County of San Diego

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September 29, 2015

David W. Gibson, Executive Officer
California Regional Water Quality Control Board
San Diego Region
2375 Northside Drive, Suite 100
San Diego, CA 92108-2700

Dear Mr. Gibson:

COUNTY OF SAN DIEGO, PERMIT R9-2013-0001 – REVISED WATER QUALITY IMPROVEMENT PLAN FOR THE SAN LUIS REY WATERSHED MANAGEMENT AREA – PIN NO. 794836:WCHIU

On behalf of the Participating Agencies (PAs) in the San Luis Rey Watershed Management Area, the County of San Diego is pleased to submit the attached revised Water Quality Improvement Plan (WQIP) in accordance with the requirements set forth in Provision F.1.b.(3) of Order R9-2013-0001, as amended by Order No. R9-2015-0001, the National Pollution Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watershed within the San Diego Region, NPDES No. CAS0109226 (Permit).

The WQIP has been revised in response to comments received from Regional Water Board staff on two occasions; first, August 5, 2015 which consisted of a general comment letter applicable to all WQIPs in the region; and second, August 19, 2015, which consisted of a compliance matrix specific to the San Luis Rey WQIP. Comments were also received from other organizations. The San Luis Rey PAs used the aforementioned compliance matrix that described deficiencies in the June 2015 plan submittal, as a guide for revisions to the WQIP and noted how each comment was addressed in the revised version being submitted. How each comment was addressed is described in the compliance matrix, which is enclosed with this letter.

We appreciate your staff's continued willingness to provide feedback and guidance during this process. If you have any questions or comments, please contact me at (858) 694-3672 or e-mail at Todd.Snyder@sdcounty.ca.gov.

Sincerely,

Todd Snyder

TODD E. SNYDER, Manager
Watershed Protection Program

Enclosures: Compliance Matrix
San Luis Rey River Water Quality Improvement Plan (CD)

cc: Mo Lahsaiezadeh
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SAN LUIS REY RIVER
WATERSHED MANAGEMENT AREA
WATER QUALITY IMPROVEMENT PLAN

Submitted by

City of Oceanside
City of Vista
County of San Diego
Caltrans

Prepared by:

Modeling by:

September 2015

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County of San Diego

SARAH E. AGHASSI
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SAN LUIS REY WATERSHED MANAGEMENT AREA, WATER QUALITY IMPROVEMENT PLAN, STATEMENT OF CERTIFICATION

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.

Sarah Aghassi
SARAH E. AGHASSI
Deputy Chief Administrative Officer
Land Use and Environment Group
County of San Diego

9/24/15
Date

September 25, 2015

SAN LUIS REY RIVER WATERSHED MANAGEMENT AREA, WATER QUALITY IMPROVEMENT PLAN

Statement of Certification

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.

M.A. Lahsaiezadeh

Sept 25, 2015

Mo Lahsaiezadeh
Environmental Officer
Clean Water Program
Water Utilities Department
City of Oceanside

Date

CITY OF VISTA
CALIFORNIA

September 24, 2015

SAN LUIS REY RIVER WATERSHED MANAGEMENT AREA, WATER QUALITY IMPROVEMENT PLAN, Statement of Certification

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.

GREG MAYER
City Engineer

9/24/15
Date

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Help save water!

September 15, 2015

STATEMENT OF CERTIFICATION

SAN LUIS REY RIVER WATERSHED MANAGEMENT AREA, WATER QUALITY IMPROVEMENT PLAN, (PERMIT PROVISION F.1.b), REVISED AS OF SEPTEMBER 2015

I certify, under penalty of law, that this Water Quality Improvement Plan submittal 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 known violations.

BRUCE L. APRIL
Deputy District Director, Environmental

9/18/2015
Date

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ACRONYMS AND ABBREVIATIONS

%	Percent
<	less than
ASBS	Area of Special Biological Significance
BIOL	Biological Habitats of Special Significance
BMP	Best Management Practices
CALTRANS	California Department of Transportation
CEDEN	California Environmental Data Exchange Network
CLRP	Comprehensive Load Reduction Plan
CWA	Clean Water Act
FIB	Fecal Indicator Bacteria
GIS	Geographical Information System
HPWQC	Highest Priority Water Quality Condition
IBI	Index of Biological Integrity
IDDE	Illicit Discharge Detection and Elimination
JRMP	Jurisdictional Runoff Management Program
JURMP	Jurisdictional Urban Runoff Management Program
LTEA	Long-Term Effectiveness Assessment
MEP	Maximum Extent Practicable
MLS	Mass Loading Station
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
PERMIT	San Diego Regional Water Quality Control Board Order Number R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region
PWQC	Priority Water Quality Condition
RMR	Annual Receiving Waters and Urban Runoff Monitoring Report; or Regional Monitoring Report
RW	Receiving Water
RWQCB	Regional Water Quality Control Board, San Diego Region
SANDAG	San Diego Association of Governments
SBPAT	Structural BMP Prioritization and Analysis Tool

SLR	San Luis Rey
SMC	Southern California Stormwater Monitoring Coalition
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
TWAS	Temporary Watershed Assessment Station
USEPA	United States Environmental Protection Agency
WMA	Watershed Management Area
WMAA	Watershed Management Area Analysis
WQBEL	Water Quality Based Effluent Limit
WQIP	Water Quality Improvement Plan
WQO	Water Quality Objective
WURMP	Watershed Urban Runoff Management Program

EXECUTIVE SUMMARY

INTRODUCTION (CHAPTER 1)

The California Regional Water Quality Control Board, San Diego Region (Regional Board) adopted a National Pollutant Discharge Elimination System (NPDES) Permit (Order R9-2013-0001, NPDES No. CAS0109266) (Permit) for discharges from Municipal Separate Storm Sewer Systems for the San Diego Region on May 8, 2013. The adoption of this Permit represents a shift from prescriptive, activity based permit requirements to a strategic, outcome driven approach focused on watershed-wide improvements through collaborative jurisdictional planning and implementation. Provision B of the Permit requires the phased development and implementation of a Water Quality Improvement Plan (Plan) for the region's watersheds, including San Luis Rey Watershed.

The *goal* of this Plan is to further the Clean Water Act's objective to protect, preserve, enhance, and restore water quality and beneficial uses. By prioritizing and addressing water quality conditions that are influenced by storm drain discharges, the Participating Agencies in the San Luis Rey Watershed will be able to utilize key resources to address the most important issues. Furthering the Clean Water Act's objective will be accomplished through an adaptive planning and management process. This process identifies the priority and highest priority water quality conditions (PWQCs and HPWQCs) linked to storm drain discharges and implements strategies through the Jurisdictional Runoff Management Programs (JRMPs). These strategies will be utilized to improve the quality of storm drain discharges that will, in turn, improve water quality in receiving waterbodies.

The *purpose* of this Plan is to guide Participating Agencies' jurisdictional programs.

The Plan development process is based on guidance from the Permit, and is outlined in the adjacent figure. This Plan was developed in three phases to address the following five steps:

1) Identification of the priority and highest priority water quality conditions;
2) Identification of numeric goals for bacteria in the watershed;
3) Identification of potential sources and development of implementation strategies to achieve the numeric goals;
4) Development of the monitoring and assessment program to evaluate progress of implemented strategies toward achieving the goals; and
5) Assessment of progress periodically through the adaptive management process.

Once this Plan is approved by the Regional Board, the Participating Agencies will implement the strategies and monitoring programs. Then, as described in Chapter 5, annually or with the Report of Waste Discharge as appropriate, the Participating Agencies will assess the progress of the Plan and use the adaptive management process to make adjustments as needed to achieve improved water quality in the watershed.

The San Luis Rey Watershed is located in northern San Diego County and is bordered to the north by the Santa Margarita River Watershed and to the south by the Carlsbad and San Dieguito River Watersheds. The River extends over 55 miles and has a watershed of approximately 360,000 acres. The San Luis Rey River discharges to the Pacific Ocean in the City of Oceanside. Population in the watershed is approximately 190,000 (U.S. Census Bureau, 2011), mostly centered in the Cities of Oceanside and Vista, and unincorporated communities of Fallbrook, Bonsall, and Valley Center. Over 54 percent of the land in the watershed is undeveloped; other land uses include residential, agricultural, parks and open space, commercial/industrial, freeways/roads, recreation, and schools (Project Clean Water, 2010).

The Participating Agencies include the Cities of Oceanside and Vista, the County of San Diego, and the California Department of Transportation (Caltrans). Although Caltrans is not a part of the regional Permit, Caltrans will work cooperatively with the local jurisdictions.

PUBLIC PARTICIPATION PROCESS

As required by the Permit, the Participating Agencies implemented a public participation process to solicit data, information, and recommendations throughout the development of the Plan. The public process has included two public workshops and two Consultation Panel reviews.

The first public workshop was held October 7, 2013. The workshop provided an overview of this Plan's development process and Participating Agencies accepted the public's suggestions for water quality improvement priorities, likely sources, and potential strategies. The second public workshop was held on June 24, 2014, and focused on potential numeric goals for the highest priority water quality condition and potential strategies that could be implemented to achieve the numeric goals.

The Consultation Panel consists of representatives from the Regional Board, the environmental community, the development community, the Industrial Environmental Association, and the San Diego County Farm Bureau. The first Consultation Panel Meeting was held on January 29, 2014, to discuss the draft Provision B.2 document (Chapter 2). The document contained proposed priority water quality conditions, likely sources, and potential strategies to improve water quality conditions in the watershed. The second Consultation Panel Meeting was held on August 21, 2014, to provide an overview of the draft Provision B.3 document (Chapter 3) and discuss the proposed strategies and schedules. Further input from the Consultation Panel was requested on October 16, 2014, to review the Participating Agencies jurisdictional goals. The Participating Agencies considered the Consultation Panel's valuable input and used it to streamline the jurisdictional goals and improve the linkage between the strategies and their expected outcome to meet the goals.

PRIORITY WATER QUALITY CONDITIONS (CHAPTER 2)

The Participating Agencies identified water quality priorities linked to discharges from the jurisdictions' stormwater conveyance system (discharges) to be addressed by the Plan. The priorities were identified after evaluating receiving water conditions and impacts from storm drain discharges. Bacteria was identified as the highest priority water quality condition.

The Permit requires an assessment of receiving water conditions based on regulatory status (e.g., total maximum daily loads, 303(d) listings), historical and current water quality, relevant data, impacts of hydromodification, and other considerations. Building on previous assessments, multiple lines of evidence were utilized to support identification of chemical, physical, and biological impacts to receiving waters.

An assessment of the impacts of storm drain discharges on receiving water quality that considers discharge prohibitions, available storm drain discharge outfall data, locations, and discharge characteristics at storm drain discharges to receiving waters was also required.

Based on these assessments, a list of priority water quality conditions was developed for the watershed. This list was narrowed to identify the highest priority water quality condition. A summary of the highest and priority water quality conditions is included in **Table ES-1**.

Table ES- 1. Priority Water Quality Conditions in the Lower San Luis Rey Watershed

	Dry Weather	Wet Weather
Highest Priority Water Quality Condition	• Bacteria at San Luis Rey River Mouth • Bacteria in Lower San Luis Rey River	• Bacteria at San Luis Rey River Mouth • Bacteria in Lower San Luis Rey River
Priority Water Quality Conditions	• Nitrogen and Phosphorus • Total Dissolved Solids • Eutrophic Conditions • Index of Biological Integrity • Chloride • Toxicity	• Nitrogen and Phosphorus • Total Dissolved Solids • Toxicity

The Participating Agencies have also been tasked with identifying and prioritizing sources of stormwater and non-stormwater pollutants and/or stressors associated with discharges from storm drain outfalls that cause or contribute to the HPWQC, bacteria. Based on the HPWQC, evaluation of potential sources, and input from the public and Consultation Panel, the Participating Agencies developed a list of potential strategies that could improve water quality within the watershed. These potential strategies were then used to develop the proposed strategies presented in Chapter 3.

WATER QUALITY IMPROVEMENT GOALS, STRATEGIES, AND SCHEDULES (CHAPTER 3)

The Participating Agencies developed water quality improvement goals that address the water quality conditions identified in the Chapter 2. The Bacteria TMDL requires Participating Agencies to reduce bacteria levels during both dry weather and wet weather conditions within a 10- and 20-

year compliance timeline, respectively. The goals within the Plan were selected to demonstrate progress towards compliance with the Bacteria TMDL, and the strategies are the actions to be taken to obtain compliance. Multi-benefit strategies have been prioritized to achieve goals for bacteria as well as other pollutants, and will thereby address both the HPWQC and other priority water quality conditions in the watershed. The approach to achieving goals and the corresponding Plan are shown in **Figure ES-1.**

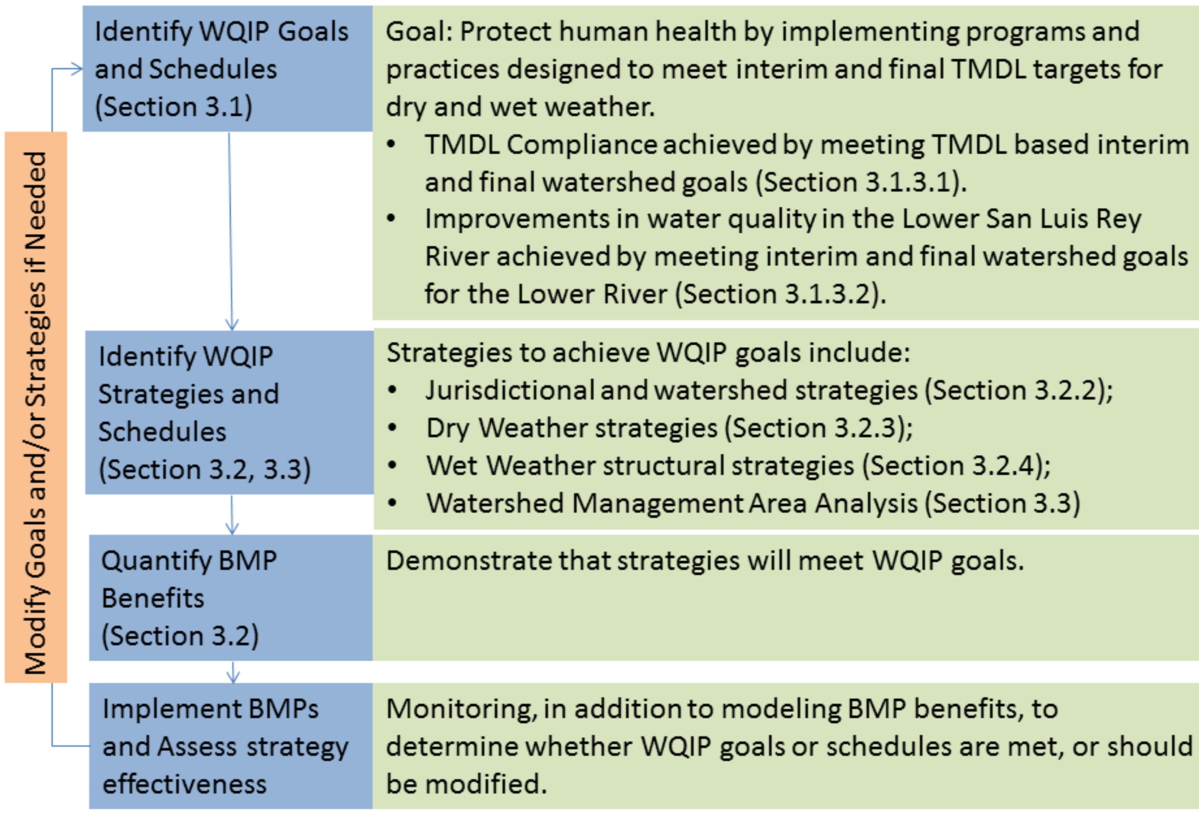

Figure ES-1. Approach for Achieving the Goals of the Plan

The watershed goals for the San Luis Rey River mouth are focused to achieve compliance with the Bacteria TMDL from Attachment E of the Permit. Likewise, the goals for the lower San Luis Rey River were also developed to support compliance with the TMDL, as improvements in water quality within the lower River will result in improvements at the compliance point. Goals in both locations were developed for dry and wet weather conditions

Each jurisdiction has developed strategies that will be implemented to work toward watershed goals. The Participating Agencies also developed optional jurisdictional and watershed strategies that, if needed, would be implemented through coordination amongst the Participating Agencies. The strategies are generally broad in nature and include suites of programmatic (a.k.a. non-structural) and structural BMPs that are expected to improve conditions within the watershed. The majority of the strategies selected are multi-benefit in nature, addressing multiple pollutants, beyond bacteria. Examples of jurisdictional strategies are included in **Table ES-2**.

Table ES-2. Examples of Strategies to Address Bacteria in the San Luis Rey Watershed

Baseline Strategies [a]	Non-Structural Strategies [b]	Optional Structural Strategies [c]
• Development and Redevelopment Planning • Construction Management and Inspections • Existing Development Management • Illicit Discharge Detection and Elimination • Education of Municipal, Industrial, Commercial, and Residential audiences • Public Outreach and Participation • Stormwater conveyance cleaning • Street sweeping • Commercial/Industrial inspections • Municipal audits	• Identification and control of sewage discharge to stormwater conveyance systems • Trash cleanups • Onsite wastewater treatment source reduction • Irrigation runoff reduction and good landscaping practices • Residential and small-scale low impact development (LID) incentive program • Commercial/industrial good housekeeping • Pet waste management programs • Redevelopment and LID implementation • Street sweeping • Stormwater conveyance cleaning	• Infiltration BMPs (e.g., basins, bioretention, permeable pavement, green streets) • Capture and use, or rainwater harvesting • Natural Treatment or filtration

[a.] Existing Jurisdictional Programs

[b.] Examples of shifting current resources and/or enhance existing Jurisdictional Programs to focus on areas/activities identified to be most effective at targeting reductions in bacteria.

[c.] Structural strategies will be considered by each jurisdiction if needed. The County of San Diego has concerns as funding sources for implementation of structural BMPs have not been identified. By reason of constraints in California law and the California constitution, Caltrans funds are subject to legislative appropriation and availability of funds.

To evaluate the ability of the proposed strategies to achieve numeric goals related to bacteria, load reductions expected to result from the implementation of these strategies were estimated for dry and wet weather. To provide reasonable assurance that implementation of this Plan will achieve the load reduction target for bacteria (the HPWQC), the assessment involved use of quantitative wet weather load reduction modeling for structural BMPs and an analytical spreadsheet approach to estimate dry weather load reductions. The result of the analysis is that predicted wet weather load reduction is greater than the estimated target load reduction; as such Plan implementation is expected to meet the HPWQC final numeric goal.

Load reductions were also quantified for nutrients to demonstrate the multi-benefit nature of the strategies and BMPs to be implemented. Although not directly related to the highest priority water quality condition, these load reductions provide quantitative estimates for improvements in priority water quality conditions that are expected over the course of implementation.

The overall strategy is to implement targeted non-structural BMPs as the primary method for achieving wet weather and dry weather load reduction goals. Due to uncertainty inherent in some of the parameters used to estimate these load reduction benefits, structural control options have been selected to be used as a backstop for achieving load reduction goals if necessary. These will be implemented as necessary based on the adaptive management model. **Figure ES-2** illustrates this concept for bacteria under wet weather conditions.

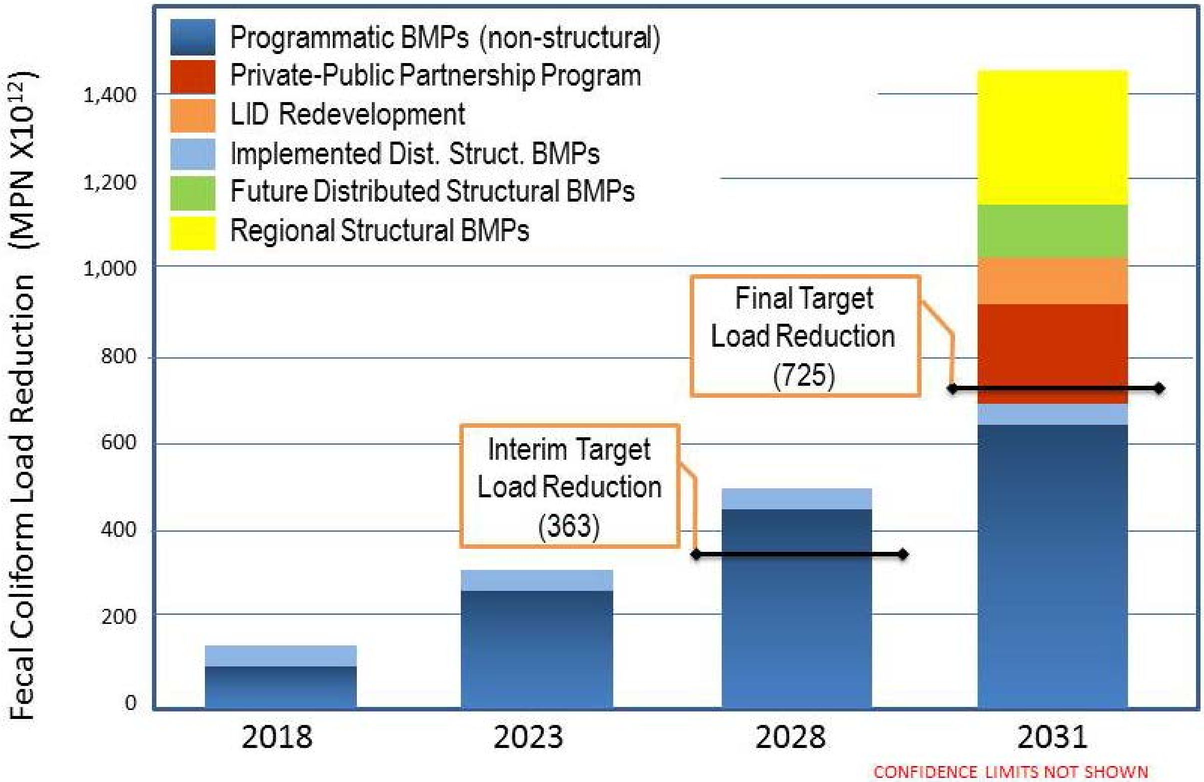

Figure ES-2. BMP Implementation Schedule and Bacteria Load Reduction Benefits for Wet Weather Conditions

Optional Watershed Management Area Analysis

The Watershed Management Area Analysis (WMAA) is an optional task described in the Permit that is intended to characterize important processes and characteristics of each watershed through creation of GIS layers that may be used for the following purposes:

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

The Participating Agencies elected to perform the watershed characterization and hydromodification management exemption mapping on a regional scale under a separate but concurrent effort to development of the Plan and it is presented in Appendix 3H.

Monitoring and Assessment Program (Chapter 4)

Based on the requirements of the Permit and through the planning process, the Participating Agencies have developed an integrated Monitoring and Assessment Program that:

- Measures the progress toward addressing the highest priority water quality conditions established in Chapter 2;
- Assesses the progress toward achieving the numeric goals and schedules provided in Chapter 3; and
- Evaluates each Participating Agency's overall efforts to implement the Plan.

The Monitoring and Assessment Program incorporates requirements of Provision D of the Permit along with the specific monitoring and assessment requirements for the Bacteria TMDL listed in Attachment E of the Permit.

The Monitoring Program includes three major components: receiving water monitoring, storm drain discharge monitoring, and special studies.

The receiving water monitoring program measures the long term health of the watershed by characterizing trends in the chemical, physical, and biological conditions of a receiving water to determine whether beneficial uses are protected, maintained, or enhanced. This program is designed to meet requirements set forth in Provision D.1 of the Permit. Long-term monitoring occurs during both wet and dry conditions for water quality and physical and biological integrity, along with sediment quality monitoring and participation in regional monitoring. The Permit also stipulates how TMDL monitoring requirements are to be incorporated into the receiving water monitoring program as described in Attachment E of the Permit. Receiving waters monitoring comprises the following programs:

- Long-term receiving water monitoring,
- Regional monitoring participation,
- Sediment quality monitoring, and
- TMDL monitoring.

The storm drain outfall monitoring program consists of dry and wet weather monitoring. The dry weather storm drain outfall monitoring program evaluates the potential contribution from storm drain discharges on receiving water quality during dry weather conditions as well as provides information for investigation and elimination of dry weather flows. This monitoring program element also assesses the ability of programs to effectively eliminate non-storm water discharges to waterbodies or waterways. The wet weather storm drain outfall monitoring program investigates the condition of the water quality of the flows that exit the storm drain outfalls during rain events to evaluate the potential influence of outfall discharges on receiving water quality.

Special studies have been selected to further investigate the HPWQCs to meet requirements of Provision D.3 of the Permit. The special studies will include both a regional special study and a special study specific to the watershed.

The assessment portion of the Monitoring and Assessment Program will evaluate the data collected under the monitoring programs, as well as the information collected as part of the Jurisdictional Runoff Management Plan. The data collected from these two programs will be used to assess the progress toward achieving the numeric goals and schedules, and to measure the progress toward addressing the highest priority water quality condition.

The Assessment Program includes an annual analysis of the monitoring data and an integrated analysis. The integrated analysis combines all analyses previously performed at the end of the Permit term, which includes the following components:

- Annual Reporting
  - Receiving Water Assessment
  - Storm Drain Outfall Discharge Assessment
  - Special Studies Assessment
- Permit Reporting (Report of Waste Discharge at end of Permit Cycle)
  - Integrated Assessment

ITERATIVE APPROACH AND ADAPTIVE MANAGEMENT (CHAPTER 5)

The Permit includes requirements for adaptive management in multiple provisions: A.4, B.5, D.4.d, and F.2.c. Chapter 5 of this Plan elaborates on the adaptive management process, including the frequencies of adaptation required by the Permit (annual versus once per Permit term), triggers, and resulting actions.

The Permit contains two conditions that may trigger adaptation annually:

1) Exceedances of water quality standards in receiving waters, and
2) New information.

In either case, modifications may be appropriate for the water quality goals, strategies, schedules, and/or Monitoring and Assessment Program. Priority water quality conditions may be modified as needed during the Permit term, but would likely be modified only as a result of assessments conducted for the Report of Waste Discharge.

The Permit also contains specific assessments to be performed during preparation of the Report of Waste Discharge. The assessments are longer term in nature, occurring only once during the Permit cycle. Because the updates to the Plan are required to undergo a full public participation process, including reconvening the Consultation Panel, modifications will consider input from the public and the Regional Board. Adaptation of Plan elements will also consider new regulations or policies as appropriate. In the Report of Waste Discharge preparation, all elements of the Plan are eligible for modifications through the required adaptive management processes. Elements that will be evaluated include the water quality conditions (i.e., priorities), goals and accompanying schedules, strategies and accompanying schedules, as well as the Monitoring and Assessment Program.

1 INTRODUCTION

1.1 PURPOSE AND GOAL OF THE WATER QUALITY IMPROVEMENT PLAN

On May 8, 2013 the California Regional Water Quality Control Board, San Diego Region (Regional Board) adopted Order No. R9-2013-0001; NPDES No. CAS 0109266, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems Draining the Watersheds within the San Diego Region (Permit). The Permit became effective on June 27, 2013.

The Permit covers portions of the Counties of San Diego, Orange, and Riverside within the San Diego Region. There are two main goals for the Permit, which now covers all Copermittees regardless of County. The first goal involves more consistent implementation, improved communication among participating agencies (particularly in the case of watersheds that cross jurisdictional boundaries), and minimizing resources spent on the permit renewal process. The second goal establishes requirements focused on achieving goals and water quality improvement outcomes rather than completing specific actions, thereby giving the Copermittees more control over how their Jurisdictional Runoff Management Programs (JRMPs) are implemented.

The Participating Agencies responsible for development of the San Luis Rey Water Quality Improvement Plan (Plan) include the Cities of Oceanside and Vista, County of San Diego and California Department of Transportation (Caltrans). Caltrans is not subject to this Permit, but is regulated under a separate Permit from the California State Water Resource Control Board (State Board; Order No. 2012-0011-DWQ). However, Caltrans has voluntarily participated in the Plan development throughout the San Diego Region.

The purpose of this Plan is to guide updates to the Participating Agencies' jurisdictional programs. These programs will be implemented to achieve the outcome of improved water quality in storm drain discharges that will, in turn, improve water quality in receiving waters. The goal of this Plan is to further the Clean Water Act's objective to protect, preserve, enhance, and restore the water quality and designated beneficial uses of waters of the state, specifically by addressing adverse water quality conditions that are associated with storm drain discharges. This goal will be accomplished through an adaptive planning and management process that identifies the Highest Priority Water Quality Condition (HPWQC) linked to storm drain discharges within a watershed and implements strategies through the jurisdictional programs to achieve improvements in the quality of storm drain discharges and, in turn, the receiving waters.

1.2 PHYSICAL SETTING

The San Luis Rey Watershed is located in northern San Diego County and is bordered to the north by the Santa Margarita River Watershed and to the south by the Carlsbad and San Dieguito River Watersheds. The San Luis Rey River originates in the Palomar and Hot Springs Mountains, both over 6,000 feet above mean sea level, as well as several other mountain ranges along the western border of the Anza Borrego Desert Park. The River extends over 55 miles across northern San Diego County forming a watershed with an area of approximately 360,000 acres or 562 square miles. The

San Luis Rey River ultimately discharges to the Pacific Ocean in the City of Oceanside. Of the nine major watersheds in the San Diego region, the San Luis Rey Watershed is the third largest. A map of the watershed is included in **Figure 1-1**.

Nearly half (49 percent) of the land in the watershed is privately owned, 37 percent is publicly owned, and the remaining 14 percent consists of six federally recognized Tribal Indian Reservations. In the western half of the watershed, private ownership dominates. Population centers include the Cities of Oceanside and Vista, and the unincorporated communities of Fallbrook, Bonsall, and Valley Center. In the eastern portion of the watershed, public lands are more prevalent. Over 54 percent of the land in the watershed is undeveloped. The next two largest land uses in the watershed are residential (15 percent) and agricultural (14 percent), with assorted other uses making up the balance (see Table 2-14). Principal agricultural uses include nurseries, citrus groves, and avocado groves (Project Clean Water, 2010).

There are six groundwater aquifers in the watershed. Moving from east to west in the watershed, these are the Warner, Pauma, Pala, Bonsall, Moosa, and Mission Basins. The annual rainfall varies considerably across the watershed, with an annual rainfall of approximately 30 inches in the eastern portion of the watershed at Palomar Mountain, to approximately 11 inches in the City of Oceanside along the Pacific Ocean.

The population within the watershed is approximately 190,000 (U.S. Census Bureau, 2011). The majority of the population lives in the downstream, urban areas within the Cities of Oceanside and Vista, and the unincorporated communities of Fallbrook and Bonsall in the County of San Diego.

The watershed consists of hydrologic units 903.11 through 903.32. The watershed is comprised of three Hydrologic Areas, which have been delineated by the Water Board based on drainage patterns: Lower San Luis (903.1), Monserate (903.2), and Warner Valley (903.3). Lake Henshaw, in the watershed, is a reservoir owned and operated by the Vista Irrigation District, a member of the San Diego County Water Authority. Lake Henshaw drains the eastern third of the watershed, capturing the water draining from the Warner Valley hydrologic area (903.3), approximately 209 square miles. This Plan applies to all three Hydrologic Areas.

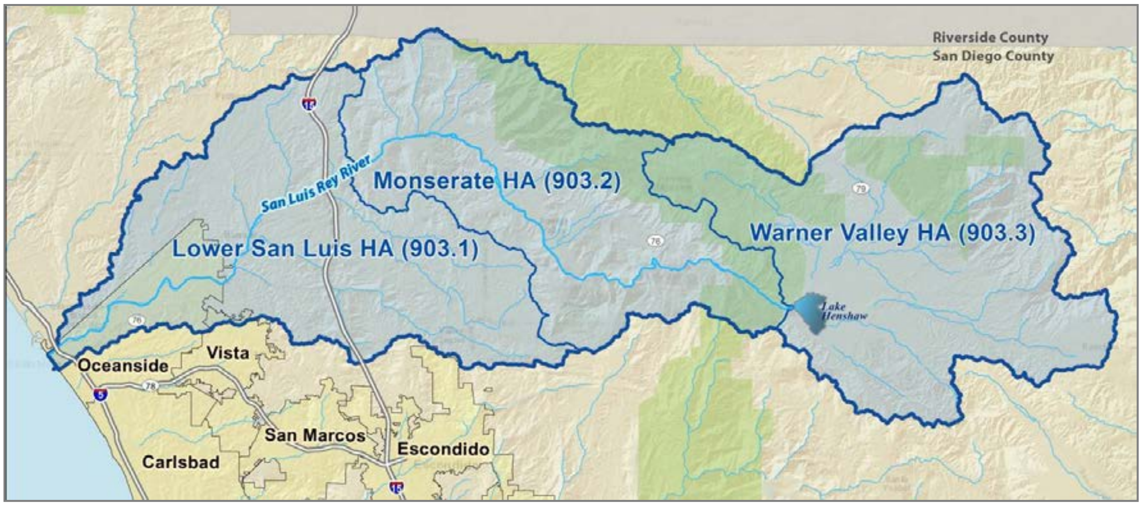

Figure 1-1. San Luis Rey Watershed
(Large format figure provided in Appendix 2F)

1.3 Regulatory Authority and Permit Requirements

1.3.1 Jurisdiction and Responsibilities

Each Copermittee must comply with the discharge prohibitions and receiving water limitations outlined in the Permit through timely implementation of control measures, other actions specified in the Permit, and collaborative development of and adherence to Water Quality Improvement Plans for each watershed in the region. The Permit limits the Copermittees' responsibilities to discharges from Copermittees' outfalls; the Permit does not require the Copermittees to manage stormwater outside of their jurisdictional boundaries, but rather to work collectively to improve stormwater management within watersheds.

This Plan is one of several documents required under the Permit, and provides an overarching "road map" to meet water quality improvement goals for the highest priority water condition in the watershed. Key dual oversight roles, especially for business, inspections and illicit discharge detection and elimination responsibilities, are outlined in each entity's Jurisdictional Runoff Management Plan. Each entity further refines the key requirements necessary to satisfy the Permit through a "stormwater" ordinance. Additionally, jurisdictional specific BMP Design Manuals provide minimum BMP guidelines for redevelopment and new development. These documents are being developed concurrently with the Plan to meet Permit deadlines and to demonstrate compliance with the Permit.

The San Luis Rey Watershed contains stormwater conveyance features under the jurisdiction of the Participating Agencies, and those that are owned and operated by other parties and regulated by separate National Pollutant Discharge Elimination System permits or other regulatory mechanisms. Discharges from non-municipal sources and activities regulated by separate permits include, for example, discharges regulated under the Phase II Small Municipal Separate Storm Sewer System General Permit (State Board Order No. 2013-0001-DWQ), discharges from industrial and construction activities regulated under the General Industrial Permit (State Board Order No. 2014-

0057-DWQ) and General Construction Permit (State Board Order No. 2012-0006-DWQ), and conditional waivers that exclude certain activities from coverage under the National Pollutant Discharge Elimination System permit program; examples of such activities include noncommercial agricultural, silvicultural, and animal operations.

Under this regulatory framework, there are two general areas of stormwater management responsibilities: (1) jurisdictional inspection and oversight, and (2) pollutant discharge control. In terms of jurisdictional inspection, the Participating Agencies have inspection responsibilities over all lands within their jurisdictional boundaries (including industrial and construction sites), except for Phase II, noncommercial agricultural, state, federal, Caltrans and Indian reservation lands, which are the primary inspection responsibility of the USEPA, State Board and/or Regional Board. However, in terms of regulatory oversight, the Participating Agencies do have some regulatory oversight over industrial lands, construction sites, Phase II, noncommercial agricultural, state, federal and Indian reservation lands. For example, the Participating Agencies implement programs to identify, investigate and enforce illicit discharges to their storm drains – any illicit discharge(s) from these lands entering a Participating Agency's storm drain(s) would be within the regulatory oversight of the affected Participating Agency and would be acted upon. Additionally, the Participating Agencies recognize their "dual oversight" role responsibility to inspect business and construction sites, even though they are not the primary permitting authority.

With regards to pollutant discharge control, various permits or conditional waivers regulate stormwater and non-stormwater discharges within the watershed. While the Participating Agencies do not have authority under the Permit to require and regulate BMPs to treat pollutant discharges from properties/entities covered under other permits, the Permit requires the Participating Agencies to control pollutants that originate from these other properties/entities if the discharge will ultimately enter the Participating Agencies' stormwater conveyance systems. For this reason, the Participating Agencies recognize that collaboration and improved communication between the various entities within the watersheds are vital so that discharges are appropriately regulated before entering the stormwater conveyance system and to improve water quality throughout the watershed.

1.3.2 Plan Requirements

This Plan was developed to adhere to specific Permit provisions. Provision A.4, Compliance with Discharge Prohibitions and Receiving Water Limitations, states that "Each Copermittee must achieve compliance with Provisions A.1.a, A.1.c and A.2.a of this Order through timely implementation of control measures and other actions as specified in Provisions B and E of this Order, including any modifications. The Plans required under Provision B must be designed and adapted to ultimately achieve compliance with Provisions A.1.a, A.1.c and A.2.a."

Provision A describes "Prohibitions and Limitations" with the following goal: "to protect the water quality and designated beneficial uses of waters of the state from adverse impacts caused or contributed to by [storm drain] discharges [which] will be accomplished through the implementation of water quality improvement strategies and runoff management programs that effectively prohibit non-stormwater discharges into the Copermittees' [stormwater conveyance systems], and reduce pollutants in stormwater discharges from the Copermittees' [storm drain outfalls] to the [Maximum Extent Practicable]." Provision A.1.a states that "Discharges from [storm drain outfalls] in a manner causing, or threatening to cause, a condition of pollution, contamination, or nuisance in receiving waters of the state are prohibited." Provision A.1.c states that "Discharges from [storm drain outfalls] are subject to all waste discharge prohibitions in the Basin Plan, included in Attachment A [Discharge Prohibitions and Special Protections] to this Order."

Provision A.2.a describes Receiving Water Limitations, and specifically states that "Discharges from [storm drains] must not cause or contribute to the violation of water quality standards in any receiving waters."

Provisions B.1 through B.6 designate the technical requirements to be addressed in development and implementation of the Plan. Specifically, Provision B.1 describes the Watershed Management Areas and responsible Copermittees covered under the Permit. Provision B.2 provides the requirements for assessing and determining the priority water quality conditions for the watershed. Provision B.3 contains requirements for developing the goals, strategies, and schedules to be developed to guide implementation. Provision B.4 addresses the monitoring and assessment program that is required to support implementation and assess progress. Provision B.5 describes the iterative approach and the adaptive management process that will be implemented over time to make improvements to the Plan. Provision B.6 specifies submittal and update requirements for the Plan.

1.3.3 Reporting Requirements

Copermittees must also comply with the reporting and outreach provisions described in Permit Provision F. Permit Provision F.1.b, which details the following requirements for Plan submittal, requiring the Participating Agencies to submit the Plan within 24 months after the commencement of coverage under the Permit (i.e., submit by June 27, 2015).

The Participating Agencies must consider revisions to the Plan based on written comments received by the close of the public comment period. As required under Provision F, the Participating Agencies have made revisions to the Plan based on public and Regional Board comments that are contained in this iteration. These modifications were submitted to the Regional Board no later than 60 days after the close of the public comment period, September 29, 2015.

