South Orange County (San Juan Hydrologic Unit) Water Quality Improvement Plan

Water Quality Improvement Goals, Strategies and Schedules Submittal (Permit Provision B.3)

Submitted to the
San Diego Regional Water Quality Control Board
By:

The County of Orange, Orange County Flood Control District and Cities of Aliso Viejo, Dana Point, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest, Mission Viejo, Rancho Santa Margarita, San Clemente, and San Juan Capistrano

Publication Date: October 1, 2016

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OC PublicWorks
Integrity, Accountability, Service, Trust
Shane L. Silsby, Director

September 28, 2016

RE: South Orange County (San Juan Hydrologic Unit) Water Quality Improvement Plan: Water Quality Improvement Goals, Strategies, and Schedules, Provision B.3

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Amanda Carr
Deputy Director
OC Environmental Resources

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September 26, 2016

City of Aliso Viejo Certification

South Orange County Water Quality Improvement Plan: B.3 Goals and Strategies

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Moy Yahya
Environmental Programs Manager

City of Aliso Viejo
Incorporated July 1, 2001

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September 26, 2016

South Orange County (San Juan Hydrologic Unit) Water Quality Improvement Plan: Water Quality Improvement Goals, Strategies and Schedules, Provision B.3 – Certification Statement

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Brad Fowler
Director of Public Works & Engineering Services
City of Dana Point

Department of Water Quality

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

David Shissler
Director of Water Quality

9/27/16
Date

505 FOREST AVE. • LAGUNA BEACH, CA 92651 • TEL (949) 497-0378 • FAX (949) 494-1864

CITY OF LAGUNA HILLS

September 27, 2016

RE: WATER QUALITY IMPROVEMENT PLAN CERTIFICATION
ORDER NO. R9-2013-0001, AS AMENDED BY ORDER NOS. R9-2015-0001 AND R9-2015-0100, NPDES NO. CAS0109266

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

Kenneth H. Rosenfield, P.E.
Director of Public Services

24035 El Toro Road • Laguna Hills, California 92653 • (949) 707-2600 • FAX (949) 707-2633
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SIGNED CERTIFIED STATEMENT

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Nasser Abbaszadeh, Director of Public Works
City of Laguna Niguel

9/26/16
Date

CITY of LAGUNA WOODS

September 27, 2016

City of Laguna Woods Certification

South Orange County Water Quality Improvement Plan: B.3 Goals and Strategies

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Moy Yahya
Water Quality Manager

CITY OF LAKE FOREST

September 29, 2016

RE: South Orange County (San Juan Hydrologic Unit) Water Quality Improvement Plan: Water Quality Improvement Goals, Strategies, and Schedules Submittal, Provision B.3

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Devin Slaven, CPSWQ, QSD/QSP
Environmental Manager
CITY OF LAKE FOREST

cc: Thomas Wheeler, P.E., Director of Public Works/City Engineer

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City of Mission Viejo

Public Works Department

September 28, 2016

Subject: **Water Quality Improvement Plan Chapter B.3 Submittal on Behalf of the City of Mission Viejo by the OC Public Works – Stormwater Program**

Per Attachment B of the Regional Permit, please find below my certification regarding the submittal of the Water Quality Improvement Plan Chapter B.3 submittal on behalf of the City of Mission Viejo by OC Public Works – Stormwater Program:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Joe Ames, P.E.
Assistant City Engineer
City of Mission Viejo

City of Rancho Santa Margarita

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

E. (Max) Maximous, PE
Public Works Director/City Engineer

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Public Works / Engineering

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September 29, 2016

RE: South Orange County (San Juan Hydrologic Unit) Water Quality Improvement Plan: Goals, Strategies and Schedules Submittal

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Certified by:

Tom Bonigut

Tom Bonigut, P.E.
Deputy Public Works Director

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"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Steve May, Director of Public Works and Utilities
City of San Juan Capistrano

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Acronyms

ASBS	Areas of Special Biological Significance
BMP	Best management practices
BPJ	Best Professional Judgment
CEQA	California Environmental Quality Act
CFS	Cubic feet per second
CWA	Clean Water Act
EMC	Event mean concentration
ESA	Federal Endangered Species Act
FC	Fecal Coliform
FIB	Fecal Indicator Bacteria
GIS	Geographic Information System
GPM	Gallons per minute
GRBOD	Geomorphically-referenced basis of design
HPWQC	Highest priority water quality conditions
HSA	Hydrologic Sub Area
HU	Hydrologic Unit
IBI	Index of Biological Integrity
IDDE	Illicit Discharge, Detection and Elimination
IRWM	Integrated Regional Watershed Management Plan
JRMP	Jurisdictional Runoff Management Plan
LID	Low impact development
LIPS	Local implementation plans
MPN	Most probable number
MS4	Municipal Separate Storm Sewer System
MST	Microbial source tracking
NEPA	National Environmental Policy Act
NOA	Notice of Applicability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NSE	Natural Source Exclusion
OC	Orange County
OCFCD	Orange County Flood Control District
OCTA	Orange County Transportation Authority
OWTS	On-site wastewater treatment system
PWQC	Priority water quality conditions
RAA	Reasonable Assurance Analysis
RMV	Rancho Mission Viejo
ROMP	Runoff Management Plan

ROWD	Report of Waste Discharge
SAMP	Special Area Management Plan
SBPAT	Structural BMP Prioritization and Analysis Tool
SCCWRP	Southern California Coastal Water Research Project
SDRWQCB	San Diego Regional Water Quality Control Board
SEEP	SmarTimer Edgescape Evaluation Project
SOC	South Orange County
SOC WMA	South Orange County Watershed Management Area
SSO	Site-specific objectives
SWRCB	State Water Resources Control Board
TDS	Total dissolved solids
TLR	Target load reduction
TMDL	Total Maximum Daily Load
TSS	Total suspended solids
WDID	Waste Discharger Identification
WDR	Waste Discharge Requirements
WLA	Waste load allocations
WMA	Watershed Management Area
WMAA	Watershed Management Area Analysis
WQIP	Water Quality Improvement Plan
WQO	Water Quality Objective
WY	Water Year

Executive Summary

Background

Provision B of the San Diego Regional Municipal Separate Storm Sewer Systems (MS4) Permit (Order R9-2013-0001 as amended by Order No. R9-2015-001 and Order No. R9-2015-0100) requires the development of a Water Quality Improvement Plan (WQIP, the "Plan") for the San Juan Hydrologic Unit (South Orange County). Chapter B.2 of this Plan was submitted to the San Diego Regional Water Quality Control Board (SDRWQCB) on April 1st, 2016. Chapter B.2 identified three Highest Priority Water Quality Conditions (HPWQCs) based on a holistic review of available watershed data:

- Pathogen Health Risk at Beaches
- Channel Erosion and Associated Geomorphic Impacts for Inland Waters
- Unnatural Water Balance/Flow Regime in Inland Waters

Other priority water quality conditions (PWQC) were also identified.

Water Quality Improvement Goals, Strategies, and Schedules (B.3 Submittal)

Chapter B.3 of this Plan describes water quality improvement goals for each of the HPWQCs and describes the strategies and schedules for achieving these goals. This Chapter has been divided into planning "tracks" based on each HPWQC. Each planning track describes overall goals, specific numeric goals, strategies, and schedules to meet the requirements of the MS4 Permit. This Plan also demonstrates within each track that implementation of the Plan elements as described will reasonably achieve the goals, both interim and final. Each track is based on an adaptive approach, where the resulting monitoring and assessment efforts are expected to be considered in future updates and refinements of the Plan. Monitoring and assessment and adaptive management plans will be described in Chapter B.4, scheduled for submittal to SDRWQCB by April 1, 2017.

Beyond the HPWQC planning tracks, Chapter B.3 also describes how the Plan addresses the other priority water quality conditions. Finally, this Chapter includes a Watershed Management Area Analysis (WMAA) pursuant to Permit Provision B.3.b.(4) that has specific significance for subsequent development of alternative compliance projects and demonstration of appropriate exemptions from hydromodification management.

Pathogen Health Risk

The overall goals for this track is to manage health risk associated with contact water recreation in coastal waters to an acceptable level and maintain existing high quality of water present at many swimming beaches. For the purpose of goal setting and strategy evaluation, fecal indicator bacteria (FIB) are used as indicators of pathogens because they are easier and less costly to measure. However, the ultimate goal of this Plan is to address actual pathogens that pose a risk to human health. Allowable FIB loads for the South Orange County Watershed Management Area (SOC WMA) are defined by the "Twenty Beaches and Creeks Bacteria Total Maximum Daily Load" and "Baby Beach in Dana Point Harbor" Total Maximum Daily Loads (Bacteria TMDLs). To demonstrate (quantitatively) compliance with the TMDLs, goals for this track are expressed as percent load reductions conforming to the mandated reductions indicated in Table 6.3 of Attachment E of the Permit.

The strategies that have been developed to achieve the goals include a primary emphasis on the control of human waste sources and a secondary emphasis on controlling more general sources of indicator bacteria. This Plan describes suites of programmatic (i.e., non-structural) and structural BMPs. Strategy implementation will prioritize a specific program for identification and abatement of human sources of pathogens. This includes extensive application of microbial source tracking (MST) methods followed by abatement and verification actions. This approach is supplemented by other programmatic and source control efforts as well as new structural treatment controls. Anticipated bacteria load reductions from strategy implementation were modeled to provide reasonable assurance that implementation of this Plan will achieve the targets by the compliance deadline of April 1, 2031. The majority of the strategies identified in this Plan are multi-benefit in nature, addressing multiple pollutants, beyond bacteria.

Channel Erosion and Associated Geomorphic Impacts – Inland Receiving Waters

Within the network of streams and creek systems in the South Orange County Watershed Management Area (SOC WMA), certain reaches are experiencing adverse geomorphic impacts resulting from severe erosion, such that the underlying physical form of the stream is impacted. This condition influences the physical habitat (i.e., channel geometry, substrate, vegetation) and hydraulic flow regimes (i.e., velocity distributions, erosive energy) of a channel. The Plan establishes as an overall goal for this HPWQC abatement of excess erosion where these processes are determined to be an active and primary source of impairment to geomorphic form and function within an impaired reach. A rapid aerial screening of approximately 170 lineal miles of inland receiving waters was conducted to identify reaches that appear to be experiencing erosion and associated geomorphic impacts associated with urbanization. As part of screening reaches, several factors were used to evaluate the degree of recent instability, extents of impact, potential for uplift of beneficial uses via rehabilitation, opportunities

and constraints. Based on these assessments, this plan establishes a goal of rehabilitating 23,000 lineal feet of streams using a geomorphically-referenced approach to abate excess erosion and scour while maintaining dynamic morphology of the active channel (rather than full stabilization) and provide conveyance for design flood flows over a period extending to 2042.

The primary strategy to address these impacts is rehabilitation of geomorphically unstable channels within urbanized corridors and publicly owned rights-of-way using a multi-benefit geomorphically-referenced basis of design, where feasible. This design paradigm emphasizes a complete design approach that considers safe conveyance of flood flows (infrequent conveyance condition) while providing the ecological benefits of establishing a dynamically-stable channel reach to convey the geomorphically-significant flows (more frequent conveyance condition), while restoring or maintaining recreational uses. Near-term planning efforts are identified to better characterize candidate reaches and determine the scope and schedule of specific projects to meet the established goals. These efforts will include evaluation of combinations of upland (i.e., detention) and in-stream (i.e., rehabilitation) actions. This will be followed by implementation of specific projects. Regular collection of high-resolution remote-sensed ground surface and vegetative cover data will be used to identify other areas of channel erosion and determine the need for future abatement efforts.

Unnatural Water Balance and Flow Regime – Inland Receiving Waters

Within the network of inland receiving waters, anthropogenic sources of dry weather flows are a major component of the current urban water balance and are known to contribute to unnatural quantity and timing of flows in many stream systems. Based on evaluation of spatial data relationships in the SOC WMA (See Chapter B.2), there appears to be a correlation between dry weather MS4 discharges to stream channels, flows in these channels, and impairments to water quality and beneficial uses. As such, the overall goal for this HPWQC is to effectively eliminate unnatural dry weather flows from storm drain outfalls to inland receiving waters. This goal applies to all MS4 outfalls, subject to the definitions and exceptions that are identified in the Plan and will be conducted over a period extending to 2047. Exceptions apply to outfalls where it is appropriate for flow to continue and where specific criteria are met related to water quality.

The strategies identified in this Plan focus specifically on identifying and eliminating unnatural and unpermitted, non-exempted dry weather flows from the MS4 into inland receiving waters, with priority for the locations where unnatural dry weather flow inputs arising from an unnatural urban water balance are exacerbating in-stream water quality conditions and contributing to unnatural in-stream regimes. Strategies to address these flows include source control, incentives, and educational measures to

promote water conservation and reduction of unnatural flows into the MS4 and structural BMP retrofit strategies to divert and capture water at high priority outfalls, where appropriate. An outfall prioritization approach is included in this Plan and will be updated over time to determine appropriate strategies for each outfall. These strategies are intended to be implemented within a broader watershed and water management context and align with water conservation and water recycling efforts. Some of the strategies in this Plan are ongoing and have resulted in significant progress, while some strategies are new as part of this Plan. New near-term efforts include additional data collection and analysis to better characterize conditions within the WMA and determine specific new control actions.

Prohibitions and Limitations Compliance Option

As allowed per Provision B.3.c (Prohibitions and Limitations Compliance Option), the Permittees intend to rely on implementation of the WQIP to demonstrate compliance with the requirements of Provisions A.1.a, A.1.c, A.1.d, A.2, and A.3.b. The Plan lists the other PWQCs that are being optionally enrolled in B.3.c provision per the allowance stated in Provision B.3.c.(1)(a)(v) and the spatial extent to which these PWQCs apply. The PWQCs listed include the PWQCs from Chapter B.2 for which a HPWQC plan has not already been directly developed. While HPWQC plans were not directly developed to target the PWQCs identified, this Plan demonstrates that the strategies identified to meet the goals established for the three HPWQCs will have co-benefits related to these PWQCs.

Optional Watershed Management Area Analysis

The Permittees elected to perform the optional WMAA described in Permit Provision B.3.b.(4). This analysis is intended to characterize important processes and characteristics of each watershed through creation of GIS layers. The WMAA is specifically intended to be used for the following purposes:

- To identify candidate projects that could potentially be used as offsite alternative compliance options for Priority Development Projects in lieu of satisfying full onsite retention, biofiltration, and hydromodification runoff requirements.
- To identify and/or prioritize areas where it is appropriate to allow certain exemptions from onsite hydromodification management BMPs for Priority Development Projects.

It is important to note that the WMAA is separate from and has different purposes than the planning tracks for the HPWQCs presented in the B.3 Chapter.

Forward

This document describes the planning efforts and analyses performed as part of the Water Quality Improvement Plan (Plan) for South Orange County as partial fulfillment of the requirements of the Regional Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit (Order R9-2013-0001, NPDES No. CAS0109266) (Permit) and subsequently amended by Order No. R9-2015-001 and Order No. R9-2015-0100). Specifically, this document and associated appendices have been prepared to be consistent with the submittal requirements and schedule for Permit Provision B.3.

The Plan is being developed in phases to meet the submittal requirements indicated in the Permit, facilitate public and Consultation Panel input, and build logically upon sequential efforts. The required Plan submittals and submission due dates are as follows:

- Provision B.2 – Priority Water Quality Conditions (April 1, 2016)
- Provision B.3 – Goals, Strategies and Schedules (October 1, 2016)
- Complete WQIP (meeting the requirements of Provision B) (April 1, 2017)

Development of the B.3 Chapter of the Plan was initiated following submission of the B.2 Chapter of the Plan in April 2016 and a public meeting held on April 14, 2016. A Consultation Panel meeting, open to the public, to solicit input on the development of the B.3 Chapter was conducted on September 1, 2016 followed by a public meeting conducted on September 27, 2016. The B.3 Chapter builds on the conclusions from the B.2 Chapter, whereby strategies and goals were developed to address the highest priority water quality conditions (HPWQCs) within the South Orange County Watershed Management Area (SOC WMA), also known as the San Juan Hydrologic Unit. Conditions (B.2) and resulting strategies and goals (B.3) were evaluated for the five subwatersheds of the San Juan Hydrologic Unit (HU) as listed below and as depicted in **Appendix A** - Figure A-1:

- Laguna Coastal Streams Watershed
- Aliso Creek Watershed
- Dana Point Coastal Streams Watershed
- San Juan Creek Watershed
- San Clemente Coastal Streams Watershed

Future WQIP planning efforts leading up to submission of the Complete WQIP in April 2017 will include development of an associated monitoring and assessment plan consistent with Provision B.4 of the Permit. The B.4 Chapter of the WQIP will indicate

the specific actions used to measure progress of the implemented strategies towards achieving the goals indicated in this document (i.e., B.3 Chapter of the Plan) and define the parameters of the iterative and adaptive approach that will be used for subsequent updates of this Plan.

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Section 1

1 INTRODUCTION

Provision B.3 of the Permit, "Water Quality Improvement Goals, Strategies and Schedules," describes the requirements to develop specific water quality improvement goals and strategies to address the water quality conditions identified for the SOC WMA. These goals and strategies must effectively prohibit non-stormwater discharges to the stormwater conveyance system, reduce pollutants in stormwater discharges from the stormwater conveyance system to the maximum extent practicable, and protect water quality standards in receiving waters. This provision requires interim and final numeric (i.e., quantifiable) goals for the highest priority water quality conditions (HPWQC). Additionally, this Plan contains numeric milestones for certain additional priority water quality conditions pursuant to the criteria and compliance pathways described in Section B.3.c of the Permit (Prohibitions and Limitations Compliance Option).

In developing this Chapter of the Plan to meet the requirements of Provision B.3, and as initiated during the development of the B.2 Chapter, efforts have been based on extending the three key themes identified in the Orange County Stormwater Program's Report of Waste Discharge (ROWD, 2014) on the State of the Environment in the San Diego Region:

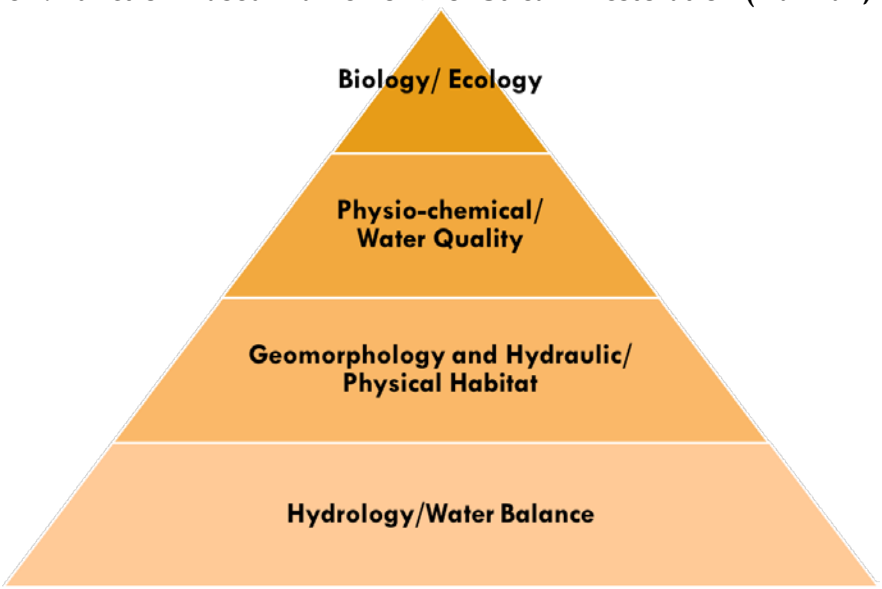
- Focus on priority areas and constituents rather than trying to monitor all constituents, potential issues, and locations
- Increase the integration of data from a wider range of sources
- Continue to evolve from a strictly discharge-specific approach to a risk-based prioritization approach

This approach will continue to be utilized for the development of the monitoring and adaptive management plan that will be included in the complete Plan submittal.

Consistent with this approach, priority conditions were identified within the receiving waters that, based on the best available data and information, warrant consideration for focused activity, manifested through the implementation of water quality improvement strategies. While improvement in the form, function, and achievement of beneficial uses of receiving waters is the ultimate goal of the Plan, the priority conditions identified in

the B.2 Chapter represent the functional "knobs and levers" that will be addressed through MS4 strategies and whose effectiveness can be monitored and adapted over time. Beneficial uses are much more likely to be achieved when watersheds and receiving waters exhibit "normal form and function." For purposes of developing actionable Plan strategies, form and function of receiving waters are conceptualized as a function-based framework of dependent layers where improvement in the integrity of an underlying layer makes it more likely to achieve positive outcomes for overlying layers, and is depicted in **Figure 1**.

Figure 1: Function-Based Framework for Stream Restoration (Harman, 2012)



As indicated in **Figure 1**, an important premise of the framework is that efforts to improve riparian biological communities (pinnacle) are likely to be most successful if the supporting foundational layers are in place. Additionally, an improvement implemented closer to the base of this hierarchy is likely to have the most far-reaching positive reinforcement cycle and/or reduce the degree of compensation needed to affect improvements at higher dependency levels.

Based on this framework, a durable and actionable set of highest priorities were established in the B.2 submittal. These priorities have been translated into the overarching goals that form the basis of this Plan[1], and the resulting selection of strategies to achieve those goals. These goals include:

1 By agreement dated February 10, 2015, pursuant to Water Code section 13228, Phase I MS4 discharges within the City of Lake Forest located within the San Diego Water Board Region are regulated by the Santa Ana Water Board Order No. R8-2015-0001 (NPDES No. CAS618030) upon the later effective date of this

- Manage health risk associated with contact water recreation in coastal waters to an acceptable level;
- Maintain the existing high quality of water present at many swimming beaches, and
- Restore or maintain recreational and biological beneficial uses of inland receiving waters to the extent reasonably achievable.

As Plan implementation progresses, goals addressing priority water quality conditions will be regularly re-evaluated as part of the monitoring and adaptive management process, including filling data gaps and monitoring progress over time.

The following sections indicate the specific goals and strategies for each of the highest priority water quality conditions (HPWQC) as summarized in **Table 1**. In addition, the Plan also includes associated goals and strategies addressing priority water quality conditions (PWQC) (discussed in **Section 2.4**).

Order or Santa Ana Water Board Tentative Order No. R8-2015-0001. In accordance with the terms of the agreement between the San Diego Water Board and the Santa Ana Water Board, the City of Lake Forest must implement the requirements of the Bacteria TMDL in Attachment E of this Order, participate in preparation and implementation of the Water Quality Improvement Plan for the Aliso Creek Watershed Management Area as described in Provision B of this Order and continue implementation of its over-irrigation discharge prohibition in its City Ordinance, Title 15, Chapter 15, section 14.030, List (b).

Table 1: HPWQCs for the San Juan Hydrologic Unit

Condition	Temporal Extent	Geographic Extent (or narrative criteria for future effort to define geographic extent)	B.3 Section Addressing HPWQC
Pathogen Health Risk	Dry and Wet weather	Beaches • Where recreational use/high value and persistent exceedances of FIB standards (limited extent in dry; most beaches during wet)	Section 2.1
Channel Erosion and Associated Geomorphic Impacts	Wet weather	Stream Reaches • Where excess channel erosion is actively occurring • Where degraded channel form has become limiting factor in channel ecology • Areas with highest intensity of recreational use/visibility • Where sediment or particulate-bound pollutants from channel erosion contributing to downstream water quality impairment or complicating restoration efforts • Excludes reaches exempted from hydromodification requirements	Section 2.2
Unnatural Water Balance/ Flow Regime	Dry weather	Stream Reaches • Outfalls determined to be ponded or flowing in dry weather with connectivity to inland receiving waters • Reaches of inland receiving waters that are determined to be unnaturally perennial due to MS4 effects on water balance • Areas with other observed issues exacerbated by unnatural water balance/flow regime (e.g., low IBI, high eutrophication, high invasive species) • Areas with highest intensity of recreational use/visibility	Section 2.3

2 GOALS, STRATEGIES AND SCHEDULES

2.1 Pathogen Health Risk

2.1.1 Overview

Human pathogens refer to a wide category of microorganisms, such as bacterium, protozoa, and viruses that causes disease in humans. Waterborne, fecal-derived human pathogens are a key source of impairment of recreational beneficial uses. Fecal indicator bacteria (FIB) are used as indicators of pathogens present in water because they are present at high concentrations and are easier and less costly to measure. FIB do not cause illness directly, but epidemiologic studies have shown correlations between indicator bacteria (enterococcus, fecal coliform, *Escherichia Coli* and total coliform) presence and gastrointestinal illness caused by pathogens.

The control of FIB presents unique challenges, since they are ubiquitous in the environment and the presence of bacteria from regrowth as well as natural sources can be significant. In contrast to human pathogens, however, FIB originate from both anthropogenic and non-anthropogenic (natural background) sources which presents significant challenges to effectively address. Anthropogenic sources (e.g., pet waste, human waste, sewage leaks) and natural sources such as birds, wildlife, non-fecal environmental sources and resuspension from sediment and regrowth, all contribute to FIB within the watershed and receiving waters.

Allowable FIB loads for the SOC WMA are defined by the "Twenty Beaches and Creeks Bacteria Total Maximum Daily Load" and "Baby Beach in Dana Point Harbor" Total Maximum Daily Loads (Bacteria TMDLs). The purpose of the Bacteria TMDLs are to protect the health of those who recreate in waterbodies receiving runoff from the SOC WMA by reducing the amount of human pathogens discharged to the waterbodies through dry weather urban runoff, stormwater, and other sources. The Bacteria TMDLs require Permittees to attain required load reductions during both dry weather and wet weather conditions within compliance timelines indicated in the respective sections of Attachment E of the Permit. The goals and strategies within the Plan are focused to attempt to demonstrate compliance with the Bacteria TMDLs.

Concurrent with the development of this Plan, as part of the 2014 triennial review, the San Diego Regional Water Quality Control Board (SDRWQCB) initiated a Basin Plan Amendment project to evaluate Primary Contact Water Recreation (REC-1) Water Quality Objectives (WQO) and subsequently revise the Twenty Beaches and Creeks Bacteria TMDL (aka "Reopener"). This update is timely and is expected to consider the results of related studies completed since the original adoption of the TMDL in 2010 to represent an improved linkage between WQOs and associated management actions, and reduction of pathogen-related human health risk. Under a Memorandum of Understanding by the County of San Diego, City of San Diego and the County of Orange and the San Diego Regional Water Quality Control Board (SDRWQCB), an associated effort currently being conducted as an element of the Reopener is a Bacteria TMDL Cost Benefit Analysis & Recommendations for TMDL Revisions. The purpose of this effort will be to identify and evaluate expected quantitative and qualitative costs of TMDL compliance measured against expected health and environmental benefits and the associated economic benefits. The analysis will consider relevant social, economic and environmental factors and explore the costs and benefits of keeping the existing wet weather TMDL targets for bacteria indicators. Other studies and efforts anticipated to be considered in the Reopener include the recently completed or nearly completed following studies:

- Wet Weather Epidemiology: Surfer Health Study (SCCWRP, 2016a);
- Microbiological Water Quality at Reference Beaches and an Adjoining Estuary in Southern California during a Prolonged Drought (SSCWRP, 2016b), and
- Wet and Dry Weather Natural Background Concentrations of Fecal Indicator Bacteria in San Diego, Orange, and Ventura County, California Streams (SSCWRP, 2015).

