Marina del Rey
Enhanced Watershed Management Program Plan

Prepared For:

Marina del Rey Enhanced Watershed Management Program Agencies

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

June 25, 2015

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Prepared By:

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ABC Laboratories	Aquatic Bioassay and Consulting Laboratories, Inc.
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
AVS	acid volatile sulfide
BMP	best management practice
BSS	City of Los Angeles Bureau of Street Services
Caltrans	California Department of Transportation
CCC	criterion continuous concentration
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIMP	Coordinated Integrated Monitoring Program
CMP	Coordinated Monitoring Plan
CMC	criterion maximum concentration
CNG	compressed natural gas
County	County of Los Angeles
CSM	continuous simulation model
CTR	California Toxics Rule
CWA	Clean Water Act
DDT	dichlorodiphenyltrichloroethane
EMC	event mean concentration
ER-L	effects range low
EWMP	Enhanced Watershed Management Program
EWRI	Environmental and Water Resources Institute
FCG	fish contaminant goal
FHWA	Federal Highway Administration
GIS	Geographic Information System
HSPF	Hydrologic Simulation Program - FORTRAN
LACDBH	Los Angeles County Department of Beaches and Harbors
LACFCD	Los Angeles County Flood Control District
LADPW	Los Angeles County Department of Public Works
LAUSD	Los Angeles Unified School District
LARWQCB	Los Angeles Regional Water Quality Control Board
LAX	Los Angeles International Airport
LCC	life cycle cost
LDCP	City of Los Angeles Department of City Planning
LDL	low detection limit
LFD	low flow diversion
LID	Low Impact Development
LSPC	Loading Simulation Program in C++
MAL	Municipal Action Level
MCM	Minimum Control Measure
MDL	method detection limit
MdR	Marina del Rey
MdRH	Marina del Rey Harbor
MLE	multiple lines of evidence
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
MS4 Permit	Municipal Separate Storm Sewer System Permit
NOI	Notice of Intent

NPDES	National Pollutant Discharge Elimination System
NPV	net present value
O&M	operations and maintenance
OEHHA	Office of Environmental Healy Hazard Assessment
p,p'-DDE	p,p'-dichlorodiphenyldichloroethylene
PCB	polychlorinated biphenyl
PIPP	public information and participation program
POTFW	wash-off potency factor
PVS	Palos Verdes Shelf
RAA	Reasonable Assurance Analysis
RCP	reinforced concrete pipe
ROW	right of way
RV	recreational vehicle
RWL	Receiving Water Limitation
SEM	simultaneously extracted metals
SQO	Sediment Quality Objective
State	State of California
TMDL	Total Maximum Daily Load
TSO	Time Schedule Order
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
WESTON®	Weston Solutions, Inc.
WLA	waste load allocation
WMA	Watershed Management Area
WMMS	Watershed Management Modeling System
WQBEL	water quality based effluent limitations

1.0 INTRODUCTION

The Marina del Rey (MdR) watershed is a small subwatershed located in the larger Santa Monica Bay watershed. The Marina del Rey Harbor (MdRH) was officially opened in 1965 and is the world's largest man-made small craft harbor. The tributary area served by a Municipal Separate Storm Sewer Sysem (MS4) that drains to MdRH is approximately 1,409 acres and consists of portions of the cities of Culver City and Los Angeles, as well as portions of the unincorporated County of Los Angeles (County). The MdR Watershed Management Area (WMA) is one of the smallest WMAs in the County of Los Angeles, but it is also one of the most important and active watersheds.

The MdR watershed has one of the most aggressive Total Maximum Daily Load (TMDL) schedules for both toxics and bacteria and often leads the way in TMDL implementation for the rest of the County.

The extensive ongoing efforts of the County, Los Angeles County Flood Control District (LACFCD), and the cities of Culver City and Los Angeles (collectively known as the MdR Enhanced Watershed Management Program [EWMP] Agencies) to improve water quality in the MdR watershed include implementing best management practices (BMPs) to reduce pollutants from stormwater runoff to the harbor. Over the past 10 years, the responsible agencies in the MdR watershed have spent tens of millions of dollars in special studies, low-flow diversions, non-structural BMPs, structural BMPs, and monitoring efforts. The water quality in the harbor has significantly improved as a result of the cooperative efforts of the MdR EWMP Agencies.

1.1 Enhanced Watershed Management Plan Overview

On December 28, 2012, the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Permit (MS4 Permit) became effective upon adoption by the Los Angeles Regional Water Quality Control Board (LARWQCB). This new MS4 Permit establishes the waste discharge requirement for stormwater and non-stormwater discharges within the watersheds of Los Angeles County. The MS4 Permit includes provisions that allow Permittees to voluntarily choose to implement an EWMP.

The EWMP for the MdR watershed is a collaborative effort of the EWMP Agencies, comprised of the County, LACFCD, and the cities of Los Angeles and Culver City. The MdR EWMP will cover the areas owned by the MS4 Permittees within the watershed (Figure 1-1). The WMA does not include the area adjacent to the Ballona Wetlands owned by the State of California (State) nor does it include the California Department of Transportation (Caltrans) right-of-way (ROW) areas because these agencies are not members of the MdR EWMP Agencies. The WMA also does not include the water areas within the MdR watershed because they are considered non-point sources and are not covered by the MS4 Permit.

Figure 1-1: Marina del Rey Watershed Jurisdictional Boundaries

Development of the MdR EWMP in accordance with the MS4 Permit includes the following elements:

1. Identification of water quality priorities, including an evaluation the of existing water quality conditions, classification of pollutants, assessment of known and suspected pollutant sources in the watershed, and prioritization of water quality issues in the watershed.
2. Characterization of the existing and potential control measures within the watershed.
3. Addressing the approach to incorporate reasonable assurance analysis (RAA) in the optimization of MdR watershed control measures.
4. Development of an EWMP implementation schedule.
5. Public and stakeholder input.
6. Adaptive management framework.
7. Estimation of implementation costs and financial strategy

1.2 MdR Watershed Land Use and Drainage Characteristics

The MdR watershed is bordered by the Santa Monica Bay Watershed to the west and the Ballona Creek watershed to the north and east. The MdRH is open to the Santa Monica Bay through the main channel and shares a common breakwater with Ballona Creek. The MdR watershed consists of four subwatersheds, referred to as Subwatersheds 1 to 4 (Figure 1-2). Table 1-1 summarizes the MdR watershed acreage by subwatershed.

The MdRH is an active harbor for pleasure craft, consisting of the main channel and eight basins (A to H). Basins A, B, C, G, and H are known as the Front Basins. Basins D, E, and F are known as the Back Basins and are located in Subwatershed 1. The MdR Watershed Management Area also includes the Venice Canals and the tributary area to the Ballona Lagoons, which discharge to the MdRH, near the exit to the Santa Monica Bay (Subwatershed 2). The Caltrans ROW areas, which are located mainly within the City of Los Angeles in Subwatersheds 1 and 4, and the portions of the Ballona Wetland (49.3 acres) located on State land in Subwatershed 1 are outside the boundaries of the MdR EWMP MS4 Permit area.

Figure 1-2: MdR Land Use and Subwatersheds

Table 1-1: Summary of Marina del Rey Subwatershed Acreage

Agency	EWMP MS4 Permittee	Sub-watershed 1 (acres) (Harbor)	Sub-watershed 2 (acres) (Ballona Lagoon)	Sub-watershed 3 (acres) (Boone Olive)	Sub-watershed 4 (acres) (Oxford Basin)	EWMP Watershed (acres)	% EWMP Watershed Area
City of Los Angeles	Yes	32.9	278.1	70.5	589.8	971.3	69%
County of Los Angeles	Yes	336.2	46.8	0.0	12.7	395.7	28%
City of Culver City	Yes	0.0	0.0	0.0	42.2	42.2	3%
Los Angeles County Flood Control District	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Area of EWMP Agencies		**369.1**	**324.9**	**70.5**	**644.7**	**1409**	**100%**
Caltrans	No	5.4	0.0	0.0	26.4	31.8	NA
State of California (Ballona Wetland)	No	49.3	0.0	0.0	0.0	49.3	NA
MdRH Watershed Area		**423.8**	**324.9**	**70.5**	**671.1**	**1490**	-

The following land uses are found in the MdR watershed:

- The MdRH land area in Subwatershed 1 (369.1 acres) is almost entirely composed of unincorporated County land and has many small drains that discharge into all the basins. The MdR Small Drain Survey, completed for the Los Angeles County Department of Beaches and Harbors (LACDBH, 2004a), identified approximately 724 small outfalls that discharge directly into MdRH, the majority of which serve the individual parcels and small roads among the basins. The remaining drains are located in the streets surrounding the basins. The City of Los Angeles, Caltrans, and the City of Culver City are not responsible for any outlets that drain directly to the harbor.
- Subwatershed 2 (324.9 acres) does not drain into the MdRH Front or Back Basins, but drains into the Venice Canal and the Ballona Lagoon, which discharge into the MdRH main channel mouth.
- Boone Olive Pump Plant serves Subwatershed 3, a tributary area of 70.5 acres that lies entirely within the boundaries of the City of Los Angeles. The pump station discharges into Basin E.
- Subwatershed 4 lies primarily within the jurisdiction of the Cities of Los Angeles and Culver City and totals approximately 644.7 acres (excluding Caltrans areas). Its corresponding runoff discharges into the Oxford Basin, a man-made flood control basin occupying approximately 10 acres within the County. Situated north of the Back Basins, Oxford Basin is operated by the LACFCD. It drains into Basin E through two tide gates and storm drain piping. The Oxford Retention Basin Multi-Use Enhancement Project is currently underway. Once completed this project will provide multiple benefits through enhanced water circulation, contaminated soil removal, bioswale construction as well as native and drought resistant landscaping. An expected

outcome of the project is a reduction of pollutants discharged to Marina del Rey Harbor Basin E from Oxford Basin.

Table 1-2 presents the land use acreages by subwatershed and Table 1-3 shows the land use acreages by jurisdiction.

Table 1-2: Land Use Acreages by Subwatershed (acres)

Land Use Class	Subwatershed Acreage*								Total (acres)	Percent EWMP Watershed Area
	1		2		3		4			
	acres	% of Subwatershed	acres	% of Subwatershed	acres	% of Subwatershed	acres	% of Subwatershed		
Single-Family Residential	1.8	0.5%	45.8	14.1%	22.9	32.5%	167.2	25.9%	237.7	16.9%
Multi-Family Residential	149.9	40.6%	131.8	40.6%	21.1	29.9%	96.8	15.0%	386.3	27.4%
Institutional/Public Facilities	8	2.2%	10.1	3.1%	2.6	3.7%	67.2	10.4%	87.9	6.2%
Commercial and Services	107.2	29.0%	22.8	7.0%	1.6	2.3%	123.7	19.2%	268.6	19.1%
Industrial/Mixed with Industrial	0.2	0.1%	0.2	0.1%	0.3	0.4%	27	4.2%	27.7	2.0%
Transportation/Road ROW	38.2	10.3%	83.3	25.6%	22	31.2%	153.8	23.9%	297.3	21.1%
Developed Recreation/Marina Parking	41.6	11.3%	0.7	0.2%	0	0.0%	1.9	0.3%	44.2	3.1%
Beach	8.2	2.2%	0	0.0%	0	0.0%	0	0.0%	8.2	0.6%
Water**	6.4	1.7%	30.3	9.3%	0	0.0%	7.1	1.1%	43.8	3.1%
Vacant	7.6	2.1%	0	0.0%	0	0.0%	0	0.0%	7.6	0.5%
Total	**369.1**	**100%**	**325**	**100%**	**70.5**	**100%**	**644.7**	**100%**	**1409**	**100%**

*Acreage excludes Caltrans and State owned land (Ballona Wetland) not in EWMP Area

**Marina Boat Area and MdRH Water not included in "Water" class acreage provided here. Water class includes Ballona Lagoon (14.4 acres), Venice Canals (15.9acres), Oxford Basin (7.1 acres), and Ballona Shoreline and other water (6.4 acres)

Table 1-3: Land Use Acreages by EWMP Agency Jurisdiction

Land Use Class	EWMP Agencies Jurisdictional Areas (Acres)*			
	City of Culver City	City of Los Angeles	County of Los Angeles	Total
Single-Family Residential	6.8	230.6	0.3	237.7
Multi-Family Residential	0	229.4	170.2	399.6
Institutional/Public Facilities	0	83.7	4.2	87.9
Commercial and Services	24.3	122.3	108.7	255.3
Industrial/Mixed with Industrial	0	27.7	0	27.7
Transportation/Road ROW	11.1	246.4	39.8	297.3
Developed Recreation/Marina Parking	0	0.9	43.3	44.2
Beach	0	0	8.2	8.2
Water**	0	30.3	13.5	43.8
Vacant	0	0	7.6	7.6
Total	42.2	971.3	395.7	1409

*Acreage excludes Caltrans and State-owned land (Ballona Wetland) not in EWMP Area.

**Marina Boat Area and MdRH Water not included in "Water" class acreage provided here. Water class includes Ballona Lagoon (14.4 acres), Venice Canals (15.9acres), Oxford Basin (7.1 acres), and Ballona Shoreline and other water (6.4 acres)

2.0 LEGAL AUTHORITY

Section VI.A.2.b of the MS4 Permit requires each of the EWMP agencies to provide documentation that they have the necessary legal authority to implement the provisions of the Permit. EWMP agencies must also provide documentation that they have the legal authority to implement the control measures identified in the EWMP (Permit Section VI.C.5.b.iv.6). This documentation is included in Appendix D.

3.0 REGULATORY BACKGROUND

3.1 Section 303(d) List 2010

The federal Clean Water Act (CWA), Section §303(d), requires states to identify waters that do not meet applicable water quality standards despite the treatment of point sources by the minimum required levels of pollution control technology. States are required not only to identify these "water quality limited segments" but also to prioritize such waters for the purpose of developing TMDLs. A TMDL is defined as the "sum of the individual waste load allocations (WLAs) for point sources and load allocations for nonpoint sources and natural background" (40 Code of Federal Regulations [CFR] 130.2), such that the capacity of the waterbody to assimilate constituent loads (the loading capacity) is not exceeded. A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis (U.S. Environmental Protection Agency [USEPA], 2000).

The §303(d) list, which was last updated in 2010 identified a number of constituents of concern for the MdRH Back Basins and Marina Beach (Table 3-1). Marina Beach is also commonly known as Mother's Beach.

Table 3-1: Summary of Section 303(d) Listings

Water Body	Constituent	Final Listing Decision
Marina del Rey Harbor - Back Basins	Chlordane (tissue and sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Copper (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	DDT* (tissue)	Do Not Delist from §303(d) list (TMDL required list)
	Dieldrin* (tissue)	Do Not Delist from §303(d) list (TMDL required list)
	Fish Consumption Advisory	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Indicator bacteria	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Lead (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	PCBs (tissue and sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Sediment toxicity	Do Not Delist from §303(d) list (being addressed with USEPA-approved TMDL)
	Zinc (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
Marina del Rey Harbor Marina Beach	Indicator bacteria	List on §303(d) list (being addressed by USEPA-approved TMDL)

*USEPA-approved TMDL has made a finding of non-impairment for this constituent.
DDT - dichlorodiphenyltrichloroethane

3.2 Existing TMDLs Summary

The Marina del Rey watershed is subject to three TMDLs; the Santa Monica Bay Nearshore Debris TMDL (Debris TMDL), the Marina del Rey Harbor Mother's Beach and Back Basin Bacteria TMDL (Bacteria TMDL), and the Toxic Pollutants in Marina del Rey Harbor TMDL (Toxics TMDL). Each of these TMDLs are briefly summarized below. A fourth TMDL, the Santa Monica Bay DDTs and PCBs TMDL was established by the EPA and provides general implementation guidelines to calculate load allocations through applicable permits and TMDLs for the various watersheds in the Santa Monica Bay. For the MdR watershed, these loads were defined as part of the MdR Toxics TMDL, therefore, the targeted milestones and schedule approved in the Toxics TMDL will be followed, when applicable, for the total PCBs and total DDTs for the MdR watershed.

The compliance schedules for the applicable TMDLs are presented in Table 3-2.

Table 3-2: TMDL Compliance Schedules

TMDL	Matrix	Parameters	Goal	Compliance Date
Marina del Rey Harbor Toxic Pollutants TMDL	Harbor water	Dissolved Copper (from boats)	Meet LAs	3/22/2024
	Harbor sediments (Back Basins)	Copper, lead, zinc, chlordane, PCBs, DDTs, p'p-DDE	Interim Sediment Allocations	3/22/2016
			Final Compliance	3/22/2018
	Harbor sediments (Front Basins)		Interim Sediment Allocations	3/22/2019
			Final Compliance	3/22/2021
Marina del Rey Mother's Beach and Back Basins Bacteria TMDL	Harbor water	Total coliform, fecal coliform, *Enterococcus*	Interim time frame for compliance with allowable exceedance days for summer and winter dry weather	12/28/2017**
			Original final and TSO final dates for compliance with allowable exceedance days for summer and winter dry weather	12/28/2017**
			Compliance with allowable exceedance days for wet weather and geometric mean targets	7/15/2021
Santa Monica Bay Nearshore and Offshore Debris TMDL	Trash		20% reduction	3/20/2016
			40% reduction	3/20/2017
			60% reduction	3/20/2018
			80% reduction	3/20/2019
			100% reduction	3/20/2020

PCB – polychlorinated biphenyls
p,p'-DDE – p,p'-dichlorodiphenyldichloroethylene
**Deadline or time frame identified in Bacteria TDML Time Schedule Order No. R4-2014-0142

3.2.1 Santa Monica Bay Nearshore Debris TMDL

The Debris TMDL was adopted by the LARWQCB on November 4, 2010 (Resolution No. R10-010 and became effective upon adoption by the USEPA on March 20, 2012. Responsible agencies identified for the Debris TMDL include, among others, the County, the City of Culver City, and the City of Los Angeles. The Debris TMDL established numeric targets and waste load allocations of zero discharge of trash and plastic pellets to waterbodies within the Santa Monica Bay WMA, which includes MdRH. The trash WLA applicable to the MS4 Permittees shall be complied with through the Ballona Creek Trash TMDL (Resolution No. R08-007).

3.2.2 Bacteria TMDL

The Bacteria TMDL was originally adopted by the LARWCQB on August 7, 2003 (Resolution No. 2003-012) and became effective on March 18, 2004 upon approval by the USEPA. The Bacteria TMDL was revised by the LARWQCB on June 7, 2012 (Resolution No. R12-007) and a Time Schedule Order (TSO) was approved on July 10, 2014 (TSO No. R4-2014-0142). The responsible agencies identified for the Bacteria TMDL include the County, LACFCD, City of Los Angeles, the City of Culver City, and Caltrans.

The Bacteria TMDL established numeric bacterial compliance targets based on the acceptable health risk for marine recreational waters as defined by the USEPA. The numeric targets are expressed as both single sample limits and rolling geometric means (Table 3-3).

Table 3-3: Bacteria TMDL Numeric Targets

Indicator	Rolling 30-Day Geometric Mean Limit*	Single Sample Limit
Total coliform	1,000 MPN/100 mL	1,000 MPN/100 mL if fecal > 10% of total, or 10,000 MPN/100 mL**
Fecal coliform	200 MPN/100 mL	400 MPN/100 mL
Enterococcus	35 MPN/100 mL	104 MPN/100 mL

*The geometric mean is calculated weekly as a rolling geometric mean using 5 or more samples, for 6-week periods starting all calculation weeks on Sunday.
** Total coliform single sample limit of 10,000 most probable number (MPN) decreases to 1,000 when the fecal coliform value is greater than 10% of total coliform value.

The TMDL WLAs are expressed as allowable exceedance days, or the number of days on which sampling results can surpass the numeric targets and WLAs. For single sample targets, allowable exceedance days are specified by three defined seasons (summer dry, winter dry, and wet weather) and vary by monitoring site. Each season has its own compliance dates (interim and final), requirements, and limits, as presented in Table 3-4.

Table 3-4: Bacteria TMDL Compliance Seasons

Compliance Season	Summer Dry Weather April 1 – October 31		Winter Dry November 1- March 31		Wet Weather Rain Event*	Geometric Mean Year Round
Deadline	December 28, 2017**		December 28, 2017**		July 15, 2021	
Compliance Monitoring Location	Allowable Exceedance Days/Year					
	TSO Interim Compliance	Final Compliance	TSO Interim Compliance	Final Compliance	Final Compliance	Final Compliance
MdRH-1	22	0	60	9	17	0
MdRH-2	11	0	19	2	3	0
MdRH-3	12	0	12	2	3	0
MdRH-4 (S)	3	0	5	2	3	0
MdRH-4 (D)	2	0	3	2	3	0
MdRH-5	5	0	3	2	3	0
MdRH-6 (S)	3	0	5	2	3	0
MdRH-6 (D)	4	0	4	2	3	0
MdRH-7	4	0	5	2	3	0
MdRH-8 (S)	1	0	2	2	3	0
MdRH-8 (D)	2	0	2	2	3	0
MdRH-9 (S)	1	0	2	2	1	0
MdRH-9 (D)	0	0	2	2	1	0

MdRH-1 is sampled Monday-Friday while MdRH-2 is sampled Monday and Saturday. All other locations are sampled weekly on Mondays.

*Rain event ≥ 0.1 inches at LAX rain gauge, and 3 days following the end of the rain event.

** Deadline identified in Bacteria TDML Time Schedule Order No. R4-2014-0142

3.2.3 Toxics TMDL Summary

The Toxics TMDL was adopted by the Regional Board on October 6, 2005 (Resolution No. 2005-012), and was approved by USEPA and became effective on March 22, 2006. The responsible agencies identified for the Toxics TMDL include the County, LACFCD, City of Los Angeles, City of Culver City, and Caltrans. The Toxics TMDL originally addressed certain metals and organics in the Back Basins of MdRH (Basins D, E, and F) but was amended in 2014 to include the Front Basins of MdRH (Basins A, B, C, G, and H). Interim and Final compliance milestones are provided in the TMDL, and the compliance schedule is included in Table 3-2.

The constituents addressed by the Toxics TMDL are copper, lead, zinc, chlordane, total polychlorinated biphenyls (PCBs), p,p’-dichlorodiphenyldichloroethylene (p,p’-DDE), and total dichlorodiphenyltrichloroethanes (DDTs). Under the MS4 Permit, compliance with the sediment WLAs for copper, lead, zinc, chlordane, p’p-DDE and total DDT may be demonstrated via any one of three different means: (a) qualitative sediment condition of unimpacted or likely unimpacted via the interpretation and integration of multiple lines of evidence is met (b) sediment numeric targets are met in bed sediments, or *(c) final sediment WLAs are met*.

This EWMP focuses on demonstrating that compliance may be achieved through meeting final sediment WLAs for the contaminants in the MdR Toxics TMDL through the implementation of structural and non-structural control measures. However, compliance based on implementation of control measures is one part of a three-pronged compliance strategy. Special studies carried out in support of TMDL implementation will be used to update compliance strategies. A Stressor ID Study is required under the Toxics TMDL and is planned to be conducted in the MdR Harbor in the year 2016. This study will identify stressors causing toxicity to biological organisms in the harbor. Results from this study, and others, may impact compliance strategies and BMPs specified in this EWMP. Special studies related to dissolved copper are also planned in the Harbor, as well as a bacteria source identification study. Outcomes of the special studies, Permit-required and TMDL-required monitoring will be assessed as part of the Adaptive Management Process and the EWMP will be adapted, if necessary, to enable compliance through the most efficient means possible. Figure 3-1 illustrates this multi-pronged compliance strategy.

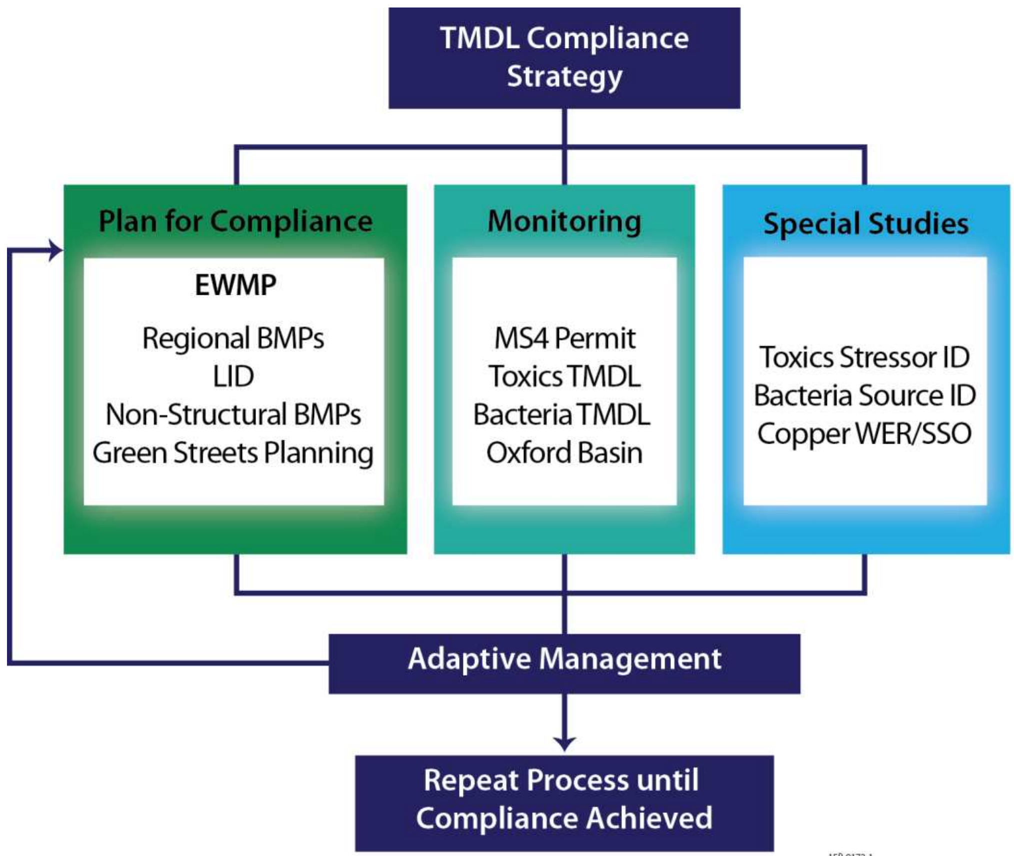


Figure 3-1: TMDL Compliance Strategy

3.2.3.1 Sediment Numeric Targets

The Toxics TMDL established sediment numeric targets using the effects range low (ER-L) (Long et al., 1995) guidelines for copper, lead, zinc, chlordane, total DDTs, and p,p’-DDE. The sediment numeric target for total PCBs in sediments was selected to protect human health from consumption of contaminated fish (Table 3-5).

