OC Public Works
Integrity, Accountability, Service, Trust
Shane L. Silsby, Director

January 31, 2020

Dave Gibson, Executive Officer
California Regional Water Quality Control Board, San Diego Region
2375 Northside Drive, Suite 100
San Diego, CA 92108

Subject: South Orange County Watershed Management Area (San Juan Hydrologic Unit) 2018-19 Water Quality Improvement Plan Annual Report, Orange County MS4 Copermittees, Place ID: 794813:HYu

Dear Mr. Gibson:

The County of Orange, in cooperation with the Orange County Flood Control District and the 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 (Permittees), is pleased to submit the following document:

- South Orange County Watershed Management Area (San Juan Hydrologic Unit) 2018-19 Water Quality Improvement Plan Annual Report

This submittal comprises a South Orange County Watershed Management Area (SOC WMA) Water Quality Improvement Plan (WQIP) Annual Report prepared by the County as Principal Permittee and 12 individual Jurisdictional Runoff Management Program (JRMP) Annual Reports.

In a letter dated September 6, 2019, the San Diego Regional Water Quality Control Board (San Diego Water Board) provided comments on the 2017-18 SOC WMA WQIP Annual Report (WQIP AR Review Letter). The WQIP AR Review Letter also included Attachment 1 Adaptive Management General Topics which includes 11 elements that are to be assessed and addressed within the 2018-19 WQIP and JRMP Annual Report submittals for each WMA and Permittee in the San Diego Region. The 2018-19 SOC WMA WQIP Annual Report address these comments and Adaptive Management General Topics throughout the report. A summary of the WQIP AR Review Letter responses is provided in Appendix G and Adaptive Management General Topic in Appendix H.

At this time, the Permittees are revising the Comprehensive Human Waste Source Reduction Strategy (CHWSRS) Work Plan in response to comments provided in the WQIP AR Review Letter. This update will be completed shortly as it's currently going through a review by the SOC WMA Integrated Regional Water Management (IRWM) Management Committee. Responses to comments on the CHWSRS Work Plan will be submitted to the San Diego Water Board when the revisions to the work plan is complete.

Comments pertaining to the Coto De Caza MS4 outfall is addressed in the County of Orange's Jurisdictional Runoff Management Program (JRMP) Annual Report.

If you have questions, please contact Cindy Rivers at (714) 955-0674.

Sincerely,

Amanda Carr
Deputy Director
OC Environmental Resources

300 N. Flower Street, Santa Ana, CA 92703
P.O. Box 4048, Santa Ana, CA 92702-4048
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OC PublicWorks
Integrity, Accountability, Service, Trust
Shane L. Silsby, Director

RE: South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan Annual Report

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."

Amanda Carr
Deputy Director
OC Environmental Resources

1/30/20
Date

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RE: South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan Annual Report

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Moy Yahya, Environmental Programs Manager, City of Aliso Viejo

12-13-2019

Date

RE: South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan Annual Report

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Lisa Zawaski
Senior Water Quality Engineer
City of Dana Point

31 January 2020
Date

South Orange County Watershed Management Area (San Juan Hydrologic Unit)
WQIP Annual Report, Signed Certified Statement (PIN 236118)

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, P.E.
Director of Water Quality
City of Laguna Beach

1/28/2020
Date

Cc: Mary Vondrak, Senior Water Quality Analyst

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.

Kenneth H. Rosenfield, P.E.
Assistant City Manager/Public Services Director
City of Laguna Hills

1/8/2020
Date

CELEBRATING 30
City of LAGUNA NIGUEL
1989 - 2019

CITY of LAGUNA NIGUEL

30111 Crown Valley Parkway / Laguna Niguel, California, 92677
Phone / 949-362-4300 Fax / 949-362-4340

RE: South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan Annual Report (2018-2019 Report Year)

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."

Jacki Scott
Public Works Director/City Engineer
City of Laguna Niguel

12-6-2019
Date

RE: South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan Annual Report

SIGNED CERTIFIED STATEMENT:

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Moy Yahya, Water Quality Manager
City of Laguna Woods

11-6-2019
Date

South Orange County Watershed Management Area (San Juan Hydrologic Unit)
WQIP Annual Report, Signed Certified Statement (PIN 236212)

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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Greg Raths
Mayor

Brian Goodell
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Wendy Bucknum
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Trish Kelley
Council Member

Edward Sachs
Council Member

Subject: **South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan Annual Report**

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."

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

12/6/2019
Date

CITY OF RANCHO SANTA MARGARITA
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RE: Final South Orange County (San Juan Hydrologic Unit) Water Quality Improvement Plan

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."

Brendan Dugan
Public Works Director/City Engineer
City of Rancho Santa Margarita

1/31/20
Date

City of San Clemente

RE: South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan Annual Report

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Dave Rebensdorf
Utilities Director

1/30/2020
Date

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Subject: South Orange County Watershed Management Area (San Juan Hydrologic Unit) Water Quality Improvement Plan 2018-19 Annual Report

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.

Thomas Toman
Public Works Director
City of San Juan Capistrano

1/27/20
Date

South Orange County Watershed Management Area

Water Quality Improvement Plan
2018–19 Annual Report

Submitted to:
San Diego Regional Water Quality Control Board

Submitted by:

January 31, 2020

SOUTH ORANGE COUNTY
WATERSHED MANAGEMENT AREA

Water Quality Improvement Plan 2018-19 Annual Report

Submitted to the

San Diego Regional Water Quality Control Board

By:

The South Orange County Watershed Management Area Permittees (PID 794813) which consists of the County of Orange (PID 246113), Orange County Flood Control District (PID 246115) and the Cities of Aliso Viejo (PID 205031), Dana Point (PID 219073), Laguna Beach (PID 236118), Laguna Hills (PID 236131), Laguna Niguel (PID 236133), Laguna Woods (PID 236148), Lake Forest (PID 236212), Mission Viejo (PID 240995), Rancho Santa Margarita (PID 251715), San Clemente (PID 255215), and San Juan Capistrano (PID 255344)

January 2020

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Executive Summary

The South Orange County Watershed Management Area (SOC WMA) Water Quality Improvement WQIP (WQIP) identifies highest priority water quality conditions for the San Juan Hydrologic Unit and describes a framework of goals, strategies, and schedules, to protect and improve the condition of water bodies within this nearly 500 square mile region.

This annual report presents actions, milestones, and monitoring assessments from the 2018-19 reporting year. WQIP implementation commenced with acceptance by the Executive Officer of the San Diego Regional Water Quality Control Board on June 20, 2018. Therefore, this report covers the first full year of WQIP implementation. This report includes jurisdictional program activities between July 1, 2018, and June 30, 2019, and monitoring activities between October 1, 2018, and September 30, 2019. Discussion of WMA activities includes efforts and milestones through the end of December 2019.

The WQIP is oriented around three highest priority water quality conditions (HPWQCs): pathogen health risk, unnatural water balance and flow regime, and geomorphic impacts and channel erosion. Additionally, the WQIP includes monitoring and assessment program (MAP) and special studies updates, and other cross-cutting efforts that support measuring progress toward addressing the HPWQCs.

HPWQC Highlights

The main body of the annual report includes an overview of each HPWQC, actions taken, performance relative to milestones and goals, and commentary about outcomes via environmental condition assessments. Highlights of the actions taken and progress made for HPWQC are listed below.

Pathogen Health Risk

- Completed development of a proposed Work Plan for the Comprehensive Human Waste Source Reduction Strategy (CHWSRS) and submitted it for review and approval in June 2019.
- Initiated microbial source tracking (MST) investigations consistent with the CHWSRS Work Plan, including an investigation at the San Clemente Pier in response to elevated fecal indicator bacteria, and applied MST methods as part of outfall capture feasibility studies at 11 outfalls.
- Inspected and cleaned over 660 miles of channels and stormdrains, resulting in over 3,000 tons of trash and debris collected.
- Street sweeping programs collected over 4,900 tons of trash and debris throughout the WMA.
- Implemented bird netting and falconry to deter birds at beaches with elevated fecal indicator bacteria.
- Implemented comprehensive human services programs to address and clean up abandoned encampments.
- Achieved “Honor Roll” status in the Heal the Bay 2018-19 Beach Report Card at 6 beaches in the WMA.

Unnatural Water Balance and Flow Regime

- Conducted dry weather outfall capture feasibility studies at 20 major outfalls, including high-resolution flow monitoring, innovative analytical methods, and incorporation of water consumption data to improve flow source identification.
- Continued the development of performance measures and calculation guidance to support a quantitative approach toward measuring progress in future reports.
- Developed an inventory of permitted discharges and assessed their potential contribution to unnatural flows at MS4 outfalls.
- Developed an inventory of water impoundments, withdrawals, and diversions and assessed their potential impact on dry weather flow regimes.
- Began work on the Flow Ecology Special Study, intended to characterize current flow regimes and support decisions about flow management to support desired habitats and species.
- Initiated the "Smart Watershed Network" project as part of a task force formed by Moulton Niguel Water District (MNWD), consisting of Permittees, and local non-profit coalitions, which focuses on dry weather urban runoff issues, and has already supported a number of initiatives.

Geomorphic Impacts and Channel Erosion

- Conducted the first season of Hydromodification Management Plan (HMP) effectiveness monitoring.
- Received and reviewed geomorphic monitoring conducted by Rancho Mission Viejo for San Juan Creek and tributaries.
- Initiated the process to finalize the Conceptual Geomorphically Referenced Basis of Design Guidelines (GRBoD).
- Continued to require HMP design standards for Priority Development Projects.
- Initiated the Aliso Creek Project Collaboration Framework, with a desired outcome of improving geomorphic conditions to support functional and resilient riparian ecosystems

Achievement of Milestones

As part of enrollment in the Provision B.3.c compliance option, the WQIP includes annual milestones. Annual milestones for the 2018-19 reporting year were completed as planned and are summarized below.

HPWQC	2019 Milestone	Status	Cross Reference for Additional Detail
Pathogen Health Risk	Developed the CHWSRS Work Plan with input from stakeholders and submitted for San Diego Regional Water Quality Control Board Review	Met	Section 3.2.1
Channel Erosion	Performed the first year of ongoing HMP effectiveness monitoring in Chiquita Creek	Met	Section 5.2.1, Appendix A.4
Channel Erosion	Received and assessed stream monitoring data and reports associated with the Rancho Mission Viejo development	Met	Section 5.2.1, Appendix A.4
Unnatural Water Balance	Completed an inventory of permitted facilities in the WMA and assessed their potential contribution to dry weather flows	Met	Section 4.2.1and 7.6

HPWQC	2019 Milestone	Status	Cross Reference for Additional Detail
Unnatural Water Balance	Completed an inventory of water impoundments in the WMA and assessed their potential contribution to dry weather flows	Met	Section 4.2.1 and 7.7

MAP Assessment

The table below provides an overview of sampling events conducted in the 2018-19 reporting year. Dry weather samples collected as part of the Unified Beach Monitoring is used to assess dry weather compliance with Baby Beach TMDL and Beaches and Creek TMDL. Instances of these sample counts are notated in the table.

Summary of 2018-19 MAP Sampling Events

Monitoring Programs		Sampling Duration	Sampling Events Conducted (Count)	Samples/Observations Collected (Count)
WMA Monitoring Assessments				
Receiving Water Monitoring	Wet	Oct 2018 – Mar 2019	2 sampling events at 7 monitoring locations	27 composite samples (nutrients, metals, pesticides, and other parameters, aquatic toxicity), and 28 grab samples (indicator bacteria)
MS4 Outfall Field Screening	Dry	Apr 2019 – Sep 2019	2 events	792 outfalls field screenings (320 outfalls had at least two field screening records)
MS4 Outfall Discharge Assessment	Wet	Oct 2018 – Jan 2019	1 sampling event at 12 outfalls and 2 sampling events at 2 outfalls	16 composite samples (conventional, nutrients, metals) and 14 grab samples (1 with conventional, nutrients, metals, indicator bacteria, 13 with only indicator bacteria)
	Dry	Apr 2019 – Sep 2019	2 sampling events conducted at 58 outfalls (11 were observed to be ponded or dry)	92 grab samples (nutrients, metals, pesticides, toxicity, indicator bacteria, other parameters)
MS4 Outfall Discharge Assessment (Outfall Capture Feasibility Study)	Dry	May 2019 – Sep 2019	6 sampling events (3 events at 9 outfalls and water sources; 3 events at 11 outfalls and water sources)	118 grab samples (select general minerals, indicator bacteria, Personal Care Products (PPCPs), HF183, water isotopes, nitrate isotopes, and other parameters; 9 grab samples counted in MS4 Outfall Discharge Assessment samples above).
HMP Effectiveness Assessment	Dry	Aug 2019	1 event at 5 stations	No water chemistry samples collected; 5 field measurements and additional metrics (channel conditions, bioassessment, and CRAM)

Monitoring Programs		Sampling Duration	Sampling Events Conducted (Count)	Samples/Observations Collected (Count)
ASBS Monitoring Assessment	*Implemented as part of Bight Regional Monitoring*			
Regional Monitoring Assessments				
Urban Stream Bioassessment	Dry	Apr 2019 – Jun 2019	1 sampling event at 7 targeted stations and 4 SMC stations	11 grab samples (general minerals, nutrients, aquatic toxicity), and 4 sediment samples (pesticides, toxicity)
Unified Beach Monitoring	Dry	Oct 2018 – Sep 2019	47 sampling events at 48 stations	861 grab samples (indicator bacteria)
Bight Regional Monitoring	Dry	Aug 2019 – Sep 2019	8 sampling events at 2 stations	16 grab samples (coliphage)
Total Maximum Daily Loads				
Baby Beach (Dana Point Harbor)	Wet	Oct 2018 – Sep 2019	13 sampling events at 4 stations	44 grab samples (indicator bacteria, total suspended solids)
Beaches and Creeks (Aliso Creek, San Juan Creek, San Clemente)	Wet	Oct 2018 – Mar 2019	20 sampling events	715 grab samples (indicator bacteria)
	Dry	Oct 2018 – Sep 2019	17 sampling events	512 grab samples (indicator bacteria; samples collected/counted in the Unified Beach Monitoring samples above)
	Dry	Oct 2018 – Sep 2019	47 sampling events at 4 stations	140 samples (indicator bacteria; samples collected/counted in the Unified Beach Monitoring samples above)
Beaches and Creeks and Baby Beach - Microbial Source ID)	Dry	Oct 2018 - Sep 2019	114 sampling events at 6 monitoring locations	213 grab samples (microbial indicators)

Special Studies and Other Cross-Cutting Efforts

Special studies and program management cut across all HPWQCs, providing valuable information for setting baselines and maintaining focus on the goals of the WQIP. Key cross-cutting efforts are summarized below.

San Diego Regional Reference Streams and Beaches Studies

In July 2018, we initiated an assessment of nutrients and metals data collected from 2012-2015 which included wet weather sampling during eight storm events at five sites, for a total of 126 samples. In addition, 180 samples were collected during dry weather sampling in 10 intermittent stream sites in 10 watersheds located in San Diego, Orange and Ventura Counties. Sites were selected to meet reference screening criteria and to represent a mix of watershed size and sedimentary versus igneous/metamorphic geology. The human-associated fecal microbial source marker HF183 was used to eliminate sites or samples with potential human contamination, a helpful assurance for nutrients and organic matter concentrations. Wet and dry weather concentrations, loads and fluxes from this study were compared with data from previous studies in the region. The final report "Wet and Dry Weather Natural Background

Concentrations of Nutrients, Heavy and Trace Metals, and Conventional Constituents in Southern California Streams" is included in Appendix I.

Stormwater Quality Asset Inventory and Pollutant Load Reduction Estimates

In recognition of the need to standardize water quality asset tracking and performance assessment, we are implementing a special study to develop a water quality asset inventory and model the pollutant load reduction provided by those assets. As part of this study, we are developing an open-source web application (OC Stormwater Tools). We have completed modules to support best management practice (BMP) inventory, condition assessment, maintenance tracking, catchment delineations, and trash capture calculations. Permittees have inventoried more than 3,400 BMPs and 400 water quality management plan (WQMP) sites in the WMA thus far. Work is in progress to continue populating the inventory. Work is also in progress on modules to calculate pollutant load reductions and support progress reporting.

Evaluation of Baseline and Reference In-stream Flow Conditions

We initiated the "Flow Condition" or "Flow Ecology" special study in Spring 2019. The purposes of the study are to (1) evaluate current flow conditions using key ecological flow metrics, (2) evaluate potential changes in flow conditions and ecological flow metrics in the future, and (3) provide datasets to support future decisions about ecosystem restoration and flow management.

In 2019, we performed foundational analyses for this study including data compilation, hydrologic modeling, and review of available habitat and species data. We also held multiple workshops with key stakeholders, and defined scenarios and anticipated study work products. Each of these efforts will continue into 2020.

Watershed-Scale Project Collaboration - Aliso Creek Watershed Collaboration Group

Following direction from the SOC WMA Integrated Regional Water Management (IRWM) Group Executive Committee, County staff initiated a watershed-scale project collaboration framework to develop and support water resource projects by providing valuable collaboration opportunities among partners. Introduction of this framework commenced within the Aliso Creek Watershed with plans to mirror similar efforts in other watersheds of the SOC WMA. A wide range of stakeholders are participating in the Aliso Creek Watershed Collaboration Group including Permittees, water and wastewater agencies, environmental non-profits, transportation agencies, Federal and State regulatory/resource agencies, academic institutions, and other non-governmental organizations. The Aliso Creek Watershed Collaboration Group met three times in 2019, resulting in a unified set of "desired outcomes" for the watershed and a framework for coordinating project contributions to these outcomes. Additional information regarding stakeholder outreach conducted during the reporting year is included Appendix E.

WQIP Performance Measures and Results Chains

We worked toward a performance-based approach for tracking outcomes in WQIP implementation, including developing draft performance measures for each HPWQC and draft calculation guidance for a subset of these measures. This approach is intended to enable us to maximize water quality benefits achieved from implementation of strategies and demonstrate progress towards achieving goals.

Report Structure

The main body of the annual report includes detailed information about HPWQCs, progress of strategy implementation, achievement of milestones, monitoring and assessment program findings, and progress on special studies and other cross-cutting efforts. The appendices to the annual report include detailed analyses, datasets and full context for various aspects of WQIP implementation. An annotated outline of the appendices is included below.

Appendix A: WMA Monitoring Assessments

Appendix A.1: Receiving Water Monitoring Assessment

Appendix A.2: MS4 Outfall Discharge Assessment

Appendix A.3: Sediment Monitoring Assessment

Appendix A.4: HMP Effectiveness Monitoring Assessment

Appendix A.5: Area of Special Biological Significance Monitoring Assessment

Appendix B: Regional Monitoring Assessments

Appendix B.1: Southern California Stormwater Monitoring Coalition Regional Monitoring Program

Appendix B.2: Unified Beach Monitoring Assessment

Appendix B.3: Southern California Bight Regional Monitoring Program

Appendix C: TMDL Assessments

Appendix C.1: Baby Beach TMDL

Appendix C.2: Beaches and Creeks TMDL

Appendix D: Quality Assurance Report and Monitoring Completeness

Appendix E: Public Education and Outreach

Appendix F: Jurisdictional Runoff Management Program Annual Report Forms, Jurisdictional Highest Priority Water Quality Condition Strategies Updates

Appendix G: 2017-18 Water Quality Improvement Plan Annual Report Review Letter Response to Comments

Appendix H: Adaptive Management General Topics

Appendix I: Wet and Dry Weather Natural Background Concentrations of Nutrients, Heavy and Trace Metals, and Conventional Constituents in Southern California Streams

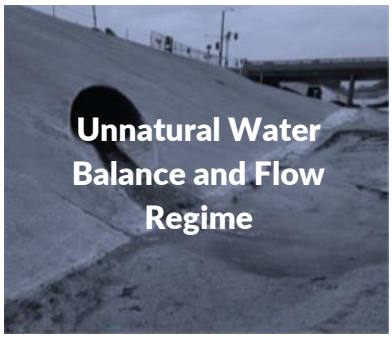
Appendix J: WQIP Amendments

1 Introduction

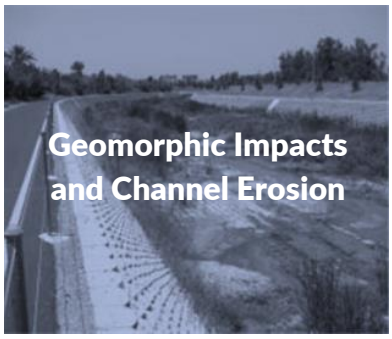
1.1 WQIP Background

The South Orange County Watershed Management Area (SOC WMA) Water Quality Improvement Plan (WQIP) identifies priority water quality conditions for the San Juan Hydrologic Unit and describes a system of goals and strategies to protect and improve the condition of its water bodies. The WQIP is oriented around three highest priority water quality conditions (HPWQCs):

This priority applies to recreational waters in dry and wet weather conditions. Strategies focus on addressing human sources of pathogenic microorganisms to reduce health risks to swimmers, surfers, and other water recreators.