The overall outcomes of this update cannot be foreseen; however, any significant update from this process will affect the current TMDL requirement and future TMDL implementation. The Plan described in this Chapter has been developed with consideration of both the current regulatory requirements and potential future directions, recognizing the ongoing comprehensive work. In line with both contexts, the Plan identifies activities that directly address sources of human pathogens as well as FIB via a suite of non-structural (e.g., programmatic) efforts. Additionally, this Plan identifies structural strategies within the SOC WMA to achieve goals for reducing FIB to meet the Bacteria TMDL limits at the coastline.

These strategies are expected to have multi-pollutant benefits, and will thereby address the other priority water quality conditions (PWQCs) in the watershed. Priority water quality conditions were identified according to the process described in the B.2 submittal of the Plan (submitted April 1, 2016) and typically includes conditions where

water quality analysis or impairment listings have identified and confirmed that the constituent or condition is not meeting applicable water quality standards.

2.1.2 Prohibitions and Limitations Compliance Option

This Plan is being developed consistent with Permit Provision B.3.c that allows the implementation of the approved Plan to demonstrate compliance with the Permit. As such, required goals specific to the Bacteria TMDL in Attachment E of the Permit have been developed using load reduction metrics, which is one possible pathway for demonstrating compliance with the TMDL. Should monitoring data collected during the implementation of this Plan indicate that other compliance pathways are being satisfied e.g., there are no exceedances of the receiving water limits or effluent limits in MS4 discharges (as indicated in Attachment E of the Permit), then the Plan will be evaluated to determine if continued Plan implementation is warranted. The different compliance pathways indicated in Attachment E of the Permit includes:

- Elimination of direct or indirect discharges from MS4;
- No exceedance of the final receiving water limits in the receiving water or downstream of MS4 outfalls;
- No exceedance of the final effluent limitations at MS4 outfalls;
- Annual pollutant loads reductions for discharges from MS4 outfalls are greater than or equal to final effluent limitations;
- Exceedances of final receiving water limits are demonstrated to be due to natural sources, and pollutant loads from MS4 are not causing or contributing to exceedance, and
- Implement the accepted WQIP.

2.1.3 Goals and Schedules

Numeric goals were developed to support Plan implementation and will be used to measure progress toward addressing this HPWQC. Numeric goals may take a variety of forms, but must be quantifiable so that progress toward and achievement of the goals are measurable. In accordance with the Permit and applicable regulatory drivers i.e., Bacteria TMDLs, final goals and reasonable interim goals have been developed. An interim goal is required for each five-year period from Plan approval to the anticipated final goal compliance date as indicated in Attachment E of the Permit (including an interim goal for this Permit term). To demonstrate (quantitatively) compliance with the Prohibitions and Limitations Compliance Option of the Permit (Provision B.3.c), goals are expressed as percent load reductions conforming to the mandated reductions indicated in Table 6.3 of Attachment E of the Permit. Interim and final goals for bacteria load reductions complying with Attachment E of the Permit are indicated in **Table 2** and **Table 3** for wet and dry weather conditions, respectively. Numeric goals were set and associated estimated load reductions for wet weather strategies proposed in the Plan were modeled using Fecal Coliform (FC), as a surrogate for all FIB as the available

monitoring datasets for best management practice (BMP) performance and land use–based loading for this parameter are more robust than other indicator bacteria at this time.

As noted above, goals based on reduction of FC loads are based on one of the six compliance pathways indicated in the Permit. Establishing goals based on this compliance pathway is for the purpose of Plan development and implementation. This approach is not intended to preclude eventual demonstration of compliance via one of the other compliance pathways identified.

Table 2: Pathogen Health Risk Numeric Goals – Wet Weather

Hydrologic Sub-Area (HSA)	Metric	Annual Baseline Load (Fecal Coliform) [a]	Final Outcome [c]	1st Permit Term 2015 – 2018 [b]	2nd Permit Term 2018 – 2023 [b]	3rd Permit Term 2023 – 2028	4th Permit Term 2028 – 2033
						Meet TMDL Interim Compliance Date April 4, 2028 [b]	Meet TMDL Final Compliance Date April 4, 2031 [b]
San Joaquin Hills, Laguna Hills	Goal expressed as percent load reduction in MS4 discharges	1,115 x 10^{12} MPN	Reach mandatory reduction of wet weather bacteria loading from MS4 discharges identified in Attachment E of the Permit	6.5%	13.0%	26.0%	52.07%
Aliso		4,765 x 10^{12} MPN		3.3%	6.7%	13.3%	26.62%
Dana Point		1,542 x 10^{12} MPN		1.9%	3.7%	7.4%	14.86%
Lower San Juan		11,191 x 10^{12} MPN		1.6%	3.2%	6.4%	12.82%
San Clemente		2,553 x 10^{12} MPN		3.1%	6.1%	12.3%	24.58%

a- As modeled for Water Year 1993 (the 90th percentile rainfall year), based on land uses and BMPs as of 2001 (the TMDL baseline year)

b- Percent of Fecal Coliform loads reduced from MS4 outfalls from baseline load as measured at the compliance points at the Pacific Ocean Shoreline

c- Or achieve new WLAs or site specific objectives if TMDL is modified

Table 3: Pathogen Health Risk Numeric Goals – Dry Weather

Hydrologic Sub-Area (HSA)	Metric	Annual Baseline Load (Fecal Coliform) [a]	Final Outcome [c]	1st Permit Term 2015 – 2018 [b]	2nd Permit Term 2018 – 2023	
					TMDL Interim Compliance Date April 4, 2020 [b]	TMDL Final Compliance Date April 4, 2021 [b]
San Joaquin Hills, Laguna Hills	Goal expressed as percent load reduction in MS4 discharges	32.4 x10^{12} MPN	Reach mandatory reduction of dry weather bacteria loading from MS4 discharges identified in Attachment E of the Permit	22.9%	45.9%	91.72%
Aliso		65.6 x10^{12} MPN		23.9%	47.8%	95.58%
Dana Point		22.2 x10^{12} MPN		23.8%	47.5%	95.03%
Lower San Juan		77.4 x10^{12} MPN		18.6%	37.1%	74.21%
San Clemente		39.8 x10^{12} MPN		23.6%	47.1%	94.23%

a- 2010 TMDL (R9-2010-0001) – Attachment A, Table on page A27; the TMDL baseline year is 2001

b- Percent of Fecal Coliform loads reduced from MS4 outfalls from baseline load as measured at the compliance points at the Pacific Ocean Shoreline

c- Or achieve new WLAs or site specific objectives if TMDL is modified

2.1.4 Strategies and Schedules

The Permit establishes that WQIP strategies should be identified based on their likelihood to "effectively prohibit non-stormwater discharges to the stormwater conveyance system, reduce pollutants in stormwater discharges from the stormwater conveyance system to the maximum extent practicable, protect the beneficial uses of receiving water from MS4 discharges, and/or achieve the interim and final numeric goals identified under Provision B.3.a" [B.3.b].

Water quality improvement strategies selected for this Plan are categorized as either non-structural or structural BMPs. Non-structural BMPs are management actions or programs designed to reduce or eliminate pollutant loading at the source. Non-structural BMPs can be municipal programmatic or regulatory measures, public education and outreach, financial incentives, or other source management programs designed to effect behavioral changes. Structural BMPs can be either distributed (smaller scale) or regional (larger scale) facilities. Distributed BMPs are treatment or volume mitigation BMPs implemented at the neighborhood, parcel or site scale and includes features such as green streets, rainwater harvesting, and Low Impact Development-type solutions. Regional structural BMPs are treatment or volume mitigation BMPs implemented to treat subwatershed or catchment scale drainage areas.

This Plan prioritizes targeted non-structural BMPs for early implementation, with emphasis on those that most directly address risks to human health. Source control measures have been aggressively implemented to date and will continue to be aggressively implemented early in the implementation of this Plan to address dry weather compliance goals as discussed in detail in **Section 2.3**. Wet weather load reductions will be achieved primarily through implementation of source identification and control BMPs, where strategies targeting sources of human pathogens and FIB will be prioritized for early implementation. Source identification and abatement begins with non-structural activities and may result in identification and implementation of structural abatement approaches.

Achievement of dry weather goals is anticipated to be achieved mostly through the efforts that have already occurred to date (Implemented BMPs, see Section 2.1.4.1) and by new strategies indicated in subsequent sections that will investigate and abate dry weather sources of human pathogens and the efforts to eliminate anthropogenic dry weather flows. As noted in Section 2.3.2 of the 2014 ROWD, significant progress has already been made to address dry weather exceedances at the coastline.

Within this larger framework, the criteria for strategy selection included:

- Ability to most directly and effectively protect the beneficial use of interest, which is water contact recreation;
- BMP effectiveness, particularly for human pathogens and FIB, with consideration for incidental benefits to other priority water quality conditions;
- Provision of multiple benefits, including but not limited to habitat, recreation, economic, and water resources benefits;
- The degree to which the strategy is sustainable, implementable, and cost-effective, and
- Strategies that improve and promote cooperation and collaboration between responsible agencies and other governmental agencies (Caltrans, water and sewer agencies, etc.) and other agencies, such as private or non-profit organizations, as well are internal jurisdictional departments.

The following subsections describe the specific strategies within each of these categories to be implemented on jurisdictional or watershed-wide scales.

2.1.4.1 Implemented BMPs

Through diligent actions and program implementation in the SOC WMA since 2001 (the TMDL baseline year), structural BMPs have been implemented that contribute to dry and wet weather FIB load reductions. Implemented measures include:

- Redevelopment,
- Channel restoration,
- Landscape retrofits,
- Nuisance water diversions (dry weather),
- Ozone and UV disinfection systems (dry weather),
- Catch basin inserts (wet and dry), and
- Trash separation units (wet and dry).

Implemented BMPs are depicted on Figure A-15 of **Appendix A**. For the purpose of demonstrating reasonable assurance that the strategies will achieve the goals, quantifications of dry and wet weather load reductions for implemented BMPs since 2001 are documented in two Comprehensive Load Reduction Plans (CLRPs) for the San Juan Creek (SDRWQCB, 2012 updated 2015) and Aliso Creek (SDRWQCB, 2012, updated 2014) watersheds. These plans document load reductions from implemented BMPs as listed above for both watersheds. **Table 4** presents the reported dry and wet weather fecal coliform load reductions from implemented BMPs in the respective watersheds.

Table 4: Fecal Coliform Load Reductions from Implemented BMPs in San Juan and Aliso Creek Watersheds

Watershed	Watershed Dry Reduction (%) (2003-2016)	Watershed Wet Reduction (%) (2003-2016)
San Juan Creek	90.0%	10.0%
Aliso Creek	103.6%	18.0%

Of these cumulative estimated load reductions from these watersheds, approximately 0.2 to 1.7% and 1 to 3% is derived from landscape retrofit projects and catch basin retrofits for dry and wet weather, respectively. These two strategies are the primary structural BMPs that have been implemented in the San Joaquin Hills, Laguna Hills, Dana Point, and San Clemente HSAs. As such, an average of 2% of FC load reduction from baseline loads is included in the estimated wet weather load reductions for implemented BMPs presented in **Table 5**. The wet weather load reductions for all of the structural BMPs implemented for San Juan Creek and Aliso Creek as reported in **Table 4** are brought forward into the cumulative load reduction accounting presented in **Table 5**.

2.1.4.2 Programmatic Strategies (Non-structural BMPs)

The non-structural strategies in the Plan are primarily strategies building on the required Jurisdictional Runoff Management Plans (JRMPs) elements in Provision E of the MS4 Permit. These include the JRMP requirements as well as modifications/ enhancements within the program elements to provide a more focused approach specifically addressing human pathogens and FIB.

JRMP-Based Strategies: Local Implementation Plans (LIPs), also known as JRMPs, primarily address non-structural and pollution prevention controls. The Permittees are required to identify jurisdictional strategies that will be implemented as part of their JRMP that are designed to effectively prohibit non-stormwater discharges to the MS4, reduce pollutants in stormwater, and protect beneficial uses of receiving waters. Achievement of these outcomes will ultimately be measured against the interim and final numeric goals as discussed in **Section 2.1.3**. Summary tables of on-going JRMP-based strategies are presented in **Appendix B**. In addition to the load reductions anticipated from JRMP implementation, additional strategies are proposed to specifically target control of sources of human pathogens. These strategies are discussed in **Section 2.1.4.3**.

Due to limited data quantifying the effectiveness of these programmatic strategies, wet weather load reductions of programmatic BMPs are not as readily modeled as those of structural BMPs. Programmatic, non-structural BMPs that fall into this category include:

- Identification and control of sewage and other sources of human fecal waste discharges to Permittees' MS4s,
- Trash cleanups,
- Onsite wastewater treatment system (OWTS) source reduction,
- Good landscaping practices,
- Commercial/industrial good housekeeping (emphasis on food outlets),
- Pet waste controls,
- Animal facilities management,
- Erosion monitoring and repair,
- Street and median sweeping,
- MS4 cleaning, and
- Education and outreach.

Each of these elements has either been phased in or greatly expanded since the baseline TMDL year of 2001. One such program is the Countywide Area Spill Control (CASC) Program. The CASC program began in 2000 as a pilot project between the County and the Orange County Sanitation District (OCSD) to proactively prevent and respond to sanitary sewer overflows (SSOs) in the unincorporated North Tustin area. During the 2009-10 reporting period, in response to Fourth Term Permit requirements, CASC evolved into a countywide program. The main focus of CASC remains the containment and recovery of large Sanitary Sewer Overflows (SSOs) which have the potential to significantly impact receiving waters resulting in beach closures and health advisory postings. The overall objectives of CASC are to:

- Create broader awareness regarding the causes of SSOs and development of measures that can be implemented in order to prevent them;
- Improve the interagency coordination when responding to SSOs;
- Identify the resources needed when responding and mitigating impacts;
- Develop predictive tools for identifying potential impacts; and
- Protect the beneficial uses of the local water bodies.
- Implement the program throughout the entire Orange County area.

Best professional judgment and the results of studies reinforce the qualitative effectiveness of these programmatic BMPs (HDR, 2014). To account for the expected pollutant load reduction from these non-modeled, nonstructural BMPs, a ten percent FIB load reduction from baseline loads is included in the quantification (HDR, 2014). The inclusion of these programmatic BMPs in the Plan and the assumed ten percent

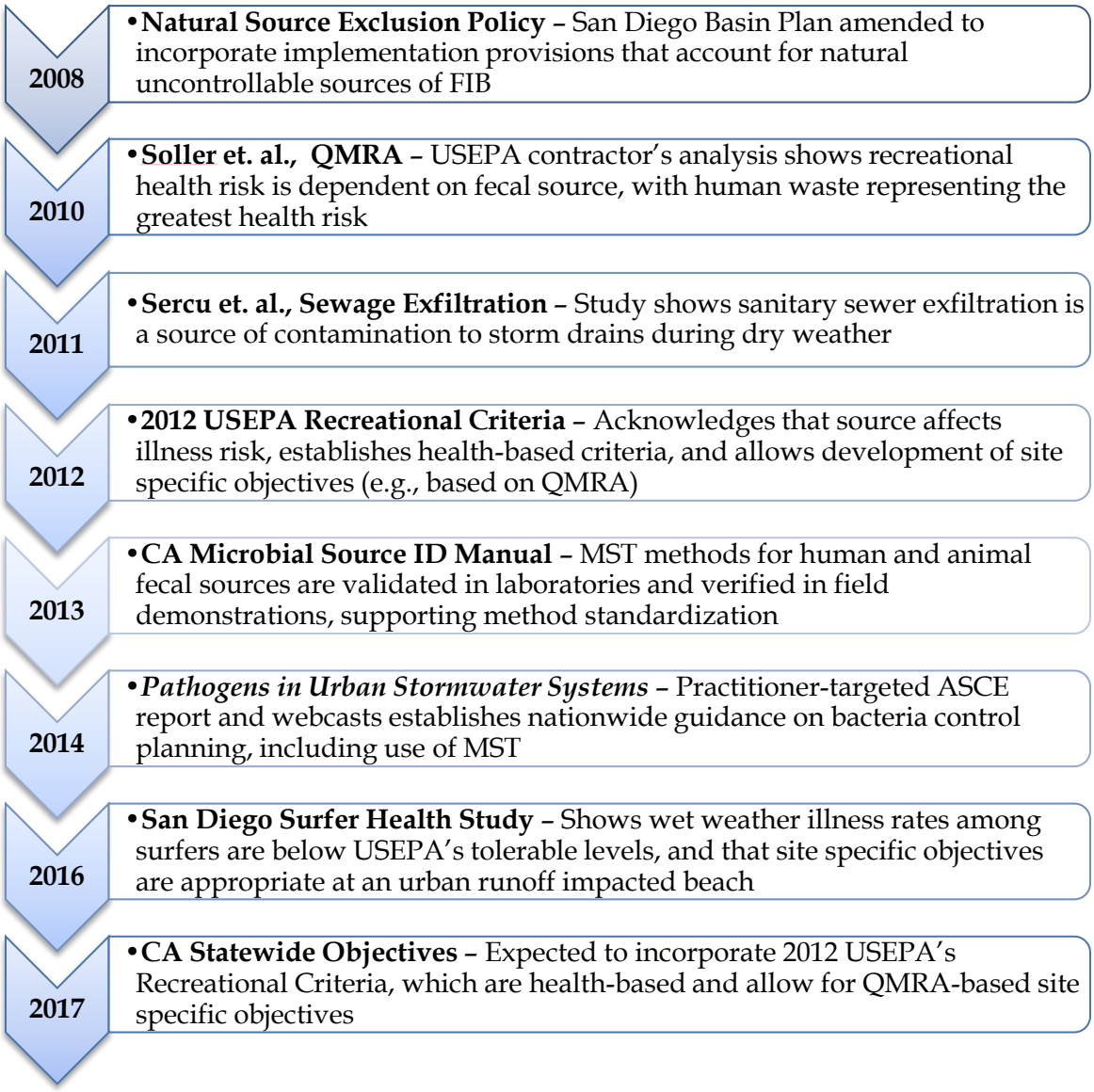
reduction could be evaluated and updated throughout the implementation period as pollutant loading and BMP performance data are collected.

2.1.4.3 Human Pathogen Source Control Strategy

Beyond the existing JRMP efforts to control sources of human pathogens, this Plan includes a new aggressive plan for human waste source identification and abatement that will be implemented as a WMA strategy.

Numerous ongoing efforts throughout Southern California – which SDRWQCB staff are involved with, tracking, or are aware of – are beginning to show that a microbial source tracking (MST)-based and pathogen-focused compliance approach should result in greater public health benefit (i.e., the outcome desired by regulators, public, elected officials, and permitted dischargers) for significantly lower cost than traditional bacteria TMDL implementation planning approaches. For traditional approaches that primarily emphasize structural stormwater BMP retrofits to control FIB loading, post-implementation compliance may remain elusive based on monitoring results (due to the ubiquitous and uncontrollable nature of FIB). As a result, following the extensive structural retrofits, jurisdictions may then be prompted to begin source tracking as a special study (i.e., as a *regulatory modification* tool). In contrast, what is proposed in this Plan is a MST-based and pathogen-focused compliance approach which begins with source tracking (as an *implementation planning* tool) to focus pathogen abatement efforts and structural BMPs implementation based on targeted information regarding the nature and extent of human sources. This approach emphasizes MST in combination with advanced MS4 IDDE strategies, followed by the human waste abatement/remediation measures that they identify, as a **comprehensive human waste control BMP** (not a "study") that is expected to result in significant long-term pathogen reduction benefit during both dry and wet weather. To further support the basis for this approach, a timeline of the key scientific and regulatory advancements underpinning this strategy is summarized in **Figure 2**.

Figure 2: Scientific and Regulatory Advancements Underpinning the Recommendation for a MST-Based and Pathogen-Focused Compliance Approach

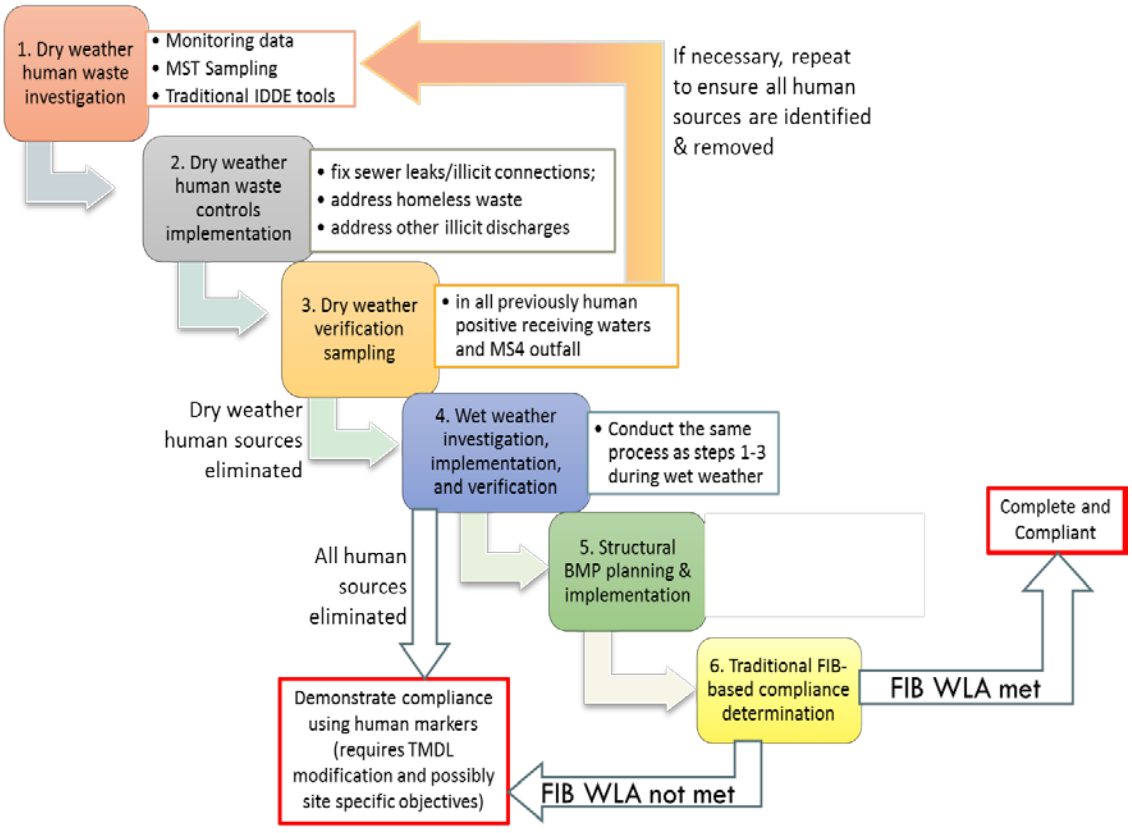


Over 20 MST studies have been performed to identify and abate human sources in Southern California (**Appendix E**). At least two of these studies have been conducted in Orange County, sampled in the MS4, and used the State's recommended/validated MST markers for detection of human fecal contamination. Both of these studies were for dry weather. A study at Doheny State Beach frequently found multiple human markers in MS4 discharges, while a study at Poche Beach did not find any human marker detections. The Poche Beach study may be an outlier in that most other studies found at least some human markers in MS4 samples. While many of the studies did not use the

latest validated human markers (HF183 and HumM2), in most cases the positive human results are still valid.

A new MST-based and pathogen-focused compliance approach (based on the key scientific and regulatory advancements) is proposed in the Plan to meet (or revise) the final Bacteria TMDL Waste Load Allocations (WLAs). This "Comprehensive Human Waste Source Reduction Strategy" will focus on aggressively and comprehensively investigating and effectively eliminating human waste sources in the watersheds, to reflect the fact that these sources are both higher risk (to public health) and more controllable than non-human anthropogenic and non-anthropogenic sources of FIB. **Figure 3** provides an overview of this proposed Comprehensive Human Waste Source Reduction Strategy and the following text provides additional details for each of the steps.

Figure 3: Steps for Comprehensive Human Waste Source Reduction Strategy



Work Plan Development

The MST portion of this strategy will be planned in accordance with the California Microbial Source Identification Manual (Manual, SCCWRP, 2013b), which includes EPA-recognized markers for the identification of human fecal contamination. These methods are currently in the final stages of being standardized by the EPA. The work plan will also reflect recent SCCWRP findings or recommendations regarding proper number of sampling events, and new statistical methods for translating MST results into a likelihood of human waste presence. The Work Plan will also reflect any other post-Manual advancements such as the California MST Marker Aging Study, which measured FIB/marker/pathogen decay rates in the environment (to support proper interpretation of MST results), and identification of appropriate thresholds for presence of human waste, as well as any other relevant publications or proven technological advancements that are available at the time of plan development. The Work Plan will also include consideration for and performance of prioritization of where investigations shall be conducted, i.e., which outfalls need investigation. Investigations will not be conducted for outfalls to receiving waters not (or no longer) listed as impaired for indicator bacteria or those receiving waters that meet the final receiving water limitations. Finally, the Work Plan will also indicate a process for plan adaption based on information obtained during plan execution.

Dry Weather Investigations, Controls, and Verification (Steps 1-3)

As indicated in the studies summarized in **Appendix E**, dry weather human marker detections are common, but their presence varies from one subcatchment/outfall to another. While it is recognized that dry weather control of FIB (and likely human pathogens, though not measured) has been effective through the implementation of approximately 40 low-flow diversion projects at storm drains discharging to beaches, dry weather sources of FIB and pathogens elsewhere in the watershed (upstream of diversions) or downstream of the diversions during bypass may still be contributing to exceedances of FIB standards during wet weather. Furthermore, performing investigations during dry weather better enables the identification of sewer leaks, illicit sewer connections, and other illicit waste discharges, as there are fewer inputs into the system during dry weather. For these reasons, the strategy begins with dry weather investigations to identify human pathogen sources that also contribute during wet weather. The dry weather investigation phase will be followed by wet weather investigations after dry weather source abatement is completed (since wet weather mobilizes additional waste sources from the watershed).