If issues concerning the Plan are resolved through discussions among the Participating Agencies, the Regional Board, and interested parties, and resulting modifications, then the Regional Board Executive Officer is authorized to provide written notification of acceptance to the Participating Agencies that the Plan meets the requirements of Provision B. The Participating Agencies must commence with implementation of the Plan, in accordance with the water quality improvement strategies and schedules therein, upon written notification of acceptance of the Plan by the Regional Board Executive Officer.

During implementation of the Plan, the Participating Agencies must correct any deficiencies in the Plan identified by the Regional Board in the updates submitted with the Plan Annual Report following a request by the Regional Board.

The Plan must be made available on the Regional Clearinghouse, as required by Provision F.4, within 30 days of receiving the notification of acceptance of the Plan by the Regional Board Executive Officer.

Permit Provisions F.2.c and F.3.d provide specific reporting requirements for Plan updates and Annual Reports, as shown in **Table 1-1**.

Table 1-1. Reporting Requirements

Permit Required Reporting	Frequency	Detailed Data and Information
Plan Updates (Provision F.2.c)	• As needed; and • Upon Office of Administrative Law and USEPA approval of any TMDL Basin Plan amendment with WLAs assigned to Participating Agencies during the term of the Permit	• Participating Agencies must "develop and implement a public participation process to obtain data, information and recommendations for updating" the Plan; • Participating Agencies must consult with the Consultation Panel on proposed updates of the Plan; • Participating Agencies must submit proposed updates and supporting rationale, and recommendations from the public and Consultation Panel in the Plan Annual Reports, or as part of the Report of Waste Discharge.
Annual Reports (Provision F.3.d)	• Annual	• Receiving water and storm drain discharge monitoring data summary (Provisions D.1 and D.2); • Progress of special studies required pursuant to Provision D.3; • Findings from assessments required pursuant to Provision D.4; • Plan implementation progress, per Provisions F.3.d.i-vi; • Jurisdictional Urban Runoff Management Program Annual Report form; and • Data or documentation used in developing the Plan Annual Report, upon request from Regional Board.

1.4 Water Quality Improvement Plan Development Process

This Plan has been developed in three phases, according to the process for development described in the Permit. The process for development of this Plan is outlined by the diagram below.

The first phase of development identified the priority water quality conditions and potential water quality improvement strategies (Provision B.2). The results were summarized in the first submittal to the Regional Board.

The second phase of development identified numeric goals for bacteria in the watershed, and strategies that will be implemented to achieve the numeric goals (Provision B.3).

The third phase of Plan development included a monitoring and assessment program (Provision B.4) to provide feedback to program managers, and is described in Chapter 4. An adaptive management process (Provision B.5) to facilitate future adjustments and improvements to the Plan is described in Chapter 5.

1.4.1 Document Overview

This Plan is organized into the following chapters to address Permit requirements for Water Quality Improvement Plan development (**Table 1-2**).

Table 1-2. Structure of the Plan

Chapter Content	Permit Requirements Addressed
Chapter 2. Priority Water Quality Conditions	
Presents the water quality priorities that were identified after evaluating receiving water conditions and impacts from storm drain discharges.	B.2.Priority Water Quality Conditions
Chapter 3. Water Quality Improvement Goals and Schedules	
Watershed interim and final goals are presented for dry and wet weather conditions, along with strategies and schedules developed to achieve the goals.	B.3 Water Quality Improvement Goals, Strategies and Schedules
Chapter 4. Monitoring and Assessment Program	
Presents the integrated Monitoring and Assessment Program developed based on the requirements of the Permit and Plan process.	B.4. Monitoring and Assessment Program
	D. Monitoring and Assessment Program Requirements
Chapter 5. Iterative Approach and Adaptive Management	
Elaborates on the adaptive management processes, including the frequencies of adaptation required by the Permit (annual versus once per Permit term), triggers, and resulting actions.	B.5 Iterative Approach and Adaptive Management

In addition, as part of the Plan's Development, the Participating Agencies have collaboratively crafted a document "crosswalk" to provide permit provision references to the corresponding Plan document sections. This crosswalk is intended to ease the review process and is included as Appendix A1.

1.4.2 PUBLIC PARTICIPATION

The Participating Agencies implemented a public participation process to solicit data, information, and recommendations that were utilized in the development of the Plan. On September 23, 2013 the Participating Agencies issued a public call for data and information, announced future public workshops, and advertised a schedule of the opportunities for the public to participate in the Plan development process. Participation included the opportunity for members of the public to provide comments during the various stages of the Plan development process.

The first public workshop was held on October 3, 2013. During the workshop, an overview of the planning process was provided and the Participating Agencies received the public's suggestions for water quality improvement priorities, likely sources and potential strategies. The second public workshop was held on June 24, 2014, and focused on potential numeric goals for the identified highest priority water quality condition (bacteria) and the strategies that should be implemented to achieve the numeric goals. Comments received during the public workshop focused on controlling anthropogenic sources of bacteria, education and outreach to address pet waste, and addressing septic system impacts. Public comments were also received online. All input received was considered during development of this Plan.

The Participating Agencies formed a Consultation Panel (Panel) to provide recommendations during the development of this Plan. The Panel consists of representatives from the Regional Board, the environmental community, the development community, the Industrial Environmental Association, and the San Diego County Farm Bureau. The Panel includes the following individuals:

- Laurie Walsh (Regional Board)
- Julia Escamilla (Environmental Community)
- Tory Walker (Development Community)
- Jeremy Jungreis (Industrial Environmental Association)
- Eric Larson (San Diego County Farm Bureau)

The first Consultation Panel Meeting was held on January 29, 2014, to discuss the draft Provision B.2 document (Chapter 2 of this Plan). The document contained proposed priority water quality conditions, likely sources and potential strategies to improve water quality conditions in the watershed. The second Panel Meeting was held on August 21, 2014, to provide an overview of the draft Provision B.3 document (Chapter 3 of this Plan) and discuss the proposed goals, strategies and schedules. A third request for Panel input was sent by email on October 16, 2014, to review the Participating Agencies' jurisdictional goals. Panel feedback received at the workshops, online and at meetings was vital to the development of this Plan. Specific modifications to the draft chapters that were made in response to feedback are detailed below.

1.4.2.1 Chapter 2 *Priority Water Quality Conditions*

The Panel was provided a draft of Chapter 2, *Priority Water Quality Conditions*, for review and comment prior to their first meeting on January 29, 2014 at the City of Vista. The Participating Agencies gave a presentation that covered the purpose and contents of the draft chapter, including an overview of the methodology used to select the priority water quality conditions, and public comments received during the first public workshop. Comments from the Consultation Panel were received in mid-February. The Panel's recommendations were considered by the Participating Agencies and the draft chapter was revised according to Panel input where appropriate.

The primary focus of the revisions in response to Panel comments was on the methodology for the identification of priority water quality conditions (**Section 2.3**). The Participating Agencies developed a revised methodology for determining the priority and HPWQC to more effectively incorporate various sources of data indicating water quality impacts. The methodology remains a four step process; however, a scoring system was developed to make the process quantitative and transparent. Additionally, per the request of the Panel, best professional judgment is included in the updated process to allow effective focus of resources to solve problems.

Key revisions to the January 2014 draft of Chapter 2 based on Panel input include:

- Inclusion of an Executive Summary;
- Section 2.4, Identification of Stormwater Conveyance System Sources of Pollutants and/or Stressors was expanded to provide clarification of stormwater conveyance system sources;
- Section 2.5, Identification of Potential Water Quality Improvement Strategies was updated to include potential implementation strategies recommended by Consultation Panel;
- Appendix 2D was updated with the revised methodology scoring; and
- Appendix 2F was added to include larger format watershed maps to assist with readability.

During the public process, the Participating agencies requested suggestions for and input on potential strategies that could be implemented within the watershed to address the HPWQC, bacteria. The potential strategies were identified during the October 7, 2013 public workshop, the January 29, 2014 Consultation Panel meeting, and the public review period for the first interim deliverable to the Regional Board (May 17 – June 17, 2014). The identified potential strategies were considered for inclusion in this Plan and are provided in Appendix 3A. Many of the jurisdictional strategies discussed in Chapter 3 and listed in detail in Appendix 3B are derived or adapted from potential strategies identified during the public process.

1.4.2.2 Chapter 3 *Goals, Strategies and Schedules*

The second Consultation Panel meeting was held at the City of Vista on August 21, 2014, to discuss Provision B.3, *Goals*, *Strategies and Schedules*. The Participating Agencies provided an overview of the draft chapter and requested input on proposed draft goals, strategies and schedules. After consideration of Panel input, the Participating Agencies transmitted a memorandum to the Panel on October 16, 2014, to solicit their input on the jurisdictional numeric goals (discussed in **Section 3.1.3**), and requested that comments be provided by October 30, 2014 (a two week review period). In response to the Consultation Panel's comments, the goals were streamlined and the associated text was expanded to provide a comprehensive explanation of the anticipated outcomes and how progress toward achieving the goals would be measured. Text was also added to **Section 3.2** to clarify the linkage between the strategies and goals, and to explain how selected strategies will affect progress toward the goals.

1.4.2.3 San Luis Rey River Watershed Water Quality Improvement Plan

The Plan was submitted to the Regional Water Quality Control Board on June 27, 2015 as required by the Permit. The submittal triggered a public review period ending on July 31, 2015. Comments were received from the following entities:

- San Diego Regional Water Quality Control Board
- San Diego Coastkeeper
- Surfrider Foundation
- Torrent Resources
- Tory R. Walker Engineering

Comments generally addressed the following concerns:

- the Plan should include more detail on load reductions for other constituents to be considered a "comprehensive" plan;
- goals should be more clearly linked to the highest priority water quality conditions, including the Lower San Luis Rey River;
- interim goals must be developed to demonstrate progress towards final goals and at least one interim goal must be expressed as a reasonable increment of the final goal;
- schedules for achieving goals must be as soon as possible and reflect the shortest practicable time to achieve the goals;
- best management practices to be implemented as part of the strategies must be included in the plan;
- all potential strategies identified by the public must be incorporated into the Plan – as potential strategies considered in Chapter 2;
- strategies must be better linked to the priority water quality conditions and goals;
- optional strategies need to clearly identify the timeframe, triggers, and resources required for implementation and must include a combination of BMPs (non-structural and structural), incentives, retrofitting, and stream, channel, and/or habitat rehabilitation projects;
- the Watershed Management Area Analysis must include a list of candidate projects;
- monitoring locations must support the assessment of progress towards goals; and
- public input was not adequately considered during development of the Plan.

Since receipt of these comments, the Participating Agencies have worked extensively with Regional Board staff to develop acceptable approaches to address each concern. The most extensive revisions were made within Chapter 3 and associated appendices addressing concerns related to the goals, strategies, and schedules. The Participating Agencies are confident that the modifications to the Plan demonstrate their strong commitment to improvements in water quality in the San Luis Rey River Watershed and ensure that the Plan meets Permit requirements.

2 PRIORITY WATER QUALITY CONDITIONS

The Permit requires that this Plan identify the water quality priorities associated with storm drain discharges in the watershed, and allows the larger watershed to be separated into sub-watersheds to focus water quality prioritization and jurisdictional runoff management program implementation efforts. As described in Section 1.2, the San Luis Rey Watershed has been separated into three hydrologic areas, or subwatersheds, to focus implementation efforts.

2.1 ASSESSMENT OF RECEIVING WATER CONDITIONS

Provision B.2.a of the Permit requires consideration of the following information when assessing receiving water conditions to identify water quality priorities based on the impacts of storm drain discharges on receiving water beneficial uses. Each of these items is specifically discussed in the following sections as noted:

1) Receiving waters listed as impaired on the Clean Water Act Section 303(d) List of Water Quality Limited Segments (303(d) List) (**Section 2.1.1**);
2) TMDLs adopted and under development by the Regional Board (**Section 2.1.2**);
3) Sensitive or highly valued receiving waters (**Section 2.1.3**);
4) Receiving water limitations of Permit Provision A.2 (**Section 2.1.4**);
5) Known historical versus current physical, chemical, and biological water quality conditions (**Section 2.1.5**);
6) Physical, chemical, and biological receiving water monitoring data (**Section 2.1.6**);
7) Available evidence of erosional impacts in receiving waters due to accelerated flows (i.e., hydromodification) (**Section 2.1.7**);
8) Available evidence of adverse impacts to the chemical, physical, and biological integrity of receiving waters (**Section 2.1.8**); and
9) The potential improvements to the overall condition of the watershed that can be achieved (**Section 2.1.9**).

The information listed above is summarized in the following subsections.

2.1.1 CLEAN WATER ACT SECTION 303(D) LIST OF WATER QUALITY LIMITED SEGMENTS

Appendix 2A contains the names of the waters listed as impaired according to the Clean Water Act Section 303(d) List of Water Quality Limited Segments (303(d) List) and potential sources of the impairments identified in the 303(d) List. The 303(d) listed receiving waters in the watershed are shown in **Figure 2-1**.

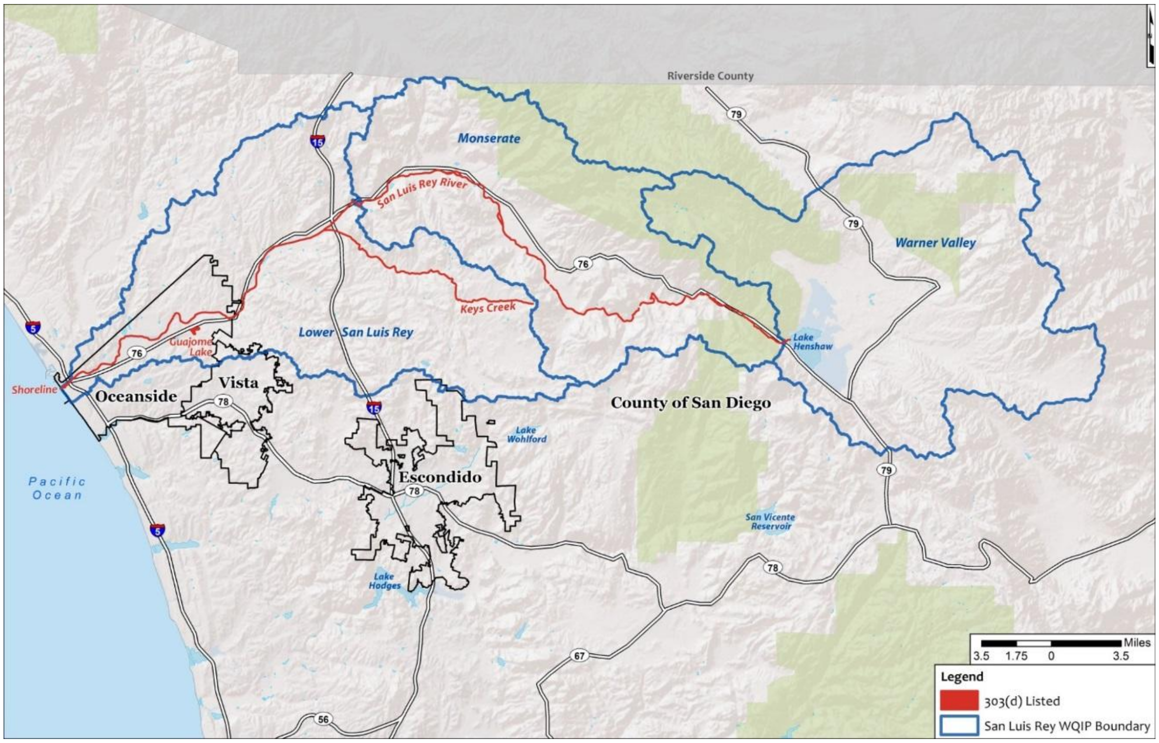

Figure 2-1. Water Bodies within San Luis Rey Watershed with 303(d) List Impairments

(Large format figure provided in Appendix 2F)

2.1.2 TMDLs Adopted and Under Development

There is one TMDL for bacteria that has been adopted regionally and applies to receiving waters within the watershed – the *Revised Total Maximum Daily Loads for Indicator Bacteria, Project 1 – Twenty Beaches and Creeks in the San Diego Region*. The receiving waters covered by the bacteria TMDL are summarized in **Table 2-1**. There are no other TMDLs affecting the watershed currently in development by the Water Board.

Table 2-1. TMDLs Adopted in San Luis Rey Watershed

Sub Watershed	Water Body Name	Water Body Type	Pollutant	Adoption Date
Lower San Luis Hydrologic Area	Pacific Ocean Shoreline at San Luis Rey River mouth, San Luis Rey Hydrologic Unit	Coastal & Bay Shoreline	Total Coliform Fecal Coliform Enterococcus	2010

2.1.3 Sensitive or Highly Valued Receiving Waters

Sensitive or highly valued receiving waters include those designated as estuaries by the National Estuary Program under Clean Water Act Section 320, wetlands as defined by the State or U.S. Fish and Wildlife Service's National Wetlands Inventory, waters having the Preservation of Biological

Habitats of Special Significance (BIOL) beneficial use designation, and water bodies identified as Areas of Special Biological Significance (ASBS).

Figure 2-2 shows a map of the receiving waters in the watershed that fall under one of these categories.

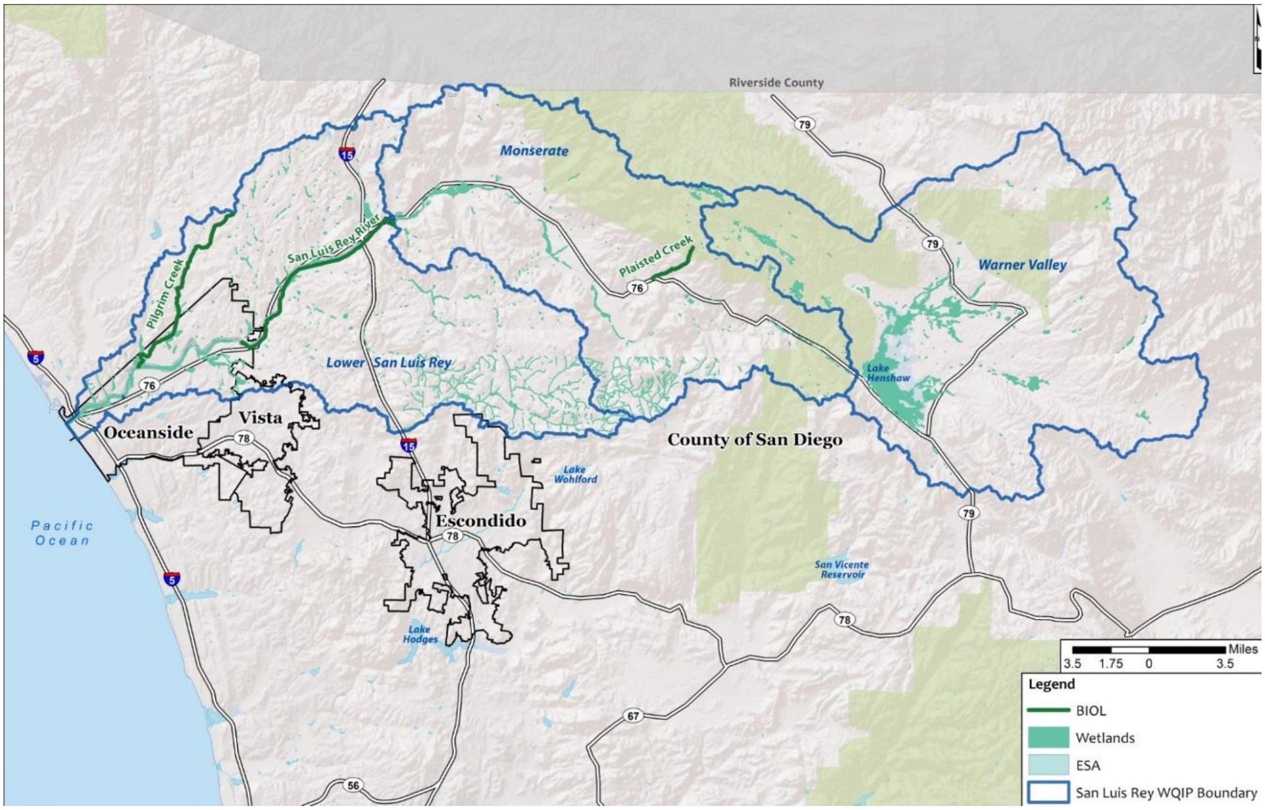

Figure 2-2. Sensitive or Highly Valued Water Bodies in the San Luis Rey River Watershed
(Large format figure provided in Appendix 2F)

2.1.4 Receiving Water Limitations of Provision A.2

Provision A.2 of the Permit states that storm drain discharges *"may not cause or contribute to the violation of water quality standards in any receiving waters,"* including, but not limited to the following:

(a) The Regional Board's Basin Plan;

(b) Other State Board Plans, such as the Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries, and the Ocean Plan;

(c) State Board policies on water and sediment quality such as the Water Quality Control Policy for the Enclosed Bays and Estuaries of California, the Sediment Quality Control Plan, and the Statement of Policy with Respect to Maintaining High Quality of Waters in California; and

(d) Priority pollutant criteria defined by the USEPA through the National Toxics Rule and the California Toxics Rule.

Note that the portion of Provision A.2 that states storm drain discharges *"must not alter natural ocean water quality in an ASBS* [Areas of Special Biological Significance]*"* is not applicable to the watershed because there are no Areas of Special Biological Significance in the watershed.

2.1.5 *Known Historical Versus Current Physical, Chemical, and Biological Water Quality Conditions*

The Participating Agencies assessed historical and current water quality conditions using the following datasets:

- 2005 - 2010 Long-Term Effectiveness Assessment (Weston, 2011)
- 2011 - 2012 Receiving Waters and Urban Runoff Monitoring Report (Weston, 2013), and
- The 2005 Baseline Long-Term Effectiveness Assessment

The San Diego County Permittees developed the Long-Term Effectiveness Assessment in accordance with the 2007 San Diego Municipal Stormwater Permit (NPDES Order No. R9-2007-0001), to assess the effectiveness of the Receiving Waters Monitoring Program and regional, watershed, and jurisdictional programs. The Long-Term Effectiveness Assessment report was released in 2011 (Weston, 2011); it includes annual trend assessments using historical wet weather data from the Mass Loading Station and three additional Temporary Watershed Assessment Stations to assess data on a watershed-wide scale. The general process for receiving water assessment included: 1) compilation of data, 2) comparison of data to benchmarks (developed specifically by the Copermittees Regional Monitoring Workgroup), 3) determination of frequency of exceedance of benchmarks, 4) establishment of a "water quality rating", and 5) preparation of tables, maps, summaries, etc. The Long-Term Effectiveness Assessment builds upon the assessment methods used in the Baseline Long-Term Effectiveness Assessment and provides a robust analysis of water quality and program implementation for San Diego County.

The Long-Term Effectiveness Assessment for the receiving waters in the San Luis Rey Watershed was performed by compiling data from regional monitoring conducted under the Permit (i.e., previous Regional Monitoring Reports) and the Stormwater Monitoring Coalition. Of these data sources, only monitoring data collected under the regional monitoring programs under the Permit were representative of wet weather conditions. Dry weather data were provided by both sources. The most current data for the watershed are presented in the annual Regional Monitoring Report, which covers the 2011-2012 sampling season in the watershed (Weston, 2012). The Regional Monitoring Report includes data from Copermittee monitoring programs, Stormwater Monitoring Coalition, and San Diego Coastkeeper. Due to the rotational nature of the Copermittee monitoring programs under the previous Permit (Order R9-2007-0001), the most recent receiving water dataset is from monitoring performed during the 2010-2011 monitoring year. The majority of receiving water data was collected from the Lower San Luis Rey Hydrologic Area, with two Coastkeeper sampling locations located in the Monserate Hydrologic Area. Receiving water sample locations in the watershed are indicated in **Figure 2-3**.

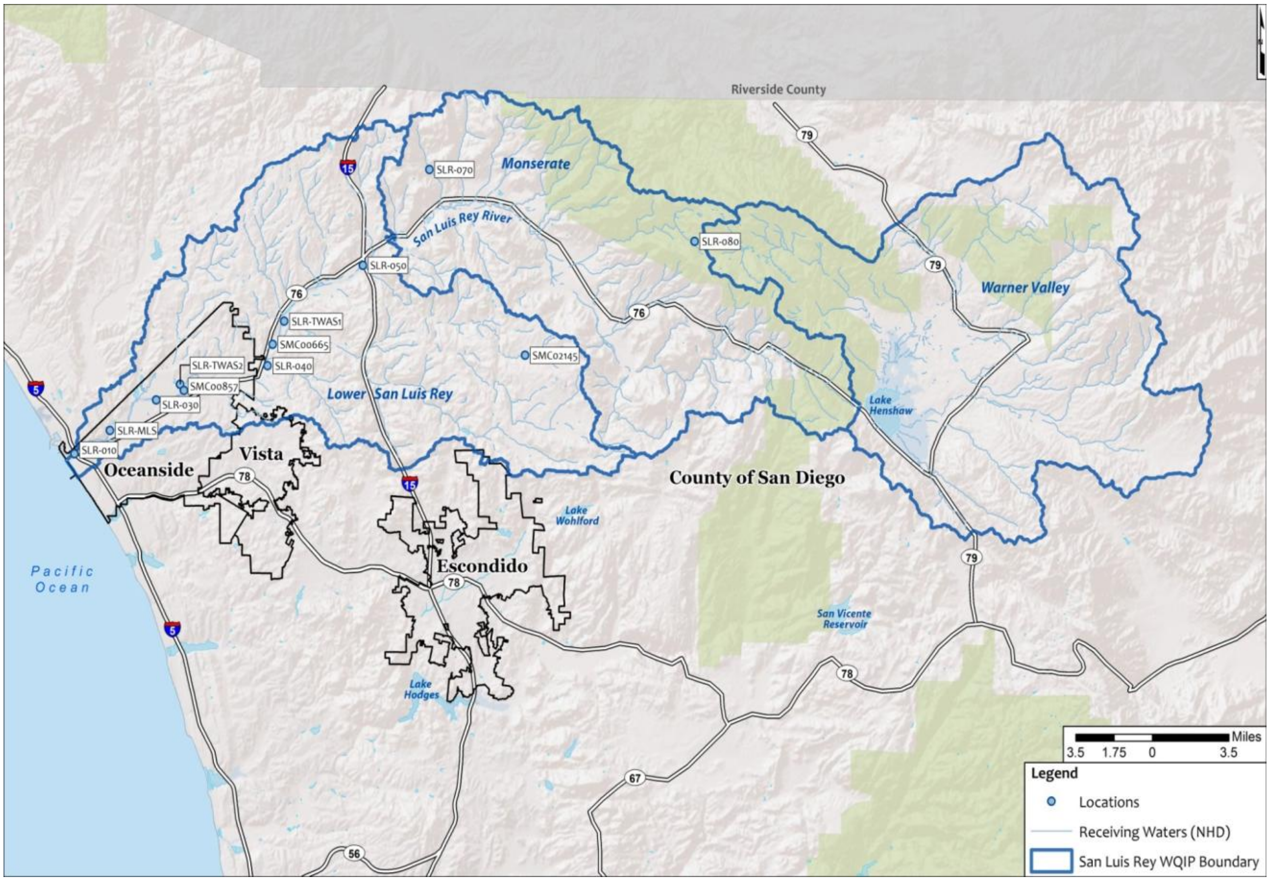

Figure 2-3. Receiving Water Sample Locations

(Large format figure provided in Appendix 2F)

Data from the Long-Term Effectiveness Assessment and Regional Monitoring Report were compared to benchmarks for physical, chemical and bacteriological water quality data. Constituents were identified as high or medium priority based on the percentage of the dataset that exceeded the benchmarks. Constituents with greater than 50% exceedances were considered high priority, and constituents with 25-50% exceedances were considered medium priority. Biological water quality conditions were assessed using data from toxicity testing and bioassessment monitoring (Index of Biotic Integrity scoring, California Rapid Assessment Method, and observed/expected ratios). Results are discussed for wet and dry weather in the following subsections. The receiving water quality priorities from the Long-Term Effectiveness Assessment are similar to those of the previous assessment in the 2005 Baseline Long-Term Effectiveness Assessment.

The wet weather and dry weather chemistry data were compared to the water quality benchmarks shown in **Table 2-2.** The table is not inclusive of all analytical measurements that were conducted. In general, water quality objectives are defined in the San Diego County Copermittee Regional Monitoring Program as benchmarks for comparison to monitoring results and do not necessarily reflect regulatory compliance for municipal stormwater discharges. Additional water quality benchmarks and sources are included in the Appendix 2C tables.

Table 2-2. Water Quality Benchmarks

Constituent	Units	Wet Weather Water Quality Benchmark	Dry Weather Water Quality Benchmark	Source
pH	pH units	6.5-9.0	6.5-9.0	Basin Plan [a]
Nitrate as N	mg/L	10	10	Basin Plan [a]
Nitrate/Nitrite as N	mg/L	10	10	Basin Plan [a]
Nitrite as N	mg/L	1	1	Basin Plan [a]
Total Nitrogen	mg/L	NA	1	Basin Plan [a]
Total Phosphorus	mg/L	2	0.1	MSGP 2000 [b], Basin Plan [a]
Dissolved Phosphorous	mg/L	2	0.1	MSGP 2000 [b], Basin Plan [a]
Total Suspended Solids	mg/L	100	58	MSGP 2000 [b]
Total Dissolved Solids	mg/L	500	500	Basin Plan [a]
Fecal Coliform	MPN/ 100 mL	400	400	Basin Plan [a] REC-1
Enterococci	MPN/ 100 mL	NA	151	Basin Plan [a]
Total Coliform	MPN/ 100 mL	NA	NA	Basin Plan [a] (Bays and Estuaries and Shell Criteria)

NA indicates no criteria or published value was available or applicable to the matrix or program.

a. San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

b. Multisector General Permit for Industrial Activities, Section 2.

2.1.5.1 Wet Weather

Table 2-3 and **Table 2-4** show a summary of data from the Long-Term Effectiveness Assessment (2005-2010) and the most recent regional Copermittee monitoring (2010-2011) for wet weather for the watershed. The analyses were based on nine storm events at the Mass Loading Stations (MLS) (with the exception of the pesticides which were based on three storm events) and two storm events at the Temporary Watershed Assessment Station (TWAS) sampling site (TWAS-1). The TWAS-2 sampling site was established after the assessment was completed and therefore is not presented in **Table 2-3.** Regional Monitoring Report analyses are based on two storm events at each of the three sites.

Results from these reports indicate that the overall list of water quality conditions present in the watershed has remained consistent over time, with bacteria, sediment, total dissolved solids, and toxicity identified as water quality conditions of concern during wet weather. Benthic alterations, included in the wet and dry weather assessments, were also identified as a concern across the monitoring stations. The conditions of concern identified in the Long-Term Effectiveness Assessment were supported by the recent monitoring results presented in the Regional Monitoring Report. The Long Term Effectiveness Assessment also included bifenthrin and chlorpyrifos, which were not identified as concerns from the recent year of Regional Monitoring Report data. The one year of Regional Monitoring Report data also indicate pH as a concern at the Mass Loading Station, and toxicity concerns at different locations than identified in the Long Term Effectiveness

Assessment. There was only one year of data analyzed for the TWAS-2 site, where additional constituents of concern were identified, including diazinon, malathion, total phosphorous, and *H. azteca* toxicity.

Table 2-3. Wet Weather Long Term Effectiveness Assessment Findings for San Luis Rey Watershed

2011 LTEA Receiving Water Assessment [a]		
Constituent Groups	Sampling Site (no. of samples)	
	SLR-MLS (9 [b])	SLR-TWAS-1 (2)
Gross Pollutants	-	-
Oil & Grease	-	-
Metals	-	-
Pesticides	Bifenthrin [b]	**Bifenthrin**, Chlorpyrifos
Organics	-	-
Toxicity	-	*C.dubia* reproduction
Benthic Alterations (IBI)	Poor IBI, O/E	Poor IBI, O/E
Bacteriological	Fecal Coliform	Fecal Coliform
Nutrients	-	-
Dissolved Minerals	Total Dissolved Solids	Total Dissolved Solids
Sediments	Turbidity	Total Suspended Solids / Turbidity

a. Bold with gray shading indicates high priority conditions (greater than 50% of results above benchmark); gray shading alone indicates medium priority (between 25% and 50% of results above benchmark); no shading and "- " indicates low priority (less than 25% of results above benchmark).

b. While most constituents were sampled nine (9) times at the MLS, bifenthrin was sampled three (3) times.

Table 2-4. Wet Weather Regional Monitoring Report Summary for San Luis Rey Watershed

2011-2012 Regional Monitoring Report Assessment [a]			
Constituent Groups	Station (no. of samples)		
	SLR-MLS (2)	SLR-TWAS-1 (2)	SLR-TWAS-2 (2)
Chemistry	pH		Diazinon, Malathion
Toxicity	C. dubia	C. dubia	C. dubia, H. azteca
Benthic Alterations [b]	Very Poor	Very Poor	Very Poor
Bacteriological	Fecal Coliform	Fecal Coliform	Fecal Coliform
Nutrients			Total Phosphorus
Dissolved Minerals [c]	Total Dissolved Solids	Total Dissolved Solids	Total Dissolved Solids
Sediments		Total Suspended Solids, Turbidity	Total Suspended Solids, Turbidity

a. Bold with gray shading indicates high priority conditions (greater than 50% of results above benchmark); gray shading alone indicates medium priority (between 25% and 50% of results above benchmark); no shading and "- " indicates low priority (less than 25% of results above benchmark).

b. One (1) IBI bioassessment sample is collected each year during ambient (dry) conditions and is used for both the dry and wet assessment.

c. Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.

2.1.5.2 Dry Weather

Data from the Long Term Effectiveness Assessment and the most recent Regional Monitoring Report for dry weather for the watershed are summarized in **Table 2-5** and **Table 2-6**. Dry weather receiving water analyses for both the Long Term Effectiveness Assessment and the Regional Monitoring Report were based on two samples at each site. Stormwater Monitoring Coalition data consisted of one sample at each site, while third party data consists of larger datasets (ranging from 3-7 samples per site), as these sampling programs generally occurred on a more frequent basis. The Stormwater Monitoring Coalition and third party data were included in the Long Term Effectiveness Assessment and Regional Monitoring Report as appropriate.

The list of water quality conditions of concern during dry weather was consistent between the Long Term Effectiveness Assessment and the most recent Regional Monitoring Report. The primary water quality conditions of concern identified in the Long Term Effectiveness Assessment during dry weather include bacteria, nutrients, and dissolved minerals. Benthic alterations, included in the wet and dry condition assessments, also appear to be a concern across the monitoring stations. These four conditions of concern identified in the Long Term Effectiveness Assessment were supported by recent monitoring results in the Regional Monitoring Report.

Chloride and sulfate were identified as high priorities in the Long Term Effectiveness Assessment data set at both sites, turbidity was identified as medium priority at the MLS site, and Chemical Oxygen Demand (COD) was identified as medium priority at the TWAS-1 site. The recent year of Regional Monitoring Report data did not identify these constituents as priorities. In addition, the Regional Monitoring Report noted toxicity concerns at the Mass Loading Station and TWAS-2 sites in the one year of data.

Table 2-5. Summary of LTEA Findings for Dry Weather in San Luis Rey Watershed

Constituent Groups	2011 LTEA Receiving Water Assessment [a]	
	Station (no. of samples)	
	SLR-MLS (2)	SLR-TWAS-1 (2)
Gross Pollutants	-	COD
Oil & Grease	-	-
Metals	-	-
Pesticides	-	-
Organics	-	-
Toxicity	-	-
Benthic Alterations (IBI)	Poor IBI, O/E	Poor IBI, O/E
Bacteriological	Ent, FC	Ent
Nutrients	TP, DP, TN	TP, TN
Dissolved Minerals	TDS, CL, SO4	TDS, CL, SO4
Sediments	Turb	-

a. Bold with gray shading indicates high priority conditions (greater than 50% of results above benchmark); gray shading alone indicates medium priority (between 25% and 50% of results above benchmark); no shading and "- " indicates low priority (less than 25% of results above benchmark).

COD – chemical oxygen demand, Ent – enterococcus, FC – fecal coliform, DP – dissolved phosphorous, TP - total phosphorous, TN – total nitrogen, CL – chloride, SO4 – sulfate, Turb – turbidity, TDS – total dissolved solids

Table 2-6. Summary of 2011-2012 Regional Monitoring Report for Dry Weather in the San Luis Rey Watershed

2011-2012 Regional Monitoring Report Assessment [a]			
Constituent Groups	Station (no. of samples)		
	SLR-MLS (2)	SLR-TWAS-1 (2)	SLR-TWAS-2 (2)
Chemistry			
Toxicity		C. dubia	C. dubia
Benthic Alterations [b]	Very Poor	Very Poor	Very Poor
Bacteriological	Enterococci, Fecal Coliform	Enterococci	Enterococci
Nutrients	DP, TP, TN	TP, TN	DP, TP, TN
Dissolved Minerals [c]	TDS	TDS	TDS

a. Bold with gray shading indicates high priority conditions (greater than 50% of results above benchmark); gray shading alone indicates medium priority (between 25% and 50% of results above benchmark); no shading and "- " indicates low priority (less than 25% of results above benchmark).

b. One (1) IBI bioassessment sample is collected each year during ambient (dry) conditions and is used for both the dry and wet assessment.

c. Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.

DP – dissolved phosphorous, TP - total phosphorous, TN – total nitrogen, TDS – total dissolved solids

2.1.6 *PHYSICAL, CHEMICAL, AND BIOLOGICAL RECEIVING WATER MONITORING DATA*

The Permit requires the Participating Agencies to consider "available, relevant, and appropriately collected and analyzed physical, chemical, and biological receiving water monitoring data, including, but not limited to, data describing:

(a) Chemical constituents,

(b) Water quality parameters (i.e., pH, temperature, conductivity, etc.),

(c) Toxicity Identification Evaluations for both receiving water column and sediment,

(d) Trash impacts,

(e) Bioassessments, and

(f) Physical habitat."

Available data for the watershed were discussed in the previous section. **Table 2-7** summarizes the locations of receiving water samples and the constituents that have been measured. **Figure 2-4** includes a map of the locations where receiving water sampling data have been collected. It should be noted that almost all receiving water sampling locations are located in the Lower San Luis Rey Hydrologic Area, with two 3rd party (Coastkeeper) sampling locations in the Monserate Hydrologic Area, and none in the Warner Valley Hydrologic Area.

Table 2-7. Receiving Water Data Stations and Parameters

Station IDs	Data	Wet/ Dry	Chemical Constituents	Water Quality Parameters	Toxicity Identification Evaluations	Trash Impacts	Bioassessments	Physical Habitat
SLR-MLS SLR-TWAS1 SLR-TWAS2	National Pollutant Discharge Elimination System Program	Wet/ Dry	☑	☑	☑	☑	☑	☑
SMC00665 SMC00857 SMC02145	Stormwater Monitoring Coalition Regional Monitoring	Dry	☑		☑		☑	
SLR-010 SLR-030 SLR-040 SLR-050 SLR-070 SLR-080	Third Party Coastkeeper	Dry	☑					

2.1.7 HYDROMODIFICATION

A review of the available regional-scale data did not identify increased erosional impacts in the receiving waters as a result of accelerated flows (hydromodification). Anecdotal information regarding localized sedimentation resulting from a discrete storm event was reported during the public workshop on October 7, 2013. Photographs were presented showing sedimentation impacting areas of the Pauma Valley Country Club. No additional evidence of erosional impacts in receiving waters has been identified from review of the submitted data; however, monitoring programs to measure the impacts of hydromodification are in their early stages. A Geographic Information System mapping exercise evaluating the potential for soil erosion was conducted to proactively identify areas at risk.