This priority applies to streams and estuaries, particularly during dry weather. Strategies focus on reducing unnatural flows to these systems to restore natural flow regime, decrease pollutant loads, and improve water quality, riparian habitat, and biological condition.



This priority applies to streams that are experiencing excess channel erosion and associated impacts to the physical structure of the streams. Strategies focus on restoration of priority segments to help arrest further degradation and improve physical conditions for habitat regeneration to occur.

Together, these three HPWQCs serve as a framework for guiding near-term actions and assessing progress toward addressing issues of importance to the local community.

1.2 Annual Report Purpose & Objectives

We[1] have prepared this annual report to provide clear and targeted information to demonstrate compliance with the San Diego Regional MS4 Permit (Order R9-2013-0001 as amended by Order No. R9-2015-001 and Order No. R9-2015-0100) (Permit) and consistency with the commitments of the WQIP. We intend to achieve several other objectives with the form and content of this report:

- Summarize relevant information in a convenient format
- Focus on HPWQC and effective actions to improve them

[1] The use of "we" "our" and "us" in this annual report is intended to refer to the South Orange County Permittees, which includes the County of Orange, Orange County Flood Control District, and the 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.

- Clearly differentiate between completed actions and future expectations
- Communicate the value of a collaborative, integrated stormwater program

This annual report presents actions (i.e., implementation of strategies), performance (i.e., achievement of milestones), and monitoring results from the 2018-19 reporting year; however, it should be noted that significant environmental outcomes of the WQIP are unlikely to be discernible from environmental variability at the annual time scale. Therefore, this annual report will be complemented every five years by a more detailed integrated assessment and adaptive management process that may recommend changes in strategies, milestones and other elements of the WQIP.

1.3 Regulatory Basis and Time Period Included

We developed the WQIP in response to Provision B of the Permit. The WQIP was accepted by the San Diego Regional Water Quality Control Board (Water Board) Executive Officer on June 20, 2018. Per Provisions B.3.c.(2) and F.3.b.(3) of the Permit, the WQIP annual report must include (paraphrased):

- WQIP progress, including:
    - Strategies implemented or no longer implemented
    - Progress toward milestones
    - Strategies planned for the next reporting year
    - Proposed modifications to strategies
    - Previous modifications to the WQIP, Jurisdictional Runoff Management Programs (JRMPs), or Best Management Program (BMP) Design Manuals
    - Proposed modifications to the WQIP, JRMPs, or BMP Design Manuals
- Progress of special studies
- Receiving water and outfall monitoring data
- Findings of assessments

This annual report documents the first full year of WQIP implementation. This considers monitoring data collected between October 1, 2018, and September 30, 2019, as well as jurisdictional program activities from July 1, 2018, to June 30, 2019. Discussion of watershed management area (WMA) activities includes efforts and milestones through the end of December 2019.

1.4 Report Organization

We have organized this report to focus on the three primary HPWQCs and crosscutting special studies that serve one or more HPWQCs. Each HPWQCs section includes an overview of the HPWQC, actions we have taken, performance relative to milestones and goals, and commentary about outcomes via an environmental condition assessment (**Figure 1**). A summary of findings for the monitoring and assessment program (MAP) is also included.

Major components of this annual report include:

- **Executive Summary** - Provides highly summarized information about the WQIP HPWQCs, special studies, and milestones as well as an annotated outline of the appendices.
- **Annual Report Body** - Provides summarized results and evidence with references to further information available in the appendices or outside sources. The report body is intended to focus primarily on the HPWQCs, MAP and special studies overview, and cross-cutting efforts that support HPWQCs.

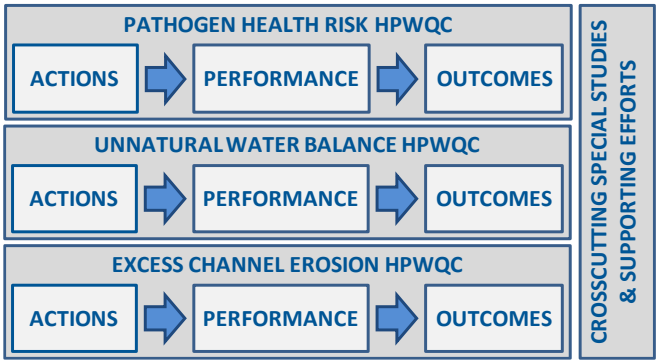


Figure 1. HPWQC Outline Flow Chart

- **Appendices** - Provides detailed analyses, datasets and full context available to back up findings and recommendations presented in the annual report body. The appendices include the following:
  - **A** - Watershed Management Area Monitoring Assessments
  - **B** - Regional Monitoring Assessments
  - **C** - Total Maximum Daily Load (TMDL) Assessments
  - **D** - Quality Assurance Report and Monitoring Completeness
  - **E** - Public Education and Outreach
  - **F** - JRMP Annual Report Forms, Jurisdictional HPWQC Strategies Updates
  - **G** - 2017-18 WQIP Annual Report Review Letter Response to Comments
  - **H** - Adaptive Management General Topics
  - **I** - Wet and Dry Weather Natural Background Concentrations of Nutrients, Heavy and Trace Metals, and Conventional Constituents in Southern California Streams
  - **J** - WQIP Amendments

1.5 B.3.c Reporting Approach

The WQIP was developed to satisfy Provision B.3.c of the Permit for the selected HPWQCs and PWQCs. This annual report is intended to support the San Diego Water Board's evaluation of ongoing compliance with Provision B.3.c of the Permit. Provision B.3.c.(2) identifies the core assessments needed to demonstrate continued eligibility for B.3.c coverage. **Table 1** summarizes our approach.

Table 1. Summary of Reporting Approach for B.3.c. Eligibility

Permit Provision	Key Required Demonstrations to Maintain B.3.c Eligibility (paraphrased)	Key Annual Report Elements to Demonstrate Eligibility
B.3.c.(2)(a)	Strategies identified in Chapter 3 of the WQIP are implemented on schedule.	Within each HPWQC section (3 through 5), we have included a summary table describing the status of strategy implementation and cross-references for additional details.
B.3.c.(2)(b)	The monitoring and assessment program described in Chapter 4 is implemented as approved; data are used to assess progress and compliance with goals.	In each HPWQC section (3 through 5) we provide a summary of key findings from the MAP. In addition, Appendix A, B, and C provide more comprehensive assessments and Appendix D presents the monitoring completeness check of the MAP and quality of the data collected.
B.3.c.(2)(c)	Annual milestones identified in Chapter 3 are met on schedule, or an acceptable rationale and WQIP adaptation is provided.	In Section 2.2, we provide a summary of milestone achievement. Additional information is included in each HPWQC section.
B.3.c.(2)(d)	Any proposed modifications to numeric goals, strategies, schedules, and/or milestones are accepted by the San Diego Water Board.	We do not propose changes to numeric goals, strategies, schedules, or milestones this reporting year.
B.3.c.(2)(e)	The iterative approach (Permit Provision A.4) is used to make changes to the WQIP over time, as needed.	Appendix H provides our response to the Adaptive Management General Topics identified by the San Diego Water Board in the September 6, 2019, review letter for the 2017-18 WQIP Annual Report. We plan to perform an integrated assessment and adaptive management process at a 5-year interval.

2 Program Summary

2.1 Highlights

Beginning with the identification of the HPWQCs in 2016, we began developing new tools, implementing new strategies and adapting elements of the MAP to align with these priorities. Last year, we reported on our first partial year of WQIP implementation, including initiation of several key efforts within the new WQIP framework. This year we are excited to report on our first full year of WQIP implementation. We continued many of the foundational activities initiated last year and expanded our efforts, including both WMA and jurisdictional strategies. Our most significant highlights include:

- Completed development of a proposed Work Plan for the Comprehensive Human Waste Source Reduction Strategy (CHWSRS) and submitted it on June 20, 2019.
- Initiated microbial source tracking (MST) investigations at the San Clemente Pier consistent with the CHWSRS Work Plan, and applied MST analysis at 11 outfalls as part of the outfall capture feasibility studies.
- Continued avian control strategies at Poche Beach and Salt Creek mouth to reduce fecal indicator bacteria counts in those recreational waters.
- Over 4,000 pounds of trash was removed from within the receiving water during three SOC WMA city-sponsored trash cleanups.
- Inspection and cleaning of the MS4, including over 660 miles of channel and pipe cleaned and inspected as well as panoramic video monitoring. Over 3,000 tons of trash and debris was reported to be removed from SOC WMA MS4s (catch basin, storm drain pipes, and channels) through these efforts.
- Street sweeping programs collected over 4,900 tons of trash and debris throughout the SOC WMA.
- To date, the countywide Adopt A Channel (AAC) Program has removed over 23,693 pounds of trash over the five years of program implementation.
- Completed the San Diego Regional Reference Streams and Beaches Studies.
- Conducted diurnal dry weather discharge monitoring to support outfall capture feasibility studies at 20 major outfalls. These cover 16 percent of developed land area and make up an estimated 37 percent of the total WMA dry weather flow. Through these studies, we are evaluating various methods to determine the source of dry weather flows and support jurisdictional and WMA flow management decisions.
- Implemented jurisdictional illicit discharge detection and elimination programs. As part of this, Permittees incorporated information from outfall field screening and outfall discharge monitoring to inform outfall prioritization and follow-up investigations.
- Developed jurisdictional inventories of individually permitted sites and water impoundments.
- Required priority development projects to implement site design, source control, and/or structural BMPs to eliminate non-exempt non-stormwater discharges as part of jurisdictional development review.
- Conducted the first season of additional Hydromodification Management Plan (HMP) effectiveness monitoring and reviewed stream monitoring conducted by Rancho Mission Viejo. This supports the assessment of the adequacy of the 2017 HMP design standards.

- Applied HMP requirements to priority development projects as part of jurisdictional development review.
- Began work on the Flow Ecology Special Study, intended to characterize current flow regimes and support decisions about flow management to support desired habitats and species. We have formed and met with key stakeholder groups to support this study.
- Initiated the Aliso Creek Project Collaboration Framework, with a desired outcome of achieving functional and resilient riparian ecosystems. Permittee participation in this group will facilitate development of watershed projects, including ecosystem restoration efforts for Aliso Creek.
- Developed additional modules of the OC Stormwater Tools to support BMP catchment delineations and implementation of the statewide trash provisions.
- Permittees used the OC Stormwater Tools platform to inventory BMPs and priority development project (PDP) sites. Current inventoried treatment BMPs cover 20,400 acres (31 percent of developed area in the WMA). Jurisdictional inventories are a work in progress.

Additional information on these highlights is provided in the following sections. Additionally, this report provides more comprehensive summaries of strategy implementation within each of the HPWQC sections.

2.2 Annual Milestones

As part of enrollment in the Provision B.3.c compliance option, the WQIP includes annual milestones. The status of 2019 milestones are summarized in **Table 2** and upcoming 2020 milestones are summarized in **Table 3**.

Table 2. Summary of Milestone Achievement for B.3.c Compliance in 2019

HPWQC	2019 Milestone	Status	Cross Reference for Additional Detail
Pathogen Health Risk	Developed the CHWSRS Work Plan with input from stakeholders and submitted for San Diego Water Board Review	Met	Section 3.2.1
Channel Erosion	Performed the first year of ongoing HMP effectiveness monitoring in Chiquita Creek	Met	Section 5.2.1, Appendix A.4
Channel Erosion	Received and assessed stream monitoring data and reports associated with the Rancho Mission Viejo development	Met	Section 5.2.1, Appendix A.4
Unnatural Water Balance	Completed an inventory of permitted facilities in the WMA and assessed their potential contribution to dry weather flows	Met	Section 4.2.1and 7.6
Unnatural Water Balance	Completed an inventory of water impoundments in the WMA and assessed their potential contribution to dry weather flows	Met	Section 4.2.1 and 7.7

Table 3. Summary of Upcoming 2020 Milestones for B.3.c Compliance

HPWQC	Upcoming 2020 Milestone
Pathogen Health Risk	Complete at least 30 percent of the scope of dry weather source investigation activities identified in the CHWSRS Work Plan
Channel Erosion	Finalize GRBoD Guidelines based on input from resource/permitting agencies

HPWQC	Upcoming 2020 Milestone
Channel Erosion	Perform the second year of ongoing HMP effectiveness monitoring in Chiquita Creek
Channel Erosion	Receive and assess stream monitoring data and reports associated with the Rancho Mission Viejo development
Unnatural Water Balance	Complete expanded outfall monitoring, perform detailed flow monitoring
Unnatural Water Balance	Complete assessment of flow regime in each major receiving water
Unnatural Water Balance	Expand transitional monitoring observations
Unnatural Water Balance	Complete first 20 outfall capture feasibility studies

2.3 Lessons Learned and Adaptive Management Considerations.

Our intent is to use the annual report as an opportunity to reflect on major lessons learned during the previous year. This supports the adaptive management process. Key lessons learned are included below:

- **We identified key challenges associated with the CHWSRS approach and developed approaches to overcome these**. Through reliance on the expertise of our water and wastewater agency partners within the South OC WMA IRWM Group to support development of the CHWSRS Work Plan, we learned a great deal about source investigation tools and methods that will work most effectively for the communities within south Orange County. Based on this partnership, we are collaborating on research efforts and exploration of advanced and improved methods to identify sources of human waste.

- **Three monitoring stations in the WMA observed increased exceedances in receiving water limitations this year: Salt Creek Mouth, Poche Beach and San Clemente Pier**. Canine, avian, and human sources are suspected. An MST investigation is underway at the San Clemente Pier, consistent with the framework established in the CHWSRS Work Plan. Additionally, we are trialing the use of avian source controls (bird netting and falconry) to reduce inputs from avian source. These cases studies will provide valuable information about the effectiveness of these strategies.

- **We saw value in a function-based stream restoration hierarchy for stakeholder collaboration.** We have found that the function-based framework for stream restoration that is foundational to the WQIP has been useful, especially as the Aliso Creek Watershed Collaboration Group continues to meet to discuss current and potential projects. A function-based framework for stream restoration has helped to align the desired outcomes developed by the collaboration group with the strategies and goals of the WQIP strategies. It has also provided a useful conceptual framework for us to organize the findings of existing studies and identify data gaps.

- **We confirmed the need to coordinate unnatural water balance management with water agency goals and restoration planning.** The WQIP includes goals to eliminate unnatural flows from MS4s to receiving waters but also identifies exception cases where it may be more beneficial to allow

dry weather flows to continue to discharge. Through stakeholder processes associated with the Aliso Creek Watershed Collaboration Group and the Flow Ecology Special Study, we have learned that these exceptions may be appropriate in some areas where dry weather flows are considered necessary to support groundwater augmentation and riparian ecosystems. This confirms the need to continue to have close coordination with water agencies and restoration planning efforts to support flow management decisions and reinforces the importance of the Flow Ecology Special Study.

- **We reflected on Adaptive Management General Topics identified by the San Diego Water Board.** The San Diego Water Board identified a list of 11 Adaptive Management General Topics for the Permittees to consider in developing this Annual Report. This served as a prompt to reflect on new data and new feedback and assess any adaptive changes to the WQIP. Appendix H includes our assessment and proposed approach for adapting the WQIP to address these topics.

While we continue to collect data and use monitoring and assessment findings and other feedback to evolve how we implement strategies, we have not conducted a significant reevaluation of priorities or strategies to date. As WQIP implementation has been underway for less than 2 years, we are primarily focused on strategy implementation and data gathering before starting a formal adaptive management process to reevaluate these strategies. We plan to perform an integrated assessment and adaptive management process at a 5-year interval.

3 Pathogen Health Risk HPWQC

3.1 Overview

Use source tracking to target cost-effective control measures that reduce pathogen loads and swimmer illness rates

Human pathogens refer to a wide category of microorganisms, such as bacterium, protozoa, and viruses that cause illness in humans. Waterborne, fecal-derived human pathogens are a key source of impairment of recreational beneficial uses due to the risk they pose to human health. Fecal indicator bacteria (FIB) (total coliform, fecal coliform, *Escherichia Coli*, and *Enterococcus*) are not human pathogens but are used as indicators of pathogens present in water as they have been historically easier and less costly to measure and have been shown to correlate with illnesses.

Numerous ongoing efforts throughout Southern California are beginning to show that a microbial source tracking (MST)-based, and pathogen-focused approach should result in greater public health benefit for significantly lower cost than traditional approaches that focus on the treatment of indicator bacteria in stormwater runoff. For example, the San Diego Region Wet Weather Bacteria Cost Benefit Analysis[2] (2017) showed that a human waste source control approach would have approximately 20 times greater benefit per unit cost than a traditional stormwater control approach. Additionally, scientific advancements in MST and pathogen detection are resulting in the commercial availability of more reliable and less expensive analytical techniques.

The strategies we have described in the WQIP align with these advancements in scientific understanding and monitoring techniques. While our current jurisdictional efforts to control bacteria will remain in effect, the new initiatives we undertake as part of the WQIP will focus principally on human waste source identification and abatement. Our approach begins with source tracking as an implementation planning tool to focus our pathogen abatement efforts and structural BMP implementation based on targeted information regarding the nature and extent of human sources. Source identification will be followed by the human waste abatement/remediation measures that they identify, which we expect to result in significant long-term pathogen reduction benefits during both dry and wet weather conditions.

[2] https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/issue3/Final_CBA.pdf

Figure 2 presents the CHWSRS work flow described in the WQIP which includes a phased approach for identification, abatement, and abatement verification of human waste sources. It also includes conceptual TMDL compliance pathways that would be assessed based on data acquired through execution of this strategy.