Step 1 - Dry weather human waste investigation, including:

a. Compiling and reviewing monitoring data (e.g., presence/frequency/locations of non-stormwater MS4 discharges, etc.), GIS datasets (e.g., sewer/stormdrain locations, ages, material, condition at last inspection, invert elevation, etc.), and other relevant information. Additional desktop and field evaluations may be conducted, such as characterization of potential sources (e.g., homeless encampments, RV parking, and outdoor recreational areas);
b. Then dry weather human marker sampling of receiving water locations and flowing MS4 outfalls (sampling details such as number of samples and thresholds for determining "human positive" are to be determined in Work Plan); and
c. Then dry weather MS4 network investigations – using CCTV, dye testing, and/or MST markers – in the MS4 networks that drain to the human positive MS4 outfalls, to locate the specific human waste inputs within these sewersheds.

The intent of Step 1 is to comprehensively assess the network tributary to each receiving water identified as a HPWQC. This is anticipated to include initial investigations within a high percentage of outfalls, and subsequent investigation within the networks to those outfalls with identified human waste presence. The details regarding outfall sampling, number of samples per outfall, and subsequent investigations within the network will be described in the Work Plan.

Step 2 - Implementation of follow-on human waste control actions to abate identified human waste sources (e.g., coordinating with sewer collection agencies or private lateral owners to address identified sewer leaks and/or illicit connections, coordinating with enforcement officials on homeless waste sources, and addressing any other identified illicit discharges to the MS4). It is recognized that coordination with the ten South Orange County Wastewater Authority (SOCWA) member agencies is a significant step in the plan. It is anticipated that the limitations/authorities of the Cities and sewering agencies will be evaluated during this step to facilitate necessary waste control actions within the context of each sewering agency's separate wastewater discharge permit, regulated individually by the SDRWQCB, and the respective SSMP (Sanitary Sewer Management Plan);

Step 3 – Dry weather verification sampling of the previously human positive MS4 outfalls (if human markers are again detected above thresholds, then repeat steps 1 and 2);

Wet Weather Investigations, Controls, and Verification (Step 4)

After dry weather results demonstrate an absence (or near absence) of human markers, repeat the human marker sampling investigation and follow-on control implementation during wet weather (since more widespread human waste sources would be mobilized

within each watershed during wet weather compared to what was already investigated and abated during dry weather);

Step 4.1 - Wet weather human waste investigation to be conducted:

a. Wet weather human marker sampling in strategic receiving water locations to limit where further sampling might be required (locations and other sampling details are to be determined in the Work Plan);
b. Then wet weather human marker sampling of flowing MS4 outfalls upstream of human positive strategic receiving water locations; and
c. Then MS4 network investigations during both wet and dry weather – using CCTV, dye testing, and/or MST markers –of the networks that drain to the human positive MS4 outfalls, to locate the specific human waste inputs within these sewersheds.

As with Step 1, the intent of this investigation to comprehensively assess the network tributary to each receiving water identified as a HPWQC where markers of human waste are present. Details regarding receiving water sampling locations, outfall sampling, number of samples per location, and subsequent investigations within the network will be described in the Work Plan.

Step 4.2 - Implementation of follow-on human waste control actions to abate identified human waste sources (e.g., coordinating with sewer collection agencies or private lateral owners to address identified sewer leaks and/or illicit connections, coordinating with enforcement officials on homeless waste sources, and addressing any other identified illicit discharges to the MS4);

Step 4.3 – Wet weather verification sampling of the previously human positive MS4 outfalls (if human markers are again detected, then repeat steps 4.1 and 4.2);

Stormwater BMP Planning and Implementation (Step 5)

As part of a separate strategy, structural treatment BMPs (infiltration, treatment, harvest and use) to address general stormwater runoff are planned later in the implementation phase of this HPWQC.

After the completion of Step 4, a Human Waste Investigation and Abatement (HWIA) Report will be developed and submitted for Regional Water Quality Control Board review and approval. This report may have implications for the whether the identified commitments to structural stormwater treatment BMPs will continue to be needed at the levels identified in this Plan. If the HWIA report demonstrates that persistent human marker detections and FIB exceedances have been eliminated, then a Plan revision could be considered to reduce or eliminate the need for structural stormwater treatment BMPs

to address this HPWQC. If persistent human marker detections have been eliminated, but FIB exceedance continue, then either structural treatment BMPs will continue to be included in the plan or an alternative compliance approach will be necessary (Step 6).

Compliance Determination (Step 6)

At the completion of Step 5, compliance determination could occur through either:

a. FIB WLAs being met, or
b. FIB WLAs are not being met and therefore prompting either:
    i. pursue a TMDL modification (e.g., antidegradation-based Natural Source Exclusion (NSE), per existing San Diego Basin Plan policy), or
    ii. perform pathogen sampling at the compliance monitoring locations and Quantitative Microbial Risk Assessment (QMRA) calculations to compute potential new site-specific objectives (SSO). QMRA is a multi-step approach used to assess human health risks associated with a specific exposure to a specific pathogen. It combines the use of pathogen dose-response relationships with a user-defined exposure pathway. Model parameters are described using probability distributions to capture variability and uncertainty. The validity of QMRA as an SSO-development tool is supported by USEPA's 2012 recommended recreational criteria technical support materials, QMRA articles published in peer-reviewed scientific journals authored by USEPA's risk assessment contractors, and the recent San Diego Surfer Health Study (which demonstrated the reliability of QMRA based on comparison with wet weather epidemiology study results).

Table 5: Comprehensive Human Waste Source Reduction Program Milestones

Action	Year
Develop (HWIA) Work Plan (including Sampling & Analysis Plan, Quality Assurance Plan) will be submitted for SDRWQCB review and approval	2018
Conduct dry weather human source investigations (Steps 1)	2018 to 2020
Conduct dry weather source abatement and verification (Step 2-3)	Beginning 2020 [a]
Conduct wet weather human source investigations (Step 4.1)	2019 to 2022
Prepare source investigation report based on results of Steps 1 and 4.1 and submitted for SDRWQCB review and discussion	2022
Conduct follow-on wet weather human waste control	Beginning 2022 [a]

actions and verification sampling (Steps 4.2 and 4.3)	
If sampling indicates persistent FIB exceedances, implementation of BMP controls and/or alternative compliance efforts (Steps 5 and 6)	2027[a]

a – Completion of source abatement may be contingent on activities by others outside of the authority of the MS4 permittees

2.1.4.4 Other Source Control Efforts

Homelessness Waste Management Program. In areas of the watershed where homeless encampments are determined to be a significant pollutant source, effective programs may include establishing ordinances that reduce encampments, enhancing programs to reduce the number of homeless people in encampments, and enforcing new and existing laws to decrease the negative impact on water quality. Options to reduce water quality impacts of homeless encampments can also be combined with efforts to reduce homelessness. For example, partnering with non-profit organizations to inspect and remove trash generated by encampments leverages existing social programs, watershed volunteer programs, and water quality programs to address a common concern. Another example would be to support partnership efforts by social service providers to provide sanitation and trash management for persons experiencing homelessness. The removal of invasive species in the watershed is an additional strategy for management of homeless encampments, as they provide shelter and allow encampments to remain hidden from view. Initial efforts will include identification and characterization of homeless and other sources of open defecation waste sources. Implementation of efforts to reduce the impact of these human sources will be targeted for the areas identified in the initial characterization step.

Recreational Vehicle Waste Disposal Education Program. Recreational vehicles are a unique source of FIB because they are mobile sources that are largely unregulated by the Permittees. Although direct regulation is not always feasible, the Permittees have developed strategies to address discharges from RVs, as they do have the potential to contribute to FIB loading the MS4s and receiving waters.

Examples of additional programs that can be implemented by Permittees that address discharges from RVs include:

- Operation of robust illicit discharge detection and elimination programs that include extensive public outreach and hotlines, staff training, and reporting, response, and clean-up of illegal discharges.
- Coordination and training with police and sheriff's departments so they understand the impacts of these types of discharges and how to respond.
- Operation of an RV dump station, which provides a facility for RV and boat owners to empty and clean their waste tanks without impacting the

environment. The dump station includes educational signage to inform RV and boat owners of the impacts of their actions.

2.1.4.5 Other Modeled Non-Structural BMPs

FIB load reductions were quantified for anticipated redevelopment within the SOC WMA. This includes both dry weather and wet weather runoff volume reduction and treatment. Additionally, FIB load reductions were quantified for forecasted implementation of incentive programs intended to convert turf to drought tolerant/absorbent landscaping combined with downspout disconnection/dispersion approaches. This program is expected to yield combined water conservation, dry weather flow reduction, and wet weather flow reduction benefits.

The wet weather load reduction quantification approach for these BMPs involved the following steps for each of these strategies. The first step was to identify the source addressed by the program. The next step was to calculate the targeted pollutant source area that the BMP will address. Once the targeted pollutant source area was calculated, the unit effectiveness of the selected BMP was modeled for a standard design (e.g., reduction of FIB per acre as a result absorbent landscaping with downspout disconnection). The potential load reduction benefit was then calculated by multiplying the unit effectiveness of the selected BMP by the targeted pollutant source area addressed. The following sections provide a brief description of the specific quantification approach for each wet weather non-structural strategy, along with relevant assumptions and explanations.

Redevelopment through Permit-Required LID Implementation. This Plan assumes that a portion of existing developed areas in the SOC WMA has been and will be redeveloped from when the TMDL was initiated to the end of the compliance period. This redevelopment is subject to the post-construction treatment requirements contained in the San Diego MS4 Permit (Provision E.3.b) and will therefore result in load reduction benefits. A bioretention system with underdrains was modeled for residential, commercial, industrial, education, and transportation land uses during the TMDL Critical Water Year (WY) of 1993 to give the FIB load reductions per acre of redevelopment. For each land use, the load reductions per acre was multiplied by the land use specific redevelopment rate, the number of land use acres, and the number of years from when the TMDL was initiated to the end of the compliance period. The rate of redevelopment requiring LID implementation for each of these land uses was extrapolated based on the rate analysis done for the Ballona Creek Implementation Plan (City of Los Angeles, 2009). The annual redevelopment rates for the land uses evaluated are as follows:

- Residential Land Use Redevelopment Rate = 0.18%

- Commercial Land Use Redevelopment Rate = 0.15%
- Industrial Land Use Redevelopment Rate = 0.34%
- Education Land Use Redevelopment Rate = 0.16%
- Transportation Land Use Redevelopment Rate = 2.7%

During the 20-year compliance timeline, this rate will result in redevelopment of approximately 6% of the MS4 area in aggregate for all the land uses evaluated. Quantifications for this program are shown in **Appendix C**.

Absorbent Landscaping/Impervious Area Dispersion Incentive Program. The intent of this program is to leverage existing incentives for water conservation being implemented by water agencies and enhance these programs to accrue benefits for stormwater management. Conversion of turf to drought tolerant/absorbent landscaping and transition from conventional irrigation to smart irrigation systems are primary emphases of existing water conservation incentive programs, such as those identified in the OC Stormwater Program Over Watering is Out campaign. These approaches have dry weather runoff reduction benefits due to water conservation and overspray reduction. They also have wet weather runoff reduction benefits because absorbent landscaping tends to produce less runoff during rainfall, and smart irrigation systems, through incorporation of forecast data and/or soil moisture sensors, reduce the likelihood of irrigation soon before or during rainfall. By partnering with water agencies and the community, additional stormwater management benefits can be accrued by incorporating approaches within these incentive programs that manage runoff at its source. This could include incentives to install impervious area dispersion techniques as part turf replacement/absorbent landscaping/irrigation system replacement efforts. Impervious area dispersion could include routing of roof downspouts, paths or driveways over absorbent landscaping, or installation of rain barrels to temporarily detain and allow later dispersion/irrigation over these areas.

Impervious area dispersion practices, coupled with turf replacement/absorbent landscaping practices, were evaluated to determine the potential load reduction that may be accomplished in the SOC WMA. The average performance for FIB load reduction, during wet weather, of these programs per dispersed impervious acre was modeled for the TMDL Critical Water Year (1993), consistent with the baseline load calculations (see **Appendix D**). The area of implementation was based on land use information and a preliminary assessment of impervious areas that could be potentially disconnected in the SOC WMA. The extent of single-family residential areas that will participate in this program was estimated to be 10 to 40% of all residences in the SOC WMA over a 16-year period. This degree of implementation is believed to be reasonable give increasingly stringent mandates for water conservation and increasing public

awareness of programs. Additionally, enhancement of incentives to achieve greater stormwater management benefit could result in greater participation.

Of those residencies assumed to implement this program, a representative distribution of residences opting for rain barrels (25%) versus those opting for direct dispersion (75%) was assumed for the purpose of load reduction quantification. Quantifications for this program are shown in **Appendix C**. Additional load reduction benefit could be achieved by expanding the LID incentive program to commercial and multi-family land uses as well.

2.1.4.6 New Structural Treatment Strategies

Wet Weather

Structural treatment strategies include a range of facility types to treat, infiltrate, or harvest and use runoff from existing developed areas. Structural treatment strategies are a lower priority within this Plan because (1) they address broad anthropogenic and non-anthropogenic sources of FIB and do not provide targeted control of human pathogens; as a result cost effectiveness for human pathogen control is expected to be relatively low compared to targeted source abatement, (2) while performance of stormwater treatment BMPs for FIB is reasonably understood, there is very limited understanding of performance of these systems for actual pathogens.

For most HSAs within the SOC WMA, estimates of total load reductions from other strategies (See **Section 2.1.5**) indicate that use of new structural stormwater treatment strategies for wet weather load reductions may not be needed to achieve target load reductions. However, given present uncertainty in the effectiveness of the programmatic/non-structural controls, new structural treatment strategies are included as committed actions in the later stages of this plan. These strategies will be planned for and implemented unless it is demonstrated as part of a subsequent plan update that these strategies can be reduced or are not needed.

Given the later phasing and lower priority of new structural treatment strategies, this plan does not describe specific projects at this time. Rather, this plan follows a four-part process for providing reasonable assurance that goals will be met:

1) Types of BMPs within this strategy are identified and general implementation guidelines are provided;
2) Tables of representative area modeling results are presented to describe the load reduction estimated to be achieved by applying a BMP of a certain type and size to treat a representative unit area of urban land;
3) Reasonable implementation assumptions are applied to the urban land in each HSA, including degree of implementation, distribution of BMP types, and typical

sizing factors to estimate load reduction that would be accrued by new structural treatment BMPs. The resulting load reduction for each HSA is presented to provide appropriate assurance that the target load reductions for each HSA can be met with a reasonable degree of implementation of structural treatment BMPs; and

4) Actual projects will be identified and an approach is described for tabulating the actual benefits of projects that will be included in the plan.

Types of BMPs and General Implementation Guidelines (Part 1)

Types of facilities that have been defined and modeled as part of the development of this Plan include:

- Distributed biofiltration, such as bioretention with underdrains, planter boxes, green streets, and proprietary biofiltration systems;
- Distributed media filters, such as sand filters or proprietary filtration systems;
- Distributed infiltration BMPs, where feasible, such as bioretention, permeable pavement or infiltration trenches;
- Regional treatment wetlands, including surface wetlands or subsurface gravel bed wetlands;
- Regional infiltration basins or chambers; and
- Runoff harvesting systems could be incorporated within wetland or infiltration systems.

These systems would be designed for both wet weather and dry weather flow treatment. Systems could be implemented within existing facilities, such as the floor of flood control facilities (if compatible with flood protection requirements), within public rights-of-way (distributed solutions only), or in open parcels. Designs will be developed based on the design criteria described in the Orange County Technical Guidance Document, or equivalent. Sizing could be less than the full design capture volume in order to optimize the use of available retrofit sites. Actual sizing of projects as they are built will be reflected in the accrued load reduction claimed toward target load reductions.

Representative Load Reduction for Unit Area of Developed Land (Part 2)

To characterize the pollutant load reduction benefits of these structural controls, a modeling analysis was conducted using the Structural BMP Prioritization and Analysis Tool (SBPAT) applied to representative urban land in the SOC WMA with various sizing factors. In general, land use runoff concentrations for FIB are similar among urban land uses (or are not statistically significantly different). Additionally, actual long-term BMP implementation is likely to address a distribution of land uses that is similar to the WMA total distribution of land uses. Therefore, a representative mix of land uses was

modeled as the watershed area to modeled BMPs rather than individual land uses treated. This modeling analysis estimated fecal coliform load reductions resulting from each BMP type and size combination for the TMDL Water Year (WY 1993). Additionally, long-term analysis was conducted for the period from 1990-2015 to estimate the long term average load reduction of a standard suite of water quality parameters, including total suspended solids (TSS), total dissolved solids (TDS), nitrogen (various species), phosphorus (dissolved and total), copper, lead, zinc (dissolved and total), and FC. Results for WY 1993 and for the long-term simulations were normalized to load reductions per acre of developed land treated. While some variability is expected based on land use type and tributary area characteristics, this uncertainty is considered lower than the underlying uncertainty in water quality data and BMP performance. Details of this analysis and results are provided in **Appendix D**.

Reasonable Implementation Assumptions for HSA Load Reduction Tabulations (Part 3)

For developing pollutant load reduction estimates, a representative mix of structural BMP types was assumed, including equal distribution of the following BMP types:

- Infiltration/bioretention
- Biofiltration/bioretention with underdrains
- Media filters (no infiltration)
- Subsurface flow wetlands (no infiltration)

The average sizing factor for BMP implementation was assumed half of the design capture volume, on average. As discussed above, the mix of BMP types and sizing factors is intended to represent a realistic and reasonable set of implementation assumptions. This is not intended to specify the only way in which BMPs may be implemented. As described in Part 4, below, the basis for actual load reduction credited for a given project will be based on the actual BMP type and sizing factor implemented and area treated.

In order to provide reasonable assurance that the TMDL target load reductions will be met, BMPs were assumed to treat different percentages of the **developed land** in each HSA:

- Aliso Creek - 20%
- Dana Point Coastal Streams - 5%
- Laguna Coastal Streams - 85%
- San Clemente - 5%
- San Juan Creek - 5%

Results are summarized in **Table 6** and details of this analysis are reported in **Appendix D**.

Based on the calculations presented in **Section 2.1.3.3**, a high level of implementation of structural treatment control measures appear necessary to implement for the Laguna HSA to provide additional load reductions to complement the identified strategies to achieve the TMDL target load reductions. The technical basis for the higher relative target load reduction for this HSA (compared to other HSAs) is not clear from the documentation provided in the TMDL and may warrant reevaluation as part of the Re-opener and revision of the TMDL that is currently in progress.

Identification and Crediting of Actual Projects (Part 4)

Within five years of the acceptance of this Plan, specific structural BMP sites, types, and conceptual designs will be developed to address the deficiency in load reduction in each HSA. The representative unit area model results presented in **Appendix D**, or subsequent updated model results, will be applied to the actual tributary area, BMP type, and sizing factor to determine the load reduction for each proposed BMP. Projects will be identified that provide approximately equivalent load reduction as the representative assumptions described in *Part 3* above (and reported in **Table 6**).

Feasible BMPs adequate to satisfy the load reduction deficiency will be scheduled for implementation to conform to the schedule for interim goal attainment described in **Section 2.1.3**.

Dry Weather

For planning of dry weather load reduction performance, it is appropriate to assume that the following BMPs will achieve full removal of dry weather flow or treatment for the tributary area to the BMP:

- Distributed biofiltration BMPs
- Distributed infiltration BMPs
- Runoff harvesting systems could be incorporated within wetland or infiltration systems
- Diversion to sewer system – 100% load reduction

Other types of BMPs that could be considered include:

- Ozone treatment
- New and pilot technologies or applications that may arise

Section 2.3.3 describes the planning approach for addressing dry weather flows from MS4s via a comprehensive outfall control strategy.

2.1.4.7 Optional Strategies

At the time of each update of the WQIP (not less than every five years), and assessment will be made regarding the degree of implementation of identified strategies versus the measured progress toward interim and final goals. If the percent of implementation is significantly higher than the percentage of the final goal achieved, optional strategies will be triggered. Additionally, data acquisition efforts and special studies and analyses described above may identify the need to initiate optional strategies or may identify new strategies. Primary optional strategies include:

More extensive application of structural controls: Locate additional sites for structural pollutant control BMPs, schedule implementation as determined to be necessary to achieve goals.

Site specific objective: Perform pathogen sampling at the compliance monitoring locations and Quantitative Microbial Risk Assessment (QMRA) calculations to compute potential new site-specific objectives (SSO)

2.1.5 Summary

Adequacy of Goals and Schedule. The goals and associated schedule for the Pathogen Health Risk HPWQC were established to conform to the final numeric goals expressed as percent load reductions specified in the TMDL (i.e., Attachment E of the Permit).

Adequacy of Strategies - Wet Weather.

The wet weather bacteria TMDL requires FIB load reductions from the baseline load by the final TMDL compliance date, April 4, 2031. Baseline loads for the SOC WMA were estimated using a watershed model as described in **Appendix D**. The benefits expected to result from implementation of the proposed non-structural and structural BMPs demonstrate that the load reduction targets for the watersheds will be achieved through implementation of this Plan. **Table 6** shows the summary of predicted wet weather load reductions from each BMP type proposed for implementation within the SOC WMA by 2031 as well as the estimated target load reduction (TLR) to meet the HPWQC final numeric goal. The table presents the average, low, and high ranges of estimated load reduction. Ranges reflect variability in baseline pollutant loading (e.g., land use event mean concentrations (EMCs)) as well as variability in BMP effectiveness and are represented by the 25th (low) and 75th percentile (high) prediction estimates. As indicated in the table the average of the range of load reductions achieved by 2031 for the TMDL Critical Water Year (1993) are greater than the TLR. Based on these results, the suite of BMPs that are proposed in this Plan to be implemented as primary strategies are sufficient to achieve the TMDL requirements. Quantification of BMP benefits for this

Plan was assessed based on a number of parameters that have inherent uncertainties and natural variability. Parameters that carry significant uncertainty include storm precipitation, rainfall-runoff response, land uses, infrastructure conditions, EMC data, BMP design and efficiency, site-specific constraints, and cost data. While assessment of potential compliance incorporates a probabilistic assessment, it is recognized that as new data become available, these parameters may change. Furthermore, any translation of BMP performance (in terms of load reduction) to TMDL compliance metrics adds additional uncertainty to the analysis.

Table 6: Summary of Final Wet Weather Bacteria Load Reductions (Fecal Coliform) by BMP Type

BMP Category	Laguna Hills/San Joaquin HSAs		Aliso HSA		Dana Point HSA		Lower San Juan HSA		San Clemente HSA	
	10^{12} MPN/Year Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]	10^{12} MPN/Year Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]	10^{12} MPN/Year Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]	10^{12} MPN/Year Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]	10^{12} MPN/Year Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]
Modeled Baseline Loads for WY 1993	1,115	100%	4,765	100%	1,543	100%	11,191	100%	2,553	100%
Final Target Load Reduction (from Table 2)	**580**	**52.07%**	**1,268**	**26.62%**	**229**	**14.86%**	**1,435**	**12.82%**	**628**	**24.58%**
Load Reductions										
Implemented BMPs (2001-2016)	22	2.0 % [1%-3%]	858	18.0 %	31	2.0 % [1%-3%]	1,119	10.0 %	51	2.0 % [1%-3%]
Programmatic Strategies (2016-2031)	268	24.0%	901	18.9%	342	22.2%	2,082	18.6%	531	20.8%
• *JRMP Programs*		*10%*[b] *[9.2%-11%]*		*10%*[b] *[9.2%-11%]*		*10%*[b] *[9.2%-11%]*		*10%*[b] *[9.2%-11%]*		*10%*[b] *[9.2%-11%]*
• *Redevelopment through Permit-Required LID Implementation*		*2.7% [2.2%-3.2%]*		*3.0% [2.3%-3.6%]*		*2.9% [2.3%-3.4%]*		*2.2% [1.8%-2.6%]*		*2.8% [2.2%-3.3%]*
• *Absorbent Landscaping/Impervious Area Dispersion Incentive Program*		*11.3% [1.6-21%]*		*5.9% [0.73%-11%]*		*9.3% [0.6%-18%]*		*6.4% [0.7%-12%]*		*8.0% [1.0%-14%]*
New Structural BMPs (2016-2031)	341	30.6% *[20%-46%]*	391	8.2% *[5%-12%]*	33	2.1% *[1%-3%]*	168	1.5% *[1%-2%]*	103	4.0% *[3%-6%]*
Total Load Reduction	**631**	**56.6%**	**2,149**	**45.1%**	**406**	**26.3%**	**3,368**	**30.1%**	**684**	**26.8%**

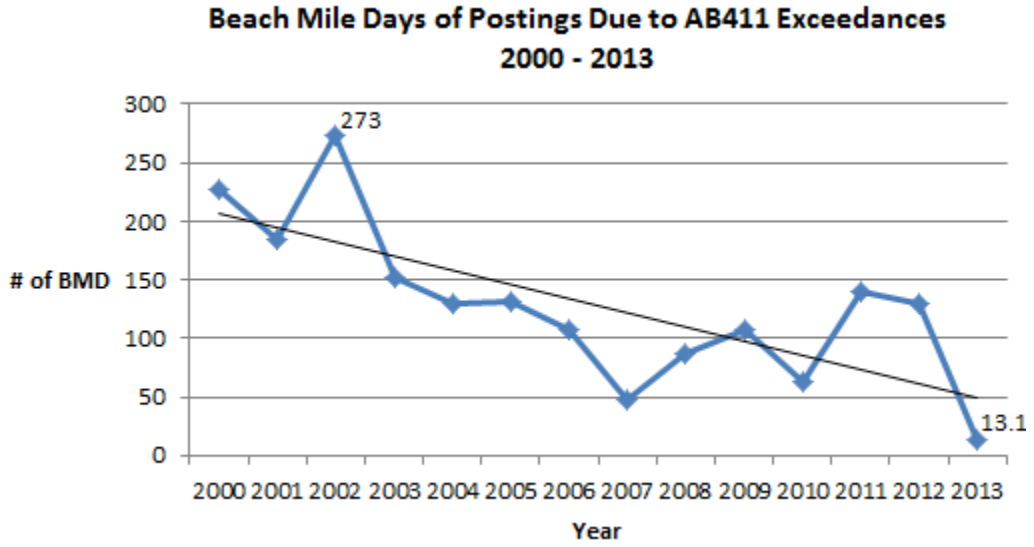
a. Range of water quality benefits represent the 25th and 75th percentile results. Range reflects variability in baseline pollutant loading (primarily driven by land use EMC's) as well as variability in BMP effectiveness.
b. HDR, 2014.
c. Fecal coliform is utilized as a surrogate for all FIB since there is an acceptable database of both land use stormwater concentrations and structural BMP performance for this constituent

Adequacy of Strategies – Dry Weather

The implementation of this Plan is expected to achieve the numeric goals for dry weather FIB load reductions through a variety of mechanisms that are proposed as well as those that have already been implemented. Dry weather load reductions are anticipated through implementation of the programmatic strategies described in **Sections 2.1.4.2.** and **2.1.4.3** where progress toward eliminating FIB and human-specific sources can be made. In addition, the strategies identified in **Section 2.3** seek to eliminate unnatural, unpermitted dry weather flows that will have commensurate reductions in FIB loading everywhere flow elimination is achieved. Specific and early commitments for eliminating or diverting dry weather flows from high priority outfalls are made in the Plan.