2.1.8 AVAILABLE EVIDENCE OF ADVERSE IMPACTS TO THE CHEMICAL, PHYSICAL, AND BIOLOGICAL INTEGRITY OF RECEIVING WATERS

As discussed earlier, the most current receiving water quality data are available in the Long Term Effectiveness Assessment and annual Regional Monitoring Report. The assessments are based on exceedances of established benchmarks and provide evidence of adverse impacts receiving waters. However, exceedances of benchmarks, although indicative of water quality impacts, do not necessarily correlate to adverse impacts to beneficial uses of the receiving waters.

Water quality conditions of concern identified for wet weather include bacteria, pesticides, benthic alterations (represented by 'very poor' benthic alteration scores), Total Dissolved Solids, Total Suspended Solids, turbidity, and toxicity. Of these, bacteria, turbidity, Total Suspended Solids, Total Dissolved Solids, and benthic alterations are the most widespread of the water quality concerns.

Water quality conditions of concern identified for dry weather include bacteria, nutrients, benthic alterations, Total Dissolved Solids, and toxicity. These conditions are found consistently at all sampling sites, with the exception of toxicity, which was not found in the most upstream site, TWAS-1.

2.1.9 POTENTIAL IMPROVEMENTS THAT CAN BE ACHIEVED IN THE WATERSHED

In addition to ongoing JRMP implementation and enhancement, the Participating Agencies have identified a number of strategies that are expected to address the water quality conditions in the watershed and therefore result in improvements in the condition of the watershed. These strategies are discussed in detail in **Section 3.2** and listed by jurisdiction in Appendix 3B. These strategies are expected to result in bacteria reduction, improve the overall condition of the watershed and result in improved scores for benthic alterations, and lowered toxicity in receiving waters. Careful consideration was given to the potential improvements in the overall condition of the watershed that can be achieved in determining priority water quality conditions (see **Section 2.3**).

2.2 ASSESSMENT OF IMPACTS FROM STORM DRAIN DISCHARGES

Provision B.2.b of the Permit requires the Participating Agencies to consider the following information to identify potential impacts to receiving waters that may be caused or contributed to by discharges from the Copermittees' storm drain outfalls:

1) The discharge prohibitions of Provision A.1 and effluent limitations of Provision A.3 (**Section 2.2.1**);
2) Available monitoring data from storm drain outfalls (**Section 2.2.2**);
3) Locations of each Copermittees' storm drain outfalls that discharge to receiving waters (**Section 2.2.3**);
4) Locations of storm drain outfalls that are known to persistently discharge non-stormwater to receiving waters likely causing or contributing to impacts on receiving water beneficial uses (**Section 2.2.4**);
5) Locations of storm drain outfalls that are known to discharge pollutants in stormwater causing or contributing to impacts on receiving water beneficial uses (**Section 2.2.5**); and
6) The potential improvements in the quality of storm drain discharges that can be achieved (**Section 2.2.6**).

The requirements listed above are addressed in the following subsections. As with the receiving water assessment, the Long Term Effectiveness Assessment served as a significant source of information for determining potential impacts associated with storm drain discharges.

The 2007 Permit required the submittal of the Long Term Effectiveness Assessment to evaluate the effectiveness of programs and to inform program modifications to the next Permit (issued in 2013). To accomplish this, receiving water and storm drain outfall water quality data were analyzed by comparing concentrations to existing benchmarks, and by using multiple lines of evidence including chemistry, toxicity, and biological data. The storm drain outfall monitoring program was relatively new and had limited data available for the Long Term Effectiveness Assessment. Accordingly, the Copermittees used a conservative definition of the potential for storm drain discharges to contribute to the identified receiving water conditions.

This broad approach resulted in a long list of water quality conditions identified in the Long Term Effectiveness Assessment for storm drain discharges that could potentially adversely affect receiving water conditions. Furthermore, an additional 450 samples were collected region-wide to supplement storm drain outfall monitoring results (see **Table 2-8**). The majority of these results were not available for the Long Term Effectiveness Assessment evaluation; however, the report containing the larger set of storm drain outfall data is currently in preparation and preliminary results appear to support the Long Term Effectiveness Assessment findings. Additional factors, such as relative contribution of storm drain discharges to receiving waters conditions and the controllability of the potential source(s) by the Participating Agencies, are considered in the report. This approach will allow the Participating Agencies to focus implementation efforts on receiving water conditions that are likely a result of storm drain discharges and that are within their control. The LTEA provided a discussion of discharge loads for various constituents and ranked them for wet weather flows "to establish a baseline for future comparisons of changes in the loads." The LTEA also included observations of dry weather flow conditions at the storm drain outfalls.

Table 2-8. Summary of Program Monitoring Data Collection (2008-2013)

Program Year	Random Sites	
	Wet Weather	Dry Weather
2008-2009	39	40
2009-2010	50	35
2010-2011	54	42
2011-2012	54	49
2012-2013	55	44
Total	**252**	**210**

2.2.1 PROHIBITIONS AND LIMITATIONS OF PROVISIONS A.1 AND A.3

Provisions A.1 and A.3 of the Permit, which address discharge prohibitions and effluent limitations, were considered to assess impacts from storm drain discharges. In addition, storm drain discharges are subject to prohibitions in the Basin Plan (e.g., solid waste, recycled water to lakes or reservoirs, dredged fill material, solid waste, sewage, radioactive wastes, chemical or biological warfare agents, earthen material from construction activity into waters of the state) in accordance with Provision A.1.c.

Effluent limitations for controlling discharges of pollutants to receiving waters are based on both the technology-based effluent limits (TBEL) and the water quality-based effluent limits (WQBELs) that are protective of the water quality standards of the receiving water. TBELs require a minimum level of treatment of pollutants for point source discharges based on available technologies. The Permit requires that pollutants be reduced in stormwater discharges from storm drains to the maximum extent practicable.

Applicable WQBELs are established for the TMDLs for impaired water bodies (Attachment E of the Permit). The Regional Board adopted a TMDL for bacteria (Resolution No. R9-2010-0001), which became effective April 4, 2011, requiring owners and operators of stormwater conveyance systems in the watershed to develop either a bacteria-specific, or comprehensive, multi-pollutant approach to reducing loads of bacteria and other 303(d)- listed pollutants from their storm drain discharges. In 2012, the Participating Agencies developed a comprehensive, multi-pollutant approach to implementation (Comprehensive Load Reduction Plan). In addition to bacteria, the Comprehensive Load Reduction Plan addresses other water quality impairments in the watershed including nutrients. The applicable TMDL WQBELs for the watershed appear in Appendix 2B. Participating agencies are required to meet interim WQBELs for the bacteria TMDL under dry weather conditions by April 4, 2017, and for wet weather by April 4, 2021.

2.2.2 *AVAILABLE MONITORING DATA FROM STORM DRAIN OUTFALLS*

The Permit specifies assessment of available, relevant, and appropriately collected and analyzed stormwater and non-stormwater monitoring data for the storm drain outfalls. Results from the following reports for the storm drain outfall monitoring program are summarized in this section:

- 2005 - 2010 Long-Term Effectiveness Assessment (Weston, 2011)
- 2010 - 2011 Receiving Waters and Urban Runoff Monitoring Report (Weston, 2012)
- 2011 - 2012 Receiving Waters and Urban Runoff Monitoring Report (Weston, 2013)

The 2011 Long Term Effectiveness Assessment presented urban runoff data assessments for constituents of medium and high priorities based on the results of storm drain outfall monitoring for the Regional Monitoring Program initiated in 2008. The 2012 and 2013 Regional Monitoring Reports presented storm drain outfall data assessments for medium and high priority constituents based on the San Diego County Regional Copermittees' (SDCRC) 2010 Methodology for Annual and Long-Term Data Assessments for San Diego County Watershed Management Areas, Final Draft-Version 1 (SDCRC, 2010). As discussed in **Section 2.1**, priority ratings are based on the percentage of water quality benchmark exceedances, based on water quality benchmarks in the Basin Plan. Constituents with less than or equal to a 25% exceedance rate are considered low priority, constituents with a 25% to 50% exceedance rate are considered medium priority, and constituents with greater than a 50% exceedance rate are considered high priority.

Storm drain outfall data for wet and dry weather conditions are summarized by hydrologic area and sub-watershed. The sub-watersheds include, from east to west: Warner Valley Hydrologic Area (903.3), Monserate Hydrologic Area (903.2), and Lower San Luis Rey Hydrologic Area (903.1). The locations of storm drain outfalls sampled are shown in **Figure 2-4.** In the rural areas (Warner Valley and Monserate) the limited storm drain system consists of roadways and road crossings of rivers and creeks. There are few major storm drain outfalls in the rural areas. Sampling efforts are concentrated in the urbanized areas.

The medium and high priority constituents identified in the Long Term Effectiveness Assessment and Regional Monitoring Report datasets are summarized in this section. The datasets which were used in the analysis of sub-watershed outfall data are summarized below.

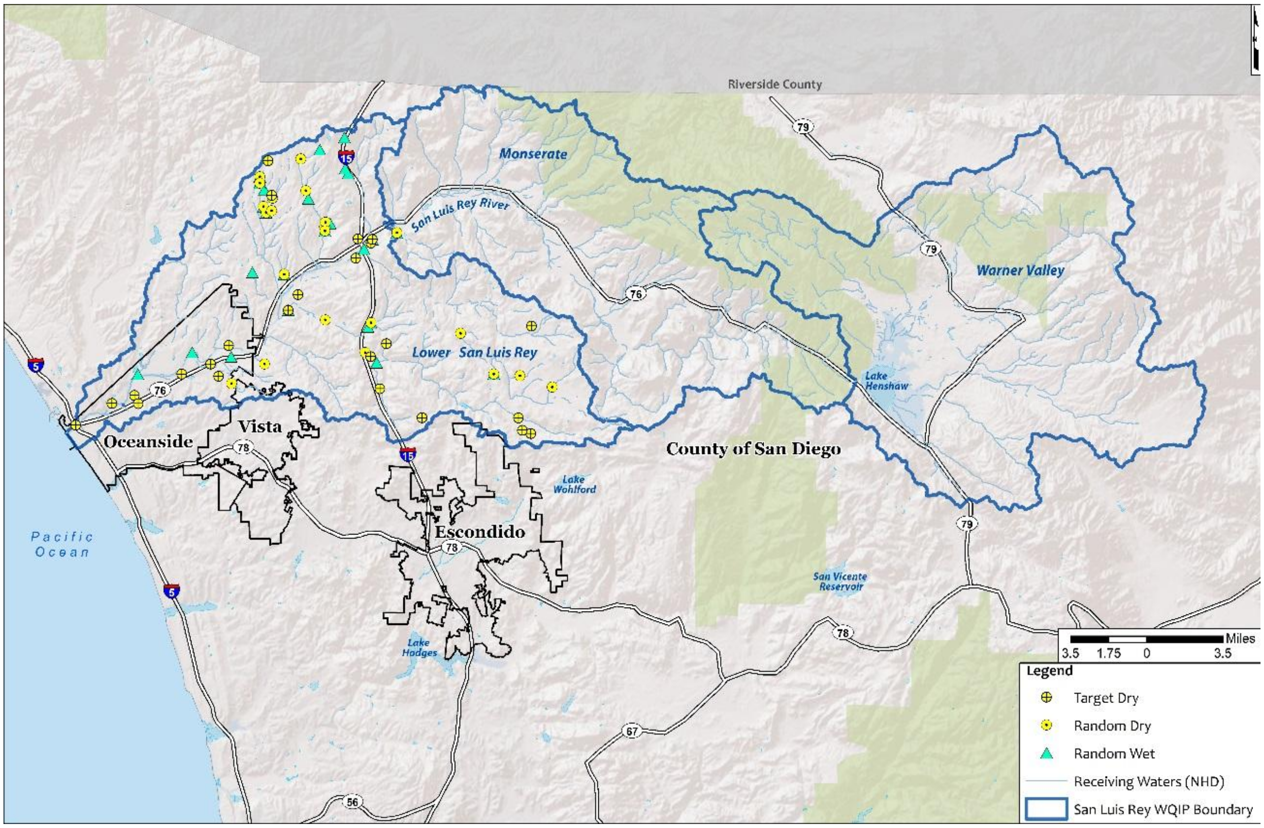

Figure 2-4. Storm Drain Outfall Monitoring Locations
(Large format figure provided in Appendix 2F)

2.2.2.1 Warner Valley (903.3)

The Warner Valley Hydrologic Area contains only limited storm drains. Monitoring efforts focused on urbanized areas in the watershed where storm drain outfalls are located. Accordingly, data is primarily representative of the lower watershed. Resulting water quality priorities are also determined based on monitoring in the lower watershed, where the receiving waters are influenced by storm drain discharges. The lack of data in the eastern, lesser populated areas of the watershed reflects this prioritization of urban areas and associated water quality conditions.

2.2.2.2 Monserate (903.2)

The Pala (903.21) subwatershed within the Monserate (903.2) Hydrologic Area included storm drain outfall dry and wet weather monitoring data from the Long Term Effectiveness Assessment and the 2010-2011 Regional Monitoring Report. There are limited storm drains in Monserate. Monitoring efforts focused on urbanized areas in the watershed where storm drain outfalls are located. Accordingly, data is primarily representative of the lower watershed. Resulting water quality priorities are also determined based on monitoring in the lower watershed, where the receiving waters are influenced by storm drain discharges. The lack of data in the eastern, lesser populated areas of the watershed reflects this prioritization of urban areas and associated water quality conditions.

2.2.2.3 Lower San Luis Rey (903.1)

The subwatershed datasets reviewed for storm drain outfall monitoring data in the Lower San Luis Rey Hydrologic Area (903.1) are summarized in **Table 2-9.**

Table 2-9. Subwatershed Datasets for Lower San Luis Rey Hydrologic Area

Subwatershed	WET			DRY		
	2011 LTEA	2012 RMR	2013 RMR	2011 LTEA	2012 RMR	2013 RMR
Woods (903.15)						
Rincon (903.16)					☑	
Valley Center (903.14)			☑		☑	☑
Moosa (903.13)		☑	☑	☑	☑	☑
Bonsall (903.12)	☑	☑	☑	☑	☑	☑
Mission (903.11)	☑	☑	☑	☑	☑	☑

2.2.2.4 Storm Drain Outfall Data Summary

The constituents commonly exceeding benchmarks in the 2011 Long Term Effectiveness Assessment, 2012, and 2013 Regional Monitoring Report wet weather and dry weather storm drain outfall discharge data include bacteria, nutrients and Total Dissolved Solids.

The monitoring data assessed in the 2013 Regional Monitoring Report identified bacteria as a high-priority constituent during wet weather and bacteria, nutrients, Total Dissolved Solids, and chloride (a component of Total Dissolved Solids) as high-priority constituents during dry weather. The wet and dry weather constituent priorities were generally confirmed for the watershed in the recent Interim Five-Year MS4 Random Data Analysis memo dated January 2, 2014 (Weston, 2014).

Table 2-10 and **Table 2-11** summarize the results of storm drain outfall monitoring for dry and wet weather for the medium and high priority constituents identified in the 2011 Long Term Effectiveness Assessment, 2012 Regional Monitoring Report and 2013 Regional Monitoring Report reports. Additional information for the storm drain outfall monitoring, such as number of samples, is provided in Appendix 2C.

Table 2-10. Storm Drain Outfall Wet Weather Data Summary

Storm Drain Outfall Wet Weather Monitoring Summary				
Data Source		2011 LTEA Storm Drain Outfall Constituents	2012 RMR Storm Drain Outfall Constituents	2013 RMR Storm Drain Outfall Constituents
Hydrologic Area	Hydrologic Sub-Area	High-Priority	High-Priority	High-Priority
		Medium-Priority	Medium-Priority	Medium-Priority
Warner Valley (903.3)	Warner (903.31) and Combs (903.32)	--	--	--
		--	--	--
Monserate (903.2)	Pala (903.21)	FC, TDS, NO3, NO3/NO2	--	--
		--	--	--
	Pauma (903.22) and La Jolla Amago (903.23)	--	--	--
		--	--	--
Lower San Luis Rey (903.1)	Woods (903.15)	--	--	--
		--	--	--
	Rincon (903.16)	--	--	--
		--	--	--
	Valley Center (903.14)	--	--	--
		--	--	--
	Moosa (903.13)	--	FC, TDS	--
		--	--	--
	Bonsall (903.12)	FC	TDS	FC
		TSS, TDS	FC	TSS, TDS
	Mission (903.11)	FC	TDS, BOD, COD, Turb, TS	--
		--	FC, TSS, NO3, NO3/NO2	--
Common High Priority Constituents Summary		FC	FC	FC

Notes:

"—" Indicates that outfalls were not sampled, or medium or high priority constituents were not identified.

FC – fecal coliform, NO3 - nitrate, NO3/NO2 – nitrate/nitrite, Turb - Turbidity, TS - Total Selenium, TDS – Total Dissolved Solids, TSS – Total Suspended Solids

Table 2-11. Storm Drain Outfall Dry Weather Data Summary

Storm Drain Outfall Dry Weather Monitoring Summary				
Data Source		2011 LTEA Storm Drain Outfall Constituents	2012 RMR Storm Drain Outfall Constituents	2013 RMR Storm Drain Outfall Constituents
Hydrologic Area	Hydrologic Sub-Area	High-Priority	High-Priority	High-Priority
		Medium-Priority	Medium-Priority	Medium-Priority
Warner Valley (903.3)	Warner (903.31) and Combs (903.32)	--	--	--
		--	--	--
Monserate (903.2)	Pala (903.21)	Ent, NO3, NO3/NO2,TN, TP	FC, Ent, NO3, TN, TP, TDS, CL	--
		FC	--	--
	Pauma (903.22) and La Jolla Amago (903.23)	--	--	--
		--	--	--
Lower San Luis Rey (HA 903.1)	Woods (903.15)	--	--	--
		--	--	--
	Rincon (903.16)	--	Ent, NO3, NO3/NO2, TN, TP, TDS	--
		--	--	--
	Valley Center (903.14)	--	FC, Ent, TN, TP, DP, TDS, CL	TN, TP, DP, TDS
		--	--	--
	Moosa (903.13)	Ent, TN, TP, TSS, TDS	FC, Ent, TN, TP, DP, TDS, CL	Ent, TN, TP, DP, TDS, CL
		FC, TSS, CL	--	FC
	Bonsall (903.12)	Ent, NO3/NO2, TN, TP, TDS, CL	Ent, TN, TP, DP, TDS, CL	FC, Ent, TN, TP, TDS
		FC	FC, NO3/NO2	CL
	Mission (903.11)	FC, Ent, TN, TP, TDS, CL	FC, Ent, TN, TP, TDS, NH3, CL	FC, Ent, TN, TP, TDS, CL
		--	--	--
Common High Priority		Ent	FC, Ent	FC, Ent
Constituents Summary		TN, TP, TDS, CL	TN, TP, DP, CL, TDS	TN, TP, TDS

Notes: "—" Indicates that outfalls were not sampled, or medium or high priority constituents were not identified.
FC – fecal coliform, Ent – enterococcus, NO3 - nitrate, NO3/NO2 – nitrate/nitrite, TN – total nitrogen, TP - total phosphorous, DP – dissolved phosphorous, CL – chloride, SO4 – sulfate, NH3 – ammonia, TDS – Total Dissolved Solids, TSS – Total Suspended Solids

2.2.3 *Storm Drain Outfall Locations for Cities of Oceanside, Vista, County of San Diego and Caltrans that Discharge to Receiving Waters*

The Permit defines an outfall as the following:

> "Outfall means a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the U.S. and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the U.S. and are used to convey waters of the U.S."

The storm drain outfall locations for the Participating Agencies that discharge to receiving waters, including the City of Oceanside, the City of Vista the County of San Diego and Caltrans, are shown in **Figure 2-5.**

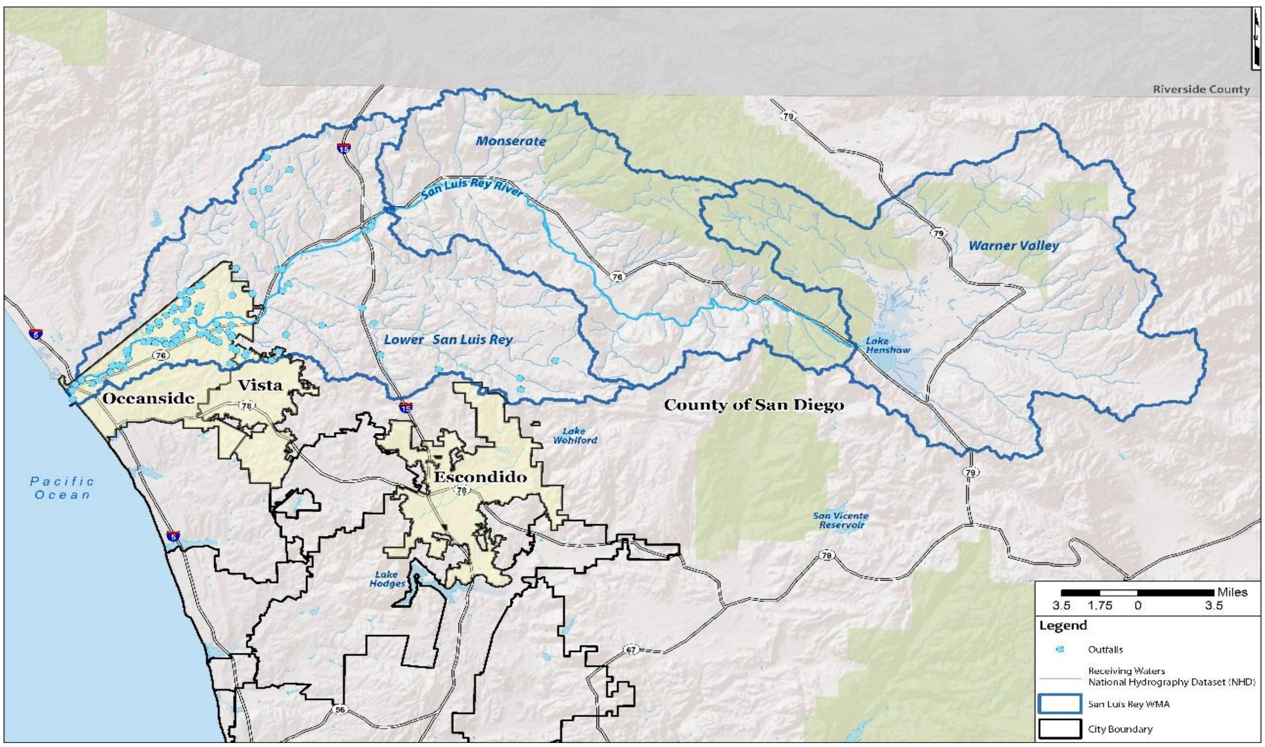

Figure 2-5. Storm Drain Outfall Locations

(Large format figure provided in Appendix 2F)

2.2.4 *Storm Drain Outfalls with Persistent Non-Stormwater Discharges*

Persistent flow is defined in the Permit as:

> "Persistent flow is defined as the presence of flowing, pooled, or ponded water more than 72 hours after a measureable rainfall event of 0.1 inch or greater during three consecutive monitoring and/or inspection events. All other flowing, pooled, or ponded water is considered transient."

The Cities of Oceanside and Vista and the County of San Diego reviewed all flowing and ponded outfalls noted during past dry weather outfall monitoring in the watershed. **Table 2-12** summarizes the Participating Agencies' storm drain outfalls with persistent non-stormwater flow draining directly to receiving waters. Outfalls lacking persistent flow are addressed by Jurisdictional Illicit Discharge Detection and Elimination programs. **Figure 2-6** shows the locations of the storm drain outfalls with persistent non-stormwater flow.

Table 2-12. Jurisdictional Storm Drain Outfalls with Persistent Non-Stormwater Flow

Jurisdiction	Station ID	Location	Latitude	Longitude
City of Oceanside	Storm Drain S006	36-inch CMP Under I-5N, Off Carmelo	33.20747	-117.385
	Storm Drain S106	Three – 36-inch pipes at NRR & Sleeping Ind.	33.26023	-117.264
	Storm Drain S122	RCP with Flap Gate at end of Tishmal Ct.	33.22181	-117.356
City of Vista	SLR-01	Border of Oceanside and Vista in Guajome Park, east of Willowbrook Dr, open channel at end of Santa Fe Trail	33.23424	-117.25785
	SLR-03	North Santa Fe Ave., south of Camino Largo, in bike lane on east side of the street (just north of storm drain on sidewalk)	33.2325	-117.24966
County of San Diego	MS4-SLR-150	Golf Club Dr. and Lake Vista Dr. intersection near Old River Rd.	33.28367	-117.21702
	MS4-SLR-155	Dublin Road at Lake Circle Ct.	33.32786	-117.15191

Note: Locations provided by Participating Agencies in 2013 for preparation of this Plan.

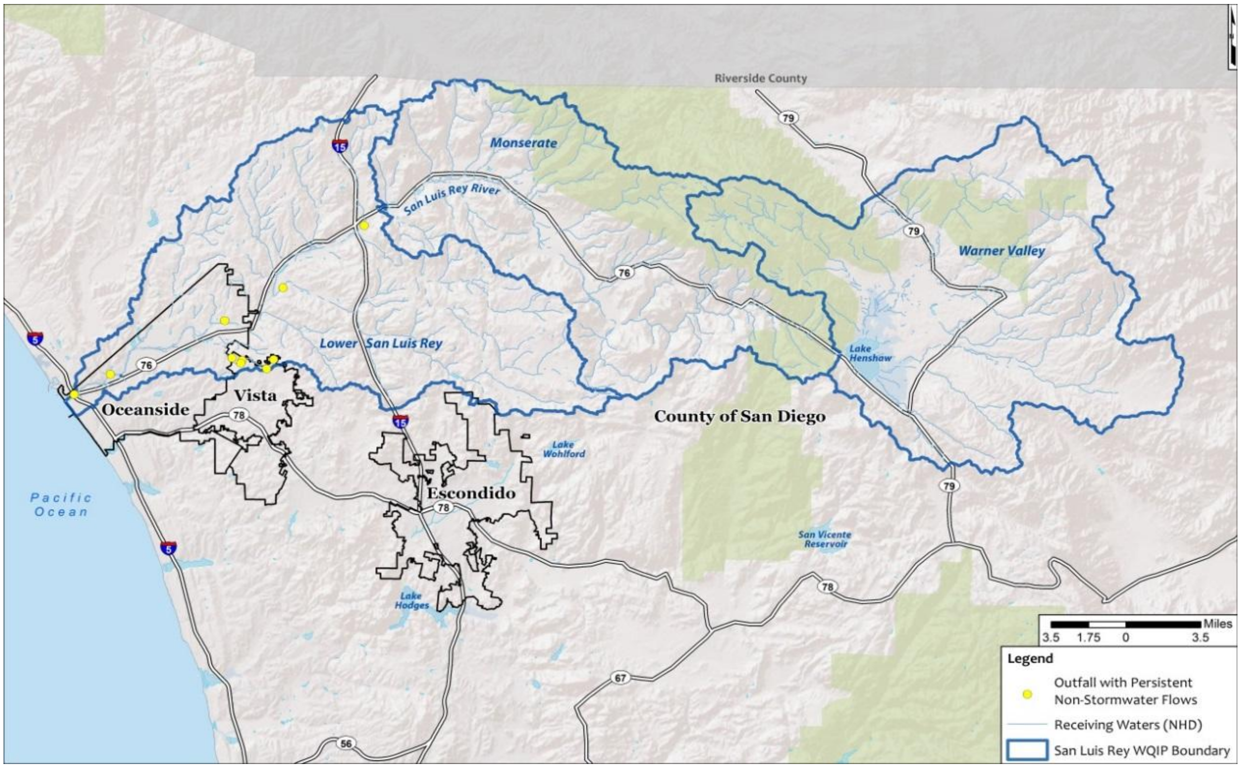

Figure 2-6. Storm Drain Outfalls with Persistent Non-Stormwater Flow
(Large format figure provided in Appendix 2F)

2.2.5 *Storm Drain Outfalls Known to Discharge Pollutants*

The Permit (Provision B.2.b.5) requires an assessment of the locations of storm drain outfalls that are known to discharge pollutants in stormwater causing or contributing to impacts on receiving water beneficial uses. The Outfall Monitoring Workplan aims to assess the locations known to discharge pollutants causing or contributing to impacts on receiving water beneficial uses over a five-year period. The 2013 Regional Monitoring Report provided four years of data for the random wet weather storm drain discharge monitoring program. The fifth year of data is documented in the Interim Five-Year Random Data Analysis memo dated January 2, 2014 (Weston, 2014). Qualitative comparisons of results of these studies suggest similar potential linkages between water quality in storm drain outfall discharges and receiving water quality, as discussed below.

During wet weather, bacteria (fecal coliform) were identified as a priority constituent in storm drain discharges. Historical data have indicated that bacteria (fecal coliform) is a priority at the receiving water Mass Loading Station. Fecal coliform were identified as priority in receiving water in the previous Annual Reports and the Long Term Effectiveness Assessment based on data from the Mass Loading Station and Temporary Watershed Assessment Stations in the Lower San Luis and Monserate Hydrologic Areas below Lake Henshaw.

Total Dissolved Solids was identified as a medium priority constituent during wet weather in storm drain discharges and was also identified as a concern in receiving waters during wet weather. Higher Total Dissolved Solids concentrations in wet weather flows may be influenced by the longer dry periods and lower rainfall that result in a greater build-up of natural minerals. Drier wet seasons might also be influenced by dry weather flows that may be from imported sources of water for irrigation and other purposes. During dry weather conditions, Enterococci, nutrients, Total Dissolved Solids, and chloride were identified as priority constituents in urban runoff. These constituents were also above benchmarks for receiving water dry weather flows based on select Stormwater Monitoring Coalition data and past receiving water data within the drainage areas above the Mass Loading Station and Temporary Watershed Assessment Stations and below Lake Henshaw. The Long Term Effectiveness Assessment dataset indicated that Enterococci, nutrients, and Total Dissolved Solids are regional issues in developed areas of San Diego County. Fecal coliform were also identified as a high priority in dry weather storm drain outfalls, which is consistent with bacteria being a regional dry weather priority.

2.2.6 Potential Improvements That Can Be Achieved in Storm Drain Discharges

This section addresses the potential improvements (as well as activities resulting in potential improvements) in the quality of storm drain discharges that can be achieved as required by Permit Provision B.2.b.(6). Careful consideration was given to the potential improvement in quality of storm drain discharges that can be achieved in determining priority water quality conditions (see **Section 2.3**). A point of emphasis in establishing this list is achievability and controllability, particularly with respect to the storm drain system infrastructure and sphere of responsibility. **Table 2-13** provides potential improvements.

Table 2-13. Examples of Strategies to Improve Storm Drain Discharge Water Quality

Improvement Strategies	Description
Irrigation Runoff Reduction Program (dry weather)	Reduce irrigation runoff through water efficiency and turf replacement programs.
Enhanced property-based inspection program (dry weather)	Reduce pollutant discharge sources at residential land uses.
Mitigation projects (wet and dry weather)	Mitigation plan development and program standardization; develop regional mitigation projects, with an emphasis on encouraging collaborative, watershed-based planning within the jurisdictional planning departments of the Participating Agencies.
Bacteria source reduction programs (wet and dry weather)	Implementation of other bacteria source control programs, such as ordinances, outreach and education, pet waste collection dispensers, public restrooms and other homeless-targeted programs, etc. (see Bacteria TMDL Comprehensive Load Reduction Plan for additional examples).
Education and outreach (wet and dry weather)	Improve stormwater outreach and education programs to target specific pollutant-generating behaviors.
Storm Drain Maintenance and repair (wet and dry weather)	Improve or develop storm drain maintenance, cleaning and/or replacement programs.
Source tracking investigation and follow-on remediation activities (wet and dry weather)	Prevent urban wildlife access into storm drains, outreach to specific homeowners suspected of illicit recreational vehicle discharges, structural controls for capture and infiltration of dry weather flows, etc.

The example strategies include existing efforts to improve water quality as well as new opportunities to enhance or expand upon existing programs, and identify new initiatives for water quality improvement. Although the strategies may improve water quality, there are several factors contributing to water quality issues that are not easily controllable, such as sources of pollutants not attributable to the storm drain system. For example, selenium-bearing geologic formations may convey selenium to surface waters via groundwater contact. Supporting this conclusion is a monitoring study performed by the County of San Diego in Keys Creek that assessed selenium in the San Luis Rey Watershed. Based on the conclusions of this monitoring study a delisting memo has been authored and is currently pending submittal.

Total Dissolved Solids is another example where controllability by the Participating Agencies may be limited. This conclusion is supported by a County of San Diego study titled, "An Analysis of Total Dissolved Solids in San Diego County," which indicated that sources for Total Dissolved Solids include groundwater, source water supplies, or the receiving water itself (County of San Diego, 2003).

Nutrients are still another example of a condition that is not easily controlled by Participating Agencies. Substantial agricultural areas are known contributors of nutrients in the watershed; this has been corroborated by a study in the adjacent Santa Margarita watershed, Draft Memorandum:

Sources of Nutrients within the San Margarita River Watershed (LWA, 2013).

The Comprehensive Load Reduction Plan identified potential dry weather sources of bacteria like dry weather flows from areas without storm drain systems, stream sediments, homeless encampments along the riparian corridor, birds, beach sand, beach wrack, pets on beach, bather shedding, failing septic systems, etc. that are not currently considered by the Bacteria TMDL. These sources, which are generally unrelated to discharges from storm drains, have been shown to contribute to bacteria concentrations in other Southern California coastal watersheds. Additionally, groundwater flows, irrigation runoff, and other sources of dry weather flows contribute to the mobilization of pollutants.

2.3 Identification of Priority Water Quality Conditions

The Permit requires that Participating Agencies identify the HPWQC in the watershed. The HPWQC may consist of pollutants, stressors or receiving water conditions that are caused or contributed to by storm drain discharges and that are presumed to most adversely affect the quality of receiving waters in the watershed. These conditions will be the basis for identifying water quality improvement strategies that would be implemented (through the JRMPs) to achieve needed improvements in the quality of storm drain discharges and receiving waters. The following sections present the process used to establish the HPWQC based on the information and data presented in **Sections 2.1 and Section 2.1.9**

2.3.1 Process to Identify Priority and Highest Priority Water Quality Condition

The following process was used to identify the pollutants, stressors or receiving water conditions that, based on available data, are believed to most adversely affect the quality of receiving waters in the watershed. This multi-step process was designed to increase confidence that water quality conditions are consistently and clearly evaluated according to the Permit criteria (described below) to identify the highest priorities for the watershed.

The 4-step screening process is shown schematically in **Figure 2-7.** The process begins with assessing the receiving water and watershed-level conditions (step 1, accomplished in **Section 2.1**), followed by an assessment of potential storm drain system contributions to these conditions (step 2, accomplished in **Section 2.1.9**). The primary data sources for the known conditions in the watershed were the Long Term Effectiveness Assessment and the most recent Regional Monitoring Reports (Weston, 2012) (Weston, 2013), as well as conditions submitted for consideration by the public and 3rd party sources during the initial data call associated with the public workshop conducted on October 7, 2013. Conditions that were considered were inclusive of chemical, physical, and biological conditions of potential concern, as discussed in detail in **Sections 2.1 and 2.1.9** of this report. Regulatory documents such as the 303(d) list, TMDLs, and associated studies were also consulted.

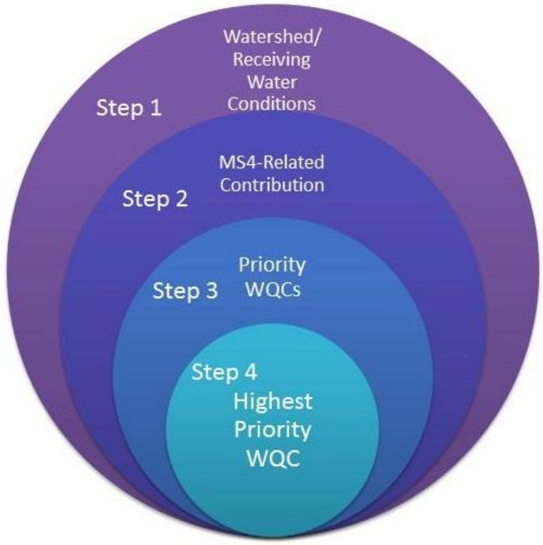

Figure 2-7. Schematic Representation of General Methodology to Determine Highest Priority Water Quality Conditions

Step 3 involved screening potential conditions according to Permit criteria and watershed-specific considerations to establish a list of ***priority water quality conditions***. The Permit criteria include the following:

a) Associated impaired beneficial use(s);

b) Geographic and temporal extent of the condition;

c) Storm drain discharge may cause or contribute to condition; and

d) Adequacy of data used to determine condition.

Noted conditions were evaluated through a series of questions developed from the Permit criteria as shown in **Figure 2-8**. Conditions were scored according to a "Yes/No" binary outcome (1 or 0) and then tallied to assess if the condition met a minimum threshold to qualify as a PWQC. Stakeholder-defined priorities were evaluated based on the availability and quality of supplemental information provided by agencies and/or stakeholders during the call for data. Each condition was also assessed separately for wet and dry weather.

Step 3 – Priority Water Quality Condition Assessment[1]

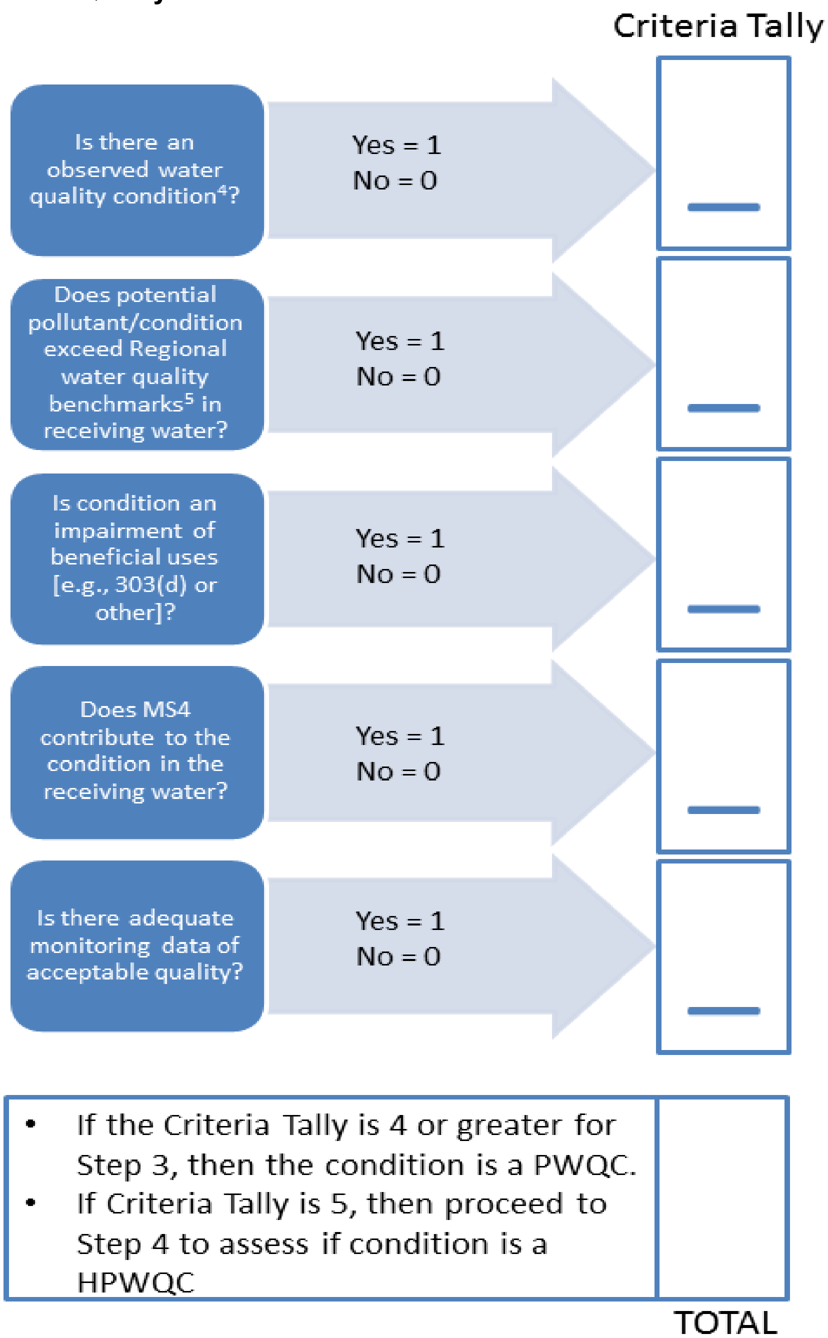

Figure 2-8. Steps to Determine PWQC (Step 3)

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[1] Stormwater managers use Best Professional Judgment (BPJ) to aid in prioritization of programs and projects. Factors to be included limit the number of HPWQC, and are based on consideration of multiple benefit effects of current BMPs and other jurisdictional programs, as well as the cost effectiveness of new strategies.

