiration and infiltration. The bioretention system typically includes a minimum 2-foot top layer of a specified soil and compost mixture underlain by a gravel-filled temporary storage pit dug into the in-situ soil. As defined in this Ordinance, a bioretention BMP may be designed with an overflow drain, but may not include an underdrain. When a bioretention BMP is designed or constructed with an underdrain it is regulated by the Municipal NPDES Permit as biofiltration.

"Bioswale" means a LID BMP consisting of a shallow channel lined with grass or other dense, low-growing vegetation. Bioswales are designed to collect stormwater runoff and to achieve a uniform sheet flow through the dense vegetation for a period of several minutes.

"City" means the City of Torrance, California.

"Clean Water Act (CWA)" means the Federal Water Pollution Control Act enacted in 1972, by Public Law 92-500, and amended by the Water Quality Act of 1987. The Clean Water Act prohibits the discharge of pollutants to Waters of the United States unless the discharge is in accordance with an NPDES permit.

"Commercial development" means any development on private land that is not heavy industrial or residential. The category includes, but is not limited to: hospitals, laboratories and other medical facilities, educational institutions, recreational facilities, plant nurseries, car wash facilities, mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses and other light industrial complexes.

"Commercial Malls" means any development on private land comprised of one or more buildings forming a complex of stores which sells various merchandise, with interconnecting walkways enabling visitors to easily walk from store to store, along with parking area(s). A commercial mall includes, but is not limited to: mini-malls, strip malls, other retail complexes, and enclosed shopping malls or shopping centers

"Construction" means any construction or demolition activity, clearing, grading, grubbing, or excavation or any other activity that result in land disturbance. Construction does not include emergency construction activities required to immediately protect public health and safety or routine maintenance activities required to maintain the integrity of structures by performing minor repair and restoration work, maintain the original line and grade, hydraulic capacity, or original purposes of the facility. See "Routine Maintenance" definition for further explanation. Where clearing, grading or excavating of underlying soil takes place during a repaving operation, State General Construction Permit coverage by the State of California General Permit for Storm Water Discharges Associated with Industrial Activities or for Stormwater Discharges Associated with Construction Activities is required if more than one acre is disturbed or the activities are part of a larger plan

"Control" means to minimize, reduce, eliminate, or prohibit by technological, legal, contractual or other means, the discharge of pollutants from an activity or activities.

"Development" means any construction, rehabilitation, redevelopment or reconstruction of any public or private residential project (whether single family, multi-unit or planned unit development); industrial, commercial, retail and other nonresidential projects, including public agency projects; or mass grading for future construction. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Directly adjacent" means situated within two hundred (200) feet of the contiguous zone required for the continued maintenance, function, and structural stability of the environmentally sensitive area.

"Discharge" means when used without qualification the discharge of a pollutant.

"Discharge of a pollutant" means any addition of any pollutant or combination of pollutants to waters of the United States from any point source or, any addition of any pollutant or combination of pollutants to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. The term discharge includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by a state, municipality, or other person which do not lead to treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

"Discharging" directly means outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject, property, development, subdivision, or industrial facility, and not commingled with the flows from adjacent lands.

"Discretionary project" is defined in the same manner as Section 15357 of the Guidelines for Implementation of the California Environmental Quality Act contained in Title 14 of the California Code of Regulations, as amended, and means a project which requires the exercise of judgment or deliberation when the City decides to approve or disapprove a particular activity, as distinguished from situations where the City merely has to determine whether there has been conformity with applicable statutes, ordinances or regulations.

"Disturbed area" means an area that is altered as a result of clearing, grading, and/or excavation.

"Engineer" means the City Engineer and persons directed by him or her and under the instruction and supervision of the City Engineer who are assigned to enforce this chapter.

"Environmentally sensitive area (ESA)" means an area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments (California Public Resources Code § 30107.5). Areas subject to storm water mitigation requirements are areas designated as Significant Ecological Areas by the County of Los Angeles (Los Angeles County Significant Areas Study, Los Angeles County Department of Regional Planning (1976) and amendments); an area designated as a Significant Natural Area by the California Department of Fish and Games Significant Natural Areas Program, provided that area has been field verified by the Department of Fish and Game; an area listed in the Basin Plan as supporting the Rare, Threatened, or Endangered Species (RARE) beneficial use; and an area identified by the City as environmentally sensitive.

"Flow-through treatment BMPs" means a modular, vault type "high flow biotreatment" devices contained within an impervious vault with an underdrain or designed with an impervious liner and an underdrain.

"Full Capture System" means any single device or series of devices, certified by the Executive Officer, that traps all particles retained by a 5 mm mesh screen and has a design

treatment capacity of not less than the peak flow rate Q resulting from a one-year, one-hour storm in the sub-drainage area.

"Good housekeeping practices" means common practices related to the storage, use or cleanup of materials, performed in a manner that minimizes the discharge of pollutants. Examples include, but are not limited to, purchasing only the quantity of materials to be used at a given time, use of alternative and less environmentally harmful products, cleaning up spills and leaks, and storing materials in a manner that will contain any leaks or spills.

"General Construction Activities Storm Water Permit (GCASP)" means the general NPDES permit adopted by the State Board which authorizes the discharge of stormwater from construction activities under certain conditions.

"General Industrial Activities Storm Water Permit (GIASP)**"** means the general NPDES permit adopted by the State Board which authorizes the discharge of stormwater from certain industrial activities under certain conditions.

"Green Roof" means a LID BMP using planter boxes and vegetation to intercept rainfall on the roof surface. Rainfall is intercepted by vegetation leaves and through evapotranspiration. Green roofs may be designed as either a bioretention BMP or as a biofiltration BMP. To receive credit as a bioretention BMP, the green roof system planting medium shall be of sufficient depth to provide capacity within the pore space volume to contain the design storm depth and may not be designed or constructed with an underdrain.

"Hillside" means property located in an area with known erosive soil conditions, where the development contemplates grading on any natural slope that is twenty-five percent (25%) or greater and where grading contemplates cut or fill slopes.

"Illicit connection" means any human-made conveyance that is connected to the storm drain system without a permit, excluding gutters, roof-drains and other similar connections. Examples include channels, pipelines, conduits, inlets or outlets that are connected directly to the storm drain system.

"Illicit discharge" means any discharge to the storm drain system that is prohibited under local, state or federal statutes, ordinances, codes or regulations. This includes all non-stormwater discharges except discharges pursuant to a separate NPDES permit and discharges that are exempted or conditionally exempted in accordance with Part III the Municipal NPDES permit.

"Industrial/Commercial Facility" means any facility involved and/or used in the production, manufacture, storage, transportation, distribution, exchange or sale of goods and/or commodities, and any facility involved and/or used in providing professional and non-professional services. This category of facilities includes, but is not limited to, any facility defined by either the Standard Industrial Classifications (SIC) or the North American Industry Classification System (NAICS). Facility ownership (federal, state, municipal, private) and profit motive of the facility are not factors in this definition.

"Industrial Park" means land development that is set aside for industrial development. Industrial parks are usually located close to transport facilities, especially where more than one transport modalities coincide: highways, railroads, airports, and navigable rivers. It includes office parks, which have offices and light industry.

"Infiltration BMP" means a LID BMP that reduces stormwater runoff by capturing and infiltrating the runoff into in-situ soils or amended onsite soils. Examples of infiltration BMPs include infiltration basins, dry wells, and pervious pavement.

"Infiltration" means the downward entry of water into the surface of the soil.

"Low Impact Development" or "LID" consists of building and landscape features designed to retain or filter stormwater runoff.

"Material" means any substance including, but not limited to: garbage and debris; lawn clippings, leaves, and other vegetation; biological and fecal waste; sediment and sludge; oil and grease; gasoline; paints, solvents, cleaners, and any fluid or solid containing chemicals.

"Municipal NPDES Permit" means the Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities Therein, Except the City of Long Beach (Order No. R4-2012-0175), NPDES Permit No. CAS00401), issued by the California Regional Water Quality Control Board—Los Angeles Region, and any successor permit to that permit.

"Municipal Separate Storm Sewer System (MS4)" means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

1. Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States;

2. Designed or used for collecting or conveying stormwater;

3. Which is not a combined sewer; and

4. Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR Section 122.2.

"New development" means land-disturbing activities; structural development, including construction or installation of a building or structure, creation of impervious surfaces; and land subdivision.

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"Non-stormwater discharge" means any discharge to a municipal stormwater system that is not composed entirely of stormwater.

"NPDES permit" means any waste discharge requirements issued by the Regional Board or the State Water Resources Control Board in the form of an NPDES permit pursuant to Water Code Section 13370 (other than the Municipal NPDES Permit).

"Outfall" means a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances with connect segments of the same stream or other waters of the United Sates and are used to convey waters of the United States. (40 CFR Section 122.26(b)(9))

"Parking lot" means land area or a facility for the parking or storage of motor vehicles used for businesses, commerce, industry or personal use with a lot size of five thousand (5,000) square feet or more of surface area, or with twenty-five (25) or more parking spaces.

"Planning priority projects" means those projects specified in Section 18.04.105.C of this chapter that are required to incorporate appropriate storm water mitigation measures into the design plan for their respective projects.

"Pollutant" means those pollutants defined in Section 502(6) of the federal Clean Water Act (33 U.S.C. Section 1362(6)), or incorporated into California Water Code Section 13373. The term "pollutant" shall not include uncontaminated stormwater, potable water or reclaimed water generated by a lawfully permitted water treatment facility.

"Project" means all development, redevelopment, and land disturbing activities. The term is not limited to "Project" as defined under CEQA (California Public Resources Code Section 21065).

"Rainfall Harvest and Use" means a LID BMP system designed to capture runoff, typically from a roof but can also include runoff capture from elsewhere within the site, and to provide for temporary storage until the harvested water can be used for irrigation or non-potable uses. The harvested water may also be used for potable water uses if the system includes disinfection treatment and is approved for such use by the local building department (Order No. R4-2012-0175).

"Receiving Water**"** means "water of the United States" into which waste and/or pollutants are or may be discharged.

"Redevelopment" means land-disturbing activity that result in the creation, addition, or replacement of 5,000 square feet or more of impervious surface area on an already developed site. Redevelopment includes, but is not limited to: the expansion of a building footprint; addition or replacement of a structure; replacement of impervious surface area that is not part of routine maintenance activity; and land disturbing activity related to structural or impervious surfaces. It does not include routine maintenance to maintain original line and grade, hydraulic

capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Regional Board" means the California Regional Water Quality Control Board—Los Angeles Region.

"Restaurant" means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption. (SIC Code 5812).

"Retail gasoline outlet" means any facility engaged in selling gasoline and lubricating oils.

"Routine Maintenance" includes, but is not limited to projects conducted to:

1. Maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

2. Perform as needed restoration work to preserve the original design grade, integrity and hydraulic capacity of flood control facilities.

3. Includes road shoulder work, regrading dirt or gravel roadways and shoulders and performing ditch cleanouts.

4. Update existing lines and facilities, which include replacing existing lines with new materials or pipes, to comply with applicable codes, standards, and regulations regardless if such projects result in increased capacity.

5. Repair leaks.

Routine maintenance does not include construction of new lines or facilities resulting from compliance with applicable codes, standards and regulations. New lines are those that are not associated with existing facilities and are not part of a project to update or replace existing lines.

"Runoff" means any runoff including storm water and dry weather flows from a drainage area that reaches a receiving water body or subsurface. During dry weather it is typically comprised of base flow either contaminated with pollutants or uncontaminated, and nuisance flows.

"Significant Ecological Area" means an area that is determined to possess an example of biotic resources that cumulatively represent biological diversity, for the purposes of protecting biotic diversity, as part of the Los Angeles County General Plan. Areas are designated as SEAs, if they possess one or more of the following criteria:

1. The habitat of rare, endangered, and threatened plant and animal species.

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2. Biotic communities, vegetative associations, and habitat of plant and animal species that are either one of a kind, or are restricted in distribution on a regional basis or within Los Angeles County.

3. Habitat that at some point in the life cycle of a species or group of species, serves as a concentrated breeding, feeding, resting, migrating grounds and is limited in availability either regionally or within Los Angeles County.

4. Biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or represent an unusual variation in a population or community.

5. Areas important as game species habitat or as fisheries.

6. Areas that would provide for the preservation of relatively undisturbed examples of natural biotic communities in Los Angeles County.

7. Special areas.

"Site" means the land or water area where any facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

"Source control BMP" means any schedule of activities, prohibition of practices, maintenance procedures, managerial practices or operational practices that aim to prevent stormwater pollution by reducing the potential for contamination at the source of pollution.

"Standard urban stormwater mitigation plan" or "SUSMP" means a report submitted by an applicant for approval by the Engineer prior to issuance of a building, grading, planning or similar permit outlining the necessary LID requirements and BMPs which must be incorporated into design plans for development or redevelopment projects.

"Storm Drain System" means any facility or any parts of the facility, including streets, gutters, conduits, natural or artificial drains, channels and watercourse that are used for the purpose of collecting, storing, transporting or disposing of stormwater and are located within the City.

"Stormwater runoff" means that part of precipitation (rainfall) which travels via flow across a surface to the MS4 or receiving waters from impervious, semi-pervious or pervious surfaces. When all other factors are equal, runoff increases as the perviousness of a surface decreases.

"Structural BMP" means any structural facility designed and constructed to mitigate the adverse impacts of stormwater and urban runoff pollution (e.g. canopy, structural enclosure). Structural BMPs may include both treatment control BMPs and source control BMPs.

"Treatment" means the application of engineered systems that use physical, chemical or biological processes to remove pollutants. Such processes include, but are not limited to,

filtration, gravity settling, media adsorption, biodegradation, biological uptake, chemical oxidation and UV radiation.

"Treatment control BMP" means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption or any other physical, biological or chemical process.

"Urban runoff" means surface water flow produced by non-stormwater resulting from residential, commercial and industrial activities involving the use of potable and nonpotable water.

5-7.105 Construction and application.

This chapter shall be construed to assure consistency with the requirements of the federal Clean Water Act and acts amendatory or supplementary to the Federal Clean Water Act, applicable implementing regulations, and the Municipal NPDES Permit, and any amendment, revision or reissuance of the Municipal NPDES Permit.

5-7.106 Inspection.

The Engineer, or his representative, shall be authorized at any reasonable time to enter the premises of any property discharging to the MS4 to determine compliance with the provisions of this chapter; such inspection may include but not be limited to: sampling, monitoring, reviewing, photographing, videotaping and inspecting treatment facilities and discharge location.

5-7.107 Storm drain impact fees.

A. Every applicant for a permit pursuant to Section 9-1.02 of this Code for development construction shall pay a storm drain impact fee.

B. The proceeds of the storm drain impact fee shall be applied to offset the City's costs of enforcing the order as a result of development construction, and the amount of the storm drain impact fee shall not exceed the City's reasonable costs therefor.

C. The amount of the storm drain impact fee shall be established by resolution of the City Council, as amended from time to time, in accordance with the provisions of this section, as amended from time to time.

D. The City Engineer shall administer and collect the storm drain impact fee.

E. Permits issued pursuant to Section 9-1.02 for development construction shall not be issued until payment of the storm drain impact fee.

5-7.108 Critical source of pollution inspection fee.

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A. Every person required to obtain a license pursuant to Torrance Municipal Code Section 6-1.06 and also engaged in a business designated in the Municipal NPDES permit as a critical source of pollution shall pay an annual critical source of pollution inspection fee.

B. The proceeds of the critical source of pollution inspection fee shall be applied to offset the City's costs of performing the inspections required by the Municipal NPDES permit and the amount of the critical source of pollution inspection fee shall not exceed the City's reasonable costs therefor.

C. The amount of the critical source of pollution inspection fee shall be established by resolution of the City Council as amended from time to time in accordance with provisions of this section.

D. The License Clerk and Collector shall administer and collect the critical source of pollution inspection fee.

E. No license issued pursuant to Torrance Municipal Code Section 6-1.06 shall be issued or renewed until payment of the critical source of pollution inspection fee is received by the License Clerk and Collector.

5-7.109 Prohibited activities.

A. Illicit Discharges and Connections. It is prohibited to commence, establish, use, maintain or continue any illicit connections to the MS4 or any illicit discharges to the MS4. This prohibition against illicit connections applies to the use, maintenance or continuation of any illicit connection, whether that connection was established prior to or after the effective date of this chapter.

B. Littering. No person shall throw, deposit, place, leave, maintain, keep or permit to be thrown, deposited, placed, left or maintained or kept, any refuse, rubbish, garbage, or any other discarded or abandoned objects, articles or accumulations, in or upon any street, alley, sidewalk, storm drain, inlet, catch basin conduit or drainage structure, business place, or upon any or private plot of land in the City, so that the same might be or become a pollutant. No person shall throw or deposit litter in any fountain, pond, lake, stream, or other body of water within the City. This section shall not apply to refuse, rubbish or garbage deposited in containers, bags or other appropriate receptacles which are placed in designated locations for regular solid waste pick-up and disposal.

C. Disposal of Landscape Debris. No person shall dispose of leaves, dirt, or other landscape debris into the municipal separate stormwater system.

D. Non-stormwater Discharges. The following non-stormwater discharges into the MS4 are prohibited unless in compliance with a separate NPDES permit or pursuant to a discharge exemption by the Regional Board, the Regional Board's Executive Officer, or the State Water Resources Control Board:

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1. The discharge of untreated wash waters to the MS4 when gas stations, auto repair garages, or other type of automotive service facilities are cleaned;

2. The discharge of untreated wastewater to the MS4 from mobile auto washing, steam cleaning, mobile carpet cleaning, and other such mobile commercial and industrial operations;

3. To the maximum extent practicable, discharges to the MS4 from areas where repair of machinery and equipment, including motor vehicles, which are visibly leaking oil, fluid or antifreeze, is undertaken;

4. Discharges of untreated runoff to the MS4 from storage areas of materials containing grease, oil, or other hazardous substances, and uncovered receptacles containing hazardous materials;

5. Discharges of commercial/municipal swimming pool filter backwash to the MS4;

6. Discharges of untreated runoff from the washing of toxic materials from paved or unpaved areas to the MS4; provided, however, that nonindustrial and noncommercial activities which incidentally generate urban runoff, such as the hosing of sidewalks, shall be excluded from this prohibition;

7. To the maximum extent practicable, discharges to the MS4 from washing impervious surfaces in industrial/commercial areas which results in a discharge of untreated runoff to the MS4, unless specifically required by state law, or the City's Municipal code, or Los Angeles County's Health and Safety Codes, or permitted under a separate NPDES permit;

8. Discharges from the washing out of concrete trucks into the MS4;

9. Discharges to the MS4 of any pesticide, fungicide or herbicide, banned by the USEPA or the California Department of Pesticide Regulation; or

10. The disposal of hazardous wastes into trash containers used for municipal trash disposal where such disposal causes or threatens to cause a direct or indirect discharge to the MS4.

E. Car Washing. No motor vehicle, boat, trailer, or other type of mobile transportation may be washed, other than at a commercial carwash, unless such vehicle is being washed by:

1. A resident at their residence using a hand-held bucket or a water hose equipped with an automatic shutoff nozzle as long as water does not flow onto streets; or

2. A business that has an approved car wash facility for its fleet vehicles, provided that water does not flow onto streets.

5-7.110 Exempted discharges, conditionally exempted discharges or designated discharges.

A. Discharges from those activities specifically identified in, or pursuant to, Part III.A.1-3 of the Municipal NPDES Permit as being exempted discharges, conditionally exempted discharges or designated discharges shall not be considered a violation of this chapter; provided that, consistent with Part III.A.1-3 of the Municipal NPDES Permit:

1. Any applicable BMPs developed pursuant to the Municipal NPDES Permit are implemented to minimize any adverse impacts from such identified sources;

2. The discharger meets all notification, reporting and recordkeeping requirements; and

3. The discharger has conducted all applicable monitoring requirements.

B. Discharges in Violation of the Municipal NPDES Permit. Any discharge that would result in or contribute to a violation of the Municipal NPDES Permit, either separately or in combination with other discharges, is prohibited. Liability for any such discharge shall be the responsibility of the person(s) causing or responsible for the discharge, and such person(s) shall defend, indemnify and hold harmless the City from all losses, liabilities, claims or causes of actions in any administrative or judicial action relating to such discharge.

5-7.111 Good housekeeping provisions.

Owners and occupants of property within the City shall comply with the following requirements:

A. Septic Waste. No person shall leave, deposit, discharge, dump, or otherwise expose any chemical or septic waste to precipitation in an area where a discharge to City streets or MS4 may or does occur.

B. Use of Water. Runoff of water used for irrigation purposes shall be minimized to the maximum extent practicable. Runoff of water from the permitted washing down of paved areas shall be minimized to the maximum extent practicable.

C. Storage of Materials, Machinery and Equipment. Machinery or equipment that is to be repaired or maintained in areas susceptible to or exposed to stormwater, shall be placed in a manner so that leaks, spills and other maintenance-related pollutants are not discharged to the MS4.

D. Removal and Disposal of Debris from Industrial/Commercial Motor Vehicle Parking Lots. Industrial/commercial motor vehicle parking lots with more than twenty-five (25) parking spaces that are located in areas potentially exposed to stormwater shall be swept regularly or other equally effective measures shall be utilized to remove debris from such parking lots.

E. Food Wastes. Food wastes generated by nonresidential food service and food distribution sources shall be properly disposed of and in a manner so such wastes are not discharged to the MS4.

F. Best Management Practices. Best management practices shall be used in areas exposed to stormwater for the removal and lawful disposal of all fuels, chemicals, fuel and chemical wastes, animal wastes, garbage, batteries, or other materials which have potential adverse impacts on water quality.

G. Maintenance of Structural BMPs. Structural BMPs shall be properly operated and maintained, consistent with the approved SUSMP. Records and documentation of such maintenance shall be provided to the Engineer upon request.

5-7.112 Requirements for industrial/commercial and construction activities.

A. Industrial/Commercial and Construction Related Dischargers Generally. Each discharger associated with industrial/commercial activity or construction activity, or other discharger described in any general NPDES permit addressing such discharges, as may be issued by the U.S. Environmental Protection Agency, the State Water Resources Control Board, or the Regional Board shall comply with all requirements of such NPDES permit and the City's development construction program. Each discharger identified in an individual NPDES permit shall comply with and undertake all activities required by such permit. Proof of compliance with any such NPDES permit and the City's development construction program may be required in a form acceptable to the Engineer prior to the issuance of any grading, building or occupancy permits, or any other type of permit or license issued by the City.

B. Non-stormwater discharges to the MS4 from industrial, commercial or construction activities in violation of any applicable NPDES permit or the City's development construction program are prohibited.

C. Source Control BMPs for Industrial/Commercial Facilities. Industrial/commercial facilities shall implement the effective source control BMPs listed in Table 10 of Part VI.D.6.f. of the Municipal NPDES Permit, unless a particular pollutant generating activity does not occur on a facility's site.

5-7.113 Standard urban stormwater mitigation plan (SUSMP) and low impact development (LID) requirements for new development and redevelopment projects.

A. Objective. Pursuant to Part VI.D.7.b of the Municipal NPDES Permit, the provisions of this section establish requirements for construction activities and facility operations

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of development and redevelopment projects to comply with the current Municipal NPDES Permit to lessen the water quality impacts of development by using smart growth practices and integrate LID practices and standards for stormwater pollution mitigation through means of infiltration, evapotranspiration, biofiltration, and rainfall harvest and use. Except as otherwise provided herein, the City shall administer, implement and enforce the provisions of this section.

B. Scope. This section contains requirements for stormwater pollution control measures in development and redevelopment projects and authorizes the City to further define and adopt stormwater pollution control measures, and to develop LID principles and requirements, including but not limited to the objectives and specifications for integration of LID strategies. As specified in this section, certain Planning Priority Projects shall meet the requirements of this section through the preparation and submittal of a standard urban stormwater mitigation plan (SUSMP), which shall include the applicable LID requirements set forth in this section as an element of the SUSMP.

C. LID Standards Manual. The Engineer shall prepare, maintain, and update, as deemed necessary and appropriate, a manual ("LID Standards Manual"), which shall include urban and stormwater runoff quantity and quality control development principles and technologies for achieving compliance with the provisions of this section. The LID Standards Manual shall also include technical feasibility and implementation parameters, as well as other rules, requirements, and procedures as the Engineer deems necessary, for implementing the provisions of this Chapter.

D. Applicability – Planning Priority Projects. The following development and redevelopment projects shall be designated as Planning Priority Projects, which are subject to City conditioning and approval for the design and implementation of post-construction controls to mitigate storm water pollution prior to completion of the projects, and shall meet the requirements of this section:

1. New Development Projects.

a. All development projects equal to one (1) acre or greater of disturbed area that adds more than 10,000 square feet of impervious surface area.

b. Industrial parks 10,000 square feet or more of surface area.

c. Commercial malls 10,000 square feet or more of surface area.

d. Retail gasoline outlets with 5,000 square feet or more of surface area.

e. Restaurants (Standard Industrial Classification (SIC) of 5812) with 5,000 square feet or more of surface area.

f. Parking lots with 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces.

g. Streets and roads construction of 10,000 square feet or more of impervious surface area. Street and road construction applies to standalone streets, roads, highways, and freeway projects, and also applies to streets within larger projects.

h. Automotive service facilities (Standard Industrial Classification (SIC) of 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) 5,000 square feet or more of surface area.

i. Projects located in or directly adjacent to, or discharging directly to an Significant Ecological Area (SEA), where the development will:

(i) Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and

(ii) Create 2,500 square feet or more of impervious surface area.

j. Single-family hillside homes.

2. Redevelopment Projects

a. Land disturbing activity that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site on Planning Priority Project categories.

b. Where Redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-construction stormwater quality control requirements, the entire project must be mitigated.

c. Where Redevelopment results in an alteration of less than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to post-construction stormwater quality control requirements, only the alteration must be mitigated, and not the entire development.

d. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of facility or emergency redevelopment activity required to protect public health and safety. Impervious surface replacement, such as the reconstruction of parking lots and roadways which does not disturb additional area and maintains the original grade and alignment, is considered a routine maintenance activity. Redevelopment does not include the repaving of existing roads to maintain original line and grade.

e. Existing single-family dwelling and accessory structures are exempt from the Redevelopment requirements unless such projects create, add, or replace 10,000 square feet of impervious surface area.

E. Stormwater Pollution Control Requirements. The site for every Planning Priority Project shall be designed to control pollutants, pollutant loads, and runoff volume to the maximum extent feasible by minimizing impervious surface area and controlling runoff from impervious surfaces through infiltration, evapotranspiration, bioretention and/or rainfall harvest and use. In addition, the following specific requirements apply:

1. New Single-Family Hillside Homes. A new single-family hillside home development project shall include mitigation measures to:

a. Conserve natural areas;

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b. Protect slopes and channels;

c. Provide storm drain system stenciling and signage;

d. Divert roof runoff to vegetated areas before discharge unless the diversion would result in slope instability; and

e. Direct surface flow to vegetated areas before discharge, unless the diversion would result in slope instability.

2. Street and Road Construction of 10,000 square feet or more. Street and road construction of 10,000 square feet or more of impervious surface shall follow the City's Green Street Manual developed by the Engineer and approved by City Council resolution. The City's Green Street Manual shall be based on the USEPA guidance regarding Managing Wet Weather with Green Infrastructure: Green Streets (December 2008 EPA-833-F-08-009).