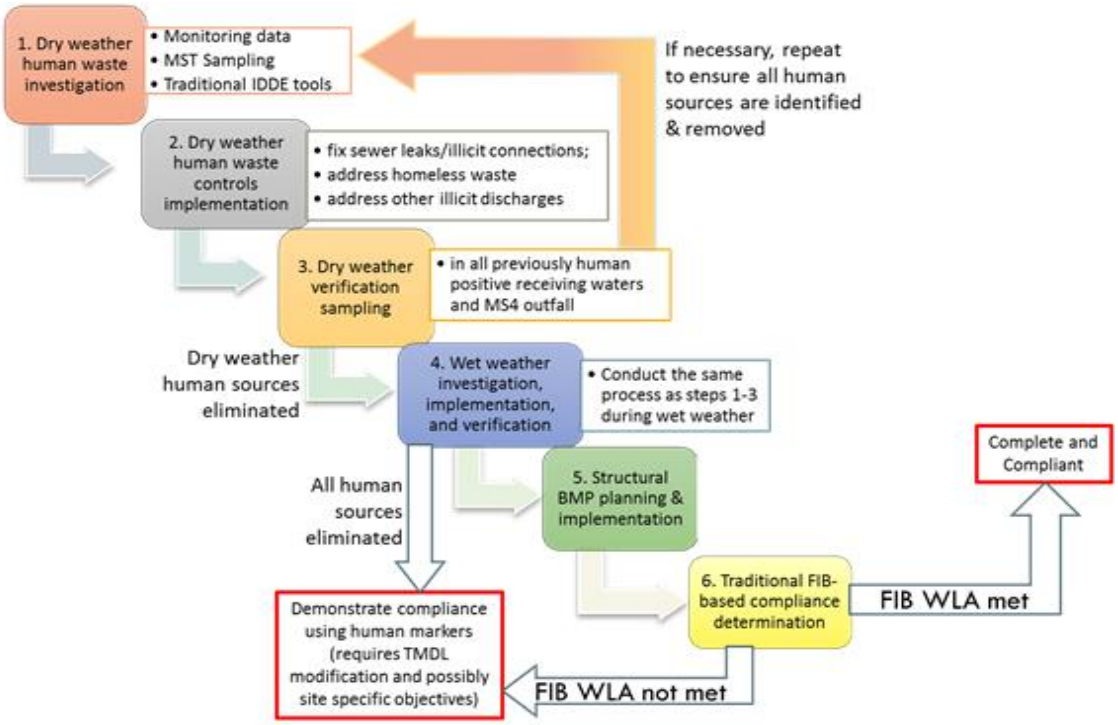


Figure 2. Comprehensive Human Waste Source Reduction Strategy Work Flow

3.2 2019 Progress Report

3.2.1 Actions

During this reporting year, a proposed CHWSRS Work Plan was developed with stakeholder participation and through collaborative partnership with all of the water and wastewater agencies. We also continued ongoing jurisdictional source control strategies and other strategies to achieve indicator bacteria TMDL compliance. Below are highlights from these efforts. A comprehensive table of strategy implementation for this HPWQC is included in **Table 4**.

Human pathogen source control strategy. We initiated development of the CHWSRS Work Plan in September 2018. The development of this work plan included collaboration with water and wastewater agencies through the SOC WMA Integrated Regional Water Management (IRWM) Group during quarterly Management Committee meetings. We initiated coordination with the SOC WMA IRWM Group in December 2019 and continued that throughout the development of the proposed work plan. Substantial data collection and coordination with these agency partners was necessary to characterize existing conditions in the SOC WMA and develop an actionable work plan based on the best available information. In addition, we held a public workshop on March 4, 2019, to present the overall development process of

the work plan and to receive public input on the proposed approach. We provided drafts of the work plan to the SOC WMA IRWM Group for review and comment on April 29 and May 22, 2019. Several additional meetings were conducted with key staff from the San Juan Basin Authority (SJBA), South Orange County Wastewater Authority (SOCWA), and Santa Margarita Water District (SMWD), as well as other wastewater agencies during work plan development. Comments and recommendations were incorporated into the final proposed work plan submitted to the Water Board on June 20, 2019, meeting the milestone of submitting it 12-months from WQIP acceptance.

This strategy was developed as a core element of the WQIP approach in addressing the pathogen health risk HPWQC. The work plan was developed using a tiered framework (**Figure 3**) which outlines a step by step process of:

- Tier 1 Beach Water Quality Assessment - assess water quality at each beach segments based on receiving water conditions. Beach segments with associated TMDLs or listed on the 303(d) list for FIB are assessed based on available water quality data. If water quality conditions indicate high exceedance levels and/or an elevated human health risk at a particular beach segment, then proceed to Tier 2. If conditions are meeting applicable Water Quality Objectives (WQOs), based on California's recently adopted Bacteria Provisions, the associated catchments draining to the beach segments are considered low priority and will continue to be monitored through the WQIP MAP (TMDL and Unified Beach Water Quality Monitoring and Assessment Program).
- Tier 2 Upstream Water Quality Assessment - assess water quality of upstream conditions, including inland surface waters (creeks) and the MS4 outfalls. A similar assessment of water quality conditions is conducted for creeks with associated TMDLs or listed on the 303(d) list for FIB, as well as for outfalls within the MS4. The same criteria for beach water quality assessment are used: if water quality conditions indicate high exceedance levels and/or elevated human health risk, then proceed to catchment prioritization. If conditions are meeting applicable WQOs, based on California's recently adopted Bacteria Provisions, the associated catchments draining to the creeks or MS4 outfalls are considered low priority and will continue to be monitored through the WQIP MAP. In addition, connectivity of the MS4 to creeks, and creeks to the beaches is evaluated at this stage.
- Catchment Prioritization – upstream catchments are prioritized based on a number of key factors that include available information on water quality (as referenced in Tier 1 and Tier 2), potential sources of human waste, and other factors that relate to the potential impact each catchment may have on water quality conditions in impaired receiving waters. Catchment prioritization results will be used to inform Tier 3 source identification needs and subsequent steps.
- Tier 3 Source Identification Investigation Monitoring - focuses on source identification based on the results of Tier 1 and Tier 2 assessments, and catchment prioritization. Source identification investigations will begin by confirming catchments that may contribute to elevated risk levels and REC-1 impairments through the collection of additional receiving water and outfall monitoring data. Catchment prioritization results will be leveraged to support the source identification phase. Detailed monitoring plans will be developed to assist with locating sources within priority areas. The results will guide source abatement activities and Tier 4 performance monitoring.
- Source Abatement - implements human waste control actions based on the findings of Tier 3. Source abatement strategies will be tailored in different locations based on the identified sources.
- Tier 4 Performance Monitoring - focuses on evaluating the impact and/or success of abatement activities for identified sources. Following source abatement, performance monitoring will be

conducted to confirm the source(s) identified were eliminated or successfully mitigated through other means.

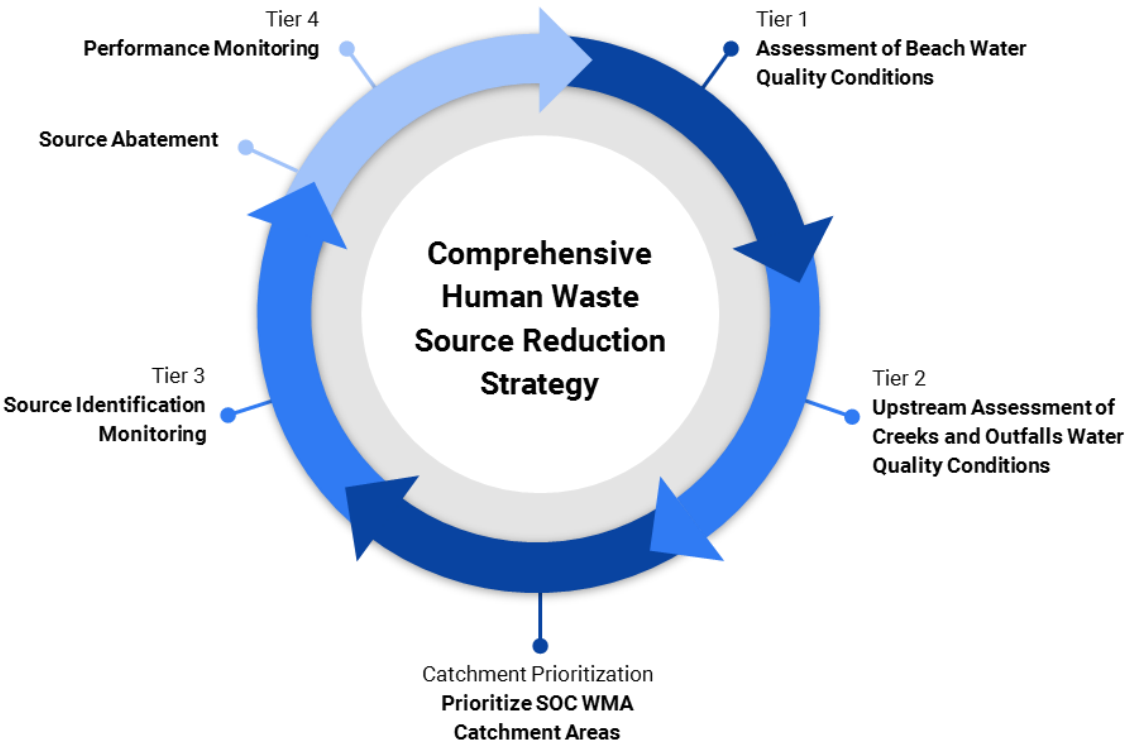


Figure 3. CHWSRS Work Plan Tiered Framework

On September 6, 2019, we received a letter from the Water Board entitled, "*Annual Report Review for Year 2017-18: South Orange County (San Juan) Watershed Management Area Water Quality Improvement Plan (WQIP)*" (WQIP Letter). The WQIP Letter included comments from the Water Board's review of the proposed draft CHWSRS Work Plan submitted on June 20, 2019. We are working on revising the work plan in an effort to address the WQIP Letter comments. Similar to the stakeholder process implemented during work plan development, the SOC WMA IRWM Group Management Committee will be given the opportunity to review the revised work plan.

Following unauthorized encampment trends. Consistent with our focus on human waste sources, we expanded our focus on identifying locations of unauthorized encampments and updating trends where available. In 2019, the biennial Orange County Point in Time count was conducted by the County of Orange, CityNet, 211 OC, as well as service providers, law enforcement and more than 1,000 volunteers using an electronic mapping system. The count found 6,860 individuals are without a home in Orange County. The individuals were broken down into different demographic groups including veterans (311), transitional ages youth (271), seniors (677), families (466: made up of 584 adults and 966 children), and emergency or transitional shelters (2,899) and unsheltered (3,961). Orange County saw a 121 percent increase in the number of emergency shelter beds from 2017 to 2019. This was an increase in 1,390 beds in total.

Jurisdictional strategies to address unauthorized encampments are summarized in Appendix F. Strategies include cleanups of abandoned encampments, comprehensive case management, service referrals, and

utilizing city specific data collected during the 2019 Point in Time count. Detailed maps of the location of the individuals surveyed during the 2019 Point in Time Count for all of Orange County are included in the "Everyone Counts 2019 Point in Time Summary[3]."

SOC WMA encampment trends will assist in future source identification investigations as part of the CHWSRS Work Plan implementation.

Ongoing investment in jurisdictional housekeeping measures. In the 2018-19 reporting year, we continued to implement bacteria and pathogen source control strategies, including:

- Implementing pet waste source control programs, including public education and outreach.
- Implementing illicit discharge detection and elimination programs.
- Collecting over 4,000 pounds of trash and debris from within receiving waters from three SOC WMA city-sponsored trash cleanup events.
- Requiring BMPs in PDPs based on the provisions of the Permittees' BMP Design Manuals. Approximately 66 PDPs were in review, about 49 PDPs were approved, and about 10 PDPs were granted occupancy.
- Operating existing dry weather flow diversions and treatment systems.
- Inspection and cleaning of the MS4, including over 660 miles of channel and pipe cleaned and inspected as well as panoramic video monitoring and National Association of Sewer Service Companies (NASSCO) screening of about 23 percent of the City of Laguna Niguel's MS4 drainage system. Over 3,000 tons of trash and debris was removed collectively from SOC WMA MS4s (catch basin, storm drain pipes, and channels).
- Implementing street sweeping programs that collected over 4,900 tons of trash and debris throughout the SOC WMA.
- Incentivizing private sewer lateral repair or replacement through the City of Laguna Beach's private sewer lateral program.
- Implementing the countywide Adopt A Channel (AAC) Program. To date, the AAC program has removed over 23,693 pounds of trash over the five years of program implementation.

Full detail of our efforts is provided in Appendix F.

Trial use of HF183, HF18-PMA and Next Generation DNA Sequencing with OCFS. We are currently evaluating the use of novel tools including next generation DNA sequencing (NGS) and analysis of human DNA marker (HF183) in samples treated with propidium monoazide (PMA) to differentiate sources of dry weather discharge (groundwater, potable water, recycled water, and raw sewage) to the MS4 as part of the OCFS and help to differentiate between HF183 from recycled water source compared to raw sewage sources.

City of San Clemente Pier Bacteria Source Characterization Study. The City of San Clemente contracted with a consultant to implement the Pier Bacteria Source Characterization Study. The goal of the study is to identify the source(s) causing fecal indicator bacteria exceedances underneath the San Clemente Pier. The Study utilizes the California Microbial Source Identification Manual and the SOC WMA CHWSRS to identify and abate any human waste sources draining from the watershed as well as identify other non-human sources that could be contributing to the recreational water quality objective exceedances.

[3] http://www.ocgov.com/civicax/filebank/blobdload.aspx?BlobID=92093

Appropriate BMPs will be proposed to abate the specific sources. During this reporting year the following tasks were implemented:

- Work Plan was drafted
- Visual observations conducted: land based and water based
- Installation and servicing of flow meters in storm drains
- Start of water quality sampling
- Formation of the Stakeholder Advisory Committee (SAC).

The goal of the SAC is to provide feedback on Study work products, reach consensus on project outcomes and next steps, support cost-effective solutions that address the highest priority of bacteria sources and protect public health. The Study is planned to be completed by the summer of 2020.

Table 4. Strategy Implementation Summary for the Human Pathogen Health Risk HPWQC

Strategy	Purpose of Strategy for HPWQC	Type	Planned Timing	Implementation during Reporting Year	Progress on Target?	References or Discussion
Operate Existing BMPs	Continue to operate BMPs to provide ongoing water quality benefits. This is part of maintaining existing progress toward goals.	Jurisdictional	Ongoing	Existing BMPs, including UV treatment and low flow diversions were operated. Significant effort was also invested to inventory existing BMPs and WQMP sites within the OC Stormwater Tools, which can be used to assess the condition and perform maintenance.	Yes	Progress on BMP Inventory is reported in Section 7.2. BMP addressing Bacteria TMDLs are included in Appendix C.1 and C.2
Implement Existing Programmatic/JRMP Strategies (Non-structural BMPs)	Implement various non-structural JRMP strategies to control sources of human pathogens to receiving waters. This strategy includes ongoing implementation of existing JRMP strategies and adaptation of strategies through the adaptive management process. The WQIP does not include specific metrics for strategy implementation. JRMP strategies are summarized in Appendix D of the WQIP and are contained in current JRMPs.	Jurisdictional	Ongoing	Each Permittee implemented its JRMP in 2018/2019. Implementation is summarized in the Jurisdictional Strategy Implementation Summaries (Appendix F). As part of the Performance Measures effort (Section 7.4), the Permittees are working toward standardized reporting metrics to characterize JRMP implementation more quantitatively.	Yes	JRMP Annual Reports and Jurisdictional Strategy Implementation Summaries (Appendix F).
Human Pathogen Source Control Strategy	Identify human waste sources to receiving waters, develop prioritized abatement actions, and demonstrate elimination or reduction of sources. This approach has been estimated to be more cost-effective than controlling general stormwater sources of FIB. Through this strategy, we will quantify the extent of human waste, and measure the effectiveness of abatement efforts. This is the primary new strategy identified in the WQIP for the first permit term. Implementation of this strategy forms the basis for near term milestones.	WMA	Develop the CHWSRS Work Plan by June 2019. Begin implementation in 2019/2020.	The proposed CHWSRS Work Plan was submitted in June 2019. The stakeholder process to develop the work plan helped support the development of a collaboration framework that will support implementation. Initial implementation efforts have begun.	Yes	CHWSRS Work Plan Submittal
Other Human Waste Source Control Efforts	Develop new jurisdictional programs to target high priority sources of human waste to receiving waters, as needed. These may include strategies such as Unauthorized Encampment Cleanups, Recreational Vehicle Waste Disposal, and other sources. These are intended to be implemented as part of the CHWSRS approach.	Jurisdictional	To be developed to target priority areas identified through initial CHWSRS investigations.	Source control toolbox developed as part of the CHWSRS Work Plan. Some jurisdictions have incorporated new human waste control strategies into their JRMP. Additional jurisdictional efforts are anticipated in 2019/2020.	Yes	CHWSRS Work Plan Submittal JRMP Annual Reports and Jurisdictional Strategy Implementation Summaries (Appendix F).
Redevelopment through Permit-Required LID Implementation	Reduce pollutant loads over time via the implementation of effective LID BMPs and elimination of dry weather flows. The Technical Guidance Document describes BMP design standards. Permittees require these design standards to be met as part of plan review.	Jurisdictional	Ongoing	Permittees required PDPs to implement TGD requirements and tracked development approvals. Permittees also invested in enhancing their inventory of WQMP sites using the OC Stormwater Tools platform.	Yes	JRMP Annual Reports and Jurisdictional Strategy Implementation Summaries (Appendix F).

Strategy	Purpose of Strategy for HPWQC	Type	Planned Timing	Implementation during Reporting Year	Progress on Target?	References or Discussion
Absorbent Landscaping/ Impervious Area Dispersion Incentive Program	Reduce both dry weather and wet weather flow through landscape conversion and reduction in irrigation water usage. This strategy supports both reduction in indicator bacteria as well as reduction in unnatural flows.	WMA	Ongoing	The Permittees provide financial and institutional support for the H_2OC "Overwatering is Out Campaign" which promotes water agency rebates for water conservation efforts such as the MWDOC Waterwise Landscape Program. The sum of outdoor rebate programs such as these has reduced irrigation water by an estimated 2,900 ac-ft per year of irrigation water since 2010. We believe this has translated to significant reduction in dry weather flow. Additional details are in Section 4.2.1. In 2020, the Permittees will reassess the effectiveness of non-structural measures, including an evaluation of the feasible level of reductions that can be expected from water efficiency rebate programs.	Yes	See Section 4.2.1.
New Low Flow Diversions or Dry Weather Treatment System Retrofits	Divert or treat dry weather runoff to prevent human pathogens from entering receiving waters from MS4 outfalls. This may be appropriate where sources are elevated in outfall monitoring. Outfall capture is appropriate where reduction in streamflows would not impair beneficial uses.	Jurisdictional	Prioritized implementation following completion of Outfall Capture Feasibility Studies and CHWSRS investigations.	Not implemented this year. This is consistent with the planned implementation phasing described in the WQIP. The Permittees are in the process of conducting 20 outfall capture feasibility studies to be completed in 2020. These outfalls make up approximately 37 percent of estimated dry weather flow in the WMA.	Yes	Not applicable.
Stormwater Treatment BMP Retrofits	Treat stormwater runoff to reduce human pathogen loads to receiving waters. This may be needed where CHWSRS implementation does not adequately abate sources, and more general treatment of stormwater is needed.	Jurisdictional	Identification of conceptual BMP opportunities by 2023. Phased implementation based on results of CHWSRS implementation.	Not implemented this year. This is consistent with the planned implementation phasing described in the WQIP.	Yes	Not applicable.
Trash BMPs	Reduce trash discharge to receiving waters to help reduce sources of bacteria and pathogens.	Jurisdictional	Not specifically identified for this HPWQC. Statewide Trash Amendments require implementation over a 10-year timeframe.	Jurisdictions continue to install full trash capture systems. Implementation is summarized in the Jurisdictional Strategy Implementation Summaries (Appendix F). There are currently more than 2,600 trash capture systems inventoried in the OC Stormwater Tools platform in the WMA. This inventory is in progress and does not represent the full inventory of trash capture BMPs.	Yes	Implementation is summarized in the Jurisdictional Strategy Implementation Summaries (Appendix F). See OC Stormwater Tools implementation summary in Section 7.1.

3.2.2 Performance: Achievement of Milestones and Goals

Our actions lead to the delivery of milestones and progress toward numeric goals established in the approved WQIP. This annual report focuses on measurable performance while recognizing that it is early in the implementation period.

Annual Milestones. As outlined in Section 3.2.1, we developed the CHWSRS Work Plan with input from stakeholders as well as water and wastewater agency partners, and submitted the Work Plan for review by San Diego Water Board staff. This satisfies the 2019 milestone for this HPWQC.