PWQCs identified through the process described in **Figure 2-8** (step 3) then advanced to the ***highest priority water quality condition*** screening process (step 4). A series of *additional* factors were considered in determining the HPWQCs as described below:

- **Approved TMDL in effect**. Conditions subject to an approved TMDL are automatically elevated to a HPWQC, as regulatory goals and schedules included in the Permit are in effect and urgency established. Existence of an approved TMDL is not a requirement for designation as a HPWQC, however.
- **Spatially Appropriate and robust dataset or basis to support condition**. This criterion underscores the need to have well-supported information that is collected and reported by participating agencies, or other parties as appropriate. The dataset or basis is considered robust if the condition is encountered in multiple data sources and is spatially relevant.
- **Stormwater/non-stormwater runoff a predominant source.** Where storm water or non-storm water discharges are considered a predominant or major source for the wet or dry weather condition, respectively, then the condition may be considered a HPWQC. This would exclude conditions, such as Total Dissolved Solids during dry weather that are primarily derived from groundwater or source water supplies rather than being derived from urban hardscapes or other land surfaces.
- **Controllable by Participating Agency (i.e., availability of effective treatment options).** Consistent with the scope of the Permit, this requirement stipulates that conditions are controllable (or can be feasibly addressed or treated) at the point of entry, within, or at the outlets from the stormwater conveyance system. This requires the availability of feasible options for treating the condition. Pollutants/conditions determined to be uncontrollable would not be considered a HPWQC.

These criteria are depicted as a step-wise process in **Figure 2-9**. Step 3 (**Figure 2-8**) and Step 4 (**Figure 2-9**) appear together as a consolidated prioritization methodology in Appendix 2E.

Step 4 – Highest Priority Water Quality Condition Assessment[2]

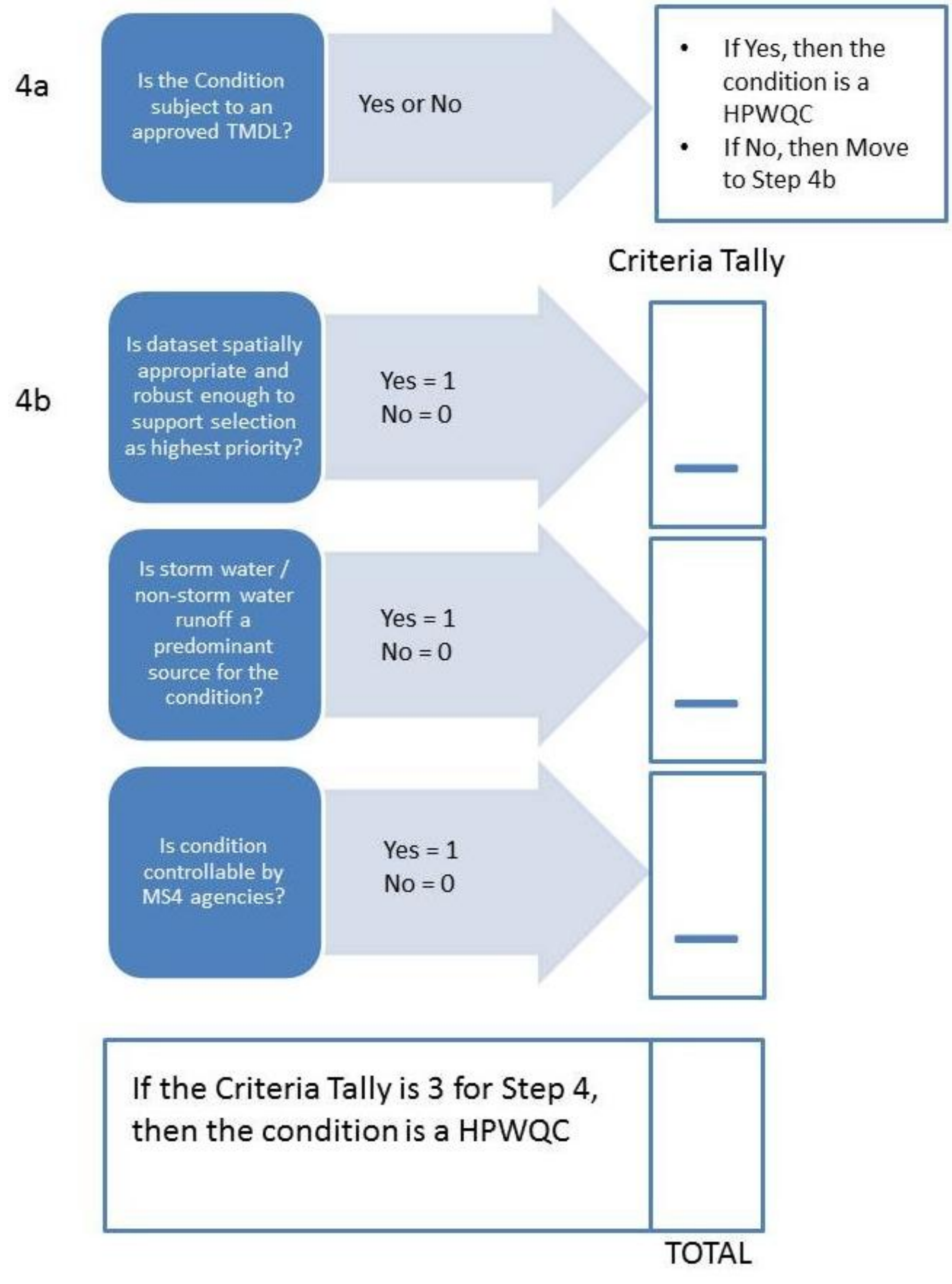

Figure 2-9. Steps to Determine HPWQCs (Step 4)

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[2] Stormwater managers use Best Professional Judgment (BPJ) to aid in prioritization of programs and projects. Factors to be included limit the number of HPWQC, and are based on consideration of multiple benefit effects of current BMPs and other jurisdictional programs, as well as the cost effectiveness of new strategies

All water quality conditions that were identified based on the data sources discussed in **Section 2.3.1** were evaluated according to the process illustrated in **Figure 2-9** (step 4). Results of this evaluation are shown in matrix tables located in Appendix 2D, for both wet and dry weather conditions. The condition and associated sub-watershed/impacted water body are indicated in the first 3 columns. Column 4 indicates if the condition has been observed in the watershed, as supported by agency data, public input, or other 3rd party data. Column 5 indicates whether the condition is subject to a 303(d) listing. Column 6 indicates if the condition exceeds benchmarks established in the Long Term Effectiveness Assessment or Regional Monitoring Reports. Regional water quality benchmarks were developed by the San Diego Regional Monitoring Workgroup for use in assessing the regional monitoring program results. This series of columns indicates the watershed-level and receiving water conditions as developed in **Section 2.1** of this report as step 1 of the process shown in **Figure 2-7.** Columns 7 and 8 indicate whether storm drain discharges contribute to the condition, and column 9 contains an assessment of the data adequacy, comprising step 2 of the process. As indicated in **Figure 2-8**, if the criteria tally equals 4 or more, then the condition becomes a PWQC (step 3). This determination as to whether each condition is or is not a PWQC is shown in column 10 of the table.

The remaining columns on the right side of the matrix tables (columns 11 through 15) show the process for determining whether a PWQC is a HPWQC (step 4 from **Figure 2-7**), based on the methodology shown in **Figure 2-9**. PWQCs subject to an approved TMDL are automatically elevated to HPWQC. PWQCs not subject to an approved TMDL are evaluated with regards to the robustness of the data set identifying the condition (Column 12), whether stormwater or non-stormwater is the predominant source for the PWQC (Column 13), and finally whether the PWQC is controllable to a substantial degree by the storm drain system (Column 14). As indicated in **Figure 2-9**, if the criteria tally equals at least 3, then the PWQC becomes a HPWQC.

Figure 2-10 shows the column headings from the matrix tables in Appendix 2D as described above.

Left side of Appendix 2D table (Step 3)

1	2	3	4	5	6	7	8	9	10
Sub Watershed	Extent (water body name) B.2.C.(1)(b)	Condition or Pollutant	Condition observed in SLR WMA Yes - 1 No - 0	Impaired Beneficial Use B.2.c.(1)(a) Yes - 1 No - 0	Exceeds LTEA/RMR Benchmarks Yes - 1 No - 0	Potential sources (2010 Integrated Report)	MS4 Discharge that may contribute to condition B.2.c.(1)(d) Yes - 1 No - 0	Monitoring data and data gaps B.2.c(1)(e)/Other Rationale Yes - 1 No - 0	PWQC?

Right side of Appendix 2D table (Step 4):

11	12	13	14	15
Approved TMDL Yes - HPWQC No - Continue	Spatially Appropriate and Robust Dataset Yes -1 No -0	Storm water as predominant source Yes - 1 No - 0	Sources controllable by MS4 Agency Yes - 1 No -1	HPWQC?

Figure 2-10. PWQC and HPWQC Matrix Table Headings in Appendix 2D

2.3.2 PRIORITY WATER QUALITY CONDITIONS

According to the process described in **Section 2.3.1**, potential water quality conditions in the watershed were screened to identify a subset of priority conditions. Tables in Appendix 2D present the assessment of conditions according to the above criteria. The following PWQCs for dry and wet weather were identified:

- Eutrophic Conditions (Dry);
- Chloride (Dry);
- bacteria (Wet and Dry);
- Nitrogen and Phosphorus (Wet and Dry);
- TDS (Wet and Dry);
- Toxicity (Wet and Dry); and
- Benthic Alterations (Dry)

Additional water quality conditions noted for the watershed include the following as supplied during the first public workshop on October 7, 2013:

- Impediment to natural delivery of sand type sediment to the shoreline from the upper watershed as a result of sediment trapped in reservoirs/dams (the commenter proposed identifying this issue as hydromodification);
- Nutrients associated with waste water treatment plant expansion (the commenter proposed to group this with other nutrient conditions in the watershed);
- Trash; and
- Localized sedimentation (the commenter proposed identifying this issue as hydromodification)

These conditions are assessed according to the process described in **Section 2.3.1** and appear in Appendix 2D.

2.3.3 HIGHEST PRIORITY WATER QUALITY CONDITIONS

PWQCs were further screened, as described in **Section 2.3.1,** to establish the HPWQC for the watershed. The Appendix 2D tables indicate the screening process results for each of the priority conditions assessed, for both wet and dry weather. The criteria and results from these tables, as illustrated in **Figure 2-10**, are summarized as follows:

- **Approved TMDL in effect.** The sole TMDL currently in effect for the Lower San Luis Rey River HA is the Twenty Beaches and Creeks Bacteria TMDL, therefore bacteria was automatically elevated to a HPWQC.
- Spatially appropriate and robust dataset or basis to support condition. On this basis, chloride was removed from consideration.

- **Stormwater/non- stormwater runoff a likely predominant source**. Conditions and pollutants that do not meet this criterion include eutrophication, chloride, Total Dissolved Solids, and nutrients for dry weather conditions.
- **Controllable by Participating Agency and/or presence of effective treatment options.** The condition of poor Index of Biointegrity (IBI) was determined to be controllable and restorable within receiving waters, but not within the majority of the stormwater conveyance system. Total Dissolved Solids was removed in wet weather.

Only one (1) HPWQC meets the above criteria in the San Luis Rey Watershed: **bacteria in the Lower San Luis Rey River Hydrologic Area[3].**

Bacteria have been a focus in the watershed since adoption of the Bacteria TMDL (Regional Board Resolution No. R9-2010-0001), the purpose of which is to protect the health of those who recreate at beaches receiving runoff from the San Luis Rey Watershed. The TMDL requires Participating Agencies to attain required load reductions during both dry weather and wet weather conditions within a 10- and 20-year compliance timeline, respectively. In 2012, Participating Agencies developed a Comprehensive Load Reduction Plan that proposed programs designed to achieve TMDL-specified bacteria load reductions, as well as reducing loads of other 303(d) listed pollutants. The cost to comply with the Bacteria TMDL in the San Luis Rey Watershed is significant and was estimated to be $126 – $277 million dollars (Geosyntec, 2012).

2.4 Identification of Sources of Pollutants and/or Stressors

The Permit requires that the Participating Agencies "identify and prioritize known and suspected sources of stormwater and non-stormwater pollutants and/or stressors associated with [storm drain] discharges that cause or contribute to the highest priority water quality conditions" as identified under **Section 2.3** (Provision B.2.c). Provision B.2.d states that the identification of known and suspected sources of pollutants and/or stressors that cause or contribute to the HPWQCs must consider the following:

1) Pollutant generating facilities, areas, and/or activities with the watershed;
2) Locations of the Copermittee's stormwater conveyance systems;
3) Other known and suspected sources of non-stormwater or pollutants in stormwater discharges to receiving waters within the watershed;
4) Review of available data; and
5) Adequacy of available data to identify and prioritize sources and/or stressors associated with storm drain discharges.

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[3] Specific reaches of receiving waters within the Lower San Luis Rey River Hydrologic Area that are associated with the HPWQC are indicated in Appendix 2D.

The items listed above were used to identify pollutants and stressors that *potentially* contribute to the HPWQC, bacteria, and the findings of this evaluation are discussed further in the following sections. It should be recognized that the following discussion is not an admission that listed conditions, pollutants, and/or stressors from storm drain discharges are *known* to contribute to the HPWQC. Discussion of BMPs that could address the potential sources discussed in this section can be found in Appendix 3A.

Table 2-14 presents a summary of the land uses, the corresponding number of acres for each land use, and the percent of the total area that each land use comprises to help in the prioritization of pollutants and their sources. Residential, commercial/industrial, and recreational areas, as well as schools, and freeways and roads within agencies' jurisdictional boundaries are generally considered to be within the storm drain system. Agriculture, vacant/undeveloped, and park/open space areas are typically outside of the storm drain system. Identification of sources will therefore focus on the first set of land use categories, since those are areas in which control strategies can more effectively be implemented. Identification of land uses and their associated potential impact to water quality conditions within the watershed are presented in greater detail in Chapter 3.

Table 2-14. San Luis Rey Watershed Land Uses

Land Use	Acres	Percent Total Area
Residential	54,842	15.2%
Commercial/Industrial	13,739	3.8%
Schools	567	0.2%
Recreation	3,325	0.9%
Freeways/Roads	7,225	2.0%
Parks/Open Space	31,854	8.9%
Agriculture	52,092	14.5%
Vacant/Undeveloped	195,593	54.3%
County of Riverside	649	0.2%
Total	359,886	100%

Source: SANDAG

2.4.1 Pollutant Generating Facilities, Areas, and/or Activities

The Permit requires the Participating Agencies to consider pollutant generating facilities, areas, and/or activities within the watershed, including, but not limited to, the following:

1) Each Copermittee's inventory of construction sites, commercial facilities or areas, industrial facilities, municipal facilities, and residential areas;
2) Publicly owned parks and/or recreational areas;
3) Open space areas;
4) All currently operating or closed municipal landfills or other treatment, storage or disposal facilities for municipal waste; and

5) Areas not within the Copermittee's jurisdictions (e.g., Phase II stormwater conveyance systems, tribal lands, state lands, federal lands) that are known or suspected to discharge to stormwater conveyance systems.

The Participating Agencies are required to maintain a list of construction sites, municipally owned parks or recreation areas, landfills, and commercial, industrial, and municipal facilities which were used to identify potential sources of pollutants. These sites are inspected on a frequency detailed in the Permit and municipal-specific JURMPs. **Table 2-15** provides a summary of the applicable pollutant generating facilities, areas, and/or activities within each Participating Agency's boundaries.

Table 2-15. Summary of Applicable Pollutant Generating Facilities, Areas, and/or Activities by Jurisdiction

Potential Pollutant Source Areas	City of Vista	City of Oceanside	County of San Diego
Construction, Commercial, Industrial, Municipal, Residential Facilities and/or Areas	☑	☑	☑
Publicly Owned Parks and/or Recreational Areas	☑	☑	☑
Open Space Areas	☑	☑	☑
Municipal Landfills or Other Treatment, Storage or Disposal Facilities for Municipal Waste		☑	☑
Areas Not Within the Copermittee's Jurisdictions	☑	☑	☑

The Participating Agencies have identified a number of potential sources for the HPWQC, bacteria, including but not limited to food establishments, commercial animal facilities, nurseries, residential areas and agricultural areas, which are discussed in the subsections below in accordance with Permit Provision B.2.d.(1).

2.4.1.1 Pollutant Generating Facilities

Table 2-16 presents a summary of the pollutant generating facilities, areas, and/or activities from the City of Vista 2012-2013 JURMP Annual Report, City of Oceanside 2011-2012 JURMP Annual Reports and the County of San Diego 2009-2010 JURMP Annual Report. Specific facility location information is provided in the JURMPs. As listed in **Table 2-14**, the total residential area within the watershed is approximately 54,842 acres. The potential pollutant sources for the watershed are discussed below.

Table 2-16. Commercial, Industrial, and Construction Sites

Land Use	City of Vista	City of Oceanside	County of San Diego
Commercial Sites	537	1,085	340
Industrial Sites	181	59	8
Construction Sites	29	0	1,406

2.4.1.2 Parks, Recreational and Open Space Areas

As presented in **Table 2-14**, publicly owned parks and/or open space areas make up 31,854 acres and recreational land use makes up 3,325 acres within the watershed. Based on review of available data, there are 20 parks and three marinas within the City of Oceanside, nine parks within the County of San Diego, and approximately 1,250 acres of open space/parks in the City of Vista.

2.4.1.3 Landfills or Other Treatment Facilities for Municipal Waste

Table 2-17 shows a summary of data from the City of Oceanside 2008-2009 and 2009-2010 JURMP Annual Reports and the County of San Diego 2009-2010 JURMP Annual Report for all currently operating or closed municipal landfills or other treatment, storage or disposal facilities for municipal waste. The City of Oceanside has one closed landfill. The County of San Diego has two inactive landfills, Bonsall and Valley Center Landfills, within the County of San Diego and watershed. At the time this report was prepared, the City of Vista did not have municipal treatment facilities or landfills within their jurisdiction.

Table 2-17. Landfills or Other Treatment Facilities for Municipal Waste

Land Use	City of Vista	City of Oceanside	County of San Diego
Landfill Site	None	1 inactive site	2 inactive sites: • Bonsall Landfill • Valley Center Landfill

2.4.1.4 Areas not Within the Participating Agencies' Jurisdictions

Tribal lands, federal lands, state parks, and lands regulated by the State Board Phase II Permit are considered to be outside of the jurisdictional land use authority of the Participating Agencies. Discharges from tribal, federal, and state owned lands are generally regulated directly by the USEPA. Large campuses (e.g., colleges, hospitals) are often regulated under a separate Phase II Permit issued by the State Board, provisions of which are enforced directly by the State Board. It is important to recognize that each of these land uses and jurisdictions contributes to the loading of pollutants, including bacteria. **Figure 2-11** shows the areas outside of the Participating Agencies' jurisdictions, including tribal lands, state lands, and federal lands as well as Camp Pendleton's Phase II storm drain system area subject to requirements in the State Board Water Quality Order No. 2013-0001-DWQ.

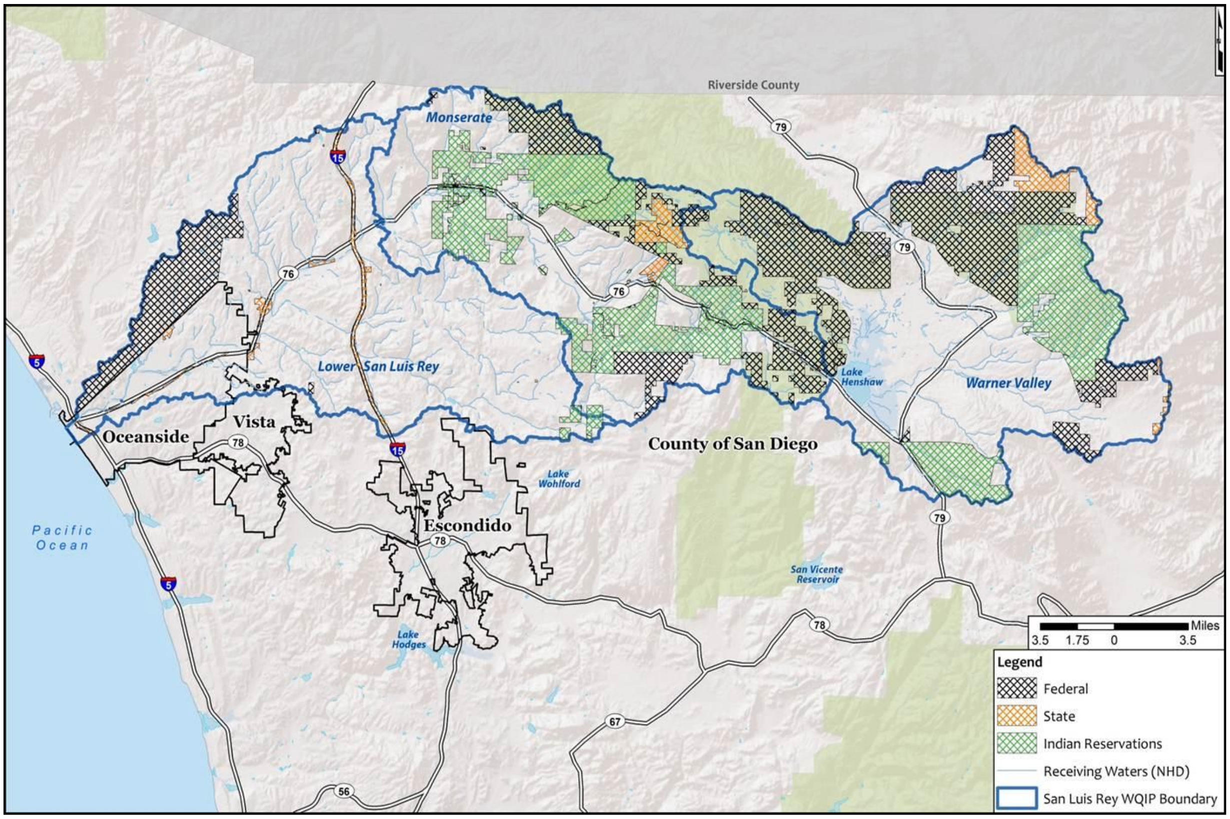

Figure 2-11. Areas Not within the San Luis Rey Participating Agencies' Jurisdictions
(Large format figure provided in Appendix 2F)

2.4.2 LOCATION OF THE PARTICIPATING AGENCIES' STORMWATER CONVEYANCE SYSTEMS

The Permit requires that the Participating Agencies provide the locations of their stormwater conveyance systems, including, but not limited to, the following:

(a) All storm drain outfalls that discharge to receiving waters; and

(b) Locations of major structural controls for stormwater and non-stormwater (e.g., retention basins, detention basins, major infiltration devices, etc.).

The locations of the storm drain outfall system for each jurisdiction within the watershed are shown in **Figure 2-5.**

2.4.3 OTHER POTENTIAL SOURCES

The Permit requires that the Participating Agencies consider other known and suspected sources of non-stormwater discharges or pollutants in stormwater discharges to receiving waters within the watershed, including, but not limited to, the following:

(a) Other storm drain outfalls (e.g., Phase II Municipal and Caltrans);

(b) Other National Pollutant Discharge Elimination System permitted discharges;

(c) Any other discharges that may be considered point sources (e.g., private outfalls); and

(d) Any other discharges that may be considered non-point sources (e.g., agriculture, wildlife or other natural sources).

Based on review of other potential sources, those identified generally fall into three categories: lands outside of the Participating Agencies' jurisdictions, discharges regulated under other statutes (e.g., individual or general NPDES permit, conditional waiver), and environmental sources.

Lands that are physically outside of Participating Agencies' jurisdictions include tribal, federal (e.g., military bases), and state owned lands (e.g., State Parks). Discharges from these lands are typically regulated by USEPA. Participating Agencies do not have authority to regulate these sources.

There are many point source discharges within the watershed that are regulated under other statutes by the Regional and/or State Boards. Examples of discharges and the associated regulatory mechanisms include:

- Discharges from small stormwater conveyance systems: State Board Order No. 2013-0001-DWQ;
- Onsite wastewater treatment systems: Regional Board Conditional Waiver #1;
- Sanitary sewer overflows: State Board Order No. 2006-0003-DWQ;
- Publicly owned treatment works : Individual National Pollutant Discharge Elimination System permits;
- Groundwater: Multiple Regional Board permits (e.g., Order R9-2008-0002);
- Industrial sites: State Board Industrial Storm Water General Permit Order 2014-0057-DWQ; and
- Construction sites (>1 acre): State Board Construction Storm Water General Permit Order No. 2012-0006-DWQ.

Regulation of these sources is generally the responsibility of the permitting agency (i.e., State Board, Regional Board); however, some are regulated by both the permitting authority and the Participating Agencies (e.g., industrial sites, construction sites, illicit discharges).

Environmental sources are most often non-point in nature. These include sources of pollution that are naturally present in the environment and others that are not naturally present, but may be anthropogenically influenced. Participating Agencies have limited control over these sources through stormwater conveyance system regulation. Examples of environmental sources of pollution present within the watershed include wildlife, kelp, natural erosion, bacterial regrowth, natural groundwater, and wildfires. Natural sources that can be anthropogenically influenced include groundwater altered by imported water supply, aerial deposition of transportation and industrial pollutants, and erosion exacerbated by hydromodification[4].

In addition, several additional sources specific to bacteria were identified within the watershed including homeless populations living near receiving waters, sludge/sewage disposal sites, and portable bathroom facilities. Non-anthropogenic sources were also noted. The Regional Board attempted to address natural loading during development of the Bacteria TMDL.

This Plan focuses on storm drain discharges; though it considers watershed conditions and priorities, it must do so in the context of the Participating Agencies' obligations for storm drain discharges. Where sources are outside of the regulatory authority or controllability of the Participating Agencies and these sources are impacting water quality within the watershed, the Participating Agencies will look for opportunities within the limits of their authority to address these sources themselves, or, where applicable and feasible, to collaborate with appropriate regulatory agencies to control these sources of bacteria. **Table 2-18** summarizes the potential pollutant sources for bacteria discussed in this section.

Table 2-18. Potential Sources of Bacteria

General Source Categories [a]	Targeted Source Categories	Source Categories Outside of Participating Agency Control
• Construction • Commercial • Industrial • Municipal Parks and Recreation Areas • Municipal Burn Sites and Landfills • Residential	• Food Establishments • Commercial Animal Facilities • Nurseries • Residential Land Uses • Agricultural Land Uses • Human Sources (sewer infrastructure, onsite wastewater treatment systems, homeless encampments)	• Natural Sources (e.g. wildlife, kelp, open space) • Tribal Lands • Federal Lands • State Lands • Private Outfalls • Phase II Storm Drain Outfalls

[a] Areas and Activities Within Participating Agency Control

2.4.4 *Review of Available Data*

The Permit requires that the Participating Agencies provide the findings of storm drain sources of pollutants and/or stressors from the available data reviewed, including, but not limited to, the following:

(a) Findings from illicit discharge detection and elimination programs;

(b) Findings from s outfall discharge monitoring, findings from receiving water monitoring, findings from outfall discharge and receiving water assessments; and

[4] In contrast to other anthropogenically influenced natural sources, erosion caused by hydromodification is addressed under the Permit through the Land Development requirements in Provision E.3.

(c) Other available, relevant, and appropriately collected data, information, or studies related to pollutant sources and/or stressors that contribute to the HPWQC.

2.4.4.1 Illicit Discharge Detection and Elimination Programs

The following illicit discharge/illegal connection (IC/ID) inspections which occurred as part of the jurisdictional illicit discharge detection and elimination programs within the watershed were reported in the City of Oceanside 2012-13 JURMP Annual Report, City of Vista 2012-2013 JURMP Annual Report, and the County of San Diego 2010-2011 JURMP Annual Report (**Table 2-19**).

Table 2-19. Illicit Discharge Detection and Elimination Programs

	City of Vista	City of Oceanside	County of San Diego
IC/ID inspections	4	10	75

Based on review of the findings of these programs, sources of bacteria and nutrients in the storm drain system could include the following:

- Food establishments;
- Commercial animal facilities;
- Nurseries;
- Residential land uses; and
- Agricultural land uses.

2.4.4.2 Findings from Storm Drain Discharge and Receiving Water Monitoring and Associated Assessments

The Permit requires the Participating Agencies to present the findings of potential pollutant sources from available storm drain outfall monitoring, receiving water monitoring, and storm drain outfall discharge and receiving water assessment data. Potential pollutant sources have not been well-identified in available reports. This may be due to the monitoring locations, which do not represent a single land use type and therefore cannot be used to distinguish pollutant sources. The Long Term Effectiveness Assessment states that single family residential land use areas may contribute to bacteria levels above water quality benchmarks. The Regional Monitoring Reports do not identify specific pollutant sources.

2.4.4.3 Other Data or Studies Related to Pollutant Sources

The Permit requires the Participating Agencies to consider "other available, relevant, and appropriately collected data, information, or studies related to pollutant sources and/or stressors that contribute to the highest priority water quality condition."

The Lower San Luis Rey Bacteria Source Identification Project (Bacteria Tracking Study; MACTEC, et. al., 2011) presented the following key observations about bacteria as a water quality condition. Note that the Bacteria Tracking Study assessed bacteria and host-specific microbe levels only for the lower portion of the watershed and east to Bonsall Bridge.

Dry and Wet Weather

- Across the project timeframe, there was evidence of human-related bacterial sources near the river mouth during both the wet and dry seasons. An active sewer pipe was identified and retrofitted as part of the post-project investigation.
- There was a strong signal of avian feces contamination at the river mouth location during wet and dry seasons.
- Potential pollutant sources may include leaking sewers/septic, homeless encampments, sediment, and groundwater; however these sources were not confirmed through this study.

Wet Weather

- During wet weather, averages were less than the 25th percentile concentration for developed watersheds, and many sites fell into the range of natural watersheds.
- Multiple locations in the river main stem and tributaries east of the mouth showed evidence of human-related bacterial sources during wet weather. Additionally, bacteria loadings were high during storm events, suggesting a "first flush" of bacteria during wet weather.

Dry Weather

- Dry season bacteria concentrations were generally protective of human health standards near the river mouth, while wet season concentrations were generally higher.
- During the dry season, bacteria levels in the main stem of the river east of the mouth exhibited bacteria levels that were generally less than the range typically found in developed watersheds.
- Average bacteria concentrations at the river mouth during the dry season were generally less than range for developed watersheds, and closer to the typical range found within natural watersheds.

Additionally, a report prepared by Armand Ruby Consultants documented a bacteria source prioritization process (ARC, 2011). This report recommended splitting bacteria sources into categories of dry versus wet, as well as human, anthropogenic, non-human, and non-anthropogenic. It also recommended focusing on sources with a potential pathway into a storm drain or receiving water.

Following the method outlined in the Armand Ruby Consultants report, potential bacteria sources were ranked based on the following weighted factors:

- Human health risk;
- Magnitude;
- Geographical distribution; and
- Frequency.

The scores were tabulated and then ranked separately within each of the three categories.

Table 2-20 shows the ranking of dry and wet weather sources for bacteria sources in the watershed.

Table 2-20. Rankings for Dry and Wet Weather Bacteria Sources

Source	Dry Weather Rank	Wet Weather Rank
Human		
Sanitary Sewer Overflows	1	1
Leaky Sewer Pipes (Exfiltration)	2	3
Homeless Encampments	3	2
RVs (Mobile)	4	4
Leaky Failing Septic Systems	5	5
Illegal Discharges	6	10
Dumpsters	7	7
Trash Cans	8	6
Illicit Connections	9	8
Landfills	10	11
Garbage Trucks	11	12
Illegal Dumping	12	13
Porta-Potties	13	9
Bathers	14	15
Gray Water Discharges	15	14
Pools	16	16
Hot Tubs	17	17
Boaters	N/A	N/A
Bio solids Re-use	N/A	N/A
Anthropogenic, Non-Human		
Birds (Gulls, Pigeons, etc.)	1	1
Pets	2	2
Dumpsters	3	4
Trash Cans	4	3
Wash water	5	5
Rodents (Mice, Rats and Rabbits)	6	6
Livestock – Domestic Animals	7	7
Livestock – Agricultural	8	8
Manure Re-use	9	13
Landfills	10	10
Garbage Trucks	11	11
Vectors	12	12
Stormwater Conveyance System Infrastructure - Biofilm/Regrowth	13	15

Source	Dry Weather Rank	Wet Weather Rank
Manure Re-use Non-Agricultural	14	16
Litter	15	14
Outdoor Dining/ Fast Food	16	9
Manure/Compost	17	19
Grease Bins	18	17
Reclaimed Water	19	20
Contaminated Soil (incl. Dredge Spoils)	20	18
Soil	21	21
Green Waste	22	23
Irrigation Tail water	23	22
Soil and Decaying Plant Matter	24	24
Food Processing	N/A	N/A
Bio-Tech Manure Management	N/A	N/A
Non-Anthropogenic		
Wildlife (Birds and Others)	1	1
Wrack line (Flies and Decaying Plants)	2	2
Algae	3	4
Plants	4	3
Soil	5	5

Based on the number of potential human sources identified in the prioritized source list, as well as evidence from the Bacteria Tracking Study of the presence of human fecal markers throughout the lower watershed during both wet and dry weather, the Comprehensive Load Reduction Plan recommends targeting human sources of bacteria. In addition to the benefit of reducing bacteria loads and helping to meet TMDL requirements, focused efforts on controlling human inputs would most directly address pathogen levels and public health risks associated with recreation in receiving waters.[5]

Based on these studies, the highest rated potential sources of human-related bacteria to the watershed include:

- Sanitary sewer overflows;
- Leaking sewer pipes;
- Homeless populations; and

[5] Furthermore, controlling human and anthropogenic/non-human sources of bacteria may help to support a Natural Source Exclusion (NSE) request during TMDL reopener in 2016.

- Leaking septic systems.

In addition, sources for the HPWQC can be prioritized spatially with Geographic Information System-based, quantitative analysis of bacteria loading performed as part of the San Luis Rey Comprehensive Load Reduction Plan (Geosyntec, 2012). The results developed from this analysis were represented through catchment priority indices (CPIs) within the watershed (below Lake Henshaw) as presented in **Figure 2-12**. This information can be used to focus resources in particular areas to address sources that contribute to the HPWQC.

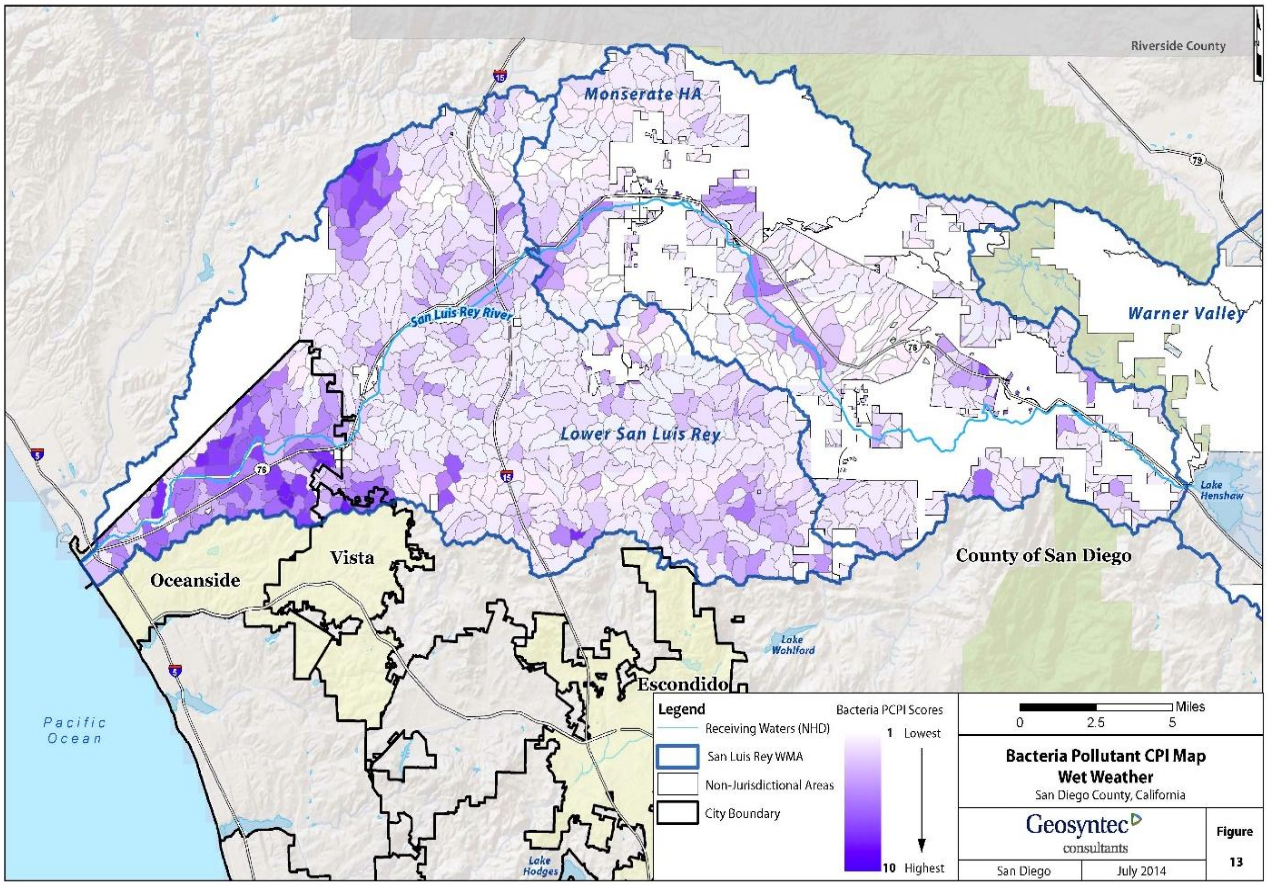

Figure 2-12. Bacteria Pollutant CPI Map – Wet Weather
(Large format figure provided in Appendix 2F)

2.4.5 Data Adequacy

The Permit requires that the Participating Agencies consider the "adequacy of the available data [used] to identify and prioritize sources and/or stressors associated with [storm drain] discharges that cause or contribute to the highest priority water quality conditions" in the watershed. As discussed above in **Section 2.4.4.2,** potential pollutant sources have not been well-identified in available reports. This may be due to the monitoring locations, which do not represent a single land use type and therefore, cannot be used to distinguish specific pollutant sources. In these cases, Participating Agencies must use best professional judgment and local knowledge of watersheds to identify water quality issues.

