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VACANT
CHIEF FINANCIAL OFFICER

1149 SOUTH BROADWAY, 10TH FLOOR
LOS ANGELES, CA 90015
TEL: (213) 485-0587
FAX: (213) 485-3939
WWW.LACITYSAN.ORG

June 27, 2014

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

Dear Mr. Unger:

SUBMITTAL OF WORK PLAN FOR ENHANCED WATERSHED MANAGEMENT PROGRAM FOR JURISDICTIONAL GROUPS 2 AND 3 OF THE SANTA MONICA BAY WATERSHED

Please find attached the Work Plan for the Enhanced Watershed Management Program (EWMP) for Jurisdictional Groups 2 and 3 of the Santa Monica Bay watershed. The City of Los Angeles, as lead agency for Jurisdictional Groups 2 and 3, has prepared this Work Plan on behalf of itself, the County of Los Angeles, Los Angeles County Flood Control District, and the Cities of El Segundo and Santa Monica. All agencies have reviewed this Work Plan prior to submission to the Regional Water Board, and we appreciate the collaboration by all agencies in the preparation of the document.

The Work Plan for the EWMP for Jurisdictional Groups 2 and 3provides the following: a summary of the water quality priorities per section VI.C.5.a of the new MS4 Permit (Order No. R4-2012-0175); processes for identifying and selecting regional BMPs and potential customization of institutional measures; the approach to the Reasonable Assurance Analysis based on the guidance document provided by the Regional Water Board; and the schedule EWMP development and stakeholder involvement.

Jurisdictional Groups 2 and 3 of the Santa Monica Bay watershed look forward to proceed with the development of the EWMP in collaboration with Technical Advisory Committee, the Regional Water Board, and other watershed stakeholders. Should you have any questions about this submittal, please contact me at Shahram.Kharaghani@lacity.org or phone (213) 485-0587, or your staff may contact Dr. Huub Cox at Hubertus.Cox@lacity.org or phone (213) 485-3984.

Sincerely,

Robert Vega for

SHAHRAM KHARAGHANI, Ph.D., P.E., BCEE
Program Manager

SK:HC
WPDCR9135

Attachment

c: Renee Purdy, California Regional Water Quality Board, Los Angeles Region
Ivar Ridgeway, California Regional Water Quality Board, Los Angeles Region
Adel Hagekhalil, City of Los Angeles, Bureau of Sanitation
Donna Chen, City of Los Angeles Bureau of Sanitation
Gary Hildebrand, County of Los Angeles, Department of Public Works
Rick Valte, City of Santa Monica
Stephanie Katsouleas, City of El Segundo

Enhanced Watershed Management Program Work Plan

Prepared by:

City of Los Angeles
Los Angeles County Flood Control District
County of Los Angeles
City of Santa Monica
City of El Segundo

The MWH Team

MWH® Geosyntec consultants CWE M2 Resource Consulting, Inc.

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List of Acronyms

Acronym	Definition
AED	Allowable Exceedance Day
ASCE	American Society of Civil Engineers
Basin Plan	Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties
Bay	Santa Monica Bay
BIOL	Preservation of Biological Habitats of Special Significance Beneficial Use Designation
BMP	Best Management Practice
CALTRANS	California Department of Transportation
CASQA	California Stormwater Quality Association
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIMP	Coordinated Integrated Monitoring Program
City	City of Los Angeles
CML	Compliance Monitoring Location
COMM	Commercial and Sport Fishing Beneficial Use Designation
County	County of Los Angeles
CSMP	Coordinated Shoreline Monitoring Plan
CTR	California Toxics Rule
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
DP	Dissolved Phosphorus
DPW	Los Angeles County Department of Public Works
ED	Exceedance Day
EMC	Event Mean Concentration
EPA	Environmental Protection Agency
ESA	Environmentally Sensitive Area
ESCP	Erosion and Sediment Control Plan
EWMP	Enhanced Watershed Management Plan
FC	Fecal Coliform
GIS	Geographic Information System
GM	Geometric Mean
IBD	International BMP Database
IC/ID	Illicit Connections and Illicit Discharges
IND	Industrial Service Supply Beneficial Use Designation
IRWMP	Integrated Regional Water Management Plan
JG2/JG3	Jurisdictional Groups 2 and 3 of the City of Los Angeles
L-SWPPP	Local Storm Water Pollution Prevention Plan

List of Acronyms

Acronym	Definition
LA	Los Angeles
LACFCD	Los Angeles County Flood Control District
LAX	Los Angeles International Airport
LFD	Low-Flow Diversion
LID	Low Impact Development
MAR	Marine Habitat Beneficial Use Designation
MCM	Minimum Control Measure
MG/L	Milligrams per Liter
MIGR	Fish Migration Beneficial Use Designation
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
MUN	Municipal and Domestic Supply Beneficial Use Designation
MWH	MWH Americas, Inc.
N	Nitrogen
NA	Not Applicable
NAV	Navigation Beneficial Use Designation
NH_3	Ammonia
NO_3	Nitrate
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
OPTI	Online Project Tracking and Integration System
Permit	Los Angeles Regional Water Quality Control Board Order No. R4-2012-0175
PIPP	Public Information and Participation Program
QA/QC	Quality Assurance/Quality Control
RAA	Reasonable Assurance Analysis
RARE	Preservation of Rare and Endangered Species Beneficial Use Designation
REC-1	Water Contact Recreation Beneficial Use Designation
REC-2	Noncontact Water Recreation Beneficial Use Designation
Regional Board	Los Angeles Regional Water Quality Control Board
RWL	Receiving Water Limitation
SCCWRP	Southern California Costal Research Project
SHELL	Shellfish Harvesting Beneficial Use Designation
SMB	Santa Monica Bay
SMBEWMP Group	Santa Monica Bay EWMP Group
SMB WMA	Santa Monica Bay Watershed Management Area
SMURRF	Santa Monica Urban Runoff Recycling Facility
SPWN	Fish Spawning Beneficial Use Designation
SQMP	Stormwater Quality Management Plan
SUSMP	Standard Urban Stormwater Mitigation Plan
SWAMP	Surface Water Ambient Monitoring Program

List of Acronyms

Acronym	Definition
SWMM	Storm Water Management Model
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
WARM	Warm Freshwater Habitat Beneficial Use Designation
WERF	Water Environment Research Foundation
WDID	Waste Discharger Identification
WILD	Wildlife Habitat Beneficial Use Designation
WMA	Watershed Management Area
WMP	Watershed Management Plan
WQBEL	Water Quality-Based Effluent Limitation

Section 1
Introduction

1.1. BACKGROUND AND REGULATORY FRAMEWORK

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. R4-2012-0175 (Permit) was adopted November 8, 2012 by the Los Angeles Regional Water Quality Control Board (Regional Board) and became effective December 28, 2012. The purpose of the Permit is to ensure the MS4s in Los Angeles County are not causing or contributing to exceedances of water quality objectives set to protect the beneficial uses in the receiving waters in the Los Angeles region.

The Permit allows Permittees to customize their stormwater programs through the development and implementation of a Watershed Management Program (WMP) or an Enhanced Watershed Management Program (EWMP) to achieve compliance with receiving water limitations (RWL) and water quality-based effluent limits (WQBEL). Jurisdictional Groups 2 and 3 (JG2/JG3) of the City of Los Angeles (City), City of Santa Monica, City of El Segundo, Unincorporated areas of the County of Los Angeles (County), and the Los Angeles County Flood Control District (LACFCD), collectively referred to as the Santa Monica Bay (SMB) EWMP Group (SMB EWMP Group), submitted a notice of intent (NOI) to develop an EWMP in June of 2013 to fulfill the requirements of the Permit. This EWMP Work Plan establishes the basis for the EWMP that is consistent with Part VI.C.5-C.8 of the Permit, and:

1. Prioritizes water quality issues resulting from stormwater and non-stormwater discharges from the MS4 to receiving waters within the SMB EWMP Group area;

(i) Identifies strategies to implement control measures and Best Management Practices (BMPs) to achieve the outcomes specified in Part VI.C.1.d of the Permit;

(ii) Provides a process to modify strategies, control measures, and BMPs as necessary based on analysis of monitoring data in order to ensure that applicable WQBELs,, RWLs),, and other milestones set forth in the EWMP Work Plan are achieved in the required timeframes; and

2. Provides appropriate opportunity for meaningful stakeholder input, including but not limited to, a permit-wide technical advisory committee.

1.2. SANTA MONICA BAY EWMP GROUP AREA

The SMB EWMP Group falls within the boundaries of JG2 and JG3, which are located within the central region of the Santa Monica Bay Watershed. Subwatersheds within the SMB EWMP Group Area include the urbanized Dockweiler and Santa Monica subwatersheds, as well as natural open space located in the Castle Rock, Pulga Canyon, Temescal Canyon, and Santa Monica Canyon subwatersheds.

SMB EWMP Group members have developed the EWMP Work Plan for the SMB EWMP Group area. The JG2/JG3 area totals 34,362 acres within the Santa Monica Bay Watershed and

Figure 2-1 illustrates the extent of the SMB EWMP Group Area. The geographical scope of the SMB EWMP Group area excludes areas of land totaling 9,124 acres for which the MS4 permittees do not have jurisdiction, including land owned by the State of California, Caltrans, the United States Government, and an area of the Chevron Facility located in the City of El Segundo. With the exclusion of these areas, the SMB EWMP Group area covers 25,238 acres. Approximately 49 percent of the SMB EWMP Group area is open space, and approximately 93 percent of the open space is located the northern subwatersheds and approximately 7 percent is located in the Dockweiler subwatershed. This open space has served to host several existing regional multi-benefit projects. The SMB EWMP Group will identify additional regional projects to retain all non-stormwater runoff and stormwater runoff from the 85th percentile, 24-hour storm events described in the MS4 permit, as well as additional control measures for areas in the watershed that cannot be addressed by a regional project.

1.3. STAKEHOLDER PARTICIPATION

The SMB EWMP Group is committed to providing the opportunity for stakeholder input throughout the development of the EWMP and has participated in working groups to facilitate collaboration among stakeholders and the technical team. The SMB EWMP Group conducted a stakeholder workshop to inform stakeholders about progress to date and future plans, as well as to receive stakeholder feedback. At the first stakeholder meeting on April 10, 2014, workshops were held for the EWMP Work Plan and the EWMP. Stakeholder collaboration will continue throughout implementation of the EWMP.

1.4. ENHANCED WATERSHED MANAGEMENT PROGRAM DEVELOPMENT PROCESS

The EWMP Work Plan for the SMB EWMP Group includes three major components, as follows:

1. Water Quality Priorities: The identification of water quality priorities is an important first step in the EWMP process. Water quality priorities, described in Section 3, are defined for individual constituents within a specific water body, termed as water body-pollutant combinations (WBPCs). Categories of the WBPCs are defined in the Permit. Priorities are assigned to the WBPCs based on the categorization. The water quality priorities will provide the basis for prioritizing implementation activities within the EWMP, and the selection and scheduling of BMPs in the Reasonable Assurance Analysis (RAA).

2. Watershed Control Measures: Development of the EWMP requires identification of control measures/BMPs, as described in Section 4, expected to be sufficient to meet receiving water and effluent limitations set forth in the MS4 Permit (Regional Board, 2012). BMPs vary in function and type, with each BMP providing unique design characteristics and benefits from implementation. The overarching goal of BMPs in the EWMP is to reduce the impact of stormwater and non-stormwater on receiving water quality. The EWMP emphasizes specific regional BMP called Regional EWMP projects that capture the 85th percentile, 24-hour storm from upstream areas, and the Permit provides a specific determination of compliance for those captured areas.

3. Reasonable Assurance Analysis: A key element of each EWMP is the RAA, described in Section 5, which is used to demonstrate "…that the activities and control measures…will achieve applicable WQBELs and/or RWLs with compliance deadlines during the Permit term" (Section C.5.b.iv.(5), page 63). While the Permit prescribes the RAA as a quantitative demonstration that control measures, specifically BMPs, will be effective, the RAA also promotes a modeling process to identify and prioritize potential control measures to be implemented by the EWMP. In other words, the RAA not only demonstrates the cumulative effectiveness of BMPs to be implemented, it also supports their selection. Furthermore, the RAA considers the applicable

compliance dates and milestones for attainment of the WQBELs and RWLs, and therefore supports BMP scheduling.

1.5. ENHANCED WATERSHED MANAGEMENT PROGRAM PLAN OVERVIEW

This EWMP Work Plan has been prepared to outline the steps that will be taken by the SMB EWMP Group in order to implement the SMB EWMP in compliance with the requirements and deadlines set forth within the MS4 Permit. This document is organized into the following sections:

- **Section 1 –** Introduction
- **Section 2** – Watershed Characterization
- **Section 3** – Identification of Water Quality Priorities
- **Section 4** – Watershed Control Measures
- **Section 5** – Reasonable Assurance Analysis Approach
- **Section 6** – EWMP Development
- **Section 7** – References

Section 2
Watershed Characterization

This section provides an overview of the watershed and characterizes pertinent features.

2.1. GEOGRAPHICAL DESCRIPTION

The SMB EWMP Group falls within the boundaries of JG2 and JG3, which are located within the central region of the Santa Monica Bay Watershed Management Area (SMB WMA), and encompasses an area of approximately 34,362 acres. The boundary of the Santa Monica Bay, as defined for the National Estuary Program, extends from the Los Angeles/Ventura County line to the northwest, southward to Point Fermin located on the Palos Verdes Peninsula to the southeast. The land area that drains into the Bay follows the crest of the Santa Monica Mountains on the north to Griffith Park, then extends south and west across the Los Angeles coastal plain to include the area east of Ballona Creek and north of the Baldwin Hills. South of Ballona Creek the natural drainage is a narrow coastal strip between Playa del Rey and Palos Verdes (Regional Board, 2011). **Figure 2-1** shows the SMB EWMP Group within the SMB Watershed.

2.2. WATER BODIES AND SUBWATERSHEDS

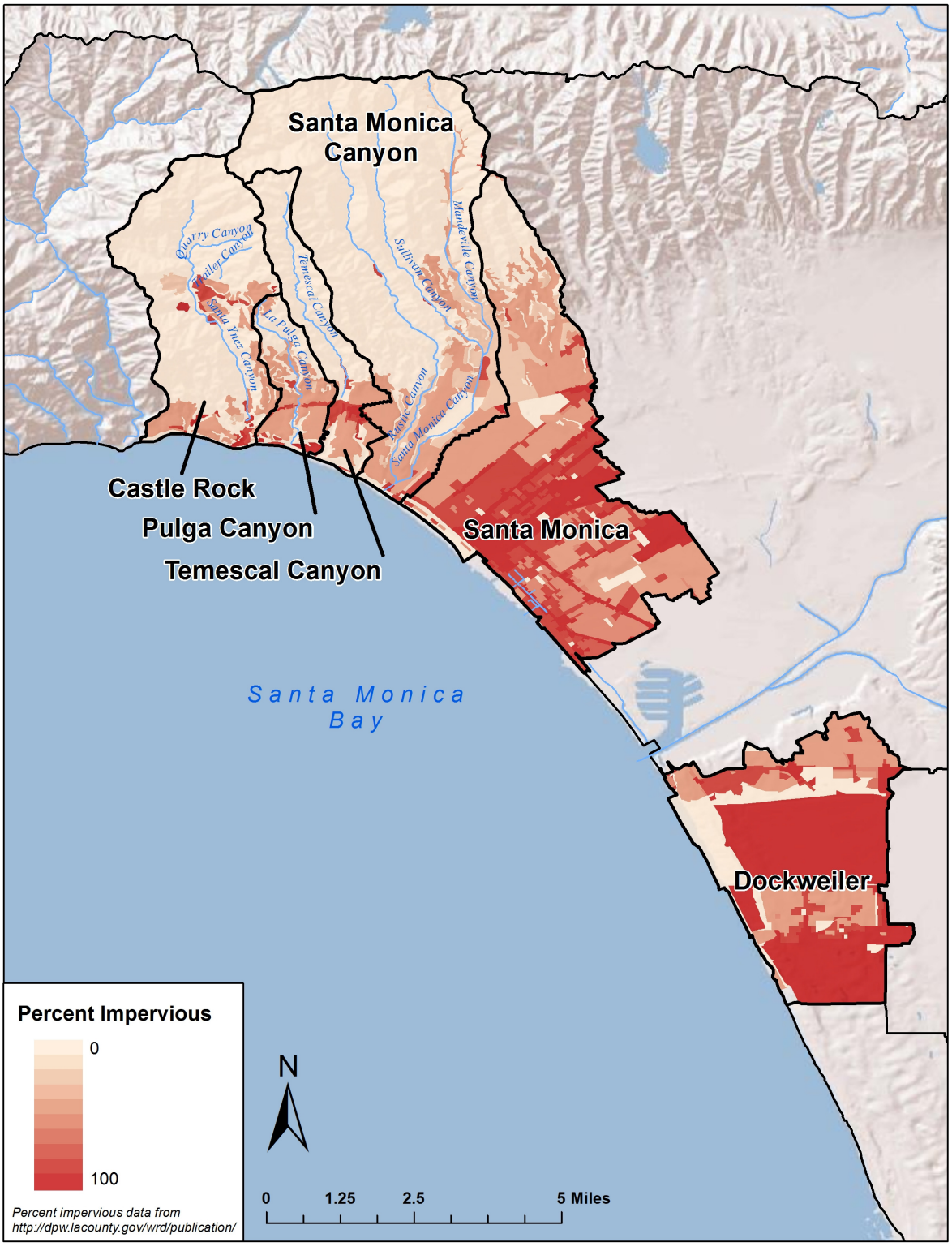
Subwatersheds within the SMB EWMP Group Area include the mostly open space Castle Rock, Pulga Canyon, Temescal Canyon, and Santa Monica Canyon subwatersheds in addition to the more urbanized Dockweiler and Santa Monica subwatersheds. Approximately 67 percent of the SMB EWMP Group area is pervious according to GIS data from the Los Angeles County Department of Public Works, the large majority of which comes from the northern-most subwatersheds of Castle Rock, Pulga Canyon, Temescal Canyon and Santa Monica Canyon. Water bodies and their contributing subwatersheds are summarized in **Table 2-1**. **Figure 2-2** shows the location of the subwatersheds within the SMB EWMP Group area.