In addition to the anticipated load reductions from future strategy implementation, significant efforts have been made throughout the SOC WMA to address dry weather flows and the associated FIB loading. At least 40 flow diversion and dry weather treatment projects have been implemented along the SOC coastline to reduce the effects of dry weather discharges. As noted in the 2014 ROWD, long-term monitoring shows that exceedances of FIB regulatory standards have been decreasing steadily over time. Improved conditions during dry weather has been mirrored by a decrease over the past several years in beach closures due to contamination, as measured by Beach Mile Days. This metric is calculated by multiplying the length in days of each closure by the length (in miles) of beach affected and is a more accurate measure of the impact on beach users than the simple number of closures. This downward trend is depicted in **Figure 4**.

Figure 4: The total number of Beach Mile Days (the product of the length of beach posted times the length of beach posted) posted due to exceedances of standards during the April 1 – October 31 (2014) summer swimming season.



Both the 2014 ROWD, as indicated above, and the 2014-2015 City of Laguna Beach Baby Beach TMDL compliance progress report (see section 2.1.7.1) indicate significant progress towards achieving the dry weather targets. As such, it is reasonable that the strategies identified, combined with refinements or additions to this Plan as part the iterative approach, will result in achievement of the interim and final goals.

2.1.6 Annual Milestones for Next Permit Cycle

Consistent with Provision B.3.c of the MS4 Permit, annual milestones are identified for this HPWQC in **Table 7**.

Table 7: Annual Milestones for Pathogen Health Risk HPWQC

Year	Action
2018	• Complete Work Plan (including Sampling & Analysis Plan, Quality Assurance Plan) for submission to SDRWQCB for review and approval
2019	• Complete at least 30 percent of the scope of dry weather source investigation activities identified in the Work Plan
2020	• Complete the full scope of dry weather source investigation activities identified in the Work Plan; initiate abatement and verification efforts • Complete at least 25 percent of the scope of wet weather source investigation

Year	Action
	activities identified in the Work Plan
2021	• Complete at least 50 percent of the scope of wet weather source investigation activities identified in the Work Plan
2022	• Complete the full scope of wet weather source investigation activities identified in the Work Plan; initiate abatement and verification efforts • Prepare dry weather and wet weather source investigation summary report (interim report; will include proposed abatement efforts)

2.1.7 Other Compliance Determinations

2.1.7.1 Baby Beach TMDL

Compliance with the TMDL for Baby Beach in Dana Point Harbor (Resolution No. R9-2008-0027) is documented in annual progress reports from the City of Dana Point and County of Orange, the most recently documented in the FY2041-15 annual progress report. The compliance timelines for FIB in this watershed are in the past: 2009 for wet weather and 2014 for dry weather, except for wet weather *Enterococcus* that is September 15, 2019. As noted in the progress report, significant progress has been made including:

1) Dry weather final TMDL targets have been achieved in receiving waters for total coliform. No dry weather exceedances of the total coliform 30-day geometric mean target occurred during the reporting period.
2) Dry weather final TMDL targets have been achieved in receiving waters for fecal coliform. No dry weather exceedances of the fecal coliform 30-day geometric mean target occurred during the reporting period.
3) Exceedances of the enterococcus numeric targets in receiving waters occurred for both the 30-day geometric mean and single sample maximum during dry weather. However, with the implementation of the dry weather diversion BMP, all run-off has been eliminated and the required load reduction for the MS4 during dry weather has been achieved.
4) Wet weather numeric targets for total coliform in receiving waters were generally met, with only one exceedance during the reporting period. There continues to be an overall declining trend in concentrations.
5) Wet weather numeric targets for fecal coliform in receiving waters were generally met, with only four exceedances during the reporting period.

Exceedance rates have continuously declined from 32% in the baseline years to 13% in the progress years to 9.5% in the current reporting period.

6) Wet weather exceedance rates for enterococcus in receiving waters were 50% below baseline years. Exceedance rates have declined from 55% in baseline years to 33% in the progress years to 27% in the current reporting period.

The Baby Beach TMDL Technical Report (SDRWQCB, 2008) found that less than 0.1% of dry weather loadings and less than 5% of wet weather loadings of indicator bacteria were attributed to urban runoff. The overwhelming majority was from natural/background sources. With a coordinated watershed-wide effort that includes monitoring, special studies, and load reduction BMPs, overall loadings of indicator bacteria have been reduced 50% to 90% during dry weather condition and 60-95% in wet weather conditions since the baseline years, significantly above and beyond the requirements of the TMDL.

2.2 Channel Erosion and Associated Geomorphic Impacts – Inland Receiving Waters

2.2.1 Overview

2.2.1.1 Introduction

Within the network of streams and creek systems in the SOC WMA, certain reaches have experienced adverse geomorphic impacts resulting from severe erosion, such that the underlying physical form of the stream has been altered. This condition influences the physical habitat (i.e., channel geometry, substrate, vegetation) and hydraulic flow regimes (i.e., velocity distributions, erosive energy) of a channel. Physical habitat and hydraulic conditions are elements of stream form and function near the foundation of the stream rehabilitation hierarchy described by Harman (2012). In other words, management efforts focused at this level of the pyramid are likely to be needed in some cases as a first step toward restoration of biological and recreational beneficial uses in these stream reaches. For these reasons, channel erosion and associated geomorphic impacts was identified as a HPWQCs in Chapter B.2. The extent of this HPWQC applies to those reaches that are undergoing significant erosional impacts where the resulting impacts to channel form and function is an important limiting factor in restoration of beneficial uses.

2.2.1.2 Historical and Current Context

Prior to urbanization, farming, grazing other land use activities began to have hydromodification impacts on some streams in Southern California (SCCWRP, 2013) through changes in runoff hydrology (e.g., from changes in watershed vegetation and compaction), change in sediment transport (e.g., from road crossings), modification of channel form (e.g., channelization), and changes in riparian vegetation (e.g., vegetation removal, invasive species colonization). Early urbanization typically contributed to greater impacts to flow regime and sediment supply and often included further channelization or piping of streams to accommodate excess runoff volumes and peak flowrates, with a focus on the peak design storm (e.g., the 100-year event). With early MS4 Permit implementation, development was required to implement source control practices, water quality treatment BMPs, and in some cases peak flow control for storms occurring more frequently (e.g., the 2-year and 5-year storms). As the state of the scientific knowledge of hydromodification impacts has developed, modern MS4 Permits have enacted more stringent flow control and sediment management criteria intended to avoid new hydromodification impacts. Additionally, resource agencies have become less accepting of modifications of natural channels.

Much of the development in the WMA occurred at interim periods in this trajectory. This has resulted in a wide range of conditions and at various points in their response to

pre-urban and urban disturbances. Today, stream channels in the WMA can be loosely classified into several categories:

1. Streams that have been fully channelized or piped, with a sole design basis for safely conveying the peak 100-year flowrate. These systems most often present no reasonable opportunity to restore riparian beneficial uses.
2. Streams that have been engineered to provide stability in up to a peak flood design flowrate (e.g., through grade controls structures; bank protection), but include soil and vegetation elements that continue to support some biological processes. Typically, the capacity of these systems is based on the required peak flood design flowrate. Introducing elements to slow water and create additional habitat is typically incompatible with maintaining this design basis. Therefore, these systems present limited opportunity to restore riparian beneficial uses.
3. Streams that have significant natural reaches (i.e., unarmored and unimproved), receiving runoff from areas that were developed prior to modern hydromodification control standards. These streams are often in various states of adjustment in response to urbanization. The degree to which systems are resilient to long term hydromodification impacts (i.e., can resist changes or can reestablish a new stable form after changes occur) is dependent on the degree of alteration of inputs and the local geology of the stream system. While hydraulic regimes and stream form may be modified, the establishment of a new stable form tends to result in reduction in active erosion and establishment of new mature vegetation.
4. Streams that have significant natural reaches (i.e., unarmored and unimproved) and receive runoff from areas solely developed to include modern hydromodification control standards. While adjustments may still occur in sensitive channels, it is expected that modern standards will be effective in avoiding most forms of hydromodification impacts. However, where streams experienced erosion and incision prior to development, this may continue even with full modern hydromodification control of project discharges.
5. Streams that do not receive urban runoff and have not been improved. These systems may experience impacts associated with non-urban land uses, but are not the focus of this plan.

In the rapid assessment of stream reaches conducted in Chapter B.2, the majority of reaches identified as experiencing hydromodification impacts were those in category 3 above. The degree to which the channel has reestablished a new stable form is a key factor in the management actions appropriate for these reaches.

2.2.1.3 Focus of This Plan

The plan described in this Chapter focuses on identifying locations where (1) excess erosion and scour is actively occurring and is an important limiting factor in channel ecology, and (2) there are reasonable opportunities to implement rehabilitation projects designed to serve the full range of flow and temporal conditions (e.g., peak flows; geomorphically-significant flows; low flows). Feasible rehabilitation projects to abate excess erosion, implemented over a range of time, are anticipated to improve physical habitat and hydraulic regime (i.e., underlying tiers in the stream rehabilitation framework layer), facilitating the conditions for improvements in the associated biological communities (pinnacle of pyramid).

This Plan places the highest priority on locations where streams remain unstable and have not reestablished a new stable form. Macro-scale erosion impacts were initially identified through a rapid screening assessment of the stream systems within the SOC WMA as depicted in Figure A-9 from Chapter B.2. Further screening level investigations efforts have been conducted as part of preparing this plan. However, given the episodic nature of channel erosion and limitations of aerial photography methods (e.g., tree cover, varying resolution), there remains uncertainty regarding the severity of current erosive impacts and the active effect they are having on channel form and physical habitat. Therefore, strategies described in this Plan will include conducting more detailed investigations of these reaches to determine the need for and feasibility of rehabilitation. Finally, this Plan includes advanced monitoring techniques based on LiDAR data for the entire urban stream network in the WMA to provide a more thorough assessment of existing conditions and allow earlier identification of future unstable conditions to allow less intensive interventions to be completed prior to the development of severe erosive impacts.

As a key element of this plan, a "geomorphically-referenced" stream rehabilitation/enhancement approach will be implemented that will aim to abate excess ongoing erosion while maintaining dynamic morphology of the active channel (rather than full stabilization) and provide conveyance for design flood flows. Where opportunity allows, these projects will also be designed to provide habitat improvement, water quality benefits, recreational (and associated safety) improvement, and utility protection. Successful rehabilitation projects that have been conducted within the WMA highlight the commitment of the respective agencies to restore stream systems that have been adversely impacted from developed watershed runoff. Examples include:

- Narco Channel Restoration at J04 – 800 LF
- Upper Sulphur Creek Restoration (from outfall at Rancho Niguel Park, to Crown Valley Park) – 13,200 LF

- Middle Sulphur Creek Ecosystem Restoration (within Crown Valley Park, to MNWD Treatment Plant) - 2,200 LF
- J03P01 Restoration (within Crown Valley Park) – 3,000 LF

A *draft Conceptual Geomorphically Referenced Basis of Design (GRBOD) Guideline* is included as part of this Plan (**Appendix G**) and will be finalized as an early milestone in Plan implementation. An important aspect of watercourse rehabilitation per this draft Guideline is to continue to accommodate flood conveyance purposes and mitigate geomorphic impacts, while providing a channel form that is conducive to riparian ecosystems. This can be conceptually achieved through use of "softer" approaches (e.g., buried grade control structures, soft meanders, live stakes and other biotechnical streambank stabilization, riparian buffer, step-pools, etc.) in the active channel coupled with more engineered approaches where needed. However, it must also be acknowledged that some reaches are constrained, such that it may only be feasible to abate erosion and maintain flood conveyance purposes. In this approach, a reduction in excessive downstream sedimentation and reduction of risks to property or recreational uses is still a desirable outcome of rehabilitation.

2.2.1.4 Role of Flow Control

In Chapter B.2, wet weather hydrologic modification (e.g., wet weather runoff volume and peak flow increases) and sediment supply reduction were also examined as potential high priority water quality conditions. While wet weather flow and sediment supply regimes have clearly been impacted by urbanization and are an underlying cause of past and active geomorphic impacts, this was not identified as a HPWQC for two primary reasons. First, where channel degradation has occurred, correcting hydrologic inputs is not adequate alone to rehabilitate stream form. For example, where channel incision has occurred and the channel has been disconnected from the flood plain, the cumulative energy of streamflow tends to be more concentrated within the active channel such that predevelopment hydrologic inputs would incur a higher rate of sediment transport than predevelopment sediment transport. Additionally, room for natural meandering is limited by reduction in channel corridor width. Second, the reasonable level of improvement that can be expected for wet weather flow regimes is limited in most developed watersheds. While flow and volume management was not identified as a HPWQC, it will be considered and achieved in three primary way: (1) in developing erosion management and rehabilitation plans for impacted reaches, the ability to achieve improved upland flow control will be considered, (2) flow control and volume reduction will be incidental outcomes from implementation of strategies identified for the Pathogen Health Risk HPWQC, and (3) new development and redevelopment projects will implement flow duration control and sediment management described in the South Orange County Hydromodification Management Plan (SOC HMP, 2015).

2.2.2 Goals and Schedules

The overall goal for this HPWQC is to abate excess erosion where these processes are determined to be an active and primary source of impairment to geomorphic form and function within an impaired reach. Abatement of excess erosion and scour through "geomorphically-referenced" approaches that maintain a more natural stream form (rather than full stabilization) is intended to provide the physical setting necessary for the channel to be revegetated with natural species and establish more natural bed and bank materials, which can support restoration of riparian and recreational beneficial uses and reduce downstream of water quality impacts caused by erosion and sedimentation. The specific numeric goals to demonstrate progress towards addressing channel erosion and associated geomorphic impacts within the SOC WMA stream systems are based on lineal measurements of channel lengths where excess erosion and scour will be abated using a geomorphically-referenced approach. These goals were established based on a reasonable assessment of the length of reach where this approach may be desirable and feasible.

2.2.2.1 Reach Prioritization Assessment to Support Numeric Goal Setting

As part of Chapter B.2, a rapid aerial screening of approximately 170 lineal miles of inland receiving waters was conducted to identify reaches that appear to have experienced serious geomorphic impact associated with urbanization. This assessment was intended to support an initial estimate of the spatial extent of this HPWQC. However, this assessment did not consider a number of factors that influence the relative uplift of beneficial uses that would be provided by a rehabilitation project or the likelihood that a rehabilitation project will be determined to be appropriate and feasible to implement. For example, the location of the reach within the watershed and the degree to which the reach has reestablished a stable channel form influence much uplift of watershed process and beneficial uses could be obtained and whether rehabilitation efforts would be appropriate.

As part of setting numeric goals for this HPWQC, an additional assessment was completed for the subset of potential priority reaches initially identified in Chapter B.2. This assessment included a number of factors identified in the paragraphs below. The purpose of this assessment was to estimate the reasonable length of stream where rehabilitation is needed, appropriate and feasible.

Degree of recent instability. The degree of instability was assessed based on a series of historical aerial photographs from 1994 to present via Google Earth Pro. Observations of channel evolution (or lack thereof) was compared to reference reaches of similar watershed sizes located upstream of the influence of urbanization (in cases where urbanization occurred prior to 1994) or assessment of the channel form of the specific

reach prior to the time of urbanization (in cases were urbanization occurred after 1994). In several cases, the geomorphic observations that were noted as indicators of instability in the previous assessment (for example, migration of active channel or sloughing of outer floodplain banks) were found to be consistent with natural or pre-urban channel form. In these cases, the reach was removed from consideration as a HPWQC reach.

Extents of impact. The same series of historical aerial photographs from 1994 to present were used to confirm or revise of the extents of the upstream and downstream limits of the impact. This review resulted in increasing the length of impact of two reaches compared to the extents originally identified in Chapter B.2.

Potential for uplift of beneficial uses via rehabilitation. Various factors were considered in a preliminary assessment of the potential for uplift of biological and recreational beneficial uses via rehabilitation projects, including:

- Relationship to infrastructure, particularly where erosion may be threatening infrastructure or public safety.
- Relationship to recreational features (parks, trails, schools, etc.) such that the actual recreational beneficial use associated with the reach is higher.
- Degree of current instability. Does the channel still appear to be actively eroding based on evaluation of response to recent wet winters – 2004/2005 and 2010/2011? Or does the channel appear to have evolved to a new stable form? What portion of the reach is currently experiencing elevated erosion?
- Degree of vegetative cover in wet and dry years. The extent of mature woody vegetative cover that resist erosion following wet years was used as an indicator for evaluating current degree of instability and active erosion. It was also used to evaluate whether there would be significant incidental impacts to habitat associated with a project.
- Potential impacts of excess erosion and sedimentation from the reach of interest on downstream resources or projects. For example, in-stream infiltration projects or estuary restoration.
- Opportunity to improve habitat connectivity via rehabilitation of a reach that lies between two reaches that are in better condition, including opportunities to provide fish passage (e.g., in San Juan and Trabuco Creeks)

Opportunity and constraints. Various factors were assessed to gauge the relative opportunity and constraints associated with completing an in-stream rehabilitation project, including:

- Flood design flows (100-year return interval), existing channel capacity, and degree of excess or deficiency in capacity, where known. This influences whether increases in channel roughness (from additional vegetation) and

reduction in channel slope (as part of a rehabilitation approach) could be allowable.
- Right of way width and encroachments on the floodplain of the channel.
- Ownership the channel right of way and adjacent parcels.
- Existing hydraulic structures and infrastructure, which can improve stability by controlling grade (by design or otherwise) or can complicate rehabilitation efforts by creating areas of concentrate stream energy.
- Known existence or absence of prior design and feasibility efforts.
- Estimated degree of design and permitting complexity.

Based on these preliminary assessments, a qualitative rating of low, medium, or high was assigned for (1) potential uplift of beneficial use, (2) opportunity for rehabilitation, and (3) constraints/complexity associated rehabilitation, and a summary of the basis for each rating was prepared. Based on these ratings, an overall "likelihood" rating between 0 and 100 percent was assigned to each reach. This rating presents an overall assessment of the probability that a rehabilitation project will be determined to be desirable, appropriate, and feasible for a given reach. If the need was determined to be low, then the reach was removed from consideration, and the likelihood of a rehabilitation project was set to zero. Where the need for rehabilitation was confirmed, then the opportunity and constraints were assessed to estimate the probability that a project could happen.

The reach length multiplied by the probability of rehabilitation was used as the basis for establishment of reasonable goals. **Table 8** provides a summary of the ratings prepared and various information about the reach that was used to support ratings. Associated map exhibits showing the locations of the candidate reaches appear in **Appendix F**. This assessment was based on limited data sources and is not intended to take the place of appropriate field investigation and engineering studies that are identified as strategies for implementing these goals.

Table 8: Potential Reach Rehabilitation Information Summary

Reach ID	Watershed	Watershed Context	Potential Uplift of Beneficial Uses	Opportunity	Constraints/ Complexity	Probability Estimate	Timeframe Rating	Assessment No(s).	Ownership	Reach Length (ft)	Est. Average Right-of-Way Width (ft)	Est. Slope (%)	OCFCD Reach No.	Design flow Q100 (cfs)	Existing flow (cfs)	Ex/Q100 flow rate ratio
ALC01	Aliso Creek	Aliso Creek upstream of El Toro Road and downstream of Portola Parkway	**Moderate.** Areas of bank failure and scour are clear Bank failure compromised bike path following 2011 Active channel vegetation does not readily reestablish Nexus to bikeway	**Moderate.** OCFCD ownership Excess capacity exists in most sections Some existing drop structures, however with long spacing	**Moderate.** Relatively narrow right of way No known study of this reach for restoration Major drainage deficiency at El Toro cross at downstream limit	40%	Mid to Long	104-531-22 104-541-04 104-541-06 104-531-20 104-531-19	Orange County Flood Control District	2,613	280	1.59	J01-45	5,585	13,812	2.47
ALC01a (added upstream of ALC01)	Aliso Creek							104-143-30 104-541-06 104-143-39 104-143-30 104-143-30	Orange County Flood Control District	3,300	TBD	~1.5%	J01-48	5,585	NP	NC
ALC02	Aliso Creek							104-531-22	Orange County Flood Control District	473	274	1.98	J01-44	5,585	6,248	1.12
ALC03	Aliso Creek	Aliso Creek downstream of Metrolink rail, adjacent to Los Alisos Blvd	**Moderate/Low.** Reach is semi-natural between two engineered sections Does not appear to exhibit major instability Heavily vegetated	**Moderate/low.** Public ownership Adjacent to golf course/open space	**Moderate.** Relatively narrow right of way Adjacent golf course	20%	Mid to long	No data 617-421-01 613-363-05	Private City of Lake Forest Orange County Flood Control District	1,228	182	0.64	J01-28	4,582	4,000	0.87
ALC04	Aliso Creek	Aliso Creek downstream of I-5	**High.** Severe erosion and bank failure in parts Bikeway and trail threatened by channel migration and bank failure	**Moderate.** Public ownership Has been identified by OCCR as potential projects	**Moderate** Adjacent infrastructure Relatively narrow right of way I-5 crossing creates concentrated energy	60%	Near to mid	620-461-21 620-461-19 620-461-20	County of Orange City of Laguna Hills	3,443	347	1.29	J01-19	4,582	5,000	1.09

Reach ID	Watershed	Watershed Context	Potential Uplift of Beneficial Uses	Opportunity	Constraints/ Complexity	Probability Estimate	Timeframe Rating	Assessment No(s).	Ownership	Reach Length (ft)	Est. Average Right-of-Way Width (ft)	Est. Slope (%)	OCFCD Reach No.	Design flow Q100 (cfs)	Existing flow (cfs)	Ex/Q100 flow rate ratio
ALC05	Aliso Creek	Aliso Creek downstream of Moulton Parkway	**Moderate.** Some erosion and instability in portions; however strong revegetation Relationship to trail system	**Moderate** Public ownership	**Moderate** Somewhat narrow valley	40%	Mid to Long	623-011-50 623-011-51	County of Orange	1,895	375	0.61	J01-10	4,582	5,200	1.13
ALC06	Aliso Creek	Mid reach of Aliso Creek near the 73 toll road	**Moderate** Portions of reach have bank instabilities, but not as evident as downstream reaches Grade controlled at Pacific Park Drive crossing Relationship to trail system, parks, and middle school	**Moderate** Public ownership	**Moderate** Road crossings and culvert More constrained floodway Heavily vegetated Large streamflows	40%	Mid to Long	634-012-09 634-012-12 634-341-01 634-012-22	County of Orange	4,056	678	0.98	J01-10	7,400	5,982	0.81
								634-341-02 634-342-02	City of Aliso Viejo							
ALC07	Aliso Creek	Mid-lower reach of Aliso Creek within Aliso-Wood Canyon Park	**Moderate/High** Portions of reach have clear bank instabilities Need for mainstem Aliso Creek restoration has been long identified in planning efforts	**Moderate** Within predominantly open space areas Mostly County owned Reasonable floodplain width for restoration Preliminary feasibility analysis demonstrated viable technical options	**Moderate/High** Heavily vegetated Large streamflows Major permitting considerations Contingent on ACOE process	60%	Mid to Long	No data	Private	2,626	700	0.23	J01-2.3	6,500	6,438	0.99
								639-011-18	County of Orange							
ALC08	Aliso Creek							655-051-04	County of Orange	4,488	1,408	0.01	J01-2.2	10,800	NP	NC

Reach ID	Watershed	Watershed Context	Potential Uplift of Beneficial Uses	Opportunity	Constraints/ Complexity	Probability Estimate	Timeframe Rating	Assessment No(s).	Ownership	Reach Length (ft)	Est. Average Right-of-Way Width (ft)	Est. Slope (%)	OCFCD Reach No.	Design flow Q100 (cfs)	Existing flow (cfs)	Ex/Q100 flow rate ratio
SCC01	San Clemente Coastal Streams	Two branches of Segunda Deshecha downstream of Avenida Talega	**Low/Moderate.** Limited signs of instability. Original indications appear to be part of natural channel form. Within golf course/No recreational use.	**Low.**	**High** Private ownership Limited signs of property/ infrastructure threat. Narrow corridor. Well vegetated.	Remove from priority	NA	708-032-06 701-161-01	Private	497	134	6.21	N/A	NP	NP	NC
SCC02	San Clemente Coastal Streams							708-032-06 701-161-01	Private	827	182	1.61	N/A	NP	NP	NC
SCC03	San Clemente Coastal Streams							708-032-04 708-032-06 701-161-01	Private	757	94	3.79	N/A	NP	NP	NC
SCC04	San Clemente Coastal Streams	Branch of Segunda Deshecha downstream of Calle Saluda	**Low/Moderate.** Limited signs of instability. Original indications appear to be part of natural channel form. No recreational use.	**Low.**	**High** Private ownership Limited signs of property/ infrastructure threat. Narrow corridor. Well vegetated.	Remove from priority	NA	701-332-14 701-332-10	Private	1,851	381	3.12	N/A	NP	NP	NC
SCC05	San Clemente Coastal Streams	Headwaters branch of Prima Deshecha parallel with Avenida Vista Hermosa	**Low/Moderate.** Limited signs of instability. Original indications appear to be part of natural channel form. No recreational use.	**Low.**	**High** Private ownership Limited signs of property/ infrastructure threat. Narrow corridor. Well vegetated.	Remove from priority	NA	679-161-06 679-161-21 679-161-23 679-161-16 679-281-04 679-281-05 679-161-13 679-281-09 679-161-24 679-161-22 679-161-17 679-281-06	Private	2,057	102	3.80	N/A	NP	NP	NC
SJC01	San Juan Creek	Headwaters of Trabuco Creek No significant urban impacts	**Low.** No significant urban impacts; change evolution appears to be	**Moderate.** Space and some public ownership.	**High.** Minimal opportunity for uplift given good existing	Remove from priority	NA	842-061-01	Private	3,053	1,109	2.22	L02-20	14,400	6,800	0.47
								842-051-13	Orange County Transport Authority							