The data used to determine the HPWQC is spatially and temporally relevant to the area covered by this Plan, and was *"appropriately collected and analyzed."* Therefore, it is considered adequate to accurately identify bacteria as the HPWQC affecting the watershed. There is, however, a shortage of data available to assess the sources of bacteria to the stormwater conveyance system. Special studies, such as microbial source tracking and illicit discharge detection and elimination studies would be useful in addressing these data gaps. The Bacteria Tracking Study was helpful in identifying areas of the watershed with elevated levels of both bacteria and human-related bacteria. Results from the study will continue to aid in prioritizing future source tracking and identification efforts.

3 WATER QUALITY IMPROVEMENT GOALS, STRATEGIES, AND SCHEDULES

Provision B.3 the Permit, "Water Quality Improvement Goals, Strategies and Schedules," describes the requirements to develop specific water quality improvement goals and strategies to address the water quality conditions identified for the San Luis Rey Watershed. These goals and strategies must effectively prohibit non-stormwater discharges to the stormwater conveyance system, reduce pollutants in stormwater discharges from the stormwater conveyance system to the maximum extent practicable, and protect water quality in receiving waters.

Goals are set to measure progress towards addressing the highest priority water quality condition (bacteria) to protect recreational uses.

Strategies are the existing or planned activities or projects that can be implemented to demonstrate reasonable progress towards achieving the goals.

Chapter 3 defines the goals, strategies and schedules for achieving those goals. The goals include interim and final numeric (i.e., quantifiable) goals for the HPWQC, fecal indicator bacteria (bacteria), for wet weather and dry weather in the lower San Luis Rey Watershed.

Wet Weather is defined as a storm event of >0.1 inch of rainfall and the following 72 hours after the end of rainfall.

Dry Weather is defined as all days where the preceding 72 hours has been without measurable precipitation (>0.1 inch).

Indicator bacteria are important indicators for recreational beneficial uses. Indicator bacteria do not cause illness directly, but some epidemiologic studies[1] have shown correlations between the presence of indicator bacteria and gastrointestinal illness caused by pathogens. Indicator bacteria are used as detection surrogates or proxies for pathogens because they are easier and less costly to measure. Allowable bacteria loads for the watershed are defined by the Bacteria Total Maximum Daily Load (TMDL), identified in Attachment E of the Permit. The purpose of the Bacteria TMDL is to protect the health of those who recreate in waterbodies receiving runoff from the watershed by reducing the amount of bacteria discharged to the waterbodies through urban runoff, stormwater, and other sources.

[1] For example: EPA/600/R-10/168: "Report on the 2009 National Epidemiologic and Environmental Assessment of Recreational Water Epidemiology Studies (NEEAR): Boquerón Beach, Puerto Rico, and Surfside Beach, SC of the paper published in Environmental Health" (PDF, 449pp., 16.78 MB)

The control of bacteria presents unique challenges, since they are ubiquitous in the environment, are living organisms and the amount of bacteria from regrowth as well as natural sources can be significant. (Colford, Wade, Schiff, Wright, Griffith, Sandhu, Burns, Sobsey, Lovelace, and Weisberg, 2007) Anthropogenic sources and natural sources contribute to bacteria within the watershed. To better understand the contribution from natural sources of bacteria, the San Diego Municipal Copermittees are currently carrying out a San Diego Region Reference Study. An objective of this study is to collect necessary data to account for the natural sources of bacteria in a watershed that are beyond the control of the Copermittees.

Anthropogenic sources of bacteria are caused or produced by humans and include, but are not limited to, failing septic systems, illegal sewage disposal, and pet waste.

Natural sources of bacteria include, but are not limited to, bird and wildlife feces, re-suspension from sediment, and regrowth.

The Bacteria TMDL requires Participating Agencies to reduce bacteria levels during both dry weather and wet weather conditions within a 10- and 20-year compliance timeline, respectively. The goals are focused to demonstrate progress towards compliance with the Bacteria TMDL, and the strategies are the actions to be taken to obtain compliance.

Multi-benefit strategies have been prioritized to achieve goals for bacteria as well as other pollutants, and will thereby address both the HPWQC and other PWQCs in the lower watershed. PWQCs and the HPWQC were identified according to the process described in **Section 2.3**. The PWQCs typically include conditions where water quality analysis have identified and confirmed that the constituent or condition is not meeting water quality standards and the stormwater conveyance system is a likely contributor to the condition. The PWQCs and HPWQC were identified in Chapter 2 and are presented in **Table 3-1**.

Table 3-1. Priority Water Quality Conditions in Lower San Luis Rey Watershed

Condition	Dry Weather	Wet Weather
Highest Priority Water Quality Condition	• Bacteria at San Luis Rey River mouth • Bacteria in lower San Luis Rey River	• Bacteria at San Luis Rey River mouth • Bacteria in lower SLR
Priority Water Quality Conditions	• Nitrogen and Phosphorus • Eutrophic Conditions • Total Dissolved Solids • Index of Biotic Integrity • Chloride • Toxicity	• Nitrogen and Phosphorus • Total Dissolved Solids • Toxicity

An iterative, adaptive management approach that will increase the strategies' effectiveness to improve water quality will be used to achieve the numeric goals for bacteria. The approach, with corresponding Chapter 3 sections noted, is presented in **Figure 3-1** and will be further discussed in Chapter 5.

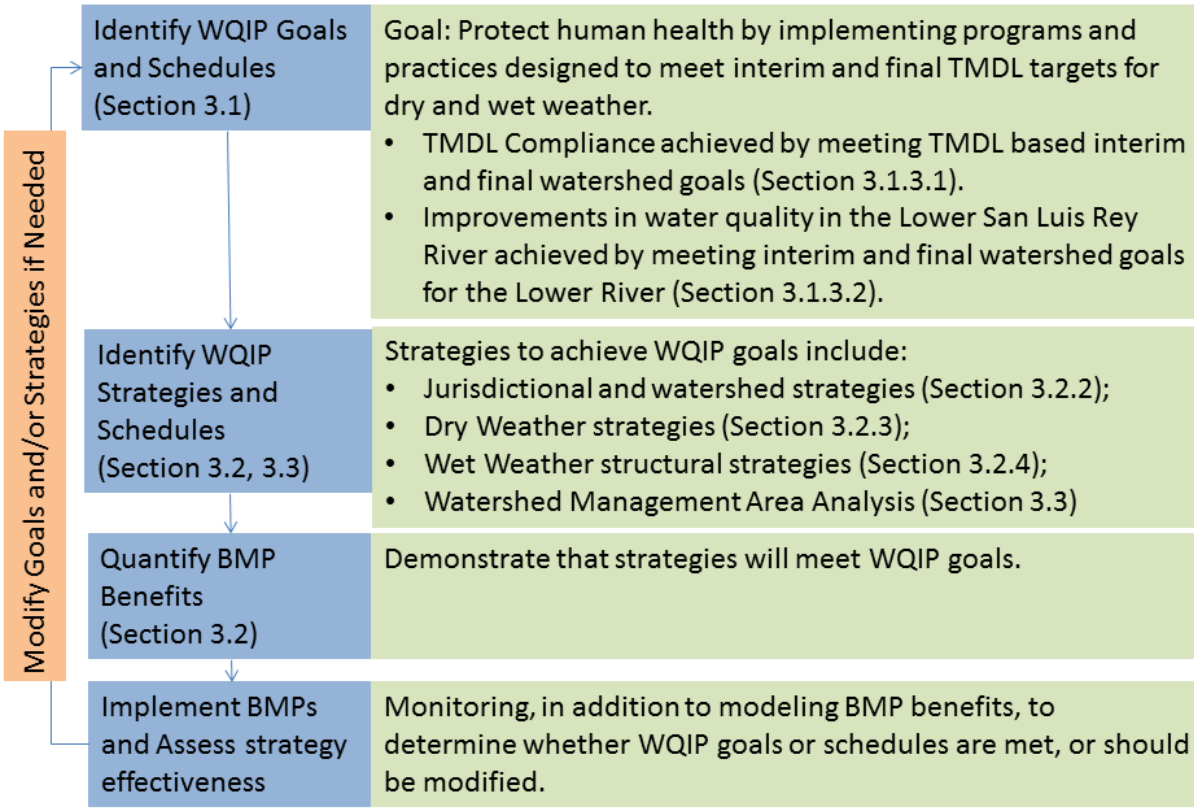

Figure 3-1. Iterative Approach for Achieving Goals

3.1 Water Quality Improvement Goals and Schedules

The purpose of establishing goals is to "support Water Quality Improvement Plan implementation and measure reasonable progress towards addressing the highest priority water quality condition" [B.3.a.(1)]. The Permit requires that goals be reflective of criteria or indictors to measure incremental progress towards addressing the HPWQC over the course of implementation of the Plan.

As described in Chapter 2, bacteria is the HPWQC for dry and wet weather in the lower watershed. The goals of this Plan are focused to achieve compliance with the Bacteria TMDL from Attachment E of the Permit, which presents different options or pathways to achieve compliance. The goals are presented for dry and wet weather conditions as follows:

- Interim watershed goals to address bacteria in the lower river based on 5-year Permit terms.
- Interim watershed goals based on the interim Bacteria TMDL compliance pathways.

- Final watershed goals to address bacteria in the lower river.
- Final watershed goals based on final Bacteria TMDL compliance pathways.

The TMDL goals are already established in Attachment E of the Permit, and are herein referred to as "required goals". They reflect the multiple pathways outlined in the Permit for compliance with the TMDL. Each compliance pathway would result in water quality improvements, but each demonstrates the improvements in a different way. Since the Permit allows any of these pathways to be followed to achieve compliance (i.e. demonstration of progress toward all compliance pathways is not required), the compliance pathways are independent of each other.

The compliance pathways are based on three types of metrics:

- receiving water conditions that are evaluated by comparing measured conditions with water quality objectives (numeric values and allowable exceedance frequencies – included to account for natural sources of bacteria);
- conditions of discharges from Copermittee's storm drain outfalls that are evaluated by comparing measured conditions to water quality objectives and/or required load reductions; and
- implementation of the Plan (i.e., establishment of goals, implementation of strategies and schedules).

Modeling has been conducted to establish numeric targets for the goals. Since there is an opportunity in 2016 to update the bacteria TMDL based on sound scientific studies, which may amend the current targets, goals may be modified based on outcomes of the bacteria TMDL revision process. As the Plan is implemented, the Participating Agencies will use adaptive management, as discussed in Chapter 5, to re-evaluate goals and improve strategies to effectively address priorities.

Figure 3-2 illustrates the timelines and relationships between the goals; additional details on the proposed schedule are provided in **Section 3.1.5.**

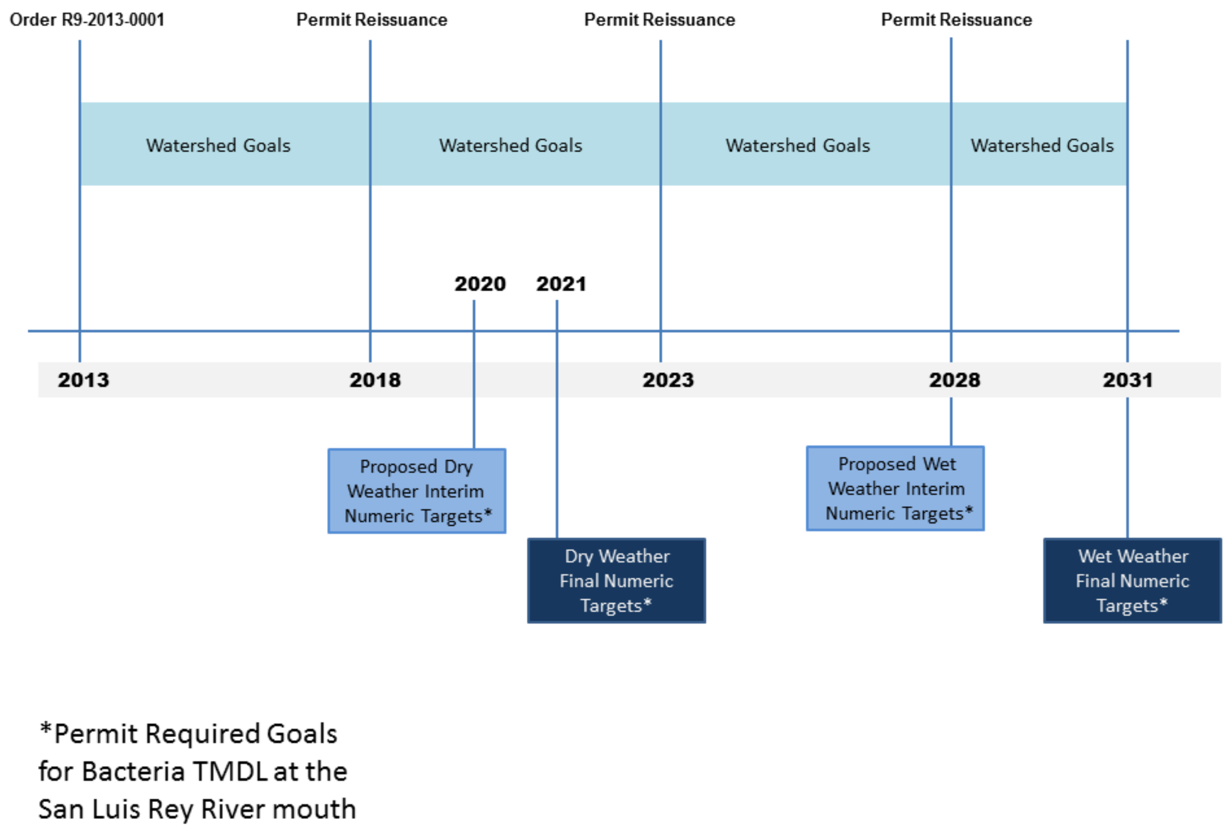

Figure 3-2. Timelines and Relationships between Bacteria TMDL Numeric Targets

3.1.1 TMDL Compliance Pathways for Required Interim Goals

Since each TMDL compliance pathway provides an independent option to demonstrate progress and ultimately compliance with the TMDL, any one of the following compliance pathways may be used for assessment purposes. That is, all pathways do not have to be assessed, but are options. The compliance pathways to achieve interim required goals, summarized from Attachment E of the Permit, are presented in **Table 3-2.**

Table 3-2. Pathways to Achieve Required Interim TMDL Goals

Pathway	Title	Interim Target	Metric	Values to be met		
				Indicator	Dry	Wet
1 OR	Meet bacteria allowable exceedance frequency of receiving water objectives	No exceedances of the interim receiving water limitations;	Exceedance frequencies as measured in receiving waters.	Total Coliform[a]	4.7% AEF[c]	45% AEF
				Fecal Coliform	12.6% AEF	44% AEF
				Enterococcus	16% AEF	47% AEF
2 OR	No discharge from stormwater drain outfalls	No direct or indirect discharge from the Participating Agencies' storm drain outfalls to the receiving water;	Assessment of presence/ absence of flow and connectivity with receiving water.	No discharge from storm drain outfalls to receiving waters.		
3 OR	Reduce loads at storm drain outfalls	The pollutant load reductions for discharges from the Participating Agencies' storm drain outfalls are greater than the required load reduction;	Pollutant load reductions.	Total Coliform	19.07% reduction	2.81% reduction
				Fecal Coliform	19.55% reduction	1.56% reduction
				Enterococcus	43.69% reduction	5.85% reduction
4	Implement Water Quality Improvement Plan and use adaptive management	The Participating Agencies develop and implement an accepted Water Quality Improvement Plan.[b]	Implementation of jurisdictional strategies	Implementation of jurisdictional strategies as developed in accepted Plan and designed to meet interim goals 1, 2 and/or 3.		

a. Receiving water limitations for total coliform only apply to beaches.

b. The accepted Plan must provide reasonable assurance that the interim TMDL compliance requirements in Attachment E of the Permit will be met via implementation, must be accepted by the Regional Board, and must be fully implemented by the Participating Agencies.

c. AEF - allowable exceedance frequency is the percent of samples that can exceed the single sample maximum of geometric mean and still be in compliance; the AEF is calculated based on bacteria concentration measurements from a reference beach.

3.1.2 *Compliance Pathways for Required Final Goals*

Similar to the interim TMDL goals, the final TMDL goals include multiple pathways to demonstrate compliance. The final goal pathways, summarized from Attachment E of the Permit, are presented in **Table 3-3.**

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Table 3-3. Pathways to Achieve Required Final TMDL Goals

Compliance Pathway	Final Target	Final Metric	Measurement					
			Indicator	Dry Weather			Wet Weather	
1 OR	No exceedances of the final allowable exceedance frequency in the receiving water;	Bacteria concentrations (MPN or CFU/100 ml) and exceedance frequencies in receiving waters;		SSM[a]	GM[b]	AEF[c]	SSM	AEF
			Total Coliform	10,000	1,000	0%	10,000	22%
			Fecal Coliform	400	200	0%	400	22%
			Enterococcus	104	35	0%	104	22%
2 OR	No direct or indirect discharge from the Participating Agencies' storm drain outfalls to the receiving water;	Assessment of presence/absence of flow and connectivity with receiving water;	Flow observations or measurements.					
3 OR	There are no exceedances of the final allowable exceedance frequencies at the Participating Agencies' storm drain outfalls;	Bacteria concentrations (MPN or CFU/100 ml) and exceedance frequencies in discharges;		Dry			Wet	
				SSM	GM	AEF[d]	SSM	AEF[e]
			Total Coliform[f]	10,000	1,000	0%	10,000	22%
			Fecal Coliform	400	200	0%	400	22%
			Enterococcus	104[g] 61[h]	35	0%	104[g] 61[h]	22%
4 OR	The pollutant load reductions for discharges from the Participating Agencies' storm drain outfalls are greater than or equal to the final required load reductions;	Load reductions in discharges are greater than or equal to required load reductions. The calculation requires an understanding of the baseline load[i], which can be used to estimate a target load reduction[j];		Percent Reduction (Dry)			Percent Reduction (Wet)	
			Total Coliform	38.13%			5.62%	
			Fecal Coliform	39.09%			3.12%	
			Enterococcus	87.38%			11.69%	
5 OR	Exceedances of the final allowable exceedance frequencies in the receiving water are due to loads from natural sources and pollutant loads from the Participating Agencies' storm drain outfalls are not causing or contributing to the exceedances;	Microbial source tracking results as measured in the receiving water downstream of storm drain outfalls;	Microbial source tracking results show anthropogenic markers are below the limits of reporting for most receiving water samples at the time of the bacteria exceedance(s).					
6	The Participating Agencies develop and implement an accepted Water Quality Improvement Plan that includes a watershed model or other watershed analytical tool(s).	Implementation of jurisdictional strategies designed to meet goals. Use an adaptive management approach to improve implementation of jurisdictional strategies to reach goals.	Implementation of jurisdictional strategies as outlined in the Water Quality Improvement Plan, and of the required monitoring and assessment program.					

a. SSM = single sample maximum or the highest allowable concentration of bacteria contained in one discreet sample.
b. GM = geometric mean calculated based on multiple samples over a given time frame as defined by the Ocean Plan.
c. AEF = allowable exceedance frequency is the percent of samples that can exceed the single sample maximum of geometric mean and still be in compliance; the AEF is calculated based on the presence of bacteria loading from natural sources.
d. For dry weather days, the dry weather bacteria densities must be consistent with the single sample maximum REC-1 water quality objectives in the Ocean Plan for discharges to beaches and the Basin Plan for discharges to creeks and creek mouths.
e. The 22% single sample maximum allowable exceedance frequency only applies to wet weather days.
f. Total coliform effluent limitations only apply to storm drain outfalls that discharge to the Pacific Ocean Shorelines and creek mouths listed in Table 6.0 of Attachment E of Order R9-2013-0001.
g. This enterococcus effluent limitation applies to storm drain discharges to segments of areas of the Pacific Ocean Shoreline listed in Table 6.0 of Attachment E of Order R9-2013-0001.
h. This enterococcus effluent limitation applies to storm drain discharges to segments of areas of creeks or creek mouths listed in Table 6.0 of Attachment E of Order R9-2013-0001.
i. The baseline loads for the lower watershed were determined through modeling and are presented in Appendix 3C.
j. The baseline fecal coliform load (1993 water year) equals 6,186 x 10^{12} MPN resulting in a target load reduction of 723 x 10^{12} MPN for wet weather.

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3.1.3 WATERSHED MANAGEMENT AREA GOALS

The Participating Agencies have developed watershed goals that address TMDL compliance at the mouth of the San Luis Rey River and those that address bacteria along the lower San Luis Rey River as show in **Table 3-4** through **Table 3-7**. These goals will meet the overall purpose of the Permit: to protect the physical, chemical, and biological integrity of waterbodies. Watershed level goals will address compliance at the San Luis Rey River mouth. Goals applicable at mouth of San Luis Rey River are based on compliance pathways as illustrated in **Table 3-2** and **Table 3-3.** Goals along the lower San Luis Rey River are based on improvements in water quality at storm drain outfalls.

3.1.3.1 Bacteria TMDL Goals

Based on the interim and final TMDL compliance pathways detailed in **Table 3-2** and **Table 3-3**, respectively, the Participating Agencies have developed watershed level goals for dry and wet weather at the mouth of San Luis Rey River as shown in **Table 3-4** and **Table 3-5**. These goals will demonstrate progress toward compliance with the Bacteria TMDL. The options applicable to receiving waters will be assessed at the TMDL compliance point, located off the beach at the mouth of San Luis Rey River. For the load reduction compliance option, load reductions for the dry and wet weather will be measured as % bacteria load reduction from storm drain outfalls. Any combination of the TMDL goals may be used to demonstrate compliance with the Bacteria TMDL.

The water quality improvement plan implementation option involves a programmatic approach that would reduce dry and wet weather bacteria loading from storm drain outfalls through implementation of a suite of non-structural or programmatic source control BMPs. During wet weather, these BMPs would result in a 10% reduction of the bacteria loads from the storm drain system. Dry weather load reductions from programmatic BMPs are expected to be in the range of 8.1 – 37.4%. Program adjustments will be made according to the adaptive management process and may require the incorporation of more effective strategies or changes in program design. As a back up to the programmatic BMPs, based on adaptive management and other applicable triggers being met, and availability of necessary resources (e.g., funding and staff resources), the Participating Agencies may opt to implement structural and/or other optional strategies to achieve additional total load reduction to meet the requirements of the TMDL. The County of San Diego is concerned that a long term funding source to construct and maintain structural BMPs has not been identified. Strategies are further discussed in **Section 3.2**, and detailed tables of the Participating Agencies' programmatic BMPs are included in Appendix 3B.

3.1.3.2 Bacteria Goals for Lower San Luis Rey River

For the lower River, the Participating Agencies will focus on flow elimination at persistently flowing outfalls during dry weather and load reductions in storm drain discharges during wet weather. As with the WQIP implementation option of the TMDL compliance goal, these goals would be achieved through implementation of programmatic source control BMPs that are further discussed in **Section 3.2** and detailed in Appendix 3B.

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Table 3-4. Watershed Management Area Numeric Dry Weather Goal for Bacteria TMDL – San Luis Rey Hydrologic Unit at the San Luis Rey River Mouth

Compliance Pathway	Title	Metric[a]	Baseline	Final Outcome	1st Permit Term 2013 – 2018	2nd Permit Term 2018 – 2023: TMDL Interim Compliance Date April 4, 2020[b]	2nd Permit Term 2018 – 2023: TMDL Final Compliance Date April 4, 2021
1; or	No Discharge from MS4	Discharge from MS4 outfall	To be established during FY 15-16 monitoring	Elimination of flow from MS4 discharges	Flow eliminated from 25% of outfalls or cumulative flow from storm drain outfalls reduced by 25 %	Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50 %	Flow eliminated from 100%[c] of outfalls or cumulative flow from storm drain outfalls reduced by 100 %[c]
2; or	Meet TMDL Limits in Receiving Water	Bacteria concentrations & exceedance percentage in receiving waters	Not applicable	Achievement of WQOs or allowed exceedance percentage for bacteria	None	Bacteria concentrations at the compliance point identified in the Monitoring and Assessment Plan are below the applicable WQO (e.g., 400 mpn/100mL single sample maximum for Fecal Coliform)[i] or TMDL allowed exceedance percentage[d] of 4.7% for Total Coliform; 4% for Fecal Coliform; 16% for *Enterococcus*	Bacteria concentrations at the compliance point identified in the Monitoring and Assessment Plan are below the applicable WQO or TMDL allowed exceedance percentage[e] of 0% for Total Coliform, Fecal Coliform and *Enterococcus*
3; or	MS4 Discharge Meets TMDL Limits	Bacteria concentrations & exceedance percentage in MS4 discharges					
4;	MS4 Discharge Load Reduction	Load reductions in MS4 discharges	10.0 x 10^{12} MPN during Water Year 1993 (based on TMDL modeling)[f]	Reach mandatory reduction of dry weather bacteria loading from MS4 discharges identified in Attachment E	Loads[g] are reduced by 9.5% for Total Coliform; 9.8% for Fecal Coliform; 21.8% for Enterococcus from MS4 outfalls	Loads[h] are reduced by 19.07% for Total Coliform (TC), 19.55% for Fecal Coliform (FC), 43.69% for *Enterococcus (Ent)* from the MS4 outfalls	Loads[i] are reduced by 38.13% for Total Coliform (TC), 39.09% for Fecal Coliform (FC), 87.38% *for Enterococcus (Ent)* from the MS4 outfalls
5; or	Exceedance due to Natural Sources	Exceedances due to natural sources, and MS4 outfall loads not causing or contributing to exceedances	To be established during FY 14-15 monitoring	Elimination of anthropogenic fecal markers from MS4 discharges	Number of MS4 outfalls with human fecal markers detected are reduced by 25%	Number of MS4 outfalls with anthropogenic fecal markers detected are reduced by 50%	Number of MS4 outfalls with anthropogenic fecal markers detected are reduced by 100% and storm drain outfall loads are not causing or contributing to exceedances.
6	Water Quality Improvement Plan (WQIP)	Implement WQIP	Not Applicable	Implementation of the WQIP in accordance with Attachment E of Permit	Implement WQIP supported by a reasonable assurance as accepted by the San Diego Water Board	Submit and fully implement WQIP, accepted by the San Diego Water Board, which provides reasonable assurance that interim TMDL compliance requirements will be achieved by the interim compliance dates	Develop and implement WQIP as follows: (i) incorporate BMPs required under Permit Provision 6.b.(2)(c) in WQIP (ii) Include analysis to demonstrate that implementation of BMPs required by Provision 6.b.(2)(c) achieves compliance with Specific Provisions 6.b.(3)(a), 6.b.(3)(b), 6.b.(3)(c), 6.b.(3)(d), and/or 6.b.(3)(e) (iii) The results analysis must be accepted San Diego Water Boards as part of the WQIP (iv) Responsible Copermittee continue to implement the BMPs in (i), AND (v) Responsible Copermittee continue to perform specific monitoring and assessments from Provision 6.d to demonstrate compliance with Specific Provisions 6.b.(3)(a), 6.b.(3)(b), 6.b.(3)(c), 6.b.(3)(d), 6.b.(3)(e), and/or 6.b.(3)(f)
	a. Eliminate anthropogenic dry weather flows from storm drain outfalls	% reduction of flow or number of outfalls with persistent flows	To be established FY 15-16 using dry weather flow measurements.	Effectively eliminate anthropogenic dry weather flow from storm drain outfalls to receiving water.	Reduce by 20% the aggregate flow or the number of persistently flowing outfalls.	Reduce by 75% the aggregate flow or the number of persistently flowing outfalls.	Eliminate 100% anthropogenic dry weather discharges and accompanying bacteria loads from storm drain outfalls to the receiving water.

a. In accordance with Permit Provisions 6.b.(3)(a)-(e) and 6.c.(3)(a)-(g) of Attachment E to Order R9-2013-0001.
b. Request moving Interim TMDL Compliance Date from April 4, 2017 (per Attachment E, 6.c(1)) to April 4, 2020 to allow adequate time to investigate and mitigate bacteria sources, and monitor progress and adjust implementation through the adaptive management process.
c. Goal of 100% flow elimination in accordance with Provision 6.b.(3)(a).
d. Interim dry weather Allowable Exceedance Percentages were calculated based on half the value of the existing 30-day Geometric Mean of exceedance percentages based on beach sample data from 2004 through 2010: ; Annual Bacteria TMDL Monitoring Report is included in Appendix I of the Transitional Monitoring and Assessment Report for the San Luis Rey River Watershed Management Area (2012-2014). From this report, the San Luis Rey River watershed compliance reduction milestones/existing and interim and final exceedance frequencies are provided in Table 1–2 on page 1 – 8 (specifically, footnote "a" under the table). The interim and existing exceedance frequency calculation methodology is summarized in Section 2.4 on page 2-6 of the document.
e. Final dry weather Allowable Exceedance Percentages are from Tables 6.2a, 6.2b, and 6.2c of Attachment E to Order No.R9-2013-0001.
f. Value derived from table on page A33 of Attachment A to TMDL Resolution No.R9-2010-0001 for the San Luis Rey River watershed; monthly value translated in annual load for watershed by multiplying by 12. Baseline load for County of San Diego was calculated as a proportion of County land area to that of the overall watershed, i.e. approximately 48%Values calculated as half of the interim goals.
g. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 43.69%.
h. Values taken from Table 6.3 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 87.38%.
i. Goal of 100% of exceedances demonstrated to be due to natural sources in accordance with Provision 6.b.(3)(e).

Table 3-5. Watershed Management Area Numeric Wet Weather Goal for Bacteria TMDL – San Luis Rey Hydrologic Unit at San Luis Rey River Mouth

Compliance Pathway	Title	Metric[a]	Baseline	Final Outcome	1st Permit Term 2013 – 2018	2nd Permit Term 2018 – 2023	3rd Permit Term 2023 – 2028 Meet TMDL Interim Compliance Date April 4, 2028[b]	4th Permit Term 2028 – 2033 Meet TMDL Final Compliance Date April 4, 2031
1; or	No Discharge from MS4	Discharge from MS4 outfalls	To be established during FY 15-16 monitoring	Elimination of flow[l] from MS4 discharges	Flow eliminated from 10% of outfalls or cumulative flow from storm drain outfalls reduced by 10%	Flow eliminated from 25% of outfalls or cumulative flow from storm drain outfalls reduced by 25%	Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50%	Flow eliminated from 100%[c] of outfalls or cumulative flow from storm drain outfalls reduced by 100 %[c]
2; or	Meet TMDL Limits in Receiving Water	Bacteria concentrations & exceedance percentage in receiving waters	Not applicable	Achievement of allowed exceedance percentage for bacteria	None	None	Bacteria concentrations are below the applicable WQO (e.g., 400 mpn/100mL single sample maximum for Fecal Coliform)[n] or TMDL allowed exceedance percentage[d] of 45% for Total Coliform; 44% for Fecal Coliform; 47% for *Enterococcus*	Bacteria concentrations are below the applicable WQO or TMDL allowed exceedance percentage[e] of 22% for Total Coliform, Fecal Coliform and *Enterococcus*
3; or	MS4 Discharge Meets TMDL Limits	Bacteria concentrations & exceedance percentage in MS4 discharges						
4; or	MS4 Discharge Load Reduction	Load reductions in MS4 discharges	$3{,}835 \times 10^{12}$ MPN during Water Year 1993 (based on modeling)[f]	Reach mandatory reduction of dry weather bacteria loading from MS4 discharges identified in Attachment E	Loads[g] are reduced by 0.70% for Total Coliform; 0.39% for Fecal Coliform; 1.5% for Enterococcus from MS4 outfalls	Loads[h] are reduced by 1.4% for Total Coliform; 0.78% for Fecal Coliform; 2.9% for Enterococcus from MS4 outfalls	Loads[i] are reduced by 2.81% for Total Coliform; 1.56% for Fecal Coliform; 5.85% for Enterococcus from MS4 outfalls	Loads[j] are reduced by 5.62% for Total Coliform; 3.12% for Fecal Coliform; 11.69% for Enterococcus from MS4 outfalls
5; or	Exceedance due to Natural Sources	Exceedances due to natural sources, and MS4 outfall loads not causing or contributing to exceedances	To be established during FY 14-15 monitoring	Elimination of anthropogenic fecal markers from MS4 discharges	Number of MS4 outfalls with human fecal markers detected are reduced by 10%	Number of MS4 outfalls with human fecal markers detected are reduced by 25%	Number of MS4 outfalls with anthropogenic fecal markers detected are reduced by 50%	Number of MS4 outfalls with anthropogenic fecal markers detected are reduced by 100%[k] and storm drain outfall loads are not causing or contributing to exceedances.

Compliance Pathway	Title	Metric[a]	Baseline	Final Outcome	1st Permit Term 2013 – 2018	2nd Permit Term 2018 – 2023	3rd Permit Term 2023 – 2028 Meet TMDL Interim Compliance Date April 4, 2028[b]	4th Permit Term 2028 – 2033 Meet TMDL Final Compliance Date April 4, 2031
6	Water Quality Improvement Plan (WQIP)[l]	Implement WQIP	Not Applicable	Implementation of the WQIP in accordance with Attachment E of Permit	Implement WQIP supported by a reasonable assurance as accepted by the San Diego Water Board	Implement WQIP supported by a reasonable assurance as accepted by the San Diego Water Board	Submit and fully implement WQIP, accepted by the San Diego Water Board, which provides reasonable assurance that interim TMDL compliance requirements will be achieved by the interim compliance dates	Develop and implement WQIP as follows: (i) incorporate BMPs required under Permit Provision 6.b.(2)(c) in WQIP (ii) Include analysis to demonstrate that implementation of BMPs required by Provision 6.b.(2)(c) achieves compliance with Specific Provisions 6.b.(3)(a), 6.b.(3)(b), 6.b.(3)(c), 6.b.(3)(d), and/or 6.b.(3)(e) (iii) The results analysis must be accepted San Diego Water Boards as part of the WQIP (iv) Responsible Copermittee continue to implement the BMPs in (i), AND (v) Responsible Copermittee continue to perform specific monitoring and assessments from Provision 6.d to demonstrate compliance with Specific Provisions 6.b.(3)(a), 6.b.(3)(b), 6.b.(3)(c), 6.b.(3)(d), 6.b.(3)(e), and/or 6.b.(3)(f)
	a. Focus on programmatic BMPs and use adaptive management to increase effectiveness	% bacterial load reduction	3,835 x 10^{12} MPN during Water Year 1993	Reduce bacteria loads from baseline by at least 10% from storm drain outfalls to meet TMDL required load reductions.	Implement programmatic (non-structural) BMPs to achieve source reduction of bacteria loads from the storm drain outfalls.	Reduce bacteria loads by 2% from the storm drain outfalls through continued implementation of programmatic BMPs and, based on adaptive management, focus and enhance efforts where needed.	Reduce bacteria loads by an additional 4% (total 6%) from the storm drain outfalls by continued implementation of programmatic BMPs.	Reduce bacteria loads by an additional 4% (at least 10% total) from the storm drain outfalls by continued implementation of programmatic BMPs.
	b. Structural BMPs[m] (as needed and as funding is available)	% bacterial load reduction based on quantitative model	3,835 x 10^{12} MPN during Water Year 1993	Reduce baseline bacteria loads by 1.7% from storm drain outfalls to receiving water to meet TMDL required load reductions.	Reduce by 0.3% the baseline bacteria loads from distributed BMPs constructed between 2003 and 2009 during redevelopment.	Reduce bacteria loads by an additional 0.5% (total 0.8%) through participation in the public private partnership program. Begin planning & design for additional long-term structural BMPs.	Reduce bacteria loads by an additional 0.6% (total 1.4%) through additional participation in the public private partnership program and reduction through BMPs required through redevelopment (3.2 %); Continue planning & permitting for long-term structural BMPs.	Reduce bacteria loads by 0.3% (total 1.7%). Construct distributed and regional structural BMPs if necessary to meet goal.

a. In accordance with Permit Provisions 6.b.(3)(a)-(e) and 6.c.(3)(a)-(g) of Attachment E to Order R9-2013-0001.
b. Request moving Interim TMDL Compliance Date from April 4, 2021 (per Attachment E, 6.c(1)) to April 4, 2028 to allow adequate time to investigate and mitigate bacteria sources, and monitor progress and adjust implementation through the adaptive management process.
c. Goal of 100% flow elimination in accordance with Provision 6.b.(3)(a).
d. Interim wet weather Allowable Exceedance Percentages are from Tables 6.5 of Attachment E to Order No.R9-2013-0001.
e. Final wet weather Allowable Exceedance Percentages are from Tables 6.2a, 6.2b, and 6.2c of Attachment E to Order No.R9-2013-0001.
f. Value from modeled baseline load as indicated in Appendix 3C of the WQIP.
g. Values calculated as half of the 2nd Permit Term goals.
h. Values calculated as half of the interim goals
i. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* is the controlling indicator.
j. Values taken from Table 6.3 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* is the controlling indicator.
k. Goal of 100% of exceedances demonstrated to be due to natural sources in accordance with Provision 6.b.(3)(e).
l. To meet the final wet weather target load reduction of 11.69% for Fecal Coliform, the County through quantitative modeling has demonstrated a 10% reduction from programmatic BMPs and a 1.7% reduction from structural BMPs. Progress will be monitored and adjustments through adaptive management will be used to update the plan.
m. The County of San Diego is concerned that a long-term funding source is not identified for constructing and maintaining structural BMPs, if structural BMPs are needed to meet compliance. The implementation of strategies to achieve goals will depend upon approval of funding in future annual budgets.

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Table 3-6. Dry Weather Watershed Goals for Lower San Luis Rey River[a]

Title [b]	Number	Metric	Baseline	1st Permit Term Numeric Goals 2013 – 2018	2nd Permit Term Numeric Goals 2018 – 2023
					Meet TMDL Final Compliance Date of April 4, 2021
Reduce bacteria contributions from persistent dry weather flowing outfalls	1; or	Presence/absence of dry weather flow at persistent flowing outfalls [c]	Establish during transitional monitoring or FY15-16 monitoring and update annually as needed	Effectively eliminate flow from 20% of persistently flowing outfalls	Effectively eliminate anthropogenic flow from 100% of outfalls
	2	Dry weather flow at persistent flowing outfalls [c]	Establish during transitional monitoring or FY15-16 monitoring and update annually as needed	Reduce by 20%, the aggregate flow from persistently flowing outfalls	Reduce by 100%, the aggregate flow from persistently flowing outfalls

a. West of Interstate 15

b. The goals may be adapted as monitoring data is collected and analyzed.

c. Flow is defined as all dry weather flows except groundwater, other exempt, or other permitted non-stormwater flows

Table 3-7. Wet Weather Watershed Goals for Lower San Luis Rey River[a]

Title [b]	Metric	Baseline	1st Permit Term Numeric Goals 2013 – 2018	2nd Permit Term Numeric Goals 2018 – 2023	3rd Permit Term Numeric Goals 2023 - 2028	4th Permit Term Numeric Goals 2028-2033
						Meet TMDL Final Compliance Date of April 4, 2031
Reduce bacteria contributions from outfalls during wet weather	Bacteria load reductions at storm drain outfalls	To be developed through transitional wet weather outfall monitoring program or historical storm drain monitoring[c].	Identify five key drainage areas [d] within the Lower SLR River HA; develop baseline loading estimates at these five outfalls.	Reduce bacteria loads cumulatively or at key outfalls by 1.17%.	Reduce bacteria loads cumulatively or at key outfalls by 5.85%.	Reduce bacteria loads cumulatively or at key outfalls by 11.69%[e].

a. West of Interstate 15

b. The goals may be adapted as monitoring data is collected and analyzed.

c. *Transitional Monitoring and Assessment Program Report for the San Luis Rey River Watershed Management Area (2012 – 2014). Appendix K - Five-Year Assessment of Random and Targeted MS4 Outfall Discharge Data Collected under NPDES Permit Order No. R9-2007-0001 in San Diego County Watersheds.* 2015. Prepared for the County of San Diego City of Oceanside and City of Vista by Weston Solutions Inc. http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=44&Itemid=34

d. Key drainage areas may be identified based on factors such as loading estimates, microbial source tracking data, source identification, size of pipe, proximity to receiving water, or other appropriate methods.

e. This load reduction is consistent with the *MS4 Discharge Load Reduction* TMDL compliance pathway to protect recreational uses at the San Luis Rey River Mouth (#4 in **Table 3-5**).