Table 2-1
Santa Monica Bay EWMP Area Water bodies/Tributaries and Subwatersheds

Subwatershed	Water Body	Water Body/Tributary
Castle Rock	Santa Ynez Canyon	Quarry Canyon Trailer Canyon
Pulga Canyon	La Pulga Canyon	
Temescal Canyon	Temescal Canyon	
Santa Monica Canyon	Santa Monica Canyon	Rustic Canyon Creek Sullivan Canyon Creek Mandeville Canyon Creek
Santa Monica	Santa Monica Bay	
Dockweiler	Santa Monica Bay	

Figure 2-1
Santa Monica Bay EWMP Group Area

Figure 2-2
Santa Monica Bay Subwatersheds



Section 3
Identification of Water Quality Priorities

In accordance with the Permit Section IV.C.5(a), water quality priorities have been established for the EWMP. The water quality priorities identified in this section provide the basis for prioritizing project implementation; selecting and scheduling BMPs; and focusing monitoring activities developed in the CIMP. Details on the development of the water quality priorities will be included in the CIMP.

3.1. WATER QUALITY CHARACTERIZATION

Figure 3-1 identifies the receiving waters in the SMB EWMP Group area, as depicted in the Water Quality Control Plan, Los Angeles Region (Basin Plan) (Regional Board, 1995, Updated 2011). Ultimately, all receiving water bodies are tributary to the Santa Monica Bay. **Table 3-1** summarizes the beneficial uses for each water body in the SMB EWMP Group area, as designated in the Basin Plan. As beneficial uses designated as "potential" have not yet been established, these uses will not be evaluated further in the EWMP Work Plan.

Figure 3-1
Water Bodies

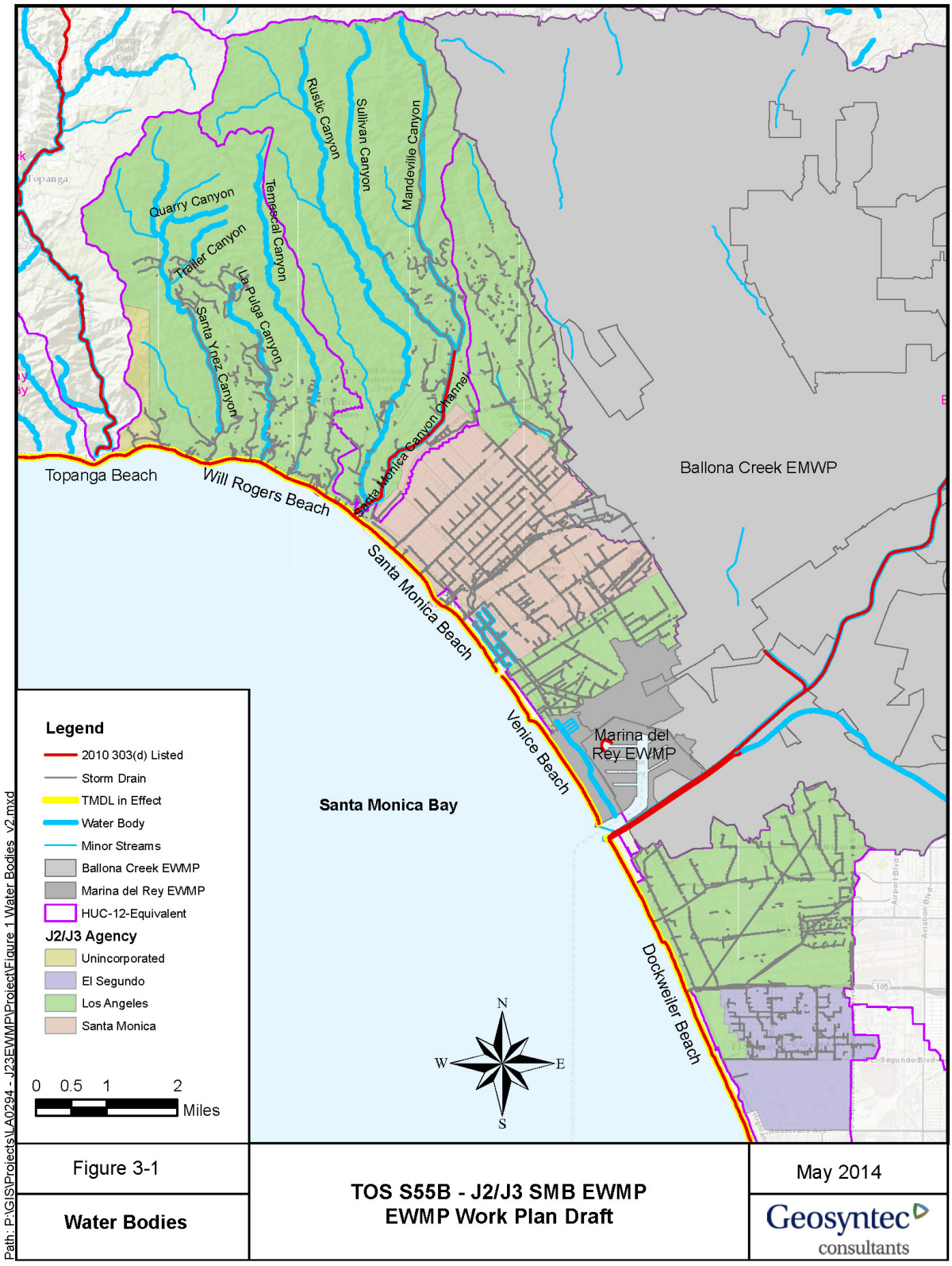


Table 3-1
Beneficial Uses of Water Bodies and Coastal Features Designated in the Basin Plan

Water Body (and Tributaries)	Beneficial Uses													
	MUN[1]	WARM	WILD	RARE	REC-1	REC-2	IND	NAV	COMM	MAR	BIOL	MIGR	SPWN	SHELL
Santa Monica Bay - Nearshore Zone^			E	Ee			E	E	E	E	Ean	Ef	Ef	Ear
La Pulga Canyon [a]			E	Ee			E	E	E	E	Ean	Ef	Ef	Ear
Temescal Canyon [a]			E	Ee			E	E	E	E	Ean	Ef	Ef	Ear
Santa Monica Canyon Channel	P*	P	P		Ps	I								
Rustic Canyon Creek	P*	I	E		I	I								
Sullivan Canyon Creek	P*	I	E		I	I								
Mandeville Canyon Creek	P*	I	E		I	I								
Santa Ynez Canyon	P*	I	E	E	Pk	E								
Quarry Canyon [a]	P*	I	E	E	Pk	E								
Trailer Canyon [a]	P*	I	E	E	Pk	E								
Will Rogers Beach			E		E	E		E	E	E			P	E
Santa Monica Beach			E		E	E		E	E	E		E	Eas	E
Venice Beach			E	E	E	E		E	E	E		E	Eas	E
Dockweiler Beach			E		E	E	E	E	E	E			P	

Beneficial Use Designations: **MUN** = Municipal and Domestic Supply; **WARM** = Warm Freshwater Habitat; **WILD** = Wildlife Habitat; **RARE** = Preservation of Rare and Endangered Species; **REC-1** = Water Contact Recreation; **REC-2** = Noncontact Water Recreation; **IND** = Industrial Service Supply; **NAV** = Navigation; **COMM** = Commercial and Sport Fishing; **MAR** = Marine Habitat; **BIOL** = Preservation of Biological Habitats of Special Significance; **MIGR** = Fish Migration; **SPWN** = Fish Spawning; **SHELL** = Shellfish Harvesting

[1] Asterisked MUN designations are designated under State Water Resources Control Board Resolution No. 88-63 (SB 88-63) and Regional Board Resolution No. 89-03 (RB 89-03). Some designations may be considered for exemption at a later date.

P = Potential beneficial use

I = Intermittent beneficial use

E = Existing beneficial use

a = Beneficial use designations apply to all tributaries to the indicated water body, if not listed separately.

e = One or more rare species utilize all bays, estuaries, lagoons and coastal wetlands for foraging and/or nesting

f = Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

k = Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County DPW

s = Access prohibited by Los Angeles County Department of Public Works (DPW)

an = Areas of Special Biological Significance (along coast from Latigo Point to Laguna Point) and Big Sycamore Canyon and Abalone Cove Ecological Reserves and Point Fermin Marine Life Refuge.

ar = Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach.

as = Most frequently used grunion spawning beaches. Other beaches may be used as well.

^ = Nearshore is defined as the zone bounded by the shoreline or the 30-foot depth contours, whichever is further from the shoreline. Longshore extent is from Rincon Creek to the San Gabriel River Estuary.

3.1.1. Water Quality Objectives/Criteria

The Clean Water Act (CWA) requires that the SWRCB and Regional Water Quality Control Boards conduct a water quality assessment that addresses the condition of its surface waters [required in Section 305(b) of the CWA] and provides a list of impaired waters [required in CWA Section 303(d)] that is then submitted to the USEPA for review and approval. The 2010 Integrated Report and updated 303(d) list were approved by the State Water Resources Control Board on August 4, 2010 and by the USEPA on October 11, 2011. The 2010 303(d)-listed water bodies and associated pollutants within the SMB EWMP Group area are summarized in **Table 3-2**.

The water bodies previously listed in **Table 3-1** are subject to water quality objectives in the Basin Plan, or Basin Plan Amendments, such as those to implement total maximum daily loads (TMDLs). There are currently four TMDLs in effect for the water bodies within the SMB EWMP Group area as listed in Attachment M of the Permit, plus one that has not yet been approved by the USEPA, and is therefore not yet effective. These TMDLs are summarized in **Table 3-3**.

Table 3-2
2010 303(d)-Listed Water Bodies in the SMB EWMP Group Area

Water Body	Pollutant Class	Pollutant	Notes
Santa Monica Bay Beaches	Pathogens	Coliform Bacteria	Addressed by Bacteria TMDL
	Pesticides	DDT	Addressed by PCB/DDT TMDL
	Other Organics	PCBs	Addressed by PCB/DDT TMDL
Santa Monica Bay Offshore/Nearshore	Trash	Debris / Plastic Pellets	Addressed by Trash TMDL
Santa Monica Bay	Pesticides	DDT (tissue & sediment)	Addressed by PCB/DDT TMDL
	Other Organics	PCBs (tissue & sediment)	Addressed by PCB/DDT TMDL
	Toxicity	Sediment Toxicity	Addressed by PCB/DDT TMDL
	Miscellaneous	Fish Consumption Advisory	Addressed by PCB/DDT TMDL
Santa Monica Canyon Channel	Metals/Metalloids	Lead	TMDL does not currently exist
	Pathogens	Indicator Bacteria	303(d) list states that impairment is addressed by SMB Beaches Bacteria TMDLs[1]

[1] http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/01084.shtml

Table 3-3
Santa Monica Bay TMDLs

TMDL Name	Agency	Effective Date
SMB Beaches Bacteria TMDL, Reconsideration of Certain Technical Matters of the SMBB Bacteria TMDL, Resolution R12-007[a]	Regional Board	Not yet effective
SMB TMDL for DDT and PCBs	USEPA	March 26, 2012
SMB Nearshore Debris TMDL, Resolution R10-010	Regional Board	March 20, 2012
SMB Beaches Bacteria TMDL, Dry Weather, Resolution 2002-004[b]	Regional Board	July 15, 2003
SMB Beaches (SMBB) Bacteria TMDL, Wet Weather, Resolution 2002-022[b]	Regional Board	July 15, 2003

[a] This TMDL revision is not yet approved by USEPA.
[b] This TMDL was revised pursuant to Resolution R12-2007.

Table 3-4 identifies the applicable WQBELs and/or RWLs established pursuant to TMDLs included in Attachment M of the Permit. The water quality objectives as listed in the Basin Plan are also applicable to water bodies based on the designated beneficial uses. The Trash TMDL final WQBELs are effective March 20, 2020. The effective date of the PCB and DDT final WQBELs will be determined in the EWMP since this is an EPA-developed TMDL that lacks a compliance schedule. The Bacteria TMDL final WQBELs and RWLs are currently effective for dry weather and those for wet weather will become effective July 15, 2021.

Table 3-4
Final Permit RWLs and WQBELs for SMB TMDLs

Reference	Parameter	Effluent Limitation/ Receiving Water Limitation
SMB Nearshore Debris TMDL	Trash – WQBEL	Zero
	Plastic Pellets – WQBEL	Zero
TMDL for PCBs/DDT (for LA County MS4)	DDT – WQBEL	27.08 g/yr (based on 3-year averaging period)[2]
	PCBs – WQBEL	140.25 g/yr (based on 3-year averaging period)
SMB Beaches Bacteria TMDL	Total coliform (daily maximum) – WQBEL	10,000 Most Probable Number (MPN)/100 mL
	Total coliform (daily maximum), if the ratio of fecal-to-total coliform exceeds 0.1 – WQBEL	1,000 MPN/100 mL
	Fecal coliform (daily maximum) – WQBEL	400 MPN/100 mL
	Enterococcus (daily maximum) – WQBEL	104 MPN/100 mL
	Total coliform (geometric mean[1]) – WQBEL/RWL	1,000 MPN/100 mL
	Fecal coliform (geometric mean[1]) – WQBEL/RWL	200 MPN/100 mL
	Enterococcus (geometric mean[1]) – WQBEL/RWL	35 MPN/100 mL

[1]The rolling 30-day geometric mean is calculated based on the previous 30 days. The reopened 2012 TMDL, which has not yet been approved by USEPA, modified this to weekly calculation of a rolling six week geometric mean using five or more sample, starting all calculation weeks on Sunday.
[2]Group load-based WQBELs that apply to all SMB MS4 dischargers; the individual load-based WQBELs for SMB EWMP Group members would be an area-weighted fraction of this.

Grouped RWLs for the SMB beaches Bacteria TMDL are also expressed in the Permit in terms of allowable exceedance days (AEDs), which vary by season and by Coordinated Shoreline Monitoring Plan (CSMP) monitoring station. These AEDs are summarized in Attachment M of the Permit. These grouped RWLs are currently effective for dry weather and will be effective July 15, 2021 for wet weather.

3.1.2. Detailed Data Analysis

A detailed monitoring data analysis was conducted to identify WBPCs demonstrating exceedance(s) of applicable receiving water limitations.

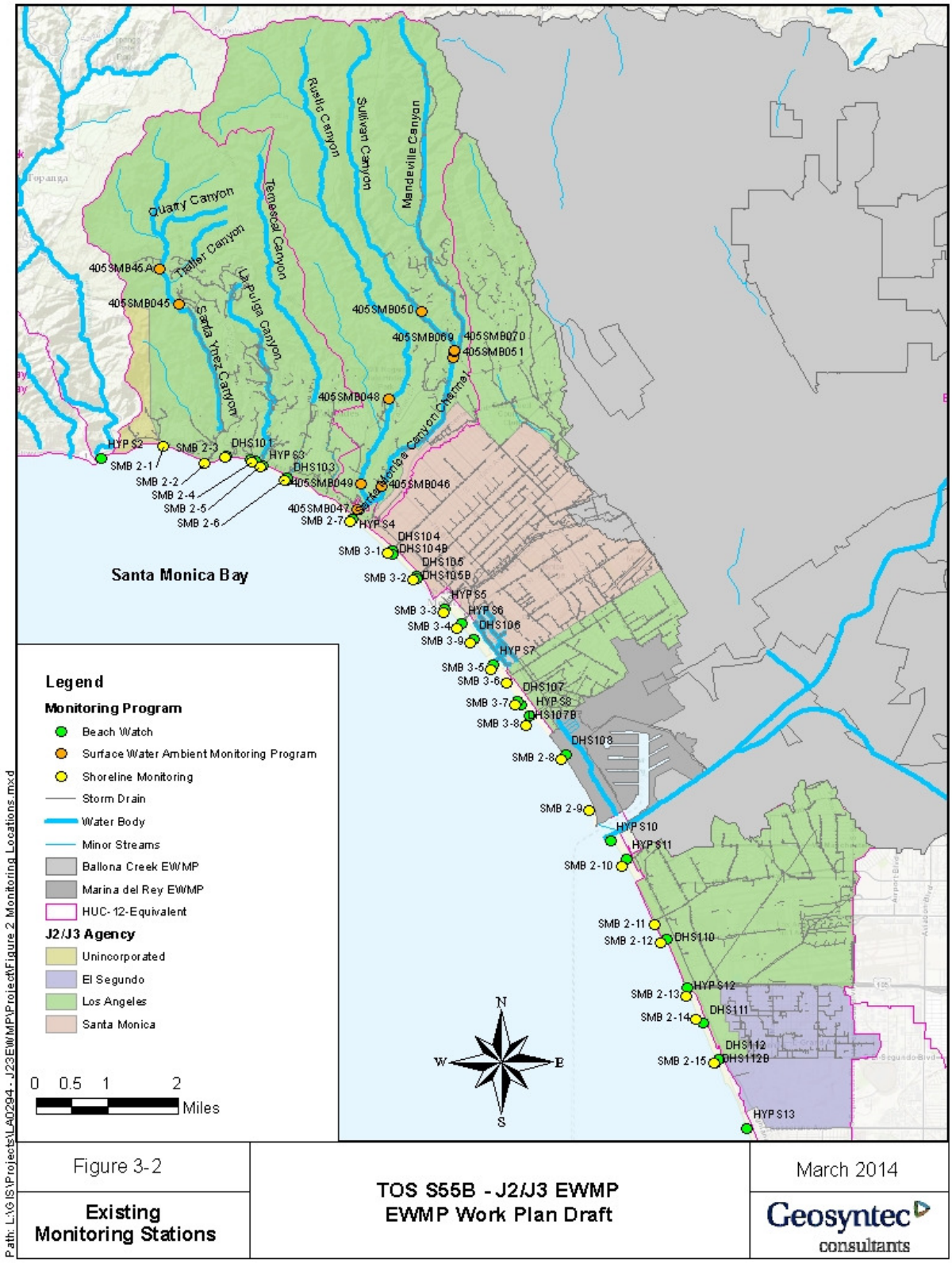
Monitoring data analyzed are summarized in **Table 3-5**, and existing monitoring stations are shown in **Figure 3-2**. It should be noted that the data presented are receiving water quality data and do not imply MS4 contributions.