Table 3-5: Toxics TMDL Sediment Numeric Targets

Constituent	Numeric Target for Sediment
Chlordane	0.5 µg/kg
Total PCBs	3.2 µg/kg
Total DDTs	1.58 µg/kg
p-p'-DDE	2.2 µg/kg
Copper	34 mg/kg
Lead	46.7 mg/kg
Zinc	150 mg/kg

3.2.3.2 Water Column Numeric Targets

The Toxics TMDL established a final numeric target for PCBs in the water column using the California Toxics Rule (CTR) criterion for the protection of human health from the consumption of aquatic organisms. A numeric target for dissolved copper in the water column was also established based on the CTR Criterion Maximum Concentration (CMC) and Criterion Continuous Concentration (CCC) (Table 3-6). The MS4 Permittees are not subject to this criteria.

Table 3-6: Toxics TMDL Water Column Numeric Targets

TMDL Phase	Numeric Target (µg/L)
Total PCBs	0.00017*
Dissolved copper	Acute – 4.8/Chronic – 3.1

*Receiving water quality samples shall be collected monthly and analyzed for total PCBs at detection limits that are at or below the minimum levels. The minimum levels are those published by the State Water Resources Control Board in Appendix 4 of the Policy for the Implementation of Toxic Standards for Inland Surface Water, Enclosed Bays, and Estuaries of California, March 2, 2000. Special emphasis should be placed on achieving detection limits that will allow evaluation relative to the CTR standards.

3.2.3.3 Fish Tissue Numeric Targets

The Toxics TMDL fish tissue numeric target of 3.6 µg/kg for total PCBs is the Office of Environmental Health Hazard Assessment (OEHHA) Fish Contaminant Goal (FCG).

3.2.3.4 Sediment Waste Load Allocations

Loading capacity was estimated based on the annual average total suspended solids (TSS) loads into MdRH under the assumption that the finer sediments transport the majority of constituents. The Toxics TMDL for sediment was calculated based on the estimated loading capacity and the numeric sediments targets (Table 3-7).

Table 3-7: Toxics TMDL Numeric Targets and Loading Capacity

Metals	Numeric Target (Load Allocation) ER-L(mg/kg)	TMDL Loading Capacity(kg/year)
Copper	34	2.88
Lead	46.7	3.95
Zinc	150	12.69
Organics	**ER-L (µg/kg)**	**TMDL (g/year)**
Chlordane	0.5	0.04
PCBs	22.7	1.92
Total DDTs	1.58	0.13
p-p'-DDE	2.2	0.19

3.2.3.5 Water Column Load Allocations

The load allocation for dissolved copper from boats is a reduction of 85% from the baseline copper load from boats of 3,609 kg/year. The MS4 Permittees are not subject to this criteria and this load reduction is not included in the EWMP.

3.2.3.6 Stormwater Waste Load Allocations

WLAs for stormwater are also included in the Toxics TMDL for each of the MS4 Permittees (Table 3-8).

Table 3-8: Toxics TMDL Stormwater Waste Load Allocations

Permittees	Copper (kg/year)	Lead (kg/year)	Zinc (kg/year)	Chlordane (g/year)	Total PCBs (g/year)	Total DDT (g/year)	p'p-DDE (g/year)
MS4	2.26	3.10	9.96	0.0332	1.51	0.10	0.15
Caltrans	0.036	0.05	0.16	0.0005	0.024	0.0017	0.0024
General construction	0.23	0.32	1.02	0.0034	0.16	0.011	0.015
General industrial	0.012	0.016	0.053	0.0002	0.008	0.0006	0.0008
Total	**2.54**	**3.49**	**11.2**	**0.04**	**1.70**	**0.12**	**0.16**

4.0 IDENTIFICATION OF WATER QUALITY PRIORITIZATION

4.1 Approach to Data Compilation and Analysis

In accordance with the MS4 Permit, existing water quality conditions were characterized using data from relevant studies and monitoring completed within the past 10 years. The EWMP Agencies have conducted extensive monitoring in the harbor Table 4-1 provides a summary of the data and studies used in the evaluation. Additional information and detailed data analysis are presented in the Marina del Rey EWMP Work Plan (Appendix F).

Table 4-1: Summary of Data and Studies Used in the Evaluation

Report	Parameters	Stormwater / MS4	Harbor Water	Sediment	Sediment Cores	Fish Tissue
Toxics TMDL Monitoring (2010-2013)	Organics	x	-	x	-	x
	Metals	x	x	x	-	-
	Conventional	x	-	x	-	-
	Toxicity	-	-	x	-	-
Storm-Borne Sediment Monitoring (2011)	Organics	x	-	-	-	-
	Metals	x	-	-	-	-
	Conventional	x	-	-	-	-
Special Study – Low Detection Limits (2011)	Organics	x	-	x	-	-
Special Study - Partitioning Coefficient (2011)	Organics	x	-	x	-	-
	Metals	x	x	x	-	-
	Conventional	x	x	x	-	-
MdRH Annual Reports (2002-2007)	Organics	-	-	x	-	-
	Metals	-	-	x	-	-
	Conventional	-	x	-	-	-
	Bacteria	-	x	-	-	-
MdRH Sediment Characterization Study (2008)	Organics	-	-	x	x	-
	Metals	-	-	x	x	-
	Conventional	-	x	x	-	-
	Toxicity	-	-	x	-	-
Oxford Basin Study (2010)	Organics	-	x	x	x	-
	Metals	-	x	x	x	-
	Conventional	-	x	x	x	-
	Bacteria	-	x	x	-	-
Bight '03 (2003)	Organics	-	-	x	-	-
	Metals	-	-	x	-	-
	Conventional	-	-	x	-	-
	Toxicity	-	-	x	-	-
Bight '08 (2008)	Organics	-	-	x	-	-
	Metals	-	-	x	-	-
	Conventional	-	-	x	-	-
	Toxicity	-	-	x	-	-
Bacteria TMDL Monitoring (2007-2013)	Bacteria	-	x	-	-	-
Nonpoint Source Bacteria Study (2006)	Bacteria	x	x	x	-	-

4.2 Summary of Findings

The Marina del Rey EWMP Work Plan (Appendix F) contains detailed findings of the data compilation and analysis. The following section summarizes the findings by matrix. Findings summarized by constituent may be found in the Work Plan.

4.2.1 Stormwater

Stormwater monitoring was conducted as part of the Toxics TMDL coordinated monitoring plan at five stations (Figure 4-1). A total of 23 storms were monitored in accordance with the Toxics TMDL Coordinated Monitoring Plan (CMP) during the 3-year period (2010 to 2013). Two special studies and one pilot study were also conducted; the Low Detection Limit (LDL) Special Study (Brown & Caldwell 2011a); the Partitioning Coefficient Special Study (Brown & Caldwell 2011b); and the Storm-borne Sediment pilot study (Brown & Caldwell 2013).

Because the Toxics TMDL targets for stormwater are sediment based, it is not feasible to make an assessment of water quality exceedances based on water column data. For this report, the data were compared to the CTR water column criteria to provide a general sense of the water quality conditions in the stormwater to help guide the prioritization of water quality issues. Key findings include the following:

- Dissolved copper and dissolved zinc frequently exceeded the CTR CMC in Toxics TMDL monitoring, whereas dissolved lead rarely exceeded the CTR CMC (one sample exceeded at CTR CMC at MdR-C-2 on 3/8/2013).
- Partitioning Coefficient Study results for copper in stormwater showed that concentrations were above background levels and may be contributing to copper in the MdRH.
- Chlordane was not detected in any of the Toxics TMDL monitoring samples above the Method Detection Limit (MDL). The MDLs were below the CTR CMC for acute toxicity for freshwater (2.4 µg/L). The LDL Special Study results for chlordane in stormwater achieved lower MDLs. The low MDL results confirmed that chlordane levels were below the applicable criterion.
- Total PCBs were not detected above the MDL for the first two monitoring years of Toxics TMDL monitoring. During the third year of monitoring total PCBs were detected during two events at all stations. The field trip blank also had total PCB results above the MDL for each of those events.
- LDL Special Study results for total PCBs achieved lower MDLs. The results showed that all samples exceeded the harbor water numeric target of 0.00017 µg/L by a factor of at least 12.

Figure 4-1: Toxics and Bacteria TMDL Monitoring Locations

4.2.2 Harbor Water

Water quality samples have been collected in MdRH for more than 25 years as part of the Annual Report Monitoring for MdRH (Aquatic Bioassay & Consulting Laboratories, Inc. [ABC Laboratories] 2001 to 2008). Samples were analyzed for indicator bacteria and physical parameters (e.g., temperature, salinity, dissolved oxygen). A bacteria non-point source special study was conducted in 2006 (Weston Solutions, Inc. [WESTON], 2007) and monitoring under the Bacteria TMDL began in 2007, with more frequent sampling and observational data collection. In 2010, copper, lead, zinc, total PCBs, and chlordane were added to the list of constituents and monitored monthly as part of the Toxics TMDL CMP.

Dissolved copper concentrations in the water column exceeded the Toxics TMDL numeric target (4.8 µg/L) at all stations during all years, with the exception of MdRH-F-4 and MdRH-F-5 in 2011. Concentrations were comparable within the Front and Back Basins, particularly between stations MdRH-B-1, MdRH-B-2, MdRH-F-1, and MdRH-F-2 (Basin D, Basin E, Basin A, and Basin B, respectively). The Partitioning Coefficient Special Study collected samples at the same stations as the Toxics TMDL monitoring at surface, mid-depth, and at-depth (Brown and Caldwell, 2011). The results showed that copper concentrations were higher near the surface and lowest at the deepest sample depths.

There were no exceedances of the Toxics TMDL water column PCB numeric target for the Toxics TMDL monitoring. However, as part of the LDL Special Study, lower MDLs were achieved. It was determined that all samples collected as part of the LDL study exceeded the final Toxics TMDL numeric target of 0.00017 µg/L by at least a factor of 12. The highest concentrations were observed in Basin F.

Chlordane results exceeded the saltwater CTR CMC for one sample, MdRH-B-1 in October 2011. Chlordane was also analyzed as part of the LDL Special Study, and lower MDLs were achieved (0.028 ng/L). Only one result was above the CTR for Human Health; however, the trip blank associated with the sample also had detection greater than the CTR for Human Health. These results are therefore qualified because of the results of the field blank analysis.

Bacteria TMDL monitoring began in 2007 with monitoring of nine compliance stations and five ambient stations. In 2009 monitoring at the ambient stations was discontinued due to the low bacteria concentrations observed during the first two years of monitoring. The Bacteria TMDL requires daily or weekly monitoring at the nine compliance stations within the MdRH, along with samples collected at depth at four stations. Historical bacteria data are also available from monitoring conducted prior to 2007 as part of the MdRH Annual Monitoring conducted by the LACDBH. A Non-Point Source Study was conducted in 2006 to assess the potential sources of bacteria from within the MdRH. The findings of the study showed that birds were a likely source of bacteria to the MdRH.

The Bacteria TMDL is split into three seasons: summer dry, winter dry, and wet weather. Data were analyzed and presented for each season. The highest proportion of exceedance days from the Bacteria TMDL monitoring during dry weather occurred at stations MdRH-5 and MdRH-7. Historically, the greatest proportion of exceedance days during the summer dry season occurred at MdRH-5 and MdRH-6 (MdRH-7 was not monitored prior to 2007). During winter dry weather, the highest proportion of exceedance days occurs at stations MdRH-1, MdRH-2, and MdRH-3, which are different stations from those with the most often exceedances during the summer dry season. .

Observational data are collected as part of the Bacteria TMDL monitoring. These data were assessed for patterns relating to the observed indicator bacteria concentrations. A slight correlation was observed between the animal and/or bird observation data and indicator bacteria results, with slightly higher concentrations of indicator bacteria occurring when the number of birds and/or animals observed was higher.

4.2.3 Sediment

Annual sediment monitoring and chemical testing has been conducted by the LACDBH for more than 25 years at 20 monitoring stations within the MdRH. In addition to the annual monitoring program, which ended in 2007; Bight ‘03, Bight ‘08, Bight ’13, the Oxford Basin Special Study (2010), the MdRH Sediment Characterization Study (2008), the Toxics TMDL Monitoring (2010-present), and two special studies (Brown and Caldwell 2011a, 2011b) have been conducted.

In addition to the chemistry monitoring that has been conducted, toxicity testing and benthic infauna identification have also been conducted as part of Bight ‘03, Bight ‘08, the MdRH Sediment Characterization Study (2008), and Toxics TMDL Monitoring (2010 to present). It is important to assess the chemistry along with the toxicity and biological data to gain a broader understanding of the impacts of chemistry results in the environment.

During Bight ’08, acid-volatile sulfide (AVS) and simultaneously extracted metals (SEM) analyses were conducted, as well as analysis of total organic carbon. These additional chemistry parameters allowed an assessment of the bioavailability of metals in the samples. The bioavailability analysis of the results showed that although these divalent metals occur at high concentrations within the MdRH, they are not likely bioavailable because of the high levels of sulfides and carbon also present in the sediments.

Toxicity results for the Bight ’08 support the AVS:SEM analyses, which indicated non-toxic levels at three of the five stations, low toxicity at one of the five stations, and moderate toxicity at one station. The Toxics TMDL monitoring toxicity results were also low for *E. estuarius* and *M. galloprovincialis;* however, *L. plumulosus* chronic testing showed toxicity to the sediments. The causes of the toxicity are not clear, although they do not appear to be due to metals.

A spatial assessment was completed using all available data for metals (WESTON, 2014a). Based on this assessment, metals concentrations within the MdRH were determined to be higher in the basins and main channel adjacent to the basins. Copper concentrations in MdRH were highest in the Back Basins along the back of Basin G and in the middle portion of Basin B. Lead concentrations were highest in Basin B, the main channel toward the harbor entrance, and in some samples collected near the entrance to the MdRH. Zinc concentrations followed a similar spatial pattern when compared to the copper concentrations, with the highest concentrations in Basin E, the back of Basin D, and Basin B.

Total PCBs (Aroclors and congeners separately), DDTs, and p,p’-DDE were also assessed for spatial patterns within the MdRH. Bight monitoring data, along with the 2008 Sediment Characterization data, used a sum of PCB congeners to calculate total PCBs. The Toxics TMDL monitoring uses a sum of Aroclors to calculate total PCBs. These two methods are not directly comparable; in fact, the total PCB results can be quite different. Therefore, the results were considered separately. The concentrations of Aroclor total PCBs were highest in Basin C and Basin E; however, samples exceeded the TMDL numeric target throughout the MdRH. Congener total PCB concentrations were highest in the main channel between Basins D and F, in Basin E, and at the back of Basin C. Some higher concentrations were also detected near the mouth of the harbor in the main channel; however, several samples near the mouth of the MdRH were below the TMDL numeric target, so the sediments are likely heterogeneous.

The highest single results for total DDTs were from the main channel near the mouth of the harbor and Basin E. Results were also high throughout the main channel and into Basins F and G. The p,p'-DDE results follow a pattern similar to that observed for total DDTs. The highest concentrations were in Basin E, Basin G, and near the mouth of MdRH.

4.3 Waterbody – Pollutant Classification

In accordance with the MS4 Permit, Section VI.C.5.a, water-body pollutant combinations were classified into one of the following three categories (Table 4-2):

1. Category 1 (Highest Priority) – Pollutants with receiving water limitations or water-quality-based effluent limits (WQBEL) as established in Part V1.E and Attachments L through R of the MS4 Permit.
2. Category 2 (High Priority) – Pollutants in the receiving water that are listed as §303(d) and for which MS4 discharges may be causing or contributing to the impairment.
3. Category 3 (Medium Priority) – Pollutants with insufficient data to list as §303(d) but which exceed receiving water limitations contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance.

4.3.1 MdR WMA Pollutant Classification

Category 1 (highest priority) pollutants are defined by the MS4 Permit as those constituents that have been addressed with receiving water limitations or WQBELs established through a TMDL. The Toxics TMDL, as described in Section 0, establishes waste load allocations for chlordane, total PCBs, total DDTs, p-p'-DDE, copper, lead and zinc. In addition, the TMDL establishes numeric targets for dissolved copper and total PCBs in the water column in MdRH. As a result of the establishment of the TMDL for these constituents, they are classified in accordance with the MS4 Permit as Category 1 pollutants for MdRH (Table 4-2).

The Bacteria TMDL as described in Section 3.2.2 established numeric bacterial compliance targets for fecal coliform, *Enterococcus*, and total coliform in MdRH. As a result of the TMDL, these constituents are classified in accordance with the MS4 Permit as Category 1 pollutants for MdR (Table 4-2).

Table 4-2: Waterbody – Pollutant Classification

Waterbody	Pollutant	Classification
Marina del Rey Harbor	Dissolved Copper	Category 1
	Copper	Category 1
	Lead	Category 1
	Zinc	Category 1
	Total PCBs	Category 1
	Total DDTs	Category 1
	p,p'-DDE	Category 1
	Chlordane	Category 1
	Fecal coliform	Category 1
	Enterococcus	Category 1
	Total coliform	Category 1
Ballona Lagoon/Venice Canal	None known	None

Category 2 constituents are defined in the MS4 Permit as pollutants in the receiving water that are listed as §303(d) and for which MS4 discharges may be causing or contributing to the impairment. Dieldrin is the only §303(d) listed constituent for MdRH that has not already been addressed by a TMDL (Table 3-1), however, the USEPA made a finding of non-impairment for this constituent so it will not be considered a Category 2 pollutant.

Category 3 constituents are those pollutants with insufficient data to list as §303(d) but which exceed receiving water limitations contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance. The data evaluation did not result in any constituents being classified as a Category 3 constituent.

The categorizing of constituents is intended for use in guiding the implementation schedule and priority BMPs for the EWMP. If additional data becomes available to indicate additional constituents should be added to the priority list, or if updates are made to the §303(d) list by the SWRCB, the categorization and prioritization may be updated.

The Ballona Lagoon is the only waterbody other than MdRH that falls within the MdR WMA. However, there are no available data concerning the receiving water or discharges to the receiving water.

4.4 Pollutant Source Assessment

After characterizing water quality conditions in the watershed and classifying water body-pollutant combinations into the three Permit defined categories, a pollutant source assessment was carried out to identify potential sources of pollutants in the three categories. Details of this source assessment are found in Appendix F and are summarized below.

4.4.1 Metals

The results of most sediment studies conducted in the MdRH found copper and zinc concentrations to be highest in the Back Basins. Lead concentrations were highest in the main channel. The sources of these metal were generally identified as maritime activities (e.g., hull leachate), discharge from storm drains into the receiving water, and atmospheric deposition.

The Oxford Retention Basin Sediment and Water Quality Characterization Study (WESTON, 2010a) provided insights into the potential for the Oxford Basin to act as a reservoir and potential source for contaminated sediments entering Basin E. The results of the study indicated low concentrations of metals, except chromium and lead, suggesting that re-suspension of sediments in Oxford Basin is not likely to be a source of metals in Basin E.

4.4.2 Fecal Indicator Bacteria

Water quality has been comprehensively assessed throughout the MdRH as special studies and as part of continuous monitoring programs. As a result of these studies, a number of constituent sources have been identified.

Assessments of bacterial contributions to Basin E were consistent among the majority of projects, with the Oxford Basin and Boone Olive Pump Station identified as a source of bacterial loads during wet weather. The most recent study did not indicate that the Oxford Basin was a predominant contributor to bacteria concentrations in Basin E during dry-weather flows (the Oxford Retention Basin Sediment and Water Quality Characterization Study [WESTON, 2010a]). This study was undertaken after the installation of a dry-weather diversion which redirects dry weather flows entering Oxford Basin and diverts them to the sanitary sewer.

In the bacterial source identification study (WESTON, 2007), birds were identified as a key contributor throughout MdRH and management actions targeting this source were recommended (Figure 4-2). Anthropogenic sources and transport mechanisms included boat-related maintenance activities, trash and food waste, washing activities (restaurants, restrooms, parking areas, and buildings), landscaping, and the MS4. Another key factor in the presence of bacteria within MDRH is the limited flow through the marina waters. This lack of circulation increases the potential for bacterial reservoirs to be found in locations such as pier supports and boat hulls. These locations are also prone to limited ultraviolet (UV) penetration and subsequently allow increased microbial longevity.

Bacterial concentrations in sediments were found to be very low in all studies, suggesting that marina sediments do not act as a significant reservoir of fecal indicator bacteria.

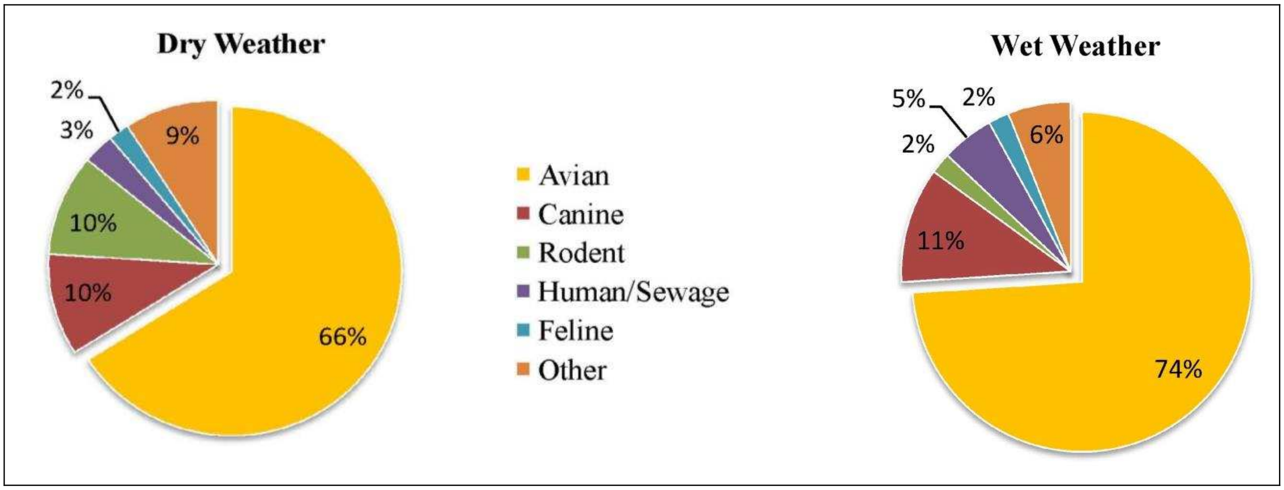


Figure 4-2: Ribotyping Results for Wet Weather and Dry Weather (WESTON, 2007)

4.4.3 Chlordane, PCBs, and DDTs

The pesticide chlordane was widely used for food crops and lawn care until 1978 when use was limited to termite control. In 1988 chlordane use was banned in the United States. Assessment of sediment in MdRH found concentrations of chlordane to be highest in the main channel, near the mouth of the harbor.

Before DDT was banned in 1972, large DDT releases occurred during agriculture or vector control applications. Emissions could also have resulted during production, transport, and disposal. DDT was released to surface waters for vector control or as a result of dry and wet deposition from the atmosphere or direct gas transfer. DDTs can be released to the soil during spraying operations from direct or indirect releases during manufacturing, formulation, storage, or disposal. Another potential source of DDT contamination in sediment is the Palos Verdes Shelf (PVS), because contaminated sediment near an outfall can act as a source of contamination to a distant part of a water-body. Fish exposed to the PVS sediments may bioaccumulate PCBs and DDTs, and when captured in the MdRH, have high levels of these pollutants even though this exposure may not have occurred in the MdRH. DDT and its metabolites may be transported from one medium to another by the processes of solubilization, adsorption, remobilization, bioaccumulation, and volatilization. It can also be transported by currents, winds, and diffusion.

From 1947 to 1983, Montrose Chemical Corporation manufactured DDT at its plant near Torrance, CA. The plant discharged wastewater containing the now-banned pesticide into Los Angeles sewers that emptied into the Pacific Ocean off White Point on the PVS. The DDT manufacturing process also resulted in groundwater and surface soil contamination on and near the Montrose plant property. It is estimated that more than 800 to 1,000 tons of DDT were discharged between the late 1950s and the early 1970s. Several other industries also discharged PCBs into the Los Angeles sewer system that ended up on the PVS by way of outfall pipes. The PVS location is defined by the large area of DDT- and PCB-contaminated sediment on the ocean floor. The contaminated sediment deposit is thin, 2 inches to 2 feet thick, and covers several square miles. The most contaminated sediment is buried under a layer of cleaner sediment that has surface concentrations of DDT and PCB that have decreased over time.

Prior to the use of copper and tributyltin as anti-fouling paints, PCBs were used in boat hull paint. It is possible that historical contamination from boat hulls may be contributing to high levels of PCBs in the Back Basins.

4.5 Prioritized Sources

Based on the source assessment, priorities within the MdR watershed were assessed and sequenced in accordance with section VI.C.5.a.iv of the MS4 Permit (Table 4-3). As specified in the MS4 Permit, the highest priority (1) is assigned to those pollutants with TMDLs according to the following criteria:

1a) Controlling pollutants for which there are established WQBELS, or receiving water limitation with interim or final compliance deadlines within the current MS4 Permit term, or whose TMDL deadlines have passed without achieving the limitations,

1b) Controlling pollutants for which there are established WQBELs or receiving water limitations with compliance deadlines (interim or final) between September 6, 2012 and October 25, 2017.

The second highest (2) priorities are established for pollutants for which receiving water limitations are exceeded, or impairment is implicated as a result of discharges from the MS4. For purposes of the prioritization, third priority (3) will be attributed to controlling pollutants with TMDL compliance dates beyond the term of the MS4 Permit.

Table 4-3: Marina del Rey Priorities

Priority	Waterbody	Pollutant	Compliance Deadlines	Priority Sources*
1a	MdRH Back Basins	Bacteria (summer and winter dry weather)	March 18, 2007 Final Compliance (TSO Final Compliance December 28, 2017). July 10, 2014 – December 27, 2017 TSO Interim Compliance Period	Birds, anthropogenic sources
1b	MdRH Back Basins	Copper	Interim Compliance March 22, 2016 Final compliance March 22, 2018.	Boats, residential, stormwater runoff
		Lead		Legacy sediment, stormwater runoff (suspended sediment)
		Zinc		Commercial contributions, stormwater runoff
		PCBs		Legacy sediment, boats, stormwater runoff (suspended sediment)
		DDTs		Legacy sediment, stormwater runoff
		p,p'-DDE		Legacy sediment, stormwater runoff
		Chlordane		Legacy sediment, stormwater runoff (suspended sediment)
3	MdRH Back Basins	Bacteria (wet weather)	July 15, 2021 final wet weather and geometric mean.	Birds, stormwater runoff, anthropogenic sources
	MdRH Front Basins	Copper	Interim Compliance March 22, 2019 Final compliance March 22, 2021.	Boats, residential, stormwater runoff
		Lead		Legacy sediment, stormwater runoff (suspended sediment)
		Zinc		Commercial contributions, stormwater runoff
		PCBs		Legacy sediment, boats, stormwater runoff (suspended sediment)
		DDTs		Legacy sediment, stormwater runoff
		p,p'-DDE		Legacy sediment, stormwater runoff
		Chlordane		Legacy sediment, stormwater runoff (suspended sediment)

*Although stormwater is not a primary source of pollutants, it is a conveyance mechanism and is treated as a point source for purposes of the Toxicity TMDL.