3. Remainder of Planning Priority Projects Require a SUSMP. Except for the projects listed in paragraphs (1) and (2) of subsection D of this section, all other Planning Priority Projects shall prepare and submit to the Engineer for review and approval a SUSMP which shall also contain LID requirements consistent with Parts VI.D.7.c and VI.D.7.d(iii) of the Municipal NPDES Permit. In addition, Planning Priority Projects subject to this paragraph (3) shall do the following:

a. Incorporate the SUSMP into Project Plans. An applicant for a Planning Priority Project identified in paragraph (3) of subsection D of this section shall incorporate into the applicant's project plans a Storm Water Mitigation Plan (SWMP), which includes those BMPs necessary to control storm water pollution from construction activities and facility operations, as set forth in the SUSMP applicable to the applicant's project. Structural or Treatment Control BMPs (including, as applicable, post-construction treatment control BMPs) set forth in project plans shall meet the design standards set forth in the SUSMP and the current Municipal NPDES Permit.

b. Verify Maintenance of BMPs. If a project applicant has included or is required to include structural or treatment control BMPs in project plans, the applicant shall provide verification of maintenance provisions. The verification shall include the applicant's signed statement, as part of its project application, accepting responsibility for all structural and treatment control BMP maintenance until such time, if any, the property is transferred.

E. Issuance of Discretionary Permits. No discretionary permit may be issued for any Planning Priority Project identified in this section until the Engineer confirms the project plans comply with the applicable requirements of this section.

F. Issuance of Certificates of Occupancy. As a condition for issuing a certificate of occupancy for a Planning Priority Project identified in this section, the Engineer shall require facility operators and/or owners to build all the stormwater pollution control BMPs and structural or treatment control BMPs that are shown on the approved project plans and to submit a signed certification statement stating that the site and all structural or treatment control BMPs will be maintained in compliance with the SUSMP and other applicable regulatory requirements.

G. Transfer of Properties Subject to Requirement for Maintenance of Structural and Treatment Control BMPs.

1. The transfer or lease of a property subject to a requirement for maintenance of structural and treatment control BMPs shall include conditions requiring the transferee and its successors and assigns to either (a) assume responsibility for maintenance of any existing structural or treatment control BMP or (b) to replace an existing structural or treatment control BMP with new control measures or BMPs meeting the then current standards of the City and the SUSMP. Such requirement shall be included in any sale or lease agreement or deed for such property. The condition of transfer shall include a provision that the successor property owner or lessee conduct maintenance inspections of all structural or treatment control BMPs at least once a year and retain proof of inspection.

2. For residential properties where the structural or treatment control BMPs are located within a common area which will be maintained by a homeowners association, language regarding the responsibility for maintenance shall be included in the projects conditions, covenants and restrictions (CC&Rs). Printed educational materials will be required to accompany the first deed transfer to highlight the existence of the requirement and to provide information on what stormwater management facilities are present, signs that maintenance is needed, and how the necessary maintenance can be performed. The transfer of this information shall also be required with any subsequent sale of the property.

3. If structural or treatment control BMPs are located within an area proposed for dedication to a public agency, said BMPs shall be the responsibility of the developer until the dedication is accepted by the public agency.

H. CEQA. Provisions of this section shall be complementary to, and shall not replace, any applicable requirements for stormwater mitigation required under the California Environmental Quality Act.

5-7.114 Enforcement.

A. Violations Deemed a Public Nuisance.

1. The following violations shall be deemed a public nuisance:

a. Any condition caused or permitted to exist in violation of any of the provisions of this chapter; or

b. Any failure to comply with any applicable requirement of either the SUSMP or an approved stormwater mitigation plan with respect to a property; or

c. Any false certification or verification, or any failure to comply with a certification or verification provided by a project applicant or the applicant's successor in interest; or

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d. Any failure to properly operate and maintain any structural or treatment control BMP on a property in accordance with an approved stormwater mitigation plan or the SUSMP, is determined to be a threat to the public health, safety and welfare, is declared and deemed a public nuisance, and may be abated or restored by any Engineer, and a civil or criminal action to abate, enjoin or otherwise compel the cessation of such nuisance may be brought by the City Attorney.

2. The cost of such abatement and restoration shall be borne by the owner of the property and the cost shall be billed to the owner of the property, as provided by law or ordinance for the recovery of nuisance abatement costs,

3. If any violation of this chapter constitutes a seasonal and recurrent nuisance, the Engineer shall so declare. The failure of any person to take appropriate annual precautions to prevent stormwater pollution after written notice of a determination under this section shall constitute a public nuisance and a violation of this chapter.

B. Concealment. Causing, permitting, aiding, abetting or concealing a violation of any provision of this chapter shall constitute a violation of such provision.

C. Civil Actions. In addition to any other remedies provided in this chapter, any violation of this chapter may be enforced by civil action brought by the City. In any such action, the City may seek any or all of the following remedies:

1. A temporary and/or permanent injunction;

2. Assessment of the violator for the costs of any investigation, inspection or monitoring survey which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this section;

3. Costs incurred in removing, correcting or terminating the adverse effects resulting from violation;

4. Compensatory damages for loss or destruction to water quality, wildlife, fish and aquatic life.

D. Administrative Enforcement Powers. In addition to the other enforcement powers and remedies established by this chapter, the Engineer has the authority to utilize the following administrative remedies:

1. Cease and Desist Orders. When a discharge has taken place or is likely to take place in violation of this chapter, the Engineer may issue an order to cease and desist such discharge, or practice or operation likely to cause such discharge and direct that those persons not complying shall: (a) comply with the requirement; (b) comply with a time schedule for compliance; and (c) take appropriate remedial or preventive action to prevent the violation from recurring.

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2. Notice to Clean. Whenever the Engineer finds any oil, earth, debris, grass, weeds, dead trees, tin cans, rubbish, refuse, waste or any other material of any kind, in or upon the sidewalk abutting or adjoining any parcel of land, or upon any parcel of land or grounds, which may result in pollutants entering the MS4 or a non-stormwater discharge to the MS4, he or she may give notice to the owner or occupant of the adjacent property to remove such oil earth, debris, grass, weeds, dead trees, tin cans, rubbish, refuse, waste or other material, in any manner that he or she may reasonably provide. The recipient of such notice shall undertake the activities as described in the notice.

E. Penalties. Violation of this chapter shall be punishable as provided in Chapter 1-2.01 of this Code. Each day that a violation continues shall constitute a separate offense.

F. Permit Revocation. To the extent the City makes a provision of this chapter or any identified BMP a condition of approval to the issuance of a permit or license, any person in violation of such condition is subject to the permit revocation procedures set forth in this code.

G. Burden of Proof. In an enforcement action, the burden of proof shall be on the person who is the subject of such action to establish that the reduction or elimination of the discharge to the maximum extent practicable has been accomplished through compliance with the best management practices available, including applicable monitoring, notifications and reporting requirements.

H. Remedies. Remedies under this chapter are in addition to and do not supersede or limit any and all other available remedies, civil or criminal. The remedies provided for in this chapter shall be cumulative and not exclusive.

5-7.115 No taking.

The provisions of this chapter shall not operate to deprive any property owner of substantially all of the market value of such owner's property or otherwise constitute an unconstitutional taking without compensation."

Section 2. **Severability**. If any section, subsection, sentence, clause, phrase or portion of this ordinance for any reason is held to be invalid or unconstitutional by any court of competent jurisdiction, such decision shall not affect the validity or the remaining portions of this ordinance. The City Council of the City of Torrance hereby declares that it would have adopted this ordinance and each section, subsection, sentence, clause, phrase or portion thereof irrespective of the fact that any one or more sections, subsections, sentences, clauses, phrases or portions were to be declared invalid or unconstitutional.

Section 3. **CEQA.** The City Council hereby finds, in the exercise of its independent judgment and analysis, that this ordinance is exempt from the California Environmental Quality Act ("CEQA") because the Low Impact Development requirements for new development and redevelopment projects of this Ordinance will not have a significant effect on the environment, and the adoption of this Ordinance and the timing thereof is mandated by the action of the Los

Angeles Regional Water Quality Control Board ("LARWQCB"). In this case, the City is acting at the direction of the LARWQCB and federal law to protect, maintain, restore and enhance natural resources and the environment. To comply with the requirements of the LARWQCB, the City Council finds that the adoption of this Ordinance is categorically exempt from the requirements of the California Environmental Quality Act ("CEQA") pursuant to CEQA Guidelines Sections 15307 and 15308. Staff is hereby directed to prepare and post a notice of exemption pursuant to Guidelines Section 15062.

Section 4. **Publication.** The City Clerk shall certify to the adoption of this Ordinance and shall cause the same to be published or posted in the manner prescribed by law.

APPROVED and ADOPTED this ____ day of _____, 2014.

DRAFT

Appendix N

Green Street Policies

RESOLUTION NO. ____

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF HERMOSA BEACH ADOPTING A GREEN STREET POLICY FOR STREET AND ROADWAY PROJECTS

The City Council of the City of Hermosa Beach does hereby resolve and order as follows:

Section 1. Purpose

It is the policy of the City of Hermosa Beach (City) to implement green street Best Management Practices (BMPs) as elements of street and roadway projects including public works capital improvement projects to the maximum extent practicable. This policy is implemented to demonstrate compliance with the Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Order No. R4-2012-0175, NPDES Permit No. CAS004001 effective December 28, 2012, and any amendment thereto (Municipal Stormwater Permit).

Green streets are amenities that provide multiple benefits including water quality improvement, groundwater replenishment, attractive streetscapes, traffic calming, pedestrian and bicycle accessibility, reduction in the heat island effect, and creation of linear or pocket parks. Green streets can incorporate a wide variety of design elements and techniques including the minimization of impervious area through reduction in street width and the application of permeable pavements, landscaped medians, bioretention, vegetated swales, infiltration, and/or storage of stormwater. Application of green techniques encourages stormwater contact with soil and vegetation to facilitate natural pollutant removal processes as well as retention and/or infiltration of stormwater to reduce runoff.

Section 2. Policy

A. Application. The City will require the application of green street strategies consistent with USEPA guidance regarding Managing Wet Weather with Green Infrastructure—Green Streets (December 2008 EPA-833-F-08-009) to the maximum extent practicable for the following types of projects:
    1. New public and private street and road construction or private development projects that include street and road construction of 10,000 square feet or more of impervious surface area;
    2. Redevelopment of streets and roads that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site.

    The term “street and road construction projects” applies to projects that are stand-alone street, road, highway, alley or walk-street projects and also applies to such projects within larger projects.

    Routine maintenance (as defined in the Municipal Stormwater Permit) and linear utility projects are excluded from these requirements. Routine maintenance includes slurry seals, repaving, and reconstruction of the road or street where the original line and grade are maintained. It also

includes road shoulder work, regrading of dirt or gravel roadways and shoulders, and performing ditch cleanouts.

B. Benefits. The City will consider opportunities to improve stormwater quality, eliminate non-stormwater runoff, replenish groundwater, create attractive streetscapes, and provide pedestrian and bicycle accessibility and safety through new development and redevelopment of streets and roadway projects and related capital improvement projects.

C. Best Management Practice (BMP) Selection and Design. The City will require projects subject to this policy to incorporate green street BMPs to address stormwater runoff from the project area using the Green Street BMP Selection Guideline shown in Attachment A.

   The most recent version of the County of Los Angeles Low Impact Development (LID) Standards Manual will serve as the design reference for selected Green Street BMPs. The City of Hermosa Beach Director of Public Works has final authority in decisions regarding project/site-specific technical feasibility for selected BMPs.

D. Retrofit Scope. The City will use the Beach Cities Enhanced Watershed Management Program to identify opportunities for green street BMP retrofits. Final decisions regarding implementation will be determined by the Director of Public Works based on the availability of adequate funding.

E. Training. The City of Hermosa Beach will incorporate aspects of green streets into internal annual staff trainings.

Section 3. The City Clerk is directed to certify the adoption of this Resolution; record this Resolution in the book of the City's original resolutions; and make a minute of the adoption of the Resolution in the City Council's records and the minutes of this meeting.

Section 4. This Resolution will become effective immediately upon adoption and will remain effective unless repealed or superseded.

PASSED AND ADOPTED this ____ day of _____, 2015.

_____

ATTACHMENT A **City of Hermosa Beach Green Street BMP Selection Guideline**						
BMP Type	**Green Street Project Location**					
	Primary Arterials, State Highway	Secondary Arterials	Other City Streets, Residential Streets	Streets without curb and gutter	Alleys	Sidewalks
Alternative Street Designs +	X	X	X	X	X	X
VEG-2 : Stormwater Planter	X	X	X			X
VEG-3 : Tree-Well Filter	X	X	X			X
VEG-4: Vegetated Swales	X	X				
VEG-5: Filter Strips				X		◆
RET-1: Bioretention	X	X	X	X		
RET-3: Infiltration Trench	X	X	X	X		
RET-5: Permeable Pavement without Underdrain		X	X		X	X
T-6: Proprietary Treatment Control Measures	X	X	X	X	X	
Curb Filtration System ++	◆	◆	◆	◆	◆	

+ Not included in County of Los Angeles Low Impact Development (LID) Standards Manual, subject to review by the City of Hermosa Beach Director of Public Works/City Engineer

++ As per City of Hermosa Beach standard design or subject to review by the City of Hermosa Beach Director of Public Works/City Engineer

◆ minimum BMPs to be implemented for green street project type

X BMPs to be considered depending on greens street project types and specific location

RESOLUTION NO. 15-0013

A RESOLUTION OF THE MANHATTAN BEACH CITY COUNCIL APPROVING A GREEN STREETS POLICY

RECITALS

1. On November 8, 2012, the Los Angeles Regional Water Quality Control Board (Regional Board) adopted the fourth NPDES Permit under the Federal Clean Water Act for discharges from the municipal separate storm sewer systems (MS4) within the coastal watershed of Los Angeles County (Permit). The Permit became effective on December 28, 2012. The Permit identified conditions, requirements and programs that municipalities must comply with to protect regional water resources from adverse impacts associated with pollutants in stormwater and urban runoff.

2. The City of Manhattan Beach (City) is a named Permittee subject to the permit. A condition of Regional Board approval of the Enhanced Watershed Management Program (EWMP) is that all participating Permittees must establish and implement a "Green Streets Policy" and include a reference to it in the City's Municipal Code. Additionally, all participating Permittees must have Low Impact Development (LID) ordinances and Green Street Policies enacted by the time of the draft EWMP submittal.

3. The City is pursuing the development of an EWMP consistent with the Permit and in cooperation with the cities of Hermosa Beach, Redondo Beach and Torrance along with the Los Angeles County Flood Control District.

4. Green Streets are enhancements to street and road projects to improve the quality of storm water and urban runoff through the implementation of infiltration measures such as bioretention and infiltration trenches and dry wells; bio-treatment/infiltration measures such flow-through planters and vegetated swales; treatment Best Management Practices (BMPs) such as catch basin filters and screens; and implementing and maintaining xeriscaped parkways and tree lined streets.

NOW, THEREFORE, THE MANHATTAN BEACH CITY COUNCIL HEREBY DETERMINES, FINDS AND RESOLVES AS FOLLOWS:

Section 1. The City Council hereby adopts as its Green Streets Policy as shown in Exhibit "A," attached hereto and incorporated herein by this reference.

Section 2. The City Council hereby directs the Public Works Director to implement Green Streets for: (1) New public and private street and road construction or private development projects that include street and road construction of 10,000 square feet or more of impervious surface area; and (2) Redevelopment of streets and roads that results in the creation, addition or replacement of 5,000 square feet or more of

impervious surface area on an already developed site following the City's Green Streets Policy, as show in Exhibit "A" which is based on the USEPA's Wet Weather with Green Infrastructure guidance (December 2008 EPA-833-F-08-009).

Section 3. Routine maintenance including but not limited to slurry seals, grind and overlay and reconstruction to maintain original line and grade are excluded from the Green Street Policy.

Section 4. The Public Works Director is authorized to make non-substantive changes to the City's Green Streets policy consistent with the requirements of the MS4 Permit.

Section 5. The adoption of this Resolution and the timing thereof is mandated by the action of the Los Angeles Regional Water Quality Control board ("LARWQCB"). In this case, the City is acting at the direction of the LARWQCB and federal law to protect, maintain, restore and enhance natural resources and the environment. To comply with the requirements of the LARWQCB, the City Council determines that the Green Streets Policy will not have a significant effect on the environment, and finds that the adoption of this Ordinance is categorically exempt from the requirements of the California Environmental Quality Act ("CEQA") pursuant to CEQA Guidelines Sections 15307 and 15308.

Section 6. At a Council Meeting held on April 7, 2015, the City Council determined that the public interest and necessity justify the adoption of the Green Street Policy.

Routine maintenance (as defined in the Municipal Stormwater Permit) and linear utility projects are excluded from these requirements. Routine maintenance includes slurry seals, repaving, and reconstruction of the road or street where the original line and grade are maintained. It also includes road shoulder work, regrading of dirt or gravel roadways and shoulders, and performing ditch cleanouts.

B. Benefits. The City will consider opportunities to improve stormwater quality, eliminate non-stormwater runoff, replenish groundwater, create attractive streetscapes, and provide pedestrian and bicycle accessibility and safety through new development and redevelopment of streets and roadway projects and related capital improvement projects.

C. Best Management Practice (BMP) Selection and Design Standard. The most recent version of the County of Los Angeles Low Impact Development Standards Manual will serve as the design reference for selected Green Street BMPs. The Director of Public Works has final authority in decisions regarding project/site-specific technical feasibility for selected BMPs.

D. Runoff Capture Design Goal. This policy establishes a minimum runoff capture design goal of the runoff produced from a 0.25 inch, 24-hour storm event for green street projects. Designers should pursue greater volume mitigation at project sites where it is practical. Project area is defined as the boundary of proposed improvements (construction/reconstruction) within the City of Manhattan Beach right of way. For new median construction/reconstruction projects, the project boundary is limited to the area that is being reconstructed. New pervious areas within the project area such as open space, medians, and parkway can be used as credit toward the capture goal. Project areas are not expected to accommodate offsite tributary runoff. Although maintenance projects are exempt from the Green Street Policy, the engineer/planner is encouraged to consider LID features where the conditions are favorable.

E. Retrofit Scope. The City will use the Beach Cities Enhanced Watershed Management Program to identify opportunities for green street BMP retrofits. Final decisions regarding implementation will be determined by the Director of Public Works based on the availability of adequate funding.

F. Training. The City of Manhattan Beach will incorporate aspects of green streets into internal annual staff training of targeted staff.

Section 7. The City Clerk shall certify to the passage and adoption of this Resolution.

PASSED, APPROVED, AND ADOPTED at a regular meeting of the Manhattan Beach City Council on April 7, 2015.

Ayes: Lesser, D'Errico, Burton and Mayor Powell
Noes: None
Absent: Howorth
Abstain: None

Wayne Powell

Mayor Wayne Powell
City of Manhattan Beach

ATTEST:

Liza Tamura
City Clerk

EXHIBIT "A"

MANHATTAN BEACH GREEN STREETS POLICY

Purpose

It is the policy of the City of Manhattan Beach (City) to implement Green Street Best Management Practices (BMPs) as elements of street and roadway projects including public works capital improvement projects to the maximum extent practicable. This policy is implemented to demonstrate compliance with the Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Order No. R4-2012-0175, NPDES Permit No. CAS004001 effective December 28, 2012, and any amendment thereto (Municipal Stormwater Permit).

Green Streets are amenities that provide multiple benefits including water quality improvement, groundwater replenishment, attractive streetscapes, traffic calming, pedestrian and bicycle accessibility, reduction in the heat island effect, and creation of linear or pocket parks. Green streets can incorporate a wide variety of design elements and techniques including the minimization of impervious area through reduction in street width and the application of permeable pavements, street trees and landscaped medians, bioretention, vegetated swales, biofiltration, and/or storage of stormwater. Application of green techniques encourages stormwater contact with soil and vegetation to facilitate natural pollutant removal processes as well as retention and/or infiltration of stormwater to reduce runoff.

Policy

A. Application. The City will require the application of Green Street strategies consistent with USEPA guidance regarding Managing Wet Weather with Green Infrastructure—Green Streets (December 2008 EPA-833-F-08-009) to the maximum extent practicable for the following types of projects:

   1. New public and private street and road construction or private development projects that include street and road construction of 10,000 square feet or more of impervious surface area;
   2. Redevelopment of streets and roads that results in the creation or addition or replacement of 5,000 square feet or more of impervious surface area on an already developed site.

The term "street and road construction projects" applies to projects that are standalone street, road, highway or freeway projects and also applies to such projects within larger projects.

Green Street Policy

Purpose

The City of Redondo Beach Department of Public Works shall implement green street BMPs for transportation corridors associated with new and redevelopment street and roadway projects, including Capital Improvement Projects (CIPs). This policy is enacted to demonstrate compliance with the NPDES MS4 Permit for the Los Angeles Region (Order No. R4-2012-0175).

Green streets are an amenity that provides many benefits including water quality improvement, groundwater replenishment, creation of attractive streetscapes, creation of parks and wildlife habitats, and pedestrian and bicycle accessibility. Green streets are defined as right-of-way areas that incorporate infiltration, biofiltration, and/or storage and use BMPs to collect, retain, or detain stormwater runoff as well as a design element that creates attractive streetscapes.

Policy

A. Application. The Department of Public Works shall require new development and/or redevelopment streets and roadway projects and CIP projects conducted within the right-of-way of transportation corridors to incorporate green street BMPs. Transportation corridors projects are major arterials as defined in the City's General Plan which add at least 10,000 square feet of impervious surface. Routine maintenance or repair and linear utility projects are excluded from these requirements. Routine maintenance includes slurry seals, repaving, and reconstruction of the road or street where the original line and grade are maintained.

B. Amenities. The Department of Public Works shall consider opportunities to replenish groundwater, create attractive streetscapes, create parks and wildlife habitats, and provide pedestrian and bicycle accessibility through new development and redevelopment of streets and roadway projects and CIPs.

C. Guidance. New development subject to this Policy shall comply with the requirements of the Los Angeles County LID Standards Manual. In addition, to the maximum extent practicable, the Department of Public Works shall use the City of Los Angeles Green Streets guidance, USEPA's *Managing Wet Weather with Green Infrastructure Municipal Handbook: Green Streets*, or equivalent guidance developed by the Department of Public Works for use in public and private developments. The Department of Public Works shall prepare, maintain, and update, as deemed necessary and appropriate or upon direction from the Los Angeles Regional Water Quality Control Board, a list of minimum requirements for green street BMPs. These minimum requirements shall be in addition to any other BMPs that the Department of Public works deems necessary to achieve the purpose and intent of this Policy.

D. Retrofit Scope. The Department of Public Works shall use the City's Watershed Management Program or Enhanced Watershed Management Program to identify

opportunities for green street BMP retrofits. Final decisions regarding implementation will be determined by the City Engineer based on the availability of adequate funding.

E. Training. The Department of Public Works shall incorporate aspects of green streets into internal annual staff trainings.

City of Torrance - Green Street Policy

Purpose

The City of Torrance shall implement green street BMPs for transportation corridors associated with new and rehabilitation roadway Capital Improvement Projects (CIPs). This policy is enacted to demonstrate compliance with the NPDES MS4 Permit for the Los Angeles Region (Order No. R4-2012-0175).

Green streets are defined as right-of-way areas that incorporate infiltration, bio-filtration, and/or storage and use BMPs to collect, retain, or detain stormwater runoff as well as a design element that creates attractive streetscapes.

Policy

The Public Works Department shall require new and/or rehabilitation streets CIP projects conducted within the right-of-way to incorporate bio-filtration (Filterra or equal) BMPs adjacent to existing or proposed catch basins. Transportation corridors projects are major arterials as defined in the General Plan which add at least 10,000 square feet of impervious surface. Routine maintenance or repair and linear utility projects are excluded from these requirements. Routine maintenance includes slurry seals, repaving, and reconstruction of the road or street where the original line and grade are maintained. New storm drain CIP projects that install catch basins within irrigated parkways within watershed areas that DO NOT drain to detention or retention basins shall also include bio-filtration BMPs to be installed adjacent to catch basins to intercept irrigation run off.

The Public Works Department and Community Development Department shall require new or redeveloped alleys that have known drainage problems to include Interlocking Pavers with Infiltration Trenches in lieu of concrete gutter for alley upgrades. (Interlocking Pavers shall be per City of Los Angeles Standard Drawing S-485-0 until a new City of Torrance Standard Drawing is approved.)

Final decisions regarding implementation will be determined by the City Engineer based on the availability of adequate funding.