Table 3-5
Existing Monitoring Programs

Program Name	Monitoring Period	Monitoring Locations	Parameters Analyzed	Frequency
Coordinated Shoreline Monitoring Program	2004-2013	Santa Monica Bay beaches	Bacteria	Varies by site, weekly or daily
Beach Watch Monitoring	2003-2012	Santa Monica Bay beaches	Bacteria	Varies
Surface Water Ambient Monitoring Program (SWAMP)	2003-2004	Inland surface waters	General suite, see Appendix A	1 sampling event each year

Water quality data was compared to WQBELs and/or water quality objectives to determine if exceedances occurred within the last five (5) years. Those constituents that had no exceedances within the past five (5) years or did not meet the 303(d) listing criteria for impairment were identified and will not be considered in the prioritization process at this time.

Figure 3-2
Existing Monitoring Stations



As part of the SWAMP, locations were each sampled twice for a suite of parameters (once in March of 2003 and once in February of 2004). The weather conditions (wet or dry) at the time of sampling were not available from the data source. An analysis of available freshwater monitoring data for the sites showed one exceedance of the receiving water limits for pH (value not between 6.5 and 8.5 pH units) at each of four monitoring locations between 2003 and 2004. Additionally, based on available data, exceedances of the *E. coli* freshwater daily maximum objective of 235 MPN/100mL at sites with an existing or intermittent REC-1 beneficial use were measured at three monitoring locations between 2003 and 2004 (SWAMP). Exceedances of the fecal coliform freshwater objective of 400 MPN/100mL applicable to sites with an existing or intermittent REC-1 beneficial use and 4,000 MPN/100mL applicable to sites with an existing or intermittent REC-2 beneficial use were measured at four monitoring locations between 2003 and 2004 (SWAMP).

Given both the limited amount of data available and the fact that such data was collected more than ten years ago, pH, E. coli, and fecal coliform will not be considered Category 3 pollutants. Furthermore, two samples are considered insufficient to characterize the water bodies. Future monitoring under the CIMP will help determine if the SMB EWMP will need to be revised to include these, or other, parameters for specific water bodies. Category 3 WBPCs will be identified based on data collected as part of the approved CIMP.

3.2. WATER BODY-POLLUTANT PRIORITIZATION

Based on the water quality characterization, the water body–pollutant combinations (WBPCs) have been classified into one of three categories, in accordance with Section IV.C.5(a)ii of the Permit. **Table 3-7** summarizes the criteria for each category, as defined by the Permit. **Table 3-8** presents the WBPCs for the SMB EWMP. This categorization is intended to prioritize WBPCs in order to guide the implementation of structural and institutional BMPs, and monitoring activities in the CIMP.

As part of the adaptive management process, categorization of WBPCs may be adjusted based on data obtained from monitoring, source evaluations, and BMP implementation. Data collected as part of the approved CIMP may result in future Category 3 designations in instances when receiving water limits are exceeded and MS4 discharges are identified as contributing to such exceedances. Under these conditions, the appropriate agencies will adhere to Section VI.C.2.a.iii of the Permit.

Table 3-7
Description of Water Body-Pollutant Prioritization Categories

Category	Description
1	Water body-pollutant combinations under Category 1 (highest priority) are defined in the Permit as "water body-pollutant combinations for which water quality-based effluent limitations and/or receiving water limitations are established in Part VI.E and Attachments L through R [of the Permit]."
2	Category 2 (high priority) water body-pollutant combinations are defined as "pollutants for which data indicate water quality impairment in the receiving water according to the State's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) and for which MS4 discharges may be causing or contributing to the impairment."
3	Category 3 (Medium Priority) designations are to be applied to water body-pollutant combinations that are not 303(d)-listed, but which exceed applicable receiving water limitations contained in the Permit and for which MS4 discharges may be causing or contributing to the exceedance.

Table 3-8
Water Body Pollutant Prioritization[3]

Category	Water Body	Pollutant	Compliance Deadline
1	SMB Beaches	Summer dry weather bacteria	7/15/2006 (Final: Single sample summer AEDs)
	SMB Beaches	Wet weather bacteria	7/15/2009 (Interim: 10% single sample ED reduction) 7/15/2013 (Interim: 25% single sample ED reduction) 7/15/2018 (Interim: 50% single sample ED reduction) 7/15/2021 (Final: Single sample AED) 7/15/2021 (Final: Geometric Mean [GM])
	SMB Beaches	Winter dry weather bacteria	11/1/2009 (Final: Single sample winter AEDs)[1]
	SMB Offshore/ Nearshore	Debris	3/20/2016 (20% load reduction) 3/20/2017 (40% load reduction) 3/20/2018 (60% load reduction) 3/20/2019 (80% load reduction) 3/20/2020 (100% load reduction)
	SMB	DDTs	Compliance schedule to be developed through EWMP[2]
	SMB	PCBs	Compliance schedule to be developed through EWMP[2]
2	Santa Monica Canyon Channel	Lead	NA
	Santa Monica Canyon Channel	Indicator bacteria	NA
3	None	None	None

[1] Compliance date per 2013 reopened TMDL, which is not yet effective (i.e., USEPA and Office of Administrative Law approval is pending).
[2] Although the TMDL lacks a formal compliance schedule for the WQBEL, the TMDL Executive Summary does state, "The time frame for attainment of the TMDL targets for the rest of Santa Monica Bay (other than the Palos Verdes shelf) is 11 years for DDT and 22 years for PCBs."
[3] Listed in order of compliance deadline, interim and final are included.

Section 4
Watershed Control Measures

As part of the development of the EWMP, the Permit specifies that control measures, also referred to as BMPs, shall be identified to ensure that stormwater discharges meet receiving water and effluent limits as established in the Permit and to reduce overall impacts to receiving waters from stormwater and non-stormwater runoff.

BMPs are grouped into two broad categories, structural and institutional. Structural BMPs are physically-constructed control measures that alter the hydrology or water quality of stormwater or non-stormwater within the MS4. Institutional BMPs are source control measures that prevent the release of flow/pollutants or transport of pollutants within the MS4 area, but do not involve construction of physical facilities. Minimum control measures (MCMs) (such as street sweeping) are a subset of institutional BMPs. Institutional BMPs are normally utilized to address runoff close to the source from a limited number of parcels.

4.1. STRUCTURAL BMPS

Structural BMPs are categorized as either distributed or regional. Distributed BMPs are designed to treat runoff from small drainage areas comprised of a single to a few parcels. Regional BMPs are designed to treat runoff from a large drainage area expected to include multiple parcels and various land uses. A subset of regional BMPs capable of capturing runoff from the 85th percentile, 24-hour storm are referred to as "Regional EWMP Projects" herein.

4.1.1. Structural BMP Subcategories

Regional and distributed structural BMPs are further defined by the subcategories identified in **Table 4-1**.

Table 4-1
Nomenclature for Categories and Subcategories of Structural BMPs

Category	Subcategory	Example BMP Types
Centralized BMPs	Infiltration	Surface infiltration basin, subsurface infiltration gallery
	Detention	Surface detention basin, subsurface detention gallery, large-scale cisterns
	Constructed Wetland	Constructed wetland, flow-through/linear wetland, subsurface flow wetlands
	Treatment Facilities	Facilities designed to treat runoff from and return it to the receiving water.
	Low Flow Diversions (LFD)	BMPs that divert runoff to the sanitary sewer (normally dry weather or non-storm water only).
Distributed BMPs	Site-Scale Detention	Dry detention pond, wet detention pond, detention chambers, small-scale cisterns, rain barrels, downspout redirect, etc.
	Green Infrastructure	Biofiltration includes vegetated BMPs with underdrains
		Bioretention includes vegetated BMPs without underdrains
		Permeable pavement, porous pavement, permeable pavers, etc.
		Green streets (often an aggregate of bioretention, biofiltration and/or permeable pavement)
		Infiltration BMPs include non-vegetated dry wells, infiltration trenches, etc.
		Bioswales include vegetative filter strips and vegetative swales
		Rainfall harvest (rain barrels, green roofs and cisterns)
	Flow-through Treatment BMPs	Treatment BMPs with a minor (or non-existent) infiltration component, often modular/vault-type BMPs including cartridge media filters
	Source Control Structural BMPs	Catch basin inserts, screens, hydrodynamic separators, trash enclosures, etc.

4.1.2. Existing Centralized/Distributed BMPs

This section summarizes available information regarding existing regional and distributed structural BMPs within the SMB EWMP Group area. In order to compile information regarding existing BMPs, a data request was distributed to the SMB EWMP Group. In addition to the information provided by the SMB EWMP Group, a review of available literature was also completed. The literature review included the NOI, the Online Project Tracking and Integration System (OPTI) Database, Integrated Regional Watershed Management Program (IRWMP) documents, and TMDL Implementation plans.

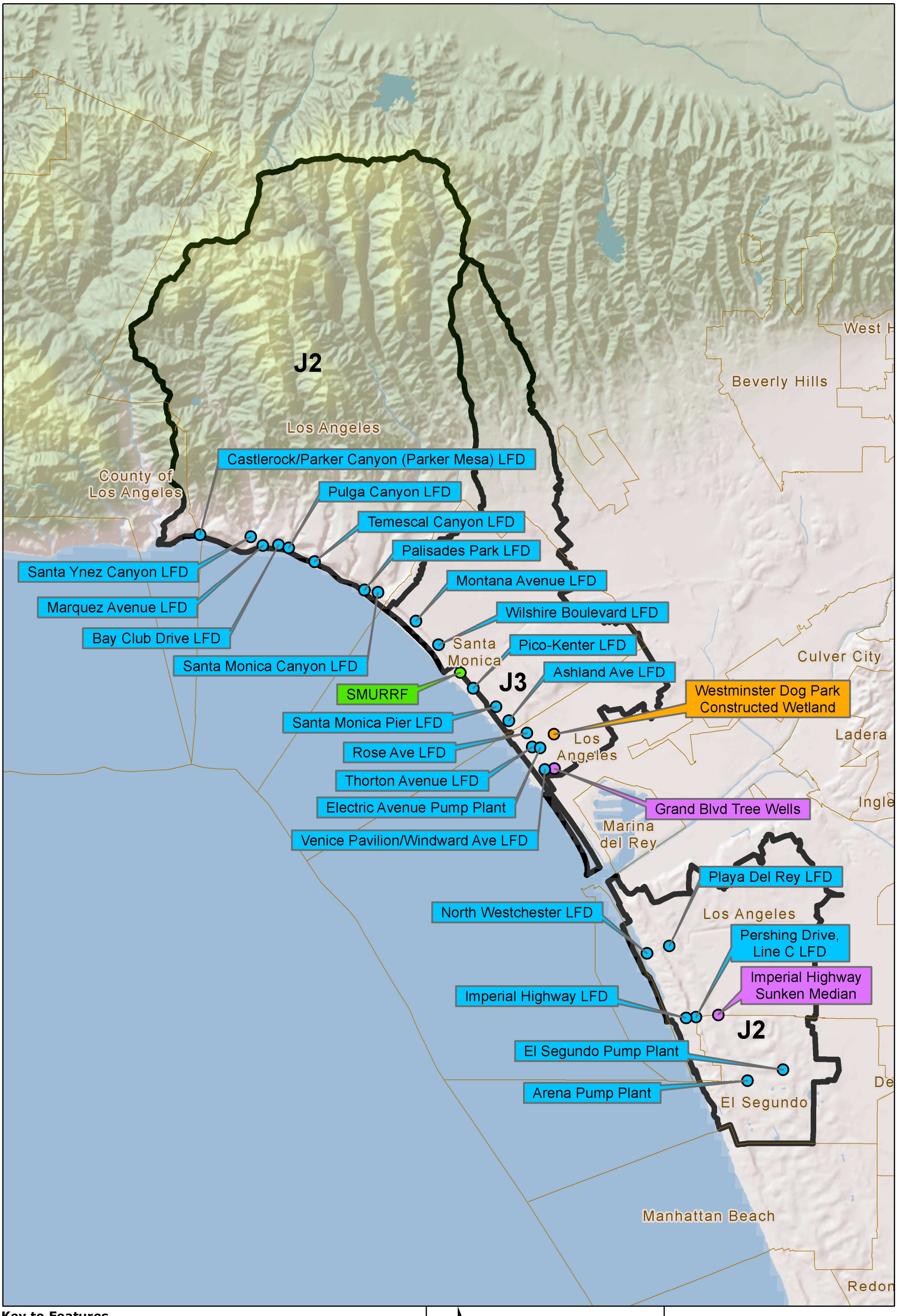
Existing Regional BMPs

Regional BMPs identified through the data request and literature review were characterized per the BMP categories defined. A total of 27 regional BMPs were identified and are summarized in **Table 4-2**. Three (3) of these regional BMPs are joint projects between multiple agencies. Of the 27 existing regional projects, 23 are Low Flow Diversions, 2 are infiltration BMPs, 1 is a constructed wetland, and 1 is a treatment facility. Locations of Existing Regional BMPs are shown on **Figure 4-1**.

Table 4-2
Summary of Existing Regional Best Management Practices by Permittee and Type

Permittee	Total BMPs Reported[1]	Number of Existing Regional BMPs Reported by Permittee			
		Infiltration	Constructed Wetland	Treatment Facility	Low-Flow Diversion[2]
El Segundo	-	-	-	-	-
Los Angeles	12	2	1	1[3]	8
Santa Monica	5	-	-	1[3]	4
County	-	-	-	-	-
LACFCD	11	-	-	-	11

[1] This column shows the number of BMPs for which each Permittee has ownership/partial ownership. As double counting occurs when multiple permittees have ownership of a project, the numbers in each column should not be added to determine the total number of physical BMPs.
[2] Low-Flow Diversions capture and divert 100% of dry flow.
[3] The Santa Monica Urban Runoff Recycling Facility (SMURRF) is a joint project between the City of Los Angeles and City of Santa Monica.



Key to Features

Regional BMPs

- Constructed Wetland
- Low Flow Diversion
- Infiltration
- Treatment Facility
- Jurisdictional Groups 2/3 (TMDL IP)
- City Boundary

N

0 0.5 1 Miles

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Date: April 23, 2014

Figure 4-1
Existing Regional BMPs within JG2 and JG3

MWH

Existing Distributed BMPs

Existing distributed BMPs were identified through the data request that included a total 2,212 BMPs in the SMB EWMP Group area. Of these distributed BMPs, 340 exist within the City of Los Angeles and 1,872 exist within the City of Santa Monica. The BMPs identified in the City of Santa Monica reflect both city-owned and privately-owned BMPs. Existing distributed BMPs within the SMB EWMP Group area are summarized by type in **Table 4-3**.

Table 4-3
Existing Distributed Best Management Practices by Permittee and Type

Permittee[2]	Number of Existing Distributed BMPs by Type Reported by Permittee										
			Green Infrastructure								
	Total BMPs Reported	Site-Scale Detention	Bioretention	Biofiltration	Permeable Pavement	Bioswale	Infiltration	Rainfall Harvest	Flow Through	Source Control	Unknown[1]
El Segundo[3]	-	-	-	-	-	-	-	-	-	-	-
Los Angeles	340	14	168	-	51	11	9	44	11	31	-
Santa Monica	1872	-	1	230	89	-	1,329	1	101	-	67
County[3]	-	-	-	-	-	-	-	-	-	-	-
LACFCD[3]	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**2212**	**14**	**169**	**230**	**140**	**11**	**1,338**	**45**	**112**	**31**	**67**

[1] BMPs listed as "unknown" are those for which a BMP category was not specified in the data request.
[2] BMPs were assigned to Permittee by geographic location in the instance that ownership information was not available.
[3] Distributed BMPs have not been implemented by El Segundo, the County, or LACFCD in the JG2JG2/JG3 area.

4.1.3. Planned Regional BMPs

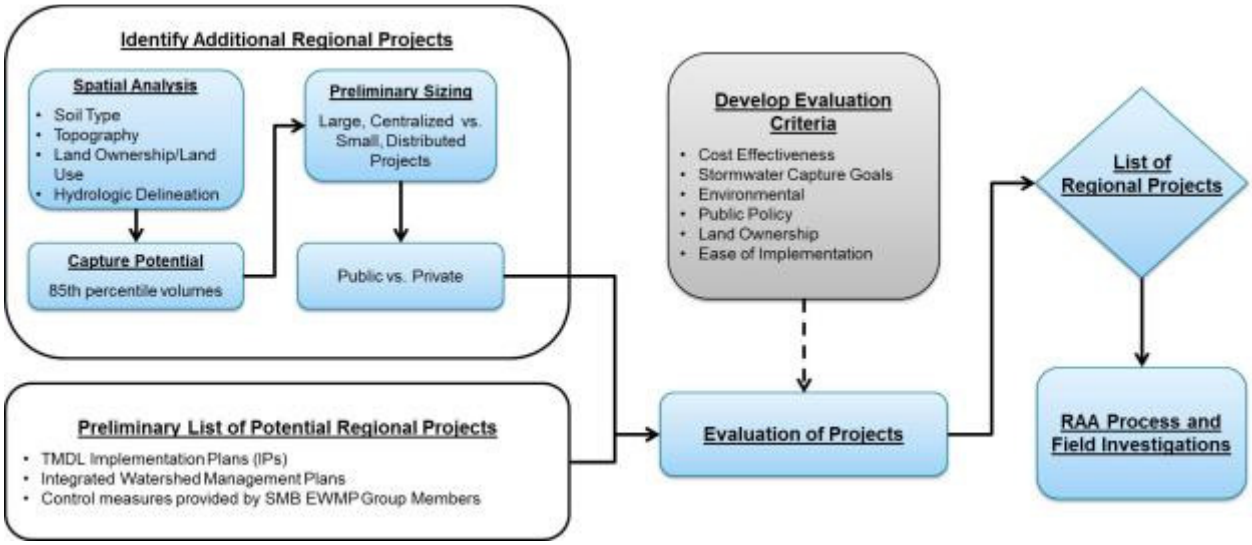
A total of ten planned regional BMPs were identified within the SMB EWMP Group area via literature review and data provided by Permittees. Planned regional BMPs are listed below:

- Penmar Water Quality Improvement Project (Phase I and Phase II)
- Santa Monica Bay Low Flow Diversion Upgrades Pkg 3 (Phase II)
- Temescal Canyon Park Stormwater BMP (Phase I and Phase II)
- Westchester Stormwater BMP
- Coastal Habitat Restoration
- Oyster Stock Enhancement in Santa Monica Bay Harbor to reduce total maximum daily loads
- Marine Park (Penmar) Project
- Los Amigos Park Cistern
- Memorial Park, Beach Parking Lot
- Ozone Park, Los Amigos Park

4.2. PROCESS FOR IDENTIFYING REGIONAL EWMP PROJECTS

The EWMP process emphasizes identifying Regional EWMP projects that are individually or collectively able to capture runoff from the 85th percentile, 24-hour storm. BMPs that have been identified above and additional BMPs will be considered as part of the EWMP process. This section presents the method that will be used to identify potential regional projects. The process to identify additional regional projects and evaluate regional projects is illustrated schematically in **Figure 4-3**.