5.0 STRUCTURAL AND NON-STRUCTURAL CONTROL MEASURES

Section VI.C.5.b of the MS4 Permit requires the identification of control measures, strategies and BMPs within the watershed with the goal of creating an efficient program to focus resources on the watershed priorities identified in Section 3.0 above. In accordance with the MS4 Permit, the objectives of the Watershed Control Measures shall include:

1. Prevent or eliminate non-stormwater discharges to the MS4 that are a source of pollutants from the MS4 to the receiving waters.
2. Implement pollutant controls necessary to achieve all applicable interim and final water quality-based effluent limitations and/or receiving water limitations pursuant to corresponding compliance schedules.
3. Ensure that discharges from the MS4 do not cause or contribute to exceedances of receiving water limitations."

The MdR watershed is very different from the other Los Angeles area watersheds because it is small and highly urbanized, with a large portion of the lower watershed within a high groundwater and tidally influenced former estuary. A combination of regional, distributed regional, and non-structural best management practices (BMPs) will be required to address attainment of the pollutant loading reductions necessary for compliance.

The following section discusses the BMPs necessary and sufficient to be implemented within the MdR WMA to achieve the estimated contaminant load reductions from the MS4 into the receiving water required for the MdR EWMP Agencies' compliance with applicable WQBELs and/or receiving water limitations (RWLs) for each TMDL, §303(d) listing, and receiving water exceedance. The analysis takes into consideration existing and planned BMPs, priority regional BMPs (Costco and the Venice Neighborhood Project), other potential regional BMPs, green streets BMPs, planned development and redevelopment projects, as well as nonstructural BMPs.

5.1 Existing BMPs

The extensive ongoing efforts of the County, LACFCD, and the cities of Culver City and Los Angeles to improve water quality in the MdR watershed include implementing various structural and non-structural BMPs to reduce pollutants from stormwater runoff to the harbor. Over the past 10 years, these responsible agencies in the MdR watershed have spent tens of millions of dollars in special studies, low-flow diversions, non-structural BMPs, structural BMPs, and monitoring efforts. The water quality in the harbor has significantly improved as a result of these cooperative efforts.

This section summarizes the existing structural and non-structural BMPs that are already in effect or are under development within the MdR watershed. This information was compiled from the Notices of Intents (NOIs), Time Schedule Orders (TSOs), MdR Bacteria and Toxics Implementation Plans, and information submitted directly by the MdR EWMP Agencies for the purpose of this EWMP development.

5.1.1 Existing Structural BMPs

Existing BMPs that have already been implemented or are in progress in the MdR watershed include the following:

- Existing sewers in MdR have been lined since 1993 to reduce sanitary sewer leaks. Since 2007, the County has lined and rehabilitated 11 miles of sewer lines and 208 manholes in the MdR watershed. – *Completed*
- Three low-flow diversions (92,000, 20,000, and 288,000 gal/day) were installed in 2006-2010 by the LACFCD at three locations to divert dry-weather non-stormwater urban runoff to a sanitary sewer flowing into the Hyperion Treatment Plant, to comply with the MdR Dry Weather Bacteria TMDL. The diversions serve 61, 310, and 148 acres, respectively. – *Completed*
- Five bioretention filter tree wells (Filterra) were installed in 2007 by LACFCD as an additional measure to prevent pollutants from entering Back Basin E. Each has a footprint of 6.5 ft by 4 ft to collect and treat dry weather runoff and stormwater, serving three subdrainage areas of 0.3, 14.1, and 16.5 acres, for a total of 30.9 acres. – *Completed*
- In the City of Los Angeles area, 293 catch basins have been retrofitted with trash screens (103 City-owned and 190 LACFCD-owned catch basins with trash screens). Catch basin cleaning has been conducted at a typical frequency of at least 2 times per year. The City of Culver City has retrofitted four catch basins with full capture devices. The County retrofitted 40 catch basins in the MdR with full-capture devices. – *Completed*
- Marina Beach Water Quality Improvement Project – In 2006 a mechanical circulator was installed in Back Basin D near Marina (Mother's) Beach. A stormwater diversion and collection system was constructed in 2007 to redirect all stormwater sheet flows from impervious areas from Parking Lot 10 and 11 which drained into Marina Beach and Back Basin D into Basin C. – *Completed*
- LACFCD is constructing seven bioretention areas on Admiralty Way as part of the Oxford Retention Basin Project Multi-Use Enhancement Project. – *In Progress*
- The retrofitting of three parking lots (Parking Lot 5, 7, and 9) and the library facility in MdR is underway based on the multi-pollutant implementation plan developed in 2011 for MdR (LADPW, 2012). The retrofitting will incorporate various treatment BMPs such as bioretention planters, biofiltration systems, porous pavement, and rain barrels. – Parking Lot 5 & 7 are *Complete*, the remaining are *In Progress*
- Oxford Basin Multi-Use Enhancement Project is currently underway. Elements of this project are designed to enhance flood protection, improve habitat, reduce runoff pollution, and improve water quality through increased circulation in the basin.- *In Progress*

Locations of existing structural control measures (that can be easily shown on a map), are shown in Figure 5-1 and are listed in Table 5-1. The table includes BMPs with their general types, date implemented, status, responsible agency, and a descriptive summary.

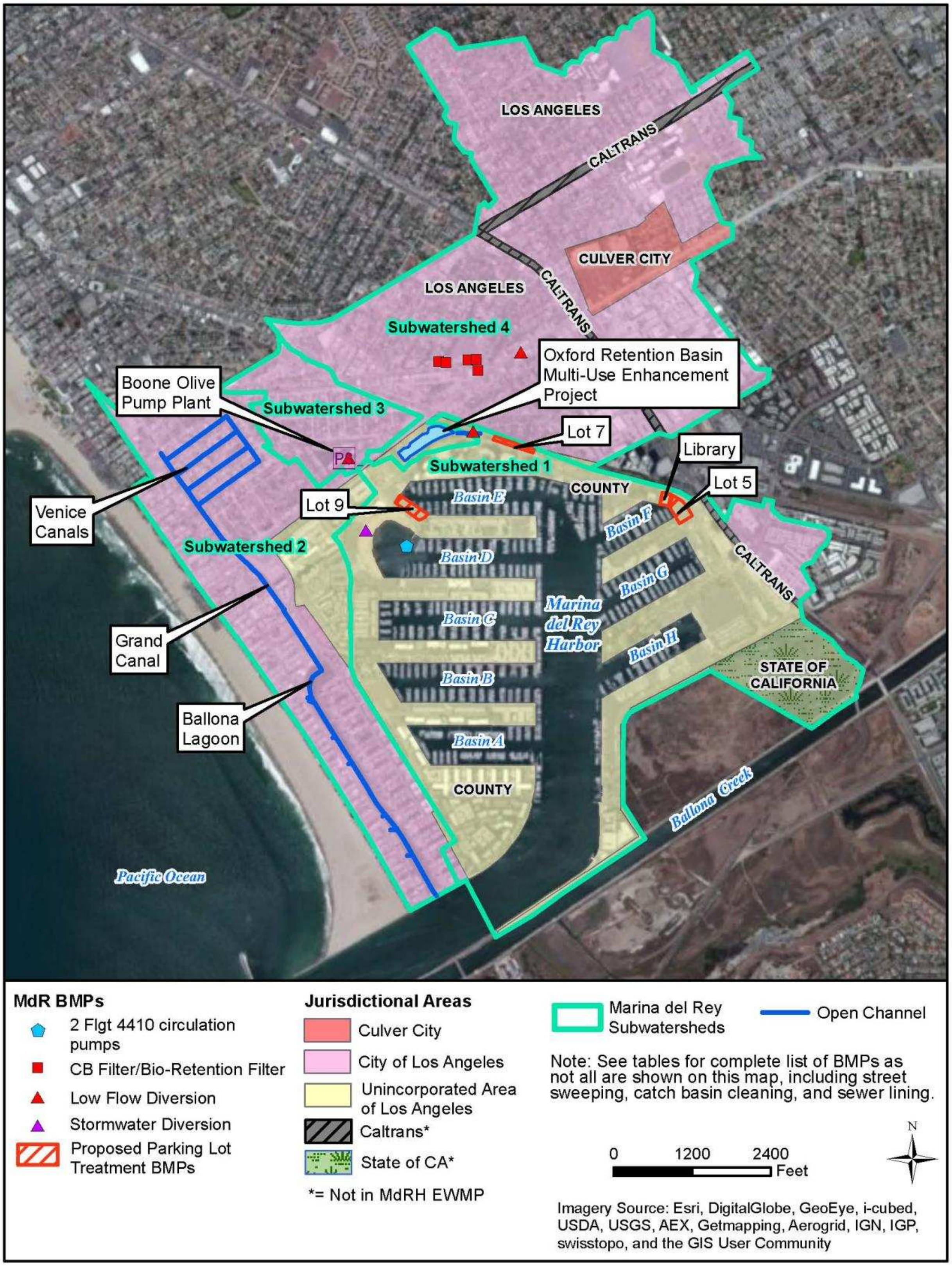


Figure 5-1: Existing Structural MCMs within MdR Watershed

Table 5-1: List of Existing Structural BMPs in the Marina del Rey Harbor EWMP Agencies WMA

Project Title	BMP Type	Status	Date	Agency	Location	Description
Marina Beach Water Quality Improvement Project – Phase I	Mechanical Circulation Device	Complete	10/2006	County, LACDBH	Basin D / Marina Beach	Two subsurface water circulators (2 Flygt 4410 circulation pumps) with 55-inch-diameter banana propellers were installed in Basin D just offshore from Marina Beach, attached under a special dock at Parcel No. 91. The circulators pump water toward the beach face at a rate of 60,000 gallons per minute (gpm) (30,000 gpm each).
Marina Beach Water Quality Improvement Project – Phase II	Stormwater Diversion	Complete	8/2007	County, LACDBH	Basin D / Marina Beach	A stormwater collection system was constructed to redirect all stormwater sheet flows from impervious areas from Parking Lot 10 and 11 currently draining into Marina Beach and Back Basin D into Basin C.
Tree Wells (5)	Bio-Retention Filter (Filterra)	Complete	1/2007	LACFCD	West and east side of Garfield Ave West and east side of Coeur D'Alene Abbot Kinney	Five bioretention filters were installed upstream of Project No. 5243 as an additional measure to prevent pollutants from entering Back Basin E. Each has a footprint of 6.5 ft by 4 ft to collect and treat dry weather runoff and stormwater serving three subdrainage areas of 0.3, 14.1, and 16.5 acres, for a total of 30.9 acres.
Project 3874, 5243, 3872	Low Flow Diversion	Complete	3/2007	LACFCD	539 Washington St. 3874 Boone-Olive Pump Station 3872 Oxford Pump Station	Three low-flow diversions (92,000, 20,000 and 288,000 gal/day) were installed at three locations to divert dry-weather non-stormwater urban runoff to a sanitary sewer flowing into Hyperion Treatment Plant, to comply with the MdRH Dry Weather Bacteria TMDL. The diversions serve 61, 310, and 148 acres, respectively.
Sanitary Sewer and Manhole Lining		Complete	1993	County, City of Los Angeles	Surrounding Basins D, E, and F	Existing sanitary sewers in MdRH have been lined since 1993 to reduce sanitary sewer leaks. Since 2007, the County has lined and rehabilitated 11 miles of sewer lines and 208 manholes in the MdRH watershed.
Catch Basin Retrofit		Complete/In Process	2011	County, City of Los Angeles, City of Culver City	Across MdR	In the City of Los Angeles area, 293 catch basins have been retrofitted with trash screens (103 City-owned and 190 LACFCD-owned catch basins with trash screens). Catch basin cleaning has been conducted at a typical frequency of at least 2 times/year. The City of Culver City has retrofitted four catch basins with full capture devices. The County plans to retrofit 40 catch basins in the MdR with full-capture devices.
Parking Lot Retrofits		In Process, Lots 5 and 7 Complete.	Yearly until 2017	County	Parking Lots 5, 7, 9, and Library	The retrofitting of three parking lots and the library facility in MdR is underway based on the multi-pollutant implementation plan developed in 2011 for MdR. The retrofitting will incorporate various BMPs such as bioretention planters, biofiltration systems, porous pavement, and rain barrels. The goal of these parking lot projects is to treat runoff coming from the County facilities before it enters the harbor.
Bird Spikes		Complete		County	Parking Lots 5, 7, 10 and 11.	On all light standards in County owned parking lots including Lots 5, 7, 10, and 11, which discharge into Basin D, E, and F.
Oxford Retention Basin Multi-Use Enhancement Project		In Process	Fall 2015	County, LACFCD	Oxford Retention Basin	This project, scheduled to begin construction in 2015, is designed to enhance flood protection, reduce runoff pollution, and significantly improve the quality of plant and wildlife habitat within the facility, as well as its aesthetic appeal. Diseased trees and non-native plants will be replaced with native, more drought-tolerant species. The project will also provide new recreational and safety amenities, including a walking path, observation areas, wildlife-friendly lighting, and more attractive tubular fencing. The project will improve water quality by increasing circulation and dissolved oxygen levels of the water in the basin by constructing a circulation berm.
Tree Wells		Proposed / In Process	Within 60 months of TSO adoption	City of Los Angeles, LACFCD	To Be Decided	LACFCD is constructing seven bioretention areas on Admiralty as part of Oxford Retention Basin project.

5.1.2 Existing Non-Structural BMPs

The EWMP Agencies have implemented numerous non-structural BMPs to improve water quality in MdRH. These BMPs are classified as planning, enforcement, monitoring, source control, and Public Information and Participation Program (PIPP) (i.e., education, outreach, and incentives). Existing non-structural BMPs are summarized in detail in Table 5-2.

The EWMP Agencies are continuing to implement MCMs required under the 2001 MS4 Permit and will continue to do so until the EWMP is approved by the Regional Board.

Table 5-2: List of Existing Non-Structural BMPs in the Marina del Rey Harbor EWMP Agencies WMA

Project Title	BMP Type	Status	Regulatory Driver / TMDL	Date	Agency	Description
PLANNING						
Marina del Rey Bacteria TMDL Implementation Plan (Marina del Rey Watershed Responsible Agencies [MDRWRA], 2007)	Planning Compliance	Complete	Bacteria	01/2007	County, Multiple	The plan includes procedures, plans, programs, and actions to be carried out throughout the MdR watershed to reduce bacteria concentrations at this impaired water body to comply with the Bacteria TMDL requirements.
Marina del Rey Multi-Pollutants Implementation Plan (LADPW, 2012)	Planning Compliance	Complete	Toxics, Trash	03/2011	County	The plan includes procedures, plans, programs, and actions to be carried out throughout the unincorporated area of MdR watershed to reduce toxics and bacteria concentrations at this impaired waterbody to comply with the Toxics and Bacteria TMDL requirements.
Marina del Rey Toxics Implementation Plan (City of Los Angeles, 2011)	Planning Compliance	Complete	Toxics	03/2011	City of Los Angeles, Multiple	The plan includes procedures, plans, programs, and actions to be carried out throughout the MdR watershed within the City of Los Angeles, Caltrans and City of Culver City boundaries to reduce bacteria concentrations at this impaired water body to comply with the Toxics TMDL requirements.
Pollution Prevention Plan	Planning Compliance	Complete	Bacteria	9/2014	County, LACFCD City of Los Angeles	The plan includes projects and actions to be carried out as part of the Dry-Weather Bacteria TMDL TSO
ENFORCEMENT						
Illegal Connection/ Illicit Discharge (IC/ID) Program	Enforcement IC/ID	Ongoing	MS4 Permit	2001 - present	LACFCD, County, City of Los Angeles, City of Culver City	This program involves coordination of multiple departments to eliminate pollution by IC/IDs to the stormwater system. The County has an active education, response, and enforcement program. The data are tracked for the County region and for the County's Road Maintenance Division (RMD), as part of its annual pre-storm season drainage inspection program. The cities of Los Angeles and Culver City have citywide programs that have also been implemented in the MdR watershed.
Construction Inspections Industrial/Commercial Facility Inspections	Enforcement Inspections (w/ Education)	Ongoing	MS4 Permit		County, City of Los Angeles, City of Culver City	Los Angeles County MS4 Permit Program has been implemented in the MdR watershed as part of a citywide and county wide program. The City of Culver City has a citywide program that has also been implemented in the MdR watershed.
Restaurant Inspections	Enforcement Inspections (w/ Education)	Ongoing	MS4 Permit	2004	County, City of Los Angeles	Annual inspections target restaurants as a potential source of bacteria, trash and other pollutants from waste disposal. This program identifies facilities lacking minimum stormwater BMPs and housekeeping practices - for waste disposal, grease containers, mop sinks, and other housekeeping activities.
Low Impact Development (LID) ordinance	Enforcement Ordinance	Existing	MS4 Permit	Jan 2009 May 2012 November 2014	County, City of Los Angeles, City of Culver City	The City of Los Angeles is currently amending sections of the LID Ordinance, as well as its Stormwater and Urban Runoff Pollution Control Ordinance (L.A.M.C. Chapter VI, Article 4.4) to meet all the MS4 Permit requirements. The County adopted a revised LID ordinance on November 12, 2013 to meet all MS4 Permit requirements. The City of Culver City adopted a similar in November of 2014.
Green Street Policy	Enforcement Ordinance	Existing	MS4 Permit	Jul 2011 November 2014	County, City of Los Angeles, City of Culver City	The City of Los Angeles, the City of Culver City, and the County have adopted a Green Street Policy that is in compliance with the requirements of the MS4 Permit for its portion in the watershed.
Standard Urban Stormwater Mitigation Plan (SUSMP)	Enforcement Ordinance	Existing	MS4 Permit	Ongoing	City of Los Angeles	The City of Los Angeles has several projects in MdR watershed as part of its implementation of the Citywide SUSMP program.
SOURCE CONTROL						
Brake Pad Partnership	Source Control Alternative Product	Complete	MS4 Permit, Toxics TMDL	2010	Multiple	MdRH Agencies have supported the Brake Pad Partnership and the adoption process of Senate Bill (SB) 346 (adopted in 2010) through monetary contributions, in-kind technical services, and committee memberships. Caltrans, in conjunction with the State Board, contributed close to $1,000,000 to research on the impacts of brake pads to surface waters. The Brake Pad Partnership is an example of true source control that will remove copper brake pads from the market, and therefore, a source of loading to the environment. SB346 requires that brake pads contain no more than 5% copper by weight by 2021 and no more than 0.5% copper by weight by 2025.
Trash Removal and Control	Source Control	Ongoing	Trash TMDL		City of Los Angeles, County, City of Culver City	The Santa Monica Bay Debris TMDL requires responsible parties to reduce their trash contribution to the Santa Monica Bay by 10% each year for a period of 10 years with the goal of zero trash to waterbodies. The County and City of Los Angeles have achieved every yearly milestone, solely through the implementation of structural measures without having to take credit for implemented institutional measures that are also resulting in a reduction of trash. Other programs are implemented by other entities for trash control. For example, the City of Los Angeles Bureau of Street Services (BSS) offers a reward for information resulting in the identification of persons committing an act of illegal dumping.
Trash Removal	Source Control	Complete	Trash TMDL/ Bacteria TMDL	Ongoing	County	Trash is removed on a daily basis from County facilities in the Marina.

Table 5-2: List of Existing Non-Structural BMPs in the Marina del Rey Harbor EWMP Agencies WMA

Project Title	BMP Type	Status	Regulatory Driver / TMDL	Date	Agency	Description
MAINTENANCE						
Street Sweeping	Maintenance	Ongoing	Toxics TMDL, Trash TMDL, Bacteria TMDL	2008	County, Multiple	County: Streets are swept 2 times/week on Mondays and Thursdays. Parking lots are swept at least 2 times/week and up to 6 times/week. Ten sweepers are used in MdRH, 4 vacuum and 6 mechanical sweepers stationed with the RMD-3 fleet. One of each is compressed natural gas (CNG) powered versus liquefied petroleum gas (LPG) powered. Lot 15: 6times/week (winter); daily (summer), Lots 11, 13 and 16: 4times/week. City of Los Angeles / Caltrans: BSS conducts sweeping: 130 mechanical broom sweepers, 100 operators, weekly sweeping for posted streets and monthly sweeping for arterial streets. Has a delegated maintenance agreement with Caltrans to sweep Venice and Lincoln/Pacific Coast Highway. The City of Culver City has a street sweeping program that includes weekly sweeping of street in its portion of MdRH. Current schedule is side streets – Monday and Tuesday 8:00 am to 12:00 pm, Washington Boulevard – Monday through Friday 4:00 AM to 6:00 AM. The City of Los Angeles BSS currently sweeps approximately 63 curb miles (some swept weekly and some swept monthly) located within the City of Los Angeles' portion of MdRH. Maintenance responsibility of Lincoln Boulevard (State Route 1) and Venice Boulevard (State Route 187) has been delegated to the City of Los Angeles by a Delegated Maintenance Agreement. Caltrans will be working closely with the City of Los Angeles to achieve optimal maintenance performance that includes sweeping, trash pickup, and drainage cleanup.
Catch Basin Cleaning	Maintenance	Ongoing	Toxics TMDL, Trash TMDL, Bacteria TMDL	2011	City of Los Angeles, County, City of Culver City	The City of Los Angeles catch basin cleaning occurs at a typical frequency of 3 to 4 times per year, targeting trash. Within the County area, catch basins are be cleaned quarterly, semi-annually or every year depending on the prioritization of each catch basin. The City of Culver City cleaning occurs 3 times per year.
County Beaches - Sanitation Program	Maintenance	Ongoing	MS4 Permit, Bacteria TMDL		County	County staff "sanitizes" the beach 7 days a week, provided the sand is not wet. A tractor with rake and screen system is used to collect trash and turn over the beach sand. This process removes solids and debris and allows the sun to "sanitize" the sand during the day. Operations are between 5 am and 1:30 pm daily.
PUBLIC INFORMATION AND PARTICIPATION PROGRAM						
Billboard Educational Campaign	PIPP Outreach, Education	Complete	MS4 Permit, Toxics TMDL	Feb 2012		This program was a countywide, 8-week billboard campaign designed to promote protective waste management practices. A used motor oil educational advertisement was displayed on 20 billboards throughout the County.
Boating Clean and Green Campaign	PIPP Outreach, Incentive	Ongoing	Toxics TMDL, Bacteria TMDL	Apr 1997	County	This statewide educational and outreach program is designed to educate boaters about environmentally sound boating practices. The County held a focus group session to bring boaters together to openly share observations on boater behavior and motivations as they relate to water pollution. The boaters shared their observations on what is needed to better enforce current boater regulations as well as what visual messages would be most effective in influencing boater behavior. Based on the results of the Boater Focus Group, the County started the "Boaters Help Keep Marina del Rey and Santa Monica Bay Clean" campaign. A series of posters were created and posted at strategic sites in the harbor.
Dock Walker Training	PIPP Education, Outreach	Ongoing	Bacteria TMDL		LACDBH	This program consists of volunteers who inspire and educate boaters and other recreational users to be safe and environmentally sound while boating in California. Through this program, general boater educational materials were developed.
Clean LA	PIPP Education, Outreach	Ongoing	Bacteria and Toxics TMDLs	2002	County	County of Los Angeles portal to a number of award-winning programs that help residents, businesses, and government keep the County clean and sustainable.
School Outreach	PIPP Education, Outreach	Ongoing	MS4 Permit, Bacteria TMDL, Toxics TMDL, Trash TMDL		City of Los Angeles, LACFCD	Los Angeles County MS4 Permit and MdRH Bacteria TMDL Implementation Plan Programs: These program includes making targeted phone calls to all public and private K-12 schools within the MdRH to notify them of the availability of environmental education programs offered by the LACFCD and City of Los Angeles, emphasizing to school administrators that these programs comply with State curriculum standards and provide opportunities to fulfill service-learning requirements.
Clean Marinas Program	PIPP Outreach, Incentive	Ongoing	Bacteria TMDL, Trash TMDL	Apr 2006	County	This program is a partnership among private marina owners, government marina operators, and yacht clubs that was developed to provide clean facilities to the boating community.

Table 5-2: List of Existing Non-Structural BMPs in the Marina del Rey Harbor EWMP Agencies WMA

Project Title	BMP Type	Status	Regulatory Driver / TMDL	Date	Agency	Description
Smart Gardening	PIPP Education, Outreach, Incentive	Ongoing	Toxics TMDL, Bacteria TMDL		County	This program targets businesses, schools, and homeowners through outreach and education materials for water-wise gardening. Topics covered include drought-tolerant plants and native plants, irrigation methods and associated water use/savings, irrigation management, and structural BMPs (i.e., rain barrels, cisterns, green roofs). The program includes educational workshops, training events, and the design/build of demonstration gardens targeting local residences and businesses. The County operates 12 Learning Centers throughout the County. They are equipped with educational and demonstration materials designed for program workshops. Each is landscaped with various backyard and drought-tolerant plants. Some of the centers also include grass recycling demonstrations. The County is partnering with the University of California Cooperative Extension "Master Gardeners" volunteers from the community. The volunteers are trained to promote environmentally responsible and sustainable horticultural practices in the home, community, and school landscapes by conducting workshops and demonstrations; speaking to community groups; educating teachers and parents at school gardens; and answering gardening questions at fairs and farmers markets as well as staffing email and phone helplines.
Marina Beach Education and Outreach Plan	PIPP Education, Outreach	Ongoing	Bacteria TMDL	12/2014	County, LACFCD, City of Los Angeles	Education and outreach plan targeting residents and visitors to Marina Beach, informing the targeted audience of potential public health risks associated with elevated levels of bacteria and the overall efforts to address impact to water qualify from bacteria as well as individual actions that can be taken. The plan was prepared as part of the dry-weather Bacteria TMDL TSO efforts.

5.2 EWMP Structural BMPs

The structural BMPs proposed in this EWMP include two priority regional BMPs; the Costco public-private partnership project and the Venice Blvd. Neighborhood Project. Additional regional projects proposed include four regional parks (Triangle, Canal, Via Dolce, and Venice of America Centennial Parks). Non-regional projects, including green streets and LID (development/redevelopment) are also important aspects of the structural BMP strategy. Based on the Adaptive Management Process, additional structural BMPs may be pursued to meet TMDL requirements including centralized BMPs on private property, and if necessary to achieve compliance, detention basins under streets that divert stormwater to the sanitary sewer (diversions) are feasible projects that can be implemented in Subwatershed 1A, 1B and sections of Subwatershed 4.

5.2.1 Regional BMPs Selection Criteria

BMP selection involves many factors such as physical site characteristics, water quality objectives, multi-benefits potential, aesthetics, safety, maintenance requirements, and cost that provide opportunities for BMP or constrain BMP selection. Typically, there is not a single answer but rather multiple solutions ranging from stand-alone regional or localized BMPs to treatment trains that combine multiple BMPs to achieve water quality objectives as well as other benefits such as flood control and recreation.

Many factors were considered during the structural BMP selection process. Five geological and hydrological characteristics were identified as important in determining the feasibility of BMP scenarios in terms of BMP type and site selection evaluation. These characteristics are depth to bedrock, type of bedrock, soil characteristics, depth to water table, and land use. In addition, other factors affecting the implementation of a BMP include compatibility with the surrounding area, health and safety, maintenance considerations, cost feasibility, and performance and risk analysis. The factors are further discussed below. Existing maps of these five characteristics, when applicable, were used whenever possible, along with Geographic Information System (GIS) analysis and aerial photography and/or remote sensing to assist in BMP site and type selection. The integration of surface and subsurface information to map such parameters will provide more data that are directly relevant in the decision-making process of urban and county planners, engineers and developers, and geotechnical investigators.