Appendix O

Structural BMP Unit Cost Tables

Table O-1. Manhattan Beach Infiltration Trench (Alternative 1) Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Demolish and remove existing asphalt or concrete	Assume 5% BMP footprint requires asphalt removal, 3" to 6" deep, bituminous roads	SY	Carollo, 2014	$6.75	548	$3,699	600	$4,051
Excavation, 250 to 2500 CY	Larger scale excavations to 3 to 8 ft depth; sub-regional detention facilities, etc.	CY	RS Means	$14.45	20,432	$295,239	24,781	$358,079
Hauling, 10 CY truck, 10 miles RT	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait	CY	Carollo, 2014	$9.00	15,324	$137,915	22,302	$200,722
Utility area drain, catch basins or manholes	Curb inlet frame, grate and curb box, large, 24"x36"	EA	RS Mean Line No 334413131582	$1,572	1	$1,572	1	$1,572
Shoring System	2 wall shoring system	SF	Carollo, 2014	$37	20,831	$770,758	25,592	$946,898
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252	500	$126,000	1,000	$252,000
Vent/Cleanout/Observation Wells	PVC, 6'' diameter	EA	RS Means Line No 220576205210	$141	25	$3,486	54	$7,636
Diversion Structure	Infiltration Basin	EA	Carollo, 2014	$40,000	1	$40,000	1	$40,000
72" corrugated steel, perforated pipe, 16 gauge (reduced for 36'' pipe with 1.2 multiplier)	Infiltration gallery	LF	RS Means	$16.63	11,715	$194,846	11,715	$194,846
CDS	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	1	$60,000	2	$120,000
Geosynthetic Fabric; non-woven geotextile	120 lb tensile strength	SY	RS Means Line No	$1.39	131,961	$183,425	146,114	$203,099

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
			313219161550					
Geo-grid	Soil stabilization grid (various sizes)	SY	Estimate from online manufacturers	$3.00	131,961	$395,882	146,114	$438,343
Washed Pea Gravel (1/4 to 1/2") - AASHTO #7 or #8 stone	Or similar gradation commonly available in the area	CY	RS Means	$70.00	–	–	8,002	$560,117
Drainage/Storage Rock (#2 stone)	Drainage fill	CY	RS Means, Line No 333650102600	$37.85	13,030	$493,174	13,030	$493,174
Subtotal						**$2,705,995**	**N/A**	**$3,820,537**

[1] Safety factor of 1.05 (low) and 1.15 (high) applied to BMP footprint

Table O-2. Manhattan Beach Infiltration Trench (Alternative 2) Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Demolish and remove existing asphalt or concrete	Assume 5% BMP footprint requires asphalt removal, 3" to 6" deep, bituminous roads	SY	Carollo, 2014	$6.75	438	$2,959	480	$3,241
Excavation, 250 to 2500 CY	Larger scale excavations to 3 to 8 ft depth; sub-regional detention facilities, etc.	CY	RS Means	$14.45	16,670	$240,874	20,148	$291,146
Hauling, 10 CY truck, 10 miles RT	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait	CY	Carollo, 2014	$9.00	12,502	$112,519	18,134	$163,203
Utility area drain, catch basins or manholes	Curb inlet frame, grate and curb box, large, 24"x36"	EA	RS Mean Line No 334413131582	$1,572	1	$1,572	1	$1,572
Shoring System	2 wall shoring system	SF	Carollo, 2014	$37	16,768	$620,417	20,589	$761,802
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252	500	$126,000	1,000	$252,000
Vent/Cleanout/Observation Wells	PVC, 6'' diameter	EA	RS Means Line No 220576205210	$141	20	$2,789	43	$6,108
Diversion Structure	Infiltration Basin	EA	Carollo, 2014	$40,000	1	$40,000	1	$40,000
72" corrugated steel, perforated pipe, 16 gauge (reduced for 36'' pipe with 1.2 multiplier)	Infiltration gallery	LF	RS Means	$16.63	9,372	$155,877	9,372	$155,877
CDS	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	1	$60,000	2	$120,000
Geosynthetic Fabric; non-woven geotextile	120 lb tensile strength	SY	RS Means Line No	$1.39	108,171	$150,358	119,507	$166,115

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
			313219161550					
Geo-grid	Soil stabilization grid (various sizes)	SY	Estimate from online manufacturers	$3.00	108,171	$324,514	119,507	$358,522
Washed Pea Gravel (1/4 to 1/2") - AASHTO #7 or #8 stone	Or similar gradation commonly available in the area	CY	RS Means	$70.00	–	–	6,401	$448,094
Drainage/Storage Rock (#2 stone)	Drainage fill	CY	RS Means, Line No 333650102600	$37.85	10,424	$394,539	13,030	$493,174
Subtotal						**$2,232,418**	**N/A**	**$3,260,853**

[1] Safety factor of 1.05 (low) and 1.15 (high) applied to BMP footprint

Table O-3. Polliwog Park Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Demolition	Assume 5% BMP footprint requires asphalt removal, 6" deep	SY	RS Means Line No. 024113175050	$9.70	237	$2,295	257	$2,494
Excavation	Assume no chemical contamination	CY	OC Public Works Abstract Report Bid No EF07398	$15.00	7,885	$118,278	10,285	$154,275
Hauling	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait. Includes cost of dust monitoring, dust control, and BMP requirements. (Conversion from CY to Ton = 1/1.8)	Tons	Carollo, 2014	$9.00	5,914	$53,225	9,257	$83,309
Finish Grading	Fine grading, loam or topsoil fine grade	SY	RS Means Line No. 312216101020	$1.16	4,731	$5,488	5,143	$5,965
Shoring System	2 wall shoring system	SF	Carollo, 2014	$37	2,918	$107,974	3,651	$135,085
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252	500	$126,000	1,000	$252,000
Diversion Structure	Cast-in-place concrete structure	EA	NMC Builders, 2008	$150,000	1	$150,000	1	$150,000
Manholes	5' ID manhole, 8' deep with cover	EA	Internal Geosyntec estimate	$4,000	1	$4,000	2	$8,000
Solids Removal (Pretreatment)	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	1	$60,000	2	$120,000
Cistern, concrete	Range of precast, cast in place, and cast in place floor with precast vault	CF	Jensen Stormwater and Contech	$8.95	148,104	$1,325,039	148,104	$1,325,039

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Traditional Asphalt Subgrade and Base Course	Plant mixed asphaltic base courses for roadways and large paved areas (2'' low and 4'' high)	CY	RS Means, Line No 321126131600	$78.35	13	$1,030	29	$2,238
Traditional Asphalt Top Course	Wearing course, plant mix asphalt, less than 300 tons	SY	RS Means Line No 321216131585	$17.31	237	$4,095	257	$4,451
Soil preparation	Topsoil placement and grading, top dress by hand, 6 inch depth	SF	OC Public Works Bid Abstract Report No ER20369 (2012)	$0.52	42,580	$22,142	46,283	$24,067
Mixed BMP Vegetation	Shrubs - broadleaf evergreen, plant 6' on center	SF	RS Means	$2.00	42,580	$85,160	46,283	$92,565
Bentonite Liner	1" - 4" thick layer	CY	www.bentoniteliner.com	$0.68	9,462	$6,434	10,285	$6,994
Geosynthetic Fabric	120 lb tensile strength	SY	OC Public Works Bid Abstract Report No EF07405 (2013)	$2.76	4,731	$13,058	5,143	$14,193
Gravel Delivery	Includes delivery (Conversion = 2Tons/CY)	Tons	Internal Geosyntec estimate	$28.00	1,577	$44,157	2,571	$71,995
Gravel Spreading and Grading	Includes spreading and grading only	CY	Internal Geosyntec Estimate	$10.00	1,577	$15,770	2,571	$25,713
Subtotal						**$2,144,143**	**N/A**	**$2,478,383**

[1] Safety factor of 1.15 (low) and 1.25 (high) applied to BMP footprint

Table O-4. Hermosa Beach Infiltration Trench Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Demolish and remove existing asphalt or concrete	Assume 5% BMP footprint requires asphalt removal, 3" to 6" deep, bituminous roads	SY	Carollo, 2014	$6.75	45	$303	49	$332
Excavation, 250 to 2500 CY	Larger scale excavations to 3 to 8 ft depth; sub-regional detention facilities, etc.	CY	RS Means	$14.45	1,321	$19,087	1,678	$24,243
Hauling, 10 CY truck, 10 miles RT	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait	CY	Carollo, 2014	$9.00	991	$8,916	1,510	$13,590
Utility area drain, catch basins or manholes	Curb inlet frame, grate and curb box, large, 24"x36"	EA	RS Mean Line No 334413131582	$1,572	1	$1,572	1	$1,572
Shoring System	2 wall shoring system	SF	Carollo, 2014	$37	2,136	$79,025	2,674	$98,931
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252	500	$126,000	1,000	$252,000
Vent/Cleanout/Observation Wells	PVC, 6'' diameter	EA	RS Means Line No 220576205210	$141	2	$286	4	$626
Diversion Structure	Infiltration Basin	EA	Carollo, 2014	$40,000	1	$40,000	1	$40,000
72" corrugated steel, perforated pipe, 16 gauge (reduced for 30'' pipe with 1.2 multiplier)	Infiltration gallery	LF	RS Means	$13.86	757	$10,485	757	$10,485
Pump		EA	www.rainharvestingsupplies.com	$2,135	2	$4,270	4	$8,540
CDS	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	–	–	1	$60,000
Geosynthetic Fabric; non-woven geotextile	120 lb tensile strength	SY	RS Means Line No	$1.39	10,228	$14,217	11,537	$16,036

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
			313219161550					
Geo-grid	Soil stabilization grid (various sizes)	SY	Estimate from online manufacturers	$3.00	10,228	$30,684	11,537	$34,610
Washed Pea Gravel (1/4 to 1/2") - AASHTO #7 or #8 stone	Or similar gradation commonly available in the area	CY	RS Means	$70.00	–	–	657	$45,956
Drainage/Storage Rock (#2 stone)	Drainage fill	CY	RS Means, Line No 333650102600	$37.85	884	$33,449	884	$33,449
Subtotal						**$368,296**	**N/A**	**$640,372**

[1] Safety factor of 1.05 (low) and 1.15 (high) applied to BMP footprint

Table O-5. Hermosa Beach Greenbelt Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Excavation	Assume no chemical contamination	CY	OC Public Works Abstract Report Bid No EF07398	$15.00	16,299	$244,482	20,669	$310,031
Hauling	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait. Includes cost of dust monitoring, dust control, and BMP requirements. (Conversion from CY to Ton = 1/1.8)	Tons	Carollo, 2014	$9.00	12,224	$110,017	18,602	$167,417
Finish Grading	Fine grading, loam or topsoil fine grade	SY	RS Means Line No. 312216101020	$1.16	8,149	$9,453	8,858	$10,275
Shoring System	2 wall shoring system	SF	Carollo, 2014	$37	4,596	$170,052	5,590	$206,840
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252.00	500	$126,000	1,000	$252,000
Diversion Structure	Cast-in-place concrete structure	EA	NMC Builders, 2008	$150,000	1	$150,000	1	$150,000
Manholes	5' ID manhole, 8' deep with cover	EA	Internal Geosyntec estimate	$4,000	2	$8,000	3	$12,000
Solids Removal (Pretreatment)	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	1	$60,000	2	$120,000
Cistern, concrete	Range of precast, cast in place, and cast in place floor with precast vault	CF	Various	$8.95	318,889	$2,852,998	318,889	$2,852,998
Soil preparation	Topsoil placement and grading, top dress by hand, 6 inch depth	SF	OC Public Works Bid Abstract Report No ER20369 (2012)	$0.52	73,344	$38,139	79,722	$41,456
Mixed BMP Vegetation	Shrubs - broadleaf evergreen, plant 6' on center	SF	RS Means	$2.00	73,344	$146,689	79,722	$159,445

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Bentonite Liner	1" - 4" thick layer	CY	www.bentonitelin er.com	$0.68	16,299	$11,083	17,716	$12,047
Geosynthetic Fabric	120 lb tensile strength	SY	OC Public Works Bid Abstract Report No EF07405 (2013)	$2.76	8,149	$22,492	8,858	$24,448
Gravel Delivery	Includes delivery (Conversion = 2Tons/CY)	Tons	Internal Geosyntec estimate	$28.00	2,716	$76,061	4,429	$124,012
Gravel Spreading and Grading	Includes spreading and grading only	CY	Internal Geosyntec Estimate	$10.00	2,716	$27,165	4,429	$44,290
Subtotal						**$4,052,630**	**N/A**	**$4,487,259**

[1] Safety factor of 1.15 (low) and 1.25 (high) applied to BMP footprint

Table O-6. Park #3 Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Excavation	Assume no chemical contamination	CY	OC Public Works Abstract Report Bid No EF07398	$15.00	4,453	$66,792	5,647	$84,700
Hauling	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait. Includes cost of dust monitoring, dust control, and BMP requirements. (Conversion from CY to Ton = 1/1.8)	Tons	Carollo, 2014	$9.00	3,340	$30,056	5,082	$45,738
Finish Grading	Fine grading, loam or topsoil fine grade	SY	RS Means Line No. 312216101020	$1.16	2,226	$2,583	2,420	$2,807
Shoring System	2 wall shoring system	SF	Carollo, 2014	$37	2,402	$88,883	2,922	$108,112
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252	500	$126,000	1,000	$252,000
Diversion Structure	Cast-in-place concrete structure	EA	NMC Builders, 2008	$150,000	1	$150,000	1	$150,000
Manholes	5' ID manhole, 8' deep with cover	EA	Internal Geosyntec estimate	$4,000	1	$4,000	1	$4,000
Solids Removal (Pretreatment)	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	1	$60,000	2	$120,000
Cistern, concrete	Range of precast, cast in place, and cast in place floor with precast vault	CF	Jensen Stormwater and Contech	$8.95	87,120	$779,435	87,120	$779,435
Soil preparation	Topsoil placement and grading, top dress by hand, 6 inch depth	SF	OC Public Works Bid Abstract Report No ER20369 (2012)	$0.52	20,038	$10,420	21,780	$11,326

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Mixed BMP Vegetation	Shrubs - broadleaf evergreen, plant 6' on center	SF	RS Means	$2.00	20,038	$40,075	21,780	$43,560
Bentonite Liner	1" - 4" thick layer	CY	www.bentoniteliner.com	$0.68	4,453	$3,028	4,840	$3,291
Geosynthetic Fabric	120 lb tensile strength	SY	OC Public Works Bid Abstract Report No EF07405 (2013)	$2.76	2,226	$6,145	2,420	$6,679
Gravel Delivery	Includes delivery (Conversion = 2Tons/CY)	Tons	Internal Geosyntec estimate	$28.00	742	$20,780	1,210	$33,880
Gravel Spreading and Grading	Includes spreading and grading only	CY	Internal Geosyntec Estimate	$10.00	742	$7,421	1,210	$12,100
Subtotal						**$1,395,618**	**N/A**	**$1,657,628**

[1] Safety factor of 1.15 (low) and 1.25 (high) applied to BMP footprint

Table O-7. Powerline Easement Infiltration Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Demolition	Assume 5% BMP footprint requires asphalt removal, 6" deep	SY	RS Means Line No. 024113175050	$9.70	–	–	1,916	$18,584
Excavation	Assume no chemical contamination	CY	OC Public Works Abstract Report Bid No EF07398	$15.00	58,056	$870,833	63,861	$957,917
Hauling	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait. Includes cost of dust monitoring, dust control, and BMP requirements. (Conversion from CY to Ton = 1/1.8)	Tons	Carollo, 2014	$9.00	24,190	$217,708	31,931	$287,375
Finish Grading	Fine grading, loam or topsoil fine grade	SY	RS Means Line No. 312216101020	$1.16	34,833	$40,407	38,317	$44,447
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252.00	300	$75,600	500	$126,000
Distribution Laterals	24" diameter RCP, includes excavation, backfill, bedding	LF	OC Public Works Bid Abstract Report No EF07398 (2012)	$156.00	500	$78,000	500	$78,000
Diversion Structure	Cast-in-place concrete structure	EA	NMC Builders, 2008	$150,000	1	$150,000	1	$150,000
Manholes	5' ID manhole, 8' deep with cover	EA	Internal Geosyntec estimate	$4,000	2	$8,000	3	$12,000
Solids Removal (Pretreatment)	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	1	$60,000	2	$120,000
Soil preparation	Topsoil placement and grading, top dress by hand, 6 inch depth	SF	OC Public Works Bid Abstract Report No ER20369 (2012)	$0.52	313,500	$163,020	344,850	$179,322
Mixed BMP Vegetation	Shrubs - broadleaf evergreen, plant 6' on center	SF	RS Means	$2.00	313,500	$627,000	344,850	$689,700

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Bentonite Liner	1" - 4" thick layer	CY	www.bentoniteliner.com	$0.68	968	$658	4,257	$2,895
Geosynthetic Fabric	120 lb tensile strength	SY	OC Public Works Bid Abstract Report No EF07405 (2013)	$2.76	34,833	$96,140	38,317	$105,754
Engineered Biofiltration Media	If possible, obtain costs for media that meets recently revised City specifications	CY	RS Means	$100.00	58,056	$5,805,556	63,861	$6,386,111
Subtotal						**$8,192,922**	**N/A**	**$9,158,105**

[1] Safety factor of 1.1 (high cost) applied to BMP footprint

Table O-8. Artesia Blvd Infiltration Unit Costs[1]

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Demolition	Assume 5% BMP footprint requires asphalt removal, 6" deep	SY	RS Means Line No. 024113175050	$9.70	–	–	267	$2,593
Excavation	Assume no chemical contamination	CY	OC Public Works Abstract Report Bid No EF07398	$15.00	9,719	$145,790	12,473	$187,097
Hauling	8 CY truck, 15 MPH average, 6 mile cycle, 20 minute wait. Includes cost of dust monitoring, dust control, and BMP requirements. (Conversion from CY to Ton = 1/1.8)	Tons	Carollo, 2014	$9.00	4,050	$36,448	6,237	$56,129
Finish Grading	Fine grading, loam or topsoil fine grade	SY	RS Means Line No. 312216101020	$1.16	4,860	$5,637	5,346	$6,201
BMP Inflow and Outflow Conveyance	48" diameter class 3 reinforced culvert	LF	NMC Builders, 2008	$252.00	300	$75,600	500	$126,000
Distribution Laterals	24" diameter RCP, includes excavation, backfill, bedding	LF	OC Public Works Bid Abstract Report No EF07398 (2012)	$156.00	500	$78,000	500	$78,000
Diversion Structure	Cast-in-place concrete structure	EA	NMC Builders, 2008	$150,000	1	$150,000	1	$150,000
Manholes	5' ID manhole, 8' deep with cover	EA	Internal Geosyntec estimate	$4,000	2	$8,000	3	$12,000
Solids Removal (Pretreatment)	More than 4 acres tributary area	EA	Carollo, 2014	$60,000	1	$60,000	2	$120,000
Soil preparation	Topsoil placement and grading, top dress by hand, 6 inch depth	SF	OC Public Works Bid Abstract Report No ER20369 (2012)	$0.52	43,737	$22,743	48,111	$25,018

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Mixed BMP Vegetation	Shrubs - broadleaf evergreen, plant 6' on center	SF	RS Means	$2.00	43,737	$87,474	48,111	$96,221
Bentonite Liner	1" - 4" thick layer	CY	www.bentoniteliner.com	$0.68	135	$92	594	$404
Geosynthetic Fabric	120 lb tensile strength	SY	OC Public Works Bid Abstract Report No EF07405 (2013)	$2.76	4,860	$13,413	5,346	$14,754
Engineered Biofiltration Media	If possible, obtain costs for media that meets recently revised City specifications	CY	RS Means	$100.00	8,099	$809,944	8,909	$890,939
Subtotal						**$1,493,141**	**N/A**	**$1,765,356**

[1] Safety factor of 1.1 (high cost) applied to BMP footprint

Table O-9. Torrance Catch Basin Inlet Filter Unit Costs

Cost Item	Units	Cost Source	Low Cost Scenario			High Cost Scenario		
			Units per catch basin	Unit Price	Line Item	Units per catch basin	Unit Price	Line Item
Heavy Metal Filter Sock	EA	Carollo	2	$175	$350	3	$175	$525
Curb Inlet Filter Box	EA	Carollo	2	$360	$720	3	$360	$1,080
Installation Curb Inlet	EA	Carollo	1	$125	$125	1	$145	$145
Curb Markers	EA	Carollo	1	$25	$25	1	$25	$25
Subtotal (per catch basin)					**$1,220**	**N/A**	**N/A**	**$1,775**

Table O-10. Torrance Catch Basin Inlet Filter Annual O&M Unit Costs

Cost Item	Units	Cost Source	Low Cost Scenario			High Cost Scenario		
			Units per catch basin	Unit Price	Line Item	Units per catch basin	Unit Price	Line Item
Maintenance twice per year	EA	Carollo	2	$150	$300	2	$155	$310
Replace 100% of filters each year	EA	Carollo	2	$175	$350	3	$175	$525
Subtotal (per catch basin)					**$650**	**N/A**	**N/A**	**$835**

Table O-11. Catch Basin Insert Unit Costs (Cities of Redondo Beach, Hermosa Beach and Manhattan Beach)

Cost Item	Description	Units	Cost Source	Low Cost Scenario Unit Cost	High Cost Scenario Unit Cost
ARS	Furnish and install with Automatic Retractable Screen (ARS). 3.5-5' size used for low cost and 28' size used for high cost	EA	Machado Lake Trash TMDL Project	$341	$2,046
CPS	Install connector pipe screen full capture trash system (CPS)	EA	Machado Lake Trash TMDL Project	$390	$390
Subtotal (per catch basin)				**$731**	**$2,436**

Table O-12. Catch Basin Insert Annual O&M Unit Costs (Cities of Redondo Beach, Hermosa Beach, and Manhattan Beach)

Cost Item	Description	Units	Cost Source	Unit Price	Low Cost Scenario		High Cost Scenario	
					Units	Line Item	Units	Line Item
Storm-season inspections (monthly)	7 monthly inspections from October to April	EA	City of Rancho Palos Verdes Approval of Catch Basin Maintenance Agreement	$14.79	7	$103.53	7	$103.53
Storm-season inspections (post-storm)	Inspections after major storm event (storms with a rainfall intensity greater than 1 inch in 12 hours)	EA	City of Rancho Palos Verdes Approval of Catch Basin Maintenance Agreement	$12.90	3	$38.70	5	$64.50
Storm-season cleanout	Cleanout of debris/sediment after major storm event	EA	City of Rancho Palos Verdes Approval of Catch Basin Maintenance Agreement	$33.69	3	$101.07	5	$168.45
Dry-weather season O&M	Inspection/cleaning during the dry season (May 1 - September 30)	EA	City of Rancho Palos Verdes Approval of Catch Basin Maintenance Agreement	$39.69	1	$39.69	1	$39.69
Admin/ Insurance	Contract Admin/Liability Insurance	EA	City of Rancho Palos Verdes Approval of Catch Basin Maintenance Agreement	$40.58	1	$40.58	1	$40.58
Disposal	Disposal of debris/sediment	EA	City of Rancho Palos Verdes Approval of Catch Basin Maintenance Agreement	$20.00	1	$20.00	1	$20.00
Subtract current cleaning cost[1]	Subtracting the current cost of cleaning a catch basin without an insert	EA	City of Rancho Palos Verdes Approval of Catch Basin Maintenance Agreement	$15.25	1	$15.25	1	$15.25
Subtotal (per catch basin per year)						**$328.32**	**N/A**	**$421.50**

[1] Subtracted from unit cost. Calculated from average total costs for cleaning non-retrofitted catch basins from 2006-2011, including contract administration costs.

Capital cost estimates were developed for varying capacities of green streets and translated into unit costs per square foot of BMP footprint. Unit costs from several example projects were averaged to determine a low and high unit cost per square foot of green streets that would be applied for distributed green street BMPs. The resulting unit cost ranged from $15.42 (low) to $31.60 (high) per square foot of BMP area. Cost items and unit prices for line items included in this analysis are shown in Table F-13. Details of the units and line items for the various capacities can be made available upon request.

Table O-13. Green Streets Unit Costs

Cost Item	Description	Units	Cost Source	Unit Price
Demolish and remove existing asphalt or concrete	Pavement removal, 3" to 6" deep, bituminous roads	SY	Carollo, 2014	$6.75
Excavation, 5 to 50 CY	Small scale excavations to 3 to 6 ft depth; curb bulb-outs, planter strips, etc.	CY	RS Means with multiplier applied	$32.51
Excavation, 50 to 250 CY	Small scale excavations to 3 to 6 ft depth; larger curb bulb-outs, planter strips, etc.	CY	RS Means with multiplier applied	$20.66
Excavation, 250 to 2500 CY	Larger scale excavations to 3 to 8 ft depth; sub-regional detention facilities, etc.	CY	RS Means	$14.45
Hauling, 10 CY truck, 10 miles RT	8 CY truck, 15 MPH ave, 6 mile cycle, 20 minute wait	CY	Carollo, 2014	$9.00
Cast In Place, Reinforced Concrete Retaining Wall[1]	4' high, $418.65/cu yd, assume 6" thick,	LF	RS Mean Line No 033053406200	$93.03
Cast in Place concrete curb and gutter, machine formed	Radius, 6" x 18", includes concrete	LF	RS Means Line No. 3211613130416	$8.65
Utility area drain, catch basins or manholes	Curb inlet frame, grate and curb box, large, 24"x36"	EA	RS Mean Line No 334413131582	$1,572
Shoring System[1]		SF	Carollo, 2014	$37
12" Storm Drain (Public ROW) - fully installed; all costs; avg 4 to 6 ft depth[2]	Please provide all inclusive unit cost including asphalt cutting, trenching, bedding, pipe placement, backfill, and re-paving. Whatever pipe material is most common in City.	LF	510-ASD12"Dia, Pipe, 12" Dia. PVC (all depths) including Excavation and Backfill	$76.00

Cost Item	Description	Units	Cost Source	Unit Price
18" Storm Drain (Public ROW) - fully installed; all costs; avg 4 to 6 ft depth[1]	Please provide all inclusive unit cost including asphalt cutting, trenching, bedding, pipe placement, backfill, and re-paving. Whatever pipe material is most common in City.	LF	510-ASD18"Dia, Pipe, 18" Dia. RCP (all depths) including Excavation and Backfill	$130.00
Mulch	Aged bark, hand spread 3" deep	SY	RS Means 329113160100	$8.56
Soil preparation	Topsoil placement and grading, top dress by hand, 6 inch depth	SF	OC Public Works Bid Abstract Report No ER20369 (2012)	$0.52
Mixed BMP Vegetation	Shrubs - broadleaf evergreen, plant 6' on center	SF	RS Means pg 641	$2.00
Drainage/Storage Rock (#2 stone)[1]	Drainage fill	CY	RS Means, Line No 333650102600	$37.85
Washed Choke Stone (1/2 to 1-1/2") - AASHTO #57 or #67 stone[2]	Crushed 1-1/2" stone, compacted, (converted from SY using 1' depth)	CY	RS Means, Line No 321123230320	$14.02
Rounded Decorative Drain Rock	Whatever is typically used in french drains and decorative features	CY	RS Means	$110.00
Engineered Biofiltration Media	If possible, obtain costs for media that meets recently revised City specifications	CY	RS Means	$100.00

[1] Line item included for high cost scenario only

[2] Line item included for low cost scenario only

Appendix P

Documentation of Legal Authority

COUNTY OF LOS ANGELES
OFFICE OF THE COUNTY COUNSEL
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JOHN F. KRATTLI
County Counsel

December 16, 2013

Mr. Samuel Unger, P.E., Executive Officer
California Regional Water Quality Control Board – Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013-2343

Attention: Mr. Ivar Ridgeway

Re: Certification By Legal Counsel For Los Angeles County Flood Control District's Annual Report

Dear Mr. Unger:

Pursuant to the requirements of Part VI(A)(2)(b) of Order No. R4-2012-0175 (the "Order"), the Office of the County Counsel of the County of Los Angeles makes the following certification in support of the Annual Report of the Los Angeles County Flood Control District ("LACFCD"):

Certification Pursuant To Order Part VI(A)(2)(b)

"*Each Permittee must submit a statement certified by its chief legal counsel that the Permittee has the legal authority within its jurisdiction to implement and enforce the requirements contained in 40 CFR §122.26(d)(2)(i)(A-F) and this Order.*"

LACFCD has the legal authority within its jurisdiction to implement and enforce each of the requirements contained in 40 CFR §122.26(d)(2)(i)(A-F) and the Order.

Order Part VI(A)(2)(b)(i)

"*Citation of applicable municipal ordinances or other appropriate legal authorities and their relationship to the requirements of 40 CFR §122.26(d)(2)(i)(A-F) and this Order*"

Citations Of Applicable Ordinances Or Other Legal Authorities

Although many portions of State law, the Charter of the County of Los Angeles, the Los Angeles County Code and LACFCD's Flood Control District Code ("Code") are potentially applicable to the implementation and enforcement of these requirements, the primary applicable laws and ordinances are as follows:

Los Angeles County Code, Title 12, Chapter 12.80 STORMWATER AND RUNOFF POLLUTION CONTROL, including:

§12.80.010 - §12.80.360 Definitions

§12.80.370 Short title.

§12.80.380 Purpose and intent.

§12.80.390 Applicability of this chapter.

§12.80.400 Standards, guidelines and criteria.

§12.80.410 Illicit discharges prohibited.

§12.80.420 Installation or use of illicit connections prohibited.

§12.80.430 Removal of illicit connection from the storm drain system.

§12.80.440 Littering and other discharge of polluting or damaging substances prohibited.

§12.80.450 Stormwater and runoff pollution mitigation for construction activity.

§12.80.460 Prohibited discharges from industrial or commercial activity.

§12.80.470 Industrial/commercial facility sources required to obtain a NPDES permit.

§12.80.480 Public facility sources required to obtain a NPDES permit.

§12.80.490 Notification of uncontrolled discharges required.

§12.80.500 Good housekeeping provisions.

§12.80.510 Best management practices for construction activity.

§12.80.520 Best management practices for industrial and commercial facilities.

§12.80.530 Installation of structural BMPs.

§12.80.540 BMPs to be consistent with environmental goals.

§12.80.550 Enforcement—Director's powers and duties.

§12.80.560 Identification for inspectors and maintenance personnel.

§12.80.570 Obstructing access to facilities prohibited.

§12.80.580 Inspection to ascertain compliance—Access required.

§12.80.590 Interference with inspector prohibited.

§12.80.600 Notice to correct violations—Director may take action.

§12.80.610 Violation a public nuisance.