Figure 4-3
Process for Evaluating Regional EWMP Projects



4.2.1. Identification of Additional Regional Projects

A list of planned regional projects has been developed for the EWMP based on a review of existing watershed planning documents, including TMDL Implementation Plans, Integrated Regional Water Management Plans, and other planning documents provided by the SMB EWMP Group. Along with this preliminary list, additional regional projects may be identified and considered for further evaluation. Additional regional projects will be identified using a detailed analysis, beginning with an initial screening to eliminate locations with fatal flaws, and culminating with an identification of parcels potentially suitable for regional projects.

Initial Spatial Analysis
Initially, a preliminary screening will identify locations that can be eliminated from consideration because they are clearly unsuitable for siting regional projects. Potential "fatal flaws" that would exclude locations include adverse conditions related to:

- **Soil Type.** Surface soils such as bedrock materials, clay, or other relatively impermeable substrate will prohibit the infiltration of stormwater. Locations where these conditions exist will be considered less preferable during the initial screening for projects involving infiltration. However, capture or treatment for release and/or reuse may still be possible in these locations.
- **Topography.** Locations with slopes greater than 25 percent will be eliminated from further consideration because of the difficulty in constructing facilities in high-relief terrain.

Additionally, areas in the headwaters of the watershed will be considered less preferable because of the paucity of stormwater runoff in these areas.

- **Unsuitable Land Ownership and/or Land Use Designations.** Land ownership and/or prior designation of land use of areas within the SMB EWMP Group Area that would prohibit regional projects will be considered less preferable. Areas that are owned by federal or state governments will be considered less preferable because of the difficulty of permitting and maintaining projects in these areas. Other considerations will include protected open spaces or wilderness areas that are less suitable for locating regional projects.

This initial spatial screening will result in identification of areas that may have the potential to meet the 85th percentile, 24-hour storm event capture volume requirement. These areas may be considered for further evaluation as potential Regional EWMP Project locations.

Capture Potential and Preliminary Sizing
Projects will be sized to capture the required volume of water at selected locations along stormwater flow paths within the SMB EWMP Group Area. A few centralized locations at lower elevations in the watershed will require larger acreage and capture capacity than numerous distributed regional facilities located higher in the watershed. The intent of the capture potential analysis is to begin to frame the practicality of a few centralized projects and evaluate the practical requirement for a larger number of more distributed regional projects. Using typical infiltration rates, the size of a potential project can be evaluated if the volume of water to be captured is known. The next step in the progressive spatial analysis is to perform preliminary sizing of required facilities at key locations in the watershed in order to provide information as to the practicality of larger centralized projects.

Analysis of Specific Project Locations
An evaluation of specific parcels that may be suitable for additional regional projects will begin with identification of those that are publically owned, such as parks, schools, flood control facilities, or other publicly-owned open spaces that may meet the area requirements identified in the evaluation of capture potential. If the number of publicly-owned parcels is not sufficient to meet anticipated capture potential, then privately-owned parcels with large open spaces, such as parking lots, will be considered.

Based on this analysis, a list of additional regional projects will be generated, which in combination, will have the potential to capture the 85th percentile, 24-hour storm event for the drainage area tributary to these locations. Information related to the projects will include the parcel location, parcel size, current ownership, and necessary infiltration capacity.

The list of additional projects generated as a result of this process will then be evaluated based on criteria developed by the MWH Team with input from SMB EWMP Group (as described in the following section).

4.2.2. Evaluation Criteria Development

The list of potential and additional regional projects will be evaluated based on criteria developed with the input from SMB EWMP Group. The purpose of the evaluation is to determine the projects best suited for Regional EWMP Projects and for achieving additional multi-benefit uses. **Table 4-4** identifies potential categories for evaluation criteria to prioritize projects and their ability to meet Permit requirements and SMB EWMP Group goals. These categories and considerations will be refined based on input from the SMB EWMP Group.

Table 4-4
Regional Project Evaluation Criteria

Criteria Category	Considerations
Cost Effectiveness	Life Cycle Cost Capital Cost Operations and Maintenance Cost Funding Options (Grants, State Revolving Fund, other funding)
Stormwater Capture Goals	Capacity or Volume of Water Captured Water Quality Groundwater Recharge/Infiltration Capacity Geographical Location Flood Control Mitigation
Environmental	Environmental Constraints Reduced Energy Consumption Consumption of Other Resources Multi-use Benefits Groundwater Contamination Concerns
Public Policy Institutional Issues	Political Constraints Education/Outreach Political Support Partnerships
Land Ownership	Public vs. Private Land Acquisition Impediments
Ease of Implementation	Permitting Schedules (short term vs. long term) Constructability Site Accessibility

4.2.3. Ranking Potential Regional Projects

The list of potential and additional regional projects will be ranked in accordance with the evaluation criteria described previously and refined with input from the SMB EWMP Group. Ranking input will be collected through a survey, to be developed with input from the SMB EWMP Group, after which a summary of the results will be distributed by the MWH Team. Initially, ranking by category will be relatively simple, using qualitative weighting descriptions such as “favorable”, “moderately favorable”, and “not favorable”. More quantitative criteria and weighting factors will be developed if necessary and if more quantitative data becomes available. Regional projects can then be ranked and further evaluated based on the results of the RAA (see Section 5) and possible field investigations.

4.3. MINIMUM CONTROL MEASURES/INSTITUTIONAL BMPS

This section summarizes the existing MCMs that are in place in the SMB EWMP Group Area along with an outline for modifying MCMs and measuring the effectiveness of customized programs.

4.3.1. Existing MCMs

The required MCMs are similar to the programs required under the previous MS4 Permit (Order No. 01-182). The Permit requires the continuation of existing MCMs until the SMB EWMP is approved by the Regional Board. The existing MCMs, much like those proposed in the Permit, are comprised of six categories. A brief description of each Program MCM and associated tasks are summarized in the following text. The implementation summaries of the Program MCM tasks identified are available in the Unified Annual Stormwater Report.

Public Information and Participation Program
The objectives of the PIPP are to measurably increase public knowledge, change waste disposal and runoff pollution generation behavior, and involve/engage target populations in stormwater pollution mitigation.

Industrial/Commercial Facilities Program
The goal of the Industrial/Commercial Facilities Program is to track, inspect, and ensure compliance at industrial and commercial facilities that are critical sources of constituents in stormwater.

Development Planning Program
The Development Planning Program implements a set of requirements for development and redevelopment projects to minimize impacts from stormwater and urban runoff, maximize amount of pervious surfaces, minimize quantity of stormwater directed to impervious surfaces and the MS4, minimize parking lot pollution through BMPs, and reduce stormwater constituent loads in general.

Development Construction Program
Similar to the Development Planning Program, the Development Construction Program aims to control stormwater pollution from active construction sites. This program is implemented through sediment control measures, retention and recycling of construction-related materials and wastes, containment of non-stormwater runoff from washing and other activity, and erosion/slope controls.

Public Agency Activities Program
The activities under the Public Agency Activities Program include sewage system maintenance and overflow/spill prevention, public yards management, streets and roads maintenance, storm drain operation and management, emergency procedures, and other essential Permittee activities.

Illicit Connections and Illicit Discharges Elimination Program
The final program under the existing MCMs is the Illicit Connections (ICs) and Illicit Discharges (IDs) Elimination Program. The program requires Permittees to document, track, and report all cases of IC/ID and implement a response procedure and methods for public reporting.

4.3.2. Customization of MCMs

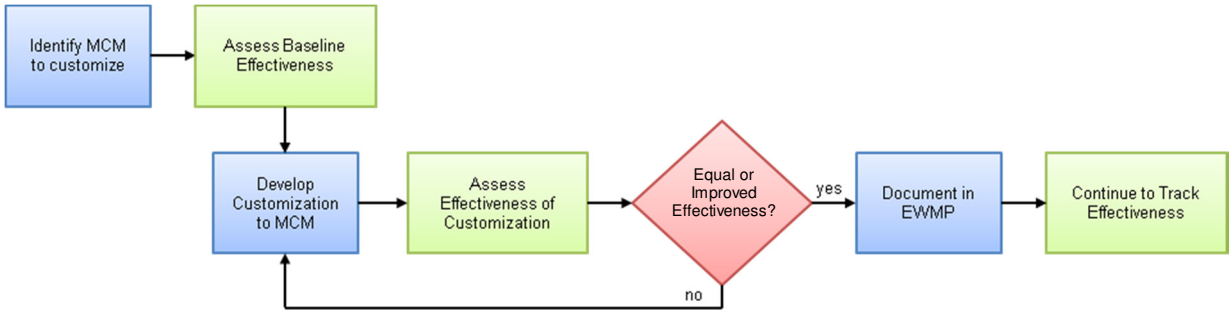
In lieu of the requirements of Parts VI.D.4 through VI.D.10 of the Permit, the SMB EWMP Group may customize MCMs within each of the general categories. The motivation for considering customization is made more apparent in the Regional Board's response to a comment that the Permit should establish

criteria that will be used to support any customization of MCMs; the Regional Board responded with the following:

> *The Order specifies that at a minimum, Permittees' programs shall be consistent with 40 CFR section 122.26(d)(2)(iv)(A)-(D). In response to comments that the Order is overly prescriptive, specifying criteria could restrict customization within these categories of minimum control measures. The criterion to allow customization is based on showing equivalent effectiveness, for example, a municipality who has identified a group of facilities within their jurisdiction as the largest source of constituents could be allowed to focus their inspection efforts on controlling the constituents from this subset of facilities.*
> (http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/StormSewer/CommentLetters/E_MCM%20Matrix%2010-26-12%20Final.pdf)

The opportunity for customization may provide benefit by allowing the SMB EWMP Group to assess the effectiveness of their current programs and to modify their programs to better serve local conditions and objectives. If an effectiveness assessment is conducted on a specific MCM activity and it can be reasonably shown that customization of the MCM would result in equal or improved effectiveness on attitudes or knowledge, behavior or implementation, load reduction, or water quality, then a defensible recommendation for modification of that activity can be made, resulting in greater resources available for more effective activities. **Figure 4-4** shows the process for identifying and implementing MCM customization.

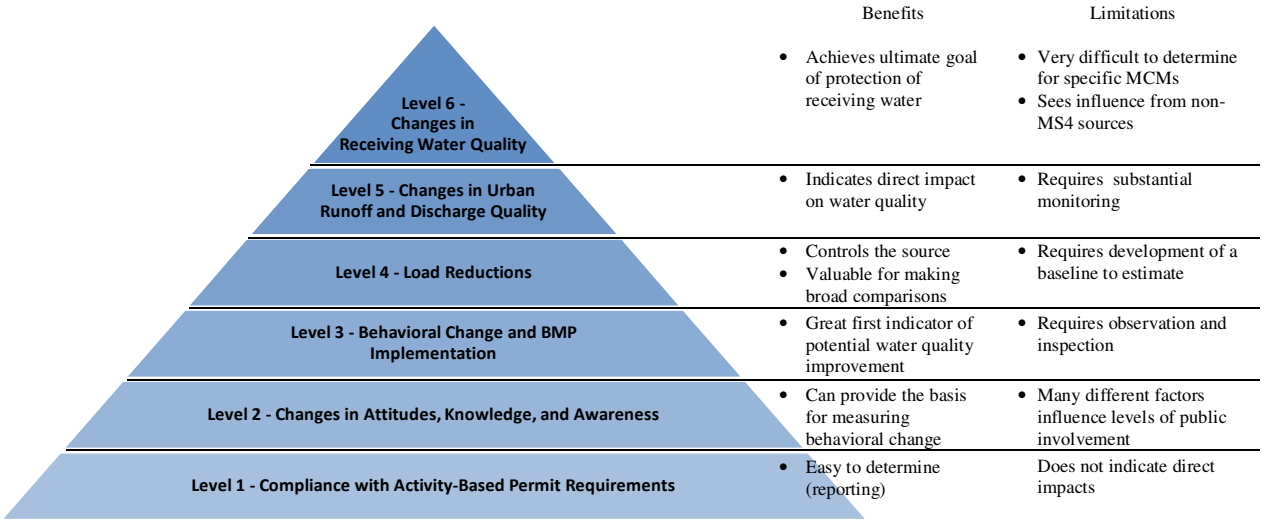
Figure 4-4
Process for Minimum Control Measure Customization



The SMB EWMP group is interested in customizing MCM activities. The first step in customizing MCM activities is the development of a framework to assess the effectiveness of each MCM in its current implementation. For each MCM that can be assessed in this manner, recommendations for customizations can be developed with reasonable assurance of impact to effectiveness.

The California Stormwater Quality Association (CASQA) provides such a framework for the effectiveness assessment of Stormwater Management Programs. The outcome is a hierarchy that categorizes the classification of outcome types (levels) that will allow MCMs to be placed into one or more categories for subsequent outcome assessment. The outcome levels, Level 1 through Level 6, are summarized in **Figure 4-5**.

Figure 4-5
General Classification of Outcome types (adapted from CASQA)



4.3.3. MCMs and Outcome Levels

The outcome types in this effectiveness assessment framework are interrelated. The Permit's stormwater management program is, by design, intended to improve the water quality in receiving waters. The means by which this goal is intended to be met is through the implementation of compliance measures by the SMB EWMP Group. Compliance with these activity-based measures results in Level 1 outcomes (Figure 4-4). Assessments of these activities can provide further deeper understanding of the outcomes they have. Ideally, each activity will contribute to the improvement at the Level 6 (Figure 4-4) receiving water quality level; however, tracking effectiveness at this level is difficult.

All SMB EWMP Group members were in compliance with the Permit during the 2011-12 reporting year (Level 1 outcome). The following is a brief description of the Program MCMs and outcome levels that can be achieved through the effectiveness assessment framework described.

Public Information and Participation Program
The PIPP is intended primarily to reach out and educate the general public, students, business owners, facility operators, city staff, and others on stormwater. This is accomplished in many ways; examples include "No Dumping" messages on storm drain inlets; public education materials; information websites; community events; reporting hotlines; and specialized awareness programs, such as the used oil program. The program elements are intended to directly impact awareness and the behavior of different target audiences (Level 2 and Level 3 outcomes). Consequently, these behavioral changes may impact constituent loads to the MS4 indirectly, but the actual Level 4 through Level 6 impact of a specific MCM in this category may be difficult to quantify.

Industrial/Commercial Facilities Program
Permittees are required to conduct an Industrial/Commercial Facilities Program designed to prevent IDs, reduce discharges of stormwater, and prevent industrial/commercial discharges to the MS4 from causing or contributing to receiving water quality exceedances. These facilities are tracked and inspected to ensure use of BMPs to control stormwater discharges. In addition, the program aims to contribute to the

education of business owners and facility operators regarding SWPPP. The effectiveness of this program can be assessed leading to insight on how awareness (Level 2) and BMP implementation (Level 3) are affected.

Planning and Land Development Program
The Planning and Land Development Program involves developers early in the land development stage, with the integration of BMPs and Low Impact Development (LID) controls to reduce constituent loading to the MS4 and minimize runoff intensity generated from impervious areas. Behavioral change (Level 3) can be assessed through permitting staff observations. Also, it may be possible to assess constituent load reductions (Level 4) through land developer BMP choices and water quality of runoff entering the MS4 (Level 5) if monitoring stations are considered during the planning stage of development and redevelopment.

Development Construction Program
Similar to the Planning and Land Development Program, the Development Construction Program establishes requirements for construction activities to eliminate illicit discharges and prevent water quality violations from stormwater discharges from the construction site. The Program establishes criteria for BMPs and controls through an Erosion and Sediment Control Plan, with elements of a SWPPP. The effectiveness of this program can be assessed through inspections to verify BMP implementation (Level 3). Level 2 awareness outcomes can be assessed through the use of a website that informs contractors on proper BMP selection and prerequisite checklists for permitting.

Public Agency Activities Program
Activities ranging from street sweeping, catch basin cleaning, public facility maintenance, and storm drain operation fall under the Public Agency Activities Program. These activities are essential MCMs that can also be measured for effectiveness. Level 3 through Level 5 outcomes (behavior, load reduction, MS4 water quality) can all be assessed through appropriate evaluation metrics. Impact to receiving water quality (Level 6) may also be possible to determine if appropriate monitoring is in place, with phased implementation of MCM activities to isolate performance evaluation.

Illicit Connections and Illicit Discharges Elimination Program
IC/IDs are controlled through the IC/ID Elimination Program and by implementing a procedure for reporting, tracking, and responding to reports of IC/IDs, as well as establishing protocols for the regular inspection of storm drains. The effectiveness of the reporting procedure can be assessed on a Level 2 (awareness) basis, and response activities can have their effectiveness determined directly through monitoring of the MS4 water quality (Level 5). A quantitative analysis of behavioral change (Level 3) as a result of enforcement actions is also achievable.

4.3.4. Next Steps to MCM Customization

The effectiveness assessment framework outlines the process to determine baseline MCM effectiveness, providing the foundation for customization. A survey has been developed and delivered to the SMB EWMP Group to document interest in customizing MCM activities. Opportunities for modifying MCM activities will be proposed by the SMB EWMP Group and customized MCMs will be justified and summarized in the EWMP Plan.

Section 5
Reasonable Assurance Analysis Approach

An important component of the EWMP is the RAA. The RAA is a process that is used to demonstrate that institutional and structural control measures are expected to be sufficient for achieving applicable WQBELs and/or RWLs that have compliance deadlines within the Permit term. In addition to using the RAA as a means to determine the efficacy of existing and potential control measures, the RAA also facilitates the selection of BMPs as well as the prioritization of BMP implementation. While the methodology of the RAA is likely to evolve over the course of EWMP development, elements of the RAA approach are described in the following sections and are consistent with the "RAA Guidelines" as issued by the Regional Board.