1. Type of and Depth to Bedrock—Bedrock that is commonly fractured, such as shallow dolomite or limestone, is highly susceptible to contamination. The fractures provide direct and rapid pathways for contaminants to reach the water table. Groundwater within sandstone formations is less susceptible because sandstone contains fewer well-connected fractures. Soil and sediment overlying bedrock slows seepage to the water table. A greater depth to bedrock increases groundwater protection. The depth-to-bedrock value limits capabilities and activities on the surface.

2. Soil Type—Soils are classified by the Natural Resource Conservation Service into the four Hydrologic Soils Groups (A, B, C and D). Soil A has the smallest runoff potential, and highest infiltration rate and Ds generally have the greatest runoff potential and lowest infiltration rate and include soils with a permanent high water table, soils with high swelling potential, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. Soils A and B are well-suited for infiltration-based BMPs such as rain gardens, permeable pavement systems, sand filter, grass swales, and buffers, often without the need for an underdrain system.

3. Depth to the Water Table—Shallow groundwater may limit the ability to infiltrate runoff. In addition, groundwater quality protection is an issue that should be considered for infiltration-based BMPs. For example, infiltration BMPs should be avoided for land uses that involve storage or use of materials that have the potential to contaminate groundwater underlying a site, such as runoff from fueling stations or materials storage areas. In addition, the deeper the groundwater table, the better the opportunity for contaminants to be filtered or to degrade.

4. Land Use—Land use cover identifies potential areas where regional and localized BMP implementation might be feasible. In addition, it allows the quantification of the degree of urbanization and imperviousness, both important factors affecting BMP type and location selection. Space constraints are frequently cited as feasibility issues for BMPs, especially for high-density, lot-line-to-lot-line development and redevelopment sites, where there is a limited amount of publicly owned land available to implement the larger scale projects that would be necessary to capture and/or reuse runoff. The primary focus will be to identify opportunities to retrofit existing conveyance systems, parks, and other recreational areas with water quality protection measures.

5. Existing Utilities—Utilities are frequently located below ground, which coincides with the feasible locations for stormwater BMPs. Typically, water and sewer piping, natural gas lines, and telephone and electrical conduits are located in the public ROW and on individual parcels. BMPs will require modification to fit into the limited available space without disrupting existing utilities, or utilities will require relocation for BMP installation.

6. Compatibility with Surroundings—Stormwater quality areas can add interest and diversity to a site, serving multiple purposes. Gardens, plazas, rooftops, and parking lots can become amenities and provide visual interest while performing stormwater quality functions and reinforcing urban design goals for the neighborhood and community. The integration of BMPs and associated landforms, walls, landscape, and materials can reflect the standards and patterns of a neighborhood and help to create lively, safe, and pedestrian-oriented districts. The quality and appearance of stormwater quality facilities should reflect the surrounding land use type, the immediate context, and the proximity of the site to important civic spaces. The standard of design and construction should maintain and enhance property values without compromising function. In addition, construction staging should be sited in a way to minimize the effect of construction mobilization and noise to adjacent tenants.

7. Health and Safety—Stormwater quality facilities must be designed and maintained in a manner that does not pose health or safety hazards to the public. The potential for nuisances, odors, and prolonged soggy conditions should be evaluated for BMPs, especially in areas with high pedestrian traffic or visibility. Urban areas are heavily populated, which adds to safety concerns when considering potential BMPs such as ponds, wetlands, and surface sand filters. Open surface systems may require additional measures such as fencing to ensure public safety and reduce vandalism. Often the only feasible location for BMPs in developed areas is underground, which presents more complex maintenance issues that trigger worker safety requirements. The installation of subsurface BMPs may require maintenance activities to be performed in confined spaces. Confined spaces have specific entry requirements to ensure safety that would need to be followed each time BMPs are inspected or maintained.

8. Maintenance—BMPs can be more effectively maintained when they are designed to allow easy access for inspection and maintenance and to take into consideration property ownership, easements, visibility from easily accessible points, slope, vehicle access, and other factors. Clear, legally-binding written

agreements assigning maintenance responsibilities and committing adequate funds for maintenance are also critical. Maintenance requirements must be carefully planned and implemented when access to subsurface BMPs is limited to manhole openings or requires the removal of grates and panels. Subsurface BMPs may be considered confined spaces and require additional measures to ensure safe access for inspection or maintenance. As a result of these potential restrictions and/or additional measures, BMP technologies that require maintenance on an annual or semiannual basis are often preferred to those requiring more frequent maintenance. Difficulty in performing the maintenance (increased level of effort) can increase the cost of the required maintenance.

9. Watershed Characteristics—The contributing drainage area is an important consideration both on the site level and at the regional level. On the site level, there must be a practical minimum size for certain BMPs related to the ability to drain and treat the associated runoff over the required drain time. On the regional level, there must be a limit on the maximum drainage area for a regional facility to assure adequate treatment of rainfall events. In addition, in a highly urbanized setting, small drainage areas and undefined outfalls limit the number of treatment strategies that can be used to treat stormwater runoff.

10. BMP Categories—BMPs can be categorized based on their functionality (storage versus conveyance) and design strategy (stand-alone versus in series; online versus offline). Storage-based BMPs provide volume reduction benefits and include bioretention and/or rain gardens, extended detention or dry basins, sand and/or media filters, constructed wetland ponds, retention or wet ponds, and permeable pavement systems. Conveyance-based BMPs include grass swales, grass buffers, constructed wetlands channels, and other BMPs that improve quality and reduce volume but only provide incidental storage. Ideally, a combination of conveyance-based and storage-based BMPs can be used to allow the implementation of multiple benefits BMPs. Given the natural variability of the volume, rate and quality of stormwater runoff, and the variability in BMP performance, using multiple practices in a treatment train that links complementary processes can expand the range of pollutants that can be treated and increase the overall efficiency of the system for pollutant removal and provide system redundancy. In addition, the land requirements for a combined facility are lower than for two separate facilities. BMPs may be designed to be online such that all of the off-site runoff from the upstream watershed and site runoff is intercepted and treated by the BMP. Locating BMPs offline requires that all on-site catchment areas flow though a BMP prior to combining with flows from the upstream off-site watershed.

11. BMP Performance—BMP performance evaluation is not required for Regional BMPs, except to the extent that they capture the 24-hour 85th percentile storm. Performance of various BMPs depends on numerous factors, such as BMP type, design, site, storm characteristics, monitoring methodology, performance measures, and pollutant loadings. The reported effectiveness data varies widely between and among different BMPs.

12. Cost Estimates—Cost effectiveness is an essential component in BMP planning and selection, especially with the stricter regulations and leaner budgets imposed on stormwater management programs. Life cycle cost (LCC), which refers to all costs that occur during the economic life of a project, should be optimized. Generally, the components of the LCC for a constructed facility include construction, engineering and permitting, contingency, land acquisition, routine operation and maintenance, and major rehabilitation costs minus salvage value. It is also recommended that the cost of administering a stormwater management program be included as a long-term cost for BMPs. One method to assess and compare the LCC of various BMPs is to use the net present value (NPV) of the whole life costs of the BMP(s) implemented, the average annual mass of pollutant removed, and the average annual volume of

surface runoff reduced to compute a unit cost per pound of pollutant or cubic feet of runoff removed over the economic life of the BMP.

13. Risk Assessment—A risk assessment was conducted for the selected BMP systems by evaluating estimated reduction efficiencies, treatment capacity, whether or not a BMP can be integrated with other BMPs, likelihood of failure, and ease of adaptive customization.

14. Other Factors—California Environmental Quality Act (CEQA) environmental consideration not listed above including but not limited to cultural resources, greenhouse gas emissions, air quality, and traffic. These considerations will be preliminarily assessed for potentially significant impact to identify permitting and potential mitigation requirements at this early assessment phase.

5.2.2 Regional BMP Selection

Using the selection criteria described above, a total of 23 potential regional BMP locations within the MdR WMA were identified. This preliminary list consisted of the Costco site, the Venice Blvd. Neighborhood Project, green streets, parks, diversions of stormwater into the sanitary sewer, and public schools. These were further evaluated and ranked based on various criteria, including depth to groundwater, public acceptance, infrastructure disturbance, maintenance factors, as well as others (Section 5.2). The resulting 18 potential regional BMP implementation sites are listed in Table 5-3. The location of the parks, the Venice Blvd. Neighborhood Project and the Costco site are shown in Figure 5-2. As mentioned previously, if additional load reductions are required after implementation of the priority projects (Costco and the Venice Blvd. Neighborhood Project) additional BMPs may be pursued to meet TMDL requirements including centralized BMPs on private property, and if necessary to achieve compliance, detention basins under streets that divert stormwater to the sanitary sewer (diversions) are feasible projects that can be implemented in Subwatershed 1A, 1B and sections of Subwatershed 4.

Table 5-3: Ranking of Potential Regional BMPs within the MdR WMA

Ranking	Site	Land -Use	Subwatershed	Jurisdiction	Agencies	Groundwater Depth (feet)
1	Costco	Private	4	City of Culver City	Costco	20-30
2	Triangle Park	Public	4	City of LA	Parks	10-19
2	Venice of America Centennial Park	Public	3	City of LA	Parks	10-19
4	Venice Blvd. Neighborhood Project (high[a])	Public/ROW	4	City of LA	LADOT	20-39
5	Green Streets[b] (medium[a])	Public/ROW	4	City of LA / City of Culver	LADOT	10-19
5	Green Streets[b] (medium[a])	Public/ROW	2	City of LA	LADOT	10-19
7	Green Streets[b] (low[a])	Public	1	County	LADOT	<10
8	Green Streets[b] (medium[a])	Public/ROW	3	City of LA	LADOT	10-19
8	Canal Park	Public	2	City of LA	Parks	10-19
8	Via Dolce Park	Public	2	City of LA	Parks	10-19
11	Twain Middle School	Public	4	City of LA	LAUSD	20-39
12	Green Streets[b] (low[a])	Public/ROW	2	City of LA	LADOT	<10
13	Green Streets[b] (low[a])	Public/ROW	4	City of LA	LADOT	<10
14	Venice High School	Public	4	City of LA	LAUSD	20-39
15	Coeur D'Elene Elementary School	Public	4	City of LA	LAUSD	10-19

Table 5-3: Ranking of Potential Regional BMPs within the MdR WMA

Ranking	Site	Land -Use	Subwatershed	Jurisdiction	Agencies	Groundwater Depth (feet)
16	Westside Leadership Magnet	Public	2	City of LA	LAUSD	10-19
17	Sanitary Sewer Diversion (1a and 1b)	Public/Private				
17	Sanitary Sewer Diversion (4)	Public/Private				

Color Code Subwatershed 1 – Subwatershed 2 – Subwatershed 3 – Subwatershed 4
[a] Referring to groundwater depth
[b] For green streets refer to the Green Streets section below
Parks - City of Los Angeles Parks and Recreation

The Costco site, although not a public site, ranked first because of its relatively large drainage area and potential capture volume, potentially the entire City of Culver City portion of the WMA. Venice of America Centennial Park and Triangle Park were the next highest ranked sites. Venice Park ranked high because of its potential to capture a large portion of its corresponding Subwatershed 3 drainage area. Other factors include the apparent lack of potential public opposition, lower infrastructure disturbance potential, and lower implementation cost. Siting a regional BMP in Triangle Park, despite its small drainage area, results in minimal negative impacts based on the ranking criteria.

Distributed regional green streets in the high groundwater depth areas in Subwatershed 4 were ranked next because of their capture and infiltration potential. Although not able to capture and retain the 85th percentile storm, green streets in Subwatersheds 4, 2, and 3 ranked high because of the large drainage area they can treat. Green street BMPs throughout the subwatersheds can result in significant volume and load reductions in the WMA, but with the greatest infrastructure disturbance and potentially the highest costs. Canal Park and Via Dolce Park are also in the top 10 BMPs.

Finally, although Twain Middle School may capture a large percentage of the 1.1-inch storm runoff volume corresponding to the drainage area of Subwatershed 4, the potential lack of public acceptance makes it an unfavorable site for a Regional BMP. The same applies to Venice High School.

The benefits of the above-mentioned BMPs, when applicable, extend beyond reduction of sediment loads, toxic pollutants, and bacterial loads. Benefits may include community enhancement through beautification, property value increase, improved beach tourism, ecosystem protection, and groundwater recharge.

Figure 5-2: Proposed Structural Control Measures and Regional Projects in MdR Watershed

5.2.3 Regional Priority Projects

The structural BMPs proposed in this EWMP include two priority regional BMPs; the Costco public-private partnership project and the Venice Blvd. Neighborhood Project. These projects will be the initial project pursued in the EWMP.

5.2.3.1 Costco

A public-private partnership between the City of Culver City and Costco has been established to pursue implementation of this Priority Regional BMP. The Costco lot is 17.5 acres and maybe used to capture the drainage from the entire Culver City portion of the MdR watershed, totaling 42 acres (Figure 5-2).

The Costco site is located within Subwatershed 4 (Figure 5-3), in an area with depth to groundwater between 20 and 30 feet. The design of a regional BMP on the site would maintain at least 10 feet between the bottom of the proposed BMP and groundwater depth, as required by the City of Culver City. This can be accomplished by designing several diversions within the storm drain network at locations closer to the source (catch basins or inlets) rather than constructing one diversion at the end of the pipe, which is fairly deep. Design considerations will be given to other geotechnical investigation factors, including the potential liquefaction hazard.

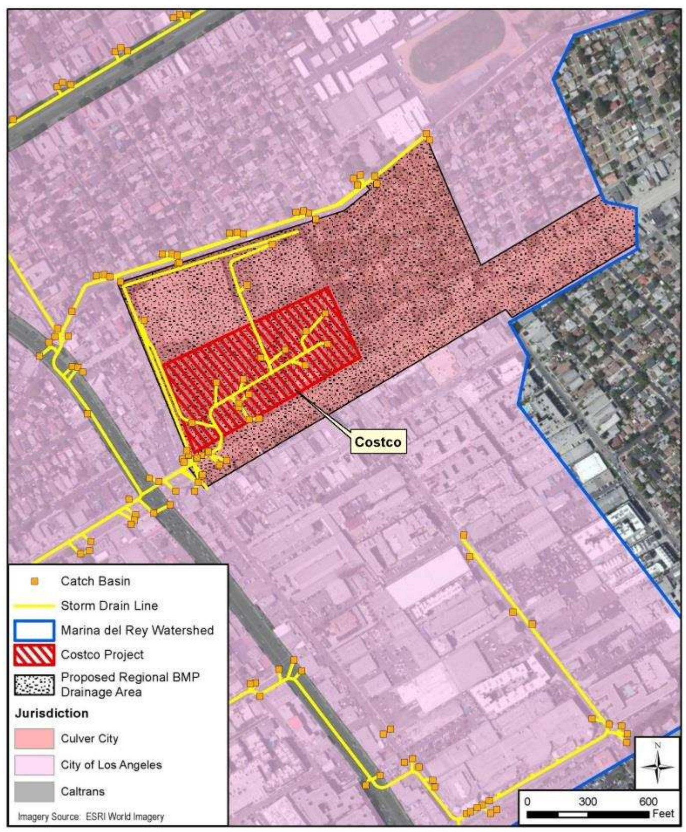


Figure 5-3: Proposed Drainage Area for Costco Regional Project

Based on the preliminary geotechnical data (Appendix E), the deep groundwater conditions at Costco Commercial Park are between 20 and 30 feet and therefore are conducive to an infiltration-type design. The geotechnical reports indicate that the top 10 to 13 feet of material directly underneath the parking lot consists of impervious clay. Approximately 3 feet of clay material below the invert of the infiltration gallery would need to be replaced with gravel or an amended soil mixture designed to allow percolation into deeper sandy soils. As a cost-saving measure, it is assumed that a portion of the excavated clay material (approximately 8,000 cubic yards) may be stockpiled on-site and then beneficially reused as backfill above the infiltration gallery. The Costco parking lot infiltration gallery would be designed to infiltrate 100% of the 85th percentile storm event runoff from the City of Culver City (design volume of 115,600 cubic feet, 42-acre drainage area). The preliminary design for this infiltration gallery consists of 757 StormChamber units installed along the edges of the parking lot (Figure 5-4). Runoff from the Costco facility (17.5 acres) would be re-directed from the existing MS4 system to the infiltration gallery. Runoff from off-site would be directed to the Costco infiltration gallery by means of a diversion structure. Detailed preliminary design estimates can be found in Appendix B.

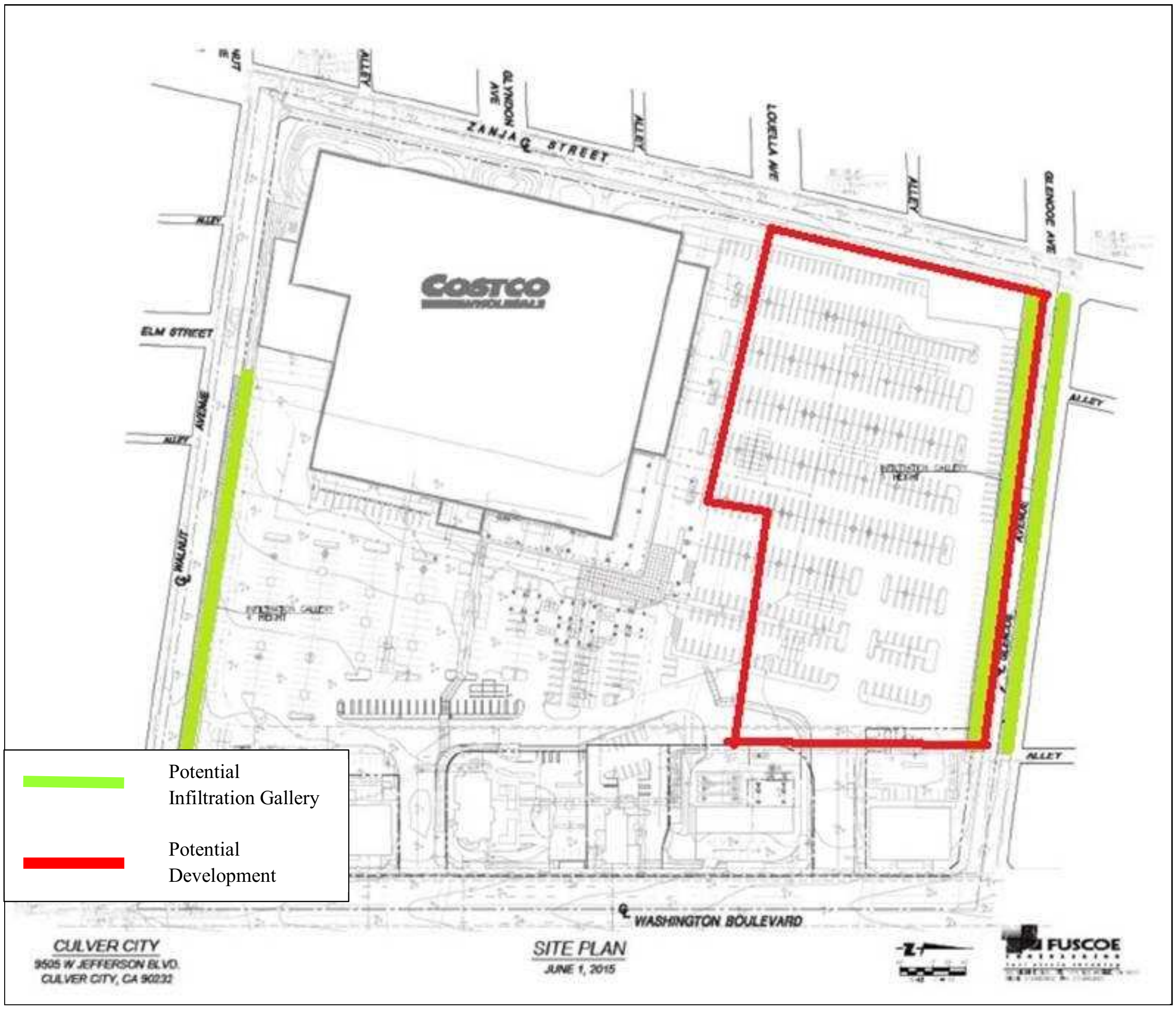


Figure 5-4: Proposed Preliminary Concept for Costco Regional BMP

Figure 5-5 provides an example of the StormChamber units proposed for the Costco infiltration gallery.

The City of Culver City is currently in negotiations with Costco and expects to have this project completed by early 2017.

Figure 5-5: Example of StormChamber Units

5.2.3.2 Venice Boulevard Neighborhood Green Streets Regional Project

The Venice Blvd. Neighborhood Project is situated in the northeast section of the watershed, in Subwatershed 4 (Figure 5-2, Figure 5-3, and Figure 5-6). The project consists of green streets that are sized to capture and infiltrate the 85th percentile storm.

Localized green streets, referred to thereafter as green streets, (not designed to capture and infiltrate the 85th percentile storm) will be needed throughout large areas of the subwatersheds to achieve the water quality load reductions required to achieve compliance with the WLAs of the Toxics TMDL and are described in Section 5.2.4.1 below.

The feasibility of the implementation of the Venice Blvd. Neighborhood Project depends upon separation from the groundwater table, spatial constraints of the project footprint and underlying soil types. Available groundwater data were used to delineate the MdR watershed into areas where infiltration would be feasible or not feasible. North of Venice Boulevard, where this project will be sited, the depth to groundwater is between 20 to 30 feet. Preliminary geotechnical investigations were

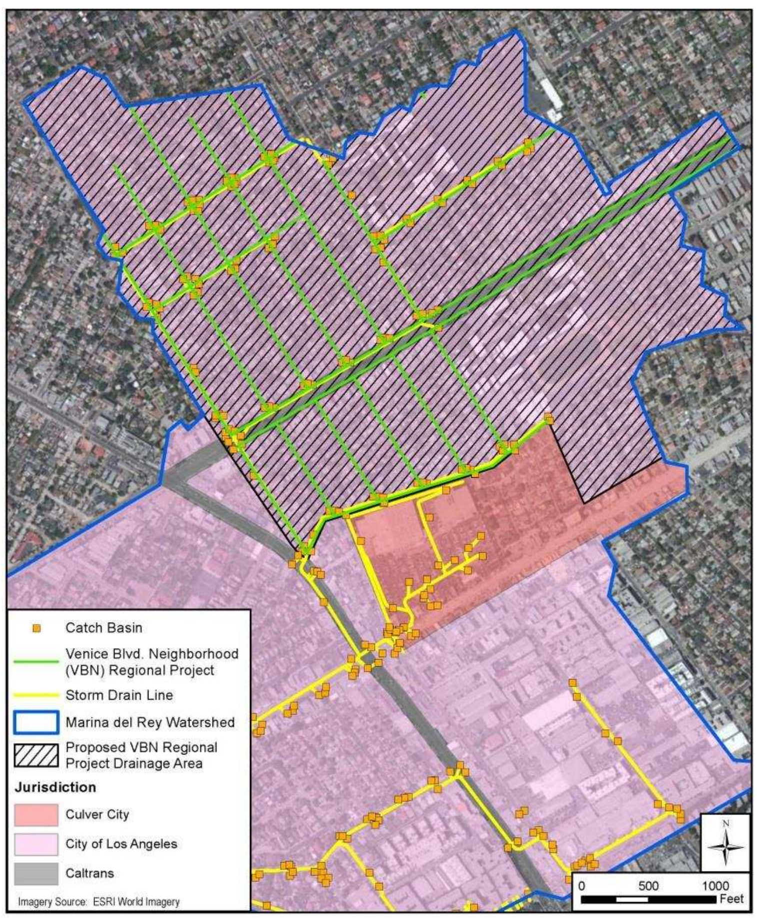


Figure 5-6: Proposed Drainage Area for the Venice Boulevard Neighborhood Green Street Regional Project

performed in several areas in Subwatershed 4 (Appendix E). Where investigated, the upper 9 to 12 feet of soils consist of clayey soils that exhibit very little to no ability to infiltrate runoff. Below these clayey materials, is a layer of course sand to silty-sand materials that exhibits the ability to infiltrate water.

In addition to subsurface conditions, a multitude of other considerations affect the area available for the adaptation of green streets. Crosswalks, street furniture, bike paths, soil conditions, and utilities need to be considered, necessitating substantive area-specific analysis. To account for these factors, a targeted analysis based on landuse type was conducted and scaled-up across the subwatershed for the implementation of the infiltration type green streets that will make up the Venice Blvd. Neighborhood Project. Design areas were selected to identify and design feasible green street BMPs in three different landuses in Subwatershed 4, multi-family residential (MFR), single family residential (SFR) and commercial/industrial (COMM) (Table 5-4, Figure 5-7).