§12.80.620 Nuisance abatement—Director to perform work when—Costs.

§12.80.630 Violation—Penalty.

§12.80.635 Administrative fines.

§12.80.640 Penalties not exclusive.

§12.80.650 Conflicts with other code sections.

§12.80.660 Severability.

§12.80.700 Purpose.

§12.80.710 Applicability.

§12.80.720 Registration required.

§12.80.730 Exempt facilities.

§12.80.740 Certificate of inspection—Issuance by the director.

§12.80.750 Certificate of inspection—Suspension or revocation.

§12.80.760 Certificate of inspection—Termination.

§12.80.770 Service fees.

§12.80.780 Fee schedule.

§12.80.790 Credit for overlapping inspection programs.

§12.80.800 Annual review of fees.

Los Angeles County Code, Title 12, Chapter 12.84 LOW IMPACT DEVELOPMENT STANDARDS, including:

§12.84.410 Purpose.

§12.84.420 Definitions.

§12.84.430 Applicability.

§12.84.440 Low Impact Development Standards.

§12.84.445 Hydromodification Control.

§12.84.450 LID Plan Review.

§12.84.460 Additional Requirements.

Los Angeles County Code, Title 22 PLANNING AND ZONING, Part 6 ENFORCEMENT PROCEDURES, including:

§22.60.330 General prohibitions.

§22.60.340 Violations.

§22.60.350 Public nuisance.

§22.60.360 Infractions.

§22.60.370 Injunction.

§22.60.380 Enforcement.

§22.60.390 Zoning enforcement order and noncompliance fee.

Los Angeles County Code, Title 26 BUILDING CODE, including:

§26.103 Violations And Penalties

§26.104 Organization And Enforcement

§26.105 Appeals Boards

§26.106 Permits

§26.107 Fees

§26.108 Inspections

LACFCD Code Chapter 21 - STORMWATER AND RUNOFF POLLUTION CONTROL including:

§21.01 Purpose and Intent

§21.03 Definitions

§21.05 Standards, Guidelines, and Criteria

§21.07 Prohibited Discharges

§21.09 Installation or Use of Illicit Connections Prohibited

§21.11 Littering Prohibited

§21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity

§21.15 Notification of Uncontrolled Discharges Required

§21.17 Requirement to Monitor and Analyze

§21.19 Conflicts With Other Code Sections

§21.21 Severability

§21.23 Violation a Public Nuisance

California Government Code §6502

California Government Code §23004

California Water Code §8100 *et. seq.*

Relationship Of Applicable Ordinances Or Other Legal Authorities To The Requirements of 40 CFR §122.26(d)(2)(i)(A-F) And The Order

Although, depending upon the particular issue, there may be multiple ways in which particular sections of the County of Los Angeles' ordinances, LACFCD's ordinances, and statutes relate to the requirements contained in 40 CFR §122.26(d)(2)(i)(A-F) and the Order, the table below indicates the basic relationship with Part VI(A)(2)(a) of the Order:

Order Part VI(A)(2)(a) Items	**Primary Applicable Ordinance/Statute**
i. Control the contribution of pollutants to its MS4 from storm water discharges associated with industrial and construction activity and control the quality of storm water discharged from industrial and construction sites. This requirement applies both to industrial and construction sites with coverage under an NPDES permit, as well as to those sites that do not have coverage under an NPDES permit.	Los Angeles County Code: §12.80.410 [illicit discharge prohibited]; §12.80.450 [construction] §12.80.460 [industrial and commercial] §12.80.470 and .480 [industrial and commercial NPDES requirements] §12.84.440 [LID standards] §12.84.445 [hydromodification control] §12.84.450 [LID Plan Review] §22.60.330 [general prohibitions] §22.60.340 [violations] §22.60.350 [public nuisance] §22.60.360 [infractions] §22.60.370 [injunction] §22.60.380 [enforcement.] §22.60.390 [zoning enforcement order] §26.103 [violations and penalties]

Order Part VI(A)(2)(a) Items	Primary Applicable Ordinance/Statute
	§26.104 [enforcement] §26.106 [permits] §26.108 [inspections] LACFCD Code: §21.05 Standards, Guidelines, and Criteria §21.07 Prohibited Discharges §21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity §21.15 Notification of Uncontrolled Discharges Required §21.17 Requirement to Monitor and Analyze §21.23 Violation a Public Nuisance
ii. Prohibit all non-storm water discharges through the MS4 to receiving waters not otherwise authorized or conditionally exempt pursuant to Part III.A.	Los Angeles County Code: §12.80.410 [illicit discharge prohibited] LACFCD Code: §21.07 Prohibited Discharges
iii. Prohibit and eliminate illicit discharges and illicit connections to the MS4.	Los Angeles County Code: §12.80.410 [illicit discharge prohibited]; §12.80.420 [illicit connections prohibited] LACFCD Code: §21.05 Standards, Guidelines, and Criteria §21.07 Prohibited Discharges §21.09 Installation or Use of Illicit Connections Prohibited §21.23 Violation a Public Nuisance

Order Part VI(A)(2)(a) Items	Primary Applicable Ordinance/Statute
iv. Control the discharge of spills, dumping, or disposal of materials other than storm water to its MS4.	Los Angeles County Code: §12.80.410 [illicit discharge prohibited]; §12.80.440 [littering and other polluting prohibited] LACFCD Code: §19.07 Interference With or Placing Obstructions, Refuse, Contaminating Substances, or Invasive Species in Facilities Prohibited §21.05 Standards, Guidelines, and Criteria §21.07 Prohibited Discharges §21.09 Installation or Use of Illicit Connections Prohibited §21.11 Littering Prohibited §21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity §21.15 Notification of Uncontrolled Discharges Required §21.17 Requirement to Monitor and Analyze §21.23 Violation a Public Nuisance
v. Require compliance with conditions in Permittee ordinances, permits, contracts or orders (i.e., hold dischargers to its MS4 accountable for their contributions of pollutants and flows).	Los Angeles County Code: §12.80.490 [notification of uncontrolled discharge] §12.80.570 [obstructing access to facilities] §12.80.580 [compliance inspection] §12.80.610 [violation a nuisance] §12.620 [nuisance abatement] §12.80.635 [violation penalty]

Order Part VI(A)(2)(a) Items	Primary Applicable Ordinance/Statute
	§12.80.640 [penalties not exclusive] §12.84.440 [LID standards] §12.84.445 [hydromodification control] §12.84.450 [LID Plan Review] §22.60.330 [general prohibitions] §22.60.340 [violations] §22.60.350 [public nuisance] §22.60.360 [infractions] §22.60.370 [injunction] §22.60.380 [enforcement.] §22.60.390 [zoning enforcement order] §26.103 [violations and penalties] §26.104 [enforcement] §26.106 [permits] §26.108 [inspections] LACFCD Code: §19.11 Violation a Public Nuisance §21.05 Standards, Guidelines, and Criteria §21.07 Prohibited Discharges §21.09 Installation or Use of Illicit Connections Prohibited §21.11 Littering Prohibited §21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity §21.15 Notification of Uncontrolled Discharges Required §21.17 Requirement to Monitor and Analyze

Order Part VI(A)(2)(a) Items	Primary Applicable Ordinance/Statute
	§21.19 Conflicts With Other Code Sections §21.23 Violation a Public Nuisance
vi. Utilize enforcement mechanisms to require compliance with applicable ordinances, permits, contracts, or orders.	Same as item v., above
vii. Control the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements among Copermittees.	California Government Code §6502 California Government Code §23004
viii. Control of the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements with other owners of the MS4 such as the State of California Department of Transportation.	California Government Code §6502 California Government Code §23004
ix. Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with applicable municipal ordinances, permits, contracts and orders, and with the provisions of this Order, including the prohibition of non-storm water discharges into the MS4 and receiving waters. This means the Permittee must have authority to enter, monitor, inspect, take measurements, review and copy records, and require regular reports from entities discharging into its MS4.	Los Angeles County Code: §12.80.490 [notification of uncontrolled discharge] §12.80.570 [obstructing access to facilities] §12.80.580 [compliance inspection] §12.80.610 [violation a nuisance] §12.80.620 [nuisance abatement] §12.80.635 [violation penalty] §12.80.640 [penalties not exclusive] §22.60.380 [enforcement.] §26.106 [permits] §26.108 [inspections]

Order Part VI(A)(2)(a) Items	Primary Applicable Ordinance/Statute
	LACFCD Code: §21.05 Standards, Guidelines, and Criteria §21.07 Prohibited Discharges §21.09 Installation or Use of Illicit Connections Prohibited §21.11 Littering Prohibited §21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity §21.15 Notification of Uncontrolled Discharges Required §21.17 Requirement to Monitor and Analyze §21.23 Violation a Public Nuisance
x. Require the use of control measures to prevent or reduce the discharge of pollutants to achieve water quality standards/receiving water limitations.	Los Angeles County Code: §12.80.450 [construction mitigation] §12.80.500 [good housekeeping practices] §12.80.510 [construction BMPs] §12.80.520 [industrial/commercial BMPs] §12.84.440 [LID standards] §12.84.450 [LID Plan Review] §22.60.330 [general prohibitions] §22.60.380 [enforcement.] §22.60.390 [zoning enforcement order] §26.106 [permits] §26.108 [inspections] LACFCD Code: §21.05 Standards, Guidelines, and Criteria

Order Part VI(A)(2)(a) Items	Primary Applicable Ordinance/Statute
	§21.07 Prohibited Discharges §21.09 Installation or Use of Illicit Connections Prohibited §21.11 Littering Prohibited §21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity §21.15 Notification of Uncontrolled Discharges Required §21.17 Requirement to Monitor and Analyze §21.23 Violation a Public Nuisance
xi. Require that structural BMPs are properly operated and maintained.	Los Angeles County Code: §12.80.530 [installation of structural BMPs] §22.60.380 [enforcement.] §22.60.390 [zoning enforcement order] §26.106 [permits] §26.108 [inspections] LACFCD Code: §21.05 Standards, Guidelines, and Criteria §21.07 Prohibited Discharges §21.09 Installation or Use of Illicit Connections Prohibited §21.11 Littering Prohibited §21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity §21.15 Notification of Uncontrolled Discharges Required §21.17 Requirement to Monitor and Analyze

Order Part VI(A)(2)(a) Items	Primary Applicable Ordinance/Statute
	§21.23 Violation a Public Nuisance
xii. Require documentation on the operation and maintenance of structural BMPs and their effectiveness in reducing the discharge of pollutants to the MS4.	Los Angeles County Code: §12.80.530 [installation of structural BMPs] §22.60.380 [enforcement.] §22.60.390 [zoning enforcement order] §26.106 [permits] §26.108 [inspections] LACFCD Code: §21.05 Standards, Guidelines, and Criteria §21.07 Prohibited Discharges §21.09 Installation or Use of Illicit Connections Prohibited §21.11 Littering Prohibited §21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity §21.15 Notification of Uncontrolled Discharges Required §21.17 Requirement to Monitor and Analyze §21.23 Violation a Public Nuisance

Order Part VI(A)(2)(b)(ii)

"*Identification of the local administrative and legal procedures available to mandate compliance with applicable municipal ordinances identified in subsection (i) above and therefore with the conditions of this Order, and a statement as to whether enforcement actions can be completed administratively or whether they must be commenced and completed in the judicial system.*"

The local administrative and legal procedures available to mandate compliance with the above ordinances are specified in those ordinances, particularly in:

Los Angeles County Code:

§12.80.550 Enforcement—Director's powers and duties.

§12.80.600 Notice to correct violations—Director may take action.

§12.80.610 Violation a public nuisance.

§12.80.620 Nuisance abatement—Director to perform work when—Costs.

§12.80.630 Violation—Penalty.

§12.80.635 Administrative fines.

§12.80.640 Penalties not exclusive.

§12.84.450 LID Plan Review.

§12.84.460 Additional Requirements.

Title 26, §103 Violations And Penalties

Title 26, §104 Organization And Enforcement

Title 26, §105 Appeals Boards

Title 26, §106 Permits

§22.60.330 General prohibitions.

§22.60.340 Violations.

§22.60.350 Public nuisance.

§22.60.360 Infractions.

§22.60.370 Injunction.

§22.60.380 Enforcement.

§22.60.390 Zoning enforcement order and noncompliance fee.

LACFCD Code:

§21.05 Standards, Guidelines, and Criteria

§21.07 Prohibited Discharges

§21.09 Installation or Use of Illicit Connections Prohibited

§21.11 Littering Prohibited

§21.13 Evidence of Compliance With Permit Requirements for Industrial or Commercial Activity

§21.15 Notification of Uncontrolled Discharges Required

§21.17 Requirement to Monitor and Analyze

§21.23 Violation a Public Nuisance

LACFCD attempts to first resolve each enforcement action administratively. However, the above cited ordinances also provide LACFCD with the authority to pursue such actions in the judicial system as necessary.

Very truly yours,

JOHN F. KRATTLI
County Counsel

By
JUDITH A. FRIES
Principal Deputy County Counsel
Public Works Division

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December 8, 2014

Mr. Sam Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013-1105

RE: Legal Authority Certification for the City of Hermosa Beach to Implement and Enforce the Requirements of LARWQCB Order R4-2012-0175

Dear Mr. Unger:

The City of Hermosa Beach submits this statement in its capacity as a co-permittee under LARWQCB Order R4-2012-0175 (NPDES No. CAS004001) (the "MS4 Permit"), in accordance with Part VI.A.2 of the Order.

I am the City Attorney of the City of Hermosa Beach, California. In that capacity, I state that it is my opinion that the City has adequate legal authority to implement and enforce the requirements in the MS4 Permit, consistent with the requirements set forth in the regulations implementing the Clean Water Act, 40 CFR § 122.26(d)(2)(i)(A-F), and to the extent permitted by state and federal law and subject to the limitations on municipal action under the California and United States Constitutions.

The primary source of the City's authority is Article 11, § 7 of the California Constitution. The City also has authority under § 13002 of the California Water Code to adopt and enforce ordinances conditioning, restricting and limiting activities which might degrade the quality of waters of the State. Pursuant to Article 11, § 7 of the California Constitution and § 13002 of the California Water Code, the City adopted Chapter 8.44 of the Hermosa Beach Municipal Code ("HBMC"), which contains the City's regulations enabling it to impose the legal requirements of the MS4 Permit (see attached analysis of legal authority). Thus, the City has the legal authority as required under Part VI.A.2 of the MS4 Permit.

Article 11, § 7 also provides the City the authority to require the use of control measures to prevent or reduce the discharge of pollutants and ensure that such control measures are properly

operated and maintained. The City's environmental requirements are also implemented in part through the application of the California Environmental Quality Act ("CEQA") process to proposed projects, as enforceable mitigation measures. The City, as a municipal corporation, has authority to enter into contracts that enable it to carry out its necessary functions, including the power to enter into interagency agreements to control the contribution of pollutants from one portion of the shared MS4 to another.

Pursuant to HBMC Chapters 1.04 Violations and Penalties, 1.08 Administrative Citations and Penalties and 8.44 Storm Water Management and Urban Runoff Pollution Control, the City's regulations may be enforced administratively, civilly and criminally. The HBMC also provides various procedures to modify and/or revoke city-issued permits for unlawful and/or environmentally disruptive activity.

Consequently, it is my opinion that the City has adequate legal authority to implement and enforce the requirements in the MS4 Permit. Please do not hesitate to contact me should you have any questions or need any additional information

Very truly yours,

Michael Jenkins
City Attorney

Enclosure

Hermosa Beach Statement of Legal Authority

A. The following list shows the relationship of the Hermosa Beach Municipal Code and other legal authorities to the MS4 permit requirements under Part VI.A.2 of the Permit:

i. Control the contribution of pollutants to its MS4 from storm water discharges associated with industrial and construction activity and control the quality of storm water discharged from industrial and construction sites. This requirement applies both to industrial and construction sites with coverage under an NPDES permit, as well as to those sites that do not have coverage under an NPDES permit.

HBMC 8.44.060 Prohibited Activities; HBMC 8.44.090 Requirements for Industrial/Commercial and Construction Activities

ii. Prohibit all non-storm water discharges through the MS4 to receiving waters not otherwise authorized or conditionally exempt pursuant to Part III.A.

HBMC 8.44.060 Prohibited Activities

iii. Prohibit and eliminate illicit discharges and illicit connections to the MS4.

HBMC 8.44.060 Prohibited Activities

iv. Control the discharge of spills, dumping, or disposal of materials other than storm water to its MS4.

HBMC 8.44.060 Prohibited Activities; HBMC8.44.080 Good Housekeeping Provisions; HBMC 8.44.090 Requirements for Industrial/Commercial and Construction Activities; HBMC 8.44.095 Standard Urban Storm Water Mitigation Plan (SUSMP) Requirements for New Development and Redevelopment Projects

v. Require compliance with conditions in Permittee ordinances, permits, contracts or orders (i.e., hold dischargers to its MS4 accountable for their contributions of pollutants and flows).

HBMC 8.44.090 Requirements for Industrial/Commercial and Construction Activities; HBMC 8.44.100 Standard Urban Stormwater Mitigation Plan (SUSMP) Requirements for New Development and Redevelopment Projects; HBMC 8.44.110 Violations of Stormwater and Urban Runoff

Pollution Control Measures; HBMC Chapter 1.04 Violations and Penalties and Chapter 1.10 Administrative Citations and Penalties

vi. Utilize enforcement mechanisms to require compliance with applicable ordinances, permits, contracts, or orders.

HBMC 8.44.110 Violations of Stormwater and Urban Runoff Pollution Control Measures; HBMC Chapter 1.04 Violations and Penalties and Chapter 1.10 Administrative Citations and Penalties

vii. Control the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements among Co-permittees.

In addition to the provisions of HBMC Chapter 8.44, which control the contribution of pollutants, the City, as a municipal corporation, has authority to enter into contracts that enable it to carry out its necessary functions, including the power to enter into interagency agreements to control the contribution of pollutants from one portion of the shared MS4 to another.

viii. Control of the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements with other owners of the MS4 such as the State of California Department of Transportation.

In addition to the provisions of HBMC Chapter 8.44, which control the contribution of pollutants, the City, as a municipal corporation, has authority to enter into contracts that enable it to carry out its necessary functions, including the power to enter into interagency agreements to control the contribution of pollutants from one portion of the shared MS4 to another.

ix. Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with applicable municipal ordinances, permits, contracts and orders, and with the provisions of this Order, including the prohibition of non-storm water discharges into the MS4 and receiving waters. This means the Permittee must have authority to enter, monitor, inspect, take measurements, review and copy records, and require regular reports from entities discharging into its MS4.

HBMC 8.44.100 Inspection Authority

x. Require the use of control measures to prevent or reduce the discharge of

pollutants to achieve water quality standards/receiving water limitations.

Article 11, § 7 of the California Constitution; California Public Resources Code § 21000 et seq. (CEQA); HBMC 8.44.080 Good Housekeeping Provisions, HBMC 8.44.090 Requirements for Industrial/Commercial and Construction Activities; HBMC 8.44.095 Standard Urban Stormwater Mitigation Plan (SUSMP) Requirements for New Development and Redevelopment Projects; HBMC Title 17 Zoning

xi. Require that structural BMPs are properly operated and maintained.

Article 11, § 7 of the California Constitution; California Public Resources Code § 21000 et seq. (CEQA); HBMC 8.44.080 Good Housekeeping Provisions, HBMC8.44.090 Requirements for Industrial/Commercial and Construction Activities; 8.44.095 Standard Urban Stormwater Mitigation Plan (SUSMP) Requirements for New Development and Redevelopment Projects; HBMC Title 17 Zoning

xii. Require documentation on the operation and maintenance of structural BMPs and their effectiveness in reducing the discharge of pollutants to the MS4.

California Public Resources Code § 21000 et seq. (CEQA); HBMC 8.44.100 Inspection Authority; HBMC 8.44.110 Violations of Stormwater and Urban Runoff Pollution Control Measures

B. Procedures available to mandate compliance with applicable municipal ordinances under HBMC Chapters 1.04 Violations and Penalties, 1.08 Administrative Citations and Penalties and 8.44 Storm Water Management and Urban Runoff Pollution Control:

1. Criminal Citation (judicial)
2. Administrative Citation (administrative)
3. Administrative Cease and Desist Order (administrative)
4. Civil Nuisance Abatement (judicial)
5. Civil Injunction (judicial)
6. Permit Revocation/Modification (administrative)
7. All other criminal and civil remedies available by law

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December 1, 2014

VIA ELECTRONIC TRANSMISSION

Mr. Samuel Unger
Executive Officer
Los Angeles Regional Quality Control Board
320 W. 4th Street, Suite 200
Los Angeles, CA 90013
sunger@waterboards.ca.gov

Re: Legal Authority of the City of Manhattan Beach to Implement and Enforce the Requirements of 40 CFR 122.26(d)(2)(i)(A-F) and RWQCB Order R4-2012-0175, NPDES Permit CAS004001

Dear Mr. Unger:

The City of Manhattan Beach (the "City"), by and through its City Attorney, hereby submits the following certification ("Statement"), pursuant to Section VI.A.2.b of Order R4-2012-0175 (NPDES Permit CAS004001), issued by the California Regional Water Quality Control Board, Los Angeles Region ("RWQCB") on November 8, 2012 and entitled "Waste Discharge Requirements for Municipal Separate Storm Sewer System ("MS4") Discharges within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating from the City of Long Beach MS4" (the "Permit").

The City is one of the co-permittees under the Permit. Section VI.A.2.b of the Permit requires the City to provide the RWQCB with a statement by its chief legal counsel, certifying that the City has the legal authority to implement and enforce each of the current requirements set forth in 40 C.F.R. § 122.26(d)(2)(i)(A-F) and the Permit. The purpose of this Statement is to describe the City's compliance with Section VI.A.2.b of the Permit. As discussed in further detail herein, it is our opinion that the City has the necessary legal authority to implement the Permit and to control and prohibit discharges of pollutants into the Municipal Separate Storm Sewer System ("MS4"). However, this Statement is not, nor should it be construed as, a waiver of any rights that the City may have relating to the Permit.

1. Legal Authority Statement

In our opinion, the City has the necessary legal authority to comply with the legal requirements imposed upon it under the Permit, consistent with the requirements set forth in the U.S. Environmental Protection Agency's regulations promulgated under the Clean Water Act, and, specifically, 40 C.F.R. § 122.26(d)(2)(i)(A-F), and to the

extent permitted by state and federal law and subject to the limitations on municipal action under the California and United States Constitutions, except as noted herein.

The City, as a general law city, has broad general police powers under the California Constitution to enact legislation for health and public welfare of the community to the extent not preempted by federal or state law. In addition, the City adopted ordinances for the purpose of ensuring that it has adequate legal authority to implement and enforce its storm water control program. The City has the authority under the California Constitution and state law to enact and enforce these ordinances, and these ordinances were duly enacted.

2. Ordinances

The City has adopted ordinances related to the regulation of urban runoff to control and prohibit discharges of pollutants into the MS4 and to comply with the requirements of the Permit applicable to it, as well as, to the extent applicable, 40 C.F.R. § 122.26 (d)(2)(i)(A)-(F). The City's Storm Water Ordinance (Chapter 18.04 of the Manhattan Beach Municipal Code ("MBMC")) is the principal City ordinance addressing the control of urban runoff. Under this ordinance, the City has the necessary legal authority to do the following:

i. 40 C.F.R. § 122.26(d)(2)(i)(A); Permit Section VI.A.2.a.i: Control the contribution of pollutants to its MS4 from storm water discharges associated with industrial and construction activity and control the quality of storm water discharged from industrial and construction sites. This requirement applies both to industrial and construction sites with coverage under an NPDES permit, as well as to those sites that do not have coverage under an NPDES permit (MBMC § 5.84.070--Requirements for industrial/commercial and construction activities);

ii. 40 C.F.R. § 122.26(d)(2)(i)(C); Permit Section VI.A.2.a.ii: Prohibit all non-storm water discharges through the MS4 to receiving waters not otherwise authorized or conditionally exempt pursuant to Part III.A (MBMC § 5.84.040--Prohibited activities; MBMC § 5.84.060--Good housekeeping provisions);

iii. 40 C.F.R. § 122.26(d)(2)(i)(B); Permit Section VI.A.2.a.iii: Prohibit and eliminate illicit discharges and illicit connections to the MS4 (MBMC § 5.84.040--Prohibited activities);

iv. 40 C.F.R. § 122.26(d)(2)(i)(C); Permit Section VI.A.2.a.iv: Control the discharge of spills, dumping, or disposal of materials other than storm water to its MS4 (MBMC § 5.84.040--Prohibited activities; MBMC § 5.84.060--Good housekeeping provisions; MBMC § 5.84.090--Enforcement);

v. 40 C.F.R. § 122.26(d)(2)(i)(E); Permit Section VI.A.2.a.v: Require compliance with conditions in Permittee ordinances, permits, contracts or orders (*i.e.*, hold dischargers to its MS4 accountable for their contributions of pollutants and flows) (MBMC § 5.84.090--Enforcement);

vi. 40 C.F.R. § 122.26(d)(2)(i)(E)-(F); Permit Section VI.A.2.a.vi: Utilize enforcement mechanisms to require compliance with applicable ordinances, permits, contracts, or orders (MBMC § 5.84.090--Enforcement);

vii. 40 C.F.R. § 122.26(d)(2)(i)(D); Permit Section VI.A.2.a.vii: Control the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements among Copermittees (MBMC § 5.84.040--Prohibited activities; MBMC § 5.84.090--Enforcement);

viii. 40 C.F.R. § 122.26 (d)(2)(i)(D); Permit Section VI.A.2.a.viii: Control of the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements with other owners of the MS4 such as the State of California Department of Transportation (MBMC § 5.84.040--Prohibited activities; MBMC § 5.84.090--Enforcement);

ix. 40 C.F.R. § 122.26(d)(2)(i)(F); Permit Section VI.A.2.a.ix: Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with applicable municipal ordinances, permits, contracts and orders, and with the provisions of this Order, including the prohibition of non-storm water discharges into the MS4 and receiving waters. This means the Permittee must have authority to enter, monitor, inspect, take measurements, review and copy records, and require regular reports from entities discharging into its MS4 (MBMC § 5.84.100--Adoption urban stormwater mitigation plan (SUSMP));

x. 40 C.F.R. § 122.26(d)(2)(i)(E); Permit Section VI.A.2.a.x: Require the use of control measures to prevent or reduce the discharge of pollutants to achieve water quality standards/receiving water limitations (MBMC § 5.84.100--Adoption urban stormwater mitigation plan (SUSMP); MBMC § 5.84.060--Good housekeeping provisions);

xi. 40 C.F.R. § 122.26(d)(2)(i)(E); Permit Section VI.A.2.a.xi: Require that structural BMPs are properly operated and maintained (MBMC § 5.84.100--Adoption urban stormwater mitigation plan (SUSMP)); and

xii. 40 C.F.R. § 122.26(d)(2)(i)(E); Permit Section VI.A.2.a.xii: Require documentation on the operation and maintenance of structural BMPs and their effectiveness in reducing the discharge of pollutants to the MS4 (MBMC §

5.84.100--Adoption urban stormwater mitigation plan (SUSMP); MBMC § 5.84.060--Good housekeeping provisions; MBMC § 5.84.090--Enforcement).

3. Implementation

Some of the City's ordinances are implemented through permit programs and others are implemented as regulatory programs. Under each ordinance, one or more City bodies, departments, or department directors are authorized and directed in each ordinance to take the actions contemplated by the ordinance (*e.g.*, to consider evidence and make findings, to issue or deny permits, to impose conditions on projects, to inspect, to take enforcement action, etc.).