5.1. MODELING SYSTEM TO BE USED FOR RAA AND BMP SELECTION

The recommended RAA approach leverages the strengths of the publicly- available, Permit-approved, GIS-based model that has already been developed for the region: the Structural BMP Prioritization and Analysis Tool (SBPAT)[1]. SBPAT is a public domain, "open source" GIS-based water quality analysis tool intended to: 1) facilitate the prioritization and selection of BMP project opportunities and technologies in urbanized watersheds; and 2) quantify benefits, costs, variability, and potential compliance risk associated with stormwater quality projects. The decision to use SBPAT for the RAA was partially based on the model capabilities and the unique characteristics of the SMB Watersheds, specifically:

- **Modeling of SMB hydrologic and watershed processes** – SBPAT utilizes USEPA's Stormwater Management Model (EPA SWMM) as the hydrologic engine, and SBPAT has been calibrated to local rainfall and SMB streamflow gauges, confirming the ability to predict stormwater runoff volumes on an annual basis;
- **SMB pollutants of concern and their compliance metric expression** – SBPAT has been utilized for planning applications related to Bacteria TMDL compliance (and specifically exceedance-day predictions, based on SMB criteria), including a demonstrated linkage of load reduction to exceedance days;
- **Availability of new open space water quality loading data** – Recently developed Event Mean Concentration (EMC) data are consistent with, and easily incorporated into, SBPAT and were developed in SMB as part of this RAA-development effort;
- **Capability to conduct opportunity and constraints investigations** – SBPAT is capable of supporting structural BMP placement, prioritization, and cost-benefit quantification, and has been applied for such purposes previously in the JG2/JG3 and other nearby SMB subwatersheds;
- **Characterization of water quality variability** – SBPAT is capable of quantifying model output variability and confidence levels, which is a component of the Regional Board's recent RAA guidance; and

[1] SBPAT is specifically referenced in the MS4 Permit Part VI.C.5.b.iv and was presented at the first two Permit Group TAC RAA Subcommittee meetings.

- **Supports quantification of interim milestones, consistent with methods addressing both structural and non-structural BMPs** – SBPAT is a wet weather tool, but implementation is easily compatible with methods for addressing dry weather and non-structural BMPs.

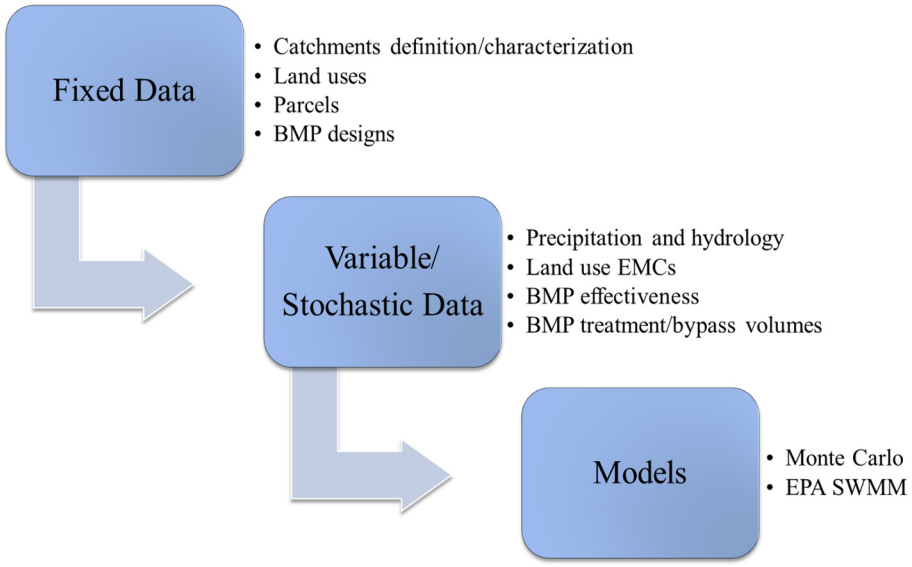
The quantification analysis component of SBPAT includes a number of features. The model:

- Calculates and tracks inflows to BMPs, treated discharge, bypassed flows, evaporation and infiltration at each 10-minute time step;
- Distinguishes between individual runoff events by defining six-hour minimum inter-event time in rainfall record, yet tracks inter-event antecedent conditions;
- Tracks volume through BMPs and summarizes and records these metrics by storm event; and
- Produces a table summary of BMP hydrologic performance, including concentration and load metrics by storm event, and consolidates these outputs on an annual basis.

5.1.1. RAA Model Data Flow

Data used for the quantification/analysis module include both fixed and stochastic parameters. The model utilizes land-use based EMCs, EPA SWMM model, USEPA/American Society of Civil Engineers/Water Environment Research Foundation (USEPA/ASCE/WERF) International BMP Database (IBD) water quality concentrations, watershed/GIS data, and a Monte Carlo approach to quantify water quality benefits and uncertainties. The flow of model data is shown in **Figure 5-1**.

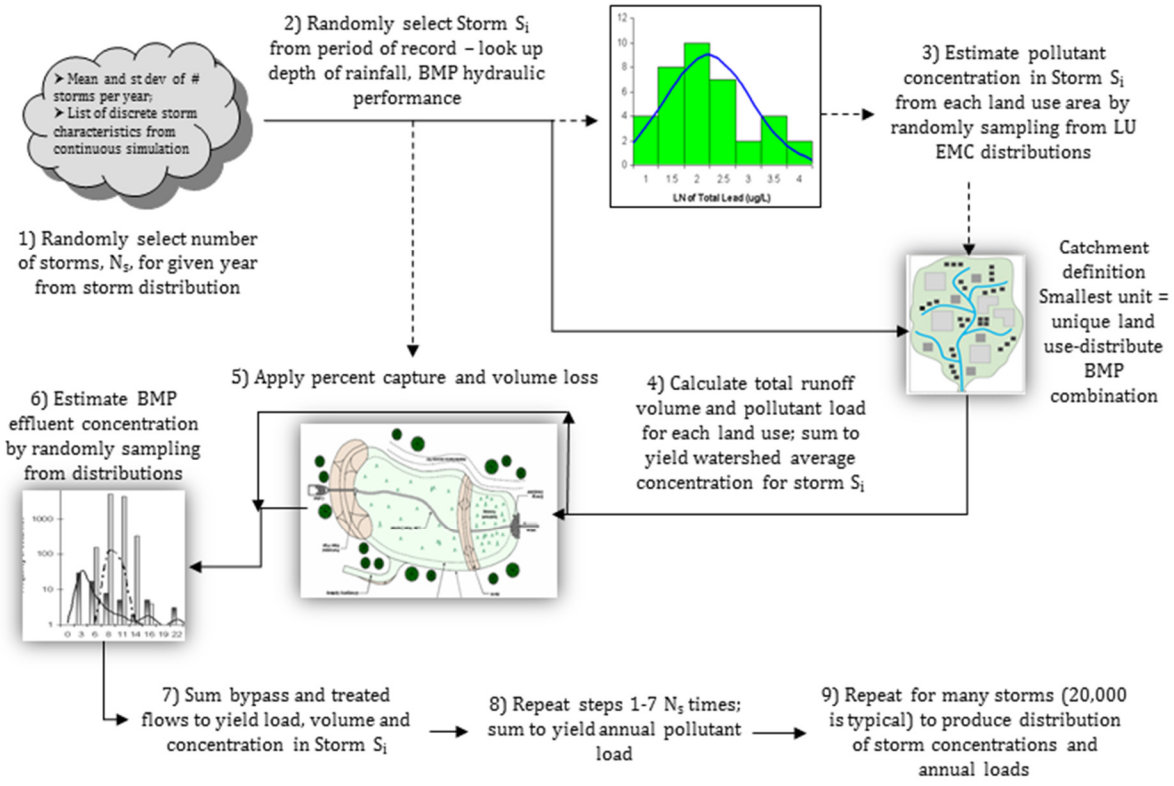
Figure 5-1
SBPAT Model Data Flow



5.1.2. SBPAT Monte Carlo Simulation

Each model simulation integrates Monte Carlo methods that rely on repeated random sampling to obtain numerical results. Model simulations are run 20,000 times to calculate a distribution of outcomes that can support the definition of confidence levels and quantify variability. Consistent with the SBPAT usage, Monte Carlo methods are typically used in physical and mathematical problems and are most suited to be applied when it is difficult to obtain a closed-form expression or when a deterministic algorithm is not desired. A schematic of SBPAT's Monte Carlo process is provided in **Figure 5-2**.

Figure 5-2
SBPAT Monte Carlo Method Components

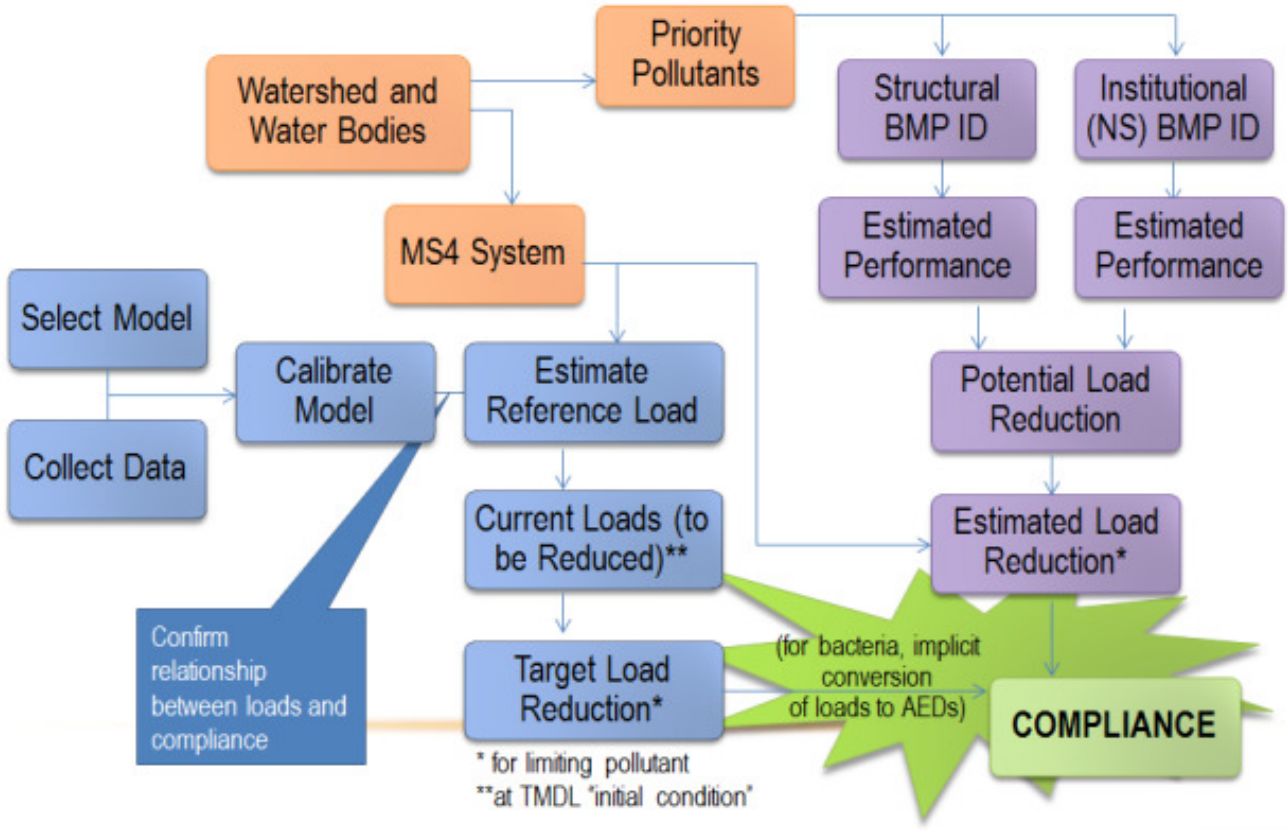


5.2. OVERVIEW OF RAA AND BMP SELECTION PROCESS

The RAA process is depicted in **Figure 5-3** and generally consists of the following steps:

1. Identify WBPCs for which the RAA will be performed;
2. Identify the MS4 service area (exclude lands of agencies not party to this EWMP such as Federal land, State land, etc.);
3. Develop target load reductions for average and 90th percentile years based on Regional Board guidance;
4. Account for existing structural and non-structural BMPs and BMPs that are planned for implementation in the future;
5. Evaluate the performance of these BMPs in terms of annual pollutant load reductions; and
6. Compare estimated load reductions with targets.

Figure 5-3
RAA Process Overview



Target load reductions represent a numerical expression of the Permit compliance metrics (e.g., bacteria AEDs for dry and wet weather) that can be modeled and can serve as a basis for confirming that the EWMP is in compliance with the Permit and that the efforts described therein, if appropriately implemented, will reasonably demonstrate and assure Permit compliance. For bacteria, an additional step will be taken to establish that, for a representative SMB subwatershed, modeled annual fecal coliform

loads (from the subwatershed) are predictive of measured annual wet weather exceedance days (based on surf zone sampling data for all bacteria indicators). Target load reductions for bacteria will then be established through the following steps:

1. Calculate each subwatershed's baseline (natural condition) loading, assuming the land use distribution of the Arroyo Sequit subwatershed (approximately 95% open space), to represent an "allowable" annual load[2] that reflects the reference condition;
2. Calculate "existing" (pre-EWMP implementation) loading using existing land uses and BMPs (e.g., LFDs) to represent the current load; and
3. Subtract the two load estimates to determine the target load reduction needed to achieve reference watershed conditions.

This approach requires a new open space land use EMC dataset for fecal coliform that reflects wet weather freshwater samples collected from the SMB reference watershed, Arroyo Sequit. This new open space EMC dataset is shown in **Table 5-1**.

Table 5-1
Default and Revised Fecal Coliform Event Mean Concentrations Statistics for Open Space/Vacant Land Use Category. (Arithmetic estimates of log mean and log standard deviation values shown.)

	Mean (MPN/100mL)	Standard Deviation (MPN/100mL)
SBPAT Default (based on SCCWRP[1] 2007b (n=2)[2]	6,310	1,310
Revised based on Arroyo Sequit samples (n=11)[2]	484	806

1. SCCWRP = Southern California Coastal Research Project
2. n = number of samples in data set

Alternatively, fecal coliform target load reductions will be estimated using an SBPAT modeling approach where a hypothetical infiltration basin at each subwatershed outlet is iteratively sized until discharge frequency meets the AEDs, with the target load reduction values then set equivalent to the load reduction achieved by the hypothetical outlet infiltration basin.

For subwatersheds with SMB Beaches Bacteria TMDL compliance monitoring locations subject to anti-degradation-based allowable exceedance days, a target load reduction of zero will be assumed, consistent with the TMDL's approach which acknowledges that historic bacteria exceedance rates for each of these subwatersheds are lower than that of the reference beach, on average.

Based on a preliminary analysis, lead is the only pollutant other than fecal coliform that will be quantitatively assessed in the RAA. Target load reductions for lead, a 303(d) listed pollutant for Santa Monica Canyon, will be estimated based on the load required to meet the California Toxics Rule (CTR) objective in MS4 discharges to this water body. This will be done by subtracting the "allowable" annual load (or existing annual volume multiplied by the CTR objective) from the existing annual load. Zero target load reductions will be set for PCBs and DDT (with TSS as a surrogate for these particulate-associated pollutants), consistent with the USEPA TMDL which sets MS4 WLAs based on existing loads.

[2] The 50th and 90th percentile years will be selected based on direction from the Regional Board.

5.2.1. BMP Selection Process

The RAA modeling process will begin with the evaluation of new or enhanced, quantifiable institutional BMPs and existing structural BMPs to assess water quality improvements (load reductions) that occurred to date. Next, if compliance is not met based on non-structural and existing BMPs, planned non-structural and structural BMPs will be modeled with consideration to scheduled completion in the context of the prioritized WBPCs and compliance deadlines (including interim milestone dates). If compliance is still not achieved by the combination of both existing and planned BMPs, additional BMPs will be identified to achieve compliance. These BMPs will be selected based on pollutants targeted, siting options, and maintenance preferences, among other criteria.

The water quality priorities defined previously in this document will be the emphasis of the RAA analysis, which will focus on quantifiable stormwater-related pollutants.

5.2.2. Scheduling

There is a need for linking RAA outcomes to interim and final TMDL compliance dates. Once the BMP implementation approach is developed for final compliance, specific activities and the potential scheduling of said activities will be established within the context of local opportunities and constraints. It is expected that to assess compliance with interim milestones, the RAA analysis will need to be implemented for interim BMP implementation scenarios. These are expected to include different levels of institutional BMPs, implemented over time (e.g., LID ordinance implementation). It is also recognized that in some cases there will be overlapping implementation efforts (e.g., institutional outreach BMPs in areas where there are also structural BMPs). These instances will be evaluated on a case-by-case basis so that double-counting of water quality benefits is avoided.

5.2.3. Uncertainty and Variability

The proposed RAA approach, which directly utilizes monitoring data to characterize natural variability, as well as Monte Carlo methods to develop stochastic relationships, is conducive to the production of metrics that quantify variability and confidence limits (which reflect the uncertainty of predicted output, such as average annual loads). These relationships are important in determining the level of BMP implementation and for the regulatory agencies to assess reasonableness. The SBPAT methods can provide statistics annualized over a longer period of record (e.g., 10-years) or can be conducted for numerous individual years. The structural BMP methodologies are also easily paired with institutional BMP quantification methods.

5.3. MODELING APPROACH

The following section summarizes components and methodology of the RAA approach.

5.3.1. Wet Weather Focus

Within the SMB EWMP Group area, most of the MS4 facilities that have discharge locations tributary to the SMB, also have low-flow diversion facilities for dry weather. These diversion facilities effectively mitigate dry weather discharges from the MS4. Because of this, the focus of the RAA approach is on wet weather conditions.

5.3.2. Dry Weather RAA Approach

Demonstrating “reasonable assurance” of compliance with dry weather limits for the SMB Beaches Bacteria TMDL requires a methodology that accounts for many factors that cannot be modeled.