3.1.4 *Goals for Caltrans*

Caltrans storm water flows are not included in the Permit; however, Caltrans is subject to similar requirements through its own Permit (State Board, 2012b). Caltrans has voluntarily contributed to the Water Quality Improvement Plan effort to provide a consistent and subwatershed-wide approach to meeting applicable TMDL requirements. The baseline strategies are continuously implemented and augmented as resources become available.

Attachment IV to the Caltrans Stormwater Permit outlines a methodology for prioritizing stream segments included in TMDLs to which Caltrans is subject. The Permit establishes BMP implementation requirements, evaluated in terms of compliance units. Caltrans is expected to achieve 1,650 compliance units per year through the implementation of retrofit BMPs, cooperative implementation, and post-construction treatment beyond Permit requirements.

Impaired reaches throughout the state will be prioritized on the basis of several factors, including, but not limited to, percent reduction needed, Caltrans drainage area contributing to the reach, and proximity to receiving waters. Reaches with metals TMDLs will likely be prioritized. This prioritization list is currently under negotiation between Caltrans Head Quarters and the State Board.

Caltrans' jurisdiction areas include roadways, land adjacent to roadways, and facilities. Caltrans' jurisdictional strategies specifically focus on BMP implementation to reduce known pollutants within these areas. Caltrans' strategies vary from those of other Participating Agencies (in both type and name) to best address freeway characterization discharges from its right-of-way. Strategies include programs developed by Caltrans Headquarters for statewide execution and District 11 implementation. Caltrans' implementation of strategies with the watershed is dependent on legislative approval.

For Bacteria TMDLs, Caltrans is expected to eliminate dry weather flows by implementing control measures to ensure effective prohibition (Provision B.2 of the Permit). For wet weather flows, Caltrans is expected to implement control measures or BMPs to prevent discharge of bacteria from the right-of-way; this can be source control and preemptive activities such as street sweeping, cleanup of illegal dumping, and public education on littering. Implementation of these controls is per the TMDL prioritization list currently under development.

3.1.5 *Schedule for Compliance with Interim and Final Watershed Goals*

The proposed schedule below reflects the time necessary to implement the proposed strategies outlined in **Section 3.2** and detailed in Appendix 3B. Since there is an opportunity in 2016 to update the bacteria TMDL based on sound scientific studies, which may modify the current targets, the Participating Agencies propose an alternative schedule for interim TMDL compliance dates. The proposed schedule for achievement of final Bacteria TMDL (and the final jurisdictional goals) is consistent with final compliance schedules contained in the Permit. The proposed schedule for the interim and final goals is provided in **Table 3-8.**

Table 3-8. Proposed Compliance Dates for Goals

Condition	Compliance Date
Interim Dry weather	April 4, 2020 [a]
Final Dry weather	April 4, 2021
Interim Wet weather	April 4, 2028 [a]
Final Wet weather	April 4, 2031

a. The interim schedules presented in the Permit are April 4, 2017 for dry weather and April 4, 2021 for wet weather; as allowed by the Permit, the Participating Agencies propose an alternative schedule for interim TMDL compliance dates.

As stated above, the Participating Agencies propose an alternative schedule for interim TMDL compliance dates. Key considerations to support moving the Dry Weather Bacteria Interim Goal from 2017 to 2020 include:

- Allow time to ramp up efforts and leverage strategies to comply with the 2013 Permit requirement to effectively prohibit discharge of dry weather flows from the storm drain outfalls to waterbodies; and
- Allow time to investigate the sources of discharges to the storm drain system that may include the following activities:
  - Ramp up efforts to address spray from over-irrigation and leverage efforts with the water conservation message from the water districts in response to the current drought conditions; and
  - Prioritize discharges from storm drain outfalls using, for example, visual observation, genetic test results, closed circuit television, or other methods, and characterize the source(s) of persistent dry weather flows.

Key considerations to support moving wet weather interim goal from 2021 to 2028 include:

- Allow time to build on the successes of the nonstructural approaches such as education and outreach to the public to pick up pet waste, increased usage of downspout disconnects and rain barrels, increased use of swales and other bioretention devices to treat rainfall close to the source.
- Allow time for the current processes on potential updates to the Bacteria TMDL from stakeholder studies and a statewide update to the bacteria standards to evolve as these efforts could affect the number and/or sizing of structural controls:
  - The Copermittees have the opportunity to revisit the Bacteria TMDL in 2016 and are in the process of conducting studies to provide the scientific basis for proposed changes to the Bacteria TMDL.
  - The State Board is conducting an effort to update the California bacterial standards for recreational activities to consider the United State Environmental Protection Agency's 2012 Recommended Recreational Guidelines. The scheduled adoption date is 2016.
- Assuming approximately seven years is required for a structural BMP to go from the planning phase through to construction, and if project planning began in 2017, the first

complete structural BMP could be installed by 2024, if needed, to meet interim compliance goals. This exceeds the current interim deadline of 2021. Additional time is required to demonstrate the effectiveness of structural BMPs and to leverage lessons learned to cost effectively plan an implementation schedule for additional structural BMPs. For jurisdictions in multiple watersheds, an interim compliance date of 2028 provides the flexibility in having a staggered phasing plan for different watersheds.

- The County of San Diego is concerned that a long term funding source has not been identified to for the construction and ongoing operation and maintenance of the structural BMPS. An interim compliance date of 2028 allows additional time needed to pursue a long term funding source.

The goals will be achieved through implementation of the strategies summarized in **Section 3.2** and further detailed in Appendix 3B. The strategies are designed to attain the watershed goals for the TMDL ocean compliance point and goals for the lower river (west of I-15). The proposed schedule for meeting interim and final numeric goals are based on the shortest practicable time reasonably required to implement new and expanded programs and to secure funding and staff resources. The County has jurisdiction in eight watersheds and must implement these new and expanded programs in all of them

3.2 Water Quality Improvement Strategies

Once the goals were set, the Participating Agencies developed strategies to meet the goals. Each jurisdiction has developed strategies that will be implemented to work toward the goals. The Participating Agencies have also developed optional watershed strategies that, if needed, would be implemented through coordination amongst the Participating Agencies. The jurisdictional strategies for each participating agency are presented in the tables in Appendix 3B. The strategies are generally broad in nature and include suites of programmatic (a.k.a. non-structural) and structural BMPs that are expected to improve conditions within the watershed. The majority of the strategies selected are multi-benefit in nature, addressing multiple pollutants, beyond bacteria.

Multi-Benefit Approach

Strategies were selected based on the ability to address multiple pollutants in addition to bacteria. In many cases, the proposed strategies mitigate both the HPWQC and several of the identified PWQC pollutants, and have potential to provide habitat, water resources, aesthetic, air quality, downstream stream integrity, and flood/drainage benefits.

3.2.1 Description of Strategies

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

Water quality improvement strategies may be categorized as either non-structural, or structural BMPs (including both distributed and regional green BMPs). Non-structural BMPs can be municipal, programmatic, or regulatory measures, public education and outreach, financial incentives, or other management programs designed to effect behavioral changes. Distributed structural green BMPs typically have fewer implementation constraints and can include features such as rainwater harvesting and Low Impact Development-type solutions. Regional structural BMPs include large-scale bioretention structures and wetland systems. Water quality improvement strategies, including non-structural and structural approaches, are identified in Appendix 3A.

Non-Structural Strategies or BMPs - Management actions or programs designed to address pollutant loading at the source.

Distributed Structural Strategies or BMPs - Treatment or volume mitigation BMPs implemented at the neighborhood, parcel or site scale and designed to detain, retain, filter, remove, or prevent the release of pollutants to receiving waters.

Regional Structural Strategies or BMPs - Treatment or volume mitigation BMPs implemented to treat stormwater from sub-watershed or catchment scale drainage areas.

This Plan prioritizes non-structural BMPs for early implementation, with emphasis on those which most directly address risks to human health. Source control measures will be aggressively implemented early on to address dry weather compliance goals to reduce non-permitted non-stormwater discharges. Dry weather load reductions associated with the dry weather compliance goals are further discussed in Appendix 3F. Wet weather load reductions will be achieved through implementation of both non-structural and structural BMPs.

Green BMPs or green infrastructure are defined as distributed or centralized/regional landscape-based stormwater control measures that utilize natural treatment processes that emphasize infiltration, capture and use, and biofiltration, thereby addressing nearly all pollutants. Green BMPs may provide flood/drainage, habitat, water resources, aesthetic, air quality, and downstream stream integrity benefits. Typical types of Green BMPs include, but are not limited to bioretention and biofilters, rain gardens, infiltration trenches and swales, green streets, pocket parks and wetland systems.

Within this larger framework, criteria for strategy selection included:

- BMP effectiveness, particularly for bacteria reduction, with consideration for the priority water quality conditions;
- Provision of multiple benefits, including but not limited to habitat, recreation, economic, and water resources benefits; and
- The degree to which the strategy is sustainable, implementable, and cost-effective.

3.2.2 Jurisdictional Strategies

The Participating Agencies have identified jurisdictional strategies that will be implemented as part of their Jurisdictional Runoff Management Programs (JRMP) that are designed to effectively prohibit non-storm water discharges to the stormwater conveyance system, reduce pollutants in stormwater, and protect beneficial uses of receiving waters. Achievement of these outcomes will ultimately be measured against the interim and final numeric goals as discussed in **Section 3.1.**

The jurisdictional strategies can be categorized into three types:

- Strategies building on the required JRMP elements in Provision E of the Permit. These include the JRMP requirements as well as modifications and enhancements within existing programs to provide a more focused approach, specifically addressing bacteria;
- Optional jurisdictional strategies that may be implemented to achieve the interim and final goals; and
- Coordinated strategies involving cooperation amongst multiple agencies working towards the common goals within the watershed.

3.2.2.1 Jurisdictional Runoff Management Plan (JRMP) Approach

Under the Permit, four primary jurisdictional programs are required to be included in each participating agency's JRMP. Each program is required to have its own inventory of sources. The four primary programs are:

- Illicit Discharge Detection and Elimination (storm drain outfall inventory) [D.2];
- Development Planning (Priority Development Project, or PDP, and BMP inventory) [E.3];
- Construction Management (Construction site inventory) [E.4]; and
- Existing Development Management (Industrial, Commercial, Municipal, Residential inventories) [E.5].

As discussed in **Section 2.4**, the Participating Agencies identified and prioritized suspected sources that contribute to bacteria loading. The Participating Agencies used that information when developing their jurisdictional programs to focus on these sources. One detail that all of the soruces have in common is that their bacteria contributions could potentially be conveyed by the Paricipating Agencies' stormwater systems. The number of storm drain outfalls in each participating agency's jurisdiction with consistent flow is included in **Table 3-9.** Additionally, commercial, industrial, and construction sites are land uses where many of the priority sources can be found. The numbers of pollutant generating facilities, areas, and activities associated with the construction and existing development inventories for each jurisdiction are presented in **Table 3-10**.

Table 3-9. Number of Copermittee Storm Drain Major Outfalls with Persistent Non-Stormwater Flow

Jurisdiction	Persistent Storm Drain Outfalls
City of Oceanside	3
City of Vista	2
County of San Diego	5

Table 3-10. Pollutant Generating Facilities, Areas, and/or Activities

Land Use	City of Vista	City of Oceanside	County of San Diego
Commercial Sites [a]	9	410 [b]	340
Industrial Sites [a]	1	24	8
Construction Sites	1	0	1,406

a. Each jurisdiction may classify commercial and industrial sites differently. Jurisdictional definitions are included in each JRMP.
b. As of 10/14/14. Due to constant business turnover, existing development inventories are working inventories.

Nonstructural BMPs to be implemented to address bacteria include those required by Provision E of the Permit. Some of these programs are new, required under the most recent Permit, while others are existing programs that have been implemented by the participating agencies for many years. Additional strategies and BMPs have been developed to complement the existing Permit requirements for JRMPs. The Participating Agencies have also included suggestions received by the public at workshops.

The following subsections and tables describe the potential sources of bacteria and the strategies and BMPs that the Participating Agencies will employ through their JRMP to address bacteria and other pollutants and associated sources within the watershed. Each jurisdiction will take specific actions to implement the strategies. These actions, further detailed in Appendix 3B, provide a bridge from the planning level strategies developed in the Plan to each jurisdiction's JRMP. For a full description of the non-structural BMPs, including specific policies and procedures, the reader is referred to the JRMP documents for each jurisdiction.

Caltrans' jurisdiction areas include roadways, land adjacent to roadways, and facilities; Caltrans' jurisdictional strategies specifically focus on BMP implementation to reduce known pollutants within these areas. Caltrans is not a party to the Permit; however, Caltrans is subject to TMDL requirements through its statewide Permit (SWRCB, 2013). Caltrans' strategies vary from those of other Participating Agencies (in both type and name) to best address typical discharges from its jurisdictional areas. Strategies include programs being implemented by both Caltrans Headquarters for statewide execution and District 11 for local implementation; implementation of these strategies within the watershed is dependent on state funding. Caltrans has voluntarily contributed to this planning effort to provide a consistent approach to meeting applicable Draft Sediment TMDL and Bacteria TMDL requirements. The strategies developed will be implemented as resources are available.

For Bacteria TMDLs, Caltrans is expected to eliminate dry weather flows by implementing control measures to ensure effective prohibition (Provision B.2 of the Permit). For wet weather flows, Caltrans is expected to implement control measures/BMPs to prevent discharge of bacteria from its ROW; this can be source control and preemptive activities such as street sweeping, clean-up of illegal dumping and public education on littering. Implementation of these controls is per their TMDL prioritization list. For more information related to the Caltrans stormwater program, the reader should refer to their Stormwater Management Plan (July 2012).

3.2.2.1.1 Illicit Discharge Detection and Elimination

Strategies to address bacteria loading developed by the Participating Agencies related to the Illicit Discharge Detection and Elimination (IDDE) Program are described in **Table 3-11**. While the focus is on bacteria, these strategies address multiple pollutant sources and constituents. For each strategy the table identifies the agencies that will implement associated programs and what sources and pollutants will be addressed. Details on the jurisdictional programs that the agencies will implement to support these watershed strategies, including the schedules for implementation and the frequencies in which these programs will be implemented, are included in Appendix 3B.

Table 3-11. Jurisdictional Strategies Related to the Illicit Discharge Detection and Elimination Program [a]

Illicit Discharge Detection and Elimination Program Strategies	Agency				Pollutant Sources					Highest Priority Water Quality Condition	Priority Water Quality Conditions				
	City of Oceanside	City of Vista	County of San Diego	Caltrans	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
Engage the public, jurisdictional staff, and other agency staff to proactively identify and report illicit discharges.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Develop and implement approaches to address the impacts of septic systems, and public and private sanitary sewer systems within the watershed.	•	•	•		•	•	•	•	•	•	•				
Implement monitoring programs to provide new information to refine the prioritization of drainage areas.		•	•	•	•	•	•	•	•	•	•	•	•	•	•
Enforce prohibitions related to illicit discharges and connections.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

a. These strategies address the HPWQC and PWQCs as indicated here, however this is not an inclusive list of pollutants that may be addressed by specific strategies implemented as part of the Plan.

3.2.2.1.2 Development Planning

Previous municipal stormwater permits in 2001 and in 2007 designated specific types of new development and redevelopment projects as "priority development projects" or PDPs, requiring specific site design, source control, and structural treatment control BMPs be implemented for qualifying projects. The 2007 Permit also required certain PDPs to implement controls to mitigate increases in peak flow and volumes of stormwater. With the 2013 Permit, these requirements were further intensified with the new requirement for full on-site retention of the 24-hour 85th percentile storm volume. With limited exceptions, new development and redevelopment projects are required to *retain* stormwater and its associated pollutants (including bacteria) on-site, to reduce the impacts on receiving waters during storm events. In most cases, the post-construction BMPs are also designed to intercept and infiltrate dry weather flows, providing significant pollutant reduction, and often full elimination under ambient conditions.

Priority Development Projects (PDPs) are new development and redevelopment projects that create, add, or replace large areas of impervious surfaces and are subject to stormwater retention and hydromodification requirements, in addition to the source control and treatment control requirements for all projects.

Projects that involve the following are classified as PDPs:

- Residential development: new development creating 10,000 square feet of impervious surfaces or redevelopment creating/replacing 5,000 square feet or more;
- Commercial developments: new development creating 10,000 square feet of impervious surfaces or redevelopment creating/replacing 5,000 square feet or more;
- Parking lots with 5,000 square feet or more of impervious surface; and
- Streets, roads, highways, and freeways with 5,000 square feet or more of impervious surface.

The implementation of baseline Permit requirements for new development and redevelopment projects will mitigate pollutants (including bacteria and other priority water quality conditions) and ensure that these projects do not cause degraded water quality conditions downstream of the project site. Participating Agencies will implement Permit requirements, aligned outreach and training programs, and are considering the potential for an alternative compliance program (further discussed in **Section 3.3**). These elements make up the strategies for the Development Planning element of the programs. The strategies developed to implement the Development Planning Program, focusing on bacteria where applicable, are included in **Table 3-12.** The table includes the strategies to be implemented by the Participating Agencies and the sources and pollutants that will be addressed. Details describing the programs that the agencies will implement to support these watershed strategies, including the schedules for implementation and the frequencies that these programs will be implemented, are included in Appendix 3B.

Table 3-12. Jurisdictional Strategies Related to the Development Planning Program [a]

Development Planning Program Strategies	Agency				Pollutant Sources					Highest Priority Water Quality Condition	Priority Water Quality Conditions				
	City of Oceanside	City of Vista	County of San Diego	Caltrans	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
Provide updated materials and enhanced outreach to convey land development requirements.		•	•		•	•	•	•		•	•	•	•	•	•
Implement a Watershed Management Area Analysis to develop watershed specific requirements for structural BMP implementation and identify a list of candidate projects that could be used as alternative compliance options for Priority Development Projects.	•	•	•		•	•	•	•		•	•	•	•	•	•
Implement a BMP compliance program to ensure proper design and maintenance planning.			•		•	•	•	•		•	•	•	•	•	•
Implement a post construction BMP compliance program to ensure proper construction and maintenance.	•	•	•	•	•	•	•	•		•	•	•	•	•	•
Enforce post construction requirements related to new and redevelopment.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

a. These strategies address the HPWQC and PWQCs as indicated here, however this is not an inclusive list of pollutants that may be addressed by specific strategies implemented as part of the Plan.

3.2.2.1.3 Construction Management

Based on the evaluations performed in the Long Term Effectiveness Assessment (LTEA) (Larry Walker Associates, Mikhail Ogawa Engineering, Weston Solutions, 2011), construction sites are unlikely to be a significant source of bacteria loading. However, there are particular sources and activities on construction sites that have the potential to generate bacteria including vehicle equipment, maintenance, and repair, portable toilets, and waste storage/handling (i.e., trash).

The participating agencies have been implementing construction stormwater programs for several Permit terms. Over this time, agency staff and the construction community have become well trained in construction stormwater management. Additional oversight is required per the State Construction General Permit (Order 2009-0009-DWQ) for sites greater than one acre. With this amount of focus, the limited sources of bacteria related to construction activities are well addressed via the existing Permit requirements. For this reason, the Participating Agencies will focus on the baseline programs for construction sites as required under the 2013 Permit.

Table 3-13 summarizes the various strategies developed to implement the Construction Program, focusing on bacteria where possible. The table includes the strategies to be implemented by the Participating Agencies and the sources and pollutants that will be addressed. Details describing the programs that the agencies will implement to support these watershed strategies, including the schedules for implementation and the frequencies in which these programs will be implemented, are included in Appendix 3B.

Table 3-13. Jurisdictional Strategies Related to the Construction Management Program [a]

Construction Management Program Strategies	Agency				Pollutant Sources					Highest Priority Water Quality Condition	Priority Water Quality Conditions				
	City of Oceanside	City of Vista	County of San Diego	Caltrans	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
Improve data tracking methods for construction inventories and inspections where necessary.	●	●	●						●	●					
Ensure that minimum BMPs are designated and required for construction projects.	●	●	●	●					●	●					
Enforce construction management requirements.	●	●	●						●	●					
Provide outreach and coordination to convey construction requirements.	●	●	●	●					●	●					

a. These strategies address the HPWQC and PWQCs as indicated here, however this is not an inclusive list of pollutants that may be addressed by specific strategies implemented as part of the Plan.

3.2.2.1.4 Existing Development Management

The Existing Development Management Program addresses a variety of sources including commercial/industrial, residential, and municipal areas and activities. Land uses within the watershed are illustrated in **Figure 3-3**. Over 25% of the land uses within the watershed are regulated under the Existing Development Management Program. These include residential, commercial/industrial, recreation, freeways/roads, and parks/open spaces.

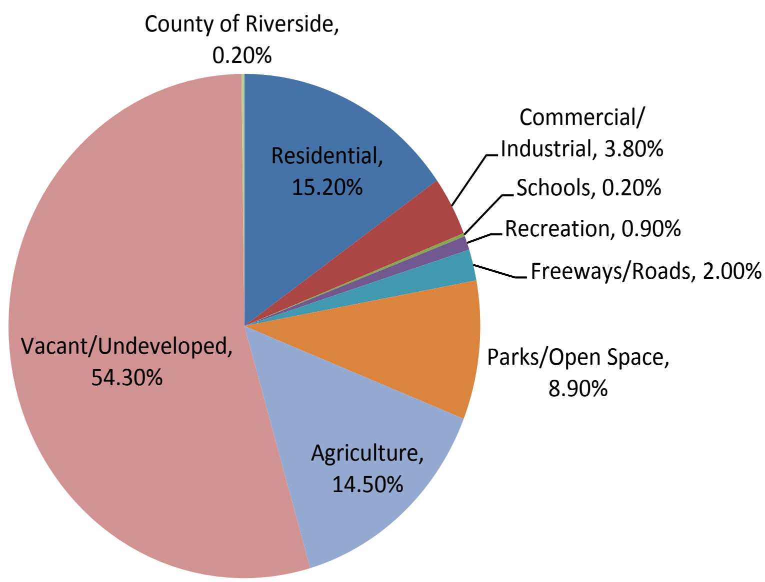

Figure 3-3. Land Use Distribution within the San Luis Rey Watershed

Based on experience implementing the Existing Development Management Program, Participating Agencies have developed strategies to enhance programs to better address bacteria within their jurisdictions. The strategies build on existing programs established in previous Permits.

Table 3-14 summarizes the various strategies to be implemented within the Existing Development Management Program to focus on bacteria. The table includes the strategies to be implemented by the Participating Agencies and the sources and pollutants that will be addressed. Details describing the programs that the agencies will implement to support these watershed strategies, including the schedules for implementation and the frequencies that these programs will be implemented, are included in Appendix 3B.

Table 3-14. Jurisdictional Strategies Related to the Existing Development Management Program [a]

Existing Development Management Program Strategies	Agency				Pollutant Sources					Highest Priority Water Quality Condition	Priority Water Quality Conditions				
	City of Oceanside	City of Vista	County of San Diego	Caltrans	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
Improve data tracking methods for existing development inventories where necessary.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Develop and implement approaches to address the impacts of improper water use and irrigation runoff.	•	•	•		•	•	•			•	•	•	•	•	•
Improve and/or continue existing pet waste programs.	•	•	•			•				•	•				
Improve trash management strategies within the watershed.	•	•	•	•	•	•	•	•	•	•					
Develop and implement approaches to address the impacts of septic systems within the watershed.	•	•	•		•					•	•				
Develop and implement approaches to reduce the impacts of public and private sanitary sewer systems within the watershed.	•	•	•		•	•	•		•	•	•				
Improve and implement existing outreach programs to target key sources of pollutants.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Continue to implement or enhance existing stormwater systems maintenance programs.	•	•	•	•	•	•	•	•		•	•				•
Develop and implement targeted programs to address issues in residential areas.	•	•	•		•					•	•	•			•

Existing Development Management Program Strategies	Agency				Pollutant Sources					Highest Priority Water Quality Condition	Priority Water Quality Conditions				
	City of Oceanside	City of Vista	County of San Diego	Caltrans	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
Improve existing inspections programs to more efficiently target key sources.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Implement existing road maintenance activities.	●	●	●			●				●		●			●
Actively enforce stormwater and urban runoff requirements for existing development.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Develop and implement a strategy to identify and facilitate retrofit opportunities in areas of existing development.	●	●	●	●	●	●	●	●		●	●	●	●	●	●
Improve coordination between agencies.	●	●	●	●	●		●			●	●				

a. These strategies address the HPWQC and PWQCs as indicated here, however this is not an inclusive list of pollutants that may be addressed by specific strategies implemented as part of the Plan.

3.2.2.2 Optional Jurisdictional Strategies

Optional jurisdictional strategies include those that agencies may implement if necessary to achieve interim and final numeric goals. Implementation of the optional strategies will be contingent on circumstances supported by the need for the additional effort, the cost/benefit as compared to other options and strategies, and the availability of funding. Some optional strategies that may be implemented are summarized in **Table 3-15**, and detailed in the individual jurisdictional strategies tables in Appendix 3B.

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Table 3-15. Optional Jurisdictional Strategies[a]

Agency	Optional Strategy	Implementation Timeframe	Triggers	Resources	Pollutant Sources	Pollutant: Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
Provision B.3.b.(1)(b)(i) - BMPs, incentives, or programs that may be implemented that are in addition to requirements of Provision B.3.b.(1)(a)											
City of Oceanside	Implement an ozone water treatment system to treat MS4 discharge water	As resources allow after interim compliance period	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined through adaptive management that implementation is necessary; and (3) pilot program success; and (4) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative funding source • Incentive items	Sources within upstream catchment area (to be determined)	•	•	•	•	•	•
City of Oceanside	Implement Closed Circuit Television Video of Vitrified Clay Pipe Sewer System (in progress)	FYs 15-16 and 16-17	Implementation of this strategy will begin in FY 15-16 for a two year period until 263 miles of VCP are video taped.	• Funding availablity from Water Department • Project approval by City Council	Wastewater	•					•
City of Oceanside	Implement incentive and rebate programs for retrofits of irrigation nozzles, controllers, rain barrels, soil moisture sensors, and turf replacement. Programs implemented in conjunction with San Diego County Authority and Metropolitan Water District of Southern California. (In progress)	FY 2015-16 Continuous, as resources are available	Implementation of this strategy was triggered due to irrigation runoff prohibitions in the MS4 Permit and drought restrictions.	This project is in progress due to • Staff resources available • Partnership Funding provided for incentive items	IC/IDs, stormwater runoff	•	•		•		•
City of Vista	Conduct repairs to targeted sewer and stormwater infrastructure where exfiltration is identified.	Implementation will begin in two to three years from determination that program will be implemented	1) WMA interim wet-weather goal has not been met; 2) Bacteria samples at monitored outfalls exceed water quality objectives; 3) Prohibited dry weather flows have been identified and eliminated; 4) Stormwater and sanitary sewer investigations identify defects with feasible repairs; 5) Funding and resources secured	Repair project would require the following resources: 1) Engineering design plans; 2) Environmental review; 3) Capital Improvement Program funding secured; 4) Resource agency permits; 5) Construction contract bid/award; 6) Project construction	Leaking sewer pipes - exfiltration	•	•	•	•	•	•
City of Vista	Implement stormwater structural Best Management Practice retrofit program. Program to identify and pursue priority areas to construct structural Best Management Practices. Inclusive of flow diversion, infiltration, or bioretention facilities. Pursue private-public partnerships in education and incentives.	Implementation will begin in four to seven years from determination that program will be implemented	1) WMA interim wet-weather goal has not been met; 2) Bacteria samples at monitored outfalls exceed water quality objectives; 3) Prohibited dry weather flows have been identified and eliminated; 4) Identification of soil areas with high infiltration rates; 5) Determined necessary to meet TMDL final goals; 6) Establishing partnerships and property access; 7) Funding and resources secured	Retrofit program would require the following resources: 1) In-field evaluation of suitable sites for infiltration; 2) Feasibiilty and design evaluation; 3) Engineering design plans; 4) Capital Improvement Program funding secured; 5) Land acquisition and/or private-public partnership agreements; 5) Construction contract bid/award; 6) Project construction; 7) Facility maintenance requirements	Diverse pollutant sources in upstream catchment of residential and transportation land uses.	•	•	•	•	•	•
County of San Diego	Implement program to provide rebates or incentives for pumping septic systems, with a focus in high risk areas adjacent to waterways (within 600 feet) or the stormwater system	Implementation will begin 1 - 2 years from determination that program will be implemented	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined through adaptive management that implemention is necessary; and (3) all of the necessary resources have been secured	(1) Partners must be identified and each partner must agree to terms of partnership; and (2) Grant funding must be awarded; and (3) target properties must be identified; and (4) owners of target properties must be willing to participate; and (5) staff resources must be identified and secured	Residential (e.g., leaky failing septic sytems, illegal discharges and connections)	•	•	•			•

Agency	Optional Strategy	Implementation Timeframe	Triggers	Resources	Pollutant Sources	Pollutant					
						Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
Provision B.3.b.(1)(b)(ii) - Incentives or programs that may be implemented to encourage or implement projects to retrofit areas of existing development											
City of Oceanside	Implement an alternative compliance program to enable "offsite" compliance for new and redevelopment projects.	3-6 years Continuous, as needed	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	• Water Quality Equivalency established • Regional Credit System Framework established • Project proponent/developer identifies potential alternative compliance sites • Project proponent/developer obtains permission to use or pruchases property for alternative compliance project • Project proponent/developer secures all needed permitting • Project proponent/developer provides funding for ongoing operation/maintenance in perpetuity	New and redevelopment	•	•	•	•	•	•
City of Oceanside	Construct the following (or equivalent) structural BMPs: • SLR WQIP – O-R-01, wetlands/wet pond (Talone Lake) • SLR WQIP - O-R-02, subsurface flow wetland (Melrose Dr. and Spur Ave) • SLR WQIP - O-R-03, subsurface infiltration basin (Bishop Park) • SLR CLRP - O-R-04, subsurface flow wetland (Capistrano Park) Refer to Appendix E for details on these structural BMPs.	4-7 years once triggered	Implementation of these structural BMPs may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	Each structural BMP project will require the following resources: • Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Engineering design • Permits • Environmental review • Right of way acquisition, if needed • Ongoing funding for operation/maintenance	Residential, Commercial, Industrial, Municipal, Construction (e.g., SSOs, leaky sewer pipes, RVs, leaky failing septic systems, illegal discharges and connections, porta-potties, pets, washwater, outdoor drinking/fast food)	•	•	•		•	•
City of Vista	Implement trash enclosure source control retrofit program. Program to incentivize and/or require retrofit of existing trash enclosure areas that exhibit structural inadequacies (e.g., uncovered, run-on, flow management)	Implementation will begin in one to two years from the determination that the program will be undertaken	1) WMA interim wet-weather goal has not been met; 2) Bacteria samples at monitored outfalls exceed water quality objectives; 3) Prohibited dry weather flows have been identified and eliminated; 4) Existing development inspections identify retrofit opportunities; 5) Determined necessary to meet TMDL final goals; 6) Consistent with city-wide implementation inclusive of Carlsbad WMA; 7) funding and resources secured	Retrofit program would require the following resources: 1) In-field evaluation of ability to retrofit existing enclosures; 2) Feasibilty and design evaluation; 3) Municipal ordinance and policy development; 4) Program funding identified and secured; 5) City Council support and approval; 6) Program implementation	Industrial/ Commercial	•	•	•	•	•	

Agency	Optional Strategy	Implementation Timeframe	Triggers	Resources	Pollutant Sources	Pollutant					
						Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
County of San Diego	Implement an alternative compliance program to enable "offsite" compliance for new and redevelopment projects.	Once triggered, 3-6 years per project	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Engineering design • Permits • Environmental review • Right of way acquisition, if needed • Ongoing funding for operation/maintenance	New and redevelopment	•	•	•	•	•	•
County of San Diego	Implement a Green Streets Retrofits program	Implementation of each green street project would begin 4 - 7 years from the determination that it will be constructed	Implementation of this strategy may be triggered on a project-by-project basis if (1) a specified interim goal has not been met; and (2) it has been determined through adaptive management that implemention is necessary; and (3) engineering design plans have been completed; and (4) environmental review has been completed; and (5) if applicable - resource agency permits have been obtained; and (6) a contract for construction has been secured; and (7) funding has been identified and secured; and (8) staff resources have been identified and secured	Each green street retrofit project would cost an average of $5,500,000 per linear mile of retrofit for construction (only; cost does not include engineering or landscaping design, environmental review, permit fees, ROW acquisition, the cost of going out to bid for a new contract, or the ongoing cost of operation and maintenance)	Municipal	•	•	•		•	•

Agency	Optional Strategy	Implementation Timeframe	Triggers	Resources	Pollutant Sources	Pollutant: Bacteria	Pollutant: Nutrients	Pollutant: Total Dissolved Solids	Pollutant: Index of Biotic Integrity	Pollutant: Chloride	Pollutant: Toxicity
County of San Diego	Construct the following (or equivalent) structural BMPs: • SLR WQIP - SDCo-R-01a, infiltration basin • SLR WQIP - SDCo-R-02, subsurface flow wetland • SLR WQIP - SDCo-R-03, subsurface flow wetland • SLR WQIP - SDCo-R-04, subsurface flow wetland Refer to Appendix E for details on these structural BMPs.	Implementation of each structural BMP project would begin 4 - 7 years from the determination that it will be constructed	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined through adaptive management that implemention is necessary; and (3) all of the necessary resources have been secured.	Each structural BMP project will require the following resources: (1) engineering design plans; and (2) environmental review; and (3) if applicable - resource agency permits; and (4) identification of a contractor to construct; and (5) if applicable - approval by the County Board of Supervisors; and (6) funding must be identified and secured, including ongoing funding for maintenance; and (7) staff resources must be identified and secured	Residential, Commercial, Industrial, Municipal, Construction (e.g., SSOs, leaky sewer pipes, RVs, leaky failing septic systems, illegal discharges and connections, porta-potties, pets, washwater, outdoor drinking/fast food)	•	•	•	•	•	•
Provision B.3.b.(1)(b)(iii) - Incentives or programs that may be implemented to encourage or implement projects that will rehabilitate the conditions of channels or habitats											
City of Oceanside	Habitat Restoration and Rehabilitation projects	3-6 years Continuous, as needed	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured. One project is in progress, the Wildlands Restoration Mitigation Bank Project along the main stem of the San Luis Rey River. http://www.wildlandsinc.com/san-luis-rey-mitigation-bank-progressing/	• Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Engineering design • Permits • Environmental review • Righ of way acquisition, if needed • Ongoing funding for operation/maintenance	Municipal	•	•	•	•	•	

Agency	Optional Strategy	Implementation Timeframe	Triggers	Resources	Pollutant Sources	Pollutant					
						Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
County of San Diego	Habitat restoration and rehabilitation projects on County Park lands	Implementation of each project would begin 2-5 years from the determination that it will be conducted	(1) an interim goal has not been met; and (2) it has been determined through adaptive management that implementation is necessary; and (3) Development of a RMP that would identify the need to restore/rehabilitate habitat; and (4) Identification of or obtaining a Funding Source (Grants, General Fund etc.); and (5) Board Approval; and (6) all of the necessary resources have been secured	Each restoration project will require the following resources: (1) engineering design plans; and (2) environmental review; and (3) if applicable - resource agency permits; and (4) identification of a contractor; and (5) 1 FTE person year to develop RMP, or (6) Funding totaling (can be expressed as average per project, ballpark or range).	Municipal (e.g., homeless encampments, rodents)	•	•	•	•	•	
County of San Diego	Flood Control Channel Rehabilitation Projects (e.g., removal of impervious lining in flood control channel and replacement with earthen or vegetated surface)	Implementation of each project would begin 4 - 7 years from the determination that it will be conducted	(1) an interim goal has not been met; and (2) it has been determined through adaptive management that implementation is necessary; and (3) Preparation of an RMP and/or identification of an appropriate location; and (4) Grant or other funding has been identified and secured; and (5) staff resources have been identified and secured; and (6) Board Approval; and (7) all of the necessary resources have been secured	Each restoration project will require the following resources: (1) engineering design plans; and (2) environmental review; and (3) if applicable - resource agency permits; and (4) identification of a contractor; and (5) 1 FTE person year to develop RMP, or (6) Funding totaling (can be expressed as average per project, ballpark or range).	All	•	•	•	•	•	

a. County of San Diego examples, a complete list of optional jurisdictional strategies for the County is included in Appendix 3B.

The decision to implement one or more optional strategies will be determined though the adaptive management process. As part of the adaptive management process, progress towards interim and final goals will be assessed annually, and once every five years, as part of the Report of Waste Discharge; the Report of Waste Discharge assessment process will consider:

- progress towards interim and final goals,
- implementation status of the strategies and BMPs,
- the appropriateness of the numeric goal(s), and
- the proximity (i.e., timeframe) of the final goal(s).

The Report of Waste Discharge assessment will aid the adaptive management process. Where the assessments indicate that the goals are appropriate and significant progress has not been achieved by the strategies and BMPs implemented, the Participating Agencies will update the watershed analysis with the most recent information available to determine whether the final goal can be met through continued implementation of the Plan as it is. If the results are affirmative, the Participating Agencies will continue implementation as planned. Where significant progress has not been achieved, the final goal has been determined appropriate, and is within the near term (e.g., 5-10 years), the Participating Agencies will move forward to implement select optional strategies based on available funding as necessary to meet the goal. The flexibility of the adaptive management process will allow each jurisdiction to adjust implementation to maximize their ability to achieve the goals.

3.2.2.3 Optional Watershed Management Area Strategies

The Participating Agencies have identified multiple coordinated efforts to be implemented within the watershed. Several of these are included in the jurisdictional programs supporting the watershed strategies, while others are included as optional strategies. These coordinated efforts are summarized in **Table 3-16**.