Reach ID	Watershed	Watershed Context	Potential Uplift of Beneficial Uses	Opportunity	Constraints/ Complexity	Probability Estimate	Timeframe Rating	Assessment No(s).	Ownership	Reach Length (ft)	Est. Average Right-of-Way Width (ft)	Est. Slope (%)	OCFCD Reach No.	Design flow Q100 (cfs)	Existing flow (cfs)	Ex/Q100 flow rate ratio
SJC02	San Juan Creek		natural.		condition.			No data	Private	1,637	435	1.64	L02-20	14,400	6,800	0.47
SJC03	San Juan Creek	Tijeras Canyon near Antonio Parkway	**Moderate** Clear channel erosion Could improve connectivity with rehabilitation Does not appear to be encroaching on infrastructure Not a clear recreational asset	**Moderate** Mostly public ownership Moderate design flow for channel dimension	**Moderate** Has not been previously been studied for rehabilitation, per our knowledge	40%	Mid	125-087-12 125-087-11 125-087-09	County of Orange	843	437	1.96	L11-1.2	3,686	NP	NC
SJC04								787-151-01	Private	1,280	629	1.56	L11-1.2	3,686	NP	NC
								125-087-12 125-087-11 125-087-09	County of Orange							
SJC04a (added)	San Juan Creek	Tijeras between SJC04 and headwaters	**Moderate** Clear channel erosion Significant sections without vegetative cover May be encroaching on development/ infrastructure Not a clear recreational asset	**Moderate** Moderate design flow for channel dimension Relatively steep slope	**Moderate** Very long section Ownership not known Has not been previously been studied for rehabilitation, per knowledge	40%	Mid to Long	125-036-19 806-051-38 125-036-20 125-087-36 125-087-03 125-087-02 814-281-10 814-281-09 125-102-01 125-036-24 814-281-08	County of Orange	10,500	TBD	2%	L11-1.3 to 1.7	2,335 to 3,686	NP	NC
SJC04b (added)	San Juan Creek	Tijeras between SJC04 and confluence with Trabuco Creek	**Moderate** Clear recent channel erosion Significant sections without vegetative cover May be encroaching on development/ infrastructure Not a clear recreational asset	**Moderate** Moderate design flow for channel dimension Relatively steep slope	**Moderate** Very long section Ownership appears private for much Has not been previously been studied for rehabilitation, per knowledge	20%	Mid to Long	787-141-04 787-151-01	Private	6,800	TBD	2%	L11-1.1/1.2	3,749	NP	NC
								125-097-20 125-097-09 125-097-03 125-097-33 125-097-34	County of Orange							

Reach ID	Watershed	Watershed Context	Potential Uplift of Beneficial Uses	Opportunity	Constraints/ Complexity	Probability Estimate	Timeframe Rating	Assessment No(s).	Ownership	Reach Length (ft)	Est. Average Right-of-Way Width (ft)	Est. Slope (%)	OCFCD Reach No.	Design flow Q100 (cfs)	Existing flow (cfs)	Ex/Q100 flow rate ratio
SJC05	San Juan Creek	Main stem Trabuco Creek; near mid watershed	**Low** Channel evolution likely within natural variability Does not appear to be a major impact to channel form	**Moderate** Mostly county or water district ownership Ample floodplain width	**High** Large stream/ large design flow Heavy vegetation	Remove from priority	NA	125-096-95 125-096-52 125-096-15 125-096-93 125-096-96 125-096-53 125-096-14 125-096-08 125-096-62 125-096-64 125-097-06 125-097-07	County of Orange	1,241	661	1.10	L02-16	18,600	18,500	0.99
SJC06								125-096-96	Private	2,768	697	1.42	L02-16	18,600	18,500	0.99
								125-096-93	Santa Margarita Water District							
								125-096-95 125-096-52 125-096-53 125-096-14 125-096-08 125-096-62 125-096-64 125-096-15	County of Orange							
SJC07	San Juan Creek	Side channel into Trabuco Creek from major storm drain outfall	**Moderate** Likely sediment contributor Could compromise infrastructure Appears to have relationship to trail system Limited uplift potential - Not mainstem; fed only by urban storm flows	**Moderate** Clear issue Partial public/water district ownership Not mainstem; simpler permitting	**Moderate** Partial private	40%	Mid	125-096-96 759-101-03	Private	1,870	115	4.04	N/A	NP	NP	NC
								125-096-93	Santa Margarita Water District							
								125-096-95 125-096-52 125-096-15 125-096-53 125-096-14 125-096-08 125-096-62 125-096-64	County of Orange							

Reach ID	Watershed	Watershed Context	Potential Uplift of Beneficial Uses	Opportunity	Constraints/ Complexity	Probability Estimate	Timeframe Rating	Assessment No(s).	Ownership	Reach Length (ft)	Est. Average Right-of-Way Width (ft)	Est. Slope (%)	OCFCD Reach No.	Design flow Q100 (cfs)	Existing flow (cfs)	Ex/Q100 flow rate ratio
SJC08	San Juan Creek	Lower portion of Trabuco Creek; reach within golf course	**Moderate** Rehabilitation could expand flood plain and improve connectivity Form has been modified (more channelized) Open standing water Appears to have some form of grade control Does not appear to be unstable	**Low/moderate** Partial public ownership Golf course adjacent and was source of previous flood plain encroachment	**Moderate/high** Relatively high design flow Meaningful rehabilitation of channel form would require land acquisition and modification of golf course.	20%	Long	125-181-55 125-181-26 125-181-51 125-181-23 125-181-59 125-181-14 125-181-57 125-181-22 125-181-53 125-181-52	Private	2,216	183	0.03	L02-16	19,000	18,500	0.97
								125-181-30 125-181-58 125-181-32 125-181-54 125-181-50 125-181-56 125-181-49	County of Orange							
SJC09	San Juan Creek San Juan Creek	Oso Creek between Gallivan Retarding Basin and Confluence with Trabuco Creek	**High** Major instability appears to be responsible for ongoing bank failures, physical habitat impact, and sediment loading Beginning to threaten OCTA infrastructure Sedimentation could complicate downstream recharge and steelhead recovery efforts	**Moderate** Relatively low peak design flow for watershed size (result of Gallivan Basin) Mostly adjacent to open space	**Very high** Mostly private ownership; have been approached by OCTA without success thus far	20%	Mid to long	637-082-71	Private	853	134	2.63	L03-1	6,600	17,931	2.72
								637-082-70	Orange County Flood Control District							
SJC10								637-082-15 637-082-14 121-050-23 121-070-57 121-070-67 637-082-71	Private	6,017	649	1.34	L03-1	6,600	17,931	2.72
								637-082-70	Orange County Flood Control District							
								121-050-16	City of San Juan Capistrano							

Reach ID	Watershed	Watershed Context	Potential Uplift of Beneficial Uses	Opportunity	Constraints/ Complexity	Probability Estimate	Timeframe Rating	Assessment No(s).	Ownership	Reach Length (ft)	Est. Average Right-of-Way Width (ft)	Est. Slope (%)	OCFCD Reach No.	Design flow Q100 (cfs)	Existing flow (cfs)	Ex/Q100 flow rate ratio
SJC11	San Juan Creek	Trabuco Creek just upstream of confluence with Oso Creek near Metrolink crossing	**Moderate/high** Clear erosion impacts Sedimentation could complicate downstream recharge efforts Based on CP member comments, fish passage is desirable Standing water in scour pool below	**Moderate** Based on CP member comments, a 65% design has been completed for this reach, suggesting potential landowner cooperation	**Moderate** Private ownership Relatively high design flow and bridge constriction may require hardened approach for scour	40%	Mid	121-050-22 121-070-67	Private	775	127	1.81	L02-5	23,000	19,200	0.83
SJC12	San Juan Creek	Lateral to Oso Creek through Mission Viejo Country Club	**Low** Existing grade control appears to be mostly controlling erosion Limited opportunity for ecological connectivity	**Low** Very narrow right of way	**High** Mostly private ownership	Remove from priority	NA	784-521-37 784-521-35	Private	740	48	0.19	N/A	NP	NP	NC
								784-521-41	City of Mission Viejo							
SJC13	San Juan Creek	Wagon Wheel Creek	**High** Clear degradation from urban runoff Recreation/safety (within OC Park) Excess sedimentation into Gobernadora Basin	**High/Moderate** Phase I under construction Mostly OCCR ownership	**Moderate** Partially private	60%	Near to mid	125-102-07 755-011-14 755-022-02	Private	4,250	250	2.40	N/A	NP	NP	NC
								755-022-04 125-102-06	County of Orange							

NP- Not provided
NC – Not calculated

2.2.2.2 Final Goals

Based on the assessment described in **Section 2.2.2.1** and **Appendix F**, this plan establishes a goal of rehabilitating **23,000 lineal feet** of streams using a geomorphically-referenced approach to abate excess erosion and scour while maintaining dynamic morphology of the active channel (rather than full stabilization) and provide conveyance for design flood flows. Additional benefits (e.g., vegetation rehabilitation, habitat rehabilitation, trails) will be incorporated into rehabilitation efforts on an opportunistic basis to realize the highest reasonable uplift in beneficial uses associated with efforts to achieve these goals.

Two additional narrative goals are established:

- Any additional reaches beyond those identified in **Appendix F** that are identified to be experiencing excess erosion or scour that threatens biological or recreational beneficial uses will be added to the plan at the earliest time that they are identified. Appropriate revisions to numeric goals will be established. Identification of additional reaches will be achieved through remote-sensing monitoring described in the strategy section or by other means. Thresholds of significance for channel erosion will be defined in Chapter B.4.
- For reaches not currently impacted by urbanization, a goal of no net increase in extent of active erosion resulting from urban development is established. This will be assessed through remote-sensing monitoring described in the strategy section or by other means.

2.2.2.3 Interim Goals and Schedules

Schedules for achievement of interim and final goals were established with consideration for the various planning elements that are typical of rehabilitation projects, including:

- Securing funding
- Obtaining property or easements, where required and possible
- Inter- or Intra-agency cooperative agreements
- Resource agency permitting
- Environmental reviews (CEQA/NEPA)
- Design, bidding, and construction

Utilizing a recent stream rehabilitation project that is nearing the construction phase (Wagon Wheel Creek Project) as a representative example of the timeline over which these planning elements typically occur, it is assumed, for the purpose of establishing

the goals for this HPWQC, that individual projects will take approximately 5-10 years to be realized if all of the planning elements described above can be put into effect in a relatively sequential fashion without large gaps of time between each element. A reasonable planning horizon timeline of approximately 20 years is considered in goal development to allow for implementation of a sufficient number of these projects, based on the rehabilitation strategy proposed in this Plan, such that assessment of the strategy's efficacy for realizing the intended outcomes of restoring habitat and the associated ecological functions can be made. This timeline is consistent with implementation timelines for strategies to address the other HPWQCs in this Plan, to be implemented over multiple Permit cycles. A planning horizon timeline significantly beyond a 20-year outlook is challenging, as changes in conditions over a multi-decadal period are difficult to foresee, and therefore does not consider the potential changes that may be identified as prudent based on the adaptive management actions that will be a part of this Plan. The numeric goals and schedules for abatement of excess channel erosion in the SOC WMA are presented in **Table 9**.

Table 9: Numeric Goals and Schedules for Channel Erosion HPWQC

Year	Length of Stream Reach Rehabilitated to Abate Excess Erosion using a Geomorphically-referenced Approach, Lineal Feet
2022	2,000
2027	6,000
2032	12,000
2037	18,000
2042	23,000 (final goal)

2.2.3 Strategies and Schedules

2.2.3.1 Overall Long-Term Strategic Vision

The long-term strategic vision for this Plan includes rehabilitation of geomorphically unstable channels within urbanized corridors and publicly owned right-of-ways using a multi-benefit rehabilitation approach, where feasible. This Plan proposes rehabilitation be conducted GRBoD where feasible. This design paradigm emphasizes a complete design approach that considers safe conveyance of flood flows (infrequent conveyance condition) while providing the ecological benefits of establishing a dynamically-stable channel reach to convey the geomorphically-significant flows (more frequent

conveyance condition), while restoring or maintaining recreational uses. Potential design elements of rehabilitation include, but are not limited to:

- Grade control/drop structures to flatten slope
- Increase channel sinuosity
- Channel widening
- Elevating active channel to reconnect it to the floodplain
- Bed and bank reinforcement
- Partial flow diversion
- Hardened outer bank limits
- Removal of concrete/hardened infrastructure and replacement with reinforced vegetated bank infrastructure (i.e., ArmorFlex).
- Fully hardened sections, where needed (i.e., high energy, space constraints, etc.)
- Energy dissipation at transitions and outfalls
- Hardened crossings for access

These design principles are conceptually presented in the GRBoD Guidelines located in **Appendix G**. Each lineal foot of channel rehabilitated using these principles will be credited towards achievement of the goals indicated in the previous section. Actual project designs may vary in specific design elements and approaches depending on the specific purposes, opportunities, and constraints of the project, but shall reflect the intent, decision process, and fundamental qualities of the GRBoD approach.

2.2.3.2 Flow Control Strategy

In addition to evaluating reaches for rehabilitation using the GRBoD approach, an important additional element will be to evaluate upstream opportunities to implement flow control. Where opportunities present, either through new facilities or retrofit of existing facilities, implementing additional upstream flow control to mitigate downstream stream energy may be the key element to allowing rehabilitation to proceed in a less "hardened" manner, i.e., more closely aligned with the GRBoD approach. Opportunities for upstream flow control will be evaluated as part of the restoration alternatives and feasibility study discussed in the next section.

2.2.3.3 Specific Near-Term Strategies

A change in paradigm for urban stream management and rehabilitation is a major initiative that requires appropriate phasing of supporting efforts and extensive inter-department and inter-agency coordination. Additionally, each of the candidate reaches identified requires a multi-faceted design and permitting process that must consider site-specific factors to formulate potential project alternatives. It was not reasonable as part of the preparation of this plan to solidify the new framework for rehabilitation or investigate each identified reach in adequate detail to determine need and feasibility or

develop a reliable cost estimate. Significant near-term effort (over the next 3 to 5 years) is required to establish the foundational elements of this plan and develop more specific project descriptions and phasing. These near-term efforts are described in this section.

Rehabilitation Alternatives and Feasibility Studies. For each of the candidate reaches identified in **Section 2.2.2** and **Appendix F**, an analysis of rehabilitation alternatives (including as assessment of whether the project will confer greater benefit than a do-nothing alternative), feasibility of these alternatives, and identification of a preferred alternative will be conducted. This analysis will include, as applicable:

- Detailed hydrologic characterization, including flood hydrology and continuous simulation hydrology
- Detailed hydraulic, geomorphic, and sediment transport characterization based on remote sensed and field data
- Evaluation of the potential ecological and recreational uplift from rehabilitation
- Detailed assessment of constraints and opportunities, including review of topography, soils/geology, land ownership, utilities, habitat, and other factors
- Preliminary engineering evaluation of restoration potential and alternatives based on the methods and performance standards described in the GRBoD (**Appendix G**) and the Orange County Hydrology Manual, including a minimum of 3 alternatives per reach and evaluation of opportunities for improved upland flow control, where applicable
- Preliminary evaluation of permitting issues
- Alternatives analysis, results, and basis for recommended alternative presented in a consistent, transparent manner
- Preliminary cost estimates, schedule requirements, and identification of key contingencies
- Realistic assessment of funding sources and appropriate phasing relative to other reaches identified and analyses

Findings of the analysis for each candidate reach will be reported to the SDRWQCB as part of WQIP reporting requirements and findings and recommendations will be incorporated into periodic updates of the Plan. Analyses and reporting will be completed within five years of plan acceptance. A specific list of proposed projects and schedules will be included in the subsequent Plan update.

Programmatic Permitting Framework for Geomorphically-Referenced Basis of Design Projects. Implementation of multi-benefit restoration projects will require coordination with multiple permitting agencies, including CWA Section 401 permitting (SDRWQCB), CWA Section 404 permitting (Army Corps of Engineers), California Fish and Game Code, Section 1602 Streambed Alteration Agreement (California Department of Fish and

Wildlife), and potentially Endangered Species Act consultation (National Marine Fisheries Service or United States Fish and Wildlife Services), the California Coastal Commission, and other entities. A CEQA process is also required for these projects of this scale. In order to streamline project development and implementation, the Permittees will work with applicable agencies to explore a programmatic permitting framework for these types of projects. A Special Area Management Plan (SAMP) may be considered.

Finalize Conceptual GRBoD Guidelines. A draft of these Guidelines is included in **Appendix G**. This version is considered draft as it has not been fully vetted internally and has not been screened with resource agencies that may be responsible for permitting and design review. The Permittees will obtain input on these Guidelines as part of the *Permitting Framework* strategy described above. Based on input received, the Permittees will finalize these guidelines and submit them for review and input from the SDRWQCB.

LiDAR Data Acquisition and Analysis. The Permittees have obtained high-resolution LiDAR data for approximately 170 miles of stream and riparian corridor within the SOC WMA for the specific purpose of supporting rehabilitation projects, measuring changes over time, and allowing for earlier identification of future instabilities. Under a current contract with Quantum Spatial and Eagle Aerial, LiDAR data will be analyzed to develop a high-resolution land surface model, hydraulic cross sections at 250-ft spacing, and land cover classifications relevant to hydraulic and geomorphic analyses (e.g., vegetation density, bare soil, standing water, and hardened surfaces. This dataset will be updated in the future at 5-year intervals or more frequently to support change analyses. The results of analyses of these data will be included in each update to the Plan, as appropriate.

Jurisdictional Implementation of Hydromodification Management Plan. As part of their jurisdictional programs, the Permittees will continue to implement the 2015 SOC HMP. From time to time, the HMP will be updated as part of an iterative process. This strategy will be ongoing. This strategy is expected to be the primary strategy for controlling new impacts to streams receiving runoff from new development, and will tend to result in improvement in hydrologic conditions in existing developed areas experiencing redevelopment.

Watershed Management Area Analysis Coarse Sediment Supply Analysis. As part of the Watershed Management Area Analysis (WMAA) included in this WQIP, the Permittees will bring forward the management guidance from the 2015 HMP to mitigate impacts to coarse sediment supplies relative to land development.

Coordination with upland control proposed for Pathogen Health Risk and Water Balance HPWQCs. As part of near- to mid-term planning efforts for the Pathogen Health Risk and Water Balance HPWQCs, upland control projects will be identified. As part of an integrated strategy, opportunities for flow control within these projects will be evaluated and included where feasible and beneficial to downstream geomorphic conditions.

Rancho Mission Viejo Ranch Plan. The overall Runoff Management Plan (ROMP) for the Rancho Mission Viejo (RMV) project was developed to mitigate and restore hydromodification impacts within the RMV project area. Through implementation of this Plan and associated tiered Plan development and approval process, geomorphic impacts are expected to be mitigated, and geomorphic conditions generally improved, as a result of development of the RMV project.

Aliso Creek Mainstem Ecosystem Restoration Project. A preferred alternative for the Aliso Creek Mainstem Ecosystem Restoration Project was published in January 2016. This project is being led by the Army Corps of Engineers with involvement from the Orange County Stormwater Program. A "Chief's Report" is scheduled for April 2018, which is the last step in the current planning process for this project. The preferred alternative for this project includes elements and considerations that are generally consistent with the GRBoD described in this Plan. The scope of the project includes the HPWQC reaches identified as ALC07 and ALC08. This project is anticipated to be a precursor for other potential future rehabilitation projects in the area including the Aliso Creek Estuary Rehabilitation Project.

Wagon Wheel Creek Restoration Project and Stormwater Management Project. This project will restore a section of Wagon Wheel Creek identified as HPWQC ID SJC013. The purposes of this project are to stabilize Wagon Wheel Creek for resource management purposes in order to protect the remaining oak and sycamore woodland and other riparian vegetation; to protect the Riley Wilderness Park and the recreational resources from flooding and to limit erosion hazards; and to ensure public safety within the Park. This project incorporates geomorphically-referenced elements that are generally consistent with those described in the GRBoD, including bioengineered grade control, riparian vegetation restoration, buried bank stabilization to protect key infrastructure, trail improvements, and stormwater detention. Bidding occurred in August 2016 and construction is anticipated to commence in the short term. This project includes prioritized rehabilitation work at 11 sites over approximately 10,000 lineal feet of stream channel (rehabilitation efforts cover a portion of this reach).

DeWitt Property Habitat Restoration Project. Laguna Canyon Creek is one of two remaining soft-bottomed creeks in the region, whereby this project will restore sections of that were damaged during flood events in 2010. A collaborative effort between the City of Laguna Beach, Laguna Canyon Foundation, and Laguna Greenbelt Inc. Laguna

Canyon Creek has resulted in a $500,000 grant from the California Natural Resources Agency to conduct the project. The project will include removal of invasive species, creek area repair and planting native plant and tree species. The project will also include interpretive trail signs to educate visitors on the riparian habitat along the creek.

Coordination with Orange County Transportation Authority (OCTA) to Identify Impacted Reaches for Measure M2, Tier 2 Funding. The OC Stormwater Program will continue to coordinate with OCTA to identify and pursue projects to rehabilitate channels experiencing erosion. The Environmental Cleanup Program helps improve overall water quality in Orange County from transportation-generated pollution. The funds are designed to supplement, not supplant, existing transportation-related water quality programs.

OCTA through Measure M2 funding programs has contributed to the Wagon Wheel Creek Restoration Project (2016-2018 construction). Additionally, OCTA is in discussion with a private property owner to identify mitigation measures for and eroding reach of Oso Creek (identified as SJC10) downstream of Gallivan Basin based on potential threats to the MetroLink rail line.

Incorporation of the GRBoD design approach proposed in this Plan into OCTA-led or OCTA-funded projects will be facilitated by the continued participation of OC Stormwater Program personnel on the OCTA Environmental Cleanup Allocation Committee that is responsible for identifying future potential projects.

2.2.3.4 Mid- to Long-Term Strategies

At this time, the implementation of specific rehabilitation projects for additional HPWQC reaches is identified as a mid- to long-term strategy for those reaches that have not yet been studied in adequate detail to determine feasibility. The completion of the alternatives analyses and feasibility studies for these reaches (identified as a near-term strategy above) serves as the basis for identifying specific projects and establishing the implementation schedule for these projects. The funding sources and time requirements for each project will be defined in the respective alternatives analysis and feasibility report. In general, it is estimated that each project will take 5 to 10 years from inception to completion.

2.2.3.5 Optional Strategies and Schedule

Additional candidate reaches may be identified through LiDAR data analysis or other means. Rehabilitation efforts for these reaches are most appropriately categorized as optional strategies at this time. Triggers for identifying additional candidate reaches will be established in Chapter B.4. Alternatives analysis, feasibility evaluation, project

identification, and scheduling for these reaches will be performed within 3 years of identification of a new candidate reach.

2.2.3.6 Schedule Estimates

Table 10 summarizes the schedules for implementation of the strategies identified in this section. More specific discussion of scheduling and contingences is provided in the previous subsections.

Table 10: Summary of Schedule for Control Activities for Channel Erosion HPWQC

Strategy	Implementation Period Ending in:					
	2020	2025	2030	2035	2040	2045
Rehabilitation Alternatives and Feasibility Studies and associated Upland Flow Control Opportunity evaluation	Completed for HPWQC reaches by 2020	As needed as new reaches are added				
Programmatic Permitting Framework for Geomorphically-Referenced Basis of Design Projects	Initiated in 2017; Completed by 2020	As needed				
Finalize Conceptual GRBoD Guidelines	Completed by 2019	Update as needed based on adaptive process				
LiDAR Data Acquisition and Analysis	Acquisition completed; analysis completed 2017	Obtain and reanalyze at 5-year interval or more frequently				
Coordination with upland controls proposed for Pathogen Health Risk and Unnatural Water Balance HPWQCs	Ongoing; opportunistic					
Aliso Creek Mainstem Ecosystem Restoration Project	Chief's Report expected Apr 2018	To be determined; schedule controlled by Army Corps of Engineers				
Jurisdictional Implementation of HMP via New development/ redevelopment program	Program updates in 2017	Ongoing program implementation and refinements to guidance, criteria, and inspections				
Watershed Management Area Analysis Coarse Sediment Supply Guidance	Completed in 2017 as part of this Plan	Refresh periodically, as needed				
RMV Ranch Plan	Ongoing implementation					
Wagon Wheel Creek Restoration Project and Stormwater Management Project	Anticipated completion by 2018					
GRBoD Rehabilitation Projects	Ongoing implementation beginning in approximately 2022					

This schedule represents an aggressive commitment to a range of new efforts and capital investments. **Table 11** summarizes estimated time requirements for these strategies.

Table 11: Summary of Time Requirements for Channel Erosion HPWQC

Strategy	Explanation of Time Requirements
Restoration Alternatives and Feasibility Studies	3 years to collect data, conduct analysis, develop recommendations and provide time for comments and coordination
Programmatic Permitting Framework for Geomorphically-Referenced Basis of Design Projects	2 to 3 years required to facilitate inter-agency process
Finalize Conceptual GRBoD Guidelines	1 to 2 years to consult resource agencies and integrate channel design process with existing flood control design requirements
LiDAR Data Acquisition and Analysis	Initial analysis available by mid-2017. Subsequent updates and interpretation require 4 to 8 months from time of data acquisition.
Coordination with upland controls proposed for Pathogen Health Risk and Water Balance HPWQCs	Contingent on project identification as part of other tracks
Aliso Creek Mainstem Ecosystem Restoration Project	Unknown
Jurisdictional Implementation of HMP via New development/ redevelopment program	Ongoing
Watershed Management Area Analysis Coarse Sediment Supply Analysis	Completed as part of April 1, 2017 Plan submittal
RMV Ranch Plan	In place and ongoing
Wagon Wheel Creek Restoration Project and Stormwater Management Project	Estimated completion by 2019.

Strategy	Explanation of Time Requirements
Rehabilitation Projects	5 to 10 years per project once specific projects are identified and determined to be feasible 2 to 3 project concurrent Est. 30 year phased implementation

2.2.3.7 Responsibility for Strategy Implementation

Table 12 categorizes strategies as WMA strategies, multi-jurisdictional strategies, or jurisdictional strategies and identifies implementation responsibility.