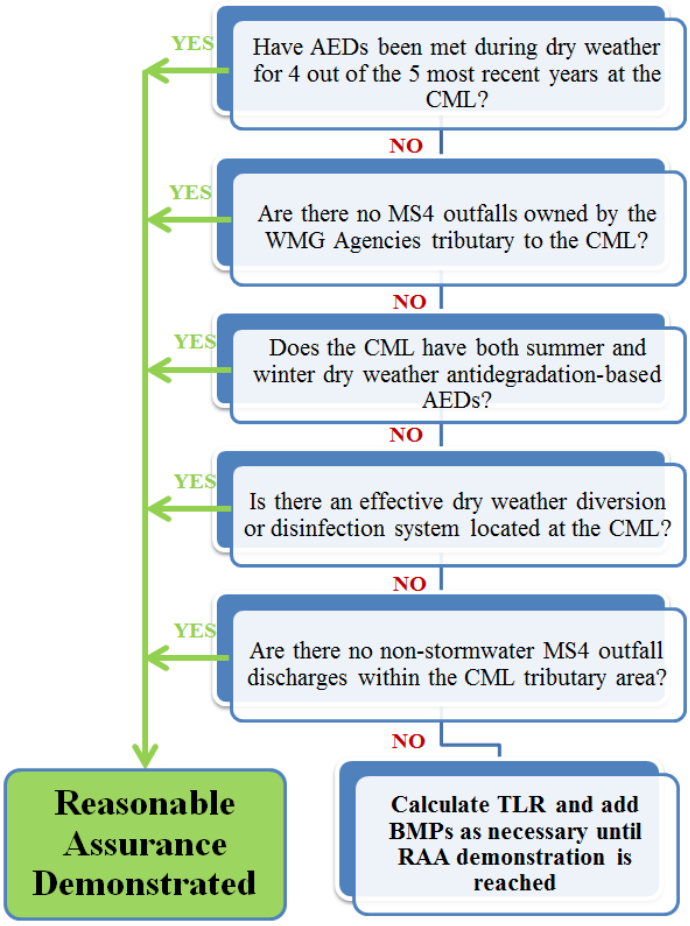
Therefore, to perform the RAA for dry weather for the SMB EWMP Group area, a semi-quantitative methodology has been developed to follow a permit compliance structure. Because fecal indicator bacteria are considered the "controlling" pollutants of concern during dry weather in the SMB EWMP Group area (i.e., if MS4 discharges are compliant for bacteria during dry weather, they will be compliant for all TMDL and 303(d) pollutants during dry weather), the methodology was developed based on bacteria. The following series of questions form the proposed dry weather RAA methodology. Each question is to be answered for each Coordinated Shoreline Monitoring Plan (CSMP) compliance monitoring location (CML). If one question is affirmative then "reasonable assurance" is considered to be demonstrated. This methodology is illustrated in **Figure 5-4**.

1. Have the allowed dry weather (summer and winter) single sample exceedance days been met based on monitoring data from recent years? To avoid making costly BMP investments based on outlier years, four out of the five most recent years may be used to evaluate this criterion.
2. Are there no MS4 outfalls owned by the SMB EWMP Group within the CML's drainage area, and therefore MS4 discharges could not be contributing to pollutant concentrations at the CML?
3. Is a dry weather diversion or disinfection system located at the CML? To meet this criterion, any such system should have records to show that it is consistently operational, well maintained, properly sized, and effectively removing bacteria in the treated effluent (in the case of disinfection facilities) so that it is effectively eliminating freshwater surface discharges to the surf zone during year-round dry weather days. If all dry weather creek flows tributary to the CML are known to be captured, infiltrated, diverted, or disinfected prior to discharging at the beach, reasonable assurance is assumed to be demonstrated.
4. Are there no non-stormwater MS4 outfall discharges within the CML's drainage area? For this criterion to be met, supporting records from the non-stormwater outfall screening program should be supplied.

For all CMLs which have not demonstrated reasonable assurance by the steps above, the total load reduction required to meet the applicable receiving water limit will be calculated based on historic monitoring data. This is accomplished by iteratively applying a reduction fraction to the historic bacteria concentration dataset until the receiving water limit (in allowable exceedance days) is met during all years. This reduction fraction will then be compared with expected dry weather BMP load (or volume) reductions within the tributary watershed. If the calculated BMP load reduction exceeds the total required load reduction, then reasonable assurance has been demonstrated.

If the calculated BMP load reduction is less than the necessary load reduction, additional BMPs (non-structural/institutional and/or structural) will be iteratively implemented in the tributary watershed until reasonable assurance can be demonstrated (i.e., until the calculated BMP load reduction exceeds the total load reduction required). Where necessary and feasible, it may be assumed that structural BMPs (such as permeable street gutters and catch basin dry wells) will be implemented to a level to eliminate existing significant non-stormwater MS4 discharges.

Figure 5-4
Dry Weather RAA Methodology Outline



5.3.3. Spatial Domain

The spatial domain of the RAA will include the priority catchments within the SMB EWMP Group area, excluding drainage areas already addressed by Regional EWMP Projects. While there are no known locations where stormwater or urban runoff flows into the SMB EWMP Group area boundaries from neighboring jurisdictions, adjustments may be made if that is found to be the case. Adjustments may also be made to account for contributions from agencies not party to the EWMP (e.g., state, federal).

GIS layers to be used in SBPAT will include the following:

- Storm drains
- Soils
- Rain gage polygons
- Parcels
- Land use
- Catchments

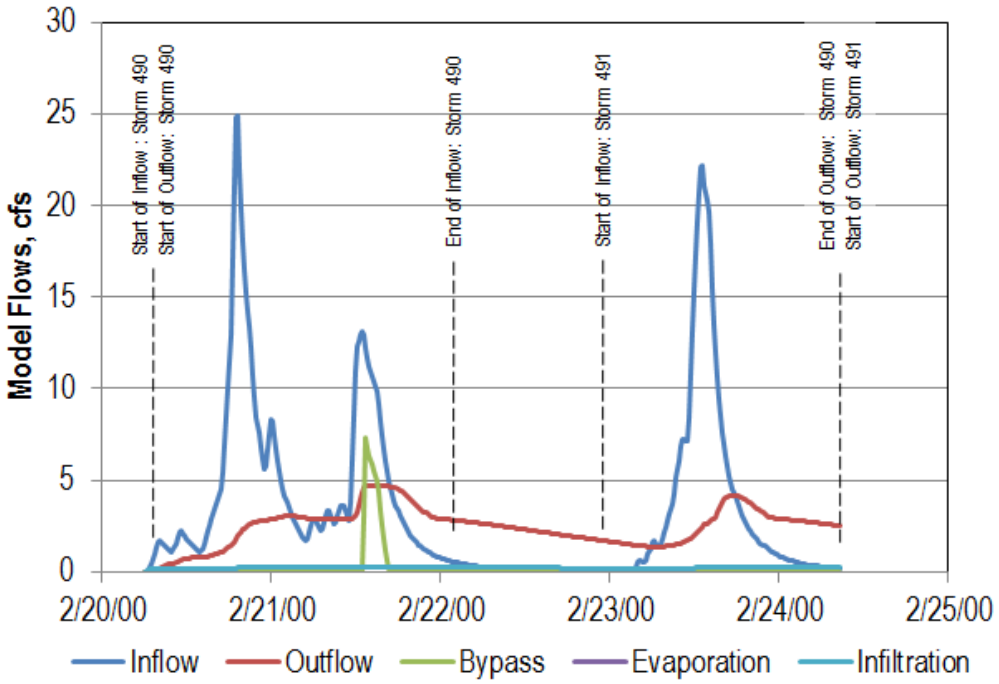
Other shapefiles such as BMP locations and BMP drainage areas will be used for background information, rather than as direct inputs to SBPAT.

5.3.4. Hydrology

SBPAT utilizes a customized version of EPA SWMM for continuously simulating study area hydrology and BMP hydraulics. Long-term, hourly rainfall data and average monthly evapotranspiration values are used along with land-use linked catchment imperviousness and soil properties to estimate runoff volumes. Revised and recalibrated SBPAT database values and EWMP-defined BMP information are used to estimate the volume of runoff generated from watershed areas and captured by BMPs. Storm events are individually tracked for the entire simulation so that the volume of runoff infiltrated, evapotranspired, captured, and released (if applicable) by BMPs are estimated for every storm event. The LACFCD Pacific Palisades rain gage D491 has been selected based on representativeness of the SMB EWMP Group area (e.g., gauge location, elevation, etc.) to identify the 90th percentile year (1995 – 86 wet days[3]), per Regional Board guidance. This year will then be simulated in SBPAT, and the model will automatically select the most appropriate rain gage for each modeled area.

An example of the SBPAT (and EPA SWMM) hydrologic and watershed modeling approach is illustrated below in **Figure 5-5**.

Figure 5-5
Example of SBPAT/SWMM Hydrologic Modeling Consideration of Storms in Long-Term Record



[3] 1995 is the 90th percentile year based on total volume, and greater than the 90th percentile year based on wet days, thus it exceeds all 90th percentile criteria.

5.3.4.1. Hydrologic Calibration

The hydrology component of SBPAT was calibrated for the Topanga Creek subwatershed, which is the only location in the SMB watershed where all data requirements (daily flow, hourly precipitation, and daily WQ) are met - no other SMB areas have sufficient data from which to calibrate. The Topanga subwatershed is located on the western edge of the SMB EWMP Group area. Since primary output for SBPAT includes annual volumes and pollutant loads, the calibration focused on accurate prediction of annual discharge volumes from the Topanga subwatershed outlet, with estimated baseflow removed. Hourly rainfall data were used for the nearby Lechuza Patrol Station #72 gauge (gauge reference ID 352b) in Malibu, with these data adjusted upward based on an annual rain depth ratio between the higher elevation Topanga Fire Station #69 gauge (gauge reference ID 6) and the coastal Lechuza gauge. Los Angeles County's Topanga Creek streamflow gauge (gauge reference ID F54C-R) was used to estimate measured annual discharge volumes for comparison with modeled volumes. The effective impervious percentage for the open space land use category and the saturated hydraulic conductivity of all mapped soil types served as calibration parameters. The resulting input parameter value adjustments are shown in **Table 5-2** and **Table 5-3.** Saturated hydraulic conductivities for all soil types were adjusted to the lower end of the allowable range from the U.S Department of Agriculture National Engineering Handbook (2009). **Figure 5-6** is a depiction of the hydrologic calibration results. The emphasis of the calibration effort focused on accurate, unbiased prediction of "non-extreme" annual conditions (annual volumes exceeding a 25-year frequency, 4% probability, were excluded from the calibration effort). Based on available data, the period of calibration was seven years, between 2005 and 2011, with water year 2007 excluded due to outlying streamflow measurement results. The calibrated input parameter values will be used for the RAA.

Table 5-2
SBPAT Calibration Adjustments: Effective Imperviousness

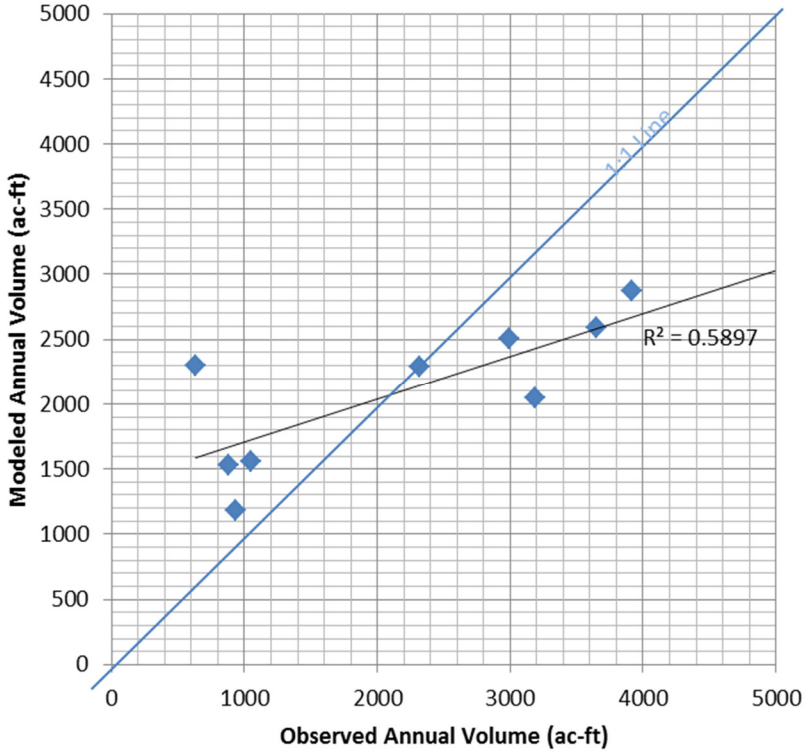
Land Use Designation	Default	Calibrated
Vacant Undifferentiated	1%	10%

Table 5-3
SBPAT Calibration Adjustments: Saturated Hydraulic Conductivity

Los Angeles County Soil Number	Saturated Hydraulic Conductivity (in/hr)[4]	
	Default	Calibrated
2	0.11	0.06
22	0.35	0.2
24	1.26	0.6
25	0.15	0.06
26	3.6	2
27	0.64	0.6
30	0.72	0.6
33	0.51	0.06
35	1.5	0.6
38	0.5	0.06
66	0.29	0.2

[4]U.S. Department of Agriculture (USDA), 2009. National Engineering Handbook (210-VI-NEH), Chapter 7. Natural Resource Conservation Service. http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=22526.wba

Figure 5-6
Annual Runoff Volumes for Topanga Subwatershed: Modeled vs. Observed



Following calibration, average prediction error (or the average of the percent differences between each observed and modeled annual runoff volume) was calculated to be 2%. According to the Regional Board's RAA Guidance Document, SBPAT model performance with respect to hydrology is in the "very good" category.

5.3.4.2. Water Quality

The priority WBPCs for the SMB EWMP Group area, combined with data availability, will dictate which WBPCs the RAA will be addressed. As previously described, SBPAT links the long-term hydrologic output from EPA SWMM to a stochastic Monte Carlo water quality model to develop statistical descriptions of storm water quantity and quality. Through this approach, the predicted runoff volumes for each storm are randomly sampled from the long-term storm event runoff volume record produced by EPA SWMM. Land use-based wet weather pollutant EMC values (**Table 5-4**) and BMP effluent concentrations for each storm are then randomly sampled from their lognormal statistical distributions. The runoff volumes (including volumes treated and bypassed by BMPs), land use EMCs, and BMP effluent concentrations are combined to determine the total pollutant loads and load reductions (difference between existing and post-BMP load estimates) for each randomly-sampled storm event. This procedure is then repeated thousands of times, each time recording the volume, pollutant concentrations, loads, and load reductions for each randomly selected storm event. The statistics of these recorded results are then used to characterize the low (25^{th} percentile), average (mean), and high (75^{th} percentile) values for the annual volume, pollutant loads, and pollutant concentrations in storm water runoff from the modeled area, with and without BMPs implemented.

Table 5-4
Proposed SBPAT Event Mean Concentrations for SMB Watersheds –
Arithmetic Estimates of the Lognormal Summary Statistics
(means with standard deviations in parentheses)[a]

Land Use	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu ug/L	TCu ug/L	TPb ug/L	DZn ug/L	TZn ug/L	FC #/100mL
Single Family Residential	124.2 (184.9)	0.40 (0.30)	0.32 (0.21)	0.49 (0.64)	0.78 (1.77)	2.96 (2.74)	9.4 (9.0)	18.7 (13.4)	11.3 (16.6)	27.5 (56.2)	71.9 (62.4)	31,100[b] (94,200)
Commercial	67.0 (47.1)	0.40 (0.33)	0.29 (0.25)	1.21 (4.18)	0.55 (0.55)	3.44 (4.78)	12.3 (10.2)	31.4 (25.7)	12.4 (34.2)	153.4 (96.1)	237.1 (150.3)	51,600 (173,400)[c]
Industrial	219.2 (206.9)	0.39 (0.41)	0.26 (0.25)	0.6 (0.95)	0.87 (0.96)	2.87 (2.33)	15.2 (14.8)	34.5 (36.7)	16.4 (47.1)	422.1 (534.0)	537.4 (487.8)	3,760 (4,860)
Education (Municipal)	99.6 (122.7)	0.30 (0.17)	0.26 (0.2)	0.4 (0.99)	0.61 (0.67)	1.71 (1.13)	12.2 (11.0)	19.9 (13.6)	3.6 (4.9)	75.4 (52.3)	117.6 (83.1)	11,800[d] (23,700)
Transportation	77.8 (83.8)	0.68 (0.94)	0.56 (0.82)	0.37 (0.68)	0.74 (1.05)	1.84 (1.44)	32.40 (25.5)	52.2 (37.5)	9.2 (14.5)	222.0 (201.7)	292.9 (215.8)	1,680 (456)
Multi-Family Residential	39.9 (51.3)	0.23 (0.21)	0.20 (0.19)	0.50 (0.74)	1.51 (3.06)	1.80 (1.24)	7.40 (5.70)	12.1 (5.60)	4.5 (7.80)	77.5 (84.1)	125.1 (101.1)	11,800[e] (23,700)
Agriculture (row crop)	999.2 (648.2)	3.34 (1.53)	1.41 (1.04)	1.65 (1.67)	34.40 (116.30)	7.32 (3.44)	22.50 (17.50)	100.1 (74.8)	30.2 (34.3)	40.1 (49.1)	274.8 (147.3)	60,300 (153,000)
Vacant / Open Space	216.6 (1482.8)	0.12 (0.31)	0.09 (0.27)	0.11 (0.25)	1.17 (0.79)	0.96 (0.9)	0.60 (1.90)	10.6 (24.4)	3.0 (13.1)	28.1 (12.9)	26.3 (69.5)	484[f] (806)

[a] EMC statistics are calculated based on 1996-2000 data for Los Angeles County land use sites (Los Angeles County, 2000), except for agriculture which are based on Ventura County MS4 EMCs (Ventura County, 2003) and fecal coliform which are based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007b). These EMC datasets are summarized in the SBPAT User's Guide (Geosyntec, 2012).

[b] The fecal coliform EMC for the single-family residential land use is based on SCCWRP dataset for "low-density residential".

[c] The default log distribution best fit summary statistics for this land use-pollutant combination produced an unreasonably high deviation, therefore the arithmetic estimate of the log mean was held constant while the log summary statistics were recomputed based on the log CoV for SFR (SCCWRP's LDR EMC).