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Table 3-16. Optional Watershed Management Area Strategies

Agencies	Optional Watershed Strategy	Implementation Timeframe	Triggers	Resources	Pollutant Sources	Pollutants					
						Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
County of San Diego, City of Oceanside and City of Vista	Construct the following (or equivalent) structural BMPs: • SLR WQIP - MJ-R-01, subsurface flow wetland • SLR WQIP - MJ-R-02, subsurface flow wetland (Refer to Appendix E)	Once triggered, 4-7 years per project; ongoing operations and maintenance thereafter	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the PAs through adaptive management that implemention is necessary; and (3) all of the resources have been identified and secured	Each structural BMP project will require the following resources: • Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Engineering design • Permits • Environmental review • Right of way acquisition, if needed • Ongoing funding for operation/maintenance	Residential, Commercial, Industrial, Municipal, Construction (e.g., SSOs, leaky sewer pipes, RVs, leaky failing septic systems, illegal discharges and connections, porta-potties, pets, washwater, outdoor drinking/fast food)	•	•	•	•	•	•
County of San Diego, City of Oceanside	Implement Sustainable Landscapes Program to encourage landscape retrofits.	FY 2016-17; Continuous until grant funding and incentives are depleted. Continue implementation when the funding and incentives items are secured.	Implementation of this strategy may be triggered if (1) it has been determined by the PAs though adaptive management that implementation is necessary; and (2) all of the resources have been secured. Continue implementation when the funding and incentives items are secured.	• Staff resources: • Grant funding • Incentive items • Partnerships	Residential (e.g., over-irrigation)	•	•	•		•	•
County of San Diego, City of Oceanside, City of Vista	Implement an invasive species (i.e., arrundo) removal program in upstream areas, rivers, or tributaries	Once triggered, 1-2 years per project	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the PAs through adaptive management that implementation is necessary; and (3) community support and partnerships established; and (4) it has been determined that invasive plants have been found to have an impact on water quality; and (5) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative funding • Permits • Partnerships • Identification of contractors	Trash and other waste from multiple land uses	•	•	•	•	•	

3.2.2.4 Nonstructural Strategies and Pollutant Reduction by Addressing Priority Sources

Nonstructural strategies reduce pollutant loading to the storm drain system by reducing pollutant generation at the source and/or by reducing mobilization of pollutants to the storm drain system and ultimately to receiving waters, or directly to receiving waters. **Table 2-20** identifies and prioritizes potential bacteria sources in the watershed. Examples of non-structural strategies and BMPs that Participating Agencies are implementing or plan to implement to address the highest priority sources of bacteria in the watershed are described below. The sources and BMPs are broken up into those directly related to human sources of bacteria and those that are not directly human, but are anthropogenic in nature.

Potential Bacteria Sources and Specific Strategies – Human Sources

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) are typically episodic events but can contribute to bacteria loads if they aren't addressed promptly. Although overflows can happen during wet weather, they more typically occur during dry weather. SSOs may occur from private sewer laterals and from the publicly owned sanitary system when blockages occur due to roots, grease, or other debris.

The Participating Agencies implement many programs to address SSOs. Examples include:

- Implementation of internal staff training programs to identify and report SSOs to ensure a prompt response.
- Where sewer departments are within Participating Agencies, coordination with stormwater staff occurs regularly and training programs are in place to encourage wastewater staff to properly respond to SSOs.
- Where sewer collections systems are operated outside of the Participating Agency, coordination with outside sewer agencies facilitates quicker response times, leading to improved containment and cleanup.
- All agencies that own or operate sewer collections systems implement Sanitary Sewer Management Plans (SSMPs) and Spill Response Plans aimed at reducing overflows, responding to those that do occur, containing them, and cleaning up.
- Existing development inspections programs address SSOs through outreach, inspections, and enforcement of ordinances. These programs are often coupled with Fats, Oils, and Grease (FOG) programs required under the SSMPs to address the effects of FOG on the sanitary systems.
- Through asset management and Capital Improvement programs, the Cities of Oceanside and Vista maintain inventories of their sanitary sewer systems and perform preventative maintenance activities that range from closed circuit television inspections and routine cleaning to full condition assessments and cured in place lining or sanitary sewer replacement projects.

Leaky Sewer Pipes

Aging infrastructure can contribute to exfiltration from the sanitary sewer system and can impact water quality in the stormwater system and receiving waters. Exfiltration is typically the result of cracks or joints in the sanitary sewer infrastructure that can allow water to flow outside of the intended conveyance. Where sanitary systems are in proximity to storm drains and or receiving waters, there is potential for cross contamination.

The Participating Agencies implement several programs to prevent water from leaving the sanitary sewer system, detect the influence of water from the sanitary sewer when it does occur, and repair the problems when identified.

- From a preventative standpoint, Participating Agencies maintain inventories of their sanitary sewer systems and perform preventative maintenance activities that range from closed circuit television inspections and routine cleaning to full condition assessments and cured in place lining or sanitary sewer replacement projects.
- Detection of exfiltration and its impact on water quality in the stormwater system is challenging. Many years of dry weather monitoring and source investigations have allowed agencies to detect and eliminate any sewer flows within the storm drain. New monitoring programs focusing on persistent dry weather flows and investigations will continue to identify areas where bacteria concentrations are elevated and trigger source investigations.
- Some agencies have performed GIS analyses to determine where sanitary sewer infrastructure intersects with the stormwater system. Coupled with water quality data, this allows agencies to prioritize areas of the stormwater system and determine if exfiltration is likely a problem, warranting further investigation and remediation.
- Where problems are detected, Participating Agencies that are responsible for the infrastructure proceed with repairs through their Capital Improvement Programs. Where exfiltration is detected and private laterals are a source, the agencies use their authority via ordinance to ensure that repairs on private property are completed.
- Based on field data, the City of Oceanisde prioritizes sewer lines to determine any need for slip-lining. Based on annual CIP budgets and emergency porjects, the City of Oceansides schedules and implement sewer line slip lining projects.

Homeless Encampments

Homeless encampments can be a source of bacteria and trash to receiving waters, but are largely outside the control of the Participating Agencies. However, there are steps that agencies are taking to reduce the effects of homeless encampments on receiving water quality. Examples include:

- When encampments are identified, the Cities of Oceanside and Vista perform periodic sweeps of the areas to remove the inhabitants. This is typically followed by cleanup of trash and debris where necessary. The sweeps are performed in coordination with law enforcement to ensure the safety of public employees.
- The Participating Agencies sponsor periodic trash cleanups along the lower San Luis Rey River which reduce the impacts of trash and associated bacteria on receiving waters. These cleanups depend on volunteers and are coordinated by the Participating Agency or in

collaboration with outside organizations (e.g., I Love a Clean San Diego, Coastkeeper, Surfrider Foundation). The events provide an excellent public outreach venue. The City of Oceanside coordinates annually the San Luis Rey River Cleanup event with fours sites along the river and one site at the SLR River Mouth.

- Coodination with Regional efforts to curb homeless issues in the watersheds.

Recreational Vehicles (RVs)

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

Examples of programs implemented by Participating Agencies that address discharges from RVs include:

- Operation of robust illicit discharge detection and elimination programs that include extensive public outreach and hotlines, staff training, and reporting, response, and clean-up of illegal discharges.
- Coordination and training with police and sheriff's departments so they understand the impacts of these types of discharges and how to respond.
- The City of Oceanside operates a RV dump station at Oceanside Harbor, which provides a facility for RV and boat owners to empty and clean their waste tanks without impacting the environment. The dump station includes educational signage to inform RV and boat owners of the impacts of their actions.
- The County operates a dump station for RV campers at Guajome County Park.

Failing Septic Systems

Malfunctioning septic systems typically contribute bacteria loads to the MS4 and receiving waters when effluent leaves the property. This can occur during dry weather, depending on the topography, or during storm events via runoff. Most septic systems are located on residential properties and permitted through the County of San Diego, but are present in parts of Oceanside and Vista.

Participating agencies have many programs in place to address the effects of failing septic systems. Examples include:

- Operation of robust illicit discharge detection and elimination programs that include extensive public outreach and hotlines, staff training, and reporting of failing septic systems.
- Residential inspections programs to identify properties with failing septic systems, triggering response and follow up.
- Coordination with the County Department of Environmental Health for follow-up remediation and enforcement.

- Coordination with wastewater staff to provide containment where effluent is leaving private property.
- The County has identified an optional strategy to provide rebates or other incentives to assist with the cost and encourage pumping and maintenance of septic systems. The program would be focused in high risk areas (within 600 feet of waterways or MS4). This optional strategy relies on grant funding and would be implemented with watershed partners.
- The City of Oceanside will report any potential failing septic systems to the County of San Diego Department of Environmental Health which is authorized to follow-up on septic system complaints, inspections and installations.

Illegal Discharges & Connections

Many types of illegal discharges contribute to bacteria loading to the MS4 and receiving waters. Illegal connections that convey these discharges are equally problematic. These challenges are typically associated with dry weather, transient in nature, and have been a focal point for the Participating Agencies' stormwater programs for many years. Full scale elimination of illegal discharges is challenging and requires a societal change in the way water is managed.

Understanding the challenges and focusing on key sources that contribute bacteria loads, Participating Agencies operate several programs designed to reduce and eliminate illegal discharges and connections to the MS4. Examples include:

- Training of municipal staff and contracts to identify and report illegal discharges and connections.
- Extensive public outreach programs to educate the public about discharge prohibitions and the effect on the environment and to encourage their use of public hotlines to report illegal discharges and connections.
- Establishment and enforcement of ordinances to probibit illegal discharges and connections to the MS4.
- Inspections of existing development to identify and eliminate illegal discharges and connections, as well as to educate residents and business owners.
- Dry weather monitoring programs designed to focus on unusual flows, investigate their sources, and eliminate the discharge.
- Construction permitting, inspections, and signoff for new and redevelopment.

Trash Cans & Dumpsters

Trash cans and dumpsters have been identified as potential sources of bacteria due to improper management and leakage. These sources can contribute to bacteria loading to the MS4 and receiving waters under dry conditions (e.g., leakage, wash downs) and wet conditions (e.g., open lids, wash off). These sources are typically issues in residential and commercial areas, but can be present in industrial, municipal, and construction land uses as well.

Participating agencies implement several programs that address bacteria loading from trash cans and dumpsters. Examples include:

- Development and enforcement of ordinances that require trash cans and dumpster areas be kept clean and free of debris. Trash can lids and dumpster areas must remain closed.
- Inspections of existing development (e.g., residential, commercial) and construction ensure that trash cans and dumpster areas are clean, free of debris, and that lids are closed.
- Outreach materials focused on trash are used to increase awareness and enforcement actions are taken where appropriate.
- Illicit discharge detection programs also ensure vigilance and reporting of issues related to trash cans and dumpsters by the public and agency staff.

Proper management of trash cans and dumpsters is also critical to curb other sources of bacteria, including birds and rodents. When trash cans, dumpsters, and trash areas are kept clean and lids are closed, the potential for birds and rodents to scatter trash and convey bacteria is reduced. Birds and rodents can also contribute bacteria directly through their waste; reducing their presence around trash areas effectively reduces this wildlife source as well.

In addition, On April 7, 2015, the SWRCB adopted amendments to the California Ocean Plan and the Inland Surface Waters, Enclosed Bays, and Estuaries Plan with the objective of reducing trash from MS4 discharges to the State's receiving waters. These provisions are collectively referred to as the Trash Amendments. It is anticipated that the Trash Amendments will take effect in fall 2015 following approval by the Office of Administrative Law (OAL). The Trash Amendments will ultimately be incorporated into the next Municipal Stormwater Permit. Final compliance must be achieved within 15 years of OAL approval or within 10 years of the first implementing permit, whichever is less.

The Trash Amendments outline two different compliance pathways; Track 1 and Track 2. Under Track 1, a jurisdiction would install a network of full capture devices in the storm drain system to intercept trash generated from high density residential, commercial, industrial, transportation, and mixed use land use areas. This approach ensures that full trash capture (and compliance) is achieved. Track 2 compliance can include a combination of storm drain retrofits and programmatic controls as long as they are collectively at least as effective as the Track 1 approach. Examples of non-structural trash reduction measures include public education, organized trash cleanups, and enhanced street sweeping.

The County has an optional strategy to implement a trash capture program that would first require completion of a baseline study to determine how much trash is transported into the storm drain system from each of its priority land use areas. This quantity of trash is referred to in the Trash Amendments as full capture equivalency and defines the trash reduction target for each land use area.

Landfills

Landfills are potential sources of bacteria, especially related to trash, but can also attract birds and rodents that have the potential to contribute to increased bacteria loads. Landfills are typically well maintained and designed to ensure that they do not degrade water quality. There are several closed disposal sites, operating composting facilities, and a transfer station in the watershed.

Participating agencies manage programs that directly address runoff issues at these facilities, thereby reducing bacteria loading from landfills.

- The primary mechanism is through existing development inspections programs. Depending on the priority of the facility, which is directly tied to its threat to water quality, inspections are performed at different frequencies and requirements are enforced as necessary.
- Each facility has either a Stormwater Pollution Prevention Plan (SWPPP) or a Facility Pollution Prevention Plan, both of which designate the minimum BMPs that must be implemented at the facility to address pollutant loading. Those that maintain and implement a SWPPP are covered under the State's Industrial General Permit.
- Minimum BMPs are also established via JRMPs and agency ordinances to provide inspections staff the legal support the need to ensure proper implementation.

Proper management of landfills is also critical to curb other sources of bacteria including birds and rodents. When maintained properly, the potential for birds and rodents to scatter trash and convey bacteria is reduced. Birds and rodents can also contribute bacteria directly through their waste; reducing their presence around landfills effectively reduces this wildlife source as well.

Porta-potties

Porta-potties can be sources of bacteria, especially if they are leaking or knocked over, causing an illicit discharge. These sources can be present during wet weather as rain can fill secondary containment pans, discharging waste in stormwater runoff. During dry weather, loading can be caused by leaking or knocked over porta-potties, especially where they are located near an MS4.

Porta-potties are typically present on construction sites and at special events. Participating agencies implement programs to ensure proper management of this type of waste. Examples include:

- Ordinances establish minimum BMPs that are required for Porta-potties. Requirements may include secondary containment pans and locations on flat ground away from storm drain inlets.
- Ordinances and JRMPs address requirements for handling Porta-potties associated with special events such as maintenance and spill response plans.
- Inspections staff are trained to ensure that BMPs associated with Porta-potties are implemented on construction sites and at special events.

Potential Bacteria Sources and Specific Strategies – Non-human, Anthropogenic

Birds (gulls, pigeon, etc.) and Rodents (mice, rats and rabbits)

Sea gulls, pigeons, and rodents are attracted to and congregate around trash, especially where it is open to the air and contains discarded food. Proper management of trash cans and dumpsters is critical to curb bacteria associated with these sources. When trash cans, dumpsters, and trash areas are kept clean and lids are closed, the potential for birds and rodents to scatter trash and convey bacteria is reduced. Birds and rodents can also contribute bacteria directly through their waste; reducing their presence around trash areas effectively reduces this type of "urban wildlife" source. These types of sources are typically issues in residential and commercial areas, but can be present in industrial, municipal, and construction land uses as well.

Participating agencies implement several programs that address bacteria loading from trash cans and dumpsters that address rodents as well. Examples include:

- Development and enforcement of ordinances that require trash cans and dumpster areas be kept clean and free of debris so as to avoid the creation of a nuisance or pollution associated with vectors (e.g., rodents). Trash can lids and dumpster areas must remain closed.
- Existing development and construction inspectors are trained to focus on trash cans and dumpster areas and ensure that requirements are met.
- Inspections of existing development (e.g., residential, commercial) and construction ensure that trash cans and dumpster areas are clean, free of debris, and that lids are closed.
- Outreach materials focused on trash are used to increase awareness and enforcement actions are taken where appropriate.
- Illicit discharge detection programs also ensure vigilance and reporting of issues related to trash cans and dumpsters by the public and agency staff.

Pets

Pet waste is a source of wet weather pollution that contains pathogens, such as bacteria, parasites and viruses. When pet waste is left on lawns, beaches, trails and sidewalks, stormwater picks up fragments as it flows to the storm drain system, or directly to a receiving water. In most cases, pet waste is associated with municipal (e.g., parks, trails) and residential land uses. Pet waste programs have been implemented by Participating Agencies for many years. Examples of BMPs implemented as part of these programs include:

- Pet waste management and outreach in municipal parks includes posting signs so that park users know to pick up after their pets and installation of pet waste bag stations at trailheads.
- Agency maintained trails often have pet waste stations for use by the public.
- Residential inspections include review of proper pet waste management to identify areas where pet waste is not disposed of properly. Where necessary, outreach materials are provided to residents.
- Outreach to homeowner's associations includes information related to proper disposal of pet waste.
- The City of Oceanside maintains four pet waste stations located along the San Luis Rey Bike Trail. This provides the public the resources needed to pick up pet waste (pet waste bag dispensers) and a convenient location to dispose of the waste (trash cans at each station.)

Wash water

Washwater can originate from a variety of sources within existing development and typically contains soaps, chemicals, and bacteria that can enter the stormwater system and receiving waters. These types of discharges are episodic or "transient" in nature and most often occur during dry weather. Participating agencies have been implementing programs to address the discharge of wash water for many years and continue to do so aggressively. Examples of practices that address washwater include:

- Training of municipal staff and contractors to identify and report illegal discharges of wash water.
- Extensive public outreach programs to educate the public about discharge prohibitions and the effect on the environment and to encourage their use of public hotlines to report illegal discharges of wash water.
- Establishment and enforcement of ordinances to probibit illegal discharges of wash water to the stormwater system.
- Inspections of existing development to identify and eliminate illegal discharges, as well as to educate residents and business owners.
- Dry weather monitoring programs designed to focus on unusual flows, investigate their sources, and eliminate the discharge.
- Construction permitting, inspections, and signoff for new and redevelopment.
- The City of Oceanside implements a comprehensive inspection program for mobile businesses when a business initially applies for a business license or a renewal of their license. An appointment is scheduled with an Oceanside Clean Water Progrma Inspector and the owner and/or operator that requires them to arrive at the inspection with all of the washing equipment and water capture devices they propose to be used. If the owner/operator can demonstrate their understanding of how to use the equipment and the equipment appears to be satrisfactory to prevent illegal discharge, the Clean Water Program provides this information to the Business Licensing staff person.

Livestock – Domestic Animals, Agricultural

Domestic livestock such as horses can be significant sources of bacteria within the watershed if not managed properly. Rural residential land uses, where lots tend to be larger and spaced apart are typically areas where domestic livestock are more common. The Participating Agencies implement several programs that address domestic animals as sources of bacteria. Examples include:

- The establishment and enforcement of minimum BMPs for existing development where livestock is present. BMPs containment or diversion of runoff via curbs and berms in animal confinement areas, routine maintenance requirements (e.g., clean site twice per week), and manure management requirements (e.g., cover stockpiles, compost waste).
- Outreach materials and programs provide information to owners of livestock explaining required BMPs, reasons for their necessity, and ways to implement BMPs properly.

- Existing development inspections programs ensure that minimum BMPs are in place and that runoff from residential and commercial areas does not impact water quality in the MS4 or receiving waters.

- Where agricultural livestock operations are present, Particpating Agencies work with the Regional Board to identify these operations and ensure that they are enrolled under the proper State permits (e.g., agricultural waiver, general industrial) depending on their operations. If runoff from these sites is impacting MS4s owned/operated by the Particpating Agencies, the Participating Agencies provide advice on BMPs, outreach, and encourage cooperation from these facilities.

Manure Re-use

If not applied properly, manure can be a significant source of bacteria when re-used as fertilizer. The participating agencies address manure re-use through several existing programs, in conjunction with existing development requirements. Examples include:

- Composting areas must be located in a fashion so as to prevent runoff to stormwater conveyance system or receiving waters.

- Existing development insepctions programs provide oversight, outreach, and enforcement where necessary to ensure proper storage and re-use of manure.

- IDDE, monitoring, and source tracking programs are in place to detect discharges and identify sources where manure re-use may be contributing to water quality problems related to bacteria.

Outdoor dining / fast food

Commercial food service establishments perform many pollutant generating activities on-site and can be a significant source of bacteria. These facilities have often been a focal point for inspections programs in the past to ensure that business owners are well educated and adhere to BMP requirements. Participating agencies have been implementing programs to address food service establishments over the past several permit terms and continue to do so. Examples of programs implemented to address bacteria (and other pollutants such as trash) from commercial food establishments include:

- Training of municipal staff and contracts to identify and report illegal discharges and connections associated with commercial food service establishements.
- Extensive public outreach programs to educate the public and business owners about discharge prohibitions and the effect on the environment and to encourage their use of public hotlines to report illegal discharges and connections.
- Establishment and enforcement of ordinances to probibit illegal discharges and connections to the stormwater system and to ensure that required BMPs are implemented at all food service establishments.

- Inspections of food service establishments to identify and eliminate illegal discharges and connections, to educate business owners, and to ensure that required BMPs are implemented.
- Dry weather monitoring programs designed to focus on unusual flows, investigate their sources, and eliminate the discharge.

3.2.2.5 Structural Strategies and Pollutant Reduction

During dry weather, pollutants from typical residential, recreational, civic, commercial and industrial activities (e.g., construction, landscaping, painting, washing, vehicle maintenance) can settle and accumulate on impervious surfaces (e.g., roofs, sidewalks, roads). Then, when it rains, these pollutants are mobilized and carried to the storm drain system and receiving waters. Structural strategies reduce pollutant loading to the storm drain system by reducing pollutants mobilized by stormwater before it enters the system or by reducing the volume of stormwater (and pollutants) delivered to the system. These structural strategies can be located strategically in the watershed to improve water quality by removing pollutants through different chemical, physical and biological processes.

Rain barrels are an example of small-scale structural strategies that collect the first flush of stormwater from rooftops and store it for later use on a pervious surface (e.g., flowerbeds, other planted areas) to keep a portion of accumulated pollutants from entering the storm drain system. Once discharged to the pervious surface, the captured rainwater infiltrates into the ground reducing the delivery of organics, sediment, pesticides, nutrients oil, and other pollutants to the storm drain system and receiving waters. An example strategy to promote rain barrel installations is a Public-Private Partnership program that offers incentives for connecting downspouts to rain barrels (i.e., disconnect downspout from direct discharge to storm drain system and install rain barrel to capture flow from downspout).

Infiltration trenches and basins are larger structural strategies that serve to capture and infiltrate stormwater from an impervious area or areas, from the size of a parking lot to a neighborhood, or an even larger area or region. Infiltration trenches and basins can be rock lined or earthen depressions that are designed to maximize infiltration, earthen varieties are often vegetated. They temporarily hold stormwater runoff to allow water to infiltrate into the underlying soil, evaporate into the atmosphere or be transpired by vegetation; these processes reduce pollutant loading to the storm drain system and receiving waters. These structures are designed to accommodate overflow and bypass during large storm events that exceed the structure’s capacity. An example is a constructed rock lined trench that collects stormwater from an adjacent parking lot to allow the water to infiltrate into subsurface soils instead of draining to a storm drain or receiving water.

3.2.2.6 Minimum BMPs

Within each of the strategies, the Participating Agencies require minimum BMPs to be implemented. Tables of minimum BMPs and the targeted pollutants for existing development for each agency is provided in Appendix 3J.

3.2.3 *Quantification of Dry Weather Strategies*

Dry weather load reductions were calculated using a tiered approach to demonstrate reasonable assurance that the strategies will achieve compliance. First, the quantifiable nonstructural BMP load reductions were estimated, then the gap between these aggressive source control programs and the TMDL required reduction level was filled using dry weather structural solutions when necessary.

The dry weather load reduction quantification approach involves similar steps for the suite of nonstructural BMPs. The first step is to calculate the load generated by the targeted pollutant source that the BMP will address, by using a percentage of the total Responsible Party pollutant baseline load which was taken from source tracking studies (Weston Solutions, 2009). Once the targeted pollutant source load was calculated, the potential load reduction benefit was calculated using the estimated effectiveness of the selected BMP. These values were based on literature when available, and if not, on best professional judgment. In both cases, predicted levels of uncertainty are high. The following sections provide a brief description of the specific quantification approach for each dry weather nonstructural BMP, along with relevant assumptions and assumption explanations.

The dry weather nonstructural BMPs that the Participating Agencies will consider implementing include:

- Identification and control of sewage discharge to Participating Agencies' Storm drain systems,
- Smart controller and turf grass replacement rebates,
- Water waste/conservation ordinances,
- Water conservation outreach and education,
- Residential and commercial site inspections/audits, and
- Other non-stormwater flow reduction strategies as needed.

Additionally, some dry weather structural controls may also be implemented as a backstop to achieve the TMDL required reduction levels. These dry weather structural BMPs may include but are not limited to: low flow diversions to sewers, storm drain and sewer system lining, catch basin dry wells, street gutter permeable pavement, bioretention swales, regional BMPs, etc.

Table 3-17 provides a summary of the dry weather quantification results and corresponding assumptions and references, while Appendix 3F contains a more detailed description of the dry weather load reduction quantification values, results, assumptions, and methods.

Table 3-17. Summary of the Dry Weather Quantification

Quantification Item	Quantitative Result	Assumptions/References
Average Annual storm drain outfall bacteria dry weather load in the watershed	20.4×10^{12} MPN/year	The baseline storm drain load was calculated by the model developed for the TMDL
Required bacteria load reduction	39.1% of the baseline storm drain load	San Diego Permit Attachment E, Table 6.6
Expected load reduction from quantifiable dry weather nonstructural BMPs (Smart controller and turf grass replacement rebates, and Residential and commercial site inspections/audit)	8.1 to 37.4% of the baseline storm drain load	See Appendix 3F for assumptions and references. Additional benefits are expected from dry weather BMPs that were not quantified and these benefits constitute an additional level of conservatism.
Expected load reduction from all dry weather structural BMPs	1.8 to 31% of baseline storm drain load	To ensure that the required bacteria load reduction is achieved, structural BMPs may be implemented to this level.
Average storm drain total load reduction	39.1% of the baseline storm drain load	

As **Table 3-17** demonstrates, the average total load reduction for dry weather is greater than or equal to the TMDL required load reduction and therefore Reasonable Assurance is demonstrated.

3.2.4 *Proposed Wet Weather Structural Strategies*

Potential water quality improvement strategies that may be implemented within the watershed include nonstructural and structural BMPs, retrofits, and stream restoration projects to complement existing and future jurisdictional efforts. Early implementation of non-structural BMPs is prioritized in this Plan. As required in Attachment E of the Permit, the proposed structural BMPs are equivalent to the suite of BMPs proposed in the Comprehensive Load Reduction Plan.

The structural BMP controls are designed to address wet weather flows, and as with other optional strategies, structural BMPs would be implemented as needed, and as funding is available, by the individual entities, organizations, or Participating Agencies. The determination of need will be based on the adaptive management process and using the Report of Waste Discharge assessment process. This Plan does not oblige the Participating Agencies to construct the measures, but identifies those that may be effective in attenuating pollutant loading to meet final numeric goals. The County of San Diego has concerns, as funding sources for implementation (construction and operation and maintenance) of structural BMPs have not been identified.

To identify activities capable of achieving TMDL-required bacteria load reductions, the Participating Agencies used a robust computer model that can simulate hydrologic and pollutant loadings to evaluate various BMP implementation scenarios. For wet weather, the Structural BMP Prioritization and Analysis Tool (SBPAT) was used. SBPAT is a GIS and USEPA Storm Water Management Model (SWMM)-based water quality model that incorporates local water quality data and runoff characteristics, as well as current information on BMP effectiveness from the International BMP database to estimate the bacteria load reductions predicted to achieve compliance under various BMP implementation scenarios. BMPs were identified based on both their cost and potential effectiveness in reducing pollutant loading in the watershed, with the goal of achieving estimated target load reductions for wet and dry weather. Refer to Appendix 3C for a description of SBPAT, and Appendix 3E for details on how the wet weather load reductions were calculated.

To determine high priority potential locations for distributed structural BMPs, the lower watershed – downstream of Lake Henshaw – was divided into catchments with an average size of 200 acres. Each catchment was analyzed using SBPAT to determine its potential pollutant load contribution, and those with the greatest potential were selected to focus distributed BMP efforts.

Using SBPAT, potential locations for regional structural BMPs were determined by identifying catchments located downstream of multiple, hydrologically linked catchments that are predicted to have high pollutant loads. Within the prioritized catchments, potential sites were selected and, based on each site's physical characteristics, appropriate site specific BMPs were identified.

The catchments where implementation of proposed distributed BMPs and the locations of proposed regional BMPs are shown in **Figure 3-4** below. The methodology for selecting catchments for distributed BMPs and for selecting and locating potential regional BMPs is discussed in greater detail in Appendix 3E.

The load reductions that would be expected to occur with placement of distributed and regional structural BMPs the selected catchments was modeled (for water year 1993) as follows:

- total average bacteria load reduction (fecal coliform) would be 1,025 x 10^{12} most probable number[2] (MPN) per year. This reduction equates to 16% of the bacteria load (fecal coliform) from the municipal land uses in watershed.

- total average total nitrogen load reduction would be 156,500 lbs. per year. This reduction equates to 31% of the total nitrogen from the municipal land uses in watershed.

- total average total phosphorus load reduction would be 19,400 lbs. per year. This reduction equates to 21% of the total phosphorus load from the municipal land uses in watershed.

The water quality benefits that are predicted to result from the proposed distributed and regional structural BMPs are summarized in **Table 3-18** and **Table 3-19** below.

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[2] Most Probable Number is a method of getting quantitative data on concentrations of discrete items from incidence data.

Table 3-18. Water Quality Benefits from Proposed Distributed Structural BMPs

Structural BMP Type	Bacteria load reduction – Fecal Coliform (10^{12} MPN/year)	Total Nitrogen load reduction (lbs/year)	Total Phosphorus load reduction (lbs/year)
	Average [Low-High] [a]	Average [Low-High] [a]	Average [Low-High] [a]
Implemented Distributed BMPs	41 [22-47]	1,300 [800-1,500]	170 [110 – 220]
Proposed Distributed BMPs	151 [86-174]	2,700 [1,800 – 3,100]	170 [150-180]

MPN = Most Probable Number

a. Range of water quality benefits represents 25th and 75th percentile results. Range reflects variability in baseline pollutant loading (primarily driven by land use EMC's) as well as variability in BMP effectiveness.

Table 3-19. Water Quality Benefits from Proposed Regional Structural BMPs

Structural BMP Type	Bacteria load reduction – Fecal Coliform (10^{12} MPN/year)	Total Nitrogen load reduction (lbs/year)	Total Phosphorus load reduction (lbs/year)
	Average [Low-High] [a]	Average [Low-High] [a]	Average [Low-High] [a]
Proposed Regional BMPs	834 [641-942]	83,600 [64,200 – 93,800]	7,900 [7,300-8,500]

MPN = Most Probable Number

Range of water quality benefits represents 25th and 75th percentile results. Range reflects variability in baseline pollutant loading (primarily driven by land use EMC's) as well as variability in BMP effectiveness.

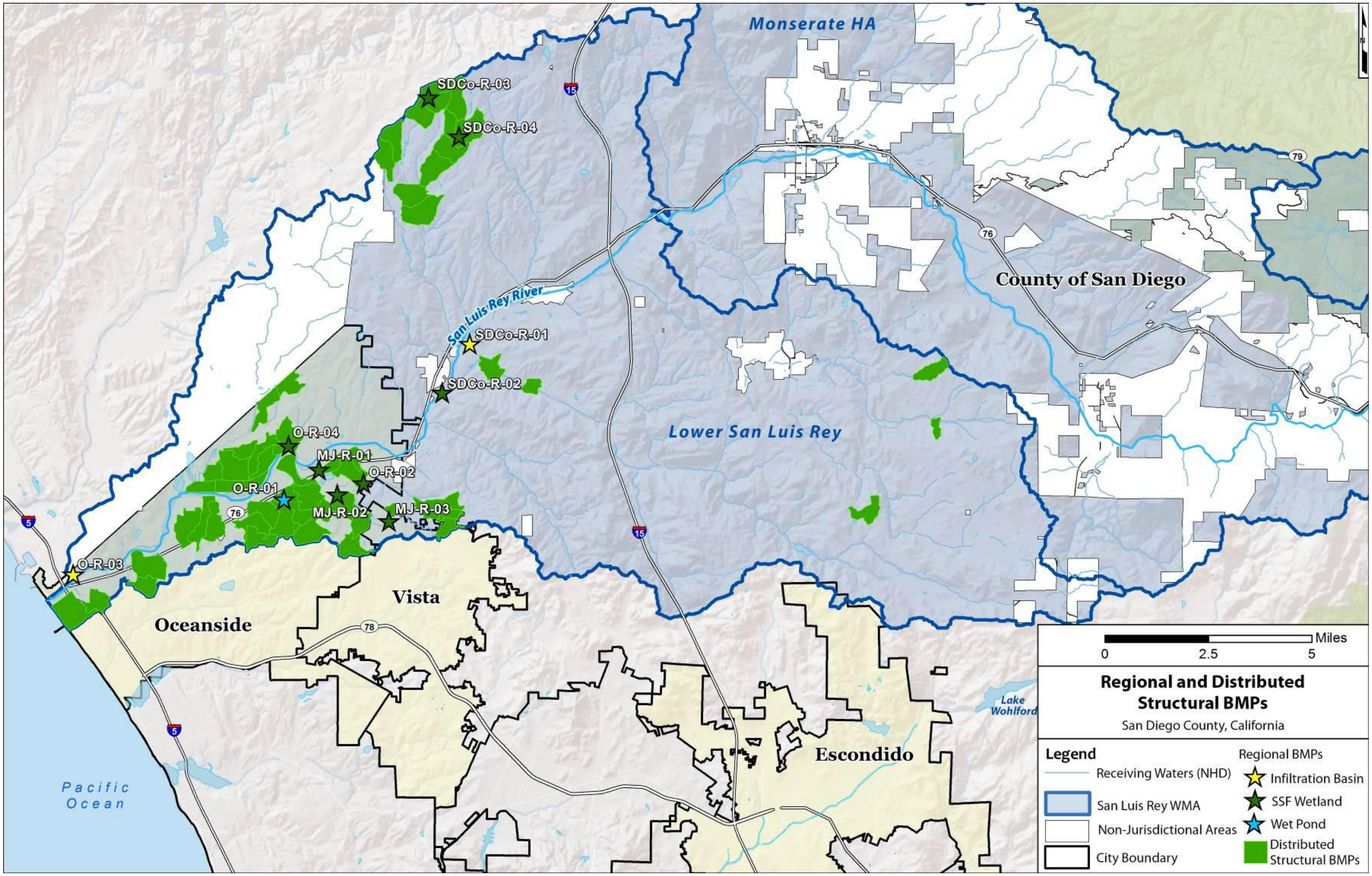

Figure 3-4. Proposed Catchments for Implementation of Distributed Structural BMPs

3.2.5 *BMP BENEFITS QUANTIFICATION METHODOLOGY*

Provision 6.b.(3).(f).(ii) of Attachment E of the Permit references an analysis that utilizes a watershed model or other analytical tools to demonstrate that the implementation of this Plan will achieve the established goals. This analysis, which is required for this compliance demonstration, is referred to herein as the BMP benefits quantification – this section describes the methodology used to conduct the BMP benefits quantification. It presents the results of the analysis, which demonstrate that the proposed jurisdictional strategies and watershed strategies meet the goals of the Plan. Not only does this analysis show compliance with the Permit, and it also gives the Participating Agencies a defensible basis for the number, type, size, location, and phasing of the strategies/BMPs identified; gives the Regional Board confidence in the strategies that the Participating Agencies have proposed; is a flexible tool that can accommodate the Plan's future adaptive management process – i.e., models can be improved with future monitoring data, and the list of strategies/BMPs can be updated accordingly as a result; and if desired, alternative regulatory scenarios can be evaluated using the models – for example, how implementation costs change as a result of a potential TMDL reopener outcome.

In order to assess the ability of the proposed strategies to achieve numeric goals, load reductions expected to result from the implementation of these strategies were estimated for wet and dry weather. The processes by which load reductions were estimated for public-private partnership programs, structural wet weather BMPs, and dry weather non-structural and structural BMPS are described in Appendix 3D, 3E and 3F, respectively.

A distinction must be made between those BMPs with sufficient available data to be modeled (the public-private partnership programs) and those that cannot be modeled due to limited data. The methodology used to quantify the benefits achieved by public-private partnership programs (i.e., LID incentive programs, redevelopment and LID implementation) was as follows:

1) Identify the source(s) addressed by the BMP;
2) Calculate the source(s) area that will be addressed by the BMP;
3) Estimate the effectiveness of the BMP at reducing the load generated by the source(s); and
4) Calculate the BMP pollutant load reduction benefit from the information obtained in Step 2 and Step 3.

A ten percent load reduction is included in the quantification to account for the expected pollutant load reduction from non-modeled, non-structural (aka programmatic) BMPs. Due to limited data quantifying their effectiveness, wet weather bacteria load reductions of proposed programmatic BMPs are not as readily modeled. The inclusion of these non-modeled, non-structural BMPs in the Plan and their assumed 10 percent load reduction could be evaluated and updated throughout the implementation period as pollutant loading and BMP performance data is collected.

3.2.5.1 BMP Water Quality Benefit Estimation

The wet weather bacteria TMDL requires a bacteria load reduction of 11.7 percent (enterococcus, see **Table 3-3**, Compliance Pathway 4) from the baseline load by the final TMDL compliance date, April 4, 2031. The benefits expected to result from implementation of the proposed non-structural and structural BMPs, as detailed in Appendices 3D – 3G, was performed to demonstrate that the load reduction target for the watershed can be achieved through implementation of this Plan. The estimated load reductions and target load reduction are provided in **Table 3-20**.

Table 3-20. Summary of bacteria Wet Weather Load Reductions by BMP type

BMP Category	Bacteria Load Reduction – Fecal Coliform [a]	
	10^{12} MPN/Year Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]
Programmatic Strategies	619 [569-676]	10% [b] [9.2%-11%]
Implemented Distributed	41 [22-47]	0.7% [0.4%-0.8%]
Public Private Partnership Program (P4)	570 [84-1057]	9.2% [1.4%-17%]
Redevelopment through Permit-Required LID Implementation	265 [212-319]	4.3% [3.4%-5.2%]
Potential Distributed	151 [86-174]	2.4% [1.4%-2.8%]
Potential Regional	834 [641-942]	13% [10%-15%]

a. Range of water quality benefits represents 25th and 75th percentile results. Range reflects variability in baseline pollutant loading (primarily driven by land use EMC's) as well as variability in BMP effectiveness.

b. HDR, 2014.

Based on the results of the BMP benefits quantification, a combination of implementation of the programmatic strategies, LID for redevelopment projects and the public-private partnership program, along with the modeled load reduction achieved by the implemented distributed BMPs, will result in a load reduction of 1,495 x 10^{12} MPN/year that is greater than the target load reduction 723 x 10^{12} MPN/year. For this reason, the need to implement distributed and regional structural BMPs is not anticipated. However, if through the adaptive management process, it is determined that the anticipated load reductions from the programmatic strategies, LID for redevelopment and public-private partnerships are not adequate, implementation of the modeled distributed and regional structural BMPs will be considered.

In addition, wet weather load reductions for nutrients are provided in **Table 3-21**.