Progress toward Goals. Our interim goals for pathogen health risk are summarized in Table 3-1, 3-2, and 3-3 of the WQIP and are consistent with Attachment E of the Permit. We are currently working to standardize bacteria load reduction calculation efforts through OC Stormwater Tools as part of the Stormwater Quality Asset Inventory and Pollutant Loading Estimates special study (Section 7.2). Bacteria load reduction and final dry and wet weather percent exceedance frequency assessment for the Baby Beach TMDL is provided in Appendix C.1 and the interim dry and wet weather percent exceedance frequency assessments for the Beaches and Creek TMDL is summarized in Appendix C.2. Overall, *Enterococcus* dry weather numeric target exceedances for the Baby Beach TMDL are below 12 percent for both the single sample maximum and 30-day geometric means. While there were exceedances for *Enterococcus*, exceedances rates have significantly declined since the baseline years (1996-2002) for both dry and wet weather conditions. With the implementation of the dry weather diversion BMPs, there was no discharge (and associated pollutant loading) from the MS4 to Baby Beach during most of the dry season, thus the required load reduction has been achieved. Additionally, the 2018-19 reporting year exceedance rates were reduced by 80 percent compared to the baseline years, thus the final wet weather compliance milestone (62.2 percent load reduction) was met.

The Beaches and Creek TMDL beach segments are meeting the dry weather percent exceedance frequency with the exception of Aliso Creek, Aliso Creek Mouth, Salt Creek (large outlet), Poche Beach, Ole Hanson Beach Club, San Clemente City Beach at Linda Lane and San Clemente Pier. Similarly, wet weather percent exceedance frequencies were met with the exception of Aliso Creek, Aliso Creek Mouth, Salt Creek (large outlet), San Juan Creek at Pacific Ocean Shoreline, San Juan Creek lower one mile, Poche Beach, and San Clemente Pier.

3.2.3 Outcomes: Environmental Condition Assessment

As we implement strategies to reduce bacteria and pathogen loads, we must also assess if our actions are resulting in the desired outcomes by monitoring environmental conditions. Datasets for assessing current conditions and trends related to human pathogen health risk remain limited so the proxy of indicator bacteria data has been used.

Trends in monitoring data indicate ongoing improvement in dry weather water quality conditions. Improvements in dry weather water quality conditions are likely attributable to our jurisdictional housekeeping efforts, structural BMP implementation, and operation of dry weather diversions. For instance, dry weather final Baby Beach TMDL targets were achieved for Total Coliform, Fecal Coliform, and *Enterococcus* during the reporting year as there was no discharge from the MS4 to Baby Beach during most of the dry season due to the operation of the low flow diversion. Additional details are provided in Section 6.3.1, 6.3.1, and Appendix C.

Increase in percent exceedance frequencies were noted in 2019 at three monitoring stations in the WMA: Salt Creek Mouth, Poche Beach and San Clemente Pier. MST samples were analyzed for human, canine and avian as these bacteria sources are suspected. All three sources of bacteria were detected at the three monitoring stations. As noted above, an MST investigation is underway at the San Clemente Pier, consistent with the framework established in the CHWSRS work plan. Additional human waste source identification investigation efforts will be conducted through CHWSRS work plan implementation.

3.3 Planned 2020 Efforts

Our planned efforts for 2020 include focused investment in three prongs of the comprehensive pathogen source control strategy:

CHWSRS Work Plan implementation. We will begin conducting prioritized investigations, including collecting, analyzing, and interpreting samples to determine the presence and magnitude of human markers in dry weather flows.

Continue Stakeholder Coordination. We will continue to coordinate and partner with water and wastewater agencies as part of CHWSRS Work Plan implementation to fill data gaps in:

- Sanitary sewer system infrastructure sewer data
- Private lateral data
- Rehabilitation/lining project locations
- Sanitary sewer system improvement or expansion capital improvement projects
- Recycled water network and infrastructure
- Areas with septic coverage (On-site Wastewater Treatment Sites)
- RV dump station locations

Continued efforts to address unauthorized encampments. For the 2019 Point in Time Count, the County increased efforts and resources to collect comprehensive data of Orange County's homeless population and help drive regional coordination of resources to assist individuals and families experiencing homelessness in Orange County. The County has concentrated its efforts on building a responsive "System of Care" in Orange County including the increase of shelter beds, recuperative care, and permanent supportive housing.

Human waste source control will be the primary focus to address this HPWQC over the next 5 years. Through this investment, we intend to develop a much better understanding of human waste sources and make significant progress in abating them, resulting in improvements in water quality, a reduction in pathogen health risk posed to swimmers, surfers, and other recreators, and a refined set of management actions focused on key remaining sources.

Our other supporting efforts planned in 2020 include:

- Assess the reliability of the human-specific (HF183) Bacteroides genotypes with PMA treatment to distinguish between viable cells (indicative of raw sewage) and dead cells. This is part of the Outfall Capture Feasibility Studies described in Section 4.2.1.
- Evaluate the use of NGS methods and pharmaceutical and personal care products (PPCPs) to help distinguish between sources of bacteria. This is also part of the Outfall Capture Feasibility Studies described in Section 4.2.1.

- Continue to develop the OC Stormwater Tools platform (See Section 7.2) to support quantification of existing BMPs and planning of future BMPs for controlling indicator bacteria and pathogens found in stormwater.
- Continue to implement jurisdictional housekeeping programs and Countywide sewer spill control programs.
- Continue public education and outreach programs, including those addressing pathogen load reductions.

4 Unnatural Water Balance

4.1 Overview

Prioritize water conservation, recycling and outfall treatments to restore riparian ecosystems and improve recreational quality

Disruption in the natural flow regime of a stream system is considered one of the key stressors associated with "urban stream syndrome" described by Walsh, et al. (2005)[4] and is a major threat to ecosystem integrity in SOC WMA. Unnatural flows from stormdrain outfalls can convert ephemeral creeks to perennial flow, providing water for invasive plants such as Arundo Donax, and carrying nutrients that can contribute to excess algal growth and associated water quality impacts. In moderate to high stress urban streams, perennialization of urban streams is associated with lower biological integrity (Mazor et al., 2012)[5]. Unnatural flows to naturally perennial systems can also affect ecosystem integrity via water quality impacts or significant changes to flow regime.

Flow regime is one of the foundations of the function-based hierarchy for stream assessment and restoration (Harman et al. 2012)[6]. In developing an overall approach to address this HPWQC, we focused on the reduction of unnatural flows as a foundational step towards restoration of more natural flow regimes to support more natural and resilient ecosystems. Additional benefits are expected to include reduction in nuisance conditions that can impair recreation experience (i.e., hiking), reduction in water waste, and water supply augmentation via urban runoff capture. Our key strategies associated with this HPWQC include:

Research source of flows. Natural flows in creeks are necessary to provide adequate water for natural processes and wildlife; however, unnatural flows can cause changes in flow regime and/or contribute pollutant loads. This strategy characterizes outfall flows to determine which are providing benefits to receiving streams and which are not. This information will be useful to recognize where flows are necessary for ecosystem function and where flows are coming from unnatural sources.

Prevent flows into the MS4. This strategy focuses on addressing unnatural, unpermitted flows into the MS4 through several categories of actions, including outreach and incentive programs, enforcement of prohibited discharges, source controls and capture systems in priority development and redevelopment projects, and retrofits with green streets and low impact development. Addressing controllable flows into the MS4 will conserve water supply, reducing use per capita, and will reduce the amount of unnatural flows conveyed through the MS4.

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[4] Walsh CJ, Roy AH, Feminella JW, Cottingham PD, Groffman PM, Morgan RP II. 2005. The urban stream syndrome: Current knowledge and the search for a cure. Journal of the North American Benthological Society 24(3):706-723.

[5] Mazor, R., Schiff, K., Ode, P., and Stein, E.D. 2012: Final Report on Nonperennial Streams. SCCWRP Technical Report 695.

[6] Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. A Function-Based Framework for Stream Assessment and Restoration Projects. US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006.

Capture or treat flows from MS4. This strategy focuses on reducing or improving unnatural flows at the outfall from the MS4 system. This includes several categories of actions, including efforts to retain and infiltrate water, capture and divert water to a treatment or water reclamation plant, and treat and discharge water (where in-stream flows are beneficial).

The ultimate goal we identified in the WQIP is to eliminate unnatural, unpermitted dry weather flows from the MS4 to inland receiving waters and estuaries. We also established milestones and interim goals are related to reduction in unnatural flows. This includes exceptions where flows are determined to be beneficial.

4.2 2019 Progress Report

4.2.1 Actions

Since identification of this highest priority water quality condition in April 2016, we have invested continuously to build richer and more useful datasets to fill data gaps to support restoration decisions and form partnerships to support unnatural water balance management. Highlights of our progress are summarized below. A comprehensive summary of strategy implementation is included in **Table 6**.

Outfall capture feasibility studies. We performed monitoring as part of 20 outfall capture feasibility studies in two rounds. Round 1 started in August 2018 and continued through June 2019. Round 2 started in July 2019 and continued through October 2019. These outfalls collectively receive runoff from 11,900 developed acres (17 percent of developed area in the WMA) and represent approximately 3.1 cfs of dry weather flow (37 percent of estimated dry weather flow in the WMA) (**Figure 4**). A high-level summary of the actions that were performed for this reporting year is provided in Section 6.1.2 and a detailed summary can be found in Appendix A.2.

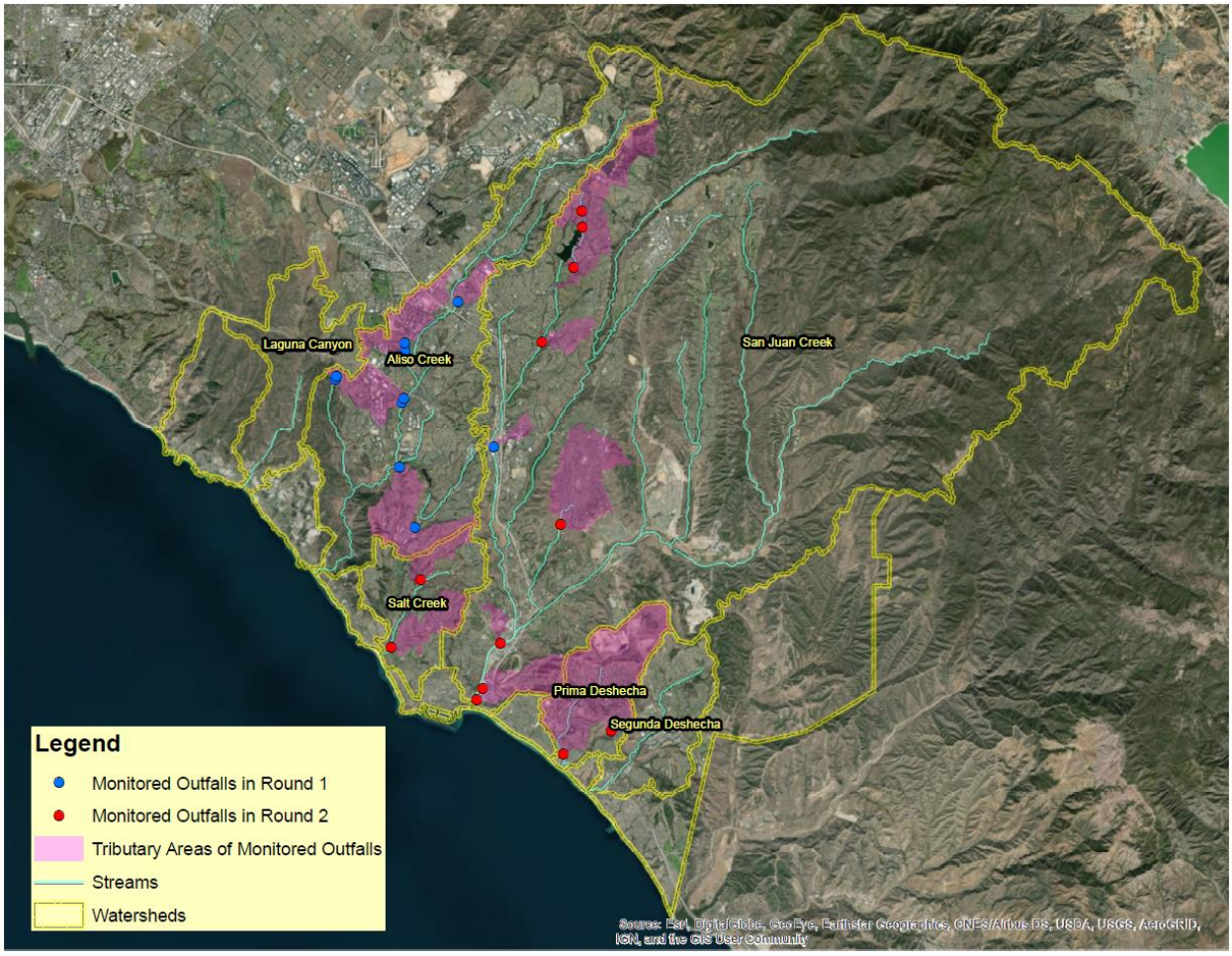

Figure 4. Spatial Scope of Outfall Capture Feasibility Studies

The purpose of these studies is to characterize flow sources and assess opportunities for water conservation, treatment, and/or diversion in these watersheds. Our additional objectives for these studies include piloting new monitoring techniques. Study elements include:

- Real-time flow metering for extended periods to measure diurnal and seasonal patterns.
- Acquisition and analysis of water consumption data overlaid temporally and spatially with outfall flow records.
- Water quality sampling to support flow-source-identification, including traditional parameters as well as innovative parameters, including stable isotopes (water, nitrate), (PPCPs), HF183, HF183-PMA, and NGS.
- Compilation and review of stormwater, sanitary, and water infrastructure in the vicinity of outfalls to assess feasibility of treatment or diversion approaches.
- Assessment of data related to in-stream flow regime and potential impacts of low flow diversion.

Figure 5 shows draft plots of water isotope results for control water samples, obtained from known sources. This analysis shows reclaimed water and sewage have similar isotopic signatures with potable

water close within range, while groundwater has considerably different signature. This suggests that isotopic analysis of outfall samples will provide useful information about sources of water.

Laboratory analyses for all parameters are expected to be completed in early 2020. We anticipate the completion of these studies in mid to late 2020.

Performance Measures and Calculation Guidance. We are working toward a more performance-based approach for reporting implementation efforts and outcomes. As part of this, we developed draft performance measures for the unnatural water balance HPWQC and draft calculation guidance. Additional information is summarized in Section 7.4.

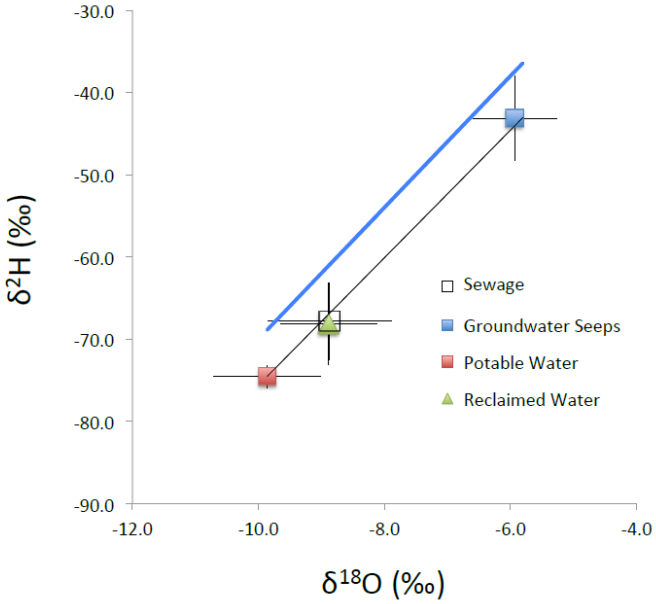

Figure 5. Draft Isotopic Ratio Plots for Control Water Samples

Permitted Discharge Inventory. We consulted various state databases such as Stormwater Multiple Application and Report Tracking System (SMARTS) and California Integrated Water Quality System (CIWQS) to determine the type and number of permitted discharges in the WMA. This inventory was intended to support assessment of flows from these sources, which are exempted from the Permit non-stormwater discharge prohibitions. A summary of our findings is in Section 7.6. We found that water agency discharges from hydrant flushing is potentially a significant source of flow that justifies further study. We found that monitoring reports do not typically provide enough information to assess potential contributions. The inventory of permitted facilities will be used as part of IDDE investigations.

Water Impoundment Inventory. We inventoried major water impoundments to assess their potential effects on flow regime. A summary of our findings is in Section 7.7.

Rebate Participation Analysis. We obtained rebate participation inventories from the Metropolitan Water District of Orange County (MWDOC) including estimates of the effectiveness of each rebate program. Inventories were provided at the individual account level but were aggregated to city and water district boundaries due to privacy concerns. From this, we summed the level of participation in the WMA. Estimates of effectiveness are based on MWDOC and Metropolitan Water District assumptions (email communication, Rachel Waite, MWDOC, 12/26/2019). **Table 5** summarizes program participation and estimated reduction in outdoor water use. We are working to develop methods to estimate the reduction in dry weather flow based on reduction in outdoor water use.

Table 5. Total WMA Water Conservation Rebate Participation Summaries (as of 2019)

Measure	Count of Participating Accounts	Total Quantity of Participation	Estimated Reduction in Average Annual Outdoor Water Usage[1], ac-ft/yr
Weather-based Irrigation Controllers	5,393	87,981 stations	1,198
Rotating Nozzles	1,058	117,723 stations	311
Turf Conversion	4,611	232 acres	1,370
Drip Conversion	31	4 acres	19
Rain Barrels and Cisterns	467	875 units	2
Sum	-	-	2,900

1- Based on MWDOC standard assumptions.

A comprehensive summary of strategy implementation is included in **Table 6**.

Table 6. Strategy Implementation Summary for the Unnatural Water Balance HPWQC

Strategy	Purpose of Strategy for HPWQC	Type	Planned Timing	Implementation during Reporting Year	Progress on Target?	References or Discussion
Outfall inspection observations (Field Screening)	Continue data collection to develop a consistent long-term dataset to characterize flow conditions. This will support development of baseline flow regimes in a subsequent update of the WQIP. This monitoring program is relevant to prioritizing actions and tracking progress toward goals.	WMA	Complete by 2020	The Permittees continued to implement the outfall inspection and monitoring program. This included multiple visits to priority outfalls during this year, using methods consistent with previous years to build a larger dataset. Monitoring observations were provided to Permittees via a dashboard in real-time to support IDDE and asset management efforts.	Yes	Appendix A.2.
Detailed flow monitoring at priority outfalls	Continue data collection to develop a consistent long-term dataset to characterize flow conditions. This will support development of baseline flow regimes in a subsequent update of the WQIP. This monitoring program is relevant to prioritizing actions and tracking progress toward goals.	WMA	Complete by 2020	As part of outfall capture feasibility studies, the Permittees conducted detailed flow monitoring at 20 priority outfalls in the WMA. These outfalls represent a total of 11,900 acres (17 percent of total developed area in the WMA) and approximately 3.1 cfs (37 percent of estimated dry weather outfall flow in the WMA).	Yes	Section 4.2.1. and Appendix A.2
High-resolution imagery analysis	Obtain repeat imagery to potentially allow change detection regarding areas of flowing or ponded conditions. This is relevant to tracking progress at 5-year increments.	WMA	Imagery obtained in 2016	No effort scheduled during the reporting year. Next effort is scheduled for 2021.	Yes	www.ocgis.com/ocpw/IllicitDischarge/#
Permitted discharge inventory	Assess the potential quantity and locations of dry weather flows that are exempted from non-stormwater discharge prohibitions in the Permit. This may inform our understanding of the prioritization and effectiveness of strategies.	Jurisdictional	Completed in 2019	Permittees reviewed state databases such as, SMARTS and CIWQCs, to identify permitted facilities, wastewater discharge permits, and water distribution system operating permits (State Water Board WQO 2014-0194 SWQ) allow various discharges.	Yes	See findings in Section 7.6.
Water impoundment inventory	Assess how and where water impoundments may influence dry weather flows. These may be a source of dry weather flow they also may reduce dry weather flow. This may inform our understanding of the prioritization and effectiveness of strategies.	Jurisdictional	Completed in 2019	Permittees reviewed aerial photography, stormwater system maps, and jurisdictional records to identify major water impoundments. Permittees reviewed operating permits and reached out to owners/operators for information. Impoundments were ranked based on their potential to influence flow regime.	Yes	See findings in Section 7.7.
Flow regime characterization	Fill data gaps and conduct analysis necessary to support flow management decisions. Assess the current streamflow and habitat supported. Identity habitat restoration and/or species recover programs that relate to flow regime. Estimate reference conditions that would be expected to occur with full removal of urban discharges. This is identified as a special study in the WQIP.	WMA	Complete by 2021	This strategy is being implemented as an element of the Flow Ecology Special Study. This special study commenced in early 2019, with stakeholder process commencing in July 2019. This study is ongoing.	Yes	Section 7.3 provides a status update on this special study.