Table 12: Summary of Responsibility for Control Activities for Channel Erosion HPWQC

Strategy	WMA or Jurisdictional Strategy?	Responsibility
Restoration Alternatives and Feasibility Studies	WMA	OC Stormwater Program
Finalize Conceptual GRBoD Guidelines	WMA	OC Stormwater Program
Programmatic Permitting Framework for Geomorphically-Referenced Basis of Design Projects	WMA	OC Stormwater Program
LiDAR Data Acquisition and Analysis	WMA	OC Stormwater Program
Coordination with upland controls proposed for Pathogen Health Risk and Water Balance HPWQCs	WMA	OC Stormwater Program
Aliso Creek Mainstem Ecosystem Restoration Project	WMA	OC Stormwater Program
Jurisdictional Implementation of HMP via New development/ redevelopment program	Jurisdictional	Each jurisdiction implements program; County leads program document updates
Watershed Management Area Analysis Coarse Sediment Supply Analysis	WMA	OC Stormwater Program
RMV Ranch Plan	Jurisdictional	County jurisdiction

Strategy	WMA or Jurisdictional Strategy?	Responsibility
Wagon Wheel Creek Restoration Project and Stormwater Management Project	Jurisdictional	OC Community Resources
Rehabilitation Projects	Jurisdictional/multi-jurisdictional	Led by jurisdiction leading/owning projects; jointly funded by jurisdictions within tributary area

2.2.4 Summary

Adequacy of Goals and Schedules.

The goals described in **Section 2.2.2** are directly related to the HPWQC identified. These goals are specific, measureable, and have interim goals at five-year intervals.

The expected outcomes of achieving these goals are directly related to restoring beneficial uses of inland receiving waters, including:

- Restoration of habitat and associated ecological functions that are allowed to regenerate within a dynamically-stable channel section, or
- Improvements in downstream water quality realized through reductions in discharges of sediment-bound pollutants precluded by stable channel section.

Adequacy Strategies Schedules.

A long-term strategy for achieving these goals is described, however at this time it is not possible to foresee precisely how this strategy will be implemented in terms of spatial application of specific design measures. The short-term strategies identified have well-defined outcomes and milestones that are intended to lead toward more precise definition of the long-term strategy. These short-term strategies represent an aggressive commitment to developing the foundation of a new program and paradigm for stream rehabilitation. The proposed approach for phasing strategies is consistent with the iterative approach described in this Plan.

Based on the long-term strategic vision, short-term strategies, optional strategies and clear milestones to trigger these strategies, it is reasonable to expect that this Plan will result in attainment of goals that will result in significant improvement of beneficial uses in receiving waters.

2.2.5 Annual Milestones for Next Permit Term

Consistent with Provision B.3.c of the MS4 Permit, annual milestones are identified for this HPWQC in **Table 13**.

Table 13: Annual Milestones for Channel Erosion HPWQC

Year	Milestone
2018	• Update of New Development/ Redevelopment Program to incorporate WMAA Critical Course Sediment evaluation into HMP • Complete analysis of 2016 LiDAR data for stream network
2019	• Finalize GRBoD Guidelines based on input from resource/permitting agencies
2020	• Complete rehabilitation alternatives and feasibility studies for the candidate reaches identified in **Appendix F**
2021	• Prepare project closure and summary report for Wagon Wheel Creek rehabilitation project including lessons learned to be incorporated into Conceptual GRBoD Guidelines • Obtain LiDAR data for 2021 condition
2022	• Complete LiDAR stream channel change analysis for 2016-2021 and identify new candidate reaches resulting from this analysis • Update WQIP to incorporate specific projects identified as part of rehabilitation alternatives and feasibility studies

2.3 Unnatural Water Balance and Flow Regime – Inland Receiving Waters

2.3.1 Overview

The SOC WMA includes more than 170 miles of significant **inland receiving water** stream reaches that receive runoff from developed land. Within this network, there are approximately 250 storm major drain outfalls (defined as outfalls greater than or equal to 36 inches) to inland receiving waters, and a similar number of minor outfalls (smaller than 36 inches) that have been inventoried. While certain outfalls and reaches have been studied in detail, the collection of consistent system-wide data regarding dry weather flow presence, magnitudes, connectivity to receiving waters has been initiated more recently and does not yet provide full coverage of the network. Initial observations indicate that approximately half of major outfalls discharge some amount of dry weather flow, and a portion of these outfalls appear to have consistent connectivity to an inland receiving water. Dry weather flows from the MS4 contribute to the in-stream flow in receiving waters to varying degrees. Some outfalls essentially form the headwaters of a stream reach while others contribute a small fraction of flow in the stream. Some of the flow at outfalls and streams is from natural sources (groundwater seepage that would occur regardless of storm drain infrastructure); however imported or recycled water is a major component of the current urban water balance and is known to contribute to unnatural quantity and timing of flows in many stream systems.

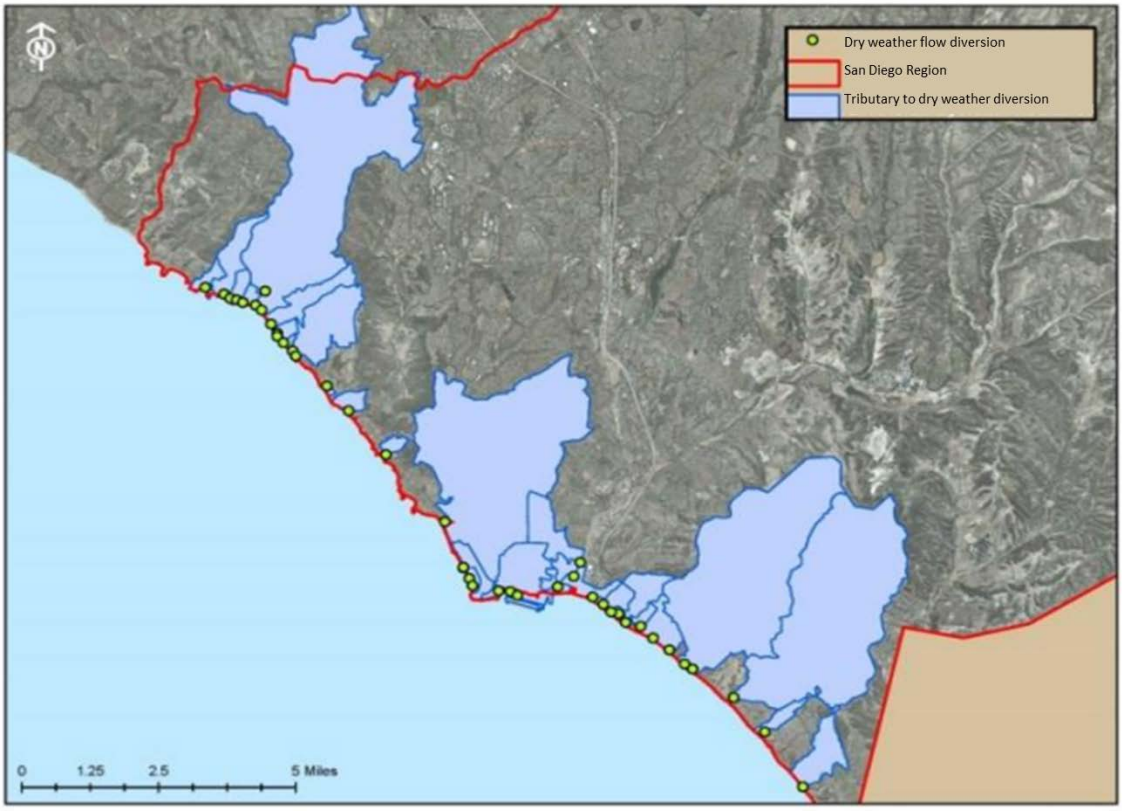
Flow regime is one of the foundations of the function-based hierarchy for stream assessment and restoration projects (Harman et al, 2012). Disruption in the natural flow regime of a stream system is considered one of the key stressors associated with "urban stream syndrome" (Walsh et al, 2005). Stream ecosystems that are subject to unnatural inputs tend to be vulnerable to changes in the quality or quantity of these inputs over time. In moderate to high stress urban streams, perennialization of urban streams is associated with lower biological integrity (Mazor et al, 2012). This study also documented a higher rate of perennial streams in urban areas than reference conditions. In streams that are naturally perennial, unnatural dry weather inputs from MS4 can have unnatural chemistry associated with source water (e.g., dissolved solids in imported water) and can carry pollutants from urban land uses (e.g., nutrients, pesticides, pathogens).

Based on evaluation of spatial data relationship in the SOC WMA (See Chapter B.2), there appears to be a correlation between dry weather MS4 discharges to stream channels, flows in these channels, and impairments to water quality and beneficial uses. This is also supported by narrative observations as part of the County's Transitional Monitoring Program. As described in Chapter B.2, unnatural water balance and flow regime has been defined as a HPWQC for **inland water bodies during dry weather conditions.**

2.3.1.1 Highlights of Progress to Date

The SOC Permittees have studied and implemented various projects to manage dry weather flows in recent years, including source control and education projects, LID planning requirements, BMP retrofits, outfall treatment systems, and outfalls diversions to sanitary sewers (which could lead to a form of water harvesting and recycling). In coastal areas, dry weather flow capture and diversion or treatment systems have been implemented extensively, covering the majority of areas draining directly to the coast (**Figure 5**). This approach has not been extensively implemented for discharges to inland receiving waters; however, some treatment systems and diversion systems are in place.

Figure 5: Tributary Area to Implemented Diversion and/or Treatment Systems in South Orange County



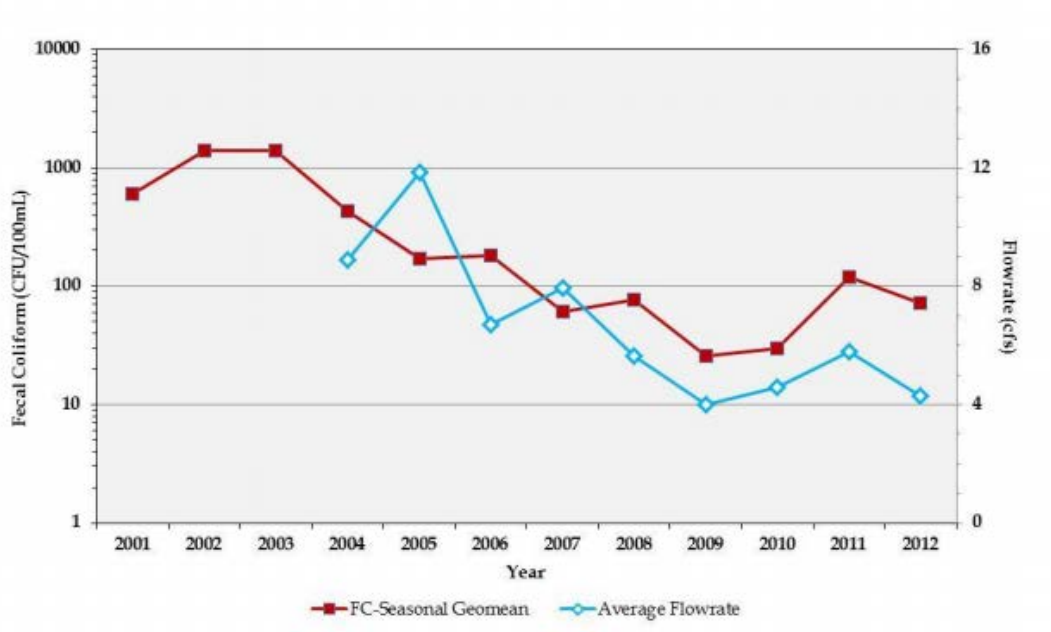
(Source: 2013 Report of Waste Discharge, State of the Environment Report)

The Permittees have implemented a number of studies and outreach initiatives related to irritation overspray reduction and water conservation, such as the SmarTimer Edgescape Evaluation Project (SEEP) completed in 2008 and the current *Overwatering is Out* initiative. Based on the SEEP study, a reduction in dry weather flows of 40 percent was estimated as a result for areas that implemented irrigation controllers, improved irrigation systems, pervious edge-scaping, and turf conversion to drought tolerant

plants. In total, dry weather BMPs implemented to date in Aliso Creek and San Juan Creek were estimated to address 57 percent and 58 percent of dry weather FIB load in these watersheds, respectively, in part from dry weather runoff volume reduction.

Consistent with expectations, dry weather flow rates in inland receiving waters appear to be declining, likely in part due to dry weather flow control efforts (e.g., outdoor water conservation) and in part due to extended drought conditions. As an indicator of urban contributions to dry weather flows, **Figure 6** plots the fecal coliform seasonal geometric mean (geomean) in Aliso Creek in comparison to the average flowrate. This provides anecdotal evidence that reduction of dry weather urban runoff (a primary source of indicator bacteria) may be declining at a rate that exceeds the decline in natural baseflows.

Figure 6: The Fecal Coliform Seasonal Geomean in the Aliso Creek Watershed Plotted in Comparison to the Average Dry Weather Flow Rate in the Creek.



Note: Fecal coliforms have declined in concert with reductions in flow of urban runoff to Aliso Creek. (Source: 2014 State of the Environment Report).

As an example of an integrated regional water management project, the Aliso Creek Water Reclamation Facility (ACWRF), operated by the South Coast Water District, became operational in 2014. This facility includes a diversion from Aliso Creek with the capability to divert and treat dry weather flows from the creek to be blended with recycled wastewater. It is located in Aliso Canyon at the Coastal Treatment Plant, about 1.5 miles inland from Aliso Beach.

2.3.1.2 Introduction to Plan

The plan described in this section focuses specifically on identifying and eliminating unnatural and unpermitted, non-exempted dry weather flows from the MS4 into **inland**

receiving waters, with priority for the locations where unnatural dry weather flow inputs arising from an unnatural urban water balance are exacerbating in-stream water quality conditions and contributing to unnatural in-stream regimes. There are five primary strategies included in this plan:

1. Focused data collection efforts of various types intended to fill data gaps, support prioritization of approaches, track progress toward goals, track progress toward attainment of beneficial uses, and support adaptive management.
2. Special studies and analyses intended to result in more precise and definitive implementation of strategies that are appropriate and effective for the specific receiving water.
3. Source control, incentives, and educational measures to promote water conservation and reduction of unnatural flows into the MS4.
4. Structural BMP retrofit strategies to divert and capture water at high priority outfalls, where appropriate.
5. Optional structural BMP retrofit strategies where it is determined that source control and educational strategies have reached their limit of effectiveness and conditions remain as a high priority.

As part of near-term implementation of this Plan, necessary attention is dedicated to defining what is "natural" and "unnatural" relative to discharges from MS4 outfalls and in-stream conditions. Some types of unnatural conditions are clear (for example, irrigation excess forming the sole flow in a stream that would otherwise be ephemeral) and will be the primary focus of initial efforts. However, where groundwater tables are higher and/or riparian systems are more altered, available datasets do not support a clear and definitive distinction of the degree to which "unnatural" flows contribute to existing impairments or the extent to which it is appropriate to remove these flows from specific systems. For example, where habitat has been established based on these flows and/or there are efforts to restore habitat or introduce desirable species, maintaining flows may be desirable, even if of unnatural origin. Additionally, not all unnatural flows are controllable via source controls in the urban landscape. Some discharges such as permitted discharges, and groundwater seepage into storm drain pipes will occur.

While this Plan takes a comprehensive watershed-based approach to the unnatural flow regime in receiving waters, this Plan also acknowledges the limits to the authority of MS4 Permittees. For the reasons above, it should be noted that the ultimate target for this Plan is not total elimination of flow from outfalls or in the receiving streams, as some flow inputs are of natural origin or are exempted/permitted and it is expected that some streams will remain perennial after elimination of targeted unnatural dry weather discharges from the MS4.

Section 2.3.2 describes interim and final goals and schedules. **Section 2.3.3** describes strategies and schedules and describes an outfall prioritization approach, based on available data that has been applied to determine appropriate strategies for each outfall. A summary of the plan is provided in **Section 2.3.4**. Annual milestones for the next Permit term are described in **Section 2.3.5.**

Integration of Plan with Other Efforts

This Plan includes specific, measureable, and reasonably-simple goals focused on unnatural flow contributions to and from the MS4. Strategies are focused on MS4 permittee actions for achieving these goals and explained in that context. However, this Plan is not intended to be implemented in isolation. It is the intent that the goals and strategies described in this Plan will be interpreted and implemented in the overall watershed and water management context, including:

- This Plan is intended to be synergistic with South Orange County Watershed Management Area Integrated Regional Watershed Management Plan (SOC IRWM) and efforts prioritized in that plan such as water conservation, water harvesting and recycling. As such, the plan for this HPWQC is built around a hierarchy of water conservation first, recycling of water second, and treatment and discharge third. The strategies described include participation in projects being led by others IRWM partners.
- While restoring more natural flow regime is a foundational element of stream rehabilitation, it is not always possible or desirable. Implementation of this Plan must consider the negative effects that flow reduction or elimination may have on in-stream habitat and how this relates to habitat rehabilitation goals. This may introduce necessary complexity and require site-specific studies in some cases, which are envisioned in the strategies described.
- Wet weather management of stormwater, particularly LID-type approaches that rely on infiltration, have a potential long-term nexus to dry weather flow management. For example, increases in base flows resulting from infiltration/groundwater recharge could improve conditions in cases where base flow augmentation is desirable, or could complicate efforts related to returning reaches to ephemeral conditions. This nexus may need to be considered in some locations and could prompt the need for region-specific strategies for overall water balance.
- It is expected that implementation of strategies will accrue benefits beyond those described in this Chapter, including reduction of pathogen sources (discussed in **Section 2.1**), and reduction of loads of PWQCs (discussed in **Section 2.4**) while also augmenting potential for reuse of water.

2.3.2 Goals and Schedules

2.3.2.1 Final Goals

The final numeric goal for this HPWQC is to effectively eliminate unnatural dry weather flows from storm drain outfalls to inland receiving waters. This goal applies to all MS4 outfalls, subject to the definitions and exceptions stated below.

For the purpose of this Plan, the following terms are defined:

- Dry weather is defined as any time that is not within a wet weather period. A wet weather period is defined as days with 0.2 inches of precipitation or greater and the subsequent three-day period.
- An inland receiving water is defined as any inland stream segment included in the Basin Plan (see named receiving waters in Chapter B.2 submittal, Figure A-1) that reasonably has the potential to support biological beneficial use(s). For the purpose of this HPWQC, a concrete or riprap channel, pipe segment, or similar, does not reasonably support biologically-related beneficial use(s).
- An unnatural dry weather flow from the MS4 is defined as any unpermitted and /or non-exempted discharge from a storm drain outfall with hydrologic connectivity to a receiving water that occurs during dry weather and is not primary of groundwater origin.
- Connectivity to a receiving water is defined as a condition under which water from a storm drain outfall has a defined and normal overland flow path to the receiving water. Water that pools and infiltrates or evaporates near the outfall, in a location outside of the active channel of the receiving stream, is not considered to be connected to the receiving water.
- Effectively eliminate means that the condition will not exist on a normal basis or form a chronic condition. Discharges that occur infrequently, as a result of unanticipated or abnormal conditions and do not cause a chronic issue are still considered to be effectively eliminated.

The final and interim goals identified in this section do not apply to discharges/outfalls that can be classified in one of the exception categories below. These exception categories have similarities to exemption categories in the MS4 Permit, but have been developed specifically for this Plan to allow site- and reach-specific approaches for restoration of beneficial uses.

- Category 1 Exception: Negligible impact to flow regime or water quality (all criteria must be met)
    - The outfall discharges to a reach that is demonstrated to be naturally perennial under normal conditions (such as from natural groundwater

sources), such that removal of all MS4 discharges would not restore the stream to a non-perennial condition, and
    - The flow rate of dry weather flow from the storm drain is relatively small relative to the in-stream flow or is relatively stable such that allowing the discharge to continue would not lead to significant unnatural variability of in-stream flowrates that threaten water quality, and
    - The water quality of the dry weather flow from the storm drain does not exceed applicable receiving water quality objectives, is determined to be from a natural source (e.g., groundwater seepage), and/or there is no connectivity to receiving waters
    - It is the intent of this exception category to be applied to outfalls discharging to stream reaches where in-stream flows are relatively large compared to the dry weather flow from the storm drain, the contribution of dry weather flow provides a net positive input to the stream, and/or the flow is determined to be of a natural source (e.g., groundwater seepage). Removal of the volume of flow from MS4 outfalls could potentially negatively affect in-stream flowrates. However, water quality issues posed by continuing to allow MS4 outfalls to discharge must be considered and addressed.
- Category 2 Exception: Discharge to permitted in-stream stormwater capture projects (all criteria must be met)
    - The outfall discharges to a stream reach that serves as a water supply augmentation project (e.g., infiltration into the stream bed) , and
    - The water supply augmentation project has received appropriate permits for this use of the stream reach, including approval to accept dry weather discharges from the MS4.
    - The intent of this exception category is to allow the Permittees to participate in and support related SOC IRWM efforts and avoid redundant or conflicting actions.
- Category 3 Exception: Discharge is desirable for habitat restoration or species recover projects
    - The outfall provides water to a reach that is being managed for habitat restoration and/or anadromous fish population conservation and recovery projects (e.g., green sturgeon, salmon and steelhead listed under the federal Endangered Species Act (ESA))
    - Water quality is determined to be appropriate (or is treated to be appropriate) to support the relevant beneficial uses.
- Category 4 Exception: Discharge is permitted or an exempted discharge not causing or contributing to impairment.

These exception categories are intended to support the development of watershed and reach-specific approaches to result in restoration or preservation of beneficial uses and/or align with integrated water management objectives. Other exception categories may be identified in future updates of this Plan that have similar purposes.

2.3.2.2 Interim Goals

Interim goals associated with this HPWQC are expressed based on the quantity of unnatural dry weather flow from the MS4 to inland receiving waters (as cubic feet per second, or as a percentage reduction).

This Plan gave careful consideration to establishing an appropriate baseline for establishing future-looking goal. As introduced in **Section 2.3.1**, significant progress has been made toward reduction of dry weather flows and dry weather pollutant loads. Education and incentive programs are currently active and structural treatment or diversion systems are in operation. These actions represent meaningful progress toward plan implementation. Additionally, the current period of monitoring data represents the effects of extreme drought conditions and conservation mandates, therefore sets a baseline that will present challenges for further improvements.

However, the ultimate goal is elimination (or justified exception) of unnatural dry weather flows from the MS4 to receiving water, which applies regardless of baseline condition. For the specific purpose of establishing interim targets, the baseline rates of unnatural dry weather flows will be established based a nominal year of 2015. The nominal baseline has been tentatively established in this Plan based on data between 2010 and 2015 and will be refined in the next plan update based on evaluation of available information obtained between 2010 and 2020. This decade-long evaluation period is intended to allow the effect of longer-term climatic cycles to be reflected in estimates of baseline dry weather discharges. It will also allow a reasonable future period (from present to 2020) for data gaps to be filled to better characterize the total magnitude and extent of dry weather discharges. A description of the strategy for filling these data gaps and establishing reliable baseline estimates is included in **Section 2.3.3.2**.

Table 14 summarizes interim goals for this HPWQC. Interim goals are based on aggregate improvement within the SOC WMA as a whole. **Section 2.3.3.3** (*Outfall Prioritization*) identifies considerations for phasing of strategies. Implementation of strategies may not necessarily result in uniform application across HSAs and jurisdictions under interim conditions.

Table 14: Interim Goals of Water Balance/Unnatural Flow Regime HPWQC

Year	Reduction in Magnitude of Unnatural Dry Weather Flow from MS4 to Inland Receiving Water, % of 2015 baseline discharge [1, 2]
2022	10%
2027	25%
2032	50%
2037	70%
2042	90%
2047	100%

1 – The nominal 2015 baseline is used specifically for interim goal setting (see discussion in text); while progress has been made prior to this date, these goals are established as future milestones measured from 2015 baseline.
2 – Dry weather flow lows from outfalls that are classified into one of the exception categories described above shall be tabulated as a reduction in total flow WMA flow magnitude

In addition to these interim goals, the estimated aerial extent of unnatural flow regime in receiving waters (as lineal feet of stream) will be used to evaluate changes in the extent of perennialized reaches resulting from interim goal attainment. It is expected that re-evaluation at regular intervals will show reduction in the extent of perennialized reaches, subject to other influences associated with natural climatic variability. The ultimate target for this metric is not total elimination, as it is expected that some streams will remain perennial after elimination of targeted unnatural dry weather discharges from the MS4. However, with various inputs to these systems in the present, it is not possible to define the extent of naturally-perennial versus unnaturally-perennial reaches at this time.

2.3.3 Strategies and Schedules

2.3.3.1 Introduction

This Plan includes a suite of strategies that are intended to serve complementary roles in meeting the goals within this Plan and making progress toward restoration of beneficial uses of inland receiving waters during dry weather. By necessity, additional data collection and analyses efforts are needed to support more precise identification of goals. These efforts are primarily short-term, with specific time limits and objectives.

Remaining strategies have been assembled based on a number of underlying considerations:

- Dry weather flow management is an integrated water management issue. The strategies defined in the plan have been developed in this context and leave flexibility for participation in projects identified as part of SOC IRWM efforts. The underlying priority in this Plan is to "start at the source" wherever feasible, conserving water and keeping water out of storm drain pipes, rather than skipping to end-of-pipe solutions.
- This approach has shown promise. There has been a general declining trend in dry weather discharge volumes through the recent drought. This is believed to be a result of effective conservation measures, such as water conservation incentives from water agencies and the County's "Overwatering is Out" campaign. Continuation of these efforts is likely to result in further improvements and more permanent landscape and behavior change.
- However, there are limits to the effectiveness of source control. Forecasts of effectiveness are uncertain and are unlikely to reach 100 percent. Additionally, not all unnatural flows are controllable via source controls in the urban landscape. Some discharges such as permitted discharges, and groundwater seepage into storm drain pipes may persist.
- Given this, structural strategies for dry weather flow reduction (e.g., diversions to sanitary sewer, retrofits within existing stormwater facilities) should be prioritized in some cases, particularly where connectivity to receiving waters remains and the nexus to in-stream issues is most serious. However, these solutions are not always feasible, can be expensive, and are not universally appropriate. Excessive application of these measures would have the effect of unnecessarily detracting from investment in other HPWQCs and unnecessarily increasing the operational costs borne by the Permittees.
- Site-specific information is critical to determine the need for structural controls, select appropriate structural measures and develop reliable cost estimates and implementation schedules. Given the large number of outfalls and receiving waters, this site-specific analyses and development of precise plans of action included as strategies to be completed within the initial term of this Plan.
- Beyond the specific strategies defined in this Plan, there are opportunities for dry weather flow management to be considered as part of other strategies that may be implemented by the Permittees based on other HPWQCs. These opportunities have been identified.

As part of implementing strategies to meet the defined, potential negative outcomes could result and must be considered in selection and phasing of strategies:

- There is potential for interim conditions to occur in some reaches during which dry weather flow inputs have been reduced but not eliminated, such that conditions associated with water stagnation may temporarily worsen until flow is completely eliminated.
- Transition from perennial reaches to non-perennial may be accompanied by a natural transition in riparian ecosystems. It is possible that temporary depressions in biological indices or compromised recreation value may result.
- In some cases, elimination of dry weather flows could have a long term detrimental effect. The allowance for exceptions and site-specific approaches within this Plan is intended to help avoid these issues.