Table 3-21. Summary of Wet Weather Load Reductions by BMP type

BMP Category	Nutrient Load Reduction [a]			
	Total Nitrogen load reduction (lbs/year) Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]	Total Phosphorus load reduction (lbs/year) Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]
Programmatic Strategies	50,400 [34,800 – 55,900]	10%[b] [7% - 11%]	9,100 [7,900 – 9,800]	10%[b] [9% - 11%]
Implemented Distributed	1,300 [800 – 1,500]	0.2% [0.2% - 0.3%]	170 [110 – 220]	0.2% [0.1% - 0.2%]
Public Private Partnership Program (P4)	10,800 [1,600 – 20,000]	2.1% [0.3% - 4%]	900 [100 – 1,700]	1% [0.1% - 2%]
Redevelopment through Permit-Required LID Implementation	7,700 [6,200 – 9,200]	1.5% [1.2% -1.8%]	1,200 [1,000– 1,400]	1.3% [1.1% -1.5%]
Potential Distributed	2,700 [1,800 – 3,100]	0.5% [0.4% - 0.6%]	170 [150-180]	0.2% [0.2% - 0.2%]
Potential Regional	83,600 [64,200 – 93,800]	17% [13% - 19%]	7,900 [7,300 – 8,500]	9% [8% - 9%]

a. Range of water quality benefits represents 25th and 75th percentile results. Range reflects variability in baseline pollutant loading (primarily driven by land use EMC's) as well as variability in BMP effectiveness.

b. HDR, 2014.

3.2.6 *Link Between Goals and Strategies*

The goals presented in **Section 3.1** were developed to demonstrate progress towards addressing bacteria, the highest priority water quality condition in the lower watershed. To achieve the goals, the Participating Agencies developed non-structural and structural BMP strategies to be implemented in key locations within the watershed over the next 10-20 years. In general, BMPs will be sequenced such that non-structural BMPs are implemented in the short term and where reductions in bacteria are not sufficient enough to achieve the goals, structural and other optional BMPs will be considered where necessary. As shown in **Table 3-17** (dry), and **Table 3-18** and **Table 3-19** (wet), anticipated load reductions for suites of non-structural and structural BMPs were quantified.

The quantification demonstrates the anticipated effectiveness of the selected BMP strategies in meeting the interim and final goals for dry and wet weather. Through modeling performed as part of the analytical process, implementation of this plan is anticipated to achieve the goals for dry and wet weather.

Watershed Dry Weather Goal

The dry weather goal for the watershed is to comply with the Bacteria TMDL dry weather requirements. To achieve this goal, the Participating Agencies will focus on eliminating all non-stormwater discharges from their storm drain outfalls as a first priority. Through residential, and commercial/industrial/municipal inspections, dry weather storm drain outfall monitoring, ICID investigations, and hotline reporting, the Participating Agencies will identify sources of flow and eliminate them where feasible. Where elimination of flow is not feasible (e.g., groundwater flows, permitted discharges), the discharges may be sampled and tested to determine whether the bacteria concentrations comply with the applicable Water Quality Objective and/or meet the load reduction requirements of the Bacteria TMDL. For any outfalls that do not meet at least one of these standards, the Participating Agencies could conduct further investigations to locate and abate the source(s) of the bacteria and/or perform analytical testing to determine whether the bacteria is naturally sourced or anthropogenic. Where bacteria cannot be reduced and/or ruled to not be anthropogenic, through adaptive management and on availability of necessary resources, the Participating Agencies will determine whether any optional jurisdictional or optional watershed strategies should be implemented.

Watershed Wet Weather Goal

The wet weather goal for the watershed is to comply with the Bacteria TMDL wet weather requirements. To achieve this goal, the Participating Agencies will focus on reducing wet weather sources of bacteria loading to the storm drain system through programmatic elements such as requirements for implementation of BMPs that address pollutant generating activities, outreach and education programs, inspections, and enforcement. In a similar manner as to how the dry weather goal would be met, the Participating Agencies would investigate sources and use adaptive management to determine the appropriate means to achieve compliance with the Bacteria TMDL wet weather requirements.

3.2.6.1 County of San Diego Example Strategies

The County of San Diego reviewed various implementation approaches, programmatic policies, opportunities for innovative potential projects, and is researching the viability of green infrastructure as well as potential structural and distributed BMPs throughout the unincorporated areas. Much of the County of San Diego's jurisdiction within the watershed predominantly consists of undeveloped land, open space, and low-density residential areas. The jurisdictional strategies reflect the need to address these types of land uses and associated stormwater issues. As such, the County has outlined strategies to enhance current programs, identify prospective opportunities, and develop innovative approaches to stormwater program management.

Strategies including education and outreach that target irrigation runoff, rebate and incentive opportunities, pilot green infrastructure projects, and multiuse treatment areas will be considered across the County's jurisdictional area.

The following strategies represent several examples selected by the County of San Diego. A complete list of strategies and a description of how each strategy will be implemented is provided in Appendix 3B. The strategies and schedules are subject to change, and are contingent upon programmatic requirements and funding availability. They will be modified through the adaptive management process as needed.

Storm Drain Discharges – Wet Weather Bacteria Reduction through Implementation of Residential Pet Waste Management Program

The County currently implements pet waste management in county parks and will continue to do so. Strategies for pet waste management may include both educational outreach and enforcement to encourage residents and pet owners to clean up after their pets. Examples of outreach includes park signage, waste bag distribution stations, receptacles for pet waste, designated dog parks, strict ordinances to regulate pet waste clean-up, and educational outreach at pet stores, animal shelters, veterinary offices, and other sites frequented by pet owners. Pet waste management practices may also include BMPs relating to horseback riding activities.

Storm Drain Discharges – Wet Weather Bacteria Reduction through Implementation of Public Education and Participation Programs

An important approach to heighten watershed stewardship and mindfulness of water quality is through public education and participation. The County will continue its public education and participation programs. The County develops, improves, and distributes outreach materials; performs outreach presentations in schools; provides outreach to large residential properties and mobile landscaping businesses; performs an over-irrigation outreach pilot study; and provides educational workshops.

The County also plans to implement a Sustainable Landscapes Program. Through an Integrated Regional Water Management Program (IRWMP) grant awarded using state Proposition 84 funds, the County of San Diego in concert with other agency and non-government partners is also developing a Sustainable Landscapes Program (SLP). The SLP consists of an integrated set of landscaping practices, including stormwater capture and use, Low Impact Development and potable water conservation that will help property owners retrofit their high water-use landscaping for more sustainable ones. The program also consists of landscape training through partners, educating property owners on the merits of soil health and management, appropriate plant selection in addition to the water savings and harvesting practices, and rebates and incentives to encourage participation. The benefits of this program are multifaceted; landscape is designed to capture the 'first flush' of storm events, Integrated Pest Management practices are promoted to reduce chemical herbicides, fertilizers and pesticides being used in landscapes, climate-appropriate plant pallets are identified and a monitoring program will ensure that anthropogenic runoff from these retrofit landscapes are eliminated.

Furthermore, the County sponsors numerous trash collection events in targeted areas of the watershed.

Storm Drain Discharges – Wet Weather Bacteria Reduction through Implementation of Structural and Small-Scale BMPs

The County will identify candidate areas of existing development that are appropriate for retrofit projects. The County plans to evaluate the feasibility of a pilot residential incentive program (public-private partnership to encourage installation of small-scale BMPs on private property). The program could encourage rain water use through installation of rain barrels, roof downspouts redirected to landscaped areas, rain gardens & other small scale bioretention/ infiltration BMPs. The County of San Diego will continue to investigate collaborative opportunities for green infrastructure implementation on public parcels and to consider green infrastructure or small scale structural BMPs to capture dry weather flows as needed.

Storm Drain Discharges – Dry Weather Bacteria Reduction through Irrigation Runoff Reduction and Good Landscaping Practices

The County proposes effective methods to reduce irrigation runoff that may include development of educational outreach materials, increased inspections, increased enforcement, tiered water rates, distribution of smart irrigation controllers and/or other financial incentive programs that decrease landscape watering volumes. Irrigation runoff reduction programs can also be integrated with BMPs that encourage landscaping and gardening practices that reduce the load of fertilizers and chemicals that end up in stormwater, such as integrated pest management, reducing fertilizer and pesticide use, xeriscaping and turf conversion. A residential inspections tracking program is scheduled to begin by FY16.

3.2.6.2 City of Oceanside Example Strategies

The City of Oceanside identified administrative policies, incentive programs, urban development management programs, and is investing in research for site locations for green infrastructure and other treatment BMPs throughout its jurisdiction in the watershed. Strategies such as education and outreach that target irrigation runoff, rebate and incentive opportunities, green infrastructure projects, and multiuse treatment areas are considered across the City's jurisdiction.

The following strategies are examples of those selected by the City of Oceanside and planned for implementation. A complete list of strategies planned for implementation and a description of each strategy is provided in Appendix 3B. The strategies and schedules are subject to change and are contingent upon annual budget approvals and funding availability. They will be modified through the adaptive management process as needed.

Public Education and Participation

A key strategy to enhance watershed stewardship and awareness of water quality is through public education and participation in the City of Oceanside. There are plans to distribute watershed-based outreach posters, provide outreach presentations at elementary schools, and host educational workshops.

Incentive and rebate programs for landscape and landscape irrigation retrofits.

The City of Oceanside actively participates and promotes rebate and incentive programs for landscape vegetation conversions and irrigation system retrofits. Households and businesses that take advantage of these incentive and rebate programs, directly benefit water quality because of the goal to prevent water waste which includes prevention of irrigation runoff. Example incentive and rebate programs may include irrigation nozzles, irrigation controllers, rain barrels, soil moisture sensors, and turf replacement with either artificial turf or California friendly plants. These programs are implemented in conjunction with the San Diego County Water Authority and the Metropolitan Water District of Southern California and when funding is available. The City of Oceanside also promotes these programs through the implementation of workshops that assist homeowners and businesses in identifying the best product for their needs, how to install and replace the specific items, and how to apply for the incentive and funding rebates.

Irrigation system evaluations for irrigated crop lands

The City of Oceanside Water Utilities Department contracts with Mission Resource Conservation District to conduct Irrigation System Evaluations for properties with one or more irrigated acres of crop land within the City of Oceanside. The primary purpose of the irrigation evaluation is to assess the performance of the system while it is in operation. The property owner and/or irrigation system operator will be provided with a report that includes: data on the system's flow rate and performance which reflect how evenly water is spread over the planting area; observations and recommendations to improve system performance; information about the soils on the property and their water holding capacity; information on crop water use patterns; and best management practices for fertilization, erosion control and pesticide use. These evaluations are important to assist agricultural growers in preventing irrigation runoff which can be a carrier of fertilizers, pesticides, sediment and bacteria to local surface waters.

Closed Circuit Television (CCTV) of Vitrified Clay Pipe Sewer Lines

The City of Oceanside finalized a contract with a consultant in FY 14-15 to perform both cleaning of all Vitrified Clay Pipe (VCP) sewer lines and to perform a Closed Circuite Televeion (CCTV) project that provides a high definition 360 degree scan of the 263 miles of VCP lines. Work is scheduled to commence in fiscal year 2015-16 and will continue over a two-year period. This will allow the Sewer Division to identify possible exfiltration and infiltration problems and other sewer line infrastructure problems. This will allow the Sewer Division to develop management measures and associated budgets and schedules to repair and address these issues in the future.

Fats, Oil and Grease (FOG) Targeted outreach to targeted residential areas and restaurants - In order to reduce bacteria loading to the San Luis Rey River, reduction and elimination of sanitary sewer overflows (SSOs) will assist in meeting the overall numeric goals for the watershed. The City of Oceanside continues to track where SSOs have occurred and where sewer line inspection and maintenance has identified a build-up of grease in the sewer line. Based on this information, residential targeted areas and restaurants will be identified for focused outreach regarding proper disposal of fats, oils, and grease, and enforcement of grease interceptor maintenance per the City Ordinance. Clean Water Program staff will collaborate with the City sewer division to determine if there is a reduction of SSOs and grease build-up in these targeted areas.

Recreation Vehicle (RV) sewage disposal and Modular Wetland

The City of Oceanside manages the Harbor Beach Campground which is basically a parking lot in the Oceanside Harbor area that allows for overnight and extended stays for recreation vehicles. There are no hookups available for sewage disposable at each of the designated sites. Nearby the RV campground is a sewage disposal station with two wastewater discharge hook-ups for recreational vehicles (RVs). Providing this opportunity for proper sewage disposal from RVs prevents RV owners and operators from illegally disposing of wastewater. Since this discharge location is within the harbor area adjacent to high use recreational waters, the City of Oceanside has installed and maintains a modular wetland system to treat and remove bacteria from wastewater that may not be properly directed into the sewage disposal hookup due to drips and accidental spills. To address bacteria, the Modular Wetland is utilizing a proprietary filter media in lightweight block format that is easy to handle and replace, for primary filtration. The Modular Wetland then uses a sub-surface flow wetland for biological remediation. Because the harbor is a harsh, salt-water environment, the system is using a well-adapted, fast growing plant with large root system bundles.

Existing Industrial and Commercial Inspections – Trash Enclosures

Trash enclosures have been determined to be a likely source of bacteria during both dry weather and wet weather conditions. Rainwater can travel through the enclosure carrying bacteria, food waste and trash to the storm drain system and possibly local surface waters. During inspections of existing industrial and commercial facilities, the trash enclosure and waste disposal areas are inspected for any possible illegal discharges and to determine proper management of waste. Enclosures that accept waste from drinking and eating establishments are highly scrutinized due to the type of waste that can be generated from them, including cooking grease storage containers, food waste and food packaging,

Pilot Project to Evaluate Non-stormwater Discharges

In addition to Permit required monitoring activities, data will be supplemented through additional discharge information collected as part of a neighborhood-specific pilot project beginning in FY 2016-17. The pilot project would involve observations, inspections, enforcement, outreach and storm drain outfall monitoring. Progress toward the goal to reduce or eliminate non-stormwater dry weather persistent flows would be measured through both the Permit required monitoring activities described above and supplementary storm drain discharge monitoring completed as part of the pilot project. Continuous flow measurements and constituent sampling for the priority water quality conditions will allow comparisons with baseline data throughout the term of the project. This will allow the City to determine with statistical validity the effectiveness in reducing non-storm water discharges and associated pollutant loading as a result of the various programmatic BMP mechanisms used.

Additional targeted neighborhoods and drainage areas with persistent non-stormwater flows will be identified during the 2015-2016 monitoring year and prioritized for implementation of observation, inspection, education outreach and enforcements tasks that are deemed successful during the pilot project to reduce the persistent flows and pollutant loading. Any new persistent outfalls will be identified on an annual basis and reported in the WQIP annual report. During the second Permit term the program will be expanded to implement the successful components of the pilot program in these prioritized targeted neighborhoods and drainage areas.

3.2.6.3 City of Vista Example Strategies

Most of the City of Vista's geographic representation is in the Carlsbad Watershed; however, a small percentage of the City's jurisdictional area (six percent) is located in the San Luis Rey Watershed; this area represents 0.2 percent of the San Luis Rey Watershed's total land area. .The majority of Vista's land use in this watershed is rural residential, some open space/parks and recreation, and limited areas of commercial/industrial land uses. The City of Vista will be implementing a wide range of jurisdictional strategies within the San Luis Rey Watershed, as well as cooperatively with Watershed Management Area-designated agencies, in support of achieving bacteria load reduction goals. Many of the strategies are multi-benefit in nature and reduce more than one type of pollutant.

City of Vista jurisdictional strategies include, but are not limited to, a broad range of outreach and education activities, incentives, inspections, enforcement authority actions, and infrastructure maintenance activities. The following narrative provides an overview of key jurisdictional strategies that will be implemented. This discussion is not meant to be inclusive, and additional jurisdictional strategies are identified in Appendix 3B. The jurisdictional strategies and schedules are subject to change through the adaptive management process, which accounts for effectiveness, cost and relative benefit..

Illicit Discharge Detection and Elimination

The City of Vista will continue to implement multiple activities and efforts in support of detecting and eliminating illicit discharges. Illicit Discharge Detection and Elimination (IDDE) is a well-established component of the City's stormwater management program. Through various means of reporting or identifying discharges, sources are investigated and the discharge is eliminated where its source is confirmed. Educating the public on prohibited discharges, as well as awareness of accessibility to the City's Water Quality Hotline (email and phone) facilitates this effort. Contractors and staff from various city divisions further support IDDE efforts while conducting inspections of infrastructure and existing facilities. As described in the City of Vista's Enforcement Response Plan, a wide range of enforcement 'tools' can be implemented to abate illicit discharges and facilitate compliance.

Sanitary Sewer Overflows (SSOs) of both private and public sanitary sewer facilities are a source of bacteria, as well as a wide range of other pollutants that IDDE activities target. Multiple City divisions respond to SSOs. Particularly at private facility SSOs, enforcement actions are taken to ensure sources of the prohibited discharge are eliminated. The City conducts routine Closed Caption Television (CCTV) and cleaning of the public sanitary sewer system to identify maintenance and repair priorities. These maintenance efforts are based on schedules identified in the City's Sewer System Management Plan (SSMP) Sanitary Sewer Mainttenance Plan (SSMP), which reduce the risk of public SSOs that discharge bacteria and other pollutants to the storm drain system and the environment.

The City of Vista has a capital improvement program to rehabilitate and repair the City's sanitary sewer system. In Fiscal Year 2015/16, the City budgeted approximately $66 million dollars to capital expenditures for sanitary sewer system facilities. The City averages four miles per year of pipeline rehabilitation/replacement.

The City of Vista will be implementing storm drain system outfall monitoring and upstream investigations to support dry weather flow reduction goals. Implementing outfall monitoring and upstream investigations consistent with Provision D.2 of the MS4 Permit will facilitate dry-weather flow source identification and elimination. Additionally, the City of Vista will be undertaking a Special Study (Vista Special Study #1), aimed at characterizing persistent flows at three major outfalls within its jurisdiction. One of these three outfalls is in the San Luis Rey Watershed. Vista Special Study #1 is intended to provide a baseline analysis of persistent flow rates and trends, while also collecting samples to evaluate potential bacteria loads to receiving waters. Samples of water chemistry and other pollutant parameters will also be collected. The outcome of this Special Study is anticipated to help direct future IDDE program efforts, and potentially other Special Studies.

Development Planning

The City of Vista is revising development requirements and guidance documents to designate new and redevelopment 'priority development projects.'. Inclusive of project thresholds, requirements, checklists, and support materials, this guidance document will replace existing development requirements (e.g., Standard Urban Stormwater Mitigation Plan or SUSMP) in the City's Stormwater

Management Manual. The City of Vista will continue to implement source control, low-impact development, and on-site structural controls for priority development projects. In addition to these forthcoming development requirements, if future interim goals of this plan are not achieved and triggers are activated, the City of Vista will implement a trash enclosure retrofit program. This program would incentivize and/or require the retrofit of existing trash enclosure areas to ensure bacteria, nutrients, and other stormwater pollutants are minimized (see City of Vista Jurisdictional Optional Strategies **Table 3-15**).

Existing Development

Through Vista Municipal Code (Chapter 13.18, *Stormwater Management and Discharge Control Program*) and by reference to the City of Vista's Stormwater Management Manual, all land uses within the City are required to comply with stormwater minimum BMPs. These minimum BMPs are enforced through compliance response, routine existing development facility inspections, and construction site inspections. The minimum BMPs target a wide range of pollutants and sources, notably sediment (which can convey bacteria), nutrients, and trash. However, some minimum BMPs explicitly target the reduction of bacteria in stormwater discharges, including but not limited to the following examples (see Appendix 3J, City of Vista Stormwater Standards Manual, June 2015):

- Eliminate illicit connections to the storm drain system
- Properly dispose of water used to clean outdoor areas
- Eliminate irrigation runoff
- Regularly inspect and maintain storm drain structures to retain design functionality
- Properly manage pesticides and fertilizers
- Keep waste storage and dumpster areas free of exposed trash, sediment and debris
- Protect waste storage and dumpster areas from contact with stormwater and non-stormwater flows onto the property
- Construction site BMPs: stockpile management, solid waste management, sanitary/septic waste management, liquid waste management

The City of Vista continues to maintain and update their watershed-based inventory of existing development facilities. These inventories will be used to conduct routine inspections, identifying non-compliance with municipal ordinances and minimum BMPs. Inclusive of the inspections will be a new effort to assess residential areas, focusing on over-irrigation and eliminatingdry-weather flows in the storm drain system. These inspections will help identify strategic locations for focused outreach, as well as siting future pet waste collection stations. The City of Vista will be implementing enhanced inspections in select Focus Areas of the Carlsbad Watershed, and results from these inspections are anticipated to also assist with targeted compliance issues in the San Luis Rey Watershed.

As previously discussed, the City of Vista implements a variety of maintenance and repair efforts to minimize SSOs from the public-owned system. However, septic systems are also present within city limits. Early in the implementation of this plan, the city will develop a list of suspected and known septic systems within its jurisdiction. Because malfunctioning septic systems have the potential to discharge bacteria, nutrients, and other pollutants to adjacent water bodies (particularly during wet weather conditions), outreach materials will be developed and distributed to encourage routine maintenance and inspections.

If interim goals of this plan are not achieved and other identified triggers are met, the City of Vista has identified Jurisdictional Optional Strategies to further address bacteria in stormwater discharges, including the following (**Table 3-15**):

- Conduct repairs to targeted sewer and stormwater infrastructure where exfiltration is identified (targeting bacteria loads)
- Implement stormwater structural Best Management Practice retrofit program (targeting bacteria, nutrients, and other pollutants)

To better understand the potential influence of Vista's stormwater discharges to the Lower San Luis Rey River, the City of Vista is proposing a second special study. Vista Special Study #2 will be implemented in Fiscal Year 2016/17to characterize discharges from Vista's existing development and its hydraulic connectivity to the Lower San Luis Rey River. Anecdotal evidence suggests Guajome Lake and adjacent wetlands have varied effects on these discharges during dry and wet weather conditions. The study will help characterize Vista's existing development discharges within the context of both the Lower San Luis Rey River and the entire San Luis Rey Watershed.

Public Education and Participation

In addition to investigation and complaint response, the elimination of dry-weather flows will require extensive outreach to residential and commercial land uses. Existing facility inspections, particularly with the new residential program, will assist in targeting areas where education and outreach can be most efficient and effective. The City of Vista currently coordinates over-irrigation complaint response with the local water purveyor, Vista Irrigation DistrictRather than reacting to observed or reported complaints, it is anticipated that future cooperative effortswill help prevent over-irrigation. The City of Vista and Vista Irrigation District identify opportunities to coordinate outreach and education on topics such as water-wise landscaping, turf replacement incentives, smart irrigation, and similar outdoor water use reduction programs.

The City of Vista will continue to sponsor/host public outreach events to promote acceptable and desirable behaviors related to stormwater pollution. Examples of such outreach events include the following:

- Hosting a site for I Love A Clean San Diego's bi-annual clean up days. These events expose nearly 100 residents to Vista's local waterbodies, brings awareness to challenges of homelessness and illegal dumping in the community, and facilitates direct interactions between city staff and residents.
- Hosting booths at events such as Vista's Strawberry Festival, The Rod Run (car show), or Summer Funfest (community park event). Staff at the booth provide outreach materials, distribute swag imprinted with the Water Quality Hotline number, and present the EnviroScape model to educate children about stormwater pollution.

3.2.6.4 Caltrans Example Strategies

Caltrans plans to continue implementation of BMP activities for proposed projects within the watershed. Caltrans also identified the implementation of drought tolerant landscaping and conversion to smart irrigation controllers within the watershed as a focus. Their strategies include utilization of municipal personnel and contractors to identify and report illicit discharges and connections. They will implement practices and procedures to address spills that have the potential to enter the stormwater conveyance system. Additionally, Caltrans will coordinate with upstream entities to prevent illicit discharges from upstream sources from entering the stormwater system. Strategies implemented by both Caltrans Headquarters for statewide execution and District 11 for local implementation.

3.2.7 Schedules for Implementing Strategies

The following sections detail the proposed schedules for phasing in the strategies discussed above. As noted earlier, the overall strategy is to pursue aggressive non-structural BMPs as the primary method for achieving wet weather load reduction goals and the sole method for achieving dry weather load reduction goals. The benefits calculations summarized in **Section 3.2.5** support the viability of this strategy.

However, there is uncertainty inherent in some of the parameters used to estimate these load reduction benefits. Therefore, structural control options have been selected to be used as a backstop for achieving load reduction goals if necessary. These will be implemented as necessary based on the adaptive management model upon which this Plan is based. **Figure 3-5** illustrates this concept for the wet weather condition of pursuing programmatic BMP implementation to the extent that they achieve the target load reduction, and then implementing structural BMPs if necessary. **Figure 3-6** and **Figure 3-7** illustrate the anticipated nutrient load reductions at each interim goal for the strategies selected to meet the goals established for bacteria.

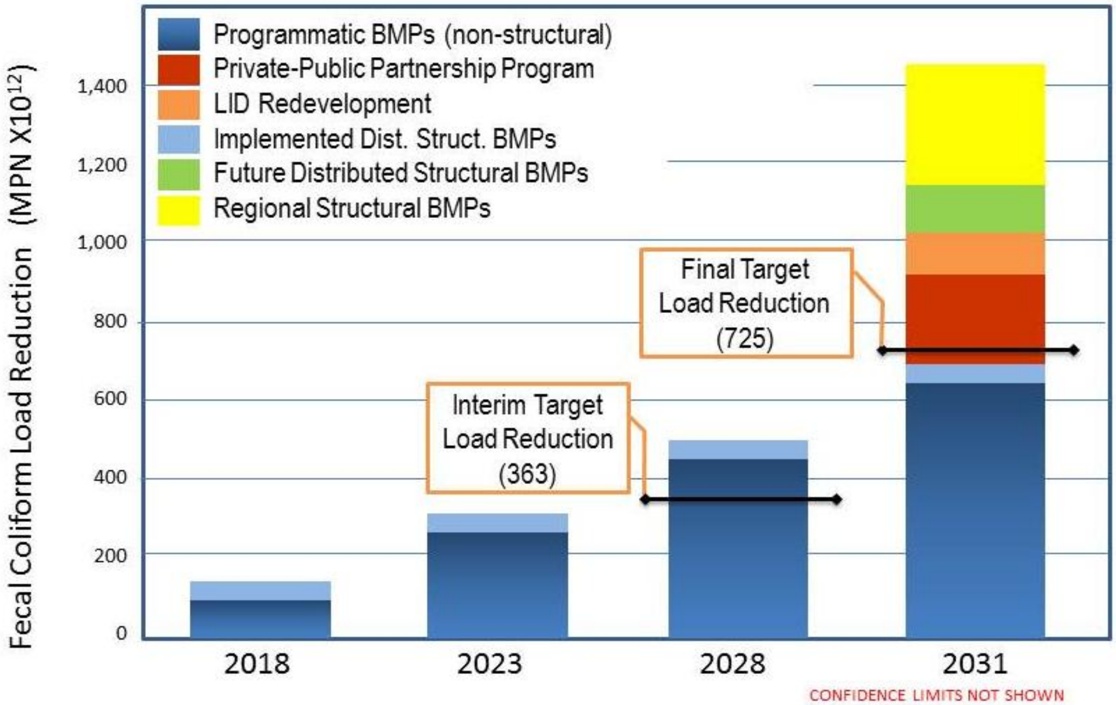

Figure 3-5. BMP Implementation Schedule and Bacteria Load Reduction Benefits

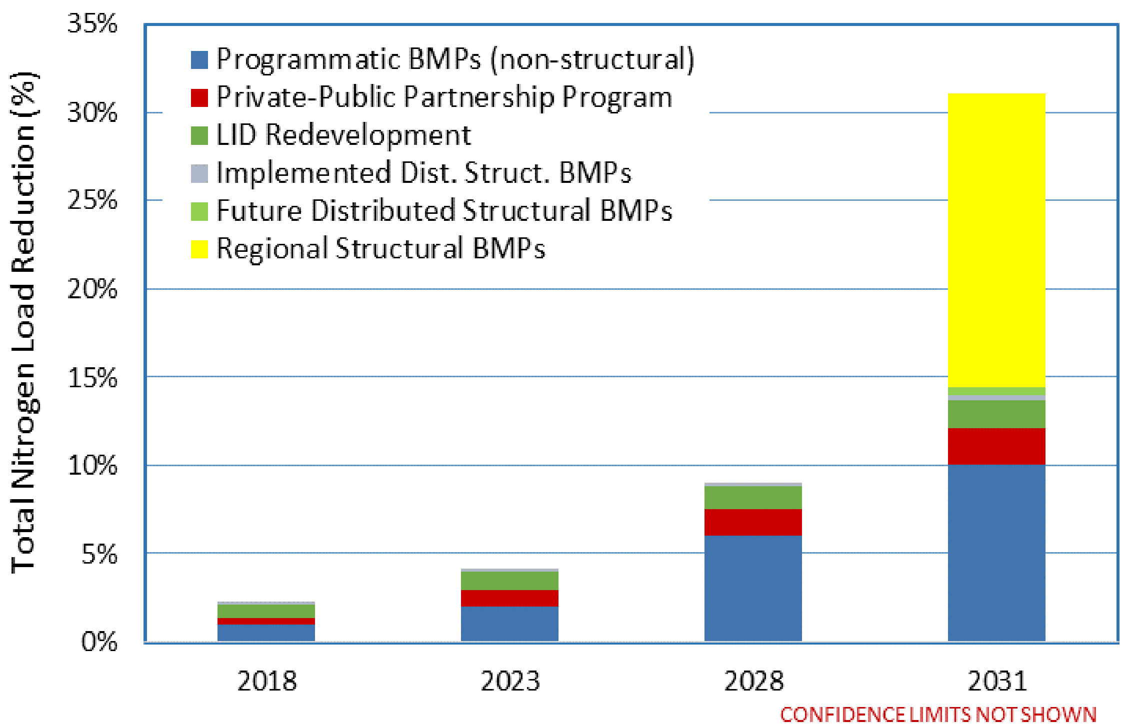

Figure 3-6. BMP Implementation Schedule and Total Nitrogen Load Reduction Benefits

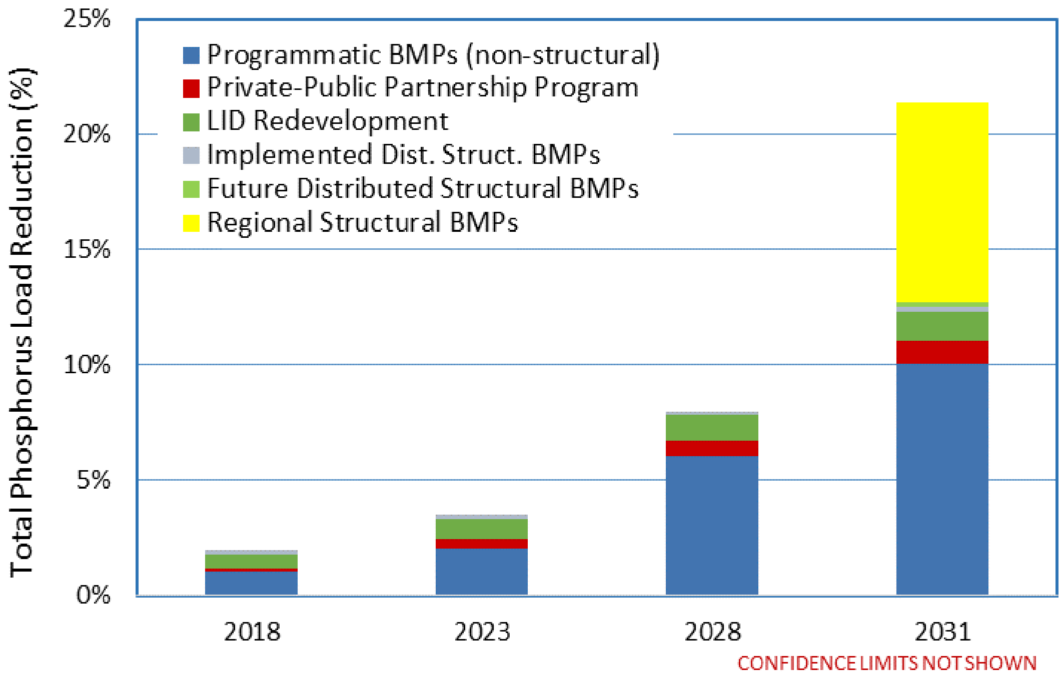

Figure 3-7. BMP Implementation Schedule and Total Phosphorus Load Reduction Benefits

3.3 Optional Watershed Management Area Analysis

The Permit provides an innovative pathway for Participating Agencies to provide offsite alternative compliance options to their land development programs by performing watershed-specific analyses characterizing each watershed. In past Permit cycles, waivers from onsite structural BMPs were possible, but only on a site-by-site basis, without consideration of the overall needs of the watershed. In contrast, the current Permit provides an option for Participating Agencies to promote implementation of controls on a watershed-based scale established by a greater understanding of the watershed needs and priorities, with the intent of greater overall water quality benefit. As indicated in the Southern California Coastal Water Research Project (SCCWRP) report (2012) that forms the basis of this provision, the first step in achieving this goal is "…identification of existing opportunities and constraints in order to prioritize areas of greater concern, areas of restoration potential, infrastructure constraints, and pathways for potential cumulative effects." The Watershed Management Area Analysis (WMAA), as denoted in the Permit, is an optional task intended to characterize important processes and characteristics of each watershed through creation of GIS layers that include the following information:

- A description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
- A description of existing streams in the watershed, including bed material and composition, and if they are perennial or intermittent;
- Current and anticipated future land uses;
- Potential coarse sediment yield areas; and
- Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.

The Participating Agencies may use the data generated from the characterization analyses indicated above for two purposes:

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

Understanding that development of a WMAA is on a jurisdiction-by-jurisdiction basis and could be time and funding intensive, the Participating Agencies elected to perform the watershed characterization and hydromodification management exemption mapping on a regional scale under a separate but concurrent effort to development of the Plans. The geospatial data and technical documentation from this project has been packaged individually for each watershed, with the WMAA in Appendix 3H.

3.3.1 Candidate Projects

The Permit allows Participating Agencies to develop a program as part of their overall JRMP that potentially allows development projects to participate in offsite alternative compliance projects that yield greater overall water quality benefit to the watershed. These alternative compliance projects would be implemented in lieu of meeting full onsite pollutant retention and hydromodification management control requirements as is required for all Priority Development Projects. As such, the County of San Diego is the only jurisdiction that has elected at this time to identify a list of potential projects, using the Regional WMAA data, as indicated in the Candidate Project list that appears in Appendix 3H. The effort to identify these projects is described in the associated San Luis Rey-specific WMAA data assessment that also appears in Appendix 3H. It should be noted that only the Candidate Project list is being supplied in the Plan and the specific provisions and programmatic details of any potential Alternative Compliance programs that may be implemented by individual Participating Agencies is not part of this Plan.

3.3.2 *HYDROMODIFICATION EXEMPTIONS*

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

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

The March 2011 Final Hydromodification Management Plan (HMP) identified certain exemptions from hydromodification management requirements by presenting "HMP applicability criteria." The Permit maintains some of these HMP applicability criteria. However, some of the applicability criteria are not included under the Permit unless the area or receiving water is mapped in the WMAA. Based on the results of the WMAA, the following exemptions from hydromodification management are proposed for the watershed:

Receiving waters that are exempt based on the Permit include:

- The Pacific Ocean
- Lakes and Reservoirs
- Existing underground storm drains or concrete-lined channels draining directly to the ocean. These systems may not represent all discharges to exempt bodies or rivers. Additional systems may be considered exempt if there is no evidence of erosion at the storm drain outfall of the conveyance system, and any other criteria determined by the local jurisdiction.

Receiving waters or conveyance systems that are recommended exempt in the watershed based on studies that were prepared as part of the Regional WMAA include:

- San Luis Rey River from Pacific Ocean to upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15;
- Existing underground storm drains or concrete-lined channels discharging directly to the recommended exempt reach of the San Luis Rey River. These systems were identified based on storm drain data provided by the Copermittees via the data call. These systems may not represent all discharges to exempt bodies or rivers. Additional systems may be considered exempt if there is no evidence of erosion at the storm drain outfall of the conveyance system, and any other criteria determined by the local jurisdiction.

4 WATER QUALITY IMPROVEMENT PLAN MONITORING AND ASSESSMENT PROGRAM

This section of the Water Quality Improvement Plan (Plan) describes the Monitoring and Assessment Program for the San Luis Rey Watershed. The Participating Agencies have developed an integrated Monitoring and Assessment Program to:

1) Measure the progress toward addressing the highest priority water quality conditions (HPWQC) established in Chapter 2;
2) Assess the progress toward achieving the goals, strategies, and schedules provided in Chapter 3; and
3) Evaluate each Participating Agency's overall efforts to implement the Plan.

The Permit supports an outcome-based approach through development and implementation of the Plan. Monitoring data collection and assessment provides the vehicle for determining whether intended outcomes are being realized or if adaptations of Participating Agencies' programs are necessary. Collection and assessment of monitoring data will guide future implementation of the Participating Agencies' management actions. Monitoring during wet and dry weather is conducted to collect observational and analytical data from storm drain outfalls and the receiving water. The data is utilized to help Participating Agencies determine whether discharges from storm drain outfalls are influencing receiving water quality, and if so, whether storm drain discharges are improving or degrading receiving water conditions over time. Participating Agencies assess the data in combination with their management actions to determine what actions are improving the quality of storm drain discharges and receiving water conditions and where additional actions are necessary.

This chapter provides an overview of the two main components: (1) Monitoring, and (2) Assessment. As stated in Provision D of Order R9-2013-001(Permit):

> *"The purpose of this provision is for the Participating Agency to monitor and assess the impact on the conditions of receiving waters caused by discharges from the Participating Agency's [stormwater conveyance systems] under wet weather and dry weather conditions. The goal of the Monitoring and Assessment Program is to inform the Participating Agency about the nexus between the health of receiving waters and the water quality condition of the discharges from their [storm drains] MS4s. This goal will be accomplished through monitoring and assessing the conditions of the receiving waters, discharges from the storm drains, pollutant sources, and/or stressors, and effectiveness of the water quality improvement strategies implemented as part of the Water Quality Improvement Plans."*

Monitoring includes sampling, inspection, and data collection at beaches, creeks, lakes, estuaries, and storm drain outfalls to observe conditions, improve understanding, and inform future management actions to improve water quality.

The Program incorporates monitoring to assess progress toward addressing the HPWQC per requirements of Permit Provision B.4. It also includes the compliance monitoring requirements of Provision D, Illicit Discharge Detection and Elimination requirements of Permit Provision E.2, and Total Maximum Daily Load (TMDL) monitoring and assessment requirements provided in Attachment E of the Permit. Assessment under this program includes annual review of the monitoring data along with a comprehensive analysis of the data at the end of the Permit term.

4.1 Monitoring Program

The Monitoring Program includes five major components:

1) Monitoring to assess goals and schedules;
2) Receiving water monitoring program that measures the long-term health of the watershed during dry and wet weather conditions;
3) Storm drain outfall monitoring program that investigates the elimination of illicit dry weather flows from storm drain outfalls and the improvement in quality of the discharges from storm drains during wet weather;
4) Special studies that take a further look into the HPWQC presented in Chapter 2; and
5) Complementary Illicit Discharge Detection and Elimination investigations and inspections of potential pollutant sources that are implemented under the Jurisdictional Runoff Management Programs.

Wet Weather is defined as a storm event of >0.1 inch of rainfall and the following 72 hours after the end of rainfall.

Dry Weather is defined as all days where the preceding 72 hours has been without measurable precipitation (>0.1 inch).

Table 4-1 presents an overview of the planned monitoring activities for the watershed. The overview includes monitoring programs, conditions, monitoring elements, and the implementation schedule for each program during this Permit term. In Chapter 2, bacteria was identified as the HPWQC for the watershed. As reflected in **Table 4-1**, monitoring is being conducted to characterize bacteria levels in the discharges from storm drain outfalls, identify potential sources of bacteria, and assess the effectiveness of strategies designed to address bacteria. Additionally, these programs will generate data to track priority water quality conditions and general health and conditions within the watershed. This section provides an