Strategy	Purpose of Strategy for HPWQC	Type	Planned Timing	Implementation during Reporting Year	Progress on Target?	References or Discussion
Outfall prioritization	Prioritize outfalls for monitoring, identify appropriate controls strategies, and prioritize program expenditures based on estimated costs and benefits.	WMA	Initial prioritization completed in 2018; update in 2021 based on additional data through 2020.	Ongoing outfall inspections and flow monitoring (described above) will support future reprioritization efforts. Prioritization was last completed as part of the 2017/2019 Annual Report. Reprioritization was not scheduled in 2019.	Yes	Appendix J of the WQIP (amended January 2019) includes the current prioritization.
Outfall capture feasibility studies	Characterize flow magnitude and likely sources of flow. Assess appropriate control strategies, including the feasibility and desirability of outfall capture. Completion of outfall capture feasibility studies is identified as an annual milestone for 2020 and is key to achieving interim goals.	WMA	Initial 20 studies complete by 2020	Outfall capture feasibility studies are in progress at 20 priority outfalls in the WMA. These outfalls represent a total of11,900 acres (17 percent of total developed area in the WMA) and approximately 3.1 cfs (37 percent of estimated dry weather outfall flow in the WMA).	Yes	Section 4.2.1. and Appendix A.2
New development/ redevelopment program	Reduce runoff volumes over time via the implementation of effective LID BMPs and the elimination of dry weather flows within PDP sites. The Technical Guidance Document describes BMP design standards. This is part of how unnatural dry weather flows will be reduced.	Jurisdictional	Program updates were completed in 2017. Implementation is ongoing.	Permittees require PDPs to implement TGD requirements and tracked development approvals. Permittees also invested in enhancing their inventory of WQMP sites using the OC Stormwater Tools platform. There are currently more than 450 WQMPs inventoried in OC Stormwater Tools in the WMA. This is a work in progress.	Yes	Implementation is summarized in the Jurisdictional Strategy Implementation Summaries (Appendix F)
Dry weather flow reduction elements in wet weather retrofit BMP or existing BMPs	Identify opportunities to manage dry weather flows within BMP retrofits or existing BMPs. This may be part of the Permittees' approach for reducing dry weather flows.	Jurisdictional	Opportunistically, as driven by other HPWQCs	Not scheduled for implementation this reporting year.	Yes	NA
Incentives for low water use landscaping and/or irrigation source controls	Reduce both dry weather and wet weather flow through landscape conversion and reduction in irrigation water usage. This is a key strategy for reducing unnatural flows while conserving water.	Jurisdictional	Ongoing	Permittees provide financial and institutional support to the H2OC "Overwatering is Out Campaign" which promotes water agency rebates for water conservation efforts. Since 2010, participated in these programs has reduced outdoor water usage by an estimated 2,900 ac-ft per year of irrigation water. We believe this could account for significant reduction in dry weather flows in the WMA. Efforts are in progress to assess this.	Yes	Section 4.2.1.
Outfall control strategies	Capture water at MS4 outfalls to meet flow management goals, where applicable.	Jurisdictional	Prioritized implementation beginning in 2021 following completion of Outfall Capture Feasibility Studies.	Not scheduled for implementation this reporting year.	Yes	NA

4.2.2 Performance: Achievement of Milestones and Goals

Annual Milestones. The 2019 milestones for this HPWQC included the permitted discharge inventory and the water impoundment inventory, which were completed as discussed above and summarized in Sections 7.6 and 7.7. This satisfies the annual milestones for this HPWQC for 2019.

Progress toward Goals. Our first interim goal calls for 10 percent reduction in unnatural dry weather flow from the MS4 to inland receiving waters by 2023. In order for us to assess progress toward this goal, it is first necessary to conduct monitoring and assessment to establish the existing flow regimes. Our WQIP calls for this assessment to be completed in 2021 based on review of flow monitoring data collected between 2010 and 2020. At that time, we will be able to begin assessing progress toward this goal. For reference, the 20 outfalls currently being studied as part of outfall capture feasibility studies comprising approximately 17 percent of total developed land area and 37 percent of estimated dry weather flow in the WMA.

4.2.3 Outcomes: Environmental Condition Assessment

In this Annual Report, we are focusing on estimating environmental outcomes associated with rebate participation, public education, and enforcement (collectively "dry weather source controls").

Dry weather source controls have been applied widely in the WMA. These are a key strategy for the unnatural water balance HPWQC. Water usage awareness and participation in rebates increased in response to the 2012 to 2016 drought. As reported last year, dry weather streamflows in Aliso Creek have shown a decreasing trend since 2010. This was considered beneficial as it has helped to reduce the frequency of the sand berm breaching at the Aliso Creek mouth. Streamflows are likely responding to the combined effect of source controls and climatic patterns (declining trend in precipitation during this period).

Study Questions. As part of assessing WQIP progress and supporting future decisions, we are asking the following study questions:

- What level of flow reduction has been observed?
- Is it possible to isolate the effect of source controls from climatic trends?
- If so, what level of flow reduction is likely attributable to source controls?

We are investigating these questions as part of the ongoing Flow Ecology Special Study. The answers to these questions have two key purposes. First, this helps assess the achievable reductions that can be expected with broader source control efforts and participation. Second, it helps forecast what streamflow conditions may be in the future with widespread application of source control efforts and anticipated changes in climatic patterns.

Methods. We are utilizing streamflow records (OCPW and USGS at lower Aliso Creek), precipitation records (OCPW, multiple gages in Aliso Creek), and water usage records from Moulton Niguel Water District (MWND) to assess temporal trends and correlations. Using MNWD water deliveries and monitored sewage return flows we were able to estimate the amount of water applied outdoors. Our analysis focuses on how water usage, outdoor water application, and antecedent precipitation totals influence late summer streamflows.

Figure 6 presents a longitudinal plot of selected variables we are exploring.

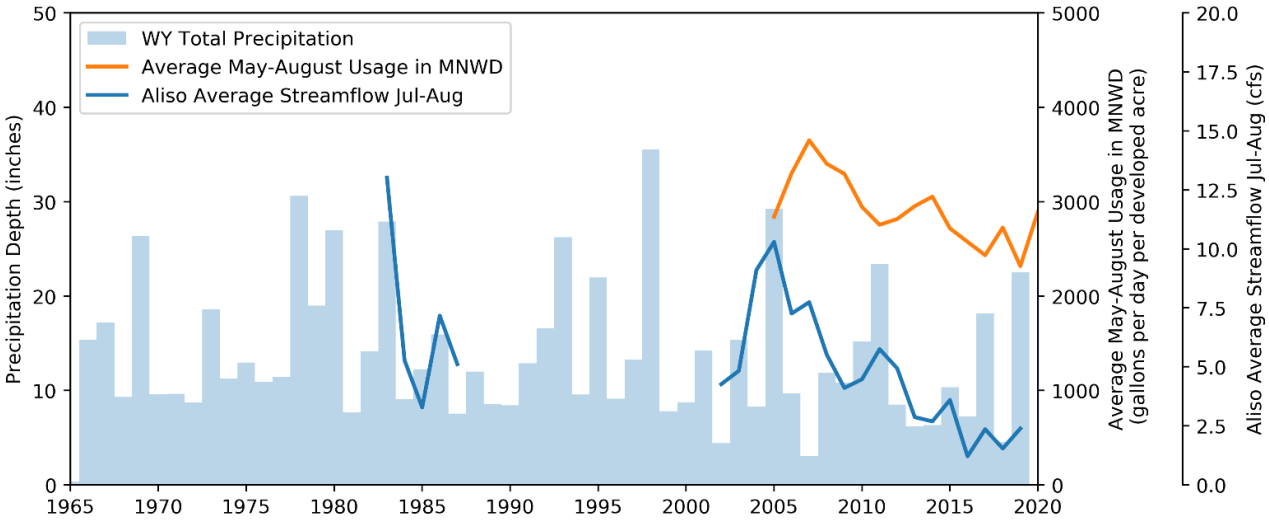

Figure 6. Plot of Precipitation, Water Usage, and Summer Streamflow

Table 7 provides key statistics from these periods.

Table 7. Comparison of Variables for Analysis Periods.

Year	Antecedent Precipitation, inches				Average Summer Water Usage (gallon per day per developed acre)		Average of July-August Stream Flow, cfs
	Prior 5 Wet Seasons	Prior 2 Wet Seasons	Prior Wet Season	February through June	Indoor + Outdoor	Outdoor Only	
1983	95.7	42.1	27.9	17.2	-	-	13.0
1984	85.8	37.0	9.1	1.2	-	-	5.3
1985	71.0	21.3	12.3	3.0	-	-	3.3
1986	79.3	28.2	15.9	9.4	-	-	7.2
1987	72.7	23.5	7.6	3.4	-	-	5.1
2002	70.7	18.7	4.4	1.2	-	-	4.3
2003	50.6	19.8	15.4	11.1	-	-	4.8
2004	51.1	23.7	8.3	6.3	-	-	9.1
2005	71.6	37.5	29.3	11.8	2,840	-	10.3
2006	67.0	38.9	9.7	7.0	3,302	-	7.3
2007	65.6	12.7	3.1	1.6	3,650	-	7.7

Year	Antecedent Precipitation, inches				Average Summer Water Usage (gallon per day per developed acre)		Average of July-August Stream Flow, cfs
	Prior 5 Wet Seasons	Prior 2 Wet Seasons	Prior Wet Season	February through June	Indoor + Outdoor	Outdoor Only	
2008	62.1	14.9	11.9	2.6	3,401	-	5.5
2009	64.7	22.7	10.8	4.7	3,294	-	4.1
2010	50.6	26.0	15.2	5.1	2,944	-	4.5
2011	64.3	38.6	23.4	5.6	2,755	2,151	5.8
2012	69.8	31.9	8.5	4.4	2,816	1,717	4.9
2013	64.1	14.7	6.2	2.0	2,953	1,880	2.9
2014	59.7	12.5	6.4	4.6	3,053	1,987	2.7
2015	54.8	16.7	10.4	3.3	2,717	1,725	3.6
2016	38.6	17.6	7.2	2.1	2,574	1,629	1.2
2017	48.3	25.4	18.2	4.2	2,433	1,479	2.4
2018	46.7	22.7	4.6	2.7	2,726	1,803	1.5
2019	62.8	27.1	22.5	12.2	2,318	1,426	2.4

Interim Assessment. Efforts are ongoing to address the research questions above. The following bullets present an initial assessment.

- Wetter winters appear to correlate to increases in summer streamflow compared to the year prior. For example, 1983, 2005, 2011, and 2019 have among the highest winter precipitation sums and also exhibited increase in summer peak flows compared to their respective preceding seasons.
- However, precipitation patterns do not appear to fully explain the downward trend in streamflow over time. As a simple assessment, the summer of 2019 was compared to similar climatic periods prior to 2010. Specifically, the summers of 2002, 2003, 2004, 2008, and 2010 each had drier antecedent conditions than 2019 in all categores. However, these years had average summer streamflow of 6.0 cfs compared to 2.4 cfs in 2019.
- During this period, the estimated outdoor water usage has declined by approximately one third.

Further assessment is needed to determine the relative contribution of urban runoff and groundwater discharge to streamflows. Evidence suggests that the decline in outdoor water usage resulting from water conservation efforts is a key contributor to reduction in unnatural streamflows.

4.3 Planned 2020 Efforts

We plan to advance multiple parallel efforts, intended to make progress toward interim goals while improving our understanding of conditions to support appropriate decisions about management actions at

an outfall level. In addition to the continuation of 2019 activities, efforts we plan to undertake in 2020 include:

Complete 20 outfall capture feasibility studies. We anticipate completing the first 20 outfall capture feasibility studies in 2020. This will support the development of outfall projects that will help us achieve goals and milestones while adhering to the WQIP hierarchy of source control, resource recovery, treatment, and diversion.

Flow Ecology special study. As described further below, we plan to continue the Flow Ecology special study. This study is intended to aid with more precise and definitive implementation of dry weather discharge control strategies for individual receiving waters and/or stream reaches within the WMA by assessing the degree of hydrologic alteration within water bodies across the WMA.

Implementation of the Smart Watershed Network grant project. This project will include installing up to 60 flow measurement stations in the Aliso Creek watershed, including outfalls and in-stream stations. The project will also develop data infrastructure to support analysis of flow metering data alongside water consumption data. This is a collaborative effort with MNWD through a grant from the Metropolitan Water District of Southern California.

5 Channel Erosion and Geomorphic Impacts

5.1 Overview

Identify and rehabilitate 23,000 linear feet of high priority erosion sites using a geomorphically-referenced design approach

Within the network of streams and creek systems in the WMA, certain reaches have experienced severe erosion resulting from historic development, 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, erosive energy) of a channel. Where erosion is active and ongoing, the effects of erosion on the physical habitat of the stream can be key barriers to the recovery of riparian ecosystems.

Our WQIP focuses on identifying and rehabilitating 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 build rehabilitation projects designed to serve the full range of flow and temporal conditions (e.g., peak flood flows; geomorphically-significant flows; low flows). By constructing feasible rehabilitation projects to abate excess erosion over a range of time, we intend to make improvements in physical habitat and hydraulic regime (i.e., underlying tiers in the stream rehabilitation framework layer) that can support improvements in biological communities.

In addition to rehabilitation of priority reaches, this HPWQC also focuses on (1) avoidance of future impacts through our ongoing implementation of the South Orange County Hydromodification Management Plan (HMP), (2) assessment of the effectiveness of the HMP, and (3) earlier detection of progressing erosion through the use of remote sensing.

5.2 2019 Progress Report

5.2.1 Actions

During this reporting year, we conducted monitoring and assessment related to the effectiveness of the HMP. We also initiated efforts to support stream rehabilitation designs. Below are highlights from these efforts. A more comprehensive summary of strategy implementation is included in **Table 8**.

HMP Effectiveness Monitoring and Assessment. We implemented the first year of HMP effectiveness monitoring within Chiquita Creek. This monitoring included cross-sectional surveys, geoform assessment, and biological surveys consistent with the accepted HMP Quality Assurance Project Plan (QAPP) (October 2018). We also received and reviewed the results of the stream monitoring program implemented by Rancho Mission Viejo. (See Appendix A.4).

Conceptual Geomorphically-Referenced Basis of Design (GRBoD) Guidelines. We initiated efforts to finalize the Conceptual GRBoD Guidelines. This effort will include coordination with internal partners (e.g., OC Parks, OC Flood) and external resource agencies (e.g., San Diego Water Board, California Fish and Wildlife, US Fish and Wildlife, US Army Corps of Engineers). These guidelines will serve as a framework for developing stream rehabilitation projects to align with WQIP goals.

Aliso Creek Watershed Collaboration Group. As discussed in Section 7.5, we initiated the Aliso Creek Watershed Collaboration Group and developed a framework of desired outcomes and collaboration norms to support project development in the watershed.

Table 8. Strategy Implementation Summary for the Channel Erosion HPWQC

Strategy	Purpose of Strategy for HPWQC	Type	Planned Timing	Implementation during Reporting Year	Progress on Target?	References or Discussion
Rehabilitation Alternatives and Feasibility Studies	Identify potential rehabilitation alternatives, evaluate the feasibility of these alternatives, and develop a prioritized list of feasible projects to seek funding. This is intended as a key foundational step to advance feasible projects to meet overall HPWQC goals.	WMA	First round to be completed in 2021	Efforts continued on fish passage and restoration project at Trabuco Creek at Metrolink and Interstate 5 Bridges, including OCPW participation. OCPW led development of the Aliso Creek Watershed Collaboration Framework which is intended to serve as a framework for advancing projects in the watershed, including potential stream rehabilitation. Initiate effort for the Rehabilitation Alternatives and Feasibility Studies and will continue in 2020	Yes	NA
Programmatic Permitting Framework for Geomorphically-Referenced Basis of Design Projects.	Determine if a programmatic framework can reduce barriers and expedite implementation of channel rehabilitation projects. This is intended as a key foundational step to advance feasible projects to meet overall HPWQC goals.	WMA	Complete in 2021	County staff have met with the Southern California Wetland Recovery Project (SCWRP) to discuss potential permitting frameworks for channel rehabilitation and mitigation projects. The Aliso Creek Watershed Collaboration Framework will also serve as a venue to develop programmatic permitting approaches.	Yes	NA
Finalize Conceptual GRBoD Guidelines	Seek input from project partners and permitting agencies to finalize the Draft Conceptual GRBoD Guidelines which were included in the WQIP. This is intended as a key foundational step to advance feasible projects to meet overall HPWQC goals.	WMA	Complete in 2020	The Permittees initiated this effort in 2019.	Yes	NA
LiDAR Data Acquisition and Analysis	Establish a baseline for stream channel topography and vegetation to support geomorphic change detection techniques at 5-year intervals over time. Provide base data to support the development of rehabilitation alternatives and feasibility studies.	WMA	Initial acquisition in 2016. Repeat acquisition scheduled for 2021.	Obtained quote from LiDAR vendor for 2021 services.	Yes	NA
Jurisdictional Implementation of Hydromodification Management Plan.	Reduce hydrologic impacts overtime via application of HMP standards to redevelopment. Avoid hydromodification impacts to stream channels via application of HMP standards to new development. This includes application of HMP standard to Rancho Mission Viejo Ranch Plan as well as other projects. The TGD and HMP describe BMP design standards.	Jurisdictional.	Ongoing	Permittees require PDPs to implement hydromodification source control requirements within the WQMPs and tracked development approvals. Permittees also invested in enhancing their inventory of WQMP sites using the OC Stormwater Tools platform. There are currently more than 450 WQMPs inventoried in OC Stormwater Tools in the WMA. This is a work in progress.	Yes	Implementation is summarized in the Jurisdictional Strategy Implementation Summaries (Appendix F)

Strategy	Purpose of Strategy for HPWQC	Type	Planned Timing	Implementation during Reporting Year	Progress on Target?	References or Discussion
Coordination with upland control proposed for Pathogen Health Risk and Water Balance HPWQCs.	Identify opportunities to enhance flow control as part of projects being planned for other HPWQCs. Flow control is a key consideration for developing rehabilitation design alternatives.	WMA	Ongoing, opportunistic. Anticipated as part of rehabilitation concepts completed in 2021.	Not implemented this year, consistent with planned phasing. The Aliso Creek Watershed Collaboration Framework will also serve as a venue to identify and vet potential upload flow control approaches.	Yes	NA
Hydromodification Management Plan Effectiveness Monitoring and Assessment	Determine if HMP standards are effective at protecting stream channels; support the adaptation of HMP design standards if determined to be needed. This is an annual milestone for 2019.	WMA	Ongoing monitoring in 2019, 2020, and 2021. Reporting in 2022.	Required monitoring for 2019 was completed and data were submitted with the Annual Report.	Yes	Data assessment included in Appendix A.4. Data submittal included with 2018-19 WQIP Annual Report
Assessment of Stream Monitoring Data Submitted by RMV	Support hydromodification effectiveness assessment described above. This is an annual milestone for 2019.	WMA	Assessed annually until RMV project monitoring requirements are completed.	RMV's 2019 stream monitoring report was assessed and submitted with this Annual Report.	Yes	Appendix A.4.
Aliso Creek Mainstem Ecosystem Restoration Project Development	Advance rehabilitation design concepts for high priority reaches of Aliso Creek that are experiencing excess erosion. This is intended to result in improvement in physical habitat which is a foundational element of addressing impairments to biological integrity	WMA (Aliso Creek Permittees)	Timing is contingent on development of an acceptable locally-preferred alternative.	OCPW led development of the Aliso Creek Watershed Collaboration Framework which is intended to serve as a framework for advancing projects in the watershed, including potential stream rehabilitation.	Yes	Section 7.5.
Habitat Rehabilitation and Restoration Projects	Implement projects to address excess erosion and provide multiple benefits. This is intended to result in improvement in physical habitat which is a foundational element of addressing impairments to biological integrity.	Jurisdictional or Multi-Jurisdictional	Initiate following the completion of the alternatives analysis.	Two projects were recently completed and are in the monitoring phase: • Wagon Wheel Creek • DeWitt Property in Laguna Canyon Creek OCPW is working with OC Parks to assess lessons learned from the Wagon Wheel Creek Project.	Yes	NA

5.2.2 Performance: Achievement of Milestones and Goals

Annual Milestones. The 2019 milestones for this HPWQC include:

- Performed the first year of HMP effectiveness monitoring in Chiquita Creek.
- Received and assessed the 2019 stream monitoring data and reports associated with the Rancho Mission Viejo development.