Table 5-4: Venice Blvd. Neighborhood Project Green Street Design Areas

Land Use	Area ID	Depth to Groundwater (ft)	Perimeter Available for BMPs (ft)	Drainage Area (acres)	Runoff Coefficient	Design Runoff Volume (acre-ft)
Multi-Family Residential	MFR-4-1	23 to 28	720	0.66	0.65	0.0394
Single-Family Residential	SFR-4-1	22	1640	3.65	0.5	0.1674
Commercial/Industrial	COMM-4-1	20	910	1.03	0.85	0.0804

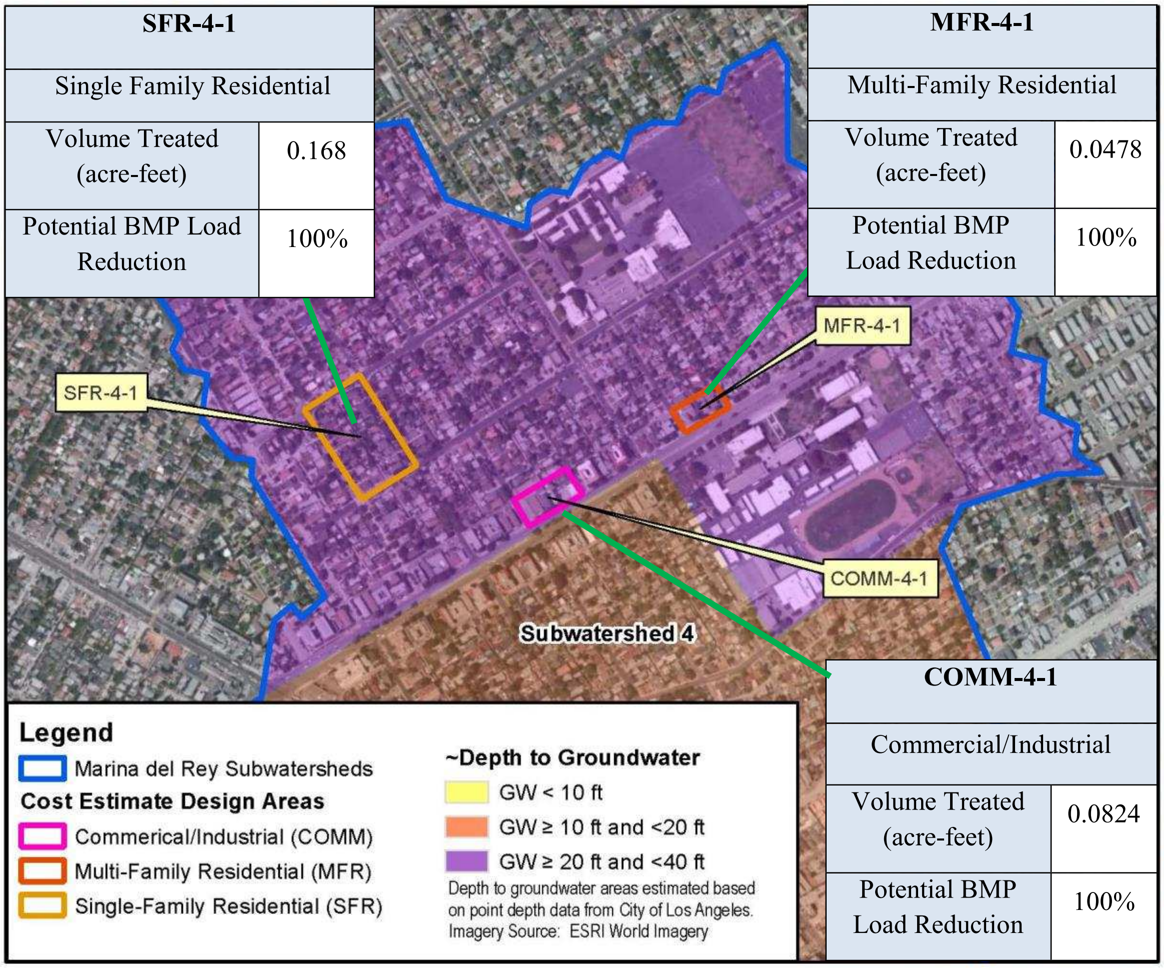
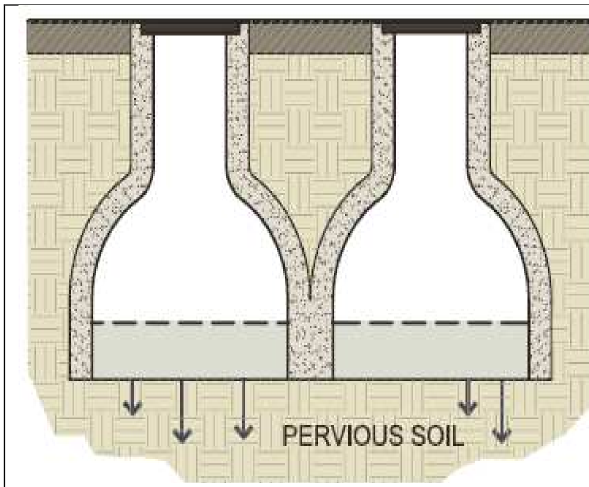


Figure 5-7: Venice Blvd. Neighborhood Project Design Areas

The design areas are representative of different landuse / groundwater depth combinations, public space limitations, roadway design, housing characteristics, and other factors discussed above. Drainage areas, design runoff metrics, block specific constraints, and concept BMP design assumptions were calculated for these design areas and are provided in Appendix A along with additional design parameters and detailed construction calculations.

For the design areas in the Venice Blvd. Neighborhood Project, infiltration galleries similar to those described in Section 5.2.3.1 would be feasible (Figure 5-8).



City of Los Angeles Low Impact Development Manual (City of Los Angeles, 2011a)

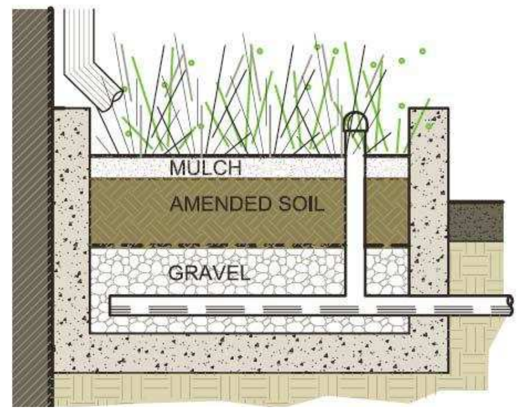
Figure 5-8: Example Infiltration Gallery

5.2.4 Future Potential Projects

5.2.4.1 Green Streets

Green streets will be needed throughout large areas of the MdR subwatersheds to achieve the water quality load reductions required to achieve compliance with the WLAs of the Toxics TMDL. For purposes of this analysis, a green street consists of BMPs installed along the driving surface or sidewalk adjacent to the main public thoroughfare (transportation land use).

Three main types of BMPs were included in the green street design analysis: infiltration-type BMPs (infiltration gallery – see Section 5.2.3.2 above); capture-type BMPs (sidewalk planters and downspout disconnections [Figure 5-9]) and filtration-type BMPs (sidewalk biofiltration and porous pavement with underdrains [Figure 5-10]).



City of Los Angeles (2011a)

Figure 5-9: Sidewalk Planter BMP Example

Figure 5-10: Example of Filtration BMP in Parking Lot 5 in Marina del Rey

City of Los Angeles Low Impact Development Manual (City of Los Angeles, 2011a)

The potential load reductions and design limitations associated with each of the infiltration, capture/reuse and filtration type BMPs considered for green streets in the MdR watershed are summarized in Table 5-5. Additional design parameters and detailed construction calculations are discussed in Appendix A.

Table 5-5: BMPs for Green Streets

Structural BMP	Load Reduction	Notes
Filtration- Porous Pavement (Road Design only)	63%	Filtration requires 24-72 hours and filtered flows are directed to the MS4. Volume of stormwater capture is limited to the capacity of the porous pavement. Requires routine annual sweeping. Vacuum sweeper recommended. *BMP design assumes a road grade of 1% and one 6-inch underdrain per 8-foot wide section of pavement.*
Biofiltration-Sidewalks	63%	Biofiltration requires 24-72 hours and units have effectively zero storage capacity. Stormwater attenuation by a cistern required (100% treatment volume). Flow is routed from and back into the MS4. Requires routine maintenance (weeding) and replacement of plants, as well as routine inspection and maintenance of the cistern.
Capture and Use	100%	Flow is routed from the MS4 into a subsurface cistern. Approximately 1300 square feet of vegetated area is needed to utilize the runoff volume captured in a 1000-gallon cistern within 14 days of an event. This type of BMP has limited feasibility in MdR watershed public right of way. If implemented as a downspout disconnect program on private property, a maximum load reduction of 20% is assumed to cut the runoff volume from a design area.
Infiltration-Sidewalks	100%	Flow directed from road via curb cuts. Requires routine maintenance (weeding) and replacement of plants. *BMP design assumes infiltration possible at 4 foot below grade.*
Infiltration-Porous Pavement	100%	Road level infiltration. Requires routine (at least monthly) sweeping. Vacuum sweeper recommended. *Road design assumes infiltration possible at 3-feet below grade. Sidewalk design (shallow infiltration design) assumes infiltration possible at 1.5-feet below grade. BMP design assumes a road grade of 1%.*
Infiltration-Infiltration Gallery	100%	Flow may be diverted from MS4, provided flow pre-treated by catch basin inserts. *Smallest BMP design assumes a minimum groundwater depth of 17 feet. This infiltration design was limited to the portion of subwatershed 4 with a depth to groundwater of ≥20 feet. BMP design assumes a road grade of 1%.*

The feasibility of the implementation of green streets depends upon many factors, including separation from the groundwater table, as well as spatial constraints of the project footprint and underlying soil types. In addition to subsurface conditions, a multitude of other considerations affect the area available for the adaptation of green streets. Crosswalks, street furniture, bike paths, soil conditions, and utilities need to be considered, necessitating substantive area-specific analysis.

Available groundwater data were used to delineate the MdR watershed into areas where infiltration type green streets would be feasible or not feasible based on the depth to groundwater. Near the harbor (Subwatershed 1) groundwater depths are very shallow (less than 10 feet) (Figure 5-2). The depth to groundwater increases as the distance from the harbor increases. Near the harbor, infiltration BMPs are not feasible and capture BMPs are limited to rain gardens (e.g., parkway bioretention) and cisterns or rain barrels. In these shallow groundwater areas, filtration (e.g., porous concrete with underdrain and proprietary filter devices such as the modular wetland systems) may be the predominant feasible BMP in the public thoroughfare. Additionally, porous pavement may be the only option to utilize in areas where there are no parkways. Figure 5-10 is an example of a filtration type BMP installed in a County owned parking lot (Parking Lot 5) in Marina del Rey.

Away from the harbor, where depths to ground are greater than 10 feet, there are opportunities for capture and infiltration type BMPs. Preliminary geotechnical investigations were performed in several areas in Subwatershed 4 and Subwatershed 3(Appendix E). Where investigated, the upper 9 to 12 feet of soils consist of clayey soils that exhibit very little to no ability to infiltrate runoff. Below these clayey materials, is an area of course sand to silty-sand materials that exhibits the ability to infiltrate water. North of Venice Boulevard the depth to groundwater is between 20 to 30 feet, and this area is where the infiltration green streets are proposed as the Venice Blvd. Neighborhood Project (Section 5.2.3.2 above).

As previously discussed, ground water depth is just one consideration when determining green street feasibility. Neighborhood characteristics such as street furniture, crosswalks, bike paths all need to be considered as do soil conditions and utilities. These factors necessitate substantive area-specific analysis.

In order to consider these factors, a watershed-wide, targeted analysis was conducted and scaled-up across each subwatershed for the implementation of green streets. A total of six example areas were used to develop and design feasible green streets BMPs in residential, commercial, and industrial areas representative of the conditions throughout the MdR watershed. Three of the design areas are located in Subwatershed 4 within the area for of the Venice Blvd. Neighborhood Project and are discussed in Section 5.2.3.2. The remaining design areas are listed in Table 5-6 and shown in Figure 5-7.

Table 5-6: Design Areas for Green Streets

Land Use	Area ID	Depth to Ground water (ft)	Perimeter Available for BMPs (ft)	Drainage Area (ac)	Runoff Coefficient	Design Runoff Volume (cft)
Multi-Family Residential	MFR-2	18	800	0.69	0.75	2,063
Multi-Family Residential	MFR-1	<10	300*	1.03	0.75	3,094
Single-Family Residential	SFR-3	12 to 13	1080	1.56	0.6	3,740
Commercial/Industrial	COMM-4-2	10 to 13	300**	2.86	0.85	9,701

*300ft length of road along Panay Way. No sidewalks.

**In large commercial parks, limited ROW access. Short length of block ~150ft. Driveways ~20ft.

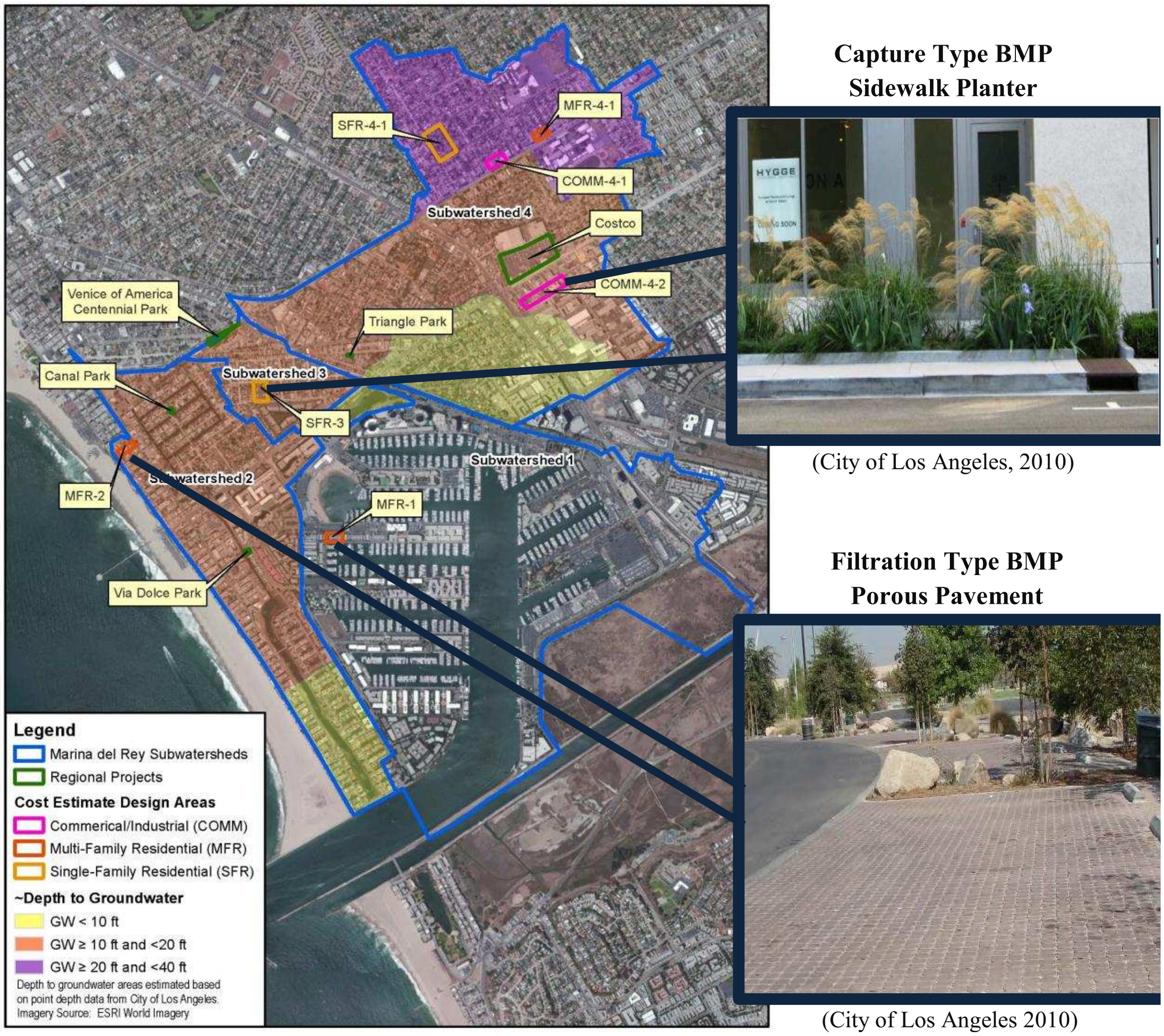


Figure 5-11: Project Design Areas and Example BMPs

The design areas are representative of different landuse / groundwater depth combinations, public space limitations, roadway design, housing characteristics, and other factors discussed above. Drainage areas, design runoff metrics, block specific constraints, and concept BMP design assumptions were calculated for these design areas. The design area analysis indicates that capture type BMPs such as sidewalk planters may be feasible at COMM-4-2 and at SFR-3 and that filtration type BMPs are feasible at MFR-2 and MFR-1 (Figure 5-11). Additional details are provided in Appendix A.

5.2.4.2 Parks

Four parks were considered for regional infiltration BMPs in the MdR watershed: Canal Park, Venice of America Park, Via Dolce Park, and Triangle Park (Figure 5-12). The specific design considerations are presented in the following subsections. A summary of the implementation costs is provided in Section 8.2.3. Detailed assumptions and calculations are provided separately in Appendix B.

Figure 5-12: Park Project Locations

5.2.4.2.1 Venice of America Centennial Park

Venice of America Centennial Park is located between north and south Venice Blvd., at the northern boundary of MdR watershed in Subwatershed 3 (park footprint of approximately 0.76 acres) Figure 5-12). The groundwater table is 17 feet deep; therefore, this facility could be optimally used as a subsurface infiltration gallery. The proposed design consists of 74 StormChamber infiltration units (8 rows of 9 chambers long) with a 30-inch rock bed (6 inches above the chambers and 24 inches below). The design covers a 3,463 square foot area. The proposed infiltration units will be able to capture 100% of the park drainage area, plus an additional 3.9 acres of tributary drainage area. Although the park has significantly more space available for BMP implementation, the park location near the boundary of the watershed limits the extent of the tributary drainage area (Figure 5-13).

Figure 5-13: Venice of America Centennial Park with Potential BMP Footprint Area

5.2.4.2.2 Canal Park

Canal Park is located at the intersection of Dell Avenue and Court D in Subwatershed 2 (park footprint of approximately 0.14 acres) (Figure 5-12). The groundwater table is 17 feet deep; therefore, the facility was also designed as a subsurface infiltration gallery. The proposed design consists of 58 StormChamber infiltration units within a 2,739 square foot area (52% of the park footprint) with a 30-inch rock bed (Figure 5-14).

Figure 5-14: Canal Park with Potential BMP Footprint Area

The proposed infiltration units will be designed to capture 100% of the park drainage area, plus an additional 3.3 acres of tributary drainage area. A review of the as-built drawings for the area identified existing porous pavement and infiltration-type BMPs along Carroll Canal Court at Grand Canal Court. A thorough review of existing infrastructure would be recommended as part of the planning stages of this project. Conceptually, stormwater runoff could be directed to Canal Park from the portion of Court D east of Dell Avenue.

5.2.4.2.3 Via Dolce Park

This vacant lot is located off Via Dolce in Subwatershed 2 (park footprint of approximately 0.21 acre) (Figure 5-12). The groundwater depth is 12 feet. The proposed design consists of a shallow groundwater capture and reuse system. Three 1,000-gallon subsurface cisterns may be installed below grade and plumbed to capture runoff by means of a catch basin insert installed in Via Dolce. Figure 5-15 includes a preliminary schematic of how the BMP may be placed in the park, and is shown for general illustrative purposes only. Approximately 0.14 acre of the park space (66% of the total park footprint) would be required as landscape in order to use the 85th percentile design storm. The park would be graded to capture its own runoff and may be landscaped with a combination of groundcover and native vegetation.

Figure 5-15: Via Dolce Park with Potential BMP Footprint Area

5.2.4.2.4 Triangle Park

Triangle Park is located on Marr Road in Subwatershed 4 (Figure 5-12). The park footprint is very small (approximately 0.1 acres) and includes a sand box and basketball court. Because the depth to groundwater is only 11 feet, the only non-filtration BMP option would involve replacing the sandbox area with a 900-gallon subsurface cistern and landscape area of similar design to the Via Dolce Park project (Figure 5-16). Because of the limited space available for landscaping, this site has the capacity to capture and reuse runoff from only a 0.5-acre tributary drainage area.

Figure 5-16: Triangle Park with Potential BMP Footprint Area

5.2.4.2.5 Additional Projects

If additional load reductions are required after implementation of the priority projects (Costco and the Venice Blvd. Neighborhood Project) and other BMPs described above, additional BMPs may be pursued to meet TMDL requirements including centralized BMPs on private property, and if necessary, sanitary sewer diversions. Sanitary sewer diversions would be designed to re-direct stormwater runoff to an above or below ground storage tank that would slowly discharge the stormwater to the sanitary sewer. It may be necessary to work with private land owners in order to place the storage tanks needed. Diversions would be pursued only if required watershed load reductions are not achieved after implementation of the other BMPs described in this EWMP and may be necessary to achieve WLAs in Subwatersheds 1A, 1B, and 3.

This type of capture-divert design could be implemented at the Boone Olive Pump Station. The existing system has the capacity to capture and treat the 85th percentile 24-hour storm event from a 3.5-acre tributary drainage area in Subwatershed 3. Runoff from an additional 31.5-acre drainage area in Subwatershed 4 may be redirected to the Boone Olive Pump Station to ensure TMDL compliance targets are met. The infrastructure necessary to divert this runoff was not assessed as part of this effort.

For Subwatersheds 1A and 1B, the maximum load reduction potential was assumed for all green street programs. For example, 100% roof runoff capture was assumed through targeted aggressive downspout disconnect programs implemented in single-family residential neighborhoods. The sanitary sewer diversion project was then sized to capture the remaining filtered stormwater runoff volume to achieve TMDL compliance targets.

The project-specific information and design parameters for each of the subwatershed sanitary sewer diversion projects are summarized in Table 5-7. The tank designs assume a 0.05 cubic foot per second discharge rate to the sanitary sewer and a drawdown period of no more than 14 days. Additional capacity was added to the tanks to account for a drawdown period of greater than 14 days. More details are presented in Appendix B.

Table 5-7: Sanitary Sewer Diversion Projects

Subwatersheds	Subwatershed 1A (Back Basins)	Subwatershed 1B (Front Basins)	Subwatershed 3 (Boone Olive) /Subwatershed 4 (Oxford Basin)
Design Treatment Area (ac)	22	48	35
Tank Capacity (gallons)	0.49 million	1.60 million	1.04 million
Redevelopment Area (acres)	0.3	0.7	0.5

5.3 Development and Redevelopment

The information presented in this section was compiled from various email communications with the County, City of Los Angeles, and City of Culver City. The projects were researched and those implemented prior to the last monitoring data used for modeling (02/02/2014) were not included in the analysis as they were already accounted for in the modeling.

The City of Los Angeles development and redevelopment acreage projections are based on projected growth percentages for each land-use type provided by the City. These percentages were used, along with the existing land use areas for each category, to project development and redevelopment project acreage for each subwatershed where the City of Los Angeles has jurisdiction. The results are summarized in Table 5-8. The area of the watershed within the jurisdiction of the City of Los Angeles is projected to include 26.29 acres of development and redevelopment land, corresponding to 2.42 % of the TMDL land area (does not include Subwatershed 2). Although the purpose of the Oxford Retention Basin Multi-Use Enhancement Project is flood control, its land area is included under the development/redevelopment projects as it is planned to manage its own stormwater runoff.

The net development and redevelopment area in the TMDL compliance area of the WMA, (i.e., Subwatershed 1, 3 and 4) is estimated to be 134.489 acres or 10.12 % of that area. Subwatershed 2 is under the jurisdiction of the City of Los Angeles (278.1 acres) and the County (46.8 acres) and has a total of 9.95 acres planned for development and/or redevelopment (Table 5-8).

Table 5-8: Potential Development and Redevelopment Projects Areas within the City of Los Angeles

Land Use Class	Yearly Rate	Area within the Jurisdiction of the City of LA	Incremental Development / Redevelopment Acreage					Cumulative Development / Redevelopment Area
	(%)	(acres)	(acres)					2015-2022
			2015	2016	2018	2021	2022	
	Subwatershed 1 (Harbor)							
Residential	0.18	12.91	0	0.02	0.02	0.02	0.02	0.09
Commercial and Services	0.15	9.31	0	0.01	0.01	0.01	0.01	0.06
Industrial/Mixed with Industrial	0.34	0.18	0	0	0	0	0	0
Education	0.16	0	0	0	0	0	0	0
Transportation	2.7	5.19	0	0.14	0.14	0.15	0.15	0.58
Total Area (acres)		27.58	0	0.18	0.18	0.19	0.19	0.73
Percent of Subwatershed 1 (%)		8.49%	0	0.05%	0.05%	0.05%	0.05%	0.20%
Percent of MdR Subwatersheds 1, 3, 4 (%)		2.54%	0	0.02%	0.02%	0.02%	0.02%	0.07%
	Subwatershed 3 (Boone Olive)							
Residential	0.18	44.03	0	0.08	0.08	0.08	0.08	0.32
Commercial and Services	0.15	1.63	0	0	0	0	0	0.01
Industrial/Mixed with Industrial	0.34	0.24	0	0	0	0	0	0
Education	0.16	0	0	0	0	0	0	0
Transportation	2.7	21.96	0	0.59	0.61	0.63	0.64	2.47
Total Area (acres)		67.86	0	0.68	0.69	0.71	0.73	2.8
Percent of Subwatershed 3 (%)		96.26%	0	0.96%	0.98%	1%	1.03%	3.97%
Percent of MdR Subwatersheds 1, 3, 4 (%)		6.26%	0	0.06%	0.06%	0.07%	0.07%	0.26%
	Subwatershed 4 (Oxford Basin)							
Residential	0.18	256.32	0	0.46	0.46	0.46	0.46	1.85
Commercial and Services	0.15	98.41	0	0.15	0.15	0.15	0.15	0.59
Industrial/Mixed with Industrial	0.34	27.03	0	0.09	0.09	0.09	0.09	0.37
Education	0.16	62.08	0	0.1	0.1	0.1	0.1	0.4
Transportation	2.7	141.75	0	3.83	3.93	4.04	4.15	15.94
Oxford Basin Project		3.6	0	3.6	3.6	3.6	3.6	3.6
Total Area (acres)		589.2	0	8.23	8.33	8.44	8.55	22.75
Percent of Subwatershed 4 (%)		91.39%	0	1.28%	1.29%	1.31%	1.33%	3.53%
Percent of MdR Subwatersheds 1, 3, 4 (%)		54.35%	0	0.76%	0.77%	0.78%	0.79%	2.10%
Total Area of MdR Subwatersheds 1, 3, 4 (acres)		684.64	0	9.08	9.21	9.33	9.47	26.29
Total Area of MdR Subwatersheds 1, 3, 4 (%)		63.16%	0	0.84%	0.85%	0.86%	0.87%	2.42%
	Subwatershed 2 (Non-TMDL Area)							
Residential	0.18	146.67	0	0.26	0.26	0.26	0.27	1.06
Commercial and Services	0.15	12.98	0	0.02	0.02	0.02	0.02	0.08
Industrial/Mixed with Industrial	0.34	0.22	0	0	0	0	0	0
Education	0.16	1.79	0	0	0	0	0	0.01
Transportation	2.7	78.21	0	2.11	2.17	2.23	2.29	8.8
Total Area Subwatershed 2 (acres)		239.88	0	2.4	2.46	2.52	2.58	9.95

Figure 5-17 presents the development and redevelopment projects planned for implementation during the timeframe of the EWMP in Subwatershed 1that are under the jurisdiction of the County of Los Angeles. Under County guidelines, these projects are required to have the capacity to treat 1.5 times the design volume of the 85th percentile 24-hour storm due to the inability to infiltrate stormwater runoff in this subwatershed due to shallow groundwater. Table 5-9 lists the project in Subwatershed 1 and 2 that the County has planned for redevelopment.

The MdR WMA is projected to have development and redevelopment projects on an estimated 79.28 acres within Subwatershed 1, under both the County and City of Los Angeles jurisdictions, corresponding to approximately 21.48 % of this subwatershed. This area includes the proposed parking lot retrofits previously mentioned in Section 5.1.1. The County has two parcels planned for redevelopment in Subwatershed 2, as summarized in Table 5-9. These redevelopment projects equate to 1.92 acres, or 0.59 percent of the subwatershed.

The City of Culver City does not have planned development and redevelopment projects during the implementation timeframe of this EWMP.