The City's Storm Water Ordinance (MBMC Chapter 5.84) is the principal City ordinance addressing the control of urban runoff. This ordinance is regulatory, and applies to specified new and existing residential and business communities and associated facilities and activities, as well as new development and redevelopment, and all other specified new and existing facilities and activities that threaten to discharge pollutants within the boundaries of the City and within its regulatory jurisdiction, whether or not a City permit or approval is required. The City's Storm Water Ordinance also contains discharge prohibitions and requirements for the implementation of BMPs and other requirements necessary to implement the Permit.

Other City departments require compliance with the City's Storm Water Ordinance as a condition for issuance of relevant City permits. City departments may also impose specific conditions of approval consistent with the City's Storm Water Ordinance. All City environmental ordinances are also implemented, in part, through the application of the CEQA process to proposed projects.

4. Administrative and Judicial/Legal Procedures

In addition to the above authority, the City has in place various legal and administrative procedures to assist in enforcing the various urban runoff related Ordinances, including the following:

A. Administrative Remedies

- General Penalties (MBMC Chapter 1.04—Penalty Provisions).
- Administrative Penalties and Citations (MBMC Chapter 1.04—Penalty Provisions).

B. Nuisance Remedies

- Public nuisance under State law.
- City nuisance abatement procedures (MBMC Chapter 1.04—Penalty Provisions).

C. Criminal Remedies

- Misdemeanor citations/prosecution (MBMC Chapter 1.04—Penalty Provisions).

D. Equitable Remedies

- Injunctive relief under State law and the Municipal Code (MBMC Chapter 1.04—Penalty Provisions).
- Declaratory relief under State law.

E. Other Civil Remedies

- Federal law claims (*e.g.*, Clean Water Act and Resource Conservation and Recovery Act Citizen Suits).
- Remedies under the California Government Code.

Violations of the City's Storm Water Ordinance are deemed a "public nuisance," in which case enforcement actions can be completed administratively, or judicially when necessary.

Please contact me if you have any questions or if you need any additional information regarding the City's legal authority to enforce the Permit.

Very truly yours,

Quinn M. Barrow
City Attorney

cc: Mayor and Members of the City Council
Mark Danaj, City Manager
Raul Saenz, Utilities Manager
Candice K. Lee, Esq.
Norman A. Dupont, Esq.

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Article 1. General

5-7.101 Authorization.

The City is authorized by Article XI, Section 5 and Section 7 of the State Constitution to exercise the police power of the State by adopting regulations promoting the public health, safety and general prosperity. This chapter is enacted pursuant to authority conferred by law including but not limited to the California Health and Safety Code, Sections 5400 through 5474, the California Government Code, Sections 54725 through 54740, and 66000 through 66003, the California Code of Regulations, Title 22, the Clean Water Act, 33 U.S.C. 1251, et seq., and the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901, et seq. (§ 2, Ord. 2851 c.s., eff. October 5, 2000, as amended by § 1, Ord. 2890 c.s., eff. August 15, 2002, as amended by § 1, Ord. 2905 c.s., eff. August 5, 2003)

5-7.102 Purpose and intent.

(a) The purpose of this chapter is to ensure the future health, safety and general welfare of the citizens of the City and to improve and protect the water quality and beneficial uses of the receiving waters of the County of Los Angeles and surrounding coastal areas by:

(1) Reducing pollutants in stormwater discharges to the maximum extent practicable;

(2) Regulating illicit connections and illicit discharges and thereby reducing the level of contamination of stormwater and urban runoff into the municipal stormwater system;

(3) Regulating nonstormwater discharges to the municipal stormwater system;

(4) Incorporating into the design of new development and redevelopment projects BMPs that will reduce to the maximum extent practicable the amount of pollutants that are generated and/or discharged into the City's storm drain system and surrounding coastal waters; and

(5) Incorporating BMPs into construction activities in a manner that will reduce the level of pollutant discharged into the storm drain system to the maximum extent practicable.

(b) The intent of this chapter is to protect and enhance the quality of watercourses, water bodies and wetlands within the City in a manner consistent with the Federal Clean Water Act, the California Porter-Cologne Water Quality Control Act and the municipal NPDES permit.

(c) This chapter is also intended to provide the City with the legal authority necessary to control discharges to and from those portions of the storm drain system over which it has jurisdiction as required by the municipal NPDES permit. The municipal NPDES permit requires the City to institute a stormwater management program. The City's program parallels the Countywide Stormwater Management Plan (CSWMP) as approved by the California Regional Water Quality Control Board (CRWQCB) and as modified by the Municipal NPDES Permit. The CSWMP is also known as the Storm Water Quality Management Plan (SQMP). The SQMP includes five major elements titled: Illicit Discharge/Illicit Connection Elimination, Development Planning, Development Construction, Public Agency Activities, and Public Information and Participation. This chapter includes implementation strategies and requirements for each of these elements.

(d) This chapter also shall regulate development within the Coastal Zone in accordance with the policies of the City's Local Coastal Plan and Sections 30230, 30231, 30232, and 30240 of the California Coastal Act. (§ 2, Ord. 2851 c.s., eff. October 5, 2000, as amended by § 2, Ord. 2890 c.s. eff. August 15, 2002, as amended by § 1,

Ord. 2905 c.s., eff. August 5, 2003)

5-7.103 Definitions.

Whenever in this chapter, the following terms are used, they shall have the meaning respectively ascribed to them in this chapter unless another meaning for the word is apparent from the context. The definitions in this chapter are included for reference purposes and are not intended to narrow the scope of the definitions set forth in Federal or State law or regulations and any term used in this chapter shall have the same meaning as that term is defined in the municipal NPDES permit, or if it is not specifically defined in the municipal NPDES permit, than as such term is defined in the Federal Clean Water Act, as amended, and/or the regulations promulgated thereunder. Words used in this chapter in the singular may include the plural and the plural may include the singular. Use of masculine shall also mean feminine and neuter.

"Act" refers to the Federal Water Pollution Control Act also known as the Clean Water Act as amended, 33 U.S.C. 1251, et seq.

"Area susceptible to runoff" means any surface directly exposed to precipitation or in the path of runoff caused by precipitation which path leads off the parcel on which the surface is located.

"Authorized enforcement officer" means the City Engineer or his/her designee.

"Automotive repair shop" means a facility that is categorized in any one of the following standard industrial classifications (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.

"Best management practices (BMPs)" means any programs, activities, technology, process, siting criteria, operational methods, practices, facilities, and/or procedures that when implemented to their maximum efficiency will prevent or reduce pollutants in discharges. Examples of BMPs may include install discharge treatment systems, education and outreach, proper planning of development projects, proper cleaning of catch basin inlets, and proper sludge- or waste-handling and disposal, among others.

"Bypass" means the diversion of stormwater or urban runoff streams from any portion of a stormwater treatment facility.

"CFR" means the Code of Federal Regulations.

"City" means the City of Redondo Beach, Los Angeles County, California.

"Commercial development" means any development on private land that is not heavy industrial or single-family residential. The category includes, but is not limited to: hospitals, laboratories and other medical facilities, educa-

tional institutions, recreational facilities, plant nurseries, multi-family residential buildings, apartments, car wash facilities, mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses and other light industrial complexes.

"Directly connected impervious area (DCIA)" means the area covered by a building, impermeable pavement, and/or other impervious surfaces, which drains into the storm drain system without first flowing across permeable land area (e.g. lawns).

"Discharge" means when used without qualification the "Discharge of a pollutant."

"Discharge exception" means discharges authorized by the NPDES permit, which are exceptions to this chapter and excluded from the definitions of "illicit connections" and "illicit/prohibited discharges," as defined herein, including only:

Discharges composed entirely of stormwater, discharges covered under current EPA or Regional Water Quality Control Board issued NPDES permits, or other waivers, permits or approvals granted by an appropriate government agency (provided that the discharger is in full compliance with all requirements of the permit and

other applicable laws or regulations), discharges to the stormwater drainage system from potable water drinking supply and distribution system releases (consistent with American Water Works Association guidelines for dechlorination and suspended solids reduction practices), emergency firefighting activities, reclaimed and potable landscape irrigation systems, diverted stream flows permitted by the State Water Resources Board, natural springs, rising ground-water (excluding active dewatering), uncontaminated groundwater infiltration systems (as defined by 40 CFR 35.2005(20)), discharges from potable water sources such as passive foundation drains, and air conditioning condensation, water from crawl space pumps, passive footing drains, vehicle washing at residences or by non-profit organizations, flows from riparian habitats and wetlands, dechlorinated or debrominated swimming pool discharges, dewatering of lakes and decorative fountains and sidewalk rinsing.

Notwithstanding the above, where the City Engineer or his/her authorized representative determines that a discharge in accordance with the preceding paragraph may cause a pollutant or pollutants to be discharged to the stormwater drainage system, or may otherwise contribute to a violation of water quality standards protected by the NPDES permit, then upon the giving of thirty (30) days written notice by the City Engineer to the owner or operator of the property or facility, the discharge exception shall not apply to the subject discharge.

"Discharge of a pollutant" means: any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source" or, any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. The term discharge includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

"Discretionary project" means a project which requires the exercise of judgment or deliberation when the public agency or public body decides to approve or disapprove a particular activity, as distinguished from situations where the public agency or body merely has to determine whether there has been conformity with applicable statutes, ordinances or regulations.

"Enforcing attorney" means the City Attorney or District Attorney acting as counsel to the City or his/her appointee. For purposes of criminal prosecution, only the District Attorney and/or City Attorney shall act as the enforcing attorney.

"Engineer" means the City Engineer and persons directed by them and under their instruction and supervision who are assigned to investigate compliance and detect violations of this chapter.

"Environmentally sensitive area" means an area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments (California Public Resources Code § 30107.5). Areas subject to storm water mitigation requirements are: areas designated as significant ecological areas by the County of Los Angeles (Los Angeles County Significant Areas Study, Los Angeles County Department of Regional Planning (1976) and amendments); an area designated as a significant natural area by the California Department of Fish and Game's Significant Natural Areas Program, provided that area has been filed verified by the Department of Fish and Game; an area listed in the Basin Plan as supporting the "Rare, Threatened, or Endangered Species (RARE)" beneficial use; and an area identified by a permittee as environmentally sensitive.

"EPA" means the Environmental Protection Agency of the United States.

"Good housekeeping practices" means common practices related to the storage, use or cleanup of materials, performed in a manner that minimizes the discharge of pollutants. Examples include, but are not limited to, purchasing only the quantity of materials to be used at a given time, use of alternative and less environmentally harmful products, cleaning up spills and leaks, and storing materials in a manner that will contain any leaks or spills.

"Grease" means and includes waxes, fats, oils and other nonvolatile materials as determined by appropriate procedures set forth in 40 CFR Part 136.

"Greater than nine (9) unit home subdivision" means any subdivision being developed for ten (10) or more single- or multiple-family dwelling units.

"Hearing officer" means the City Engineer or his/her designee, who shall preside at the administrative hearings authorized by this chapter and issue final decisions on the matters raised therein.

"Hillside" means property located in an area with known erosive soil conditions, where the development contemplates grading on any natural slope that is twenty-five percent or greater and where grading contemplates cut or fill slopes.

"Illicit connection" means any man-made conveyance that is connected to the storm drain system without a permit, excluding roof drains and other similar type connections. Examples include channels, pipelines, conduits, inlets, or outlets that are connected directly to the storm drain system.

"Illicit discharge" means any discharge to the storm drain system that is prohibited under local, state or federal statutes, ordinances, codes or regulations. The term illicit discharge includes all non storm-water discharges except discharges pursuant to an NPDES permit, discharges that are identified in Part 1, "Discharge Prohibitions" of the Municipal NPDES permit, and discharges authorized by the Regional Board Executive Officer.

"Industrial user," means any source of industrial wastewater as defined in this section, or wastewater, which is subject to regulations under Section 307(b) and (c) of the Act. The term includes but is not limited to users who are identified under the Divisions A, B, C, D, E and I, in the Standard Industrial Classification Manual, 1987, Office of Management and Budget, as amended and/or by the County Sanitation Districts of Los Angeles.

"Infiltration" means the downward entry of water into the surface of the soil.

"Material" means any substance including, but not limited to: garbage and debris; lawn clippings, leaves, and other vegetation; biological and fecal waste; sediment and sludge; oil and grease; gasoline; paints, solvents, cleaners, and other fluid or solid containing chemicals.

"Municipal NPDES permit" means the "waste discharge requirements for municipal stormwater and urban runoff discharges within the County of Los Angeles" (Order No. 01-182), dated December 13, 2001, issued by the California Regional Water Quality Control Board-Los Angeles Region, and any successor permit to that permit.

"Municipal separate stormwater system (MS4)" means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, alleys, catch basins, curbs, gutters, ditches, manmade channels, or storm drains) owned by a State, city, county, town or other public body, that is designed or used for collecting or conveying storm water, which is not a combined sewer, and which is not part of a publicly owned treatment works, and which discharges to waters of the United States.

"National Pollutant Discharge Elimination System (NPDES)" means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing pretreatment requirements, under CWA §§ 307, 402, 318, and 405. The term includes an "approved program."

"New development" means all public and private residential (whether single-family, multi-unit or PUD), industrial, commercial, retail or other nonresidential construction projects, where the project requires any one or more of the following activities: grading, filling, trenching or disturbance of earth; paving or resurfacing with any medium; landscaping; construction of foundations; erection of steel, wood or other framing; installation of siding or masonry of any type; stripping, sanding, stuccoing or exterior preparation, repair and painting; interior drywall installation, plastering, installation of plumbing, electrical, finished carpentry, complete flooring or interior wall covering, whether paint or otherwise.

"Nonstormwater discharge" means any discharge to a stormwater system that is not composed entirely of

stormwater.

"NPDES permit" means any waste discharge requirements issued by the Regional Board or the State Water Resources Control Board as an NPDES permit pursuant to Water Code Section 13370 (other than the municipal NPDES permit).

"100,000 square foot commercial development" means any commercial development that creates at least 100,000 square feet of impermeable area, including parking areas.

"Parking lot" means land area or facility for the temporary parking or storage of motor vehicles used personally, for business or for commerce with an improved lot size of

5,000 square feet or more, or with twenty-five (25) or more parking spaces potentially exposed to rainwater.

"Planning priority projects" means any: (1) 43,560 or more square feet or greater of impervious area commercial/industrial developments, (2) automotive repair facilities (SIC 5013, 5014, 5541, 7532 -- 7534, and 7536 -- 7539), (3) retail gasoline outlets, (4) restaurants (SIC 5812), (5) Ten (10) or more unit homes (including single family homes, multifamily homes, condominiums, and apartments, (6) locations within or adjacent to or directly discharging to an environmentally sensitive area where the development will: (a) discharge stormwater and urban runoff that is likely to impact a sensitive biological species or habitat; and (b) create 2,500 square feet or more of impervious surface area, (7) parking lots, (8) redevelopment projects in subject categories that meet redevelopment thresholds, (9) single-family hillside home.

"Planning priority project characteristics" means any project that has the following as any part of the project: (1) vehicle or equipment fueling areas; (2) vehicle or equipment maintenance areas, including washing and repairs; (3) commercial or industrial waste handling or storage, excluding typical office or household wastes; (4) outdoor handling or storage of hazardous materials or waste; (5) outdoor work areas for activities such as, but not limited to, welding, cutting, metal fabrication, assembly, application of paints, coating or finishing; pre-cast concrete fabrication, etc.; (6) outdoor animal care confinement (kennels, stables, etc.) or slaughter; (7) outdoor food handling or processing; (8) outdoor horticulture activities (9) located in the Coastal Zone and not exempt from the requirement to obtain a Coastal Development Permit pursuant to Section 10-5.2208(a) of the Redondo Beach Municipal Code.

"Pollutants" means those "pollutants" defined in CWA § 502(6) (33 U.S.C. § 1362(6)), and incorporated by reference into California Water Code § 13373.

"Potable Water Distribution Systems Releases" means sources of flows from drinking water storage, supply and distribution systems including flows from system failures, pressure releases, system maintenance, distribution line testing, fire hydrant flow testing; and flushing and de-watering of pipes, reservoirs, vaults, and minor non-invasive well maintenance activities not involving chemical addition(s). It does not include wastewater discharges from activities that occur at wellheads, such as well construction or well maintenance.

"Pretreatment facility" means any works or devices that are used for the treatment of wastewater, prior to discharge into a public sewer.

"Private property" means any real property location, irrespective of ownership, which is not open to the general public.

"Prohibited discharge" means any discharge from public or private property to the stormwater drainage system that is not composed entirely of stormwater, or which otherwise contains any pollutant, with the exception of discharges permitted from point or nonpoint sources by (i) the NPDES permit, (ii) a State general permit or other Regional Water Quality Control Board or State Water Resources Control Board issued NPDES permit, (iii) a permit issued pursuant to the provisions of this chapter, and/or (iv) the discharge exception. Prohibited discharge shall also include any discharge, whether direct or indirect, to groundwater or any river, stream, creek, wash, harbor, bay or the Pacific Ocean.

"Project" means anything that constitutes "development," as defined in Article 10 of Chapter 5 of Title 10 of

the Redondo Beach Municipal Code.

"Rainy Season" means the calendar period beginning October 15 through April 15.

"Redevelopment" means, on an already existing developed site, the creation or addition of at least 5,000 square feet of impervious surfaces. Redevelopment includes, but is not limited to: the expansion of a building footprint or addition or replacement of a structure; structural development including an increase in gross floor area and/or exterior construction or remodeling; replacement of impervious surface that is not part of a routine maintenance activity; and disturbing activities related with structural or impervious surfaces. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, nor does it include emergency construction activities required to immediately protect public health and safety.

"Regional Board" means the California Regional Water Quality Control Board--Los Angeles Region.

"Restaurant" means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption. (SIC code 5812).

"Retail gasoline outlet" means any facility engaged in selling gasoline and lubricating oil.

"Sidewalk Rinsing" means pressure washing of paved pedestrian walkways with average water usage of 0.006 gallons per square foot, with no cleaning agents, and properly disposing of all debris collected, as authorized under Regional Board Resolution No. 98-08.

"Site Design BMP" means any project design feature that reduces the creation or severity of potential pollutant sources or reduces the alteration of the project site's natural flow regime.

"Source control BMP" means any schedules of activities, prohibitions of practices, maintenance procedures, managerial practices or operational practices that aim to prevent stormwater pollution by reducing the potential for contamination at the source of pollution.

"Standard industrial classification (SIC)" means a system of classifying a business based on the type of its activity as identified in the Standard Industrial Classification Manual, 1987, Office of Management and Budget, as amended.

"Storm event" means a rainfall event that produces more than 0.1 inch of precipitation, which is separated from the previous storm event by at least seventy-two (72) hours of dry weather.

"Stormwater drainage system" means any local or regional street gutter, channel, conduits, storm drain, constructed drain, natural or artificial drains and watercourses, lined diversion structure, wash area, inlet, outlet or other facility together with appurtenances, pumping stations and equipment, which is part of or tributary to the City's stormwater runoff system in the County-wide stormwater runoff system owned or operated by the County of Los Angeles.

"Stormwater runoff" means that part of precipitation (rainfall) which travels via flow across a surface to the storm drain system or receiving waters from impervious, semipervious or pervious surfaces. When all other factors are equal, runoff increases as the perviousness of a surface decreases.

"Structural BMP" means any structural facility designed and constructed to mitigate the adverse impacts of stormwater and urban runoff pollution (e.g. canopy, structural enclosure). The category may include both treatment control BMPs and source control BMPs.

"Treatment" means the application of engineered systems that use physical, chemical or biological processes to remove pollutants. Such processes include, but are not limited to, filtration, gravity settling, media adsorption, biodegradation, biological uptake, chemical oxidation and UV radiation.

"Treatment control BMP" means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption or any other physical, biological or chemical process.

"Unpolluted water" means water to which no pollutant has been added either intentionally or accidentally.

"Urban runoff" means surface water flow produced by non-stormwater resulting from residential, commercial, and industrial activities involving the use of potable and nonpotable water.

"Urban Stormwater Mitigation Plan (USMP)" means a plan which shall identify BMPs that shall be incorporated into the project design to mitigate/reduce pollution impacts to receiving water caused by stormwater/urban runoff. This plan shall detail appropriate/necessary Site Design, Source Control, and Treatment BMPs for the project. (§ 2, Ord. 2851 c.s., eff. October 5, 2000, as amended by § 3, Ord. 2890 c.s. eff. August 15, 2002, as amended by § 1, Ord. 2905 c.s., eff. August 5, 2003)

5-7.104 Inspection.

The Engineer, or his representative, shall be authorized at any reasonable time to enter the premises of any property discharging to the MS4 to determine compliance with the provisions of this chapter; such inspection may include but not be limited to: sampling, monitoring, reviewing, photographing, videotaping and inspecting treatment facilities and discharge location. (§ 2, Ord. 2851 c.s., eff. October 5, 2000, as amended by § 4, Ord. 2890 c.s., eff. August 15, 2002, as amended by § 1, Ord. 2905 c.s., eff. August 5, 2003)

5-7.105 Storm drain impact fees.

(a) Every applicant for a permit pursuant to Section 9-1.02 of this Code for development construction shall pay a storm drain impact fee.

(b) The proceeds of the storm drain impact fee shall be applied to offset the City's costs of enforcing the order as a result of development construction, and the amount of the storm drain impact fee shall not exceed the City's reasonable costs therefor.

(c) The amount of the storm drain impact fee shall be established by resolution of the City Council, as amended from time to time, in accordance with the provisions of this section, as amended from time to time.

(d) The City Engineer shall administer and collect the storm drain impact fee.

(e) Permits issued pursuant to Section 9-1.02 for development construction shall not be issued until payment of the storm drain impact fee. (§ 1, Ord. 2873 c.s., eff. August 10, 2001, as amended by § 5, Ord. 2890 c.s., eff. August 15, 2002, as amended by § 1, Ord. 2905 c.s., eff. August 5, 2003)

5-7.106 Critical source of pollution inspection fee.

(a) Every person required to obtain a license pursuant to Redondo Beach Municipal Code Section 6-1.06 and also engaged in a business designated in the Municipal NPDES permit as a critical source of pollution shall pay an annual critical source of pollution inspection fee.

(b) The proceeds of the critical source of pollution inspection fee shall be applied to offset the City's costs of performing the inspections required by the Municipal NPDES permit and the amount of the critical source of pollution inspection fee shall not exceed the City's reasonable costs therefor.

(c) The amount of the critical source of pollution inspection fee shall be established by resolution of the City Council as amended from time to time in accordance with provisions of this section.

(d) The License Clerk and Collector shall administer and collect the critical source of pollution inspection fee.

(e) No license issued pursuant to Redondo Beach Municipal Code Section 6-1.06 shall be issued or renewed until payment of the critical source of pollution inspection fee is received by the License Clerk and Collector. (§ 1, Ord. 3000 c.s., eff. May 17, 2007)

CHAPTER 1
GENERAL PROVISIONS

ARTICLE 1 - ADOPTION OF CODE

(O-282; O-455; O-538; O-1758)

11.1.1 HOW CODE DESIGNATED AND CITED.

The ordinances embraced in the following Divisions and Sections shall constitute and be designated as The Torrance Municipal Code and may be so cited.

(O-1758)

11.1.2 NATURE OF CODE.

This record shall consist of all of the regulatory and penal and of certain of the administrative ordinances of the City of Torrance.

11.1.3 PROVISIONS CONSIDERED CONTINUATIONS OF EXISTING ORDINANCES.

The provisions appearing in this Code, so far as they are the same as those of ordinances existing at the time of the effective date of this Code, shall be considered as continuances thereof and not as new enactments.

11.1.4 EFFECT OF REPEAL OF ORDINANCES.

The repeal of an ordinance shall not revive any ordinance in force before or at the time the ordinance repealed took effect.

The repeal of an ordinance shall not affect any punishment or penalty incurred before the repeal took effect, nor any suit, prosecution or proceeding pending at the time of the repeal, for any offense committed under the ordinance repealed.

11.1.5 VALIDITY OF CODE.

It is hereby declared to be the intention of the City Council that the sections, paragraphs, sentences, clauses and phrases of this Code are severable, and if any phrase, clause, sentence, paragraph or section of this Code be declared unconstitutional by the valid judgment or decree of a court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs and sections of this code.

ARTICLE 2 - PENAL PROVISIONS

11.2.1 GENERAL PENALTY; CONTINUING VIOLATIONS.

Whenever in this Code or in any other ordinance of the City, any act is prohibited or is made or declared to be unlawful or an offense, or the doing of any act is required or the failure to do any act is declared to be unlawful or a misdemeanor, where no specific penalty is provided for, the violation of any such provision of this Code or any other ordinance of the City shall be punishable by a fine not exceeding $500.00 or imprisonment of a term not exceeding 6 months, or by both such fine and imprisonment.

All remedies provided for herein shall be cumulative and not exclusive.

11.2.2 ISSUANCE OF CITATIONS FOR VIOLATION OF THIS CODE AND OTHER CITY ORDINANCES.

(Added by O-925)

When any person is arrested for a violation of this Code or of any uncodified ordinances of the City and such person is not immediately taken before a magistrate as prescribed in the Penal Code of the State of California, the arresting officer shall prepare in duplicate a written notice to appear in court, containing the name and address of such person, the offense charged, and the time and place where and when such person shall appear in court.

11.2.3 FAILURE TO APPEAR IN COURT IS A MISDEMEANOR.

(Added by O-925)

Any person wilfully violating his written promise to appear in court is guilty of a misdemeanor regardless of the disposition of the charge upon which he was originally arrested.

11.2.4 ISSUANCE OF WARRANT FOR FAILURE TO APPEAR IN COURT.

(Added by O-925)

When a person signs a written promise to appear at the time and place specified in the written promise to appear and has not posted bail as provided in Section 853.1 of the Penal Code of the State of California, or in any amendment thereto, or modification thereof, the magistrate shall issue and have delivered for execution, a warrant for his arrest within twenty (20) days after his failure to appear as promised, or if such person promises to appear before an officer authorized to accept bail other than a magistrate and fails to do so on or before the

date which he promises to appear, then, within 20 days after the delivery of such written promise to appear by the officer to a magistrate having jurisdiction over the offense.

11.2.5 ENFORCEMENT PERSONNEL.

(Added by O-3302; Amended by O-3543; O-3746)

a) Pursuant to the provisions of Section 836.5 of the California Penal Code, or any amendment thereof, those classifications of officers and employees of the City of Torrance set forth herein shall be authorized to exercise the powers of arrest.

b) Those officers and employees listed herein may arrest a person without a warrant whenever the officer or employee has reasonable cause to believe that the person to be arrested has committed a misdemeanor in the presence of the officer or employee that is in violation of a statute or ordinance that the officer or employee has the duty to enforce.

c) The following classification of officers and employees of the City are hereby authorized to exercise powers of arrest:

1) Assistant Finance Director;

2) Revenue Inspector Collector;

3) Director of Building and Safety;

4) Building Regulations Administrator;

5) Building Inspection Supervisor;

6) Building Inspector;

7) Environmental Services Administrator;

8) Environmental Quality Officer;

9) Public Works Inspector;

10) Senior Public Works Inspector;

11) Senior Building Inspector;

12) Senior Electrical Inspector;

13) Senior Environmental Quality Officer;

14) Senior Mechanical Inspector;

15) Senior Plumbing Inspector;

16) Senior Grading Inspector;

17) Public Works Director;

18) Deputy Public Works Director; (Operations);

19) Deputy Public Works Director; (Engineering);

20) Sanitation Services Manager;

21) Streetscape Manager;

22) Street Services Supervisor (Sanitation);

23) Street Services Supervisor (Waste Water);

24) Street Services Supervisor (Streetscape);

25) Animal Control Supervisor;

26) Animal Control Officer;

27) Fire Fighter;

28) Fire Engineer;

29) Fire Captain;

30) Fire Battalion Chief;

31) Fire Assistant Chief;

32) Senior Fire Inspector;

33) Fire Prevention Specialist;

34) Senior Fire Prevention Specialist;

35) Senior Fire Prevention Officer;

36) Hazardous Materials Analyst;

37) Hazardous Materials Specialist.