Both of these milestones were achieved. See Section 5.2.1 and Appendix A.4.

Progress towards Goals. Our first interim goal calls for 2,000 linear feet of stream reach rehabilitated to abate excess erosion using a geomorphically-referenced approach by 2023. To streamline the stream reach rehabilitation project implementation, we have initiated inter-agency efforts to pursue programmatic permitting for geomorphically-referenced basis of design projects, and have initiated a rehabilitation alternatives and feasibility studies which will continue in 2020. These strategies are set to be completed by 2021 to attain the first interim goal of 2,000 linear feet by 2023.

5.2.3 Outcomes: Environmental Condition Assessment

The hydromodification management effectiveness assessment conducted to date has primarily confirmed the validity of the large river exemption for San Juan Creek. RMV monitoring of Chiquita Canyon (which receives wet weather discharges from a flow duration control basin) have tentatively demonstrated the adequacy of this basin to avoid hydromodification impacts. Our planned geomorphic and biological monitoring of lower Chiquita Creek over the next three years will support a more focused assessment of the effectiveness of the flow duration controls described in the HMP. See Appendix A.4 for additional information.

At this time, we have not projected the expected ecological outcomes from future channel rehabilitation projects. Based on literature and the results of regional monitoring, we believe these projects will result in improvement in ecological condition. Our monitoring and assessment program calls for pre- and post-construction monitoring of rehabilitation projects.

5.3 Planned 2020 Efforts

Several efforts are planned in 2020 as summarized below.

Geomorphically-referenced Basis of Design Guidelines. We will continue to coordinate with stakeholders to develop the Geomorphically-referenced Basis of Design Guidelines. As part of this, we anticipate developing project case studies and lessons learned from design, permitting, and construction. This canguide and streamline future planning and design

Streamlined Permitting Framework. Via the Aliso Creek Watershed Collaboration Group and other coordination, we will explore opportunities to streamline permitting of stream rehabilitation projects.

Additional HMP effectiveness monitoring. We will perform the second year of additional HMP effectiveness monitoring in lower Chiquita Creek, including geomorphic and biological monitoring, as detailed in the WQIP and the HMP QAPP.

Ongoing implementation of the HMP. We will continue to require hydromodification control standards to be met by Priority Development and Redevelopment Projects, except as exempted per the WQIP.

6 Monitoring and Assessment Program

In addition to the HPWQC monitoring assessments identified in Sections 3, 4, and 5, we continued to implement the other elements of the MAP during the 2018-19 reporting year. Methodologies, results, and assessments of various monitoring programs are in Appendices A through C, and Appendix D describes the quality assurance and quality control (QA/QC) assessment performed to evaluate data accuracy and precision.

6.1 WMA Monitoring Assessments

6.1.1 Receiving Water Monitoring Assessment

Appendix A.1 includes an assessment of metals, toxicity, and pesticides data from long term mass emissions (LTME) sites. LTME monitoring is conducted throughout SOC WMA receiving waters to estimate annual loads and toxicity of a wide range of constituents during both dry and wet weather.

For the 2018-19 reporting year, we achieved compliance with Permit Provision D by conducting two wet weather monitoring events across the region at seven LTME monitoring stations. These samples were assessed by comparing results to the freshwater acute and chronic California Toxics Rule (CTR) criteria (adjusted for water hardness, if applicable). Some exceedances of CTR criteria in wet weather conditions for dissolved metals were exhibited in copper (3.7 percent acute, 3.7 percent chronic). Total selenium exceeded CTR criteria 22 percent of the time in wet weather.

Toxicity was evaluated at the seven LTME monitoring stations during the two wet weather monitoring events. Aqueous toxicity was extremely low, occurring in only 3.6 percent of storm-influenced samples. There were failed results for *Ceriodaphnia dubia* reproduction at Aliso Creek (ACJ01) and Segunda Deshecha Channel (SDCM02).

Organophosphate Pesticides (OPP) detections in wet weather were infrequent overall except for malathion (15 percent) and dichlorvos (4 percent) indicating the low presence of these types of pesticides in the watershed. Pyrethroid compounds were detected more frequently. Most commonly detected pyrethroids were bifenthrin (89 percent) and Cyfluthrin (63 percent). Compared with the 2017-18 reporting year, the occurrence of pesticides has generally decreased. Full details for the completed LTME report are available in Appendix A.1.

6.1.2 MS4 Outfall Discharge Assessment

Appendix A.2 includes a detailed summary of activities implemented as part of the MS4 Outfall monitoring program which includes: outfall inventory, dry (field screenings and water quality sampling) and wet weather outfall discharge monitoring. Additionally, components of the unnatural water balance HPWQC are discussed, including the Outfall Capture Feasibility Study (OCFS). Field screenings collected during dry weather monitoring include an evaluation of outfall flow conditions (flowing, pooled or ponded, or dry), and expanded outfall observations which includes an evaluation of the outfall's contribution to the receiving water (connectivity, receiving water flow conditions, and an estimate of the relative contribution to receiving water flow).

During the 2018-19 reporting year, the inventory of MS4 outfall structures in the SOC WMA was reviewed and updated. Using aerial imagery including high resolution LIDAR, approximately 100 additional outfalls were identified. Field-verification efforts resulted in adding 34 outfalls (greater than 36") to the inventory; other identified outfalls were already in the inventory, were not accessible, or were not found. The updated outfall inventory consists of 421 field-verified outfall structures of all sizes (323 have a diameter >36", 51 have a diameter less than <36", 13 are culverts, and 34 are box-shaped). Out of the 421 outfalls identified, 392 have been classified as accessible.

Dry Weather MS4 Outfall Discharge Monitoring

Field Screening

Outfall field screenings consisted of recording observations in an ESRI ArcCollector application. A total of two field screening events were conducted during the 2018-19 reporting year and resulted in a total of 792 outfalls visited (320 outfalls had at least two field screening records). Where connectivity to receiving water was able to be evaluated, most outfalls (112 out of 138 outfalls) contributed a small fraction of flow to receiving water (less than 10 percent). Out of the outfalls identified with persistent flow conditions, 114 were recorded as being directly connected to the receiving water. A dashboard was created to include Permittee responses to outfalls identified with persistent flow conditions and is available for viewing at this link:
https://ocpw.maps.arcgis.com/apps/opsdashboard/index.html#/d7d5f0b5615b45a3a36e860e0fc1cff8

Non-stormwater Persistent Flow MS4 Outfall Discharge Sampling

During the 2018-19 reporting year, dry weather MS4 outfall discharge samples were monitored at 58 outfalls on two separate events. Samples were collected at 47 outfalls with active flow conditions and 11 outfalls were observed as either dry or pooled/ponded during the two separate sampling events. Some of the sampling results exceeded the non-stormwater action levels (NALs) parameters for dissolved oxygen, turbidity, pH, fecal coliform, *Enterococcus*, total nitrogen, total phosphorus, MBAS, iron, manganese, cadmium, copper, nickel, and zinc.

Wet Weather MS4 Outfall Discharge Monitoring

Wet weather MS4 Outfall discharge composite samples were collected at 14 outfalls. These outfalls were also monitored during the transitional monitoring period. These outfalls represent stormwater discharges within each jurisdiction, as well as residential, commercial, industrial, and mixed-use land-uses. Some of the sampling results exceeded the following Stormwater Action Levels (SALs) parameters: nitrate and nitrite (total), and total phosphorus. Loading was calculated from annual rainfall data, tributary area, and area weighted run-off coefficients for six land-use types (residential, commercial, open, industrial, other urban, and agriculture).

Outfall Capture Feasibility Studies

During the 2018-19 reporting year, the OCFS was initiated at 20 outfalls. Samples were collected at 32 source water locations (groundwater seeps, potable water lines, recycled water lines, and sewer lines) and three diurnal sampling events were conducted at the 20 outfalls. Source water sampling locations were selected in consideration of the outfall drainage areas. Traditional and innovative (stable isotopes [water, nitrate], PPCPs, HF183, HF183- PMA, NGS parameters and field screening data were analyzed at the outfall and most source water locations. Parameter results at source waters will be compared to the results

at the outfalls in an effort to assess potential sources of the outfall discharge. An overview of the initial OCFS is included in the Appendix A.2.

6.1.3 Sediment Monitoring Assessment

The sediment monitoring assessment is included in Appendix A.3. The Regional Harbor Monitoring Program (RHMP) provides a comprehensive survey of water quality, sediment quality, and aquatic life biodiversity on a five-year cycle in four embayments in the San Diego Region: Dana Point Harbor, Oceanside Harbor, Mission Bay and San Diego Bay. These surveys aim to assess the status and trends of water and sediment quality as well as the health and diversity of marine life in the four harbors within the San Diego Region, including Dana Point Harbor. Preliminary results of the Sediment Quality Objectives (SQO) analysis show three out of the 4 stations (75 percent) in Dana Point Harbor are classified as possibly impacted while one station (25 percent) is classified as un-impacted. Comparison of overall integrated SQO station assessments over time shows a decrease of stations classified as un-impacted from 50 percent in 2013 to 25 percent in 2018. The first draft of the RHMP 2018 report is tentatively scheduled to be released in April 2020. The next round of sediment monitoring will occur during the summer of 2020.

6.1.4 HMP Effectiveness Monitoring Assessment

Appendix A.4 includes information about the hydromodification control effectiveness monitoring program, presents results obtained from monitoring efforts performed during the 2018-19 reporting year and summary of findings from the stream monitoring conducted as part of the Rancho Mission Viejo (RMV) Ranch Stream Monitoring Plan and Habitat Conservation Plan. Hydromodification control effectiveness monitoring program efforts in this first, of three, year were performed in parallel with efforts from RMV, with a comprehensive analysis of data to be published in a 2022 HMP Effectiveness Assessment Report. Appendix A.4 summarizes the cross-sectional surveys, partial CRAM assessment, and bioassessment assessment. Additional monitoring efforts including geo-form assessment and the remaining CRAM analysis are summarized in the RMV San Juan Creek Watershed Stream Monitoring Assessment 2019 Annual Report.

6.1.5 Area of Special Biological Significance Monitoring Assessment

Appendix A.5 includes information about Areas of Special Biological Significance (ASBS) monitoring within SOC WMA. Two of the identified ASBS in Southern California, Irvine Coast ASBS and Heisler Park ASBS, are located within the SOC WMA. The WQIP does not address the Irvine Coast ASBS as there are no direct MS4 discharge locations noted within the Irvine Coast ASBS coastline. For the Heisler Park ASBS, the City of Laguna Beach continues to participate in a regional monitoring program (Southern California Bight Regional Monitoring Program (Bight)). The City of Laguna Beach's response to comments from the September 6, 2019, letter entitled "Annual Report Review for Year 2017-18: South Orange County (San Juan) Watershed Management Area Water Quality Improvement Plan (WQIP)" is also included in Appendix A.5.

6.2 Regional Monitoring Assessments

6.2.1 Southern California Stormwater Monitoring Coalition Regional Monitoring Program

Appendix B.1 includes information about the SOC WMA spring and summer 2019 bioassessment monitoring, spatial pattern analyses, and special studies. We participate in a regional bioassessment

monitoring program sponsored by the Southern California Stormwater Monitoring Coalition (SMC) and managed by the Southern California Coastal Water Research Project (SCCWRP). The program is a means of assessing the biological quality of aquatic habitat by evaluating the assemblage of benthic macroinvertebrates, physical habitat condition, algae assemblages, water chemistry, and in some cases, sediment chemistry and toxicity.

The stations monitored during this assessment period included four from the SMC Regional Monitoring Program and seven historical targeted stations. Existing trends in bioassessment monitoring conducted during the 2019 sampling index period, such that stations located in urban streams scored in the *likely altered* or *very likely altered* condition categories based on their respective California Stream Condition Index (CSCI) scores. The station with the highest CSCI score was at a reference station in Bell Creek, which scored 0.90. This site was above the 10th percentile of the sites used in the CSCI reference distribution and is placed in the possibly altered condition category. Four of the remaining 10 stations scored in the same condition category. Six stations placed in the *likely* or *very likely altered* condition categories.

Biotic integrity has a strong correlation with habitat quality. Urban and heavily engineered channels provide sub-optimal habitat for benthic assemblages. Conversely, stations in areas that are at or near natural condition have beneficial habitat characteristics, such as canopy cover and complex substrate. As with previous sampling seasons, prevalent groundwater sources and corresponding dissolved solids have been observed to be a limiting factor on benthic community diversity. Biological cluster analysis clearly groups benthic communities based on geographic location and habitat conditions over the last 11 years. Additional information pertaining to metrics and historical trends are summarized in Appendix B.1.

6.2.2 Unified Beach Monitoring Assessment

Analysis for the Unified Beach Water Quality Monitoring and Assessment Program (Unified Program) monitoring data during the Unified Program reporting period (April 1 – March 30) and the AB411 Season (April 1 – October 31) is included in Appendix B.2. The purpose of the Unified Program is to continually assess coastal water quality compliance with the beneficial use standards of water contact recreation. Sampling responsibilities are shared between three partners: Orange County Public Works (OCPW) on behalf of the Permittees, Orange County Health Care Agency (OCHCA), and SOCWA. Overall, the exceedance rates remain very low, with 2.3 percent exceedance rate during the reporting period and 2.0 percent during the AB411 Season.

6.2.3 Southern California Bight Regional Monitoring Program

Appendix B.3 includes information about the Southern California Bight Regional Monitoring Program (Bight) and the work plans developed for four Bight elements: sediment quality, ocean acidification, harmful algae blooms, and trash. Water quality impacts are evaluated by the Bight on a five-year monitoring and reporting cycle, with the current cycle beginning in 2018 (Bight '18).

Bight '18 efforts were primarily focused on planning and data collection during the 2018-19 reporting year. A total of 280 sediment quality samples were collected in support of the sediment quality element during the 2018-19 reporting year, with sediment quality reports expected to be completed in 2020. An initial pilot study plan has been completed for the ocean acidification element in anticipation of the study scheduled to begin in 2020. In summer 2019, a plan to deploy mussels in approximately two dozen coastal locations was approved as part of the harmful algae bloom work plan. Trash surveys were performed at 4 SOC WMA sites in support of the Trash work plan, with additional data for epibenthic ocean debris to be evaluated alongside sediment quality samples. While a formal work plan has not yet

been released, field sampling has been initiated for the Bight '18 microbiology element. Limited data anaylsis has been completed at this stage of the five year Bight cycle.

6.3 Total Maximum Daily Load Assessments

6.3.1 Baby Beach TMDL

Appendix C.1 includes an analysis of the Baby Beach TMDL monitoring data during the 2018-19 reporting year. The Water Board adopted the Baby Beach TMDL in June 2008 and TMDL requirements were later incorporated into the Fifth Term Permit. Baby Beach water quality has significantly improved through bacteria source investigations and implementation of BMPs to address suspected bacteria sources. During the 2018-19 reporting year, exceedance rates were calculated for three fecal bacteria indicators: total coliform, fecal coliform, and *Enterococcus* and demonstrated Baby Beach TMDL compliance utilizing Permit Attachment E, Specific Provision 5.b.(3)(b), meet TMDL limits in the receiving water. Additionally, the WQIP was developed consistent with Permit Provision B.3.c Prohibitions and Limitations Compliance Option and Attachment E, Specific Provision 5.b.(3)(g), which both state that the responsible Permittees can demonstrate final TMDL compliance by developing and implementing a WQIP. Demonstrating compliance through Specific Provision 5.b.(3)(b) does not preclude Permittees from utilizing Specific Provision 5.b.(3)(g) in the future

For total coliform, compliance was demonstrated as there were no exceedances of the final numeric targets for dry and wet weather single sample maximum and dry weather 30-day geometric means standards. The final dry and wet weather compliance milestones were met for fecal coliform. Additionally, the 30-day geometric mean numeric target was met, since there were no exceedances during dry weather. *Enterococcus* dry weather numeric target exceedances are below 12 percent for the single sample maximum and 30-day geometric means. While there were exceedances for *Enterococcus*, exceedances rates have significantly declined since the baseline years (1996-2002) for dry and wet weather conditions. With the implementation of the dry weather diversion BMPs, there was no discharge (and associated pollutant loading) from the MS4 to Baby Beach during most of the dry season, thus the required load reduction has been achieved. Additionally, the 2018-19 reporting year exceedance rates were reduced by 80 percent compared to baseline year, thus the final wet weather compliance milestone (62.2 percent load reduction) has been achieved.

6.3.2 Beaches and Creeks TMDL

The analysis of Beaches and Creeks TMDL monitoring data during the 2018-19 reporting year is located in Appendix C.2 and the interim exceedance frequency were summarized in Section 3.2.2 above. The Water Board adopted the Fecal Indicator Bacteria TMDL in 2010, which includes 30 water bodies in SOC WMA. Permit Attachment E, Specific Provision 6.b.(3)(b), meet TMDL limits in the receiving water was utilized to assess compliance with the Beaches and Creeks TMDL. In the WQIP, interim compliance deadline of April 4, 2020, was identifed for dry weather and April 4, 2028, for wet weather. Additionally, the WQIP was developed consistent with Permit Provision B.3.c Prohibitions and Limitations Compliance Option and Attachment E, Specific Provision 6.b.(3)(f), which both state that the responsible Permittees can demonstrate final TMDL compliance by developing and implementing a WQIP. Demonstrating compliance through Specific Provision 6.b.(3)(b) does not preclude Permittees from utilizing Specific Provision 6.b.(3)(f) in the future

For the beach segments during dry weather, the interim and final percent exceedances for all bacteria indicators were met at Laguna Beach (Heisler Park-North, Ocean Avenue, Cleo Street, Bluebird Canyon Road, Dumond Drive), Aliso Beach (Blue Lagoon Place, West Street, Table Rock Drive, 9th Avenue), Salt Creek Beach (Salt Creek Service Road, Dana Strand Road), Ole Hanson Beach Club, San Clemente City Beach (El Portal Street Stairs, Mariposa Street, South Linda Lane, Lifeguard Headquarters, Trafalgar Canyon), and San Clemente State Beach (Riviera Beach, Cypress Shores). Dry weather interim and final percent exceedances were not met at Aliso Creek, Aliso Creek Mouth, Salt Creek (large outlet), San Juan Creek at Pacific Ocean Shoreline, Poche Beach, and San Clemente Pier.