Figure 5-17: Subwatershed 1 Potential Redevelopment Parcels

Table 5-9: Subwatershed 1 and 2 Potential Development and Redevelopment Projects within the County of Los Angeles Jurisdiction

Parcel Number	Area (acres)*	Project Description
Subwatershed 1		
10	7.32	Neptune Apartments. Demolition of existing 136-unit apartment complex and development of a 400-unit complex.
15	10.44	Bar Harbor Apartments. Replace existing 288-unit apartment complex with 585-unit apartment complex.
14 /FF	2.05	Demolition of existing parking lot and development of 126-unit apartment complex.
28	8.50	Mariner's Bay. Rehabilitation.
42, 43	3.85, 2.39	Marina del Rey Hotel. Rehabilitation of the hotel and demolition and redevelopment of private boat anchorage.
44	9.72	Commercial Development BEI Project #187-07-003C. Redevelopment will include 85,069 square feet of new buildings with concrete paved parking, driveways and landscape areas.
52, GG	2.04, 0.68	Dry stack boat storage facility. Along with appurtenant office space, customer lounge, mast-up storage spaces, and parking. Sheriff's Department / Lifeguard Boatwright facility.
55, 56, W	0.51, 1.21, 4.28	Fisherman's Village. Demolition of Fisherman's village and parking, landscaping, and development of a new mixed use commercial plaza with multi-story parking structure.
7, 8, 9	5.03, 4.51, 3.68	Marriott Hotel and Wetland Park. Construction of hotel with restaurant and other auxiliary facilities. Development of public wetland and upland park.
95, LLS	1.70, 0.23	Demolition of existing office structures and development of commercial buildings and rehabilitation of existing restaurant.
145	2.08	Marina International Hotel. Interior and exterior renovation.
147/OT	1.62	Demolition of existing landside improvements and construction of 114-unit senior accommodation facility, retail space, parking structure, marine, commercial, and community park (Parcel 21).
21	2.58	Marine commercial, retail and yacht club project with a Community Park.
UR	1.82	Parking Lot Retrofit. Lot 5
Q	0.85	Parking Lot Retrofit. Lot 7.
NR	1.58	Parking Lot Retrofit. Lot 9.
40T	0.61	Parking Lot Retrofit. Library.
Total Area	**79.28**	
Percent of Subwatershed 1	**21.48%**	
Percent of TMDL AREA	**5.63%**	
Subwatershed 2		
95, LLS	1.70, 0.23	Demolition of existing office structures and development of commercial buildings and rehabilitation of existing restaurant.
Total Area (acres)	**1.92**	
Percent of Subwatershed 2	**0.59%**	
Percent of WMA	**0.14%**	

*Land area as provided in leased parcels data set.

5.4 Control Measures Type Summary

The structural BMPs described above represent many different capture, infiltration, and treatment control measure types based on the factors discussed in this section, including land use and groundwater level. Table 5-10 presents the acreage coverage corresponding to the various BMP types to be implemented within the watershed. The BMPs in these tables include all the structural measures discussed in this section, with the exception of the sanitary sewer diversions (additional BMPs).

Table 5-10: Summary of BMP Types by Subwatershed

BMPs	Subwatershed Area (acres)					
	1A	1B	3	4	Total TMDL Area	2
Subwatershed Total						
Regional Projects	0	0	7.4	292.9	52.9	3.5
Low Impact Development (LID)*	44.1	117.8	13.9	60.3	247.9	11.9
Green Streets**	52	132.1	49.2	285.5	854.9	85.2
Additional BMPs	0	0	0	0	0	0
Non-Structural Programs	0	0	0	0	0	0
Open Space (Misc.)	**8.2**	**14.67**	**-**	**7.06**	**29.93**	**-**
Total	**104.22**	**264.54**	**70.5**	**645.7**	**1,084.90**	**100.6**

*LID includes development/redevelopment plus downspout disconnect/cisterns

**Green streets – includes sidewalk swale, porous pavement, sidewalk filtration disconnect/cisterns

5.5 EWMP Non-Structural BMPs

The direct impact of non-structural BMPs, such as aggressive street sweeping, true source control, enhanced inspections, bird exclusion devices, and runoff reduction programs, is challenging to quantify. Supporting evidence and studies do exist, however, justifying the load reduction apportionment for various nonstructural programs that may be implemented within the MdR watershed.

The Toxics TMDL assumed that non-structural BMPs would reduce loads by 30% (LARWQCB, 2005). Based on the estimates presented in the Multi-Pollutant TMDL Implementation Plan for the Unincorporated Area of Marina del Rey Harbor Back Basins (LADPW, 2012), the total reduction that could be achieved from non-structural BMPs was approximated to be 33%; however, the plan used a conservative load reduction of 25%. For the purposes of the MdR EWMP, a more conservative percent reduction, 6.5%, was used and may be modified based on the adaptive management process of BMP observed performance, evaluation, and customization.

The positive impact of some existing programmatic BMPs may continue to increase over the period of the MS4 Permit as awareness increases and enforcement is strengthened. Other programs, such as street sweeping are assumed not to have an additional effect on water quality beyond what was already captured in the monitoring results used in the RAA effort; thus, there are no plans to modify the methods or frequency of such programs over the EWMP planning horizon.

The non-structural BMP programs proposed for the MdR watershed may include activities such as modeling updates and other studies, source control, catch basin cleaning, and industry targeted outreach and education, enforcement, and inspection programs. These are briefly discussed below and listed in Table 5-11.

True source control by targeting the actual pollutant source is very effective at reducing concentrations and/or loads. One example is product substitution campaigns and enforcement. Product substitution campaigns involve identifying products that contribute to pollutant loading and water quality degradation and substituting products that are less harmful to water quality. One example is legislation that reduced the concentration of copper in brake pads in California through the Brake Pad Partnership. Evaluating alternative types of fencing (i.e., replacing galvanized metal products), prohibiting and/or restricting use of outdoor architectural copper, and the reduction of zinc in tires are other potential programs. Programs can also identify environmentally friendly businesses and services (i.e., waterless, suds-less, organic, recycled materials, nontoxic.) in the MdR WMA. Other potential programs may include targeting specific areas or programs such as trash area maintenance, parking lots, streets, dry dock/boat maintenance areas, landscape management, pest maintenance, or on-land/in-water boat maintenance services in the watershed.

A targeted aggressive MS4 and catch basin cleaning program would evaluate the existing catch basin and MS4 cleaning program within the MdR and coordinate to ensure that a baseline loading pre- and post-standard cleaning is conducted. The cleaning program would then be modified to incorporate aggressive cleaning techniques such as dry-ice freezing, steam cleaning, and other available technologies or increased cleaning frequency to once-per-month frequency, or similar techniques. Targeted cleaning programs may target specific types of catchments (i.e., in parking lots or near restaurant facilities).

Institutional controls, regulatory changes and inspection and enforcement represent important aspects of nonstructural BMPs necessary to achieve reductions in contaminant loading for the MdR watershed. These non-structural solutions may incentivize targeted audiences to proactively modify behaviors and operations to avoid the need for regulatory enforcement. Such measures include code modifications as well as inspection and enforcement measures to ensure restaurants, parking garages, and other commercial facilities comply with the applicable codes. A voluntary-led program may be developed, including incentives, for those facilities that voluntarily install wet-weather and dry-weather runoff BMPs.

Outreach and education activities will have a role in enhancing community practices throughout the watershed. Examples include billboard campaigns to promote protective waste management practices such as recycling used motor oil and batteries, and environmentally sound boating practices, in addition to ordinance development to promote sound irrigation practices.

Table 5-11: Non-Structural BMPs within the MdR WMA

Non-Structural MCM Category	Proposed Non-Structural MCMs	Potential Contaminant Reduction (%)
Watershed Studies	Pollutant Loading Model and Database; Total Suspended Solids/Pollutant Correlations	
Source Control	Collaborative Environmentally Friendly Alternative Services Program; Product Substitution Campaign	4
Municipal Separate Storm Sewer System (MS4)	Targeted Aggressive MS4 and Catch Basin Cleaning Program	1
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	Code Survey and Modification; Targeted Inspections; Business-led Voluntary BMP Implementation Program	1
Community Outreach and Education	Outreach and Education; Environmentally Friendly Boating Program; Green Gardening, and Runoff Reduction Program	0.5
Total Contaminant Reduction (%)		**6.5**

6.0 REASONABLE ASSURANCE ANALYSIS

6.1 Reasonable Assurance Analysis Setup

The purpose of the RAA is to quantitatively demonstrate that the proposed control measures included in the EWMP will "achieve applicable WQBELs and/or RWLs with compliance deadlines during the Permit term" (Section C.5.b.iv.(5) of the 2012 MS4 Permit). The RAA requires the development of a modeling process to support the selection of BMPs as well as an adaptive customization and scheduling process to demonstrate and address compliance with the MS4 Permit. The RAA for the MdR watershed complies with the RAA guidelines provided by the LARWQCB to the extent practicable and applicable to the watershed.

The RAA analyses involved multiple steps starting with identification of the watershed modeling tool (Watershed Management Modeling System [WMMS]), characterization of the modeled area (MdR WMA), including land-use and existing BMPs, and evaluation of water and sediment quality monitoring data available for the WMA as of the date of modeling. This information was integrated into the model data inputs and used for calibration of the model to ensure, to the extent reasonable, the accurate representation of simulated watershed conditions. Once calibrated, the model was run for the WMA at a subwatershed level.

The results from the RAA analyses were used as guidelines in the identification of BMPs, including regional BMPs, to be implemented throughout the MdR WMA. This analysis incorporates the identification of development and redevelopment projects; potential customization of existing BMPs; and potential regional, centralized, and distributed BMPs necessary and sufficient for compliance.

Detailed information on the model configuration processes and model methodology can be found in Appendix C.

6.1.1 Modeling Tool Selection

The MdR EWMP Agencies have selected the Los Angeles County WMMS as the model to be used for the development of the MdR EWMP. WMMS conforms to the modeling system selection criteria set by the LARWQCB–led RAA committee and is based on a regional modeling approach that was developed to simulate the hydrology and transport of sediment and metals. The approach is based on the Hydrologic Simulation Program–FORTRAN (HSPF) and Loading Simulation Program C++ (LSPC), a version of HSPF recoded into C++. The regional approach has been used to support metals TMDLs for Ballona Creek and the Los Angeles River. WMMS simulates hydrology, sediment, and general water quality on land and is combined with a stream fate and transport model. Additional detailed information related to the WMMS is available and can be accessed on the WMMS website (http://www.LACountyWMMS.com).

WMMS was used to estimate the wet weather loading for the MdR WMA for the constituents of concern, including copper, lead, zinc, and TSS. The results are presented in terms of hourly volumes and loads. As part of the RAA, the watershed modeling tool was first used to model the monitored storm events in order to calibrate stormwater runoff volumes and pollutant loads to available measured data. The calibrated model was then used to simulate the critical year, which was determined to be the 2009 wet season (Section 6.1.4) in order to determine the quantity of load reductions that will be necessary to meet the applicable TMDL requirements.

6.1.2 WMMS Model Calibration

Monitoring data collected as part of the Toxics TMDL CMP were used to calibrate the storm water runoff volumes and pollutant loads generated by WMMS for the MdR WMA. These monitoring data included 27 monitored storm events at 5 sites (MdR-3, MdR-4, MdR-5, MdRU-C-1, MdRU-C-2) (Figure 6-1) over 4 wet seasons (2010 – 2013) (WESTON, 2014a) (Figure 6-1).

Figure 6-1: Toxics TMDL Outfall Monitoring Locations

At the time of modeling, WMMS rain gauge data were available through April 2012; therefore hourly data recorded at the Electric Avenue Pumping Plan (Gauge AL461) were obtained and incorporated into WMMS. Land use values for the drainage area to each monitored site were also incorporated into the model. The summary of the land use for the drainage area to each monitored location is provided in Table 6-1. Detailed information is presented in the MdR Coordinated Integrated Monitoring Program (CIMP). WMMS model runs were performed for the monitoring periods for each monitored site drainage area.

Table 6-1: Monitoring Locations – Land Use Summary

Land Use Type	MdR-3	MdR-4	MdR-5	MdRU-C-1	MdRU-C-2
High Density Single-Family Residential	114.2	27.8	22.9		
Low Density Single-Family Residential Moderate		0.8			
Multi-Family Residential	54.6	15.1	21.1		4.5
Commercial	42.5	29.8	2.9	0.3	
Institutional	57.8		1.4		
Industrial	0.8	50.1	0.2		
Secondary Roads	106.5	29.2	22.0	2.3	2.0
Vacant		0.6			
Total	**376.4**	**153.4**	**70.5**	**2.6**	**6.5**

6.1.2.1 Runoff Volume Calibration

The modeled stormwater runoff volumes were compared to the measured volumes. Calibration of the model was performed by changing the percentages of impervious cover associated with the various land use types for each drainage area (e.g., if the model overestimated runoff, then the overall percent of impervious cover was reduced proportionally for all applicable land use types). Validation of the model was performed by running the models with the new impervious percentages and comparing the model results to the measured results. The summary of the storm water runoff volume calibration is provided in Table 6-2. Post calibrated results all fall into the RAA Guidance "Very Good" category (<10% difference)

Table 6-2: Stormwater Runoff Volume Calibration Summary

Site	Area (acres)	Uncalibrated Results		Impervious Correction Factor	Calibrated Results	
		Impervious Percentage	Runoff Volume Percent Difference		Impervious Percentage	Runoff Volume Percent Difference
MdR-3	376.4	63.4%	24.3%	0.81	51.4%	2.1%
MdR-4	153.4	75.9%	38.8%	0.72	54.6%	-0.5%
MdR-5	70.5	47.2%	-19.0%	1.20	57.4%	-0.2%
MdRU-C-1	2.6	66.6%	-11.6%	0.784	52.2%	1.4%
MdRU-C-2	6.5	56.4%	15.9%	0.863	48.7%	0.7%

6.1.2.2 Zinc Loading Calibration

A comparison of CMP chemistry data to the Toxic Pollutants TMDL indicated that zinc is the constituent that requires the largest load reduction percentage (see Appendix F for data); therefore, the model calibration focused on zinc. Modeled flow volumes were combined with CMP measured zinc concentrations to compute the zinc loading for the monitored storm events. Using the modeled flows eliminated the potential to introduce error based on the difference between modeled and measured flow volumes for individual storm events. This method also resulted in improved model fits. The measured load was compared to modeled zinc loads for these monitored storm events. A correction factor was computed based on the proportion of measured zinc load to modeled zinc load for each monitored site. This correction factor was used to make adjustments to the WMMS wash-off potency factor (POTFW) constant loading parameter values. Modeling was performed with these new POTFW parameters, and the modeled loads were compared to the measured load to verify that the modeling was calibrated for the key pollutant zinc. The storm water runoff volume calibration is summarized in Table 6-3. Modeling results were within the RAA process guidelines, and the % difference was less than those listed in the RAA guidance for very good.

Table 6-3: Stormwater Runoff Zinc Loading Calibration Summary

Site	Area (acres)	Uncalibrated Zinc Loading Percent Difference	Zinc Modeling Correction Factor	Post-Calibration Zinc Loading Percent Difference*
MdR-3	376.4	-29.5%	1.42	<1%
MdR-4	153.4	56.3%	0.64	<1%
MdR-5	70.5	138.1%	0.42	<1%
MdRU-C-1	2.6	20.5%	0.83	<1%
MdRU-C-2	6.5	26.3%	0.79	<1%

*load modeling was based on modeled flows, and therefore the percent difference values were very low, less than 1% and defined as "very good."

6.1.2.3 TSS Calibration

The Toxic TMDL is a sediment-based TMDL that considers the reduction in TSS equivalent to toxic pollutants reductions. WMMS was, therefore, also calibrated for the constituent TSS. Modeled flow volumes were combined with CMP-measured TSS concentrations to compute the sediment loading for the monitored storm events. The loading was compared to modeled TSS loads for these monitored storm events. A correction factor was computed based on the proportion of measured TSS load to modeled TSS load for each monitored site. The WMMS coding does not have POTFW parameter for TSS; therefore, the computed TSS correction factor for each monitored site was applied to the model output using a spreadsheet (post-process adjustment). The modeling results, with the TSS correction factor applied, were compared to the measured TSS load to verify modeling was calibrated for the TSS. The stormwater runoff volume calibration is summarized in Table 6-4.

Table 6-4: Stormwater Runoff TSS Loading Calibration Summary

Site	Area (acres)	Uncalibrated TSS Loading Percent Difference	TSS Modeling Correction Factor	Post-Calibration TSS Loading Percent Difference*
MdR-3	376.4	-39.2%	1.644	<1%
MdR-4	153.4	65.3%	0.605	<1%
MdR-5	70.5	136.4%	0.423	<1%
MdRU-C-1	2.6	-40.6%	1.685	<1%
MdRU-C-2	6.5	-19.2%	1.24	<1%

*load modeling was based on modeled flows, and therefore the percent difference values were very low, less than 1% and defined as "very good."

6.1.3 Subwatershed Modeling Parameters

The MdR WMA applicable to the EWMP consists of approximately 1,409 acres divided into four subwatershed areas (Figure 1-2). For more information regarding modeling land-use see Appendix C.

Table 6-5 provides a summary of the land use associated with each subwatershed area. Subwatershed 1 is divided into Subwatershed 1A, which drains to the Back Basins of the harbor (Basins D, E, and F) and Subwatershed 1B, which drains to the Front Basins of the harbor (Basins A, B, C, G, and H).

Table 6-5: Subwatershed Land Use Summary

Land Use Type	Subwatershed 1A (Front Basins)		Subwatershed 1B (Back Basins)		Subwatershed 2 (Ballona Lagoon)		Subwatershed 3 (Boone Olive)		Subwatershed 4 (Oxford Basin)	
	Area (acres)	Imp. %	Area (acres)	Imp. %	Area (acres)	Imp. %	Area (acres)	Imp. %	Area (acres)	Imp. %
High Density Single-Family Residential	-	-	-	-	45.8	42.2%	22.9	49.3%	166.3	33.9%
Low Density Single-Family Res. Moderate	0.4	6.0%	1.4	19.3%	-	-	-	-	0.8	7.9%
Multi-Family Res.	17.3	63.3%	119.8	62.3%	131.8	59.8%	21.1	48.3%	96.3	44.7%
Commercial	65.6	70.6%	94.3	63.8%	23.2	92.6%	2.9	95.0%	129.7	69.3%
Institutional	0.7	71.3%	8.2	63.3%	10.2	85.3%	1.4	95.0%	63.6	64.4%
Industrial	-	-	-	-	0.2	0.0%	0.2	95.0%	27.0	69.8%
Secondary Roads	11.8	59.8%	26.2	53.6%	83.3	67.9%	22.0	67.0%	154.8	53.5%
Vacant/ Open Space	8.2	0%	14.7	0%	33.3	0.0%	0.0	0.0%	7.1	0.0%
Total	**104.2**		**264.5**		**327.7**		**70.5**		**645.7**	

IMP - Impervious

Subwatershed 2 is not included as part of the Toxic TMDL or the Bacteria TMDL, and no CMP monitoring locations were located in the Subwatershed 2 area. Therefore, the Subwatershed 2 area was modeled without changing the calibration parameters established during the development of WMMS. The results of the Subwatershed 2 modeling are presented in this document to provide an approximate estimate of the existing conditions. Future monitoring may allow for calibration of WMMS specific to Subwatershed 2.

The calibration parameters (correction values) determined for the monitoring sites were applied to the respective subwatershed areas. The MdRU-C-1 Site is located within the Subwatershed 1 area (Figure 6-1); therefore, the MdRU-C-1 correction factors were used for Subwatershed 1. Subwatershed 3 corresponds directly to MdR-5. Subwatershed 4 includes MdR-3, MdR-4, and MdRU-C-2, and an additional 126.3 acres of unmonitored area (Figure 6-1). Therefore, modeling for Subwatershed 4 included performing four different models, including one for each of the three monitored drainage areas with the corresponding correction factors determined through the calibration process and a fourth model that included the unmonitored areas with correction factors based on the area-weighted average of the correction factors for the three monitored drainage areas. A summary of the correction factors associated with the monitored locations and subwatershed areas is provided in Table 6-6.

The results of the subwatershed modeling using WMMS were used as the foundation to perform calculations that included the existing pollutant loading, required load reductions, as well as load reductions possible using various types of BMPs. Modeling data (input and output files) are presented in Appendix C.

Table 6-6: Modeling Correction Factor Summary

Site	Area (acres)	Impervious Correction Factor	Zinc Correction Factor	TSS Correction Factor
MdR-3	376.4	0.81	1.42	1.64
MdR-4	153.4	0.72	0.64	0.605
MdR-5	70.5	1.20	0.42	0.423
MdRU-C-1	2.6	0.784	0.83	1.685
MdRU-C-2	6.5	0.863	0.79	1.24
Subwatershed 1A	104.2	0.784	0.83	1.685
Subwatershed 1B	264.5	0.784	0.83	1.685
Subwatershed 2	327.7	1.0	1.0	1.0
Subwatershed 3	70.5	1.195	0.421	0.423
Subwatershed 4	645.7	0.785	1.19	1.338

6.1.4 Toxic Pollutants Critical Period

In accordance with the Toxics TMDL and the RAA Guidance Document, the critical period for toxic pollutants for the MdR WMA was determined to be the 2009 rainfall year (July 1, 2009 to June 30, 2010). An analysis of the Los Angeles International Airport (LAX) rain gauge data spanning from 1948 to 2000 indicates that the average rainfall year is 12.43 inches. Based on the available LAX data (1940 to 2013) the rainfall year closest to this average value is 2009, with rainfall of 12.42 inches. The rain gauge data used by WMMS for 2009 have a total rainfall year value of 14.63 inches. More information on the critical year determination is provided in Appendix C.

6.1.5 Continuous Simulation Model (Toxic Pollutants)

To analyze the load reductions that may be achieved through implementing BMPs other than those designed to capture and infiltrate or reuse runoff associated with the 85th percentile storm event, continuous simulations models (CSMs) of the four watersheds were prepared to simulate how the combination of various types of BMPs would function to reduce pollutant loads during the critical year.

Consistent with the output of WMMS, the CSMs were prepared based on hourly time steps throughout the critical year. The CSMs exclude the portion of the subwatersheds that drain to BMPs designed to capture and infiltrate or reuse the 85th percentile storm event. For the remainder of the subwatershed, the CSMs perform calculations at each time step for different types of BMPs that may be implemented, including filtration (flow through treatment) BMPs, BMPs that capture runoff first and then perform treatment, BMPs that capture and infiltrate or reuse (with varying capture capacity), and areas where no BMPs are proposed, if applicable. These time step calculations include computing the portion of runoff generated in the drainage areas that would be treated or captured, whichever is applicable, by the proposed BMPs, the load remaining in the runoff after treatment, and the runoff and load that would bypass the BMPs (exceed the capacity of the selected BMPs). For BMPs that incorporate runoff capture, the CSM computes the recharge or drawdown volume of the systems that occurs during each time step.

The programing allows the user to vary certain parameters associated with the BMPs, including the drainage area (acres), treatment maximum flow rate if applicable (inches per hour associated with rainfall), BMP load reduction effectiveness, storage capacity if applicable (inches of rainfall), drainage area runoff coefficient, and maximum drawdown time (units of days) for BMPs that include capture. The user is provided a calculation summary that is dynamically linked to the time step calculations. The summary also includes the total modeled zinc load in the subwatershed, the targeted load reduction based on the Toxics TMDL waste load allocation allotted to the subwatershed, and the load reduction achieved through the combination of user-selected BMPs. The user can then make adjustments of the various BMP parameters until the desired load reductions are achieved.

More details including the key parameters used and the calculation methods relating to the CSMs are provided in Appendix C.

6.1.6 Continuous Simulation Model (Bacteria)

A bacteria CSM was prepared to calculate the existing fecal coliform loading into the Back Basins of the harbor. The bacteria CSM performs hourly time step calculations based on WMMS output data. WMMS provides data on fecal coliform loading from modeled watersheds; however, the CMP was focused on toxic pollutants and did not include sampling for and analyzing bacteria. Therefore, data are not currently available to calibrate the WMMS tool. The suggested average event mean concentrations (EMCs) for fecal coliform provided in the RAA Guidance Document were used to calculate a composite (or comingled) EMC for the Back Basin drainage area based on the suggested EMC, land use area, and land use impervious cover percentage. The data used and the results of these composite EMC calculations are provided in Table 6-7. The bacteria CSM used the composite EMC to calculate the bacteria loading being discharged from the subwatersheds based on the modeled runoff volume and composite EMC value. Load reductions were based on the volume of runoff reduction (capture) achieved by the selected BMPs for the bacteria analysis. The target load reduction analysis is discussed in more detail in Appendix C.

Table 6-7: Fecal Coliform Event Mean Concentration Calculation Summary

Land Use Type	Fecal Coliform EMC* (MPN/ 100 ml)	Subwatershed 1A		Subwatershed 3		Subwatershed 4		Back Basin Drainage Area	
		Area (acres)	Imp. Cover	Area (acres)	Imp. Cover	Area (acres)	Imp. Cover	Area (acres)	Imp. Cover
High Density Single-Family Residential	3.11E+04	0.0	32.9%	22.9	49.3%	166.3	33.9%	189.3	35.7%
Low Density Single-Family Residential Moderate	3.11E+04	0.4	6.0%	0.0	0.0%	0.8	7.9%	1.3	7.2%
Multi-Family Residential	1.18E+04	17.3	63.3%	21.1	48.3%	96.3	44.7%	134.7	47.7%
Commercial	7.99E+04	65.6	70.6%	2.9	95.0%	129.7	69.3%	198.2	70.1%
Institutional	7.99E+04	0.7	71.3%	1.4	95.0%	63.6	64.4%	65.7	65.1%
Industrial	3.76E+03	0.2	42.0%	0.2	95.0%	27.0	69.8%	27.4	69.8%
Secondary Roads	1.68E+03	11.8	59.8%	22.0	67.0%	154.8	53.5%	188.6	55.5%
Vacant	6.31E+03	8.2	0.0%	0.0	0.0%	7.1	0.0%	15.3	0.0%
Total		**104.2**	**62.3%**	**70.5**	**57.4%**	**645.7**	**51.4%**	**820.4**	**53.3%**
Composite EMC (MPN/ 100 ml)		**5.98E+04**		**2.02E+4**		**3.89E+4**		**4.03E+4**	

* Source LARWQCB, 2014
IMP = Impervious

The total bacteria load and reduction in bacteria needed to obtain compliance with the Bacteria TMDL allowable exceedance days was calculated using the CSM described above. Additional details of this analysis may be found in Appendix C. The results indicated that a reduction of 30% would be necessary to achieve compliance with the Bacteria TMDL. The load reduction associated with meeting the WLA for zinc requires capture and/or treatment of much greater volumes (95% reduction) of runoff than that required to meet the allowable exceedance days for the Bacteria TMDL. Therefore, BMPs will be designed to address the greater reduction requirement of the Toxics TMDL, which will also treat the waters for bacteria at a level greater than the required load reduction.

6.2 Reasonable Assurance Analysis Existing Conditions and Top Down Estimation of Best Management Practices

The calibrated WMMS model and the CSMs prepared for the MdR subwatersheds were used to estimate the current annual loading and associated required load reductions. Based on the estimated required load reductions, hypothetical quantities of various types of BMPs were selected and incorporated into the CSM. The CSM allowed BMP quantities and capacities to be varied until the required load reductions were achieved in the model. This is considered a top down approach, because it focuses on the volume of storm runoff that is required to be captured or treated and the associated BMPs needed to do so. The top down approach does not consider site constraints, such as geology, depths to groundwater, existing infrastructure, costs, and other important factors. The top-down approach is useful for providing managers with an understanding of the types of BMPs that may be used to achieve the required load reductions in an unconstrained environment. There are many site constraints within the MdR watershed, which are discussed in more detail in Section 4and were considered during BMP selection.