11.2.6 ISSUANCE OF CITATIONS.

(Added by O-3302; Amended by O-3386; O-3430; O-3543; O-3694; O-3713; O-3762)

Those persons holding the job titles enumerated in the Section 11.2.5 may issue citations, if at all, for those violations of the Torrance Municipal Code which are both listed in this section and for which they have the responsibility to enforce.

The following Torrance Municipal Code sections may be enforced by means of the issuance of a citation, pursuant to law, for their violation. Each such section will be for the purposes of the citation, and any subsequent prosecution, an infraction, as provided in Government Code Section 36900.

DIVISION 3

31.3.4	35.3.2	36.1.4	37.2.3
33.3.3	35.4.3	36.1.7	38.1.3
33.3.4	35.9.2	36.1.13	38.4.1
34.2.1	35.11.2	36.1.15	310.1.1
34.2.9	35.11.11	36.1.20	
35.1.2	35.12.2	37.2.1	
35.2.2	36.1.3	37.2.2	

DIVISION 4

41.1.2	41.9.1	45.2.3	46.3.1

41.1.4	41.10.1	45.4.6	46.3.2
41.1.5	43.1.2	45.4.8	46.5.2
41.1.7	43.1.3	45.4.9	46.7.2
41.1.8	43.1.4	45.6.2	48.1.2
41.5.1	43.1.5	45.6.3	48.1.3
41.6.1	43.1.7	45.6.5	48.1.5
41.6.2	43.1.8	45.6.14	48.1.7
41.6.3	43.1.9	45.6.15	48.1.8
41.6.4	43.1.11	45.6.23	49.2.1
41.7.1	43.2.9	46.2.1	49.2.6 (b)
41.8.1	43.4.2	46.2.5	49.2.9 (a)
41.8.6	44.3.15 (b)	46.2.6	42.9.10

DIVISION 6

61.1.11	61.5.5	61.6.23	62.1.3
61.1.15	61.6.2	61.6.24	62.1.4 (a)
61.1.16	61.6.4	61.6.25	62.1.4 (b)
61.1.17	61.6.5	61.6.26	62.1.5
61.2.7	61.6.6	61.6.27	62.1.6
61.3.8	61.6.8	61.6.28	62.1.7
61.3.9	61.6.9	61.6.30	62.1.8 (a)
61.3.10	61.6.10	61.6.32	62.1.8 (b)
61.3.11	61.6.11	61.6.33	62.2.1
61.4.3	61.6.13	61.7.1	62.2.8
61.4.10	61.6.14	61.9.1	62.4.2
61.5.2	61.6.17	61.12.140 (a)	63.4.3
61.5.3	61.6.18	61.12.140 (f)	63.4.4

61.5.4	61.6.19	61.12.140 (g)	

DIVISION 7

72.1.1	72.2.17	74.5.18	75.1.10
72.2.3	72.2.18	74.6.2	75.1.14
72.2.10	72.2.21	74.6.8	75.2.1
72.2.12	72.2.22	74.8.2	77.1.30
72.2.14	74.2.3	75.1.6	
72.2.15	74.2.4	75.1.8	
72.2.16	74.5.4	75.1.9	

DIVISION 8

88.5.1	88.5.4	88.6.1	88.6.14
88.5.2	88.5.7	88.6.13	88.11.2

DIVISION 9

91.4.1	91.21.1	92.2.8	97.2.3
91.4.5	91.23.1	92.2.9	97.5.1
91.4.6	91.24.1	92.5.13	97.5.4
91.4.11	91.25.1	92.5.14	97.5.6
91.7.1	91.25.3	92.10.2	97.5.12
91.8.1	91.25.6	92.13.1	97.8.2
91.9.1	91.25.7	92.18.1	97.8.3
91.10.1	91.30.1	92.21.1	97.8.4
91.11.1	91.31.1	92.22.3	97.8.5
91.11.2	91.36.3	92.30.4	97.8.6
91.13.1	91.36.6	93.1.1	97.8.7

91.15.1	91.38.1	93.1.7	
91.20.1	91.47.5	97.2.2	

11.2.7 FEES FOR THE COLLECTION OF DELINQUENT PARKING CITATIONS.

(Added by O-3716)

Any person liable for a civil penalty will be required to pay the penalty provided on the bail schedule of parking penalties for parking violations, including process service fees, and any late payment penalty. In addition, if the City incurs collection costs in conjunction with the assignment of a parking citation, those costs will be added to the penalty and the violator will be liable to the city for both the civil penalties and the collection costs.

ARTICLE 3 - RULES OF CONSTRUCTION

11.3.1 CONSTRUCTION; PROVISIONS GOVERNING.

Unless the provisions of the context otherwise require, these general provisions, rules of construction and definitions shall govern the construction of this Code. The provisions of this Code and all proceedings under it are to be construed with a view to effect its objects and to promote justice.

11.3.2 HEADINGS, EFFECT OF.

The headings of the sections of this Code are intended as catchwords to indicate the contents of the section and shall not be deemed to govern, limit, modify or in any manner affect the scope, meaning or intent of the provisions of any section.

11.3.3 REFERENCE APPLIES TO AMENDMENTS.

Whenever a reference is made to any portion of this Code, or to any ordinances of this City, the reference applies to all amendments and additions now or hereafter made.

ARTICLE 4 - DEFINITIONS

In the construction of this Code and of all ordinances of the City, the following definitions of a general nature shall apply, unless the provisions of the context or the intent of the City Council clearly requires otherwise.

11.4.1 CHARTER.

Shall mean and refer to the Charter of the City of Torrance, as amended.

11.4.2 CITY.

Shall be construed as if followed by the words of Torrance.

11.4.3 CODE.

Shall mean Torrance Municipal Code.

11.4.4 COMPUTATION OF TIME.

Shall be the time in which any act provided by law is to be done is computed by excluding the first day and including the last, unless the last day is a holiday and then it is also excluded.

11.4.5 COUNCIL.

Shall be construed to mean the City Council of the City of Torrance.

11.4.6 COUNTY.

Shall mean the County of Los Angeles.

11.4.7 DAY.

A day is the period of time between any midnight and the midnight following.

11.4.8 DAYTIME, NIGHTTIME.

Daytime is the period of time between sunrise and sunset. Nighttime is the period of time between sunset and sunrise.

11.4.9 GENDER.

The masculine gender includes the feminine and neuter.

11.4.10 IN THE CITY.

Shall mean and include all territory over which the City now has, or shall hereafter acquire, jurisdiction for the exercise of its police powers or other regulatory powers.

11.4.11 JOINT AUTHORITY.

All words giving a joint authority to 3 or more persons or officers shall be construed as giving such authority to a majority of such persons or officers.

11.4.12 MONTH.

Shall mean a calendar month.

11.4.13 NUMBER.

The singular number includes the plural, and the plural, the singular.

11.4.14 OATH.

Shall include affirmation.

11.4.15 OFFICIAL TIME.

Whenever certain hours are named herein, they shall mean Pacific Standard Time or Daylight Saving Time as may be in current use in the City.

11.4.16 OR, AND.

Or may be read and, and and may be read or, if the sense requires it.

11.4.17 OWNER.

As applied to a building or land, shall include any part owner, joint owner, tenant in common, tenant in partnership, joint tenant or tenant by the entirety of the whole or of a part of such building or land.

11.4.18 PERSON.

Includes any person, firm, association, organization, partnership, business, trust, corporation or company.

11.4.19 PERSONAL PROPERTY.

Includes every species of property, except real property, as herein defined.

11.4.20 PRECEDING, FOLLOWING.

The words preceding and following mean next before and next after, respectively.

11.4.21 PROCESS.

Includes a writ or summons issued in the course of judicial proceedings of either a civil or criminal nature.

11.4.22 PROPERTY.

Shall include real and personal property.

11.4.23 REAL PROPERTY.

Shall include lands, tenements and hereditaments.

11.4.24 ROADWAY.

Is that portion of a highway improved, designed or ordinarily used for vehicular travel.

11.4.25 SHALL, MAY.

Shall is mandatory and may is permissive.

11.4.26 SIDEWALK.

Shall be that portion of a highway, other than the roadway, set apart for pedestrian travel.

11.4.27 SIGNATURE OR SUBSCRIPTION BY MARK.

Includes mark when the signer or subscriber cannot write, such signer's or subscriber's name being written near the mark by a witness who writes his own name near the signer's or subscriber's name; but a signature or subscription by mark can be acknowledged or can serve as a signature or subscription to a sworn statement only when two (2) witnesses so sign their own names thereto.

11.4.28 STATE.

The words the state and this state shall be construed to mean the State of California.

11.4.29 STREET, HIGHWAY.

Shall be a way or place of whatever nature, publicly maintained and open to the use of the public for purposes of vehicular travel.

11.4.30 TENANT OR OCCUPANT.

The words tenant or occupant applied to a building or land, shall include any person holding a written or an oral lease of or who occupies, the whole or a part of such building or land, either alone or with others.

11.4.31 TENSES.

The present tense includes the past and future tenses, and the future includes the present.

11.4.32 WEEK.

A week consists of seven consecutive days.

11.4.33 WRITING.

Includes any form of a recorded message capable of comprehension by ordinary visual means. Whenever any notice, report, statement or record is required or authorized by this Code, it shall be made in writing in the English language unless it is expressly provided otherwise.

11.4.34 YEAR.

Shall mean a calendar year, except where otherwise provided.

ARTICLE 5 - APPEALS; PROCEDURES

(Added by O-957; Amended by O-2822)

11.5.1 FILING OF NOTICE OF APPEAL.

(Amended by O-1661; O-3528)

Except as otherwise provided in this Code, if any application for any permit or consent of any City body or official having such authority is denied or approved by any City body or official and no other body is designated in the Code to hear an appeal, the applicant, or any interested person adversely affected, upon payment of an appeal fee, the City Manager, or any member of the City Council may personally serve the City Clerk with a written notice of appeal to the City Council from such decision within fifteen (15) days after such decision.

11.5.2 CONTENTS OF NOTICE OF APPEAL, FEES.

(Amended by O-3416)

a) The notice of appeal shall contain the following information in addition to the information given by the applicant thereon or reasonably required by the City Clerk therefor:

1) The name, address, and telephone number of the applicant.

2) The type of permit desired or action requested.

3) The date on which said permit was issued or refused or the decision was made and the name of the City officer, body, or department taking such action.

4) The grounds on which the appeal is taken.

b) A fee for filing an appeal shall be charged as provided by resolution of the City Council.

11.5.3 PROCEDURE AFTER FILING.

a) Upon receipt of the notice of appeal, and the appeal fee, the City Clerk shall notify the concerned City officials, bodies or departments that an appeal has been filed and shall transmit a copy of the appeal documents to such officials, bodies or departments.

b) The concerned City officials, bodies or departments shall prepare the necessary reports for the City Council, provide public notices, posting, mailing or advertising in the same manner as provided for the original hearing or decision making process, request the appeal be placed on the agenda for hearing before the City Council within thirty (30) days of receipt of the said notice of appeal, and notify the applicant in writing of the time, date and place of the hearing not less than five (5) days before the Council hearing.

11.5.4 HEARING BEFORE COUNCIL.

The Council shall hold a hearing at the time set therefor as provided in Section 11.5.3. The Council may summon witnesses and hear evidence relating to such application, but the rules of evidence shall not apply. The Council may continue the hearing from time to time. At the conclusion thereof, the Council shall grant or deny such application or make such modifications of the decision or action appealed from with reference thereto as it may deem fit. The order of the Council shall be immediately final and conclusive, and no applicant, and no application for the same purpose may be made for one (1) year after the date of such order.

ARTICLE 6 - IN GENERAL

11.6.1 NOTICES, SERVICE OF.

Whenever a notice is required to be given under this Code, unless different provisions herein are otherwise specifically made, such notice may be given either by personal delivery thereof to the person to be notified or by deposit in the United States mail in a sealed envelope postage prepaid, addressed to such person to be notified, at his last known business or residence address as the same appears in the public records of the City or other records pertaining to the matter to which such notice is directed. Service by mail shall be deemed to have been completed at the time of deposit in the post office.

11.6.2 PROOF OF NOTICE.

Proof of giving any notice may be made by the certificate of any officer or employee of the City, or by affidavit of any person over the age of eighteen (18) years, which shows service in conformity with this Code, or other provisions of law applicable to the subject matter concerned.

11.6.3 EFFECT OF ISSUANCE OF PERMIT OR LICENSE.

(Added by O-1901)

Any permit or license issued in violation of any provisions of this Code or of any City ordinance or which purports to authorize the doing of any act prohibited by this Code or other ordinance shall be void and shall not constitute approval of any violation of any provisions of this Code or any other law or ordinance.

11.6.4 SERVICE OF NOTICE ON CITY CLERK.

(Added by O-2403; Amended by O-2732)

Unless otherwise provided by the laws of the United States of America or the State of California, or by other provisions of this Code, or by a contract to which the City is a party, service upon the City of all notices, whether or not required by law, or any other documents, including any subpoenas duces tecum for the production of any City records, shall be effected by filing such notices, subpoenas, or other documents with the City Clerk of the City.

ARTICLE 1 - GENERAL

410.1.010 DEFINITIONS.

For the purposes of this Chapter the following words and phrases shall have the meanings respectively ascribed to them by this Chapter. Words and phrases not ascribed a meaning by this Chapter shall have the meanings ascribed by the regulations implementing the National Pollutant Discharge Elimination System, Clean Water Act Section 402, 33 U.S.C. § 1342(p), including, but not limited to 40 C.F.R. § 122.2 and 40 C.F.R. § 122.26(b), and Division 7 of the California Water Code, as they may be amended from time to time, if defined therein, and if not, to the definitions in an applicable permit issued by the California Regional Water Quality Control Board - Los Angeles, as such permits may be amended from time to time.

a) "Automotive Service Facility" means a facility in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 5511, 7532-7534, or 7536-7539.

b) "Best Management Practices or BMPs" means methods, measures, schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce Pollutants in discharges to the MS4 and thence into waters of the United States. BMPs include treatment requirements, operating procedures and practices to control runoff, spillage or leaks, sludge or waste disposal and drainage from raw material storage; public education and outreach; proper planning of development projects; structural and non-structural controls; and operations and maintenance procedures which can be applied before, during and after pollution-producing activities, including, but not limited to proper clean-out of catch basins and proper waste handling and disposal. See 40 C.F.R. § 122.2.

c) "Discharge" means any release, spill, leak, pump, flow, escape, dumping or disposal, of any Pollutant, from any point source, into the environment, including waters of the United States, and City's MS4.

d) "Hazardous Materials" means any materials, wastes or mixture of wastes defined as a "Hazardous Substance" or "Hazardous Waste" pursuant to § 311(b)(2) of the Clean Water Act, 33 U.S.C. § 1321(b)(2), or the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6901 et seq., the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C. §§ 9601 et seq., or the Carpenter-Presley-Tanner Hazardous Substance Account Act, ("HSAA"), California Health and Safety Code §§ 25300, et seq., and all future amendments to any of them, or as defined by the State Water Resources Control Board or the California Regional Water Quality Control Board - Los Angeles. Where there is a conflict in the definitions employed by two or more agencies having jurisdiction over hazardous

waste or water pollution, the terms "Hazardous Materials" and "Hazardous Waste" shall be construed to have the broader, more encompassing definition.

e) "Illicit Connection" means any device or artifice, excluding roof drains and other similar connections, connected to the Municipal Separate Storm Sewer System, without a permit, through or by which an Illicit Discharge may be discharged. Examples include channels, pipelines, pipes, conduits, inlets and outlets connected directly to the Municipal Separate Storm Sewer System.

f) "Illicit Discharge" means any discharge to the MS4 that is not composed entirely of Storm Water except discharges pursuant to a NPDES permit, Permitted Discharges (which are exempt or conditionally exempt in accordance with any applicable order of the RWQCB-LA) and discharges resulting from fire fighting activities. "Illicit Discharge" includes but is not limited to wash waters from the cleaning of Retail Gasoline Outlets, auto repair garages and similar Automotive Service Facilities; runoff from mobile auto washing, steam cleaning and mobile carpet cleaning, and other similar mobile commercial and industrial operations; discharges from areas where repair of machinery and equipment, including, but not limited to motor vehicles which are visibly leaking oil, fluid or antifreeze, is undertaken; discharges of runoff to the MS4 from storage areas of materials containing grease, oil, or other Hazardous Substances, and uncovered receptacles containing Hazardous Materials; chlorinated or brominated swimming pool water and filter backwash; runoff from the washing of toxic materials from paved or unpaved areas; discharge of runoff from washing impervious surfaces at sites of industrial activity, unless specifically required by State or local health and safety codes; discharge of concrete or cement-laden wash water from concrete trucks, pumps, tools and equipment; litter; construction and demolition debris; fuel and chemical wastes; animal wastes; garbage, food and food processing wastes; cooking oil or grease; leaves, grass or other clippings, dirt or any other landscape debris or wastes; any pesticide, fungicide, or herbicide banned by or not registered with the United States Environmental Protection Agency or the California Department of Pesticide Regulation; wash or rinse water from any Restaurant or Automotive Service Facility floor mats; any liquid used as a cooling fluid in any radiator of any engine; batteries; and any other materials or solid waste which has potential adverse effects on water quality of receiving waters. "Illicit Discharge" also includes any other discharge to the MS4 that is prohibited by this Code, or any state or federal law.

g) "Industrial/Commercial Facility" means any facility involved used for the production, manufacture, storage, transportation, distribution, exchange or sale of goods or commodities, and any facility used in providing professional and non-professional services. This category of facilities includes, but is not limited to, any facility defined by the Standard Industrial

Classifications (SIC). Facility ownership (federal, state, municipal, private) and profit motive of the facility's owners or operators are not factors in this definition.

h) "Municipal Separate Storm Sewer System or "MS4" " means a conveyance or system of conveyances including municipal streets, alleys, catch basins, curbs, gutters, ditches, man-made channels, storm drains, conduits, or other facilities owned, operated, maintained or controlled by City and used for the purpose of collecting, storing, transporting or disposing of Storm Water, which are not part of a Publicly Owned Treatment Works, and which discharges directly or indirectly (through another agency's MS4) to waters of the United States.

i) "Non-Storm Water Discharge" means any discharge to a Municipal Separate Storm Sewer System that is not composed entirely of Storm Water. See Illicit Discharge above, and Permitted Discharge, below.

j) "NPDES" means the "National Pollutant Discharge Elimination System" established by § 402 of the Clean Water Act, 33 U.S.C. § 1342, as it, from time to time, may be amended.

k) "Permitted Discharge" means the following non-storm water discharges:

1) Discharges covered by a separate individual or general NPDES permit;

2) Natural flows, including the following:

A) Natural springs and rising ground water;

B) Flows from riparian habitats or wetlands;

C) Stream diversions, permitted by the State Board; and

D) Uncontaminated ground water infiltration [as defined by 40 CFR 35.2005(20)].

3) Flows from emergency fire fighting activity.

4) Flows incidental to urban activities, including the following:

A) Reclaimed and potable landscape irrigation runoff;

B) Potable drinking water supply and distribution system releases (consistent with American Water Works Association guidelines for dechlorination and suspended solids reduction practices);

C) Drains for foundations, footings, and crawl spaces;

D) Air conditioning condensate;

E) Dechlorinated/debrominated swimming pool discharges;

F) Dewatering of lakes and decorative fountains;

G) Non-commercial car washing by residents or by non-profit organizations; and

H) Sidewalk rinsing.

l) "Pollutant" means a "Pollutant" as defined in § 502(6) of the Clean Water Act, 33 U.S.C. 1362(6), or incorporated into California Water Code § 13373, discharged into water but shall not mean uncontaminated Storm Water, potable water or reclaimed water generated by a lawfully permitted water treatment facility, or any substance, the discharge of which into the MS4, through Best Management Practices, has been reduced to the maximum extent practicable. Subject to the foregoing, "Pollutant" also includes but is not limited to wash waters from the cleaning of Retail Gasoline Outlets, auto repair garages and similar Automotive Service Facilities; runoff from mobile auto washing, steam cleaning and mobile carpet cleaning, and other similar mobile commercial and industrial operations; discharges from areas where repair of machinery and equipment, including, but not limited to motor vehicles which are visibly leaking oil, fluid or antifreeze, is undertaken; discharges of runoff to the MS4 from storage areas of materials containing grease, oil, or other Hazardous Substances, and uncovered receptacles containing Hazardous Materials; chlorinated or brominated swimming pool water and filter backwash; runoff from the washing of toxic materials from paved or unpaved areas; discharge of runoff from washing impervious surfaces at sites of industrial activity, unless specifically required by State or local health and safety codes; discharge of concrete or cement-laden wash water from concrete trucks, pumps, tools and equipment; litter; construction and demolition debris; fuel and chemical wastes; animal wastes; garbage, food and food processing wastes; cooking oil or grease; leaves, grass or other clippings, dirt or any other landscape debris or wastes; any pesticide, fungicide, or herbicide banned by or not registered with the United States Environmental Protection Agency or the California Department of Pesticide Regulation; wash or rinse water from any Restaurant or Automotive Service Facility floor mats; any liquid used as a cooling fluid in any radiator of any engine; batteries; and any other materials or solid waste which has potential adverse effects on water quality of receiving waters.

m) "Restaurant" means a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC Code 5812).

n) "Retail Gasoline Outlet or RGO" means, for the purpose of this Chapter, any facility engaged in selling gasoline and lubricating oils.

o) "Solid Waste" shall have the meaning ascribed by Public Resources Code § 40191, as it, from time to time, may be amended.

p) "Storm Drain" (see Municipal Separate Storm Sewer System or "MS4," above).

q) "Storm Water" means Storm Water runoff, snow melt runoff, and surface runoff and drainage.

r) "Storm Water Pollution Prevention Plan or SWPPP" means a plan, as required by a State General Permit issued by the State Water Resources Control Board ("SWRCB"), identifying potential Pollutant sources and describing the design, placement and implementation of BMPs, to effectively prevent non-Storm Water Discharges and to reduce Pollutants in Storm Water Discharges during activities covered by the General Permit.

s) "Structural BMP" means any structural facility designed and constructed to mitigate the adverse impacts of Storm Water and urban runoff pollution (e.g. canopy, structural enclosure). The category may include both Treatment Control BMPs and Source Control BMPs.

t) "Treatment Control BMP" means any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media absorption or any other physical, biological, or chemical process.

u) "Wet Season" means the period beginning on October 1st and ending at midnight on April 15th, annually.

410.1.015 AUTHORITY TO ENFORCE AND IMPLEMENT.

Under the Torrance City Charter, Article 11, Section 7 of the California Constitution, the California Government Code, and the California Water Code, the City Manager, or the City Manager’s designee, shall have the authority to take all actions necessary to enforce and implement all NPDES Permits and waste discharge requirements.

410.1.020 ILLICIT DISCHARGES PROHIBITED.

No person shall cause any Illicit Discharge to enter the MS4 unless such discharge: (1) is authorized by an NPDES permit; or (2) is associated with emergency fire fighting activities; or (3) is a Permitted Discharge which is exempt or conditionally exempt in accordance with an applicable order of the California Regional Water Quality Control Board - Los Angeles. No Pollutant in Storm Water may be discharged to the MS4 unless the Pollutant has been

reduced to the maximum extent practicable.

410.1.030 ILLICIT CONNECTIONS PROHIBITED.

No person shall use or suffer the use of any Illicit Connection to convey an Illicit Discharge or any Pollutant to the MS4 from premises of which that person is an owner or is the person in charge of day-to-day activities. Illicit Connections are prohibited by the Clean Water Act, NPDES MS4 Storm Water Permits issued by the California Regional Water Quality Control Board - Los Angeles and this Chapter. The owner and the person in charge of day-to-day activities of premises at which an Illicit Connection is located shall obtain a permit for, or remove, the Illicit Connection within one hundred and eighty (180) days of confirmation of discovery of the Illicit Connection.

410.1.040 CONTROL OF POLLUTANTS FROM SITES OF INDUSTRIAL ACTIVITY.

a) It shall be a violation of this Chapter for any person or entity required under federal or state law to comply with the requirements for a NPDES General Industrial Activities Storm Water Permit (GIASP) for a facility or activity in the City to operate such facility or activity in the City which discharges to the City's MS4 without complying with all applicable requirements for a General Industrial Activities Storm Water Permit.

b) Any person or entity in the City required to have a General Industrial Activities Storm Water Permit for a facility or activity in the City which discharges to the City's MS4 shall retain at such facility or activity the following documents which evidence compliance with General Industrial Activities Storm Water Permit requirements: (i) a copy of the Notice of Intent to comply with the General Industrial Activities Storm Water Permit; (ii) a waste discharge identification number (WDID) issued by the State Water Resources Control Board; (iii) a Storm Water Pollution Prevention Plan (SWPPP) (iv) any required Storm Water quality data; and (v) a plan containing urban runoff Best Management Practices (BMPs).

c) Any person or entity in the City required to have a General Industrial Activities Storm Water Permit for a facility or activity in the City which discharges to the City's MS4, upon request from a duly authorized officer of the City, shall make available to the City for review, copying and inspection all of the documents described in subsection b) of this Section during any City Storm Water-related educational program or inspection and shall demonstrate compliance with such General Industrial Activities Storm Water Permit, including but not limited to demonstration of the adequacy of, and compliance with, any required SWPPP and all applicable BMPs.

410.1.050 SPILLS, DUMPING AND DISPOSAL PROHIBITED.

a) No person shall dump, deposit, release, spill, leak, pump, pour, emit, empty, discharge,

inject, bury or dispose into the environment any Solid Waste or liquid waste, including any Pollutant, in or upon any part of the MS4, or upon any public or private premises in the City, or to cause, suffer, or permit any Solid Waste or liquid waste or other Pollutant to come to be located upon, in, on or under any premises in the City, except in an authorized or permitted solid waste container or at an authorized or permitted solid waste facility or publicly owned or privately owned treatment works.

b) No person shall dispose of leaves, grass or other clippings, dirt or any other landscape debris into any part of the MS4.

c) No person shall dispose of any pesticide, fungicide, or herbicide banned by, or not registered with, the United States Environmental Protection Agency or the California Department of Pesticide Regulation, or its successor, into any part of the MS4.

d) No person shall dispose of any Hazardous Material into any Civic Litter Container or any other trash receptacle accessible to the public.

e) No person shall pour oil or grease, or the residue of oil or grease onto any parking lot, or any part of the MS4.

f) No person shall place any washout water or other liquid in any container for the disposal of Solid Waste.

g) No person shall wash Restaurant or Automotive Service Facility floor mats in any place where the wash or rinse water may flow into any part of the MS4.