For the beach segments during wet weather, the interim and final percent exceedances for all bacteria indicators were met at Irvine Cove, Laguna Beach (Heisler Park-North, Main, Ocean Avenue, Cleo Street, Dumond Drive), Aliso Beach (Blue Lagoon Place, West Street, Table Rock Drive, 9th Avenue), Salt Creek Beach (Salt Creek Service Road, Dana Strand Road), Salt Creek (large outlet), Ole Hanson Beach Club, San Clemente City Beach (El Portal Street Stairs, Mariposa Street, South Linda Lane, Lifeguard Headquarters), and San Clemente State Beach (Riviera Beach, Cypress Shores). Wet weather interim and final percent exceedances were not met at Aliso Creek, Aliso Creek Mouth, San Juan Creek at Pacific Ocean Shoreline, San Juan Creek lower one mile, San Juan Creek mouth, Poche Beach, San Clemente City Beach (Linda Lane, Trafalgar Canyon) and San Clemente Pier.

6.4 Quality Assurance Report and Monitoring Completeness

Appendix D summarizes results of QA/QC assessments and evaluations, including precision, accuracy, comparability, representativeness, and completeness of the monitoring data for the 2018-19 reporting year. Following the WQIP QAPP prepared for the WQIP, the proportion of quality assurance samples collected and analyzed for the MAP this year was approximately 10 percent of the total samples collected. In addition to the contract laboratories, QA/QC samples for bacteriological constituents are prepared and submitted to the Orange County Public Health Water Quality Laboratory for analysis following QAPP protocols. In general, the precision and accuracy of various analyses conducted by contract laboratories were satisfactory for nutrients, toxicity, general minerals, and fecal indicator bacteria. Future quality assurance investigations are planned to examine isolated issues, such as Organophosphorus Pesticide (OPP) accuracy, some trip blanks and equipment blanks that were above the reporting limits, and the accuracy of trace metal analytes. Full details with complete QA/QC reporting are available in Appendix D.

7 Cross-Cutting Special Studies and Supporting Efforts

Special studies and supporting efforts cut across all HPWQCs, providing valuable information for setting baselines and maintaining focus on the goals of the WQIP. These efforts provide the basis for adaptively managing WQIP implementation. This section summarizes the status of these efforts.

7.1 San Diego Regional Reference Streams and Beaches Studies

The San Diego Region Reference Streams and Beaches Studies (Reference Study) was initiated to gather the data necessary to derive reasonable and accurate numeric targets for bacteria, nutrients, and metals. The Reference Study primarily aimed to ascertain the naturally occurring levels of bacteria, nutrients, and metals in minimally-disturbed watersheds in the San Diego Region (SCCWRP, 2015). The Reference Study investigated conditions during both wet and dry weather and evaluated the seasonal variance of WQO exceedance frequencies for FIB. The Reference Study also analyzed the effects of hydrologic, geomorphologic, and biotic and abiotic factors on the frequency of WQO exceedance.

The Reference Study commenced in fiscal year 2011-2012, to investigate the natural background sources of FIB in response to the two established FIB TMDLs in the San Diego Region. The Reference Study has produced two reports (SCCWRP, 2015 and SCCWRP 2016) suggesting current TMDL WQOs do not adequately account for the natural and largely uncontrollable sources of bacteria generated. Additionally, nutrients and metals data collected through the Reference Study process indicate exceedances of WQOs may be wet weather driven and heavily influenced by geology. To further understand the natural loading of wet weather nutrients and metals and its potential implication to the overall water quality management strategy in the San Diego Region, an analysis of nutrient and metals data collected from the Reference Study process was proposed in the WQIP. The findings from the analysis will lead to an understanding of wet weather background nutrient and metal level in undeveloped watersheds and will provided crucial understanding in TMDL development and implementation.

7.1.1 2019 Progress and Findings Report

In July 2018, an assessment of data collected from the 2012-2015 investigations for nutrients and metals commenced as part of the Reference Study. The 2012-2015 investigations included flow-weighted sampling conducted during eight storm events at five sites, for a total of 126 samples over the period of January 2012 to May 2015. In addition, 180 samples were collected during biweekly dry weather sampling in 10 intermittent stream sites in 10 watersheds located in San Diego, Orange and Ventura Counties from January 2012 to August 2014. Sites were selected to meet reference screening criteria and to represent a mix of watershed size (varying from less than 33 square kilometers (km^2) to greater than 66 km^2) and sedimentary versus igneous/metamorphic geology. The human-associated fecal microbial source marker HF183 was used to eliminate sites or samples with potential human contamination, a helpful assurance for nutrients and organic matter concentrations. Wet and dry weather concentrations, loads and fluxes from this study were compared with data from previous studies in the region.

The Reference Study yielded three major findings:

- Exceedances occurred in natural sites during wet and dry weather but were generally low for most constituents. Among nutrients, heavy and trace metals, notable exceedances only occurred for total phosphorus (TP) (3 percent, summer dry weather), total and dissolved zinc (Zn) (23 percent,

wet weather, 17 percent, dry weather), manganese (Mn) (6 percent, dry weather), and iron (Fe) (5 percent, dry weather). Conventional constituents were notably high for total dissolved solids (19 percent wet weather, 33 percent dry weather).

- Geology was a major determinant of dry weather nutrient, metal and conventional constituent concentrations, while relationships with flow, antecedent rainfall, temperature and specific conductivity indicated pathway of source (groundwater versus land surface erosion). Catchments dominated by igneous/metamorphic geology were associated with higher chloride, phosphate (PO_4) and TP, total dissolved Fe, dissolved organic carbon (DOC), dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP), while catchments of sedimentary origin were associated with higher sulfate (SO_4), TDS, hardness, nitrate+nitrite (N+N), total and dissolved cadmium (Cd), Zn and selenium (Se). Significant correlations of TDS, SO_4, total hardness, N+N, and dissolved Cd, Fe and Lead (Pb) with other factors such as flow, antecedent rainfall, temperature and specific conductivity were likely indicative of the groundwater rather than runoff-influenced baseflow. In contrast, total Fe and Zn, PO_4, DOP, TP, DON, total nitrogen (TN), and DOC were twice the concentration during wet weather versus dry weather, indicating that strong relationships with erosional processes from land surfaces in the contributing catchments exist.
- Dry weather flow weighted means and wet weather event mean concentrations (EMC) and fluxes were on the lower end of what was previously documented for Southern California and generally one to two orders of magnitude lower than that of developed watersheds. This suggests that data from this study can be used, in addition to other regional datasets for regulatory applications of reference study in the greater southern California region.

Additional details of the Reference Study is included in the final report “Wet and Dry Weather Natural Background Concentrations of Nutrients, Heavy and Trace Metals, and Conventional Constituents in Southern California Streams” and included in Appendix I.

7.2 Special Study: Stormwater Quality Asset Inventory and Pollutant Loading Estimates

In recognition of the need to standardize asset tracking and performance assessment, we identified a special study to conduct a water quality asset inventory and pollutant load estimating analysis for one or more priority watersheds. As part of this study, we are developing an open-source web application (OC Stormwater Tools) to:

1. Build and maintain a consistent inventory of BMP assets.
2. Support field users and maintenance managers with rapid BMP condition assessment and maintenance tracking.
3. Track BMPs within private parcels and verify O&M.
4. Store tributary watershed information.
5. Calculate trash capture performance and support On-land Visual Trash Assessment (OVTA).
6. Model the performance of built and planned BMPs
7. Report progress and future projections for annual reporting.

Elements 1 through 5 are complete and are currently in use by several Permittees and their contractors. Elements 6 and 7 are in progress.

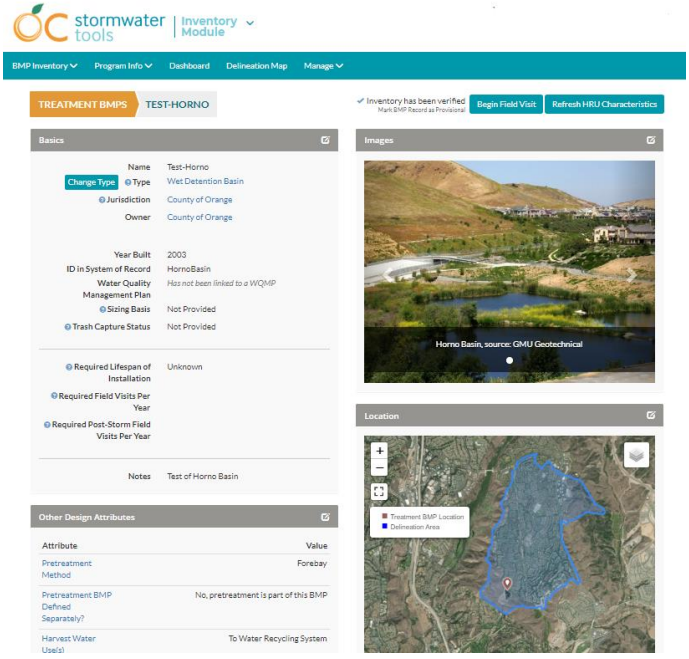

Figure 7. Example OC Stormwater Tools BMP Detail Page with Delineation Populated

7.2.1 2019 Progress Report

Major efforts undertaken and milestones achieved in 2019 as part of this Special Study include:

- Completed the Inventory Module of OC Stormwater Tools and conducted trainings attended by more than 40 jurisdictional users.
- Developed the Trash Module of OC Stormwater Tools. This has been put into use by several jurisdictions. This module quantifies the trash capture performance of inventoried BMPs. It also supports users in performing and recording OVTAs.
- Developed delineation functionality to support users in performing delineations at both local and regional scales. This module incorporated geoprocessing services to aid in development and refinement of BMP delineations.
- Developed jurisdictional BMP inventories and BMP delineations. Our progress is summarized below
- Initiated the Modeling Module to provide pollutant load and water balance estimates based on inventoried BMPs. As part of this effort, we compiled extensive supporting datasets and geospatial data services. We also developed algorithms that produce results efficiently within a web-based framework.

Table 9 and **Table 10** present a summary of the current inventory-in-progress. **Figure 8** illustrates the extent of delineations that have currently been populated. These efforts are a work in progress and do not reflect the total quantity of BMPs or treated area in the watershed. Efforts to populate the inventory are ongoing.

Table 9. Summary of BMP Types in OC Stormwater Tools Inventory (provisional, as of December 2019)

BMP Type	Count
BMPs Providing Stormwater and Dry Weather Benefit	**816**
Bioinfiltration (bioretention with underdrain)	40
Bioretention with no Underdrain	8
Bioretention with Underdrain and Impervious Liner	12
Constructed Wetland	4
Dry Extended Detention Basin	21
Drywell	2
Flow Duration Control Basin	1
Flow Duration Control Tank	2
Hydrodynamic Separator	65
Infiltration Basin	12
Infiltration Trench	33
Permeable Pavement	29
Proprietary Biotreatment	65
Proprietary Treatment Control	423
Sand Filters	11
Underground Infiltration	7
Vegetated Filter Strip	16
Vegetated Swale	58
Wet Detention Basin	7
BMPs Providing Dry Weather Benefit	**49**
Low Flow Diversion	46
Dry Weather Treatment Systems	3
BMP Intended for Trash Capture Only	**2605**
Inlet and Pipe Screens	2603
In-stream Trash Capture	2

Table 10. Summary of Area Treated by BMPs OC Stormwater Tools Inventory (provisional, as of December 2019)

HSA	Total Developed Land, ac	Area Treated by Inventoried BMPs[1]		
		Area Managed for Dry Weather[2], ac	Area Managed for Wet Weather[3], ac	Sum of All Area Managed, ac
Laguna Coastal Streams	4,010	590	1,090	1,680
Aliso Creek	15,910	490	2,500	2,980
Dana Point Coastal Streams	5,400	4,040	450	4,490
San Juan Creek	31,880	40	7,210	7,250
San Clemente Coastal Streams	9,310	3,780	210	3,990
WMA Total	66,510	8,940	11,460	20,400

[1] Work in Progress only includes non-trash BMPs with delineations
[2] Diversion or Treatment Only
[3] Includes dry weather benefits

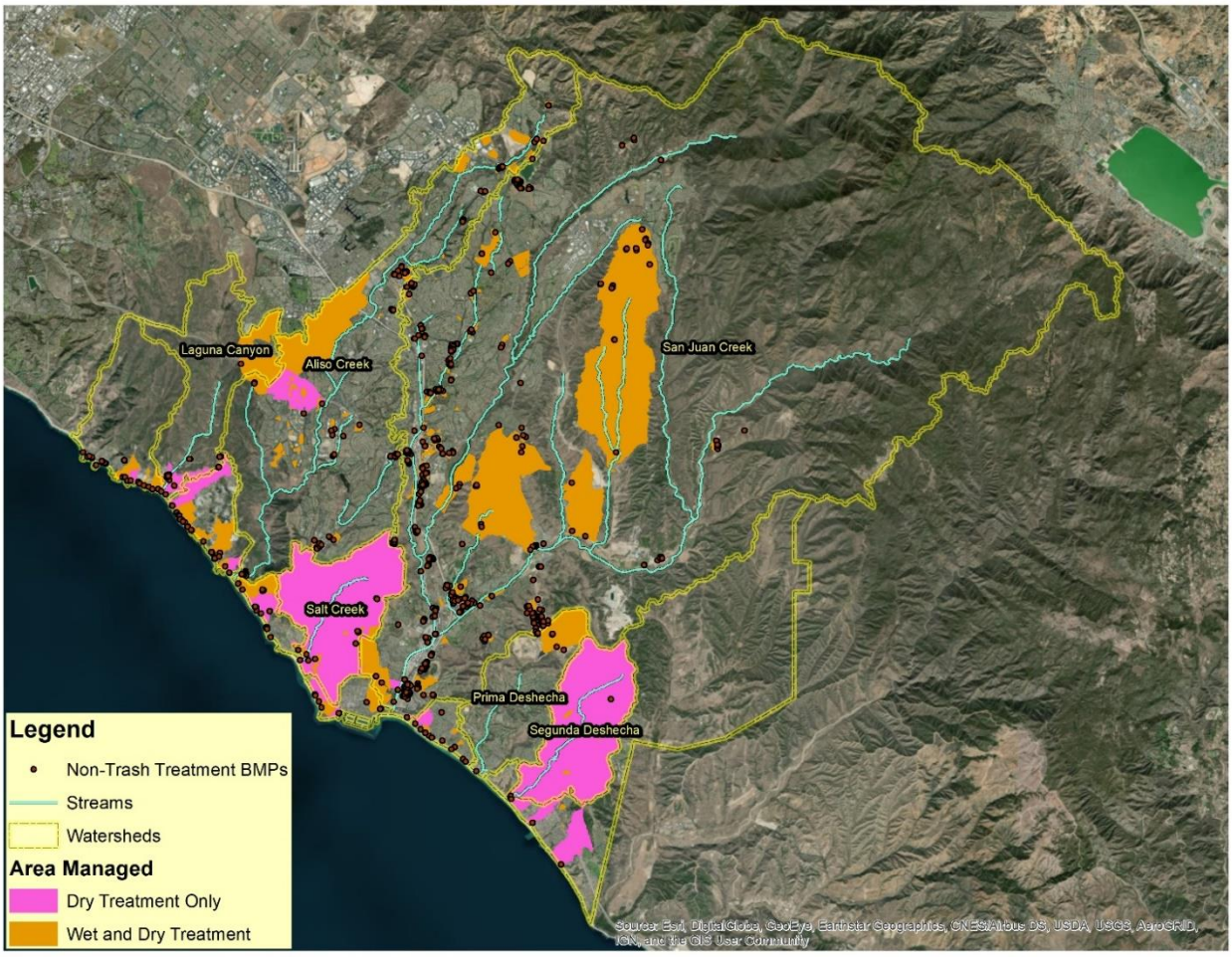

Figure 8. Area Treated by BMPs in Current OC Stormwater Tools Inventory (provisional, as of December excludes Trash Screens and In-Stream Trash Capture)

7.2.2 Planned 2020 Efforts

Major efforts planned for 2020 include:

- Finish developing the Modeling Module of OC Stormwater Tools to conduct performance quantification for flows and pollutant loads.
- Produce reporting interfaces to support future Annual Reporting efforts.
- Continue to populate inventories and delineations.

The special study portion of this project is proposed to be completed two years from WQIP approval (June 2020). Use of the OC Stormwater Tools to improve inventories and performance quantification within the WMA will continue beyond the special study term.

7.3 Special Study: Evaluation of Baseline and Reference In-stream Flow Conditions

Urbanization of the WMA has resulted in changes to flow conditions in the watershed. Developed land produces more runoff during wet weather and reduces some groundwater recharge pathways. Imported water stored in reservoirs and applied to landscaping is a relatively large portion of the watershed water balance. This has resulted in augmentation of dry weather streamflows and likely contributes to groundwater recharge. Water impoundments, withdrawals, and diversions change the flow conditions in streams. This has resulted in modified flow regimes and associated modifications in habitat.

The Permit requires the permittees to prohibit non-stormwater discharges. Additionally, the WQIP identifies unnatural water balance as a HPWQC. The WQIP acknowledges both benefits and impacts of reducing flow. Information is needed about how water balance should be managed to support improvements in the condition of riparian habitats and be compatible with overall water resources management goals.

The "Flow Condition" or "Flow Ecology" special study will evaluate current flow alteration and develop ecologically-based environmental flow recommendations for several urban watersheds that support several federally listed species within the WMA. As discussed above, the baseline and reference flow regime is of importance for prioritizing outfall strategies and judging project effectiveness. For example, this study will help inform whether a stream reach is naturally ephemeral. For perennial streams, this study can help understand what level of flow removal would be desirable to support target species.

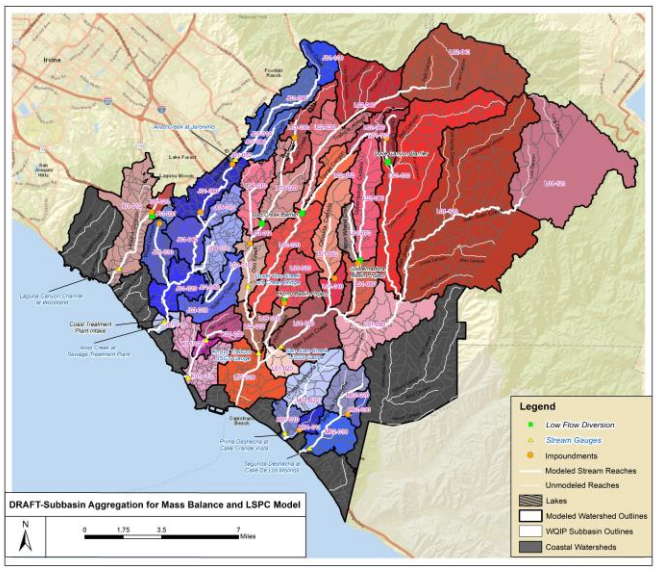

Figure 9. Draft Watershed Delineations based on Major Hydrologic Features and Habitat Regions

Combined with the Stormwater Quality Asset Inventory and Pollutant Load Estimates special study, we will use the results and findings from this special study to better characterize the receiving water conditions of the WMA. This will allow us to understand the sources of pollutants and/or stressors within streams, and better target efforts to reduce the discharge of pollutants from MS4 outfalls to receiving waters.

7.3.1 2019 Progress Report

This special study commenced in early 2019, with a stakeholder process initiated in July 2019. Key stakeholder milestones include:

- Formation of a Stakeholder Advisory Group (SAG), including Permittees, water agencies, local environmental groups, resource agencies, and others.
- Formation of a Technical Advisory Group (TAG), including resource agency representatives, water agency technical staff, academic researchers, and others.

- Meetings with the SAG held on July 17, 2019, and August 5, 2019.
- Meeting with the TAG held on October 22, 2019.
- Meetings with SMWD, SJBA, and SOCWA regarding study objectives and technical methods.