6.2.1 Toxics TMDL Existing Conditions Water Quality Modeling

As previously described in more detail, the WMMS tool was calibrated and used to model existing conditions within the MdR WMA. The output data from WMMS were then used in a CSM prepared for each subwatershed to determine the load reduction required to achieve compliance with applicable TMDLs and the various combinations of BMPs (besides those designed to capture and infiltrate or reuse the 85th percentile storm event) that could be used to achieve those load reductions. Scenarios were evaluated for each subwatershed area that included (1) 0% of the area draining to BMPs that capture and infiltrate or reuse and 100% of the area draining to other types of BMPs and (2) 50% of the area draining to BMPs that capture and infiltrate or reuse and 50% of the area draining to other types of BMPs. For each of these scenarios, the amount of drainage area treated by filtration type MCMs was varied to include the following factors: zero filtration, medium amount of area treated by filtration BMPs, and the maximum amount of area that could be treated by filtration BMPs. Details of the analysis can be found in Appendix C.

6.3 Selected BMPs Reasonable Assurance Analysis Results

As discussed in Section 3.2.3, under the MS4 Permit, compliance with the sediment WLAs for copper, lead, zinc, chlordane, p'p-DDE, and total DDT may be demonstrated by any one of three different means: (a) qualitative sediment condition of unimpacted or likely unimpacted by the interpretation and integration of multiple lines of evidence is met, (b) sediment numeric targets are met in bed sediments, or *(c) final sediment WLAs are met*. Also under the MS4 Permit, compliance with the sediment WLAs for PCBs may be demonstrated by any of four different means: (a) fish tissue targets are met in species resident to the waterbody, *(b) final sediment allocations are met*, (c) sediment numeric targets to protect fish tissue are met in bed sediments, or (d) demonstrate that the sediment quality condition protective of fish tissue is achieved in accordance with the Statewide Enclosed Bays and Estuaries Plan, as amended to address contaminants in resident finfish and wildlife..

This EWMP focuses on demonstrating that compliance may be achieved through meeting final sediment WLAs for the contaminants in the MdR Toxics TMDL. This RAA delivers a quantitative demonstration, in accordance with the MS4 Permit, that the proposed BMPs will achieve interim and final WLAs. This analysis aims to provide reasonable assurance that the BMPs selected for the MdR WMA will be sufficient to meet the interim and final numeric WLAs, through stormwater capture, filtration, and diversion, and associated TSS loading reductions. In addition to the BMPs selected based on the RAA analysis, ongoing projects, including the Oxford Basin Multi-Use Enhancement Project, will provide additional water quality benefits, such as serving as a sink for sediment-bound contaminants from the watershed. Oxford Basin is located to the north of Basin E, and receives wet weather runoff from Subwatershed 4. The RAA analysis does not include any benefits from the Oxford Basin project, as the project is still under construction. Therefore, the BMPs as proposed may not all be necessary to achieve TMDL compliance.

The proposed BMPs will be implemented where feasible and within budgetary constraints. As additional data become available through monitoring and the completion of applicable special studies, the MdR EWMP Agencies may elect to demonstrate compliance through one of the above-mentioned other means.

The effectiveness of the selected BMPs and control measures will be verified through the monitoring program developed separately under the CIMP. Based on the monitoring data analysis and results, the implemented BMPs will be adjusted as necessary to ensure adequate performance and the overall BMPs implementation schedule will be reassessed.

The diagram presented in Figure 6-2 depicts the iterative multistage nature of the BMP selection process necessary to ensure that optimal BMP strategies combinations are selected while accounting for the complex relational dynamics between the different selection considerations, such as cost, risk, and effectiveness.

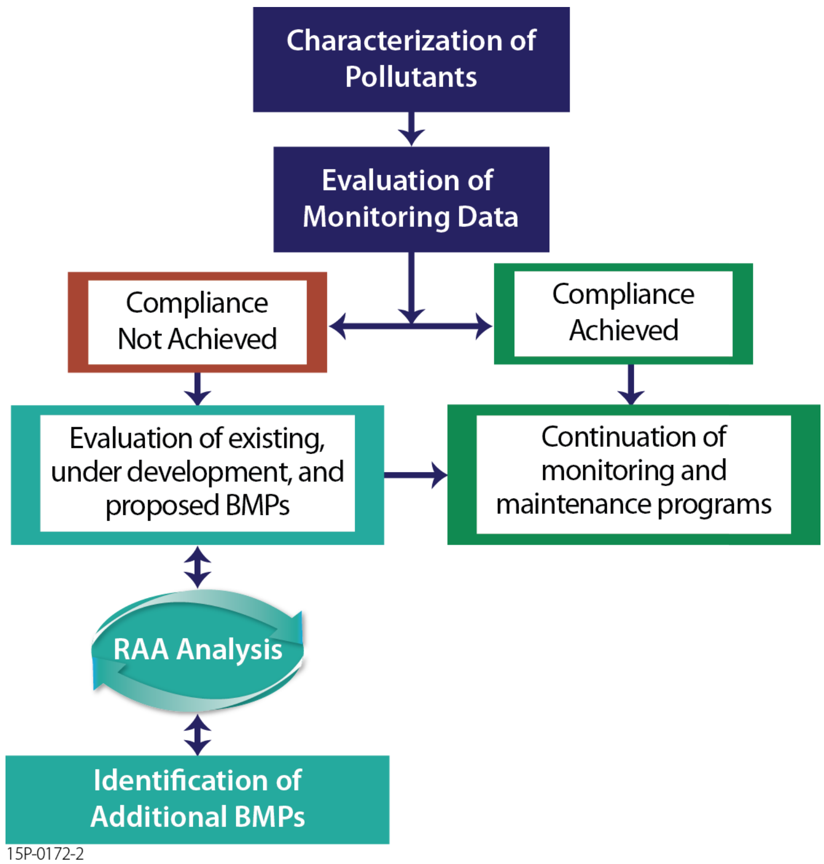


Figure 6-2: Conceptual Diagram of EWMP BMPs Implementation Analysis

The selected BMPs listed in Section 5.0 were modeled to estimate the annual capture and treatment volumes and load reductions for the critical wet year (2009). The WMMS tool was used, and the WMMS output was incorporated into the CSM for each subwatershed (see Appendix C for details). The annual results are summarized in Table 6-8.

For the non-TMDL applicable Subwatershed 2 the selected BMPs listed in Section 6.3 were modeled to estimate the annual capture and treatment volumes and load reductions for the critical wet year (2009). Similar to the modeling for drainage areas to the Front and Back Basins, Subwatershed 2 was modeled using WMMS, and the output was incorporated into the CSM to estimate BMP volumes and load reductions. Results of the analysis are included in Table 6-8.

Table 6-8: Basins Drainage Area Summary of Modeled Volumes and Load Reduction – Critical Wet Year

Parameter (units)	Sub-Watershed 1A (Back Basins)	Sub-Watershed 1B (Front Basins)	Sub-Watershed 3 (Boone Olive)	Sub-Watershed 4 (Oxford Basin)	TMDL Runoff Area Total	Sub-Watershed 2 (Non-TMDL)
Total Area (acres)	104.2	264.5	70.5	645.7	1,084.9	327.7
Runoff Area (acres)	96.0	249.9	70.5	638.6	1,054.9	294.4
Total Rainfall (in)	14.6	14.6	14.6	14.6	14.6	14.6
Total Runoff (acre-ft)	71.9	171.8	44.7	369.9	658.3	203.9
Drainage Area TSS Load (kg TSS)	7,759	18,729	1,327	36,698	64,513	14,194
Target Load Reduction	96.6%	95.5%	87.4%	95.4%	95.3%	21.5%
Regional BMPs (Costco, Parks, and Venice Blvd. Neighborhood Project)						
Capture Area (acres)	-	-	7.4	292.9	300.3	3.5
Capture Area (%)	-	-	10.5%	45.9%	28.5%	1.2%
Volume Capture (acre-ft)	-	-	3.7	139.1	142.7	1.4
Volume Capture (%)	-	-	8.0%	45.5%	23.7%	0.7%
Capture Load Reduction (kg TSS)	-	-	122	14,281	14,403	112.8
Capture Load Reduction	-	-	9.2%	38.9%	22.3%	0.8%
Green Streets BMPs						
Capture Area (acres)	52	132.1	49.2	285.5	518.7	85.2
Capture Area (%)	54.1%	52.9%	69.8%	44.7%	49.2%	26.0%
Volume Capture (acre-ft)	31.5	76.8	26.5	136.7	271.5	41.97
Volume Capture (%)	54.7%	53.3%	58.1%	44.8%	45.0%	21.0%
*Capture Load Reduction (kg TSS)	2,624	6,301	695	13,630	23,250	2,626.2
Capture Load Reduction	33.8%	33.6%	52.4%	37.1%	36.0%	19%
Low Impact Development (LID) BMPs						
Filtration Area (acres)	44.1	117.8	13.9	60.3	236.0	11.9
Filtration Area (%)	45.9%	47.1%	19.7%	9.4%	22.4%	4.0%
Volume Treated (acre-ft)	26.1	67.4	7.2	29.7	130.5	7.2
Volume Treated (%)	45.3%	46.7%	15.9%	9.7%	21.6%	3.5%
Filtration Load Reduction (kg TSS)	2,629.7	6,370.6	213.3	2,879.2	12,093	328.5
Filtration Load Reduction	33.9%	34.0%	16.1%	7.8%	18.7%	2.3%
Diversion BMPs						
Diverted Volume (acre-ft	-	-	8.2	-	-	-
Diverted Volume (%)	-	-	18.3%	-	-	-
Diverted Load Reduction (kg TSS)	1,736.8**	3,997.5**	103.1	1,834.8**	7,672.2	-
Diverted Load Reduction (%)	-	-	7.8%	-	-	-
Non-Structural BMPs						
Load Reduction (kg TSS)	504.3	1,217.4	86.3	2,385.4	4,193.3	-
Subwatershed Totals						
BMP Area (acres)	96.1	249.9	70.5	638.7	1,055.0	100.6
BMP Area (%)	100.0%	100.0%	100.0%	100.0%	100.0%	33.8%
BMP Volume (acre-ft)	57.6	144.2	37.4	305.5	544.7	50.5
BMP Volume (%)	80.0%	84.0%	83.5%	82.6%	82.7%	24.8%
BMP Load Reduction (kg TSS)	7,495.2†	17,886.2†	1,219.40	35,009.9†	61,610.7†	3,067.5
BMP Load Reduction	**96.6%†**	**95.5%†**	**91.9%**	**95.4%†**	**95.5%†**	**21.6%**

*In accordance with the RAA Guidance document, capture load reduction calculations are based on the drainage area achieving annual load reduction targets (i.e., designed for the 85th percentile event and thus in compliance with guidance).

**These additional reductions necessary to achieve compliance may include diversions, and will be determined based on the adaptive management process results.

†Includes additional reductions through diversions that will be determined based on adaptive management process.

7.0 MdR EWMP IMPLEMENTATION PLAN AND SCHEDULE

As previously mentioned, the MdR watershed is subject to subject to three TMDLs; the Santa Monica Bay Nearshore Debris TMDL, the Marina del Rey Harbor Mother's Beach and Back Basin Bacteria TMDL, and the Toxic Pollutants in Marina del Rey Harbor TMDL. Because the compliance schedule for the Toxics TMDL is the most aggressive, the Toxics WLAs were used as the primary scheduling driver for BMP implementation. . Once projects were scheduled in accordance with the Toxics TMDL goals (Table 7-1), Trash TMDL and Bacterial TMDL load reduction goals were evaluated, and additional structural and/or non-structural controls, were identified. It is worth noting that MdR EWMP Agencies have elected to demonstrate Toxics TMDL compliance through meeting final sediment WLAs for the contaminants in the TMDL. Further studies, including a planned Stressor ID Study in 2016 or effectiveness monitoring at the Oxford Basin Multi-use Enhancement Project, may indicate Toxics TMDL compliance through alternative means and may impact the implementation schedule.

To meet the compliance milestones, a phased implementation approach using a combination of structural and non-structural strategies designed specifically to reduce toxic pollutant and bacterial loading to MdR will be implemented. As detailed in the RAA section, zinc loading requires the largest load reduction and is thus the compliance driver for the Toxics TMDL (i.e., based on available data, if BMPs are implemented to achieve zinc WLA, then other toxic pollutant loads would also be below WLAs).

Table 7-1: Summary of Marina del Rey Subwatershed RAA-Required Zinc Load Reductions

	Subwatershed					EWMP Watershed[1]	
	1A	1B	2	3	4	Back Basins[2]	Front Basins[3]
Required Zinc Percent Load Reduction	96.2	95.8	21.5	88.0	95.6	95.1	95.8
Interim / Final Toxics TMDL Compliance Date	2016/2018	2019/2021	NA	2016/2018	2016/2018	2016/2018	2019/2021

[1]Excludes Subwatershed 2 area since it is outside the geographical area of MdR subject to TMDL compliance
[2]Tributary drainage area of Subwatersheds 1A, 3, and 4
[3]Tributary drainage area of Subwatershed 1B

7.1 Load Reduction Schedule

The requirements under the Toxics TMDL vary for the four subwatersheds constituting the MdR watershed. Subwatershed 1 is divided into two areas, Subwatershed 1A (area draining into back basins E, D, and F) and Subwatershed 1B (area draining into front basins A, B, C, G, H) because they have different target compliance dates in the Toxics TMDL. Subwatershed 2 is considered separately in this EWMP as it is outside the boundaries of the TMDL compliance area of the MdR WMA.

Table 7-1 lists the target Zinc load reductions and Toxics TMDL compliance dates for the various subwatersheds. The Toxics TMDL WLA compliance schedule uses a phased approach, where interim compliance is achieved through either demonstrating that 50% of the total drainage area served by the MS4 is meeting the WLA for sediment or alternatively, a 50% load reduction is achieved. Final compliance is demonstrated through 100% of the total area served by the MS4 meeting the WLA for sediment. The final compliance point occurs in 2018 for the Back Basins of the harbor and in 2021 for the Front Basins.

Under the Bacteria TMDL, the final compliance date for single sample summer and winter dry weather WLAs, expressed as allowable exceedance days (Section 3.2.2), is December 28, 2017. The final compliance point for wet weather and geometric mean bacteria WLAs is July 15, 2021.

7.2 Structural BMP Schedule

Attaining the TMDLs' water quality goals will require significant infrastructure throughout the MdR watershed. This section presents the implementation schedules required for regional and localized structural BMPs to meet the WLA by the specified interim and final compliance dates. The Toxics TMDL compliance points for the Back Basins are on a more accelerated schedule than the Front Basins, therefore projects within the subwatersheds that drain to the Back Basins (Subwatersheds 1A, 3 and 4) are given priority in the implementation schedule.

Based on the existing pollutant loads, estimated by the WMMS model, a total zinc load reduction of approximately 95.1% and 95.8% will be required to meet the zinc WLA for the Back Basins (Subwatersheds 1A, 3, and 4) and Front Basins (Subwatershed 1B), respectively. These load reductions modeled through the RAA are used in the selection, design, scheduling, and costing, of the structural and non-structural BMPs. A detailed description of design, load reduction, implementation, and cost methodology and results are found in Appendix A and Appendix B.

The expected load reduction schedule is shown as well as the applicable TMDL compliance points (both interim and final) are shown in Table 7-2. Expected load reductions from non-structural BMPs are also included in Table 7-2.

The actual implementation schedule may vary depending on the results of monitoring efforts currently underway (i.e., Coordinated Monitoring Plan), planned monitoring (Coordinated Integrated Monitoring Plan), future special studies, and future BMP effectiveness analysis, environmental documentation, stakeholder process, and funding availability. Based upon an adaptive management strategy, as more watershed-specific information relating to pollutant loads is available, more detailed schedules may be developed using this basic framework.

Table 7-2: RAA Load Reduction Schedule for MdR Watershed Back Basins and Front Basins BMPs

Area	Percent Reduction							
	Existing	2015	2016	2017	2018	2019	2020	2021
Back Basins								
Back Basins (Subwatersheds 1A, 3, 4)			**Interim**		**Final**			
Regional Projects (Costco, Parks, and Venice Neighborhood)			15.36	14.16	0.01			
Green Streets			25.43	19.1	6.67			
Low Impact Development (LID)		1.01	1.01	1.01	1.01			
Additional BMPs	0.43		4.27	2.68				
Non-Structural Programs				1.5	1.5	1.5	2	
Annual Load Reduction	**0.43**	**1.01**	**46.08**	**38.45**	**9.19**	**1.5**	**2**	**0**
Toxics TMDL Load Reduction-Cumulative Goal = 95.1%	**0.43**	**1.44**	**47.51**	**85.97**	**95.16**	**96.66**	**98.66**	**98.66**
Subwatershed 1A								
Green Streets			40.24	13.33				
Low Impact Development (LID)		4.45	4.45	4.45	4.45			
Additional BMPs				22.91				
Non-Structural Programs				1.5	1.5	1.5	2	
Annual Load Reduction	**0**	**4.45**	**44.7**	**42.2**	**5.95**	**1.5**	**2**	**0**
Toxics TMDL Load Reduction-Cumulative Goal = 96.2%	**0**	**4.45**	**49.15**	**91.34**	**97.29**	**98.79**	**100**	**100**
Subwatershed 3								
Regional Projects (Venice of America Park + Triangle Park)			5.48		0.08			
Green Streets			37.01	28.87	9.48			
Low Impact Development (LID)		0.63	0.63	0.63	0.63			
Existing BMP - Boone Olive Diversion	4.97							
Non-Structural Programs				1.5	1.5	1.5	2	
Annual Load Reduction	**4.97**	**0.63**	**43.11**	**30.99**	**11.69**	**1.5**	**2**	**0**
Toxics TMDL Load Reduction-Cumulative Goal = 88%	**4.97**	**5.59**	**48.7**	**79.7**	**91.38**	**92.88**	**94.88**	**94.88**
Subwatershed 4								
Regional Projects (Costco and Venice Neighborhood)			19.13	18.19				
Green Streets			22.54	19.35	7.52			
Low Impact Development (LID)		0.56	0.56	0.56	0.56			
Additional BMPs			5.48					
Non-Structural Programs				1.5	1.5	1.5	2	
Annual Total	**0**	**0.56**	**47.71**	**39.6**	**9.58**	**1.5**	**2**	**0**
Toxics TMDL Load Reduction-Cumulative Goal = 95.7%	**0**	**0.56**	**48.27**	**87.87**	**97.45**	**98.95**	**100**	**100**
Front Basins								
Subwatershed 1B						**Interim**		**Final**
Green Streets				7.85	12.97	16.07	13.01	0.43
Low Impact Development (LID)		3.36	3.36	3.36	3.36	3.36	3.36	
Additional BMPs						8.8	10.4	
Non-Structural Programs				1.5	1.5	1.5	2	
Annual Total	**0**	**3.36**	**3.36**	**12.71**	**17.83**	**29.73**	**28.78**	**0.43**
Toxics TMDL Load Reduction-Cumulative Goal = 95.8%	**0**	**3.36**	**6.72**	**19.43**	**37.25**	**66.99**	**95.77**	**96.2**
Non-TMDL Area								
Subwatershed 2, Green Streets, Canal Park, and Via Dolce Park scheduled after 2021								
Regional Projects (Canal Park + Via Dolce Park)								1.17^
Green Streets								19.00^
Low Impact Development (LID)		0.38	0.38	0.38	0.38	0.38	0.38	
Non-Structural Programs				1.5	1.5	1.5	2	
Annual Total	**0**	**0.38**	**0.38**	**1.88**	**1.88**	**1.88**	**2.38**	**20.17****
Water Quality Load Reduction-Cumulative Goal = 21.5%*	**0**	**0.38**	**0.76**	**2.64**	**4.52**	**6.4**	**8.78**	**28.95**

This table is based on the percent watershed area treated by BMPs (proportional load reduction for 85th percentile storm event).
*Additional load reduction is required to meet the TMDL WLA for the critical year and/or the interim target
** Scheduled after 2021, depending on results of the Adaptive Management Process
^Structural BMPs are estimated at the total load reduction required (21.5%) to ensure that planning is in place to meet potential load reduction requirements, exclusive of non-structural and development/redevelopment BMP programs.
GW = groundwater

Table 7-3: RAA Volume (acre-feet) Reduction Schedule for MdR Watershed Back Basins and Front Basins BMPs

Area	Volume (acre-feet)							
	Existing	2015	2016	2017	2018	2019	2020	2021
Back Basins								
Back Basins (Subwatersheds 1A, 3, 4)			**Interim**		**Final**			
Regional Projects (Costco, Parks, and Venice Neighborhood)	0.0	0.0	75.0	69.1	0.0	0.0	0.0	0.0
Green Streets	0.0	0.0	155.7	117.0	40.8	0.0	0.0	0.0
Low Impact Development (LID)	0.0	34.4	34.4	34.4	34.4	0.0	0.0	0.0
Additional BMPs	8.2	0.0	16.8	10.5	0.0	0.0	0.0	0.0
Non-Structural Programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual Volume Reduction	**8.2**	**34.4**	**281.9**	**231.0**	**75.3**	**0.0**	**0.0**	**0.0**
Toxics TMDL Cumulative Volume Reduction (acre-ft)	**8.2**	**42.6**	**324.5**	**555.5**	**630.8**	**630.8**	**630.8**	**630.8**
Subwatershed 1A								
Green Streets	0.0	0.0	23.7	7.8	0.0	0.0	0.0	0.0
Low Impact Development (LID)	0.0	6.5	6.5	6.5	6.5	0.0	0.0	0.0
Additional BMPs	0.0	0.0	0.0	10.2*	0.0	0.0	0.0	0.0
Non-Structural Programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual Volume Reduction	**0.0**	**6.5**	**30.2**	**14.4**	**6.5**	**0.0**	**0.0**	**0.0**
Toxics TMDL Cumulative Volume Reduction (acre-ft)	**0.0**	**6.5**	**36.7**	**51.1**	**57.6**	**57.6**	**57.6**	**57.6**
Subwatershed 3								
Regional Projects (Venice of America Park + Triangle Park)	0.0	0.0	3.6	0.0	0.1	0.0	0.0	0.0
Green Streets	0.0	0.0	13.0	10.2	3.3	0.0	0.0	0.0
Low Impact Development (LID)	0.0	1.8	1.8	1.8	1.8	0.0	0.0	0.0
Existing BMP - Boone Olive Diversion	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-Structural Programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual Volume Reduction	**8.2**	**1.8**	**18.5**	**12.0**	**5.2**	**0.0**	**0.0**	**0.0**
Toxics TMDL Cumulative Volume Reduction (acre-ft)	**8.2**	**10.0**	**28.5**	**40.4**	**45.6**	**45.6**	**45.6**	**45.6**
Subwatershed 4								
Regional Projects (Costco and Venice Neighborhood)	0.0	0.0	71.3	67.8	0.0	0.0	0.0	0.0
Green Streets	0.0	0.0	62.4	53.5	20.8	0.0	0.0	0.0
Low Impact Development (LID)	0.0	7.4	7.4	7.4	7.4	0.0	0.0	0.0
Additional BMPs	0.0	0.0	0.0	20.3*	0.0	0.0	0.0	0.0
Non-Structural Programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual Volume Reduction	**0.0**	**7.4**	**141.1**	**128.8**	**28.2**	**0.0**	**0.0**	**0.0**
Toxics TMDL Cumulative Volume Reduction (acre-ft)	**0.0**	**7.4**	**148.5**	**277.3**	**305.5**	**305.5**	**305.5**	**305.5**
Front Basins								
Subwatershed 1B						**Interim**		**Final**
Green Streets	0.0	0.0	0.0	12.0	19.8	24.5	19.9	0.7
Low Impact Development (LID)	0.0	11.2	11.2	11.2	11.2	11.2	11.2	0.0
Additional BMPs	0.0	0.0	0.0	0.0	0.0	15.1*	17.9*	0.0
Non-Structural Programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual Volume Reduction	**0.0**	**11.2**	**11.2**	**23.2**	**31.0**	**35.8**	**31.1**	**0.7**
Toxics TMDL Cumulative Volume Reduction (acre-ft)	**0.0**	**11.2**	**22.5**	**45.7**	**76.7**	**112.5**	**143.5**	**144.2**
Non-TMDL Area								
Subwatershed 2, Green Streets, Canal Park, and Via Dolce Park scheduled after 2021								
Regional Projects (Canal Park + Via Dolce Park)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Green Streets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.0
Low Impact Development (LID)	0.0	1.2	1.2	1.2	1.2	1.2	1.2	0.0
Non-Structural Programs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual Volume Reduction	**0.0**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**43.4****
Toxics TMDL Cumulative Volume Reduction (acre-ft)	**0.0**	**1.2**	**2.4**	**3.6**	**4.8**	**6.0**	**7.2**	**50.6**

This table is based on the percent watershed area treated by BMPs (proportional load reduction for 85th percentile storm event).
*Additional load reduction is required to meet the TMDL WLA for the critical year and/or the interim target
** Scheduled after 2021, depending on results of the Adaptive Management Process
^Structural BMPs are estimated at the total load reduction required (21.5%) to ensure that planning is in place to meet potential load reduction requirements, exclusive of non-structural and development/redevelopment BMP programs.
GW = groundwater

7.3 Non–Structural BMP Implementation

All MCMs that are required by the 2012 Permit will be implemented. The combined non-structural programs/projects proposed in this EWMP are estimated to reduce up to 6.5% of the pollutant loading to MdR. The non-structural programs/projects proposed will be implemented early to maximize the cumulative pollutant load removals throughout the implementation period. Generally, it is assumed that a program/project will capture the full load reduction after 2 years of implementation.

The non-structural BMP programs proposed for the MdR watershed include modeling updates and other studies, source control, catch basin cleaning, and industry targeted outreach and education, enforcement, and inspection programs. The EWMP proposed implementation schedule for non-structural BMPs is shown in Table 7-4.

Table 7-4: Implementation Schedule for Non-Structural BMPs within the MdR WMA

Category	Non-Structural Solution	Potential Contaminant Reduction (%)					
		2015	2016	2017	2018	2019	2020 - 2025
Watershed Studies	**Pollutant Loading Model and Database**						
	Long-Term Implementation and Updates						
	Total Suspended Solids/Pollutant Correlations						
Source Control	**Collaborative Environmentally Friendly Alternative Services Program**				0.5	1	2
	Planning & Assessment						
	Long-Term Implementation						
	Product Substitution Campaign				0.5	1	2
	Planning & Assessment						
	Long-Term Implementation						
Municipal Separate Storm Sewer System (MS4)	**Targeted Aggressive MS4 and Catch Basin Cleaning Program**				0.5	1	1
	Planning & Assessment						
	Long-Term Implementation						
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	**Code Survey and Modification**						
	Targeted inspections			0.5	0.5	0.5	0.5
	Evaluation/Assessment/Modification						
	Business-led Voluntary BMP Implementation Program			0.5	0.5	0.5	0.5
	Feasibility Evaluation						
	Incentive Program						
Community Outreach and Education	**Outreach and Education**			0.5	0.5	0.5	0.5
	Environmentally Friendly Boating Program						
	Green Gardening and Runoff Reduction Program						
Total Contaminant Reduction (%)				**1.5**	**3**	**4.5**	**6.5**
	Represents overall project schedule.						
	Provides additional information regarding project implementation schedule.						