410.1.060 BEST MANAGEMENT PRACTICES REQUIRED.

The owner, occupant or other person in charge of day-to-day operation of each premises within the City shall implement Best Management Practices as follows:

a) The owner or other person in charge of day-to-day operation of parking lots with more than 25 parking spaces exposed to Storm Water which parking lots are associated with industrial or commercial activities, according to the United States Office of Management and Budget Standard Industrial Classification Code, shall use BMPs to reduce the discharge of Pollutants to the maximum extent practicable. Such measures may include regular sweeping or other measures, if effective.

b) The owner or other person in charge of day-to-day operation of premises where machinery or other equipment which is repaired or maintained, at facilities or activities associated with industrial or commercial activities, according to the United States Office of

Management and Budget Standard Industrial Classification Code, shall use BMPs or other steps to prevent discharge of maintenance related or repair related Pollutants to the MS4.

c) For other premises exposed to Storm Water, the owner, occupant or other person in charge of day-to-day operations shall use BMPs, if they exist, or other steps to reduce the discharge of Pollutants to the maximum extent practicable, including the removal and lawful disposal of any Solid Waste or any other substance which, if it were to be discharged to the MS4, would be a Pollutant, including fuels, waste fuels, chemicals, chemical wastes and animal wastes, from all parts of the premises exposed to Storm Water.

410.1.070 CONSTRUCTION ACTIVITY STORM WATER MEASURES.

a) Each person applying to the City for a grading or building permit for projects for which compliance with regulations governing State Construction Activity Storm Water Permits ("GCASPs") is required, must submit satisfactory proof to City (i) that a Notice of Intent (NOI) to comply with the GCASP has been filed and (ii) that a Storm Water Pollution Prevention Plan has been prepared, before the City shall issue any grading or building permit on the construction project. A copy of the NOI and the SWPPP shall be maintained on-site during grading and construction and shall be made available for inspection, review and copying upon the request of any City inspector.

b) It shall be a violation of this Chapter for any person or entity required under federal or state law to comply with the requirements for a State Construction Activity Storm Water Permits (GCASP) for construction activity in the City to conduct, authorize or permit construction activities in the City at any facility which discharges to the City's MS4 without complying with all applicable requirements for a GCASP.

c) Each person applying for a grading or building permit for any project for which compliance with regulations governing State Construction Activity Storm Water Permits is not required, shall submit to the City for information, and shall implement a grading and construction activity runoff control program adequate to accomplish all of the following:

1) Retain on-site the sediments generated on or brought to the project site, using Treatment Control or Structural BMPs;

2) Retain construction-related materials and wastes, spills and residues at the project site and prevent discharges to streets, drainage facilities, the MS4, receiving waters or adjacent properties;

3) Contain non-Storm Water runoff from equipment and vehicle washing at the project site; and

4) Control erosion from slopes and channels through use of effective BMPs, such as limitation of grading during the wet season, inspection of graded areas during rain events; planting and maintenance of vegetation on slopes, if any, and covering any slopes susceptible to erosion.

d) No person generating or producing pavement sawcutting wastes in any street, curb or sidewalk in the City shall fail to recover and properly dispose of such sawcutting wastes, and in no case shall such wastes be permitted or suffered to enter any part of the MS4, including, but not limited to any storm drain.

e) No person performing street and road maintenance in any street in the City shall fail to manage street and road maintenance materials in a manner which prevents such materials from being discharged to the MS4.

f) No person shall wash any concrete truck or any part of any concrete truck, including, but not limited to any chute, pump or tools, in any place in the City except an area designated for that purpose by the City, if the City has designated such a place. No person shall permit or suffer any concrete rinseate or washwater from any truck, pump, tool or equipment to enter any drain, open ditch, street or road or any catch basin or any other part of the MS4.

410.1.080 VIOLATIONS.

Violation of any provision of this Chapter, any Storm Water Pollution Prevention Plan, any provision of any permit issued pursuant to this Chapter, or any Administrative Enforcement Order issued pursuant to this Chapter shall be a misdemeanor.

410.1.090 NOTICES OF VIOLATION; ADMINISTRATIVE ORDERS; AND ENFORCEMENT.

a) The City Manager, or the City Manager's designees, may issue Notices of Violation and Administrative Enforcement Orders to achieve compliance with the provisions of this Chapter, any approved Storm Water Pollution Prevention Plan or any permit issued pursuant to this Chapter. Failure to comply with the terms and conditions of such a Notice of Violation or an Administrative Order shall constitute a violation of this Chapter.

b) The City Attorney may bring civil and criminal actions to enforce this Chapter, including, but not limited to, the provisions of any Administrative Enforcement Order, any Storm Water Pollution Prevention Plan or any permit issued pursuant to this Chapter.

410.1.100 NUISANCE.

The violation of any provision of this Chapter is hereby declared to be a nuisance, and may be abated by the City in accordance with its authority to abate nuisances.

410.1.110 REMEDIES NOT EXCLUSIVE.

The remedies listed in this Chapter are not exclusive of any other remedies available to the City under any applicable federal, state or local law and it is within the discretion of the City to seek cumulative remedies.

410.1.120 INSPECTIONS; SEARCHES.

Whenever necessary to make an inspection to enforce any provisions of this Chapter and to conduct all inspections required by any applicable NPDES permit, the enforcement officer for the City may enter any property in the City regulated by this Chapter in a manner authorized by State law and take samples; inspect, review and copy records relevant to any Illicit Connection, Illegal Discharge or the Discharge of any Pollutant. The owner or other person in charge of day-to-day activities at the premises, upon request of any City inspector, shall make available for inspection, review and copying any required GIASP, GCASP, NoI, BMPs, SWPPP and any permit relevant to the reduction of the Discharge of any Pollutant to the maximum extent practicable.

410.1.130 FEES.

The City Council may establish fees for the services provided under this Chapter. Such fees shall be fixed and established from time to time by the City Council by resolution.

NPDES No. CAS 004001 Order No. 01-182

Los Angeles County Municipal Storm Water Permit (Order 01-182)
Individual Annual Report Form
Attachment U-4

I. Certification Statement

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted.

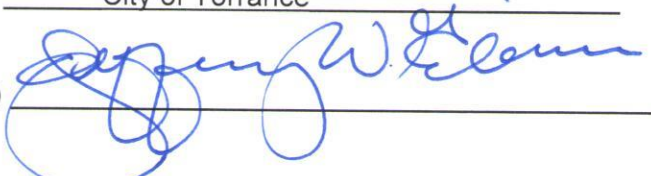
Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility, of a fine and imprisonment for knowing violations.

Executed on the 18 day of December , 2014,

at City of Torrance .

Printed Name Jeffery W. Gibson Title Community Development Director

City Name City of Torrance

(Signature) 

Signature by duly authorized representative

Appendix Q

Selection of Critical Condition Year/Days for WBPCs

BACTERIA – 90TH PERCENTILE TMDL YEAR – MANHATTAN BEACH GAGE

Manhattan Beach Gauge D1070					
Precipitation Total			Number of Wet Days		
Year	Precip. (in)	Percentile	Year	Days	Percentile
1998	29.26	100%	1998	99	100%
1995	**22**	**95%**	2010	76	95%
2005	21.94	91%	**1995**	**73**	**86%**
1993	21.7	86%	2005	73	86%
2011	17.23	82%	1993	71	82%
1992	15.74	77%	1992	67	73%
2003	14.57	73%	2011	67	73%
2010	14.35	68%	1989	66	68%
2008	14.27	64%	1999	65	64%
2001	13.78	59%	1994	60	59%
1997	12.28	55%	2000	59	55%
2004	10.9	50%	1996	58	50%
2000	10.86	45%	2004	55	45%
1996	10.23	41%	2003	53	36%
2009	8.88	36%	2006	53	36%
1991	8.28	32%	2001	52	32%
2006	7.94	27%	2009	49	27%
1994	7.69	23%	1997	45	23%
1999	7.55	18%	2008	42	18%
1989	7.44	14%	1991	41	9%
1990	4.5	9%	2002	41	9%
2002	4	5%	2007	40	5%
2007	3.47	0%	1990	39	0%

COPPER – 90TH PERCENTILE DAILY LOAD - DOMINGUEZ CHANNEL ANALYSIS REGION

Date	Inflow (cubic feet)	Copper		
		Cu Load (lb)	Cu Conc (ug/L)	Cu Load Percentile
12/27/2004	31,312,007	60.7	31.0	100%
3/20/2011	29,060,258	46.7	25.8	100%
2/12/2003	26,298,172	45.5	27.7	99%
12/28/2004	22,781,614	44.2	31.0	99%
3/15/2003	23,632,270	41.4	28.1	98%
1/7/2005	23,704,308	39.5	26.7	98%
12/19/2010	22,415,152	38.4	27.4	98%
1/1/2005	22,887,234	36.4	25.5	97%
1/27/2008	17,368,762	30.9	28.5	97%
1/25/2008	18,665,740	30.7	26.3	96%
2/20/2004	16,833,095	28.0	26.6	96%
12/15/2008	15,951,698	27.8	27.9	96%
1/20/2010	15,798,848	27.7	28.1	95%
2/6/2010	15,729,036	26.2	26.7	95%
12/20/2010	14,546,645	24.9	27.4	95%
2/24/2008	14,917,722	24.7	26.5	94%
2/24/2004	13,785,525	24.7	28.7	94%
12/18/2010	14,369,712	24.6	27.4	93%
5/1/2003	13,244,040	24.0	29.1	93%
2/26/2006	12,677,625	23.8	30.1	93%
12/7/2009	14,264,586	23.8	26.7	92%
10/19/2004	14,063,955	23.5	26.7	92%
12/31/2005	13,537,145	22.9	27.1	91%
1/6/2008	13,704,266	22.7	26.5	91%
2/17/2009	13,278,389	22.1	26.7	91%
2/20/2005	12,442,688	21.5	27.7	90%
11/30/2007	**13,129,863**	**21.1**	**25.8**	**90%**
2/11/2003	12,156,135	21.0	27.7	89%
12/22/2010	12,190,852	20.9	27.4	89%
2/11/2005	11,861,441	20.6	27.8	89%
3/28/2006	12,817,317	20.5	25.7	88%
10/25/2004	12,937,482	20.4	25.2	88%
2/5/2010	11,979,000	20.0	26.7	88%
1/23/2008	10,620,633	18.5	28.0	87%
2/3/2008	10,016,045	18.3	29.3	87%
2/18/2005	9,756,024	17.9	29.5	86%
3/25/2012	10,919,891	17.8	26.1	86%
12/15/2002	9,230,222	17.0	29.4	86%

Date	Inflow (cubic feet)	Copper		
		Cu Load (lb)	Cu Conc (ug/L)	Cu Load Percentile
2/16/2009	9,744,219	16.9	27.9	85%
12/12/2009	8,404,272	16.5	31.4	85%
2/19/2005	10,206,811	16.3	25.6	84%
2/9/2005	9,110,565	16.2	28.5	84%
10/14/2009	9,486,034	15.8	26.7	84%
1/19/2010	8,943,577	15.4	27.5	83%
1/28/2008	8,364,151	15.2	29.2	83%
11/6/2002	9,155,190	15.2	26.5	82%
1/18/2010	9,036,992	14.8	26.2	82%
4/4/2006	6,967,943	14.4	33.1	82%
12/21/2010	8,348,384	14.3	27.4	81%
2/27/2010	7,098,103	14.1	31.9	81%
1/4/2008	8,313,372	14.1	27.1	81%
11/26/2008	7,467,163	13.9	29.8	80%
1/21/2012	7,512,682	13.8	29.4	80%
10/6/2010	7,242,584	13.8	30.5	79%
2/23/2003	7,980,165	13.6	27.3	79%
2/17/2005	7,218,537	13.3	29.5	79%
12/12/2011	7,726,019	13.3	27.5	78%
1/2/2004	6,720,802	12.8	30.5	78%
12/29/2010	7,517,626	12.7	27.1	77%
1/8/2005	7,479,474	12.5	26.8	77%
10/15/2004	7,252,323	12.1	26.8	77%
10/31/2003	6,043,495	11.3	29.8	76%
3/17/2012	6,313,983	11.1	28.1	76%
2/21/2005	6,282,137	11.0	28.0	75%
4/12/2010	6,482,727	11.0	27.1	75%
11/4/2008	5,574,369	10.9	31.3	75%
11/8/2002	6,698,336	10.6	25.3	74%
2/29/2004	6,634,305	10.5	25.5	74%
3/21/2005	6,138,728	10.5	27.3	74%
2/22/2005	5,938,403	10.4	28.0	73%
4/13/2012	6,585,692	10.4	25.2	73%
2/9/2003	5,690,745	10.0	28.1	72%
3/23/2011	5,715,041	9.9	27.8	72%
12/31/2004	5,506,833	9.8	28.6	72%
1/2/2011	5,753,882	9.5	26.5	71%
2/6/2009	4,867,387	9.4	30.8	71%

Date	Inflow (cubic feet)	Copper		
		Cu Load (lb)	Cu Conc (ug/L)	Cu Load Percentile
11/4/2011	5,106,680	9.2	29.0	70%
10/13/2007	5,927,135	9.2	24.8	70%
11/20/2011	5,155,535	9.0	27.9	70%
1/22/2008	5,130,327	8.8	27.5	69%
10/5/2011	5,321,098	8.8	26.4	69%
11/9/2005	5,533,232	8.7	25.3	68%
4/11/2012	4,446,967	8.7	31.2	68%
4/26/2005	5,030,015	8.6	27.2	68%
12/25/2003	5,245,611	8.4	25.7	67%
12/5/2004	4,949,169	8.3	26.8	67%
12/18/2007	5,653,928	8.3	23.4	67%
12/25/2010	5,010,113	8.2	26.3	66%
4/14/2003	4,548,122	8.0	28.1	66%
2/25/2011	4,769,946	7.9	26.6	65%
1/22/2010	4,414,439	7.8	28.4	65%
1/21/2010	4,344,942	7.7	28.4	65%
10/18/2004	4,587,728	7.7	26.7	64%
2/5/2009	3,865,855	7.4	30.8	64%
2/22/2008	4,216,191	7.4	28.1	63%
1/23/2012	4,308,546	7.3	27.2	63%
12/17/2010	4,248,719	7.3	27.4	63%
2/16/2005	3,923,685	7.2	29.5	62%
3/21/2011	4,486,104	7.2	25.8	62%
12/18/2002	4,210,652	7.1	26.8	61%
1/24/2008	4,227,769	7.0	26.3	61%
10/19/2010	3,474,342	6.9	32.0	61%
4/20/2007	3,776,909	6.8	28.6	60%
1/28/2005	3,733,545	6.7	28.6	60%
2/11/2007	3,515,013	6.6	30.1	60%
10/30/2010	3,807,601	6.6	27.6	59%
10/16/2005	3,685,195	6.5	28.2	59%
2/1/2004	4,141,935	6.5	25.0	58%
12/4/2004	3,884,430	6.3	25.9	58%
12/19/2007	4,220,534	6.2	23.4	58%
1/5/2008	3,533,926	6.0	27.1	57%
2/27/2006	3,135,758	5.9	30.1	57%
11/28/2002	3,341,100	5.8	28.0	56%
12/17/2008	3,607,544	5.7	25.5	56%

Date	Inflow (cubic feet)	Copper		
		Cu Load (lb)	Cu Conc (ug/L)	Cu Load Percentile
2/25/2004	3,135,821	5.6	28.7	56%
1/30/2007	3,318,231	5.6	27.0	55%
3/5/2006	2,962,988	5.4	29.5	55%
12/16/2002	2,948,589	5.4	29.4	54%
1/9/2005	3,150,007	5.4	27.3	54%
4/12/2003	2,841,017	5.3	29.7	54%
5/2/2003	2,832,986	5.1	29.1	53%
2/18/2011	2,862,405	5.1	28.6	53%
2/20/2008	2,828,230	5.1	28.8	53%
4/14/2006	2,869,020	5.1	28.3	52%
11/6/2011	3,030,571	5.1	26.8	52%
2/9/2009	2,870,133	5.0	27.7	51%
1/24/2009	2,374,682	4.8	32.5	51%
1/17/2010	2,930,670	4.8	26.2	51%
9/21/2007	2,945,352	4.8	26.0	50%
2/26/2011	2,837,279	4.7	26.6	50%
12/6/2007	2,755,304	4.6	26.5	49%
12/5/2010	2,400,536	4.6	30.4	49%
12/11/2009	2,795,477	4.5	25.9	49%
10/26/2004	2,854,466	4.5	25.2	48%
5/20/2006	2,839,899	4.5	25.1	48%
11/11/2003	2,572,500	4.4	27.2	47%
11/5/2004	2,572,500	4.3	26.6	47%
2/19/2011	2,294,198	4.2	29.4	47%
2/15/2012	2,082,349	4.2	32.2	46%
12/24/2003	2,251,256	4.1	29.3	46%
1/3/2005	2,497,319	4.1	26.2	46%
5/18/2011	2,306,463	3.9	26.9	45%
4/25/2012	2,308,536	3.9	26.8	45%
11/12/2011	2,174,554	3.8	27.7	44%
1/26/2008	2,182,482	3.7	27.1	44%
12/25/2006	2,020,322	3.6	28.6	44%
3/17/2005	2,023,658	3.6	28.4	43%
2/17/2004	2,074,455	3.6	27.6	43%
1/23/2009	2,053,799	3.6	27.8	42%
2/10/2005	1,967,186	3.5	28.5	42%
2/20/2010	2,015,114	3.5	27.5	42%
2/13/2009	1,876,970	3.5	29.5	41%

Date	Inflow (cubic feet)	Copper		
		Cu Load (lb)	Cu Conc (ug/L)	Cu Load Percentile
2/22/2007	2,076,926	3.4	26.3	41%
3/13/2003	2,023,658	3.3	26.4	40%
11/7/2002	1,992,933	3.3	26.5	40%
12/27/2006	1,776,634	3.2	29.0	40%
2/24/2003	1,885,761	3.2	27.3	39%
3/25/2011	1,760,492	3.2	29.2	39%
1/13/2010	2,066,943	3.2	24.8	39%
4/26/2012	1,897,335	3.2	26.8	38%
12/23/2003	1,951,005	3.1	25.8	38%
12/3/2004	1,835,372	3.1	27.4	37%
3/24/2011	1,696,950	3.1	29.2	37%
1/3/2011	1,769,701	2.9	26.7	37%
3/26/2006	1,911,518	2.9	24.5	36%
1/13/2006	1,500,212	2.9	30.8	36%
9/22/2007	1,823,679	2.9	25.2	35%
10/20/2010	1,625,021	2.7	27.1	35%
3/26/2012	1,661,845	2.7	26.1	35%
3/2/2011	1,629,468	2.7	26.4	34%
12/20/2002	1,428,401	2.7	30.1	34%
2/9/2010	1,570,402	2.7	27.1	33%
5/17/2011	1,556,834	2.6	26.9	33%
1/26/2010	1,637,395	2.6	25.5	33%
12/5/2007	1,555,742	2.6	26.5	32%
3/27/2006	1,600,858	2.5	25.4	32%
3/31/2012	1,483,027	2.5	27.4	32%
3/1/2004	1,589,905	2.5	25.5	31%
10/16/2004	1,502,745	2.5	26.8	31%
12/22/2008	1,419,467	2.5	28.2	30%
11/8/2010	1,333,938	2.5	29.6	30%
2/17/2006	1,505,022	2.4	26.0	30%
2/10/2003	1,309,194	2.3	28.1	29%
3/30/2006	1,214,504	2.2	29.3	29%
12/8/2006	1,284,662	2.2	27.5	28%
11/3/2003	1,454,949	2.2	23.9	28%
5/22/2006	1,241,330	2.2	27.9	28%
3/22/2005	1,255,348	2.1	27.3	27%
3/1/2006	1,433,024	2.1	23.1	27%
2/21/2008	1,149,453	2.0	28.6	26%

Date	Inflow (cubic feet)	Copper		
		Cu Load (lb)	Cu Conc (ug/L)	Cu Load Percentile
11/23/2010	1,119,060	2.0	28.3	26%
4/27/2005	1,149,309	2.0	27.2	26%
2/7/2009	1,006,627	1.9	30.8	25%
2/18/2009	1,143,216	1.9	26.7	25%
3/20/2006	1,046,843	1.8	27.9	25%
10/24/2010	820,995	1.8	34.6	24%
11/29/2002	1,004,502	1.8	28.0	24%
2/2/2004	1,090,598	1.7	25.0	23%
3/6/2010	937,382	1.7	29.0	23%
12/19/2002	1,003,535	1.7	26.8	23%
5/4/2005	1,047,657	1.7	25.5	22%
4/20/2010	1,001,782	1.7	26.4	22%
11/2/2008	925,436	1.6	27.4	21%
2/19/2007	923,357	1.6	27.1	21%
2/16/2011	876,853	1.6	28.4	21%
10/25/2010	710,814	1.5	34.6	20%
9/18/2005	999,623	1.5	24.1	20%
4/11/2010	878,904	1.5	27.1	19%
3/18/2012	807,317	1.4	28.1	19%
10/4/2010	765,371	1.4	28.7	19%
2/20/2011	732,343	1.3	29.5	18%
12/6/2010	695,012	1.3	30.4	18%
3/6/2006	580,888	1.1	29.5	18%
4/11/2003	717,854	1.0	23.3	17%
4/28/2010	620,033	1.0	26.8	17%
12/26/2010	619,485	1.0	26.3	16%
4/10/2012	519,300	1.0	31.2	16%
11/12/2003	583,254	1.0	27.2	16%
11/6/2004	583,254	1.0	26.6	15%
5/21/2006	608,704	1.0	25.2	15%
12/26/2006	490,783	0.9	28.6	14%
1/2/2005	514,226	0.8	26.2	14%
2/23/2008	504,525	0.8	26.5	14%
2/18/2004	446,451	0.8	27.6	13%
1/14/2006	395,045	0.8	30.8	13%
9/20/2007	405,281	0.7	28.0	12%
3/18/2005	361,558	0.6	28.4	12%
3/14/2003	361,558	0.6	26.4	12%

Date	Inflow (cubic feet)	Copper		
		Cu Load (lb)	Cu Conc (ug/L)	Cu Load Percentile
4/13/2003	312,847	0.6	29.8	11%
10/12/2007	359,673	0.6	24.8	11%
12/13/2009	258,991	0.5	31.4	11%
12/9/2006	291,949	0.5	27.5	10%
12/21/2002	262,934	0.5	30.1	10%
3/19/2006	267,300	0.5	27.9	9%
1/10/2005	269,313	0.5	27.3	9%
3/2/2006	284,878	0.4	23.1	9%
3/31/2006	204,339	0.4	29.3	8%
3/3/2011	188,136	0.3	26.4	8%
11/25/2008	147,231	0.3	29.8	7%
5/5/2005	151,029	0.2	25.5	7%
12/10/2009	140,400	0.2	25.9	7%
2/19/2010	110,684	0.2	27.5	6%
1/7/2008	86,988	0.1	26.5	6%
9/19/2005	94,694	0.1	24.1	5%
2/15/2011	74,925	0.1	28.4	5%
1/23/2010	70,452	0.1	28.4	5%
4/27/2010	66,744	0.1	26.8	4%
12/23/2010	61,612	0.1	27.4	4%
10/13/2009	56,889	0.1	26.7	4%
11/24/2010	50,735	0.1	28.3	3%
2/14/2009	16,365	0.0	29.5	3%
4/1/2012	16,953	0.0	27.4	2%
12/14/2008	14,987	0.0	27.9	2%
10/5/2010	3,669	0.0	30.5	2%
2/18/2006	1,934	0.0	26.0	1%
12/6/2004	779	0.0	27.6	1%
12/18/2008	429	0.0	25.5	0%
3/7/2010	248	0.0	29.0	0%

LEAD – 90TH PERCENTILE DAILY LOAD - DOMINGUEZ CHANNEL ANALYSIS REGION

Date	Inflow (cubic feet)	Lead		
		Pb Load (lb)	Pb Conc (ug/L)	Pb Load Percentile
3/20/2011	29,060,258	24.9	13.7	100%
12/27/2004	31,312,007	22.4	11.4	100%
1/1/2005	22,887,234	20.7	14.5	99%
12/19/2010	22,415,152	17.2	12.3	99%
1/7/2005	23,704,308	16.6	11.2	98%
2/12/2003	26,298,172	16.3	9.9	98%
12/28/2004	22,781,614	16.3	11.4	98%
3/15/2003	23,632,270	16.2	11.0	97%
10/25/2004	12,937,482	15.8	19.5	97%
1/20/2010	15,798,848	14.1	14.3	96%
2/24/2008	14,917,722	13.7	14.7	96%
1/27/2008	17,368,762	13.3	12.3	96%
2/20/2004	16,833,095	13.0	12.4	95%
12/15/2008	15,951,698	12.5	12.5	95%
1/25/2008	18,665,740	12.1	10.4	95%
2/6/2010	15,729,036	11.4	11.6	94%
1/6/2008	13,704,266	11.3	13.2	94%
12/20/2010	14,546,645	11.2	12.3	93%
12/18/2010	14,369,712	11.0	12.3	93%
10/19/2004	14,063,955	10.4	11.8	93%
1/23/2008	10,620,633	10.0	15.1	92%
12/7/2009	14,264,586	9.9	11.1	92%
2/17/2009	13,278,389	9.8	11.9	91%
2/24/2004	13,785,525	9.6	11.2	91%
11/30/2007	13,129,863	9.5	11.6	91%
12/22/2010	12,190,852	9.4	12.3	90%
2/5/2010	**11,979,000**	**8.7**	**11.6**	**90%**
12/31/2005	13,537,145	8.7	10.2	89%
2/26/2006	12,677,625	8.7	10.9	89%
5/1/2003	13,244,040	8.6	10.5	89%
2/16/2009	9,744,219	8.4	13.8	88%
3/25/2012	10,919,891	8.3	12.1	88%
2/11/2005	11,861,441	8.2	11.1	88%
3/28/2006	12,817,317	8.1	10.2	87%
1/18/2010	9,036,992	8.0	14.2	87%
11/6/2002	9,155,190	7.9	13.8	86%
2/20/2005	12,442,688	7.9	10.1	86%
1/19/2010	8,943,577	7.7	13.8	86%

Date	Inflow (cubic feet)	Lead		
		Pb Load (lb)	Pb Conc (ug/L)	Pb Load Percentile
2/3/2008	10,016,045	7.6	12.2	85%
2/19/2005	10,206,811	7.6	11.9	85%
2/11/2003	12,156,135	7.5	9.9	84%
1/4/2008	8,313,372	7.1	13.7	84%
12/12/2009	8,404,272	7.0	13.4	84%
12/15/2002	9,230,222	7.0	12.1	83%
2/18/2005	9,756,024	6.9	11.4	83%
1/21/2012	7,512,682	6.8	14.6	82%
2/9/2005	9,110,565	6.8	11.9	82%
1/28/2008	8,364,151	6.7	12.9	82%
12/29/2010	7,517,626	6.7	14.2	81%
10/14/2009	9,486,034	6.5	11.0	81%
2/29/2004	6,634,305	6.4	15.5	81%
12/21/2010	8,348,384	6.4	12.3	80%
2/27/2010	7,098,103	5.9	13.4	80%
12/12/2011	7,726,019	5.9	12.2	79%
10/6/2010	7,242,584	5.5	12.1	79%
4/4/2006	6,967,943	5.4	12.5	79%
1/2/2004	6,720,802	5.4	12.9	78%
1/8/2005	7,479,474	5.4	11.5	78%
11/8/2002	6,698,336	5.2	12.5	77%
10/15/2004	7,252,323	5.2	11.6	77%
2/23/2003	7,980,165	5.2	10.5	77%
12/18/2007	5,653,928	5.2	14.7	76%
2/17/2005	7,218,537	5.1	11.4	76%
2/21/2005	6,282,137	4.9	12.4	75%
3/17/2012	6,313,983	4.7	12.0	75%
3/23/2011	5,715,041	4.7	13.2	75%
11/26/2008	7,467,163	4.6	9.9	74%
2/22/2005	5,938,403	4.6	12.4	74%
10/31/2003	6,043,495	4.5	12.1	74%
11/20/2011	5,155,535	4.5	14.1	73%
4/12/2010	6,482,727	4.5	11.0	73%
11/4/2008	5,574,369	4.4	12.6	72%
3/21/2005	6,138,728	4.3	11.3	72%
4/13/2012	6,585,692	4.2	10.3	72%
1/22/2010	4,414,439	4.2	15.2	71%
1/21/2010	4,344,942	4.1	15.2	71%