The technical team has completed several key foundational tasks for this study, including:

- Delineating watersheds
- Compiling water impoundment and water diversion/withdrawal information
- Developing hydrologic model inputs
- Analysis and interpretation of available streamflow and outfall flow monitoring data
- Compilation of habitat information
- Development of draft scenarios

Additional information on the special study as well as materials from the SAG and TAG meetings are available here:
https://cms.ocgov.com/gov/pw/watersheds/documents/south_oc_water_quality_improvement_plan_(wqip)/flow_ecology_special_study.asp

7.3.2 Planned 2020 Efforts

In 2020, we will continue coordination with key stakeholders, complete hydrologic analyses, and make substantial progress on the ecological analyses. We envision analyzing scenarios and producing draft data products.

7.4 Supporting Effort: Performance Measures Development

Last year, we initiated discussion on the development of a performance-based approach for tracking and measuring progress in WQIP implementation. This approach is intended to enable us to maximize water quality benefits achieved with current funds and to demonstrate incremental progress towards compliance. A performance-based approach includes clear goals, performance metrics with defined accounting standards, tracking tools and a defined adaptive management process. In 2019 we continued development of draft performance measures for each HPWQC and began work on draft calculation guidance for a subset of these measures. We anticipate completing these efforts in 2020 and being able to incorporate performance measures into next year's Annual Report.

An example draft "results chain" for the Unnatural Water Balance HPWQC is presented in **Figure 10**.

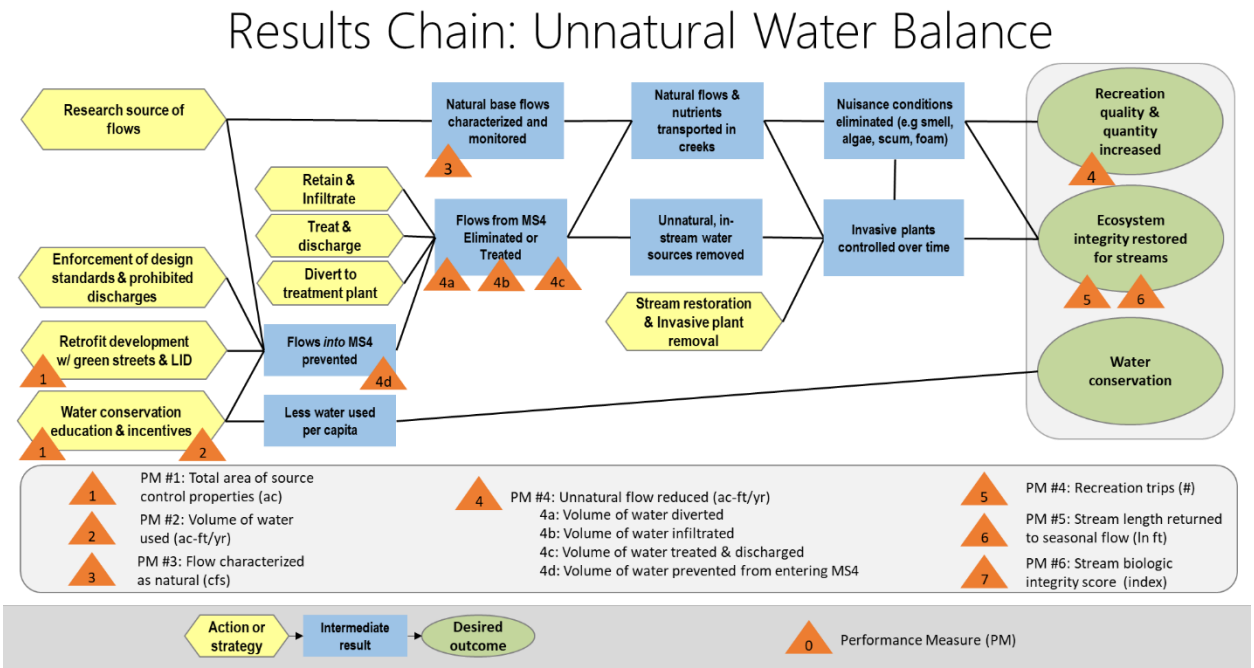

Figure 10. Example Draft Results Chain and Performance Measures for Unnatural Water Balance HPWQC

This results chain resulted in prioritization of Performance Measure 4a through 4d for development of further calculation guidance. The calculation guidance is currently under development. This is intended to provide a common framework for Permittees to estimate the benefits of various activity types for the management of unnatural flow as dipicted in **Figure 11**.

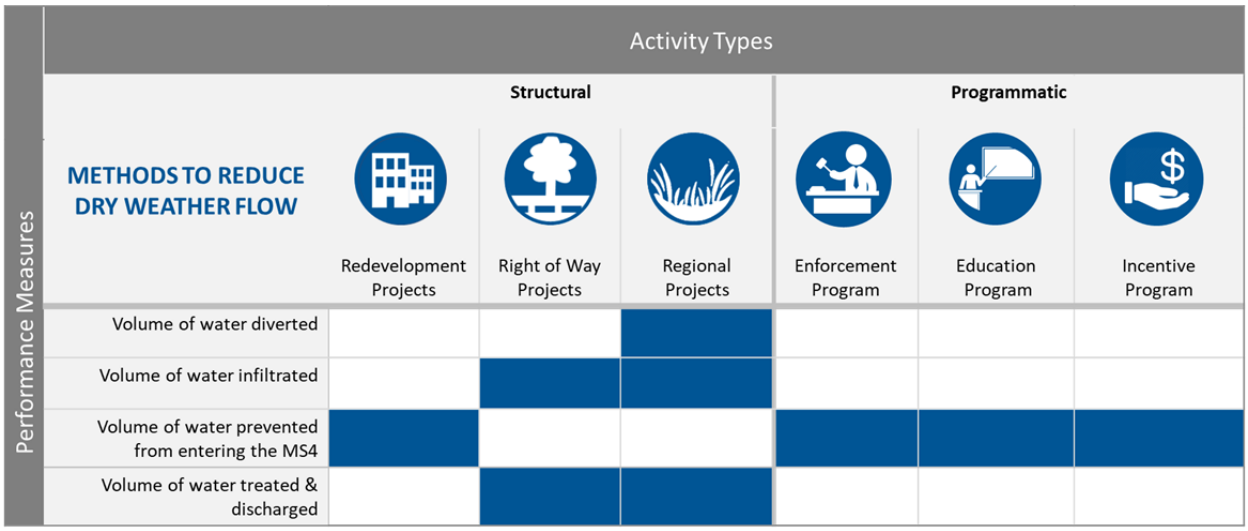

Figure 11. Activity Types and Potential Contributions to Unnatural Water Balance Performance Measures

Blue cells in **Figure 11** show the expected applicability of performance measures (as rows) to report progress in implementing WQIP activities (as columns). Activities include structural and programmatic

strategies; while performance measures focus on several types of water volume benefits. The SOC WMA is currently developing and testing methods to report these metrics consistently across the WMA. Consistent tracking of progress will allow the Water Board to understand progress and fairly award credit for effective work in improving water quality.

7.5 Supporting Effort: Aliso Creek Watershed Collaboration Group

Following direction from the SOC WMA IRWM Group Executive Committee, County staff initiated a watershed-scale project collaboration framework to develop and support water resource projects by providing valuable collaboration opportunities among partners. Introduction of this framework commenced within the Aliso Creek Watershed with plans to mirror similar efforts within the other watersheds of the SOC WMA.

The first step was defining a locally supported project coordination process that balances water resource and habitat priorities in the Aliso Creek Watershed by establishing and maintaining an open and transparent communication and collaboration method –the Open Standards for the Practice of Conservation (Open Standards). The Open Standards enable stakeholders to successfully conceptualize, partner, and fund watershed projects by (1) defining desired conditions;(2) explaining how projects will achieve desired conditions; and (3) evaluating progress toward desired outcomes.

Stakeholders from cities, water and wastewater agencies, environmental non-profits, transportation agencies, the County, Federal and State regulatory/resource agencies, academic institutions, and other non-governmental organizations actively participated in three meetings thus far in July, August, and October 2019. Meetings for this group are open to the public; however, participants have committed to the process for continuity and meetings will continually build upon prior discussion.

Thus far, the Aliso Creek Watershed Collaboration Group has developed and endorsed a set of desired outcomes and actions that can contribute to these desired outcomes. Desired outcomes are shown in **Figure 12**. This collaborative effort has key relationships to HPWQC efforts, including unnatural water balance management, stream rehabilitation, and stormwater treatment retrofits.

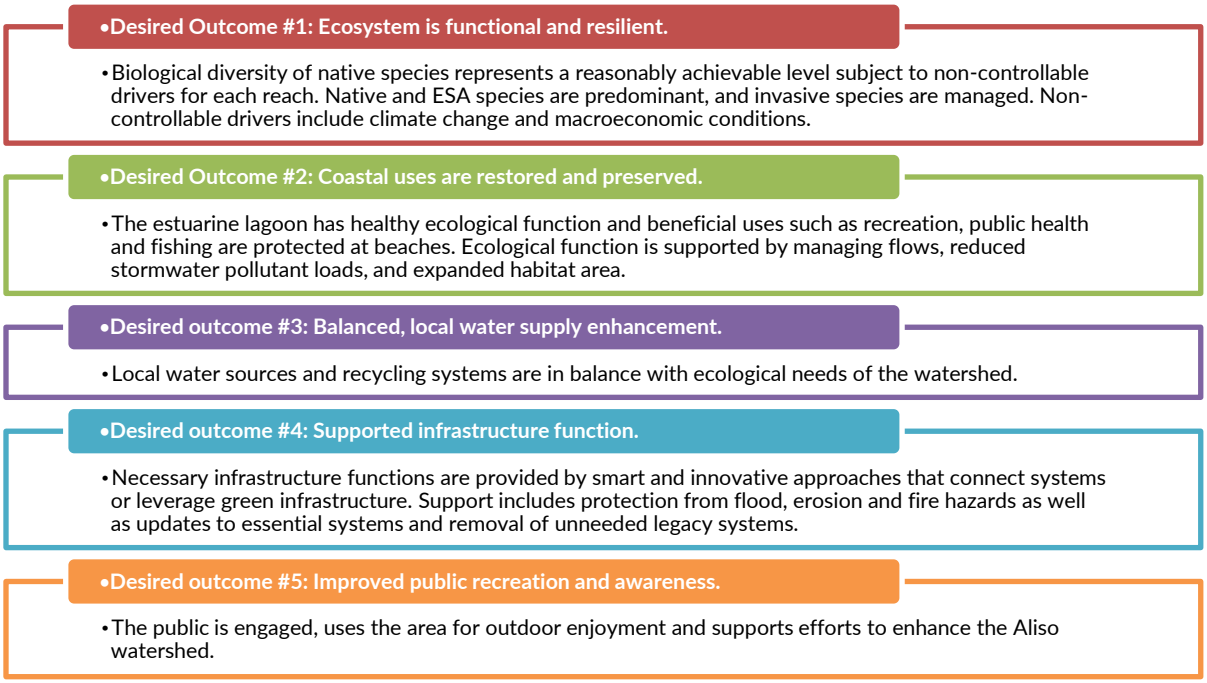

Figure 12. Operable Desired Outcomes for Aliso Creek Watershed Collaboration Group

7.6 Supporting Effort: Permitted Discharge Inventory

The Permit exempts permitted discharges from the non-stormwater discharge prohibitions. While exempt, these may still represent unnatural discharges that alter natural flow regime in stream. Development of an inventory of these potential sources is identified as a strategy in the WQIP. The purpose of this inventory is to characterize the contribution of permitted discharges to flows at the MS4 outfalls and inland receiving waters and identify strategies within the Permittees' authority to address these discharges.

We compiled this inventory from several sources:

- California Integrated Water Quality System (CIWQCs) database:
  - Construction site permits (Order 2009-0009-DWQ (As amended by 2010-0014-DWQ))
  - Individual industrial permits (Order 2014-0057-DWQ)
  - Drinking water distribution system general permit (Order 2014-0194-DWQ)
- Stormwater Multiple Application and Report Tracking System (SMARTS)
- NPDES Permits and WDRs
- Conditional Waiver NOIs (e.g., low threat discharges to land)

The inventory is posted here:
https://ocgov.app.box.com/s/qzwrb4g8me6ys9ba03870gaqulhnjnp7/folder/60782693874

We assessed the number of sites and whether information is available to assess discharges to the MS4 and surface waters.

Construction sites: There are a moderate number of active permitted construction sites present in the WMA at any given time (approximately 88 as of April 2019). Permit records do not allow us to assess

whether there are dry weather discharges from these sites. We generally believe that these have a low risk of contributing dry weather flows, unless there are significant dewatering operations. As part of jurisdictional IDDE follow ups investigations, the inventory of construction sites will be used as one line of evidence to assess potential sources.

Industrial General Permit facilities: There were 42 facilities enrolled in Order 2014-0057-DWQ (Industrial General Permit) as of April 2019. This land use is relatively uncommon in SOC WMA. The permit records available on CIWQS and SMARTS do not allow us to assess whether there are dry weather discharges from these sites. The Industrial General Permit allows certain non-stormwater discharges under specific conditions, including:

1. Fire-hydrant and fire prevention or response system flushing;
2. Potable water sources including potable water related to the operation, maintenance, or testing of potable water systems;
3. Drinking fountain water and atmospheric condensate including refrigeration, air conditioning, and compressor condensate;
4. Irrigation drainage and landscape watering provided all pesticides, herbicides and fertilizers have been applied in accordance with the manufacturer's label;
5. Uncontaminated natural springs, groundwater, foundation drainage, footing drainage;
6. Seawater infiltration where the seawater is discharged back into the source: and,
7. Incidental windblown mist from cooling towers that collects on rooftops or adjacent portions of your facility, but not intentional discharges from the cooling tower (e.g., "piped" cooling tower blowdown or drains).

These sources could contribute to unnatural flow at MS4 outfalls. These exemptions are more permissive than the Permit. However, due to the relatively small fraction of land area made up by these facilities, we do not believe these present a significant source of dry weather flow. As part of jurisdictional IDDE follow up investigation, the inventory of industrial sites will be used as one line of evidence to assess potential sources.

Wastewater permits. SOCWA holds two individual wastewater permits in the WMA, one for the Aliso Creek Ocean Outfall and one for the San Juan Creek Ocean Outfall. Based on our review of these permits and wastewater system monitoring data, there are no permitted releases from these systems to inland surface waters.

Water Agency Drinking Water Distribution System Permits: Each water agency in the WMA is covered by Order 2014-0194-DWQ. This order permits a variety of releases from the drinking water distribution system, including the drawdown of storage reservoirs, fire hydrant flushing, releases for emergency maintenance, and other releases. While this water is generally relatively clean, it can contribute to unnatural flow at MS4 outfalls.

Based on a review of the allowable sources, we consider fire hydrant flushing to be the most likely contributor to dry weather runoff to the MS4 on an ongoing, routine basis. Water agencies are permitted to flush each hydrant up to 3 times per year for up to 60 minutes at a flow rate up to 1,600 gallons per minute (gpm) or 3.6 cublic feet per second (cfs). Actual flushing practices are likely below these limits. Based on a visual survey of hydrant spacing, we estimated that there are approximately 0.25 hydrants per developed acre of land (1 hydrant for each 4 acres). **Table 11** summarizes our estimates of the amount of dry weather flow that may be generated from hydrant flushing in the urban landscape.

Table 11. Range of Annual Volume and Flowrate per Developed Area in the SOC WMA

Parameter	Minimum	Maximum	Unit
Flow rate during hydrant flushing	700	1600	gpm
Duration of hydrant flushing	10	60	mins
Frequency of hydrant flushing	1	3	times per year
Number of hydrants per developed acre	0.25	0.25	
Annual volume from hydrant test per developed acre	225	9240	cu-ft
Estimated long term average flow rate from hydrant flushing (counting all hours)	7×10^{-6}	3×10^{-4}	cfs/ac
Estimated long term average flow rate from hydrant flushing (counting only business hours when flushing likely occurs)	3×10^{-5}	1×10^{-3}	cfs/ac
Observed total average flowrate at monitored outfalls (based on MS4 monitoring program, for comparison)	3×10^{-4}		cfs/ac

Based on this analysis, hydrant testing can make up a significant portion of the average dry weather flow that has been measured at MS4 outfalls, ranging from approximately 2% at the low end to approximately 100% of flow at the high end. During the short periods when testing is occurring, the flowrates (1.5 to 3.6 cfs) would represent a large pulse of water to the stream. If crews are working on multiple hydrants within a given area, then a series of pulses to a given outfall or stream segment could produce a relatively prolonged period of elevated flow.

Hydrant flushing serves an important purpose, and we do not suggest that this O&M practice should cease. However, this does indicate that there will continue to be unnatural sources of water at MS4 outfalls even if all non-permitted, non-exempt discharges are removed. Where the stream system is sensitive to unnatural flows, then an outfall capture/diversion approach may be needed to assure dry conditions at the outfall.

The permitted dischargers inventory list can be found in Appendix F.

7.7 Supporting Effort: Water Impoundment Inventory

There are a range of types of water impoundments in the WMA, including drinking water reservoirs, recreational and decorative lakes and ponds, stormwater basins, and other impoundments. The WQIP identified the need for an inventory of impoundments due to the potential role these may play in the water balance of the watershed. These may capture and retain flows, or they may release water that augments downstream flows. The purpose of this inventory is to characterize the potential role of these impoundments in the dry weather water balance of the WMA.

We utilized National Hydrography Dataset, dam safety records, stormwater network information, and review of aerial photographs to develop this inventory. For stormwater facilities we reviewed as-built information to the extent available. For water agency facilities, we reviewed the storm drain system around these facilities to assess what drains to these and reviewed applicable permits to assess allowable discharges. For major dams, we conferred with the dam operators.

We then ranked the facilities based on their likely contribution to changes in dry weather flow regime. This inventory will be used by Permittees as part of IDDE follow-up investigations. Below is a summary of our findings from this inventory effort:

- Most water reservoirs generally do not receive much watershed runoff and do not have permitted discharges to receiving waters under normal conditions (they are allowed to discharge in emergency conditions or for maintenance).
- The Dove Canyon Reservoir receives runoff from the upper Dove Canyon Watershed. A low flow diversion operated by SMWD in Dove Canyon diverts dry weather flows downstream for use in the recycled water system.
- Earthen dams allow seepage by design. This is believed to be a source of flow in Oso Creek, from both the Upper Oso Reservoir and Lake Mission Viejo, both of which are earthen dams. For example, SMWD estimates 4,000 to 5,000 gallons per day of seepage from the Upper Oso Reservoir (email communication, Daniel Peterson, 7/16/2019). This may be a source of flow in other locations, as earthen dams are most common in the WMA.
- Lake Laguna Niguel (Sulphur Creek Reservoir) operates at a steady state, allowing water to discharge continually based on the level of inflows. There are some evapotranspiration (ET) losses. There is also an existing water right for withdrawals from the lake.
- Regional stormwater facilities generally do not contribute to flow, but some tend to reduce flow, including:
    - SMWD withdraws water from the Horno Basin for use in the SMWD recycled water system.
    - SMWD diverts dry weather flows into the Gobernadora Multi-Purpose Basin where it can recharge groundwater or be extracted. SMWD also uses this basin for storage of potable water, which could contribute to recharge in this basin.
    - The Laguna Audubon Basin appears to capture and infiltrate all dry weather flows.
    - Other stormwater facilities may allow evaporative and minor seepage losses (e.g., Wood Canyon Wetlands, Dairy Fork Wetlands).

The features described above are being considered as part of the Flow Ecology Special Study and incorporated into the hydrologic model, as applicable.

Less information is available about decorative lakes and ponds in parks, golf courses, and communities. These will be investigated further as needed as part of jurisdictional IDDE follow-up investigations. The water impoundment inventory list can be found in Appendix F.