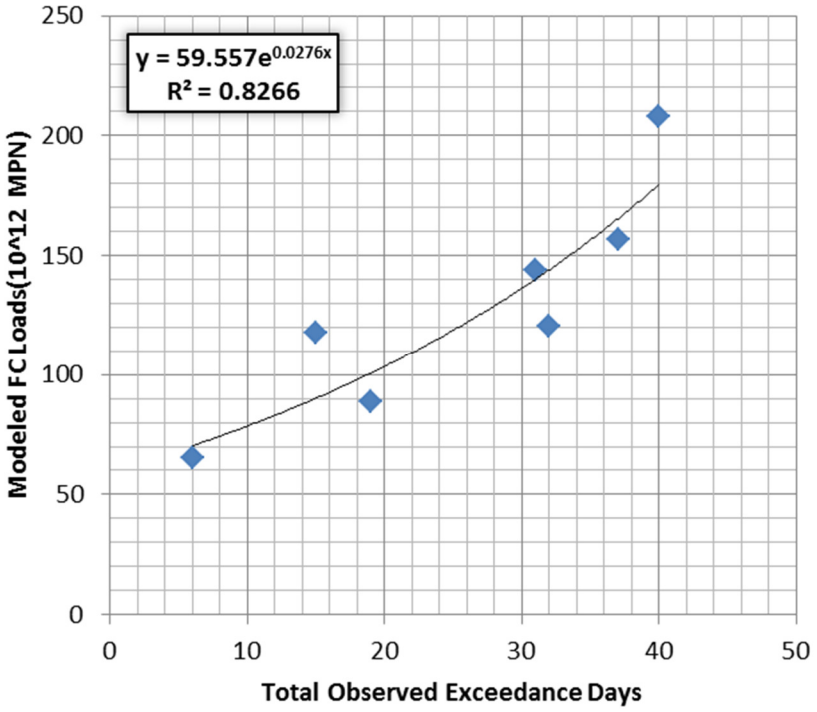
[d] Multi-family residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

[e] The fecal coliform EMC for the multi-family residential land use is based on SCCWRP dataset for "high-density residential".

[f] Open space fecal coliform EMC statistics based on *E. coli* data (divided by 0.85 to adjust to fecal coliform) for Arroyo Sequit reference watershed, or 11 samples collected between December 2004 and April 2006. Data used by Regional Board for Santa Clara River Bacteria TMDL and taken from (SCCWRP, 2005) and (SCCWRP 2007a).

For bacteria modeling, verifying the linkage between modeled fecal coliform loads (discharged from the watershed outlets) and total observed wet weather exceedance days (in the ocean, based on REC-1 daily maximum water quality objectives) is critical to establish reasonable assurance that the ocean monitoring locations will be in compliance with the Permit limits for the Santa Monica Bay Beaches Bacteria TMDL. To establish this linkage, an analysis was conducted using shoreline monitoring data at Topanaga Canyon[5] (SMB 1-18) between 2005 and 2013. **Figure 5-7** illustrates a reasonable correlation between modeled annual fecal coliform loads and observed annual exceedance days (AEDs).

Figure 5-7
Correlation between Modeled (Fecal Coliform) Loads and Observed Exceedance Days



5.3.5. Representation of Individual BMPs

Individual BMPs may be modeled within the RAA to support their effectiveness in achieving target load reductions. This section presents the approach to representing individual BMPs in SBPAT.

5.3.5.1. Data to Support Model Set-Up

The International Stormwater BMP Database (www.bmpdatabase.org) is a comprehensive source of BMP performance information, comprised of data from a peer-reviewed collection of studies that have monitored the effectiveness of a variety of BMPs in treating water quality pollutants for a variety of land use types. Water quality performance data from the IBD were used to develop effluent concentrations (averages and standard deviations) of the BMPs and constituents listed in **Table 5-4**. As with land use EMCs, the effluent quality of BMPs is highly variable. To account for this variability in SBPAT, effluent

[5] This watershed is 88% open space. This is a daily sampled compliance shoreline monitoring site.

quality data were analyzed and descriptive statistics were generated for use in the Monte Carlo statistical sampling technique.

Table 5-4
Best Management Practices and Pollutants Modeled in SBPAT1

BMPs	Pollutants
Constructed Wetland / Wetpond (with Extended Detention)	Total suspended solids (TSS)
Constructed Wetland / Wetpond (without Extended Detention)	Total phosphorus (TP)
Dry Extended Detention Basin	Dissolved phosphorus as P (DP)[2]
Hydrodynamic Separator	Ammonia as N (NH3)
Media Filter	Nitrate as N (NO3)
Sub-surface Flow Wetland	Total Kjeldahl nitrogen as N (TKN)
Treatment Plant	Dissolved copper (DCu)
Vegetated Swale	Total copper (TCu)
Biofiltration	Total lead (TPb)
Bioretention (volume reduction only)	Dissolved zinc (DZn)
Cistern (volume reduction only)	Total zinc (TZn)
Green Roof (volume reduction only)	Fecal Coliform (FC)
Porous Pavement (volume reduction only)	
Infiltration Basin (volume reduction only)	

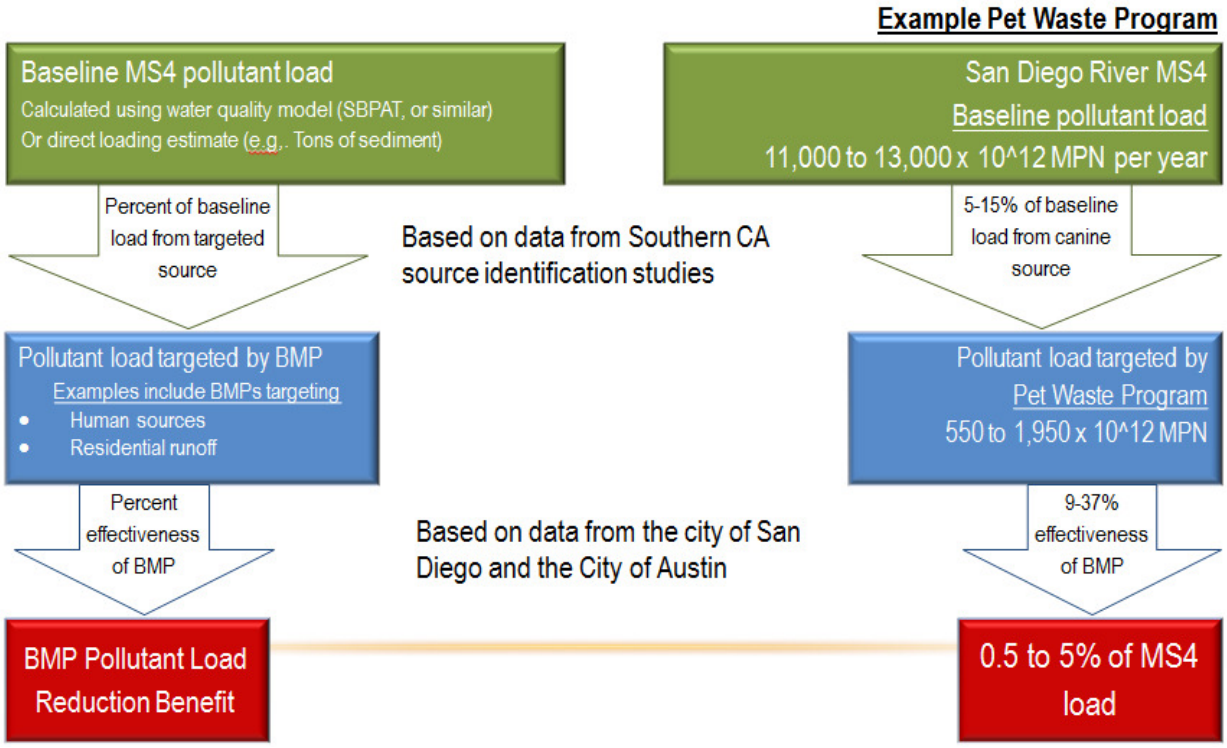
[1] All pollutants are addressed for all BMPs that provide treatment (i.e., excluding those identified as "volume reduction only").
[2] Dissolved phosphorus and orthophosphate data sets were combined to provide a larger data set and because the majority of orthophosphate is typically dissolved and many data sets either report dissolved phosphorus or orthophosphate, but not both.

5.3.5.2. MCMs and Other Institutional BMPs

Existing, recently-initiated institutional BMPs (i.e., those not modeled in the initial establishment of the TMDLs and compliance requirements) and planned institutional BMPs will be evaluated in terms of ability to reduce loads at each of the compliance modeling locations. Both wet and dry weather water quality benefits of these BMPs will be evaluated for all TMDL and 303(d) pollutants (excluding trash) where data are available to support such estimates.

Institutional (non-structural) BMPs will be quantified with assumptions and references documented. For example, bacteria and dry weather runoff reduction BMPs will be quantified consistent with methodologies utilized in recent San Diego Combined Load Reduction Plans (examples available at http://www.sbpat.net/example.html). **Figure 5-8** shows a general schematic of non-structural BMP load reduction quantification through an example using pet waste programs.

Figure 5-8
Example Institutional (Nonstructural) Best Management Practice Quantitative Approach



5.3.5.3. Structural BMPs

The goal of evaluation of structural BMPs is to achieve the remaining target load reductions by utilizing structural BMPs in combination with the benefits of institutional BMPs. The RAA will consider existing jurisdictional, subwatershed, and conveyance facility characteristics to delineate pollutant source, runoff control, and outfall monitoring strategies. This will involve a detailed review of existing conditions and datasets. This step will include the following components:

- Existing (implemented post-TMDL) and planned structural BMPs will be described by the agencies with sufficient conceptual design detail to support quantitative analysis. Based on agency input on BMP preferences, additional "proposed" structural BMP opportunities may be identified and prioritized using SBPAT's structural retrofit planning methodology, and these potential projects will be reviewed by the agencies prior to RAA modeling. The final TMDL compliance scenario will reflect the dates in which the final TMDL limits become effective.
- The water quality benefits (in terms of expected pollutant load reductions) associated with existing, planned, and proposed structural BMPs will be evaluated for wet weather using SBPAT.

5.3.5.4. Regional EWMP Project (85th Percentile Design) Definition

Regional EWMP projects meeting the 85th percentile design basis negate the need for RAA on their drainage areas. This design criterion can be met in a variety of ways. The simplest approach would be to design a structural BMP to meet the 85th percentile, 24-hour design volume. This approach is the easiest to design, but the most difficult to construct due to the required facility capacity, land availability, operations and maintenance constraints (i.e., a larger facility would be expected to require more

significant labor and/or equipment to perform the necessary maintenance actions), among other factors. An alternate approach to retain the 85th percentile storm would be to incorporate and account for the impacts of a combination of distributed BMPs upstream of the regional BMP. This would result in the effective design capacity of the regional BMP increasing over time as distributed BMPs are progressively implemented. Lastly, it may also be possible to meet the 85th percentile design criteria at a smaller regional BMP by incorporating a real-time controller in combination with infiltration and/or capture and use systems. This more innovative approach may require assumptions of different disposal options as future non-structural BMPs.

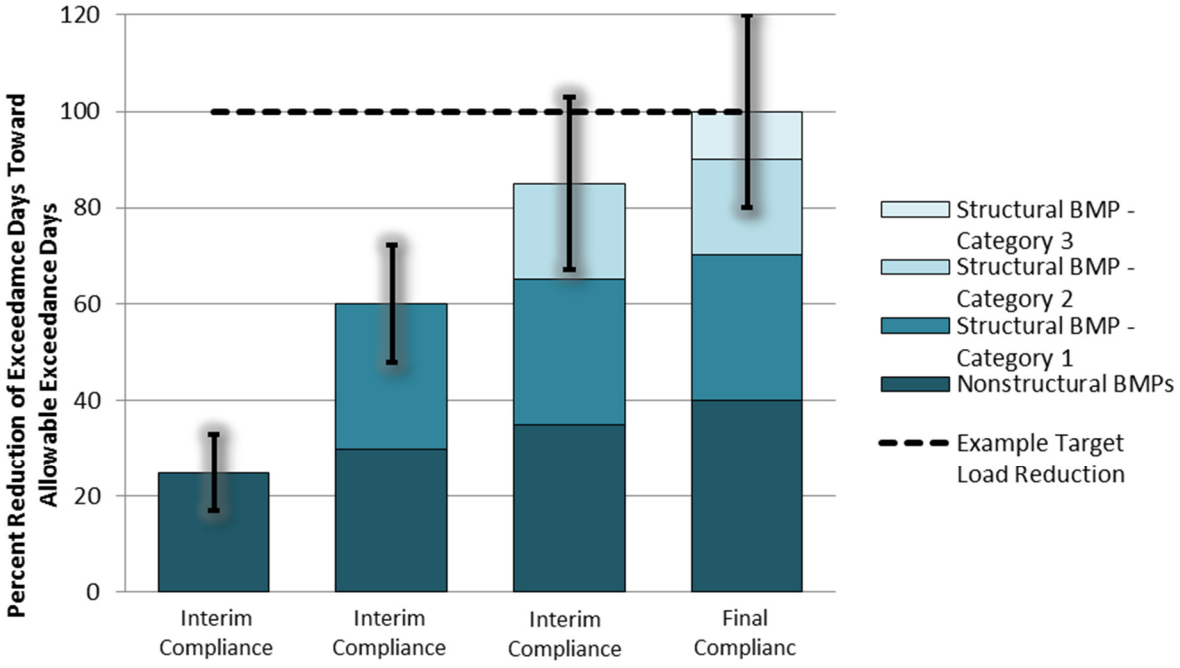
5.3.5.5. Representation of Cumulative Effect of all BMPs and BMP Selection Support

Following evaluation of the water quality benefits associated with institutional/non-structural and structural BMPs, additional pollutant load reductions necessary to achieve the target load reductions will be calculated to determine whether additional BMPs are needed to demonstrate reasonable assurance.

Estimated load reductions will be compared with the target pollutant load reductions and, for bacteria, will represent exceedance day-based compliance demonstration. Expected pollutant reduction ranges will be provided on a subwatershed basis, thereby capturing the variability inherent to precipitation patterns, land use runoff concentrations, and BMP performance. The agencies may then use discretion, based on their specific compliance risk tolerance, to interpret "reasonable assurance" based on a number of statistical options, such as whether the target annual load reductions (which may correspond to a TMDL critical conditions, such as the 90th percentile wet year) are met by the predicted average or 75th percentile annual load reductions (i.e., there is a 25% probability of compliance based on the modeling analysis). It is recognized that the Technical Advisory Committee and/or its RAA subcommittee may also express preferences or guidance for how such model output are reported.

Figure 5-9 depicts an example of a phased implementation approach to reach the desired target load reduction. In the case that BMPs address several pollutants simultaneously, this process will be evaluated for the limiting pollutant.

Figure 5-9
Conceptual Approach to Phased Implementation



5.4. PROPOSED APPROACH FOR RAA OUTPUT

This section discusses how the SBPAT output can be used by the SMB EWMP Group to incorporate different management strategies into the EWMP.

5.4.1. Jurisdictional Responsibilities

This RAA approach was developed with an emphasis on encouraging collaborative, watershed-based planning within the jurisdictional planning departments of the permittees in the SMB EWMP Group. Pollutant load reduction opportunities will be determined irrespective of jurisdictional boundaries. Once high priority areas and sources are identified, the SMB EWMP Group will identify the most feasible and effective BMPs to maximize pollutant removal and meet target load reduction requirements.

5.4.2. Example Output/Format

Table 5-5 illustrates example SBPAT output for the parameters modeled. This list will be limited to the Category 1 and 2 WBPCs previously identified for the actual RAA. As part of the adaptive management strategy, if monitoring data collected as part of the CIMP demonstrates that additional WBPCs should be identified as Category 3 due to MS4 considerations, the RAA will be updated accordingly to include these WBPCs. This output will include institutional and phased structural BMPs so that target load reductions can be expected to be met for the scheduled compliance dates. Ranges of results will also be reported (e.g., load, +/-confidence interval). The load and load reduction output will also be broken down by jurisdiction.

Table 5-5
Example SBPAT Output for each Compliance Assessment Site

Pollutant	Units	Average Annual MS4 Loads and Volumes			% of MS4 Load Removed	
		Pre-BMP	w/Dist. BMPs	w/ Dist. + Reg. BMPs	w/Dist. BMPs	w/ Dist. + Reg. BMPs
Total runoff volume	Ac-ft	220	172	172	22	22
DCu	lbs	8.8	6.9	6.8	22	23
DP	lbs	170	125	118	27	30
DZn	lbs	163	73	63	55	62
FC	10^12 MPN	52.8	35.4	24.3	33	54
NH3	lbs	435	276	190	37	56
NO3	lbs	500	384	378	23	25
TCu	lbs	18.9	10.7	8.1	43	57
TKN	lbs	1645	1257	1194	24	27
TPb	lbs	7.63	4.18	3.54	45	54
TP	lbs	235	140	98	41	58
TSS	Tons	42	19	12	54	71
TZn	lbs	218	101	66	54	70

5.5. CONCLUSIONS

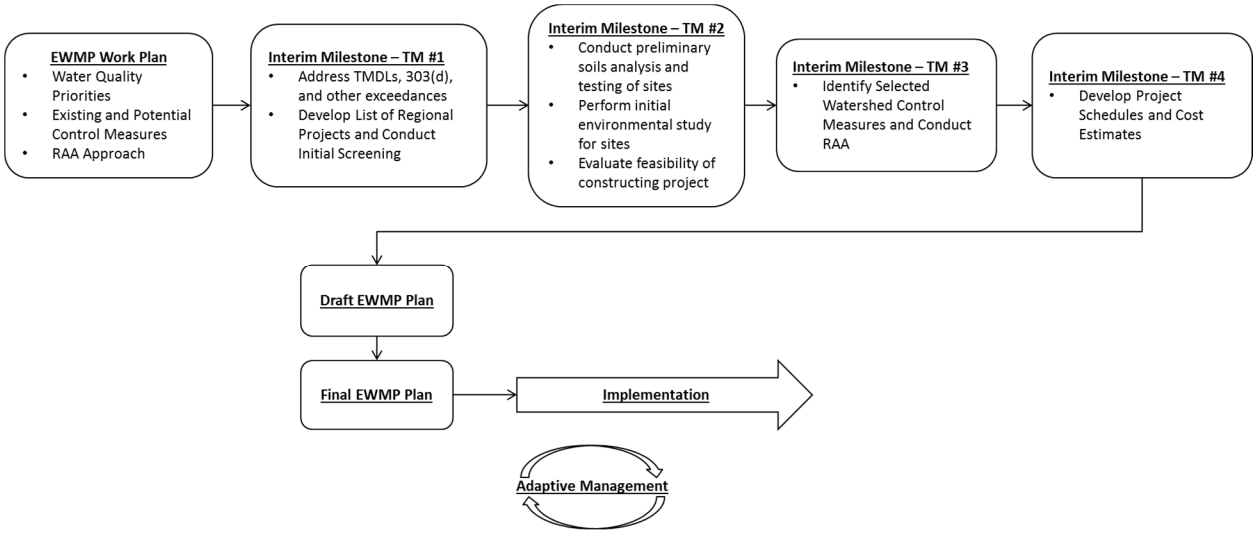
For the SMB EWMP, a wet weather modeling approach that utilizes SBPAT and meets Permit requirements and provides the informational submittal elements required by the Regional Board. It also compatible with institutional BMP analytical approaches, and provides information with respect to variability that is important for the SMB EWMP Group to establish reasonable assurance. A separate dry weather RAA methodology is also proposed to meet Permit requirements.