Date	Inflow (cubic feet)	Lead		
		Pb Load (lb)	Pb Conc (ug/L)	Pb Load Percentile
11/9/2005	5,533,232	4.1	11.8	70%
12/25/2003	5,245,611	4.1	12.4	70%
2/9/2003	5,690,745	3.9	11.0	70%
10/13/2007	5,927,135	3.9	10.5	69%
10/16/2005	3,685,195	3.9	16.9	69%
12/19/2007	4,220,534	3.9	14.7	68%
3/21/2011	4,486,104	3.9	13.7	68%
2/22/2008	4,216,191	3.8	14.6	68%
4/26/2005	5,030,015	3.7	11.9	67%
12/18/2002	4,210,652	3.7	14.1	67%
12/5/2004	4,949,169	3.7	11.8	67%
10/5/2011	5,321,098	3.6	10.8	66%
10/26/2004	2,854,466	3.5	19.5	66%
11/4/2011	5,106,680	3.5	10.9	65%
1/2/2011	5,753,882	3.5	9.6	65%
12/4/2004	3,884,430	3.4	14.2	65%
11/28/2002	3,341,100	3.4	16.4	64%
4/14/2003	4,548,122	3.4	12.1	64%
10/18/2004	4,587,728	3.4	11.8	63%
4/11/2012	4,446,967	3.4	12.2	63%
2/25/2011	4,769,946	3.3	11.2	63%
2/6/2009	4,867,387	3.3	10.9	62%
12/31/2004	5,506,833	3.3	9.6	62%
11/6/2011	3,030,571	3.3	17.3	61%
12/17/2010	4,248,719	3.3	12.3	61%
1/22/2008	5,130,327	3.2	9.9	61%
2/1/2004	4,141,935	3.1	12.0	60%
4/20/2007	3,776,909	3.1	13.1	60%
12/25/2010	5,010,113	3.1	9.9	60%
1/5/2008	3,533,926	3.0	13.7	59%
1/23/2012	4,308,546	2.9	10.7	59%
1/30/2007	3,318,231	2.8	13.7	58%
10/30/2010	3,807,601	2.8	11.9	58%
2/11/2007	3,515,013	2.8	12.9	58%
2/16/2005	3,923,685	2.8	11.4	57%
1/24/2008	4,227,769	2.7	10.4	57%
12/17/2008	3,607,544	2.7	12.0	56%
2/5/2009	3,865,855	2.6	10.9	56%

Date	Inflow (cubic feet)	Lead		
		Pb Load (lb)	Pb Conc (ug/L)	Pb Load Percentile
4/14/2006	2,869,020	2.6	14.6	56%
1/17/2010	2,930,670	2.6	14.2	55%
1/28/2005	3,733,545	2.5	10.9	55%
10/19/2010	3,474,342	2.5	11.6	54%
1/9/2005	3,150,007	2.5	12.7	54%
12/11/2009	2,795,477	2.3	13.4	54%
11/11/2003	2,572,500	2.3	14.4	53%
1/13/2010	2,066,943	2.3	17.6	53%
3/5/2006	2,962,988	2.2	12.2	53%
12/16/2002	2,948,589	2.2	12.1	52%
2/18/2011	2,862,405	2.2	12.3	52%
2/25/2004	3,135,821	2.2	11.2	51%
2/27/2006	3,135,758	2.1	10.9	51%
9/21/2007	2,945,352	2.1	11.6	51%
1/3/2005	2,497,319	2.1	13.5	50%
2/9/2009	2,870,133	2.1	11.6	50%
2/20/2008	2,828,230	2.0	11.6	49%
11/5/2004	2,572,500	2.0	12.5	49%
2/26/2011	2,837,279	2.0	11.2	49%
11/12/2011	2,174,554	2.0	14.6	48%
12/24/2003	2,251,256	1.9	13.8	48%
2/15/2012	2,082,349	1.9	14.9	47%
1/24/2009	2,374,682	1.9	13.0	47%
4/25/2012	2,308,536	1.9	13.2	47%
12/6/2007	2,755,304	1.9	10.8	46%
5/2/2003	2,832,986	1.8	10.5	46%
5/20/2006	2,839,899	1.8	10.3	46%
4/12/2003	2,841,017	1.8	10.1	45%
12/5/2010	2,400,536	1.8	11.8	45%
2/13/2009	1,876,970	1.8	15.0	44%
11/7/2002	1,992,933	1.7	13.8	44%
2/19/2011	2,294,198	1.7	11.8	44%
4/26/2012	1,897,335	1.6	13.2	43%
3/1/2004	1,589,905	1.5	15.5	43%
1/3/2011	1,769,701	1.5	13.8	42%
1/23/2009	2,053,799	1.5	11.9	42%
1/26/2008	2,182,482	1.5	11.0	42%
2/10/2005	1,967,186	1.5	11.9	41%

Date	Inflow (cubic feet)	Lead		
		Pb Load (lb)	Pb Conc (ug/L)	Pb Load Percentile
12/25/2006	2,020,322	1.5	11.5	41%
5/18/2011	2,306,463	1.4	9.9	40%
3/26/2006	1,911,518	1.4	11.6	40%
3/13/2003	2,023,658	1.4	10.8	40%
12/3/2004	1,835,372	1.4	11.8	39%
3/25/2011	1,760,492	1.3	12.0	39%
2/9/2010	1,570,402	1.3	13.3	39%
9/22/2007	1,823,679	1.3	11.2	38%
3/24/2011	1,696,950	1.3	12.0	38%
1/26/2010	1,637,395	1.3	12.3	37%
3/26/2012	1,661,845	1.3	12.1	37%
2/22/2007	2,076,926	1.3	9.7	37%
2/24/2003	1,885,761	1.2	10.5	36%
12/20/2002	1,428,401	1.2	13.8	36%
12/23/2003	1,951,005	1.2	10.0	35%
2/20/2010	2,015,114	1.2	9.5	35%
5/22/2006	1,241,330	1.2	15.2	35%
12/27/2006	1,776,634	1.2	10.6	34%
2/17/2004	2,074,455	1.2	8.9	34%
3/17/2005	2,023,658	1.1	8.9	33%
3/1/2006	1,433,024	1.1	12.5	33%
3/30/2006	1,214,504	1.1	14.7	33%
1/13/2006	1,500,212	1.1	11.6	32%
10/16/2004	1,502,745	1.1	11.6	32%
2/17/2006	1,505,022	1.0	11.2	32%
3/27/2006	1,600,858	1.0	10.5	31%
12/5/2007	1,555,742	1.0	10.8	31%
12/22/2008	1,419,467	1.0	11.8	30%
11/29/2002	1,004,502	1.0	16.4	30%
3/31/2012	1,483,027	1.0	11.0	30%
11/8/2010	1,333,938	1.0	12.1	29%
11/3/2003	1,454,949	1.0	10.8	29%
5/17/2011	1,556,834	1.0	9.9	28%
10/20/2010	1,625,021	0.9	9.3	28%
3/2/2011	1,629,468	0.9	9.2	28%
2/10/2003	1,309,194	0.9	11.0	27%
11/23/2010	1,119,060	0.9	12.8	27%
2/21/2008	1,149,453	0.9	12.3	26%

Date	Inflow (cubic feet)	Lead		
		Pb Load (lb)	Pb Conc (ug/L)	Pb Load Percentile
12/19/2002	1,003,535	0.9	14.1	26%
3/22/2005	1,255,348	0.9	11.3	26%
12/8/2006	1,284,662	0.9	10.7	25%
4/27/2005	1,149,309	0.9	11.9	25%
2/18/2009	1,143,216	0.8	11.9	25%
3/20/2006	1,046,843	0.8	12.8	24%
2/2/2004	1,090,598	0.8	12.0	24%
4/20/2010	1,001,782	0.8	12.9	23%
3/6/2010	937,382	0.8	13.7	23%
2/19/2007	923,357	0.7	12.9	23%
2/16/2011	876,853	0.7	13.2	22%
2/7/2009	1,006,627	0.7	10.9	22%
11/2/2008	925,436	0.7	11.6	21%
10/24/2010	820,995	0.6	12.4	21%
9/18/2005	999,623	0.6	9.9	21%
4/28/2010	620,033	0.6	15.9	20%
3/18/2012	807,317	0.6	12.0	20%
4/11/2010	878,904	0.6	11.0	19%
5/4/2005	1,047,657	0.6	8.9	19%
10/25/2010	710,814	0.6	12.4	19%
2/20/2011	732,343	0.5	11.8	18%
11/12/2003	583,254	0.5	14.4	18%
12/6/2010	695,012	0.5	11.8	18%
4/11/2003	717,854	0.5	10.8	17%
2/23/2008	504,525	0.5	14.7	17%
11/6/2004	583,254	0.5	12.5	16%
3/6/2006	580,888	0.4	12.2	16%
1/2/2005	514,226	0.4	13.5	16%
10/4/2010	765,371	0.4	9.1	15%
5/21/2006	608,704	0.4	10.4	15%
4/10/2012	519,300	0.4	12.2	14%
12/26/2010	619,485	0.4	9.9	14%
12/26/2006	490,783	0.4	11.5	14%
9/20/2007	405,281	0.3	12.6	13%
1/14/2006	395,045	0.3	11.6	13%
2/18/2004	446,451	0.2	8.9	12%
3/14/2003	361,558	0.2	10.8	12%
10/12/2007	359,673	0.2	10.5	12%

Date	Inflow (cubic feet)	Lead		
		Pb Load (lb)	Pb Conc (ug/L)	Pb Load Percentile
12/21/2002	262,934	0.2	13.8	11%
3/2/2006	284,878	0.2	12.5	11%
12/13/2009	258,991	0.2	13.4	11%
3/19/2006	267,300	0.2	12.8	10%
1/10/2005	269,313	0.2	12.7	10%
3/18/2005	361,558	0.2	8.9	9%
4/13/2003	312,847	0.2	10.1	9%
12/9/2006	291,949	0.2	10.7	9%
3/31/2006	204,339	0.2	14.7	8%
12/10/2009	140,400	0.1	13.4	8%
3/3/2011	188,136	0.1	9.2	7%
11/25/2008	147,231	0.1	9.9	7%
5/5/2005	151,029	0.1	8.9	7%
1/7/2008	86,988	0.1	13.2	6%
1/23/2010	70,452	0.1	15.2	6%
4/27/2010	66,744	0.1	15.9	5%
2/19/2010	110,684	0.1	9.5	5%
2/15/2011	74,925	0.1	13.2	5%
9/19/2005	94,694	0.1	9.9	4%
12/23/2010	61,612	0.0	12.3	4%
11/24/2010	50,735	0.0	12.8	4%
10/13/2009	56,889	0.0	11.0	3%
2/14/2009	16,365	0.0	15.0	3%
12/14/2008	14,987	0.0	12.5	2%
4/1/2012	16,953	0.0	11.0	2%
10/5/2010	3,669	0.0	12.1	2%
2/18/2006	1,934	0.0	11.2	1%
12/6/2004	779	0.0	9.8	1%
12/18/2008	429	0.0	12.0	0%
3/7/2010	248	0.0	13.7	0%

ZINC – 90TH PERCENTILE DAILY LOAD - DOMINGUEZ CHANNEL ANALYSIS REGION

Date	Inflow (cubic feet)	Zinc		
		Zn Load (lb)	Zn Conc (ug/L)	Zn Load Percentile
12/27/2004	31,312,007	618.6	316.5	100%
3/20/2011	29,060,258	583.6	321.7	100%
2/12/2003	26,298,172	489.6	298.2	99%
1/7/2005	23,704,308	477.5	322.7	99%
12/19/2010	22,415,152	471.6	337.0	98%
12/28/2004	22,781,614	450.1	316.5	98%
3/15/2003	23,632,270	416.3	282.2	98%
1/1/2005	22,887,234	373.7	261.5	97%
1/27/2008	17,368,762	334.6	308.6	97%
2/20/2004	16,833,095	331.2	315.2	96%
1/25/2008	18,665,740	321.0	275.5	96%
12/20/2010	14,546,645	306.0	337.0	96%
12/18/2010	14,369,712	302.3	337.0	95%
12/15/2008	15,951,698	292.3	293.5	95%
2/6/2010	15,729,036	286.8	292.1	95%
12/31/2005	13,537,145	279.1	330.2	94%
12/7/2009	14,264,586	278.9	313.2	94%
1/20/2010	15,798,848	278.6	282.5	93%
10/19/2004	14,063,955	275.4	313.6	93%
12/22/2010	12,190,852	256.5	337.0	93%
5/1/2003	13,244,040	256.2	309.9	92%
2/24/2008	14,917,722	254.5	273.3	92%
2/17/2009	13,278,389	252.3	304.3	91%
1/6/2008	13,704,266	241.8	282.7	91%
2/20/2005	12,442,688	237.8	306.2	91%
2/11/2005	11,861,441	230.4	311.2	90%
2/26/2006	**12,677,625**	**229.7**	**290.2**	**90%**
2/11/2003	12,156,135	226.3	298.2	89%
2/24/2004	13,785,525	225.8	262.4	89%
10/25/2004	12,937,482	224.5	278.0	89%
11/30/2007	13,129,863	218.6	266.6	88%
2/5/2010	11,979,000	218.4	292.1	88%
3/25/2012	10,919,891	216.7	317.9	88%
3/28/2006	12,817,317	204.7	255.9	87%
1/23/2008	10,620,633	199.6	301.0	87%
2/16/2009	9,744,219	197.5	324.7	86%
2/19/2005	10,206,811	197.2	309.5	86%

Date	Inflow (cubic feet)	Zinc		
		Zn Load (lb)	Zn Conc (ug/L)	Zn Load Percentile
12/15/2002	9,230,222	193.7	336.1	86%
2/3/2008	10,016,045	178.1	284.8	85%
12/21/2010	8,348,384	175.6	337.0	85%
1/18/2010	9,036,992	173.1	306.8	84%
2/9/2005	9,110,565	170.1	299.2	84%
1/19/2010	8,943,577	169.8	304.1	84%
11/6/2002	9,155,190	167.2	292.5	83%
1/4/2008	8,313,372	166.7	321.2	83%
2/23/2003	7,980,165	165.3	331.9	82%
2/18/2005	9,756,024	160.7	263.9	82%
10/14/2009	9,486,034	160.6	271.1	82%
12/12/2009	8,404,272	153.5	292.5	81%
12/12/2011	7,726,019	152.3	315.9	81%
1/28/2008	8,364,151	149.1	285.5	81%
1/8/2005	7,479,474	148.2	317.4	80%
2/27/2010	7,098,103	142.9	322.4	80%
11/26/2008	7,467,163	134.9	289.3	79%
10/15/2004	7,252,323	133.1	293.9	79%
1/2/2004	6,720,802	132.8	316.6	79%
4/13/2012	6,585,692	130.4	317.1	78%
1/21/2012	7,512,682	128.5	273.9	78%
10/6/2010	7,242,584	126.6	279.9	77%
12/29/2010	7,517,626	123.6	263.4	77%
11/9/2005	5,533,232	123.3	357.0	77%
3/17/2012	6,313,983	121.5	308.3	76%
10/13/2007	5,927,135	120.9	326.7	76%
2/29/2004	6,634,305	120.7	291.4	75%
4/12/2010	6,482,727	120.3	297.2	75%
2/17/2005	7,218,537	118.9	263.8	75%
3/21/2005	6,138,728	116.9	305.1	74%
11/8/2002	6,698,336	115.4	276.0	74%
11/4/2008	5,574,369	113.8	327.0	74%
12/18/2007	5,653,928	112.3	318.2	73%
4/4/2006	6,967,943	111.8	257.0	73%
12/31/2004	5,506,833	109.8	319.3	72%
2/21/2005	6,282,137	107.6	274.4	72%
1/2/2011	5,753,882	105.8	294.5	72%
3/23/2011	5,715,041	102.6	287.7	71%

Date	Inflow (cubic feet)	Zinc		
		Zn Load (lb)	Zn Conc (ug/L)	Zn Load Percentile
2/22/2005	5,938,403	101.7	274.4	71%
10/5/2011	5,321,098	99.9	300.7	70%
2/9/2003	5,690,745	99.2	279.2	70%
10/31/2003	6,043,495	99.0	262.4	70%
12/5/2004	4,949,169	96.7	313.1	69%
12/25/2003	5,245,611	95.7	292.3	69%
2/6/2009	4,867,387	92.2	303.6	68%
1/22/2008	5,130,327	92.2	287.8	68%
11/20/2011	5,155,535	90.2	280.4	68%
3/21/2011	4,486,104	90.1	321.7	67%
10/18/2004	4,587,728	89.8	313.6	67%
11/4/2011	5,106,680	89.6	281.2	67%
12/17/2010	4,248,719	89.4	337.0	66%
4/11/2012	4,446,967	88.4	318.4	66%
1/22/2010	4,414,439	87.8	318.4	65%
2/25/2011	4,769,946	87.1	292.5	65%
12/25/2010	5,010,113	86.8	277.5	65%
2/22/2008	4,216,191	86.7	329.6	64%
4/26/2005	5,030,015	86.4	275.2	64%
1/21/2010	4,344,942	86.4	318.4	63%
4/14/2003	4,548,122	84.8	298.7	63%
12/19/2007	4,220,534	83.8	318.2	63%
1/23/2012	4,308,546	82.3	305.9	62%
10/16/2005	3,685,195	80.5	349.9	62%
12/18/2002	4,210,652	75.8	288.3	61%
10/19/2010	3,474,342	74.6	343.7	61%
2/5/2009	3,865,855	73.3	303.6	61%
1/24/2008	4,227,769	72.7	275.5	60%
12/4/2004	3,884,430	72.1	297.1	60%
1/5/2008	3,533,926	70.9	321.2	60%
1/28/2005	3,733,545	69.9	300.1	59%
2/11/2007	3,515,013	69.9	318.7	59%
4/20/2007	3,776,909	68.4	290.1	58%
12/17/2008	3,607,544	66.2	294.0	58%
1/30/2007	3,318,231	66.1	318.9	58%
10/30/2010	3,807,601	65.2	274.2	57%
2/16/2005	3,923,685	64.6	263.8	57%
11/28/2002	3,341,100	63.5	304.6	56%

Date	Inflow (cubic feet)	Zinc		
		Zn Load (lb)	Zn Conc (ug/L)	Zn Load Percentile
2/1/2004	4,141,935	62.9	243.2	56%
12/16/2002	2,948,589	61.9	336.1	56%
9/21/2007	2,945,352	60.1	327.1	55%
11/6/2011	3,030,571	59.4	313.8	55%
1/9/2005	3,150,007	58.0	295.1	54%
2/27/2006	3,135,758	56.8	290.2	54%
1/17/2010	2,930,670	56.1	306.8	54%
5/2/2003	2,832,986	54.8	309.9	53%
5/20/2006	2,839,899	53.7	303.1	53%
2/9/2009	2,870,133	52.9	295.4	53%
12/6/2007	2,755,304	52.3	303.8	52%
2/26/2011	2,837,279	51.8	292.5	52%
3/5/2006	2,962,988	51.7	279.5	51%
2/25/2004	3,135,821	51.4	262.4	51%
2/18/2011	2,862,405	51.3	287.0	51%
11/5/2004	2,572,500	51.0	317.9	50%
4/14/2006	2,869,020	50.4	281.6	50%
2/20/2008	2,828,230	50.3	285.1	49%
4/12/2003	2,841,017	49.9	281.1	49%
12/11/2009	2,795,477	49.8	285.1	49%
10/26/2004	2,854,466	49.5	278.0	48%
1/3/2005	2,497,319	48.8	313.1	48%
1/26/2008	2,182,482	48.8	357.9	47%
12/5/2010	2,400,536	48.3	322.4	47%
2/19/2011	2,294,198	47.6	332.1	47%
11/11/2003	2,572,500	45.6	283.7	46%
4/25/2012	2,308,536	44.3	307.4	46%
1/13/2010	2,066,943	44.0	341.4	46%
5/18/2011	2,306,463	43.9	305.1	45%
1/23/2009	2,053,799	43.5	339.6	45%
12/24/2003	2,251,256	42.0	299.0	44%
1/24/2009	2,374,682	41.3	278.7	44%
11/12/2011	2,174,554	41.3	304.2	44%
3/26/2006	1,911,518	39.3	329.3	43%
2/24/2003	1,885,761	39.1	331.9	43%
2/20/2010	2,015,114	39.0	310.2	42%
3/17/2005	2,023,658	38.6	305.6	42%
9/22/2007	1,823,679	37.5	329.5	42%

Date	Inflow (cubic feet)	Zinc		
		Zn Load (lb)	Zn Conc (ug/L)	Zn Load Percentile
12/25/2006	2,020,322	36.9	292.5	41%
3/13/2003	2,023,658	36.9	292.0	41%
2/10/2005	1,967,186	36.7	299.2	40%
4/26/2012	1,897,335	36.4	307.4	40%
11/7/2002	1,992,933	36.4	292.5	40%
2/22/2007	2,076,926	36.2	279.3	39%
2/17/2004	2,074,455	36.0	277.7	39%
12/3/2004	1,835,372	35.5	309.8	39%
2/15/2012	2,082,349	34.9	268.5	38%
3/25/2011	1,760,492	34.8	316.5	38%
12/23/2003	1,951,005	34.6	284.4	37%
12/27/2006	1,776,634	33.7	304.3	37%
3/24/2011	1,696,950	33.5	316.5	37%
2/13/2009	1,876,970	33.0	281.6	36%
3/26/2012	1,661,845	33.0	317.9	36%
1/3/2011	1,769,701	33.0	298.3	35%
1/26/2010	1,637,395	32.6	318.5	35%
3/2/2011	1,629,468	32.3	317.5	35%
3/1/2006	1,433,024	30.7	342.7	34%
5/17/2011	1,556,834	29.7	305.1	34%
10/20/2010	1,625,021	29.6	291.6	33%
12/5/2007	1,555,742	29.5	303.8	33%
3/1/2004	1,589,905	28.9	291.4	33%
11/3/2003	1,454,949	28.9	317.8	32%
2/17/2006	1,505,022	28.2	299.6	32%
10/16/2004	1,502,745	27.6	293.9	32%
3/27/2006	1,600,858	27.2	272.4	31%
2/9/2010	1,570,402	26.8	273.4	31%
1/13/2006	1,500,212	26.4	281.6	30%
3/31/2012	1,483,027	25.1	270.8	30%
3/30/2006	1,214,504	24.5	323.1	30%
12/20/2002	1,428,401	24.2	270.9	29%
3/22/2005	1,255,348	23.9	305.1	29%
2/21/2008	1,149,453	23.7	330.9	28%
12/22/2008	1,419,467	23.6	266.6	28%
12/8/2006	1,284,662	23.6	293.9	28%
11/8/2010	1,333,938	23.0	276.2	27%
2/10/2003	1,309,194	22.8	279.2	27%

Date	Inflow (cubic feet)	Zinc		
		Zn Load (lb)	Zn Conc (ug/L)	Zn Load Percentile
9/18/2005	999,623	22.1	353.4	26%
5/4/2005	1,047,657	22.0	337.1	26%
2/18/2009	1,143,216	21.7	304.3	26%
5/22/2006	1,241,330	21.6	278.6	25%
4/20/2010	1,001,782	21.0	335.3	25%
3/6/2010	937,382	20.5	350.3	25%
4/27/2005	1,149,309	19.7	275.2	24%
11/29/2002	1,004,502	19.1	304.6	24%
2/7/2009	1,006,627	19.1	303.6	23%
11/23/2010	1,119,060	18.9	270.4	23%
3/20/2006	1,046,843	18.7	286.8	23%
12/19/2002	1,003,535	18.1	288.3	22%
2/16/2011	876,853	18.0	329.1	22%
2/19/2007	923,357	17.1	297.0	21%
2/2/2004	1,090,598	16.6	243.2	21%
11/2/2008	925,436	16.5	284.8	21%
4/11/2010	878,904	16.3	297.2	20%
3/18/2012	807,317	15.5	308.3	20%
2/20/2011	732,343	15.2	333.2	19%
10/4/2010	765,371	14.1	294.5	19%
12/6/2010	695,012	14.0	322.4	19%
10/24/2010	820,995	13.9	271.9	18%
4/11/2003	717,854	13.8	307.8	18%
4/28/2010	620,033	12.3	317.1	18%
10/25/2010	710,814	12.1	271.9	17%
11/6/2004	583,254	11.6	317.9	17%
5/21/2006	608,704	11.5	302.7	16%
12/26/2010	619,485	10.7	277.5	16%
11/12/2003	583,254	10.3	283.7	16%
4/10/2012	519,300	10.3	318.4	15%
3/6/2006	580,888	10.1	279.5	15%
1/2/2005	514,226	10.1	313.1	14%
12/26/2006	490,783	9.0	292.5	14%
2/23/2008	504,525	8.6	273.3	14%
9/20/2007	405,281	8.1	320.8	13%
2/18/2004	446,451	7.7	277.7	13%
10/12/2007	359,673	7.3	326.7	12%
1/14/2006	395,045	6.9	281.6	12%

Date	Inflow (cubic feet)	Zinc		
		Zn Load (lb)	Zn Conc (ug/L)	Zn Load Percentile
3/18/2005	361,558	6.9	305.6	12%
3/14/2003	361,558	6.6	292.0	11%
3/2/2006	284,878	6.1	342.7	11%
4/13/2003	312,847	5.5	280.5	11%
12/9/2006	291,949	5.4	293.9	10%
1/10/2005	269,313	5.0	295.1	10%
3/19/2006	267,300	4.8	286.8	9%
12/13/2009	258,991	4.7	292.5	9%
12/21/2002	262,934	4.4	270.9	9%
3/31/2006	204,339	4.1	323.1	8%
3/3/2011	188,136	3.7	317.5	8%
5/5/2005	151,029	3.2	337.1	7%
11/25/2008	147,231	2.7	289.3	7%
12/10/2009	140,400	2.5	285.1	7%
2/19/2010	110,684	2.1	310.2	6%
9/19/2005	94,694	2.1	353.4	6%
2/15/2011	74,925	1.5	329.1	5%
1/7/2008	86,988	1.5	282.7	5%
1/23/2010	70,452	1.4	318.4	5%
4/27/2010	66,744	1.3	317.1	4%
12/23/2010	61,612	1.3	337.0	4%
10/13/2009	56,889	1.0	271.1	4%
11/24/2010	50,735	0.9	270.4	3%
2/14/2009	16,365	0.3	281.6	3%
4/1/2012	16,953	0.3	270.8	2%
12/14/2008	14,987	0.3	293.5	2%
10/5/2010	3,669	0.1	279.9	2%
2/18/2006	1,934	0.0	299.6	1%
12/6/2004	779	0.0	326.3	1%
12/18/2008	429	0.0	294.0	0%
3/7/2010	248	0.0	350.3	0%