8.0 IMPLEMENTATION COSTS AND FINANCIAL STRATEGY

As mentioned in the previous sections, the Toxics TMDL compliance schedule is used in the selection and scheduling of BMPs in the MdR WMA. The Toxics TMDL compliance schedule provides for multiple pathways to achieve compliance with the sediment TMDL, including achieving designated WLAs, or alternatively demonstrating attainment of the SQOs. For the purpose of this EWMP, compliance with WLAs is used for costing and scheduling but further studies, including a planned Stressor ID Study in 2016, may show TMDL compliance through SQOs.

Life cycle costs (LCC) incorporated into project cost estimates include materials, construction, engineering design, CEQA and permitting, contingency, land acquisition, 20 years of routine operations and maintenance (O&M), and major rehabilitation costs. The cost of administering a stormwater management program for post-construction effectiveness assessment during 3 storm events was also included in this estimate. Construction costs were applied to the year in which a load reduction credit was assigned. Planning and engineering design costs were assumed to require up to 2 years of lead-time prior to the start of construction. The cost of post-construction stormwater monitoring was distributed over 3 years following project completion. The annual O&M cost was equally distributed over the remaining project schedule following project completion. All costs were translated into 2015 dollars using net present worth analysis and an average inflation rate of 3%. These values were used based on a similar methodology employed to develop the San Diego Quality of Life Initiative (SANDAG Equinox Center, 2008) and the Multi-Pollutant TMDL Implementation Plan for the Unincorporated Area of MdR Harbor Back Basins (LADPW, 2012). Additional information regarding green street project designs, design areas, cost estimates, and this methodology is presented in Appendix A. The costs shown in this EWMP are estimates only and will change based on site-specific conditions and refinement of parameters as the EWMP is implemented.

8.1 BMP Implementation Cost Summary

The cumulative costs associated with the implementation of the BMPs discussed in Section 5.0 based on the schedule presented in Section 7.0 are summarized in Table 8-1. The results are presented by jurisdiction and type of BMP (structural versus nonstructural). Total costs for implementation of the BMPs proposed in this EWMP are estimated at $391,914,197. In Table 8-2 implementation costs are broken out by drainage area (Back Basins, Front Basins and non-TMDL area) separately because they follow different TMDL compliance schedules. Costs associated Subwatersheds 1A, 3, and 4 are presented under the Back Basins and those for Subwatershed 1B are shown under Front Basins. Subwatershed 2 does not drain to either the Back Basins or the Front Basins, and is therefore not subject to the TMDL compliance schedule; its BMPs associated costs are presented separately. Table 8-2 also shows the cumulative load reduction associated for each BMP type discussed in the EWMP for each of the subwatersheds, including nonstructural BMPs.

Table 8-1: MdR Watershed BMPs Cost Estimate Schedule by Jurisdiction

MdR Watershed	Structural BMPs	Nonstructural BMPs	Operations & Maintenance	Total Cost
City Of Los Angeles	$249,052,873	$2,923,268	$32,499,182	$284,475,323
County Of Los Angeles	$87,412,319	$1,190,913	$12,001,036	$100,604,268
City Of Culver City	$6,669,040	$127,009	$38,556	$6,834,605
Total Cost (2015 dollars)	**$343,134,232**	**$4,241,190**	**$44,538,774**	**$391,914,197**

The annual breakdown of the costs for the whole WMA by BMP type and by jurisdiction are summarized in Table 8-7 and Table 8-8, for structural BMPs, and Table 8-9 and Table 8-10, for nonstructural BMPs.

Table 8-2: Load Reduction and Cost for Required Load Reductions for Back Basins and Front Basins

BMP Type	Cumulative Load Reduction Percentage	Cumulative Cost*
Back Basins (Subwatersheds 1A, 3, 4)		
Structural BMPs Total	**92.16**	**$290,406,761**
Nonstructural BMPs Total	**6.5**	**$2,524,452**
Subwatershed 1A		
Green Streets	6.27	$22,526,910
Development/Redevelopment	2.08	-
Potential Sanitary Sewer Diversion	2.68	$7,443,462
Structural BMPs Total	**11.04**	**$29,970,372**
Subwatershed 3		
Green Streets	6.47	$21,482,683
Development/Redevelopment	0.22	-
Venice of America Park	0.47	$681,486
Triangle Park	0.01	$195,464
Existing BMP - Boone Olive Diversion	0.43	-
Structural BMPs Total	**7.59**	**$22,359,634**
Subwatershed 4		
Venice Neighborhood Project (GW≥20ft)	23.93	$90,699,592
Green Streets (20ft>GW)	38.46	$127,753,965
Development/Redevelopment	1.75	-
Costco Parking Lot	5.12	$6,707,597
Sanitary Sewer Diversion	4.27	$12,915,601
Structural BMPs Total	**73.53**	**$238,076,755**
Front Basins (Subwatershed 1B)		
Subwatershed 1B		
Green Streets	50.33	$51,278,322
Development/Redevelopment	20.16	-
Sanitary Sewer Diversion	19.21	$18,194,233
Structural BMPs Total	**89.70**	**$69,472,555**
Nonstructural BMPs Total	**6.5**	**$800,437**

Table 8-2: Load Reduction and Cost for Required Load Reductions for Back Basins and Front Basins

BMP Type	Cumulative Load Reduction Percentage	Cumulative Cost*
Non TMDL Compliance Area		
Subwatershed 2		
Green Streets	24.55	$26,980,294
Development/Redevelopment	2.54	-
Canal Park	1.11	$492,869
Via Dolce Park	0.06	$320,529
Structural BMPs Total	**28.27**	**$27,793,692**
Nonstructural BMPs Total	**6.5**	**$916,301**

*Cost includes planning, design, O&M, and BMP effectiveness monitoring through 2034.

8.2 Structural BMPs Implementation Cost

8.2.1 Green Streets BMPs

Implementation of green street BMPs as well as the Venice Blvd. Neighborhood Regional Project, is constrained to the limited regions within the public domain available for implementation of structural BMP projects. Many considerations affect the extent of area available for the implementation of these BMPs within the public ROW (e.g., utilities, crosswalks, soil conditions); therefore, the design areas used to develop example BMP implementation scenarios and design were also used to test feasibility of implementation (e.g., adequate space for implementation, sufficient utility separation). Projected costs are based on the implementation of various BMPs by land use and subwatershed. The results of this analysis are provided in more detail in Appendix A.

The cost of implementation for these design area BMP projects was normalized by acreage treated in order to obtain a value (cost per acre treated) that could be scaled watershed-wide. This normalized value was used to apportion cost by land use and groundwater depth. Table 8-3 summarizes these costs for each of the subwatersheds in MdR.

Table 8-3: Green Streets BMPs Costs for the MdR Watershed

BMP Type	Cumulative Cost (2015 dollars)
REGIONAL PROJECTS	$90,699,592
Venice Blvd. Neighborhood Project (GW≥20ft, Subwatershed 4)	$90,699,592
GREEN STREETS	$250,022,174
Subwatershed 1A	$22,526,910
Subwatershed 1B	$51,278,322
Subwatershed 2	$26,980,294
Subwatershed 3	$21,482,683
Subwatershed 4	$127,753,965
CUMULATIVE COST (2015 $)	**$340,914,197**

8.2.2 Costco

The estimated implementation cost for the Costco regional BMP is presented in Table 8-4. The design assumptions and cost estimates for the Costco Parking Lot Infiltration Project Design are presented in Appendix B.

Table 8-4: Costco Parking Lot Implementation Cost

BMP Design	Regional Project ID	Treatment Area (ac)	Planning/ Design Cost	Construction Cost	20-Year O&M Cost	Monitoring Cost
Storm Chamber Infiltration Gallery	Costco Parking Lot	42	$1,546,000	$5,533,429	$64,000	$120,000

8.2.3 Parks

Four parks were considered for Regional BMPs in the MdR watershed: Canal Park, Venice of America Park, Via Dolce Park, and Triangle Park. The specific design considerations are presented in the following subsections. A summary of the implementation costs is provided in Table 8-5 below. Detailed assumptions and calculations are provided separately in Appendix B.

Table 8-5: Implementation Costs for Regional Projects - Parks

BMP Design	Regional Project ID	Treatment Area (ac)	Planning/ Design Cost	Construction Cost	20-Year O&M Cost	Monitoring Cost
Storm Chamber Infiltration Gallery	Canal Park	3.3	$139,000	$397,143	$20,000	$18,000
	Venice of America Park	3.9	$168,000	$502,176	$20,000	$36,000
Subsurface Cistern w/ Capture/Reuse	Via Dolce Park	0.18	$88,000	$214,308	$110,000	$18,000
	Triangle Park	0.05	$51,000	$80,621	$110,000	$18,000

8.2.4 Potential Sanitary Sewer Diversion Projects

The costs and project specific information for the design parameters of each of the potential subwatershed sanitary sewer diversion projects are summarized in Table 8-6. More details are presented in Appendix B.

Table 8-6: Sanitary Sewer Diversion Projects Implementation Cost

Subwatershed	Subwatershed 1A (Back Basins)	Subwatershed 1B (Front Basins)	Subwatershed 3 (Boone Olive/ Subwatershed 4 (Oxford Basin)
Design Treatment Area (ac)	22	48	35
Tank Capacity (gallons)	0.49 million	1.60 million	1.04 million
Redevelopment Area (acres)	0.3	0.7	0.5
Planning/ Design Cost	$354,000	$998,000	$338,000
Construction Cost	$7,309,020	$17,899,145	$12,604,729
20-Year O&M Cost	$596,010	$4,295,301	$1,115,655
Monitoring Cost	$60,000	$60,000	$60,000

Because of the exact drainage areas to be diverted and the tank locations are significant unknown variables, the sanitary sewer diversion project costs are limited in scope to the above ground concrete tank (rectangular), with 5-foot perimeter beyond the edge of the tank foundation, and one controller pump/diversion to connect to the sanitary sewer and a limited suite of construction BMPs. The O&M costs include inspection and maintenance of the tank, as well as an average annual sewer discharge fee (assuming 7 storms per year).

This type of project is expensive as a result of the redevelopment costs associated with obtaining property to site the tank. The lower reaches of the MdR watershed consist mainly of high-density multi-family residential land uses. These properties range in size from 0.15 acre lots with 2-3 story condominiums, to skyscrapers with hundreds of individual units and the average cost per acre is above $20,000,000. The tank design assumptions and cost estimates are presented with the regional projects designs in in Appendix B.

8.3 Non-Structural BMPs Implementation Cost

The non-structural cost estimates consist of a one-year initial pilot study cost, including project start-up and assessment, and if applicable given the type of project/program ongoing O&M costs. An inflation rate of 3% per year was used. These values were used based on a similar methodology employed for the MdR Multi-Pollutant Implementation Plan (LADPW, 2012). All non-structural costs are reported in 2015 dollars. The total cost of implementing the nonstructural programs is approximately $4.24 million, as summarized in Table 8-10.

Table 8-7: MdR Watershed Structural BMPs Cost Estimate Schedule by BMP Type

MdR Watershed	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	O&M 2026-2034	Total Cost
Venice Blvd. Neighborhood Project (GW≥20 ft)	$11,276,106	$47,900,775	$24,011,959	$1,328,876	$1,322,717	$395,180	$383,669	$372,495	$361,645	$351,112	$340,885	$2,654,171	**$90,699,590**
Green Streets (20 ft>GW)	$21,392,161	$72,313,721	$60,838,013	$36,646,653	$22,426,618	$14,011,168	$2,913,191	$2,105,757	$1,694,678	$1,645,318	$1,597,396	$12,437,500	**$250,022,174**
Potential Sanitary Sewer Diversions	$515,000	$485,437	$18,680,557	$554,934	$7,828,309	$7,600,300	$260,472	$252,886	$245,520	$223,487	$216,978	$1,689,414	**$38,553,294**
Costco	$773,000	$728,627	$5,063,871	$38,383	$37,265	$36,179	$2,602	$2,526	$2,453	$2,381	$2,312	$18,000	**$6,707,599**
Canal Park	$0	$0	$63,602	$61,750	$342,579	$5,862	$5,692	$5,526	$766	$744	$722	$5,625	**$492,868**
Via Dolce Park	$0	$0	$0	$0	$37,955	$216,329	$9,351	$9,078	$8,814	$4,093	$3,973	$30,937	**$320,530**
Venice of America Park	$84,000	$552,527	$11,897	$11,550	$11,214	$837	$813	$789	$766	$744	$722	$5,625	**$681,484**
Triangle Park	$0	$24,036	$23,336	$71,631	$9,920	$9,631	$9,351	$4,342	$4,215	$4,093	$3,973	$30,937	**$195,465**
Annual Cost (2015 dollars, $)	$34,040,268	$122,005,124	$108,693,236	$38,713,777	$32,016,577	$22,275,487	$3,585,141	$2,753,399	$2,318,858	$2,231,972	$2,166,963	$16,872,208	
Cumulative Cost (2015 dollars, $)	**$34,040,268**	**$156,045,392**	**$264,738,627**	**$303,452,404**	**$335,468,981**	**$357,744,468**	**$361,329,609**	**$364,083,008**	**$366,401,865**	**$368,633,837**	**$370,800,799**		**$387,673,007**

Table 8-8: MdR Watershed Structural BMPs Cost Estimate Schedule by Jurisdiction

MdR Watershed	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	O&M	Total Cost
												2026-2034	
City of Los Angeles	$28,222,625	$105,911,250	$83,471,079	$24,834,315	$11,212,248	$7,285,645	$2,272,044	$1,884,855	$1,610,630	$1,557,927	$1,512,551	$11,776,886	$281,552,055
County of Los Angeles	$5,044,643	$15,365,247	$20,158,285	$13,841,080	$20,767,065	$14,953,663	$1,310,495	$866,018	$705,775	$671,663	$652,100	$5,077,322	$99,413,355
City of Culver City	773,000	728,627	5,063,871	38,383	37,265	36,179	2,602	2,526	2,453	2,381	2,312	18,000	6,707,599
Annual Cost (2015 dollars, $)	34,040,268	122,005,124	108,693,235	38,713,777	32,016,577	22,275,487	3,585,141	2,753,399	2,318,858	2,231,971	2,166,963	16,872,208	
Cumulative Cost (2015 dollars, $)	**34,040,268**	**156,045,392**	**264,738,627**	**303,452,404**	**335,468,981**	**357,744,467**	**361,329,608**	**364,083,007**	**366,401,865**	**368,633,836**	**370,800,799**		**387,673,007**

Table 8-9: MdR Watershed Non-Structural BMPs Cost Estimate Schedule by Jurisdiction

MdR Watershed	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total Cost
City of Los Angeles	$1,156,986	$597,275	$424,479	$195,335	$129,973	$69,870	$69,870	$69,870	$69,870	$69,870	$69,870	**$2,923,268**
County of Los Angeles	$471,347	$243,325	$172,929	$79,578	$52,950	$28,464	$28,464	$28,464	$28,464	$28,464	$28,464	**$1,190,913**
City of Culver City	$50,267	$25,950	$18,442	$8,487	$5,647	$3,036	$3,036	$3,036	$3,036	$3,036	$3,036	**$127,009**
Annual Cost (2015 dollars, $)	$1,678,600	$866,550	$615,850	$283,400	$188,570	$101,370	$101,370	$101,370	$101,370	$101,370	$101,370	
Cumulative Cost (2015 dollars, $)	**$1,678,600**	**$2,545,150**	**$3,161,000**	**$3,444,400**	**$3,632,970**	**$3,734,340**	**$3,835,710**	**$3,937,080**	**$4,038,450**	**$4,139,820**		**$4,241,190**

Table 8-10: Cost Schedule for Non-Structural BMP s within the MdR WMA by BMP Type

Non-Structural Solution Category	Proposed Non-Structural BMP	Cost (2015 $)							
		2015	2016	2017	2018	2019	2020	2021	2022-2025
Watershed Studies	Pollutant Loading Model and Database	0	21,800	21,800	21,800	21,800	21,800	21,800	87,200
	Total Suspended Solids/Pollutant Correlations	0	0	54,500	0	54,500	0	0	0
Source Control	Collaborative Environmentally Friendly Alternative Services Program	327,000	136,250	109,000	32,700	5,450	5,450	5,450	21,800
	Product Substitution Campaign	408,750	147,150	152,600	109,000	65,400	32,700	32,700	130,800
Municipal Separate Storm Sewer System (MS4)	Targeted Aggressive MS4 and Catch Basin Cleaning Program	218,000	109,000	81,750	27,250	10,900	10,900	10,900	43,600
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	Code Survey and Modification	109,000	81,750	21,800	5,450	1,090	1,090	1,090	4,360
	Targeted inspections	70,850	49,050	21,800	16,350	16,350	16,350	16,350	65,400
	Business-led Voluntary BMP Implementation Program	299,750	179,850	87,200	32,700	6,540	6,540	6,540	26,160
Community Outreach and Education	Environmentally Friendly Boating Program	109,000	54,500	27,250	27,250	3,270	3,270	3,270	13,080
	Green Gardening and Runoff Reduction Program	136,250	87,200	38,150	10,900	3,270	3,270	3,270	13,080
Total Cost		1,678,600	866,550	615,850	283,400	188,570	101,370	101,370	405,480
Cumulative Cost		1,678,600	2,545,150	3,161,000	3,444,400	3,632,970	3,734,340	3,835,710	4,241,190

8.4 Financial Strategy

This section identifies the estimated order-of-magnitude cost of the activities, and potential funding options that the EWMP Group will be pursuing to fund the program.

Estimated costs for compliance with the 2012 MS4 Permit through the implementation of the Marina del Rey Watershed EWMP are approximated at $400 million. The EWMP Agencies will follow a multi-pronged financial strategy to maximize potential funding opportunities in support of EWMP implementation. The California Contract Cities Association and the League of California Cities, Los Angeles Division City Managers Committees commissioned a report on stormwater funding options in the Los Angeles region. The resulting report, "Stormwater Funding Options – Providing Sustainable Water Quality Finding in Los Angeles County" (Farfsing and Watson, 2014) provided a useful framework for potential funding options, which is incorporated in this section.

8.4.1 Grant Programs

The financial strategy for the EWMP includes pursuing available grant programs that potentially may be used for project implementation. These grants may include (but are not limited to) those outlined in the Table 8-11.

Table 8-11: Potential Grant Programs

Grant Program
Prop 1 Water Bond (2014)
Integrated Regional Water Management Plan
USEPA 319 Grants
Clean Beaches Initiative
Federal or State Transportation Grants
Federal or State Solid Waste Grants
Federal Emergency Management Agency (FEMA) Grants
National Institute of Health (NIH) or Public Health Related Grants

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8.4.2 Fees and Charges

The Farfsing and Watson report also identified potential strategies to fund stormwater programs through fees and charges assessed on either a local, regional or state level. These potential fees and charges are summarized in Table 8-12.

Table 8-12: Potential Fees and Charges

Potential Fees and Charges
Local Stormwater Fees
Incorporate Fees for Street Sweeping and Trash TMDLs into Solid Waste Management Fees
Local Water Conservation Fees
Stormwater Impact Fee in LID Ordinances
Car Rental Fees
District-wide Sales Tax
Continue to Pursue Passage of County-wide Parcel Tax (Clean Water, Clean Beaches Measure)

8.4.3 Legislative Strategies:

Potential legislative or policy strategies that the EWMP Agencies may pursue are outlined in Table 8-13 below.

Table 8-13: Potential Legislative Strategies

Potential Legislative Strategies
Amend Prop 218 to Define Stormwater as a Traditional Utility
Formation of Water Conservation Districts
Special Assessment District for the Watershed Management Areas
Source Control Measures Modeled after SB 346
Support the California Green Chemistry Initiative Program
Pursue rate increase for projects based on Assembly Bill (AB) 2403 to avoid triggering Proposition 218 requirements.
Monetize Stormwater Capture and Infiltration
Explore Funding Through Cap and Trade Revenues

8.4.4 Financial Strategies Moving Forward

The potential financial strategies described in this EWMP serve as a general framework for the EWMP Agencies to follow moving forward. These strategies, among others yet to be defined, will be adopted collaboratively by the member agencies and based on outcomes from the strategies described; a more detailed financial plan will be developed as the program moves forward.

9.0 ASSESSMENT AND ADAPTIVE MANAGEMENT FRAMEWORK

Adaptive management is a key component to the successful implementation, assessment and refinement of the MdR EWMP. Adaptive management is the process by which data are continually assessed in the context of improving and adapting programs to ensure the most effective strategies are implemented. In accordance with the MS4 Permit, every two years from the date of EWMP approval an adaptive management process will be implemented. The process will include consideration of the progress for the following elements as described in Part V1.C.8 of the MS4 Permit:

1. "Progress toward achieving interim and/or final WQBELS or RW limitations …according to established schedules;
2. Progress toward achieving improved water quality in MS4 discharges and achieving RW limitations through implementation of the watershed control measures based on an evaluation of outfall based monitoring data and RW monitoring data;
3. Achievement of interim milestones;
4. Re-evaluation of the water quality priorities identified for the WMA based on more recent water quality data for discharges from the MS4 and the receiving water(s) and a reassessment of sources of pollutants in MS4 discharges;
5. Availability of new information and data from sources other than the Permittees' monitoring program(s) within the WMA that informs the effectiveness of the actions implemented by the Permittees;
6. Regional Water Board recommendations; and
7. Recommendations for modifications to the Watershed Management Program solicited through a public participation process."

As additional data become available through CIMP monitoring, BMP effectiveness studies, special studies such as the Toxics TMDL required Stressor ID Study, and other scientific studies, they will be integrated and assessed to determine whether programs in the EWMP should be altered to enable compliance in the most efficient manner.

The adaptive management framework will allow the EWMP Agencies to develop an overall program consisting of efficient solutions based on evolving watershed priorities.

9.1 Effectiveness Monitoring

BMP effectiveness monitoring will be conducted for multiple years following BMP implementation. Monitoring will be tailored to the type of BMP and will include inflow versus outflow stormwater volume assessments as well as inflow and outflow constituent concentrations (or TSS) where applicable. Data collected will be compared to the effectiveness assumptions used in the RAA analysis and if actual effectiveness differs from effectiveness used in the model, the model will be re-run using the actual effectiveness data gathered. This will enable the adaptation of BMP strategies as they are being implemented to address TMDL compliance milestones. Ongoing CIMP monitoring, Oxford Basin monitoring, and Parking Lots 5 & 7 monitoring results will also be conducted.

9.2 CIMP Monitoring and Assessment Program

The EWMP Agencies submitted the MdR Watershed CIMP to the LARWQCB in June 2014. One of the main objectives of the CIMP is to leverage resources and create a regionally efficient and effective monitoring program.

The integrated review of existing monitoring programs, TMDL implementation plans, the Regional Board-approved Bacteria TMDL CMP, Toxics TMDL CMPs, and the monitoring data that were used in the development of the 2014 MdR Watershed CIMP represent the "Initial Assessment" of existing conditions in the MdR watershed.

Lessons learned during planning and implementation of Year 1 of the MdR Watershed CIMP (i.e., monitoring station appropriateness and safety considerations for wet weather receiving water monitoring) will be tracked and integrated into the overall program assessment during the quality assurance/quality control review of monitoring data and annual reporting. Each Annual Report will present a summary of TMDL and Permit compliance and will provide an opportunity to identify, as appropriate, modifications to the MdR Watershed CIMP protocols based on lessons learned and monitoring data. A formal programmatic review will occur during Years 1 and 2 of the program and will be integrated into the Year 3 implementation. A more comprehensive review and update of the MdR Watershed CIMP monitoring protocols may also become necessary, especially when preparing for the Triad Sampling for SQO analysis (required once during the 5-year Permit Order period in accordance with the SQO guidance).

9.3 CIMP Monitoring Reports and Revision Process

Every 2 years, hence during Year 3 of the implementation of the CIMP monitoring program, available monitoring information will be reviewed in the context of the receiving water monitoring program and outfall-based monitoring objectives.

If changes are needed, at any stage of the CIMP implementation, they will be made to the CIMP, incorporated into monitoring practice, and described in the next Annual Report. Identified changes will be discussed in the Annual Report and implemented starting no later than the first CIMP monitoring event of the next monitoring year. Such changes include, but are not limited to, adding/removing monitored constituents, modifying laboratories/analytical methods, or amending sampling protocols. Should major changes to the approach be required (e.g., moving or removing a stormwater outfall or receiving water monitoring station location), the modifications will be proposed in the Annual Report and in a separate letter to the Regional Board requesting Executive Officer approval of the change.

Annual Reports for MS4 Permit compliance are required to be submitted by December 15 of every year. These Annual Reports will cover the monitoring period of July 1 through June 30. These reports shall clearly identify all data collected during the monitoring year, as well as strategies, control measures, and assessments implemented by each Permittee within its jurisdiction. Annual Reports will also present watershed-scale efforts implemented by multiple Permittees. Discussion shall be provided in accordance with the requirements laid out in MRP Section XVIII. The Annual Reports will include the following:

- Annual Assessment and Reporting
  - Stormwater Control Measures
  - Effectiveness Assessment of Storm Water Control Measures
  - Non-Stormwater Control Measures
  - Effectiveness Assessment of Non-Stormwater Control Measures

- Integrated Monitoring Compliance Report
- Adaptive Management Strategies
- Supporting Data and Information
- Municipal Action Level (MAL) Assessment and Report

Municipal Action Level (MAL) reports are required to be submitted with the Annual Report and will compare monitoring data to applicable MALs identified in Attachment G of the Permit. Subwatersheds with a running average of greater than or equal to twenty percent exceedances of the MALs will be identified and beginning in year 3, a MAL Action Plan will be required for these subwatersheds.

Additionally, semi-annual data reports will be submitted with the Annual Report, and 6 months prior to the annual report (June of each year). The June 15 data submittal will include data for the monitoring period of July 1 through December 31, and the December 15 data submittal will include data for the monitoring period of January 1 through June 30. These semi-annual analytical data reports detail exceedances applicable to WQBELs, RWLs, action levels, or aquatic toxicity thresholds, with corresponding sample dates and monitoring locations.

Monthly monitoring reports are required for Bacteria TMDL compliance and annual reports are also required for Toxics TMDL compliance. These data reports will be submitted as an attachment to MS4 Permit required annual reports.

9.4 Special Studies

Special studies carried out in support of TMDL implementation will be used to assess compliance strategies in the MdR EWMP. A Stressor ID Study is required under the Toxics TMDL and is planned to be conducted in the MdR Harbor in the year 2016. This study will identify stressors causing toxicity to biological organisms in the harbor. Bight 18 monitoring will also be conducted, and results from these studies may impact compliance strategies and programs specified in this EWMP and will be evaluated upon completion. The EWMP will be adapted, if necessary, to enable compliance through the most efficient means possible.

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