Section 6
EWMP Plan Development

6.1. PROCESS FOR DEVELOPING EWMP PLAN

This section describes the process to complete the EWMP Plan. During the course of developing the EWMP Plan, interim technical memoranda will be developed to ensure timely completion. **Figure 6-1** below presents the process for developing the EWMP Plan and interim milestones. The schedule for completion of interim milestones and the EWMP Plan is presented in Section 6.2.

Figure 6-1
EWMP Plan Development Process



Additionally, the EWMP Plan is intended to be an adaptive plan that is capable of adjusting and adapting to new information, including data collection as part of the CIMP implementation. As a result, an adaptive management process will occur every two years following approval of the EWMP Plan. The adaptive management process is discussed in Section 6.3.

6.2. EWMP PLAN SCHEDULE AND MILESTONES

The NOI submitted to the Regional Board on December 16, 2013 provided a schedule of interim milestones for the development of the EWMP Work Plan, CIMP, and EWMP Plan. At this time the SMB EWMP Group does not anticipate any deviations from the schedule. Completed milestones and projected completion dates for future milestones as identified in the NOI are presented in **Table 6-1**.

Table 6-1
EWMP Schedule of Interim and Final Milestones

Deliverable	NOI Due Date[1]
EWMP Work Plan	
Draft Technical Memos • Identification of water quality priorities • Existing and future watershed control measures, identification of potential regional projects • Reasonable assurance analysis approach • Best Management Practices selection approaches	March 2014
Draft Work Plan	April 2014
Final Work Plan submitted to the Regional Board	June 2014
Coordinated Integrated Monitoring Plan	
Draft Technical Memos • Outfall and receiving water monitoring approach • Monitoring sites selection • New development and redevelopment effectiveness tracking	March 2014
Draft CIMP	April 2014
Final Draft CIMP submitted to the Regional Board	June 2014
EWMP Plan	
Technical Memos • Approach to U.S. Environmental Protection Agency TMDLs, 303(d) listings, other exceedances of Receiving Water Limitations • Final selection of regional projects • Feasibility analyses of regional projects, customization of Minimum Control Measures, identification of other BMPs • Project schedules and cost estimates	April 2015
Draft EWMP Plan	May 2015
Submit Final Draft EWMP Plan to the Regional Board	June 2015

1. Milestone due dates as presented in the Notice of Intent delivered to the Regional Board on December 16, 2013.

6.3. ADAPTIVE MANAGEMENT PROCESS

The EWMP is intended to be implemented as an adaptive program. As new program elements are implemented and information is gathered over time, the EWMP will undergo modifications to reflect the most current understanding of the watershed and present a sound approach to addressing changing conditions. As such, the EWMP will employ an adaptive management process that will allow the EWMP to evolve over time.

Part VI.C.8 of the Permit details the adaptive management process to be included in the EWMP that includes the following requirements:

i. Permittees shall adapt the EWMP to become more effective every two years from the date of program approval based on, but not limited to a consideration of

   (1) progress toward achieving WQBELs and/or RWLs;

   (2) Permittee monitoring data;

(3) achievement of interim milestones;

(4) re-evaluation of water quality priorities and source assessment;

(5) non-Permittee monitoring data;

(6) Regional Board recommendations; and

(7) recommendations through a public participation process.

ii. Permittees shall report any modifications to the EWMP in the annual report.

iii. Permittees shall implement any modifications to the EWMP upon approval by the Regional Board or within 60 days of submittal if the Regional Board expresses no objections.

The adaptations to the EWMP as called for in the adaptive management process essentially include a re-evaluation of water quality priorities, an updated source assessment, an effectiveness assessment of watershed control measures, and a RAA. The CIMP will gather additional data on receiving water conditions and stormwater/non-stormwater quality to inform these analyses. This process will be repeated every two years as part of the adaptive management process.

6.3.1. Re-Characterization of Water Quality Priorities

Water quality within the SMB EWMP AreaGroup a will be re-characterized using data collected as a result of the CIMP implementation to include the most recent data available. WBPCs may be updated as a result of changing water quality. Category 3WBPCs will be identified based on data collected as part of the approved CIMP. These classifications will be important for refocusing improvement efforts and informing the selection of future watershed control measures.

6.3.2. Source Assessment Re-evaluation

The assessment of possible sources of water quality constituents will be re-evaluated based on new information from the CIMP implementation efforts. The identification of non-MS4 and MS4 pollutant sources is an essential component of the EWMP because it determines whether the source can be controlled by watershed control measures. As further monitoring is conducted and potential sources are better understood, the assessment becomes more accurate and informed.

6.3.3. Effectiveness Assessment of Watershed Control Measures

The evaluation of BMP effectiveness is an important part of the adaptive management process and the overall EWMP. Implementation of the CIMP can provide a quantitative assessment of structural BMP effectiveness as it relates to actual pollutant load reduction to determine how selected BMPs have performed at addressing established water quality priorities. In addition, the adaptive management process is a required step for the customization of MCMs as detailed in Section 4.3.2. Effectiveness assessment becomes important for the selection of future control measures to be considered.

6.3.4. Update of Reasonable Assurance Analysis

The RAA is an iterative process that depends on the continuous refinement and calibration of the watershed models used. Data gathered as a result of the CIMP will support adaptive management at multiple levels, including (1) generating data not previously available to support model updates and (2) tracking improvements in water quality over the course of EWMP implementation.

Section 7
References

CASQA, 2006. "An Introduction to Stormwater Program Effectiveness Assessment." White Paper: http://www.scvurpppw2k.com/pdfs/0405/CASQA%20White%20Paper_An%20Introduction%20to%20Stormwater%20Program%20Effectiveness%20Assessment4.pdf.

City of Los Angeles "Projects for 5-Year Expenditure plan – Santa Monica Bay, Ballona Creek, Marina Del Rey, Dominguez Channel." Excel Database. Received November 2013.

City of Los Angeles, Concept Memo #3: Reasonable Assurance Analysis Approach, December, 2013.

City of Los Angeles. "City of Santa Monica BMPs – Private and City Owned." Excel Database. Received November 2013.

City of Los Angeles. "City of Santa Monica BMPs – City Owned." Excel Database. Received November 2013.

City of Los Angeles. "LA Sanitation Green Infrastructure Projects list." Excel Database. December 2012. Received November 2013.

City of Los Angeles. "Low Flow Development Project Information" Excel Database. January 1, 2008. Received November 2013.

City of Los Angeles. "Santa Monica Bay Watershed Regional BMP Projects." PDF Document. Received November 2013.

City of Los Angeles. "Standard Urban Stormwater Mitigation Plan (SUSMP) LID Data " Excel Database. June 2006 through September 2013. Received November 2013.

City of Los Angeles. Concept Memos. MS Word Document Received. November, 2013

City of Los Angeles. Concept Memos. November 2013.

City of Malibu, 2012. Comment Letter – Bacteria TMDL Revisions for Santa Monica Bay Beaches. May 7, 2012.

Curren J., S. Bush, S. Ha, M.K. Stenstrom, S. Lau, I.H. Suffet. 2011. Identification of subwatershed sources for chlorinated pesticides and polychlorinated biphenyls in the Ballona Creek watershed. Science of the Total Environment 409: 2525-2533.

Donigian, A. S., Jr. 2000. Lecture 19: Calibration and verification issues, Slide L19-22. HSPF training workshop handbook and CD. Presented and prepared for the U.S. EPA Office of Water and Office of Science and Technology, Washington, D.C.

Ferguson, D.M., Moore, D.F., Getrich, M.A., and M.H. Zhowandai, 2005. "Enumeration and speciation of enterococci found in marine and intertidal sediments and coastal water in southern California." Journal of Applied Microbiology 99(3).

Geosyntec Consultants and Wright Water Engineers, 2012. International Stormwater Best Management Practices (BMP) Database Pollutant Category Summary Statistical Addendum: TSS, Bacteria, Nutrients, and Metals. July 2013.

Geosyntec Consultants, 2012. A User's Guide for the Structural BMP Prioritization and Analysis Tool (OCTA-SBPAT v1.0). Prepared for Orange County Transportation Authority. November 2012.

References

Geosyntec Consultants, 2012. San Luis Rey River Watershed Comprehensive Load Reduction Plan. October.

Grant, S.B., Sanders, B.F., Boehm, A.B., Redman, J.A., Kim, J.H., Mrse, R.D., Chu, A.K., Gouldin, M., McGee, C.D., Gardiner, N.A., Jones, B.H., Svejkovsky, J., Leipzig, G.V., and A. Brown, 2001. "Generation of Enterococci Bacteria in a Coastal Saltwater Marsh and its Impact on Surf Zone Water Quality." Environmental Science and Technology 35(12).

Griffith, J.F., 2012. "San Diego County Enterococcus Regrowth Study." SCCWRP Technical Report.

Helsel, Dennis R. Nondetects and Data Analysis: Statistics for Censored Environmental Data. Hoboken, NJ: Wiley-Interscience, 2005. Print.

Imamura, G.J., Thompson, R.S., Boehm, A.B., and J.A. Jay, 2011. "Wrack promotes the persistence of fecal indicator bacteria in marine sands and seawater." FEMS Microbiology Ecology 77(1).

Izbicki, J, 2012a. "RE: MS#1092: Update submitted for "Sources of Fecal Indicator Bacteria to Groundwater, Malibu Lagoon, and the Near-Shore Ocean, Malibu, California." "RE: USGS Study". Email to Barbara Cameron. May 4, 2012 11:18 am.

Izbicki, J., Swarzenski, P., Burton, C., and L.C. Van DeWerfhorst, 2012b. "Sources of fecal indicator bacteria to groundwater, Malibu Lagoon, and the near-shore ocean, Malibu, California." Submitted 2012.

Jiang, S., McGee, C., Candelaria, L., and G. Brown, 2004. "Swimmer Shedding Study in Newport Dunes, California. Final Report." http://www.waterboards.ca.gov/rwqcb8/water_issues/programs/tmdl/docs/swimmerreport.pdf

Lee, C.M., Lin, T.Y., Lin, C.C., Kohbodi, G.A., Bhatt, A., Lee, R., and J.A. Jay, 2006. "Persistence of fecal indicator bacteria in Santa Monica Bay beach sediments." Water Research 40(14).

Litton, R.M., Ahn, J.H., Sercu, B., Holden, P.A., Sedlak, D.L., and S.B. Grant, 2010. "Evaluation of Chemical, Molecular, and Traditional Markers of Fecal Contamination in an Effluent Dominated Urban Stream." Environmental Science and Technology 44(19).

Los Angeles County Department of Public Works, 2000. Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report. July 31.

Los Angeles County Department of Public Works. 2011-2012 Annual Stormwater Monitoring Report. http://ladpw.org/wmd/npdesrsa/annualreport/index.cfm

Los Angeles Regional Water Quality Control Board (Regional Board), 2012. Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4. November 8. http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/la_ms4/2012/Order%20R4-2012-0175%20-%20A%20Final%20Order%20revised.pdf

Los Angeles Regional Water Quality Control Board (Regional Board), 2012. Regional Board Basin Plan Amendment for the Santa Monica Bay Beaches Bacteria TMDL. June 7, 2012. http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/90_New/Jan2013/Final%20BPA%20Attach%20A%20SMBB%20Dry&Wet%2007Jun12.pdf

Los Angeles Regional Water Quality Control Board (Regional Board), 2010. Proposed Amendments to the Water Quality Control Plan – Los Angeles Region for the Santa Monica Bay Nearshore and Offshore Debris TMDL. Attachment A to Resolution No. R10-010. Adopted November 4, 2010. http://63.199.216.6/larwqcb_new/bpa/docs/R10-010/R10-010_RB_BPA.pdf

References

Los Angeles Regional Water Quality Control Board (Regional Board), 2005. Total Maximum Daily Load for Metals in Ballona Creek. July 7, 2005. http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/2005-007/05_0831/StaffReport.pdf

Los Angeles Regional Water Quality Control Board (Regional Board), 2002. Draft Santa Monica Bay Beaches Bacteria TMDL, Revised Staff Report (Dry Weather Only). January 14, 2002. http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/2002-004/02_0114_tmdl%20Dry%20Weather%20Only_web.pdf

Los Angeles Regional Water Quality Control Board (Regional Board), 2002. Proposed Amendments to the Water Quality Control Plan – Los Angeles Region to incorporate the Santa Monica Bay Beaches Bacteria TMDL. Attachment A to Resolution No. 02-004. http://63.199.216.6/larwqcb_new/bpa/docs/2002-004/2002-004_RB_BPA.pdf

Los Angeles Regional Water Quality Control Board (Regional Board), 2002. Proposed Amendments to the Water Quality Control Plan – Los Angeles Region to incorporate Implementation Provisions for the Region's Bacteria Objectives and to incorporate the Santa Monica Bay Beaches Bacteria TMDL. Attachment A to Resolution No. 2002-022. http://63.199.216.6/larwqcb_new/bpa/docs/2002-022/2002-022_RB_BPA.pdf

Los Angeles Regional Water Quality Control Board (Regional Board), 1995. Updated 2011. Water Quality Control Plan, Los Angeles Region. http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/basin_plan/index.shtml

Los Angeles Regional Water Quality Control Board (Regional Board), 2012. Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4. November 8. http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/la_ms4/2012/Order%20R4-2012-0175%20-%20A%20Final%20Order%20revised.pdf

MWH Team A, Draft Water Quality Priorities Technical Memorandum, December 16, 2013. (TM 2.1)

MWH Team B, Draft Existing and Potential Control Measures Technical Memorandum, December 16, 2013. (TM 2.2)

MWH Team C, Draft Reasonable Assurance Analysis Approach Technical Memorandum, December 16, 2013. (TM 2.3)

MWH Team, Draft Existing and Potential Control Measures Technical Memorandum 2.2, December 16, 2013b.

MWH Team, Draft Monitoring Approach Technical Memorandum 3.1, December 16, 2013c.

MWH Team, Draft Water Quality Priorities Technical Memorandum 2.1, December 16, 2013a.

Online Project Tracking and Integration (OPTI) Database. http://irwm.rmcwater.com/la/dashboard.php

Phillips, M.C., Solo-Gabriele, H.M., Piggot, A.M., Klaus, J.S., and Y. Zhang, 2011. "Relationships between Sand and Water Quality at Recreational Beaches", Water Resources 45(20).

Sabino, R., Verissimo, C., Cunha, M.A., Wergikowski, B., Ferreira, F.C., Rodrigues, R., Parada, H., Falcao, L., Rosado, L., Pinheiro, C., Paixao, E., and J. Brandao, 2011. "Pathogenic fungi: An unacknowledged risk at coastal resorts? New insights on microbiological sand quality in Portugal." Marine Pollution Bulletin 62: 1506-1511.

SCCWRP, 2005. Microbiological Water Quality at Reference Beaches in Southern California during Wet Weather (SCCWRP Technical Report 448). August.

References

SCCWRP, 2007a. Assessment of Water Quality Concentrations and Loads from Natural Landscapes (SCCWRP Technical Report 500). February.

SCCWRP, 2007b. Sources, Patterns and Mechanisms of Storm Water Pollutant Loading From Watersheds and Land Uses of the Greater Los Angeles Area, California, USA (SCCWRP Technical Report 510). March.

Schueler, T. 1996. "Irreducible Pollutant Concentrations Discharged from Urban BMPs." Watershed Protection Techniques, 1(3): 100-111. Watershed Protection Techniques 2(2): 361-363.

Stein, E.D., Tiefenthaler, L.L., and Schiff, K.C., 2007. "Sources, Patterns and Mechanisms of Storm Water Pollutant Loading From Watersheds and Land Uses of the Greater Los Angeles Area, California, USA." Southern California Research Project (SCCWRP), Technical Report 510, March.

Strecker, E., Quigley, M., Urbonas, B., Jones, J., and Clary, J., 2001. "Determining Urban Stormwater BMP Effectiveness." Journal of Water Resources Planning and Management. May/June 2001.

Tiefenthaler, L., Stein, E.D., and K.C. Schiff, 2011. "Levels and patterns of fecal indicator bacteria in stormwater runoff from homogenous land use sites and urban watersheds." Journal of Water and Health 9:279-290.

U.S. Department of Agriculture (USDA), 2009. National Engineering Handbook (210-VI-NEH), Chapter 7. Natural Resource Conservation Service.

United States Environmental Protection Agency (USEPA), 1993. Subsurface Flow Wetlands for Wastewater Treatment, A Technology Assessment. July 2013.

United States Environmental Protection Agency (USEPA), 2012. Santa Monica Bay Total Maximum Daily Loads for DDTs and PCBs.

Ventura County Flood Control District, 2003. Stormwater monitoring report, 1997□2003.

Weisberg, S.B., and D.M. Ferguson, 2009. "North Santa Monica Bay Source Investigation Study, Ramirez Creek and Escondido Creek, Malibu, 2009 Summary and Recommended Studies." SCCWRP.

Weston Solutions, 2010. "Tecolote Creek Microbial Source Tracking Summary – Phases I, II, and III."

Wright Water Engineers (WWE) and Geosyntec Consultants, 2007. FAQ: Why does the International Stormwater BMP Database Project omit percent removal as a measure of BMP performance? http://www.bmpdatabase.org/Docs/FAQPercentRemoval.pdf.