Consistent with these considerations, this Plan defines a suite of non-structural and structure source controls, structural outfall controls, opportunistic approaches, and optional strategies to be selected and triggered based on outfall prioritization and adaptive management.

2.3.3.2 Data Collection Activities

Data collection efforts will be continued and expanded to improve understanding of conditions. Data collection will serve as a basis for establishing and refining goals and determining appropriate strategies for addressing dry weather flows from storm drain outfalls. The following specific data collection efforts will be completed.

Expanded transitional monitoring observations: The Permittees' transitional monitoring program has been underway since 2015. This program involves monitoring at storm drain outfalls to inland receiving waters. This has resulted in 2 to 3 site visits to most major outfalls, including visual observation of flow presence and estimations of flow magnitudes, among other observations. Based on observations from this program, there are approximately 120 major outfalls that have been identified as having consistent flow. This program was expanded in Spring/Summer 2016 to include assessments of connectivity of flow to receiving waters, the upstream and downstream conditions in the receiving water, and the relative contribution of the outfall discharge to in-stream flowrates. These expanded observations have been partly completed for major outfalls (58 out of 120 sites with estimated flow at the time of publication). Between 2017 and 2020, the Permittees will complete these expanded observations for all major outfalls, except where safety or permission issues prevent access. Additionally, this program will be extended to known minor outfalls where access can be achieved. The data collected thus far have been used as part of prioritization of outfalls discussed in **Section 2.3.3.3** and **Appendix H**. Future collected data will be incorporated into updated prioritization efforts.

Detailed flow monitoring at priority outfalls: Beginning in Spring/Summer 2016, the Permittees began detailed dry weather flow monitoring studies at high priority outfalls. Flow monitoring at 5-minute intervals is typically conducted for approximately 2 week periods. The purpose of this monitoring is to obtain a better estimate of average flow magnitude and flow patterns, including diurnal fluctuations and other variability observed in the flow pattern. Data collected to date (more than 52 stations at time of publication) has been used for prioritization of outfalls as described in **Section 2.3.3.3** and **Attachment H**. Between 2017 and 2020, this program will continue, and will include monitoring of all priority outfalls, except where access or safety issues prevent monitoring or flows are found to be too low to measure. For the purpose of this Plan, priority outfalls for flow monitoring include outfalls where transitional monitoring observations have identified consistent flow with connectivity to the receiving water and average flowrates are greater than approximately 0.02 cfs (10 gpm). This threshold is estimated to represent approximately 60 percent of the major outfalls that are estimated to have flow and accounts for approximately 95 percent of the total estimated dry weather discharge from the group of 120 major outfalls that are estimated to have some flow. This flow threshold likely represents more than 60 percent of outfalls that have flow and also have connectivity to the receiving water. If minor outfalls are identified in expanded transitional monitoring activities that exceed this threshold, they will also be monitored.

High-resolution imagery analysis: The Permittees have obtained high-resolution multi-spectral aerial imagery for the 2016. Under a current contract with Quantum Spatial and Eagle Aerial, multi-spectral imagery from 2016 will be analyzed for all stream corridors in the urbanized portions of SOC to estimate the spatial extent of open water, vegetation types that are dependent on water, and wet soils. Quantum Spatial will utilize a combination of automated object based classification and experienced photo interpretation to identify areas of standing water, well-watered vegetation, wet soil and other covers (includes impervious, non-watered vegetation, dry soil). This dataset will be updated in the future at 5-year intervals or more frequently. Future imagery will be obtained at a similar time of year at each interval (typically late spring). Similar processing methods for future data will be used to detect changes in the spatial categories identified above. The purpose of this data acquisition and periodic analysis effort is to better define the spatial extent of perennial reaches, identify connectivity from outfalls to inland receiving waters, identify outfalls that have not been previously prioritized that require additional investigation, and evaluate changes in conditions over time in response to implemented strategies and/or climatic variation. Imagery obtained from drones could also be considered to complement aerial imagery.

2.3.3.3 Special Investigations and Analyses

A number of special investigations analysis will be conducted to characterize potential sources and prioritize actions. These activities are described below.

Permitted discharge inventory: The Permittees will utilize available information and request specific information from the San Diego Regional Water Quality Control Board to prepare an inventory of permitted dischargers in the WMA and compile available and relevant information about types, magnitudes, frequency, and timing of discharges to the storm sewer or directly to an inland receiving water. The San Diego Regional Water Quality Control Board issues WDID, NOAs, WDRs, etc. for many discharges through a variety of programs, including:

> Conditional Waiver NOIs:
> www.waterboards.ca.gov/sandiego/water_issues/programs/waivers/waivers_w.shtml
>
> NPDES Permits and WDRs.
> State Water Resource Control Board (State Board) Order No. 2006-0003-DWQ, *Statewide General Waste Discharge Requirements for Sanitary Sewer Systems,*
> http://www.waterboards.ca.gov/sandiego/water_issues/programs/sso/index.shtml
>
> NPDES Permits:
> http://www.waterboards.ca.gov/sandiego/water_issues/programs/regulatory/index.shtml
>
> WDRs:
> http://www.waterboards.ca.gov/sandiego/publications_forms/general_orders.shtml
>
> Recycled Water and Septic Systems:
> http://www.waterboards.ca.gov/sandiego/water_issues/programs/ground_water_basin/recycled_subsurface/recycledwater_subsurfacedisposal_programs.shtml

The purpose of this inventory is to characterize the contribution of these sources to flows at MS4 outfalls and inland receiving waters and identify strategies within the Permittees' authority to address these discharges. Requests for data will be provided to the SDRWQCB within 3 months of plan acceptance. This inventory will be reviewed compiled and completed within six months of receiving data from SDRWQCB.

Water impoundment inventory: The Permittees will utilize available information to prepare an inventory of water impoundments in the WMA and compile available and relevant information about types, magnitudes, frequency, and timing of discharges to

the storm sewer or directly to an inland receiving water. Facilities such as lakes may have periodic discharges. The purpose of this inventory is to characterize the potential contribution of these sources to flows at MS4 outfalls and inland receiving waters and identify strategies within the Permittees' authority to address these discharges. This inventory will be completed within one year of plan acceptance.

Evaluation of Baseline and Reference In-stream Flow Conditions. There is significant complexity associated with characterizing current flow regimes in each relevant reach within the WMA, as well as data gaps associated with this effort. In addition, there is uncertainty and complexity associated with estimating reference condition (i.e., the conditions expected to result if urban inputs were removed). While desktop methods have been applied to fill gaps, site-specific validation is necessary to support appropriate management actions. These evaluations could not be reasonably completed for the more than 150 lineal miles of stream reaches within the WMA in the period allowed for initial plan development. As part of the initial three-year period of this Plan, monitoring and evaluation will be completed to:

- Define current in-stream flow regimes and associated habitat that dependent on these regimes
- Identity habitat restoration and/or species recover programs that relate to in-stream flow regimes in specific reaches
- Estimate reference conditions that would be expected to occur with full removal of urban discharges.

Results and methods will be reported and documented, and incorporated into future plan updates and outfall prioritization (described below).

Outfall prioritization: Based on monitoring data obtained as discussed above, and other available datasets, a transparent and consistent framework for prioritization of outfalls has been developed. The initial version of this framework and results is provided in **Appendix H**. This framework considers the following factors in determining the priority of outfalls for different control approaches. Specifically, this framework has been applied to identify outfalls where construction of structural outfall controls (e.g., diversion to sanitary, infiltration, as discussed in **Section 2.3.3.5**) would be most appropriate and would have the largest benefit for in-stream beneficial uses. Structural outfall controls are considered to be the most appropriate solution, if feasible, in cases where:

- Flow magnitudes are relatively high, indicating widespread sources and/or elevated contributions from sources

- There is higher connectivity to the receiving water and larger contribution to in-stream flow, indicating that impacts are more significant and benefits of flow elimination would be more significant
- There is lower diurnal fluctuation compared to other sites, indicating more groundwater seepage into pipes or permitted discharges, which may not be effected by most source controls
- The tributary area is large, suggesting a diverse range of sources that would be challenging to fully eliminate with source controls

While not yet considered in this framework, future prioritization efforts should also consider:

- Spatial phasing considerations, such as implement clusters of solutions for a given water body in a similar timeframe to limit the duration of interim conditions where flow is still present but has been reduced.
- Other projects proposed, such as upland control projects in the tributary area or in-stream restoration or capture projects downstream that may change the priority of the project.
- Estimated natural flow regime (understanding may be improved through additional data collection). In cases where the natural flow regime is perennial, then the priority may be changed to pollutant control rather than water balance management.

This prioritization framework will be maintained, updated, and/or refined for the life of this Plan as additional data become available and strategies are implemented. The purpose of this framework is intended to identify appropriate controls strategies on an outfall-by-outfall basis and prioritize program expenditures based on estimated cost and benefit.

Outfall capture feasibility studies: In addition to the data collection activities described above and utilized for outfall prioritization, it is necessary for detailed site-specific information to be compiled and evaluated to verify the feasibility of outfall capture strategies. This must be completed prior to definitive phasing and scheduling of specific projects. While significant efforts have been invested in general outfall characterization and prioritization, it was not reasonable to complete feasibility studies for each outfall as part of the initial development of this Plan. Within the two years following acceptance of the plan, at least 20 feasibility studies will be completed for the highest priority subset of outfalls. This is anticipated to result in identification of an adequate number of feasible outfall control projects to meet anticipated implementation schedules described in **Section 2.3.3.5**. Additional feasibility studies will be conducted in each permit term, based on updated prioritization, to meet the schedule for outfall capture projects

described in **Section 2.3.3.5**. Outfall capture feasibility studies will include, as applicable:

- Flow characterization via monitoring
- Groundwater exfiltration
- Water quality characterization
- Assessment of sources of flows (e.g., groundwater flow into storm drains, permitted discharges)
- Ability to obtain easements for access and power
- Evaluation of control approach and associated infrastructure requirements
- Soil and groundwater conditions (if proposing infiltration)
- Pipe alignment for diversion systems
- Estimated cost and schedule requirements
- Estimated lifecycle operating costs
- Potential negative effects on in-stream conditions and/or conflicts with in-stream restoration or species recover projects
- Other anticipated control activities that may be conflicting or overlapping (for example, if a regional treatment system is proposed upstream or downstream, this could have the effect of eliminating the need for a dry weather-specific outfall capture project)

Negative result of a feasibility study does not reduce the goals contained in the plan, however it may prompt updates to strategies and schedules, including triggering optional strategies if it appears outfall capture projects are not feasible at level currently anticipated.

2.3.3.4 Upland Source Control Strategies

Upland source controls strategies include facilities or programs intended to reduce the quantity of dry weather flow present at storm drain outfalls.

New development/redevelopment program: The Permittees will update their new development/ redevelopment planning program to include specific criteria and controls for elimination of dry weather flows leaving project sites, except where otherwise approved by an NPDES permit. In general, the incorporation of low impact development features is expected to minimize or eliminate dry weather flows from priority new development and redevelopment projects. Additionally, structural irrigation controls such as smart timers, soil moisture sensors will be required for new development and redevelopment. Drought tolerant landscaping will be evaluated as a source control. Site inspections guidelines will be updated to include inspection for dry weather flows. As program documents are updated in subsequent permit terms,

technical guidance will be reviewed in light of inspection results and continually improved.

Rancho Mission Viejo Ranch Plan: The overall Runoff Management Plan (ROMP) for the Rancho Mission Viejo (RMV) project was developed with consideration of water balance issues, including avoidance of excess infiltration and/or surface discharge of dry weather flows. Through implementation of this Plan and associated tiered plan development and approval process, water balance issues are expected to be mitigated as a result of development of the RMV project.

Dry weather flow reduction elements in wet weather retrofit BMPs: BMP retrofits implemented for control of wet weather flows (e.g., control of indicator bacteria, other benefits) can often be designed to reduce or provide treatment of dry weather flows. As wet weather retrofit projects are planned and designed, dry weather flow management will be a key design goal and included in the projects, as applicable and feasible. Examples of elements include shallow infiltration sump (where soils allow), or a subsurface flow wetland gravel bed (for treatment where soils have low permeability). This is an opportunistic strategy that does not have a definitive schedule or estimated degree of implementation.

Dry weather flow retrofits within existing stormwater facilities: This strategy would include retrofit activities within existing facilities so that they provide new or enhanced functions for reducing or treating dry weather flows. Example elements are similar to discussed above and could be achieved via minor modifications to outlet structures or minor internal earthwork. As part of outfall feasibility evaluations, the presence of existing stormwater facilities and ability to retrofit these facilities to control dry weather flows will be considered. Therefore, the schedule will be contingent on the schedules for outfall feasibility studies and implementation of outfall control strategies.

Incentives for low water-use landscaping and/or irrigation source controls: The "Overwatering is Out" initiative by the OC Stormwater Program (www.overwateringisout.org). This initiative helps raise awareness of issues, provide tips to residents and businesses, and connect residents with rebates such as the OC WaterSmart Program (Municipal Water District of OC), the SoCalWaterSmart Rainbarrel Rebate Program (Municipal Water District of SoCal), and the Turf Removal Program (Municipal Water District of OC). As part of this Plan, the Permittees will continue this program and adapt or expand it to continue to promote water conservation and reduction of excess irrigation. At each update of this Plan, opportunities for new initiatives regarding water conservation and dry weather runoff management will be evaluated.

2.3.3.5 Outfall Control Strategies

Outfall control strategies include facilities or projects constructed at or near a storm drain outfall to eliminate or treat all dry weather flows from the outfall. The outfall prioritization process described in **Section 2.3.3.3** and **Appendix H** will be applied to identify high priority outfalls where structural control measures are appropriate. Categories of structural controls include:

- *Dry weather diversion to sanitary sewer (water harvesting) at high priority outfalls:* Diversion systems involve structural retrofits within the storm sewer system or near the outfall, typically including a pump station to divert water to a nearby sanitary sewer main. These systems can be designed to achieve full elimination of discharge during dry weather conditions. A pre-treatment system, such as a trash capture system, may be needed.
- *Dry weather infiltration improvements at high priority outfalls:* This strategy would include construction of infiltration facilities at outfalls to receive dry weather flows and eliminate discharge to the receiving water. This strategy would only be applicable where soils are adequate for infiltration and groundwater quality and geotechnical considerations are addressed. Wet weather flows would be diverted around these systems, unless adequate space is available to treat wet weather flows. A pre-treatment system, such as a settling basin or hydrodynamic separator may be needed.
- *Treatment systems at high priority outfalls:* Where the in-stream flow regime is determined to be naturally perennial, it may be appropriate to continue to allow dry weather discharges subject to the criteria in Exception Category 1 (above). As part of this approach, it may be necessary to provide treatment to improve the quality of discharges in order to meet applicable water quality objectives. Treatment systems at outfalls are a broad category that could include passive treatment, such as subsurface wetlands, or active treatment, such as filtration and disinfection systems. Treatment technologies should be selected to address appropriate pollutants of concern in order to meet criteria for Exception Category 1. Pre-treatment may also be needed, such as trash screens or hydrodynamic separators.
- *San Juan Creek in-stream water augmentation project:* The members of the San Juan Basin Authority are proposing improvements to San Juan Creek to augment the local groundwater basin. Improvements may include inflatable rubber dams below Interstate 5 and/or live-bed recharge of treated water between Interstate 5 and Ortega Highway. To the extent dry weather flows are determined to be acceptable inflows to these systems, participation in this project can serve as an alternative to other structural controls for the outfalls that drain directly to these reaches. At this time, plans for San Juan Creek are preliminary and are outside of the control of the Permittees. However, the Permittees will coordinate with

this project. It may be appropriate for some Permittees to financially participate in and benefit (water quality and water supply benefits) from this project.

- *Aliso Creek Water Reclamation Facility*. The Aliso Creek Water Reclamation Facility (ACWRF), operated by the South Coast Water District, became operational in 2014. This facility includes a diversion from Aliso Creek located 1.5 miles from the stream mouth with the capability to divert and treat up to 0.8 million gallons per day (1.25 cfs) of dry weather flows from the creek to be blended with recycled wastewater. It is located at the Coastal Treatment Plant in Aliso Canyon. The Permittees were a partner in this project.

Structural controls will be implemented as part of a phased approached based on relative priority, availability of funding, and feasibility of the projects. The outcome of outfall feasibility studies described in **Section 2.3.3.3** will be used to determine the projects to be implemented in each 5-year term of this Plan.

Table 15 summarizes anticipated implementation of structure controls strategies for each 5-year term based on information available at the time of plan preparation. Based on initial prioritization described in **Appendix H**, the 35 highest priority outfalls represent approximately 75 percent of the total WMA flow magnitude. Based on the scoring approach used, these highest priority outfalls are weighted toward outfalls where the impacts of dry weather discharges are most significant. Of this group of highest priority outfalls, half are estimated to make a "major contribution" to in-stream flows (defined as making up at least 50 percent of streamflow), and an additional 30 percent of this group is estimated to have a "significant contribution" to in-stream flows (defined as making up at least 10%but less than 50% of streamflow). This group of high priority outfalls includes approximately 75% of all outfalls that have been determined to have a major contribution to in-stream flows based on assessments to date. Remaining outfalls will be addressed by upland source controls (**Section 2.3.3.4**) or other measures determined to be appropriate through the studies and analyses described in **Section 2.3.3.3**. This implementation schedule is subject to change based on additional data obtained and analyses conducted in the future, and may be augmented by optional strategies if determined to be necessary based on measured progress toward goals.

Table 15: Anticipated Phasing of Outfall Control Strategies for Unnatural Water Balance HPWQC

Year	Cumulative Number of Outfalls with New Structural Outfall Controls Implemented	Estimated Reduction in Total WMA Dry Weather Flow Resulting from Cumulative Implementation of Outfall Controls[1]
2020	2	5%
2025	10	12%
2030	20	25%
2035	26	33%
2040	32	42%
2045	35	50%

1 - Reduction is estimated based on average estimated flow magnitudes for high priority outfalls as a fraction of total estimated flow magnitude for the approximately 120 outfalls currently understood to have dry weather flows. The actual flow magnitude addressed in each permit term will depend on the actual outfalls implemented in each permit term. The total magnitude flow with connectivity to receiving waters may be refined as additional data are obtained about flow magnitudes and outfall connectivity. While the highest 35 outfalls are estimated to represent 75 percent of flow, an estimate of 50 percent is attributed to outfall capture to account for uncertainty in the outfalls that will be appropriate and feasible to capture.

2.3.3.6 In-stream Strategies for Water Quality Improvement in Dry Weather Conditions

The plan for this HPWQC includes short- to medium-term management actions that are specifically intended to manage inputs to receiving waters. Outside of the plan for this HPWQC, rehabilitation activities for inland receiving waters may be implemented. These efforts can be complementary to the efforts in this Plan to eliminate unnatural discharges. As these projects are implemented, elements can be included to support water quality issues in dry weather:

- Design of drop structures to avoid pools of stagnant water
- Removal of non-critical structures that are resulting in pools of stagnant water
- Provide low-flow channel of appropriate dimensions for dry weather flows and which can provide shading, as appropriate
- Consider gravel-bed augmentation in some sections to improve hyporheic flow and associated pollutant removal and temperature reduction.

Permittees proposing in-stream rehabilitation projects should consider these elements, as applicable and feasible. Note that these elements are not directly related to this HPWQC and are not intended to imply specific commitments as part of this Plan. The

schedule for this strategy is therefore not defined in this Plan and will be implemented on an opportunistic basis.

2.3.3.7 Optional Strategies

At the time of each update of the WQIP (not less than every five years), and assessment will be made regarding the degree of implementation of identified strategies versus the measured progress toward interim and final goals. If the percent of implementation is significantly higher than the percentage of the final goal achieved, optional strategies will be triggered. Additionally, data acquisition efforts and special studies and analyses described above may identify the need to initiate optional strategies or may identify new strategies. Primary optional strategies include:

More extensive application of structural outfall controls: Additional sites from the prioritization framework will be investigated and scheduled for structural outfall controls, as determined to be necessary to achieve goals.

More extensive retrofit of existing facilities: Instead of investigating opportunities for retrofit of existing stormwater facilities as part of outfall investigation and feasibility study, an optional strategy is to conduct a survey of existing facilities as part of a separate process. As a result, the scope of investigation would be expanded to include evaluation of existing facilities within the tributary area to outfalls that have not been identified as high priority for structural outfall controls, but where additional upland source control efforts are needed to provide reduction in flows reaching the outfall. As feasible opportunities are identified, they will be scheduled for implementation.

Pipe lining: If additional investigation reveals that unnatural dry weather flows at an outfall are resulting primarily from storm drain pipe leakage and causing water quality impairments, then a storm drain pipe lining project may be initiated in targeted areas.

2.3.3.8 Schedule and Cost Estimate Implementation of Strategies

Table 16summarizes the schedule for implementation of the strategies identified in this section. More specific discussion of scheduling and contingences is provided in the previous subsections.

Table 16: Summary of Schedule for Control Activities for Unnatural Water Balance HPWQC

Strategy	Implementation Period Ending in:					
	2020	2025	2030	2035	2040	2045
Expanded transitional monitoring observations	Completed by 2020	As needed				
Detailed flow monitoring at priority outfalls	Completed by 2020	As needed				
High-resolution imagery analysis	Completed by 2017	Obtain and reanalyze at 5-year interval or more frequently				
Permitted discharge inventory	Completed by 2018	Refresh periodically to identify new facilities				
Water impoundment inventory	Completed by 2018	Refresh periodically to identify new facilities				
Flow regime characterization	Completed by 2020	Update periodically, as needed				
Outfall prioritization	Initial prioritization completed; update in 2020 based on additional data	Update periodically, not less than every 5 years				
Outfall capture feasibility studies (cumulative number scheduled to be completed is shown)	20 studies completed by 2019	40 studies completed cumulatively	Additional studies, as needed to verify enough feasible projects to meet implementation targets			
New development/ redevelopment program	Program updates in 2017	Ongoing program implementation and refinements to guidance, criteria, and inspections				
RMV Ranch Plan	Ongoing implementation					
Dry weather flow reduction elements in wet weather retrofit BMPs	Opportunistic, subject to schedule for wet weather retrofits determined for other HPWQCs or other project drivers					
Dry weather flow retrofits within existing stormwater facilities	Identify as part of outfall feasibility studies; implement as identified and determined to be appropriate					

Strategy	Implementation Period Ending in:					
	2020	2025	2030	2035	2040	2045
Incentives for low water use landscaping and/or irrigation source controls	Ongoing "Overwatering is Out" initiative and subsequent versions, modifications, or expansions of similar programs					
Outfall control strategies	See anticipated schedule in **Table 17**.					

This schedule represents an aggressive commitment to a range of new efforts and capital investments. **Table 17** summarizes estimated new staffing requirements, budget requirements, and time requirements for these strategies. The necessity of additional data collection is the primary constraint on short-term activities. The primary new capital expenditure is associated with outfall controls. The overall plan represents a commitment to upwards of $30 million in capital investment, addition of 4 to 6 FTE and $1.5 million per year in new operational costs. To minimize short term staffing impacts and account for project lead times, this program must be phased over 20 to 30 years. Current source of budget for these projects is not identified, and project timing and phasing will be contingent on securing adequate budget.

Table 17: Summary of Time Requirements for Unnatural Water Balance HPWQC

Strategy	Time Requirements
Expanded transitional monitoring observations	1 to 2 years to visit all major and minor outfalls to collect new information
Detailed flow monitoring at priority outfalls	1 to 2 years required to complete monitoring and data analysis from priority outfalls
High-resolution imagery analysis	Initial analysis available by end of 2016. Subsequent updates require 2 to 4 months from time of data acquisition.
Permitted discharge inventory	6 months to 1 year
Water impoundment inventory	6 months to 1 year
Flow regime characterization	2 years new monitoring, 1 year analysis and reporting
Outfall prioritization	Initial prioritization completed; update contingent on completing initial data acquisition efforts; then periodic updates
Outfall capture feasibility studies	2 years to complete first set of 20 outfalls, including appropriate data acquisition and coordination with applicable agencies
New development/ redevelopment program	In place and ongoing
RMV Ranch Plan	In place and ongoing
Dry weather flow reduction elements in wet weather retrofit BMPs	Dependent on other HPWQC efforts

Strategy	Time Requirements
Incentives for low water use landscaping and/or irrigation source controls	In place and ongoing
Outfall control strategies	2 to 5 years to develop, permit, and construct project depending on complexity

2.3.3.9 Time Requirements for Optional Strategies

Feasibility and project scoping investigations for optional strategies will be completed within 1 year of identifying the need for optional controls. Strategies needed to meet interim targets will be implemented within five years of identification of feasible projects, as funding allows.

2.3.3.10 Responsibility for Strategy Implementation

Table 18 categorizes strategies as WMA strategies, multi-jurisdictional strategies, or jurisdictional strategies and identifies implementation responsibility.

Table 18: Summary of Responsibility for Strategy Implementation Unnatural Water Balance HPWQC

Strategy	WMA or Jurisdictional Strategy?	Responsibility
Expanded transitional monitoring observations	WMA	OC Stormwater Program
Detailed flow monitoring at priority outfalls	WMA	OC Stormwater Program
High-resolution imagery analysis	WMA	OC Stormwater Program
Permitted discharge inventory	Jurisdictional	SDRWQCB to provide data upon request for all permitted sites (NPDES, WDRs, NOAs, NOIs, etc.) Each jurisdiction responsible to review and compile inventory of facilities within jurisdiction
Water impoundment inventory	Jurisdictional	Each jurisdiction responsible to compile inventory of facilities within jurisdiction
Flow regime characterization	WMA	OC Stormwater Program
Outfall prioritization	WMA	OC Stormwater Program
Outfall capture feasibility studies	WMA	OC Stormwater Program
New development/ redevelopment program	Jurisdictional	Each jurisdiction implements program; County leads program document updates
RMV Ranch Plan	Jurisdictional	County jurisdiction
Dry weather flow reduction elements in wet weather retrofit BMPs	Jurisdictional/multi-jurisdictional	Led by jurisdiction leading/owning projects; jointly funded by jurisdictions within tributary area

Strategy	WMA or Jurisdictional Strategy?	Responsibility
Dry weather flow retrofits within existing stormwater facilities	Jurisdictional/multi-jurisdictional	Based on jurisdiction owning or responsible for existing facility; jointly funded by jurisdictions within tributary area
Incentives for low water use landscaping and/or irrigation source controls	WMA	OC Stormwater Program
Outfall control strategies	Jurisdictional/multi-jurisdictional	Led by jurisdiction owning outfall; jointly funded by jurisdictions within tributary area

2.3.4 Summary

Adequacy of Goals. The goals described in **Section 2.3.2** are directly related to the HPWQC identified. These goals are specific, measureable, and have interim goals at 5-year intervals.

The expected outcomes of achieving these goals are directly related to restoring beneficial uses of inland receiving waters, including:

- Restore non-perennial hydrologic conditions in reaches that have become perennialized through urbanization, providing a setting for more natural, higher quality, and more resilient ecological systems
- Reduce MS4-related dry weather pollutant loads contributing to in-stream water quality issues
- Support SOC IRWM efforts to reduce water consumption and capture dry weather flows for water supply augmentation; this provides a multiple benefit of reducing potable water demand
- Reduce hydrologic conditions conducive to invasive species, stagnation, vector, and other nuisance issues that affect water quality and recreational value
- Reduce number of concurrent stressors, which is expected to support and improve the efficiency of ongoing monitoring and assessment by allowing more precise identification of additional improvements that may be needed to restore beneficial uses, if any

With careful selection and implementation of strategies to achieve these goals, it is quite reasonable to expect that attainment of goals will result in significant improvement of beneficial uses in receiving waters.

Adequacy of Strategies. Given the spatial scope of this Plan and the data gaps that exist, it is mandatory that data collection and more focused planning efforts be included as primary near-term activities. Prioritization of these efforts is not intended to unnecessarily extend the duration of plan implementation. Rather these efforts are intended to result in a more appropriate and effective plan of action for future efforts that maximize benefit and avoid/minimize negative outcomes. Funds will also be used more efficiently due to effective planning.

The suite of controls that will be implemented is based on a hierarchy of source control before "end of pipe" control. However, the plan acknowledges the limitations of source control approaches and includes a rigorous, transparent decision framework and anticipated implementation schedule for engineered solutions to complement these approaches. Finally, optional approaches are identified to provide a contingency plan in the event that engineered solutions are not feasible or are not effective to the extent anticipated. As currently anticipated, approximately half of the total dry weather flow magnitude in the WMA will be addressed with structural measures (representing approximately one-quarter of the major outfalls) and the other half will be addressed with source control efforts. This distribution may be change as part of the iterative process.

Responsibility for initial activities has been documented in **Table 14**. Future activities, involving capital projects, have not been precisely identified and therefore responsibilities cannot be defined at this point. Specific projects and associated jurisdictional responsibility will be defined in subsequent updates of this Plan.

Based on the progress already noted toward goals, the current programs in place, and the proposed decision framework and specific commitments identified in this Plan, it is reasonable that the strategies identified, combined with refinements or additions to this Plan as part the iterative approach, will result in achievement of the interim and final goals.

Adequacy of Schedules. Key efforts are already underway and progress to date appears to be substantial. Based on the discussion presented in **Section 2.3.3.9**, the proposed schedules of goals and strategies represent a reasonable assessment of the time required to implement this Plan.

2.3.5 Annual Milestones for Next Permit Term

Consistent with Provision B.3.c of the MS4 Permit, annual milestones are identified for this HPWQC in **Table 19.**

Table 19: Annual Milestones for Unnatural Water Balance HPWQC

Year	Milestone
2018	• Update new development/redevelopment program documents to include specific measures to control dry weather flows from new development and redevelopment projects
2019	• Complete expanded transitional monitoring, detailed flow monitoring • Complete assessment of flow regime in each major receiving water • Update outfall prioritization
2020	• Complete first 20 outfall capture feasibility studies • Establish baseline quantification of Unnatural Dry Weather Flow from MS4 to Inland Receiving Water based on review of data from 2010 to 2020.
2021	• Obtain and analyze high resolution multi-spectral aerial imagery for 2021
2022	• Update Water Quality Improvement Plan to include specific outfall control projects • Document achievement of 2022 interim goal of 10 percent reduction in flow magnitude

2.4 Prohibitions and Limitations Compliance Option

As allowed per Provision B.3.c (Prohibitions and Limitations Compliance Option), the Permittees intend to rely on implementation of the Water Quality Improvement Plan to demonstrate compliance with the requirements of Provisions A.1.a, A.1.c, A.1.d, A.2, and A.3.b.

2.4.1 Highest Priority Water Quality Conditions

Provision B.3.c criteria are met for the three HPWQCs per the plans described in **Section 2.1 through Section 2.3**, including:

- Establishment of numeric goals and schedules
- Identification of strategies and schedules, including optional strategies and triggers
- Demonstration that strategies are reasonably expected to result in achievement of goals within the scheduled developed
- Establishment of annual milestones for the next five annual reporting periods

The basis for establishment of these HPWQCs is explained in Chapter B.2. A discussion of the adequacy of goals, strategies, and schedules are described in **Section 2.1.4, 2.2.4, 2.3.4**. Annual milestones are provided in **Section 2.1.6, 2.2.5,** and **2.3.5** of this Plan.

2.4.2 Priority Water Quality Conditions

Table 20 lists the other PWQCs that are being optionally enrolled in B.3.c provision per the allowance stated in Provision B.3.c.(1)(a)(v) and the spatial extent to which these PWQCs apply. The PWQCs listed in this table include the PWQCs from Chapter B.2 for which a HPWQC plan has not already been directly developed.

While HPWQC plans were not directly developed to target the PWQCs identified in **Table 20**, the strategies identified to meet the goals established for the three HPWQCs will have co-benefits related to these PWQCs. **Table 20** identifies the goals interim and final goals that pertain to each PWQC.

Table 20: Summary of Final and Interim Goals Relating to PWQCs

Condition/ Parameter	Geographic Scope (to extent known)	Relevant HPWQC Plan Elements with Co-benefits for Addressing PWQC
Nutrients and eutrophication indicators (e.g., algal growth, dissolved oxygen)	Inland water bodies where dry weather flows or standing water are present	Goals and strategies for elimination or treatment of unnatural dry weather discharges from MS4 outfalls per the plan described in **Section 2.3** are expected to have co-benefits associated with improvement in flow regime and reduction in nutrients and oxygen demanding substances originating from irrigation overspray and other urban sources. Source control strategies described in **Section 2.1** for controlling indicator bacteria and human pathogens, including pet waste management; absorbent landscaping/disconnection, street sweeping, trash management; identification and abatement of sewer cross connections and leakage entering the MS4, and other standard JRMP elements, are expected to have co-benefits for reduction of nutrients and oxygen demanding substances. Structural treatment strategies described in **Section 2.1** for controlling indicator bacteria and human pathogens, are expected to result in reduction of volume (and associated loads) and treatment of nutrients and oxygen demanding substances. Rehabilitation approaches to reduce scour pools and improve vegetative cover are expected to reduce the extent of disturbed stream channels conducive to eutrophication.

Condition/ Parameter	Geographic Scope (to extent known)	Relevant HPWQC Plan Elements with Co-benefits for Addressing PWQC
Turbidity	Inland, limited (limited to Prima and Segunda Deshecha Creeks)	Identification and abatement of major channel erosion issues per the plan described in **Section 2.2** is expected to reduce turbidity. Note, this PWQC is based on a 303(d) listing based on monitoring data obtained while there was significant active construction and prior to modern criteria for construction stormwater management and industrial site stormwater management. More stringent criteria for construction stormwater management and industrial site stormwater management are also expected to address turbidity in these watersheds.
Trash	Coastal and inland, as indicated in Exhibit A-11	Trash will be controlled through compliance with State Water Board Trash Amendments per the compliance schedule identified in the Amendments (outside of this Plan).
Index of biological integrity (IBI) or other bioassessment scores	Inland, where dry weather flows present and channel type supports biological functions	Eutrophication is a key limiting factor in biological integrity, therefore the co-benefits of HPWQCs to address eutrophication (identified above) are also anticipated to be effective for improvement of biological integrity. Rehabilitation of major active erosion issues per the plan described in **Section 2.2** combined with elimination of unnatural dry weather discharges and associated pollutant loads from MS4 outfalls per the plan described in **Section 2.3** are expected to reduce underlying physical habitat stressors that are linked to depressed biological integrity.

Condition/ Parameter	Geographic Scope (to extent known)	Relevant HPWQC Plan Elements with Co-benefits for Addressing PWQC
Toxicity and Pesticides	Inland channels, sporadic issues, where channel type supports biological functions. Toxicity is believed to be related to pesticides.	Goals and strategies for elimination or treatment of unnatural dry weather discharges from MS4 outfalls per the plan described in **Section 2.**3 are expected to have co-benefits associated reduction in pesticides. Source control strategies described in **Section 2.1** for controlling indicator bacteria and human pathogens, including absorbent landscaping/disconnection, street sweeping, trash management; identification and abatement of sewer cross connections and leakage entering the MS4 and other standard JRMP elements are expected to have co-benefits for reduction of pesticide and other potential toxic inputs (e.g., organic compounds, metals). Statewide source control and product phase-out strategies for pesticides (outside of this Plan) are also expected to result in benefits for reduction of pesticide toxicity.

2.4.2.1 Heisler Park Area of Special Biological Significance

Compliance with Attachment B to State Water Board Resolution 2012-0012, as amended by State Water Board Resolution No. 2012-0013 for Special Protections for Areas of Special Biological Significance (ASBS) shall be according to the City of Laguna Beach - Heisler Park Area of Special Biological Significance Compliance Plan (2014). The following structural control requirements indicated in the compliance plan have been constructed and are in operation.

- Heisler Park Nuisance Water Diversion Units
- Restrooms/Lift Station Rebuild Inside and Adjacent to the Heisler Park ASBS
- Low Impact Design (LID) Site Design BMPs at Heisler Park
- SmarTimer, Irrigation and Landscaping at Heisler Park
- Bluff Erosion Control and Drainage Improvements

Additional best management practices will be investigated and implemented if future monitoring indicates a problem within the Heisler Park ASBS.

2.4.3 Protection of Beneficial Uses

The principal beneficial uses addressed by this Plan include:

- REC-1 (San Juan Creek; Pacific Ocean only)
- REC-2
- WARM
- WILD
- COLD (San Juan Creek only)
- SPWN (Trabuco Creek only)

This list is based on the beneficial use present in urbanized portions of the SOC WMA (areas potentially impacted by urban runoff) that are associated with pollutants found on the 303(d) list or for which a TMDL is in place. Other beneficial uses with limited nexus to urban runoff based on spatial proximity and pollutants of concern include:

- AGR
- IND (San Juan Creek only)
- RARE (San Mateo Creek only)
- BIOL or SPWN in natural reaches outside of urbanized areas
- Various other beneficial uses applicable to coastal waters

HPWQCs have been identified in Chapter B.2 and plans for these HPWQCs have been developed in Chapter B.3 based on protection of those beneficial uses that have a nexus

to urban runoff. As described in Chapter B.2., the HPWQCs addressed in this Plan are focused on underlying water quality conditions and are specifically intended to be implemented in a phased and adaptive approach, where underlying processes and conditions are improved as the first phase. This framework has been formulated in response to the challenges presented by "urban stream syndrome" and the associated uncertainty in future conditions necessary to restore and protect beneficial uses. Within this framework, ultimate protection of beneficial uses will be achieved through (1) implementation of the strategies to address HPWQCs identified in this Plan, (2) monitoring and assessment, (3) adaptation of priority conditions, goals and/or strategies as needed, and (4) ongoing implementation of strategies to identify any new HPWQCs identified through this process. The execution of the detailed plans for HPWQCs described in **Section 2.1 through Section 2.3**, combined with monitoring, assessment, and adaptive management is expected to result in chemical, physical, and biological conditions protective of the beneficial uses of the applicable receiving waters.

Table 21 summarizes the conformance of this WQIP with the criteria in Provision B.3.c.

Table 21: Summary of Conformance to Provision B.3.c

Permit Provision	Summary of Conformance
c. PROHIBITIONS AND LIMITATIONS COMPLIANCE OPTION	
Each Permittee has the option to utilize the implementation of the Water Quality Improvement Plan to demonstrate compliance with the requirements of Provisions A.1.a, A.1.c, A.1.d, A.2, and A.3.b within a Watershed Management Area subject to the following conditions:	This option has been elected.
(1) A Permittee is eligible to be deemed in compliance with Provisions A.1.a, A.1.c, A.1.d, A.2, and A.3.b within a Watershed Management Area when the Water Quality Improvement Plan for a Watershed Management Area incorporates the following:	This provision is acknowledged
(a) Numeric goals, water quality improvement strategies, and schedules developed pursuant to Provisions B.3.a and B.3.b that include the following:	Numeric goals, water quality improvement strategies, and schedules have been defined for the three HPWQCs based on the criteria in Provisions B.3.a and B.3.b
(i) Interim and final WQBELs established by the TMDLs in Attachment E to this Order applicable to the Permittee's jurisdiction within the Watershed Management Area; AND	Goals for Pathogen Health Risk were established based on the Indicator Bacteria TMDL
(ii) Interim and final numeric goals for any ASBS subject to the provisions of Attachment B to State Water Board Resolution No. 2012-0012 (included as Attachment A to this Order) applicable to the Permittee's jurisdiction within the Watershed Management Area; AND	Not applicable. Attachment B to State Water Board Resolution No. 2012-0012 does not include goals relevant to the ASBS.
(iii) Interim and final numeric goals applicable to the Permittee's MS4 discharges within the Watershed Management Area expressed as numeric concentration-based or load-based goals for all pollutants and conditions listed on the Clean Water Act Section 303(d) List of Water Quality Impaired Segments8 for the receiving waters in the Watershed Management Area that do not have a TMDL incorporated into Attachment E to this Order; AND/OR	This option not elected.
(iv) Interim and final numeric goals for pollutants and conditions identified as receiving water priorities in the Water Quality Improvement Plan that will result in chemical, physical, and biological conditions protective of the beneficial uses of the receiving waters impacted by the Permittee's MS4 discharges within the Watershed Management Area; AND	This option elected for Channel Erosion and Unnatural Water Balance HPWQCs
(v) The Permittee has the option to include interim and final numeric goals applicable to the Permittee's MS4 discharges and/or receiving waters within the Watershed Management Area for any pollutants or conditions in addition to those described in Provisions B.3.c.(1)(a)(i)-(iv); AND	PWQCs identified in **Table 15** have been enrolled in this option. **Table 15** explains why the interim and final numeric goals for HPWQC address these PWQCs.
(vi) Schedules for achieving each final numeric goal that reflect a realistic assessment of the shortest practicable time needed for achievement; AND	**Sections 2.1, 2.2,** and **2.3** present the basis for development of schedules for goals.
(vii) For each final numeric goal developed pursuant to Provisions B.3.a and B.3.c.(1)(a)(i)-(v), annual milestones and the dates for their achievement must be included within each of the next five (5) Water Quality Improvement Plan Annual Report reporting periods, or until the final numeric goal is achieved. Annual milestones and the dates for their achievement for the 5 Water Quality Improvement Plan Annual Report reporting periods of the next permit term, or until the final numeric goal is achieved, must be provided as part of the Report of Waste Discharge required pursuant to Provision F.5.	**Sections 2.1.6, 2.2.5,** and **2.3.5** present annual milestones for each HPWQC for the next 5 annual reporting periods.
(b) An analysis that meets all of the following conditions:	
(i) The analysis, with clearly stated assumptions included in the analysis, must quantitatively demonstrate that the implementation of the water quality improvement strategies required under Provision B.3.b will achieve the final numeric goals within the schedules developed pursuant to Provisions B.3.a and B.3.c.(1)(a).	This analysis has been conducted and documented for each HPWQC. This analysis takes different forms, as applicable to the nature of the condition.
(ii) The development of the analysis must include a public participation process which allows the public to review and provide comments on the analysis methodology utilized and the	Documentation of analyses are included in Chapter B.3, which has a public comment period.

Permit Provision	Summary of Conformance
assumptions included in the analysis. Public comments and responses must be included as part of the analysis documentation included in the Water Quality Improvement Plan.	
(iii) The analysis may be performed by an individual Permittee or jointly by two or more Permittees choosing to utilize this compliance option for their jurisdictions within the Watershed Management Area.	This compliance option is elected by all Permittees in the WMA.
(iv) The analysis must be updated as part of the iterative approach and adaptive management process required under Provisions B.5.a-b.	This requirement is acknowledged
(c) Specific monitoring and assessments required pursuant to Provision B.4.a that will be performed by the Permittee capable of 1) demonstrating whether the implementation of the water quality improvement strategies is making progress toward achieving the numeric goals in accordance with the established schedules developed pursuant to Provisions B.3.a and B.3.c.(1)(a), and 2) determining whether interim and final numeric goals have been achieved. The specific monitoring and assessments must be updated as part of the iterative approach and adaptive management process required under Provision B.5.c.	This requirement is acknowledged and will be described in Chapter B.4
(d) Documentation showing that the numeric goals, schedules, and annual milestones proposed pursuant to Provision B.3.c.(1)(a), the analysis performed pursuant to Provision B.3.c.(1)(b), and the specific monitoring and assessments proposed pursuant to Provision B.3.c.(1)(c) have been reviewed by the Water Quality Improvement Consultation Panel (see Provision F.1.a.(1)(b)). Updates must be reviewed by the Water Quality Improvement Consultation Panel for any recommendations.	This requirement is acknowledged
(2) Each Permittee that voluntarily completes the requirements of Provision B.3.c.(1) is deemed in compliance with Provisions A.1.a, A.1.c, A.1.d, A.2, and A.3.b for the pollutants and conditions for which numeric goals are developed when the Water Quality Improvement Plan, incorporating the requirements of Provision B.3.c.(1), is accepted by the San Diego Water Board pursuant to Provision F.1.b or F.2.c.	This requirement is acknowledged

3 WATERSHED MANAGEMENT AREA ANALYSIS

3.1 Introduction

The Permit (Provision B.3.b.(4)), through inclusion of the Watershed Management Area Analysis (WMAA), provides an optional pathway for Permittees to develop an integrated approach for their land development stormwater planning programs by promoting evaluation of multiple strategies for water quality improvement and development of watershed-scale solutions for improving overall water quality in the watershed. The WMAA primarily applies to land development projects. In contrast, the WQIP applies primarily to existing development. Through the combination of these two elements, there may be potential for regional projects with watershed-scale benefits to be used in part to satisfy requirements for land development projects and in part to make progress towards WQIP goals.

The current Permit provides an option for Permittees to allow Priority Development Projects to satisfy stormwater control requirements on a regional- or watershed-based scale rather than onsite. The Permit indicates the first step in developing such a program and approach is "…identification of existing opportunities and constraints in order to prioritize areas of greater concern, areas of restoration potential, infrastructure constraints, and pathways for potential cumulative effects." This is a primary purpose of the WMAA. Therefore, performance of the WMAA is a first requisite step to allow for Priority Development Projects subject to post-construction pollutant control requirements to participate in offsite alternative compliance projects that yield greater overall water quality benefit to the watershed. These alternative compliance projects would be implemented in lieu of meeting full onsite pollutant retention and hydromodification management control requirements as is required for all Priority Development Projects.

As indicated, performance of the WMAA is the initial requirement to an Alternative Compliance program. Alternative Compliance program development as well as identifying qualifying alternative compliance (offsite) projects is subject to RWQCB approval (per Provision E of the Permit) and is not included in the B.3 submittal. To this end, preparation of the optional WMAA does not complete the development of an Alternative Compliance Program, but allows for continuation to pursue development of

such a program. The WMAA is comprised of the following three components as indicated in the Permit:

1. Perform analysis and develop Geographic Information System (GIS) layers (maps) by gathering information pertaining to the physical characteristics of the WMA (referred to herein as WMA Characterization). This includes, for example, identifying hydrologic and infiltration features of the watersheds, land uses, storm water conveyance and management facility locations that affect the watershed hydrology.

2. Using the WMA Characterization results, compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects. Such projects may include, for example, opportunities for stream or riparian area rehabilitation, opportunities for retrofitting existing infrastructure to incorporate storm water retention or treatment, or opportunities for regional BMPs, among others. Prior to implementing these candidate projects the Permittees must demonstrate that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of the onsite structural BMPs.

3. Additionally, using the WMA Characterization maps, identify areas within the watershed management area where it is appropriate to allow for exemptions from hydromodification management requirements that are in addition to those already allowed by the Permit for Priority Development Projects. The Permittees shall identify such cases on a watershed basis and include them in the WMAA with supporting rationale to support claims for exemptions.

The following sections describe each of these components as they apply to the SOC WMA.

3.2 Watershed Characterization

A directly applicable data set to satisfy the WMAA watershed characterization requirements has already been developed as part of the region's cooperative program to develop the Model Water Quality Management Plan (WQMP). The WQMP provides guidance to development project proponents with addressing post-construction urban runoff and stormwater pollution from new development and significant redevelopment projects that qualify as Priority Projects. A variety of geodata sets pertinent to the WMAA data requirements are available for viewing and download through the OC Environmental Resources Data Portal (https://ocenvironmentaldata.giscloud.com/). Specifically applicable to the WMAA are the (WIHMP) Watershed Infiltration & Hydromodification Management Plan data sets that are provided to evaluate opportunities for implementation of LID, identification of hydromodification conditions

of concern (HCOC), and watershed planning. In addition to the mapping exhibits provided in the B.2 section of the Plan, the following WIHMP mapping exhibits, specific to each of the five SOC HSAs, are provided in this Plan supplementing the GIS data that is available for download from the link indicated above:

- Watershed Extent
- Elevation Data
- Watershed Slope
- County Drainage Facilities
- Sub-basin and Facility Watershed Delineation
- Land Use
- Existing Imperviousness
- Existing Curve Number Analysis
- Precipitation – 85th Percentile
- Infiltration Constraints – Overall Constraints
- Infiltration Constraints – USGS D Soils (Low Permeability)
- Infiltration Constraints – Landslides
- Infiltration Constraints – Physiographic Features
- Erodibility (RUSLE)
- Feasible structural BMP siting locations

These mapping exhibits are presented in **Appendix I.1**.

3.3 Alternative Compliance Candidate Projects

The Permit requires that results from the watershed characterization noted in the previous section be used to evaluate and list candidate projects that could potentially be used as alternative compliance options for Priority Development Projects should an agency or jurisdiction opt to develop an alternative compliance program. Permittees must first conclude that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of structural BMPs onsite prior to implementing these candidate projects as alternative compliance projects.

It is anticipated that there will be a significant period of time undertaken to fully consider opting to develop an Alternative Compliance (AC) program and, if elected, develop the program. Over this period, should development of an AC program move forward, a more extensive effort to identify and list candidate projects will occur, and will be submitted as part of annual WQIP updates in accordance with Provision F. In the interim period, as part of this submittal, the stream rehabilitation projects identified in **Section 2.2** of the Plan will serve as the initial list of candidate projects for potential alternative compliance projects. As noted, these and any other potential project must first demonstrate that the project will have greater overall water quality benefit for the

WMA than fully complying with the onsite performance requirements for priority projects, in accordance with Provision E.3.c.(3).

3.4 Hydromodification Management Requirements for Coarse Sediment

Provision E.3.c.(2) describes the hydromodification management requirements for projects which includes the requirement for such projects to avoid critical coarse sediment yield, or implement measures that allow critical coarse sediment to be discharged to receiving water, such that there is no net impact to the receiving water. The function and importance of coarse sediment is described in the following passage from SCCWRP Technical Report 667 titled "Hydromodification Assessment and Management in California":

"Coarse sediment functions to naturally armor the stream bed and reduce the erosive forces associated with high flows. Absence of coarse sediment often results in erosion of in-channel substrate during high flows. In addition, coarse sediment contributes to formation of in-channel habitats necessary to support native flora and fauna."

Coarse sediment management requirements have been developed as part of the accepted 2015 SOC HMP. Specifically, Chapter 4 of the plan indicates the sediment supply management measures that are applicable to all priority projects. This chapter excerpt is provided in **Appendix I.2**.

3.5 Hydromodification Management Exemptions

Hydromodification, which is caused by both altered storm water flow and altered sediment flow regimes, is largely responsible for degradation of creeks, streams, and associated habitats in the Orange County Region. The purpose of the hydromodification management requirements in the Permit is to maintain or restore more natural hydrologic flow regimes to prevent accelerated, unnatural erosion in downstream receiving waters.

In some cases, priority development projects may be exempt from hydromodification management requirements if the project site discharges runoff to receiving waters that are not susceptible to erosion (e.g., a lake, bay, or the Pacific Ocean) either directly or via hardened systems including concrete-lined channels or existing underground storm drain systems.

Provision E.3.c.(2) of the Permit also provided interim exemptions for project discharges directly to:

1. An engineered channel conveyance system with a capacity to convey peak flows generated by the 10-year storm event all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean; and
2. Large river reaches with a drainage area larger than 100 square miles and a 100-year flow capacity in excess of 20,000 cubic feet per second, provided that properly sized energy dissipation is included at all Priority Development Project discharge points.

The Permit allows these interim exemptions to become permanent if acceptable analysis, data, and rationale for supporting the exemption can be provided. SOC stream and creek systems meeting the descriptions of the interim exemptions above were indicated in Tables 3-1 and 3-3, respectively, from the 2015 HMP as follows:

Table 3-1: Channels Exempt from Hydromodification Requirements in Orange County

Channel	Downstream Limit	Upstream Limit
Laguna Canyon Channel	Pacific Ocean	Philips Street
Sleepy Hollow Storm Drain	Pacific Ocean	Park Avenue
Bluebird Storm Drain	Pacific Ocean	Glenneyre Street
Aliso Creek Channel	Pacific Ocean	Pacific Coast Highway
Salt Creek Channel	Pacific Ocean	300 ft north of Pacific Coast Highway
San Juan Creek Channel	Pacific Ocean	Paseo Michelle
Prima Deshecha Canada Channel	Pacific Ocean	Avenida Vaquero
North Creek	Pacific Ocean	Doheny Park Road
Cacadita Canyon Storm Channel	Prima Deshecha Canada Channel	Via Cascadita
Segunda Deshecha Canada Channel	Pacific Ocean	Calle Frontera
Marquita Storm Channel	Pacific Ocean	Encino Lane
Trafalgar Storm Drain	Pacific Ocean	South Ola Vista

Table 3-3: Exempt River Reaches in South Orange County

River	Downstream Limit	Upstream Limit
San Juan Creek	Outfall to Pacific Ocean	Caper Park Road

These river and channel reaches were reevaluated as part of the Plan to determine if proposing a permanent exemption from hydromodification requirements is appropriate. All of the systems indicated above are recommended for permanent exemption either because it is a fully hardened system all the way to the ultimate receiving water, i.e., the Pacific Ocean, or the conveyance channel is not likely susceptible to hydromodification impacts. The rationale for systems meeting the second conclusion is provided in **Appendix I.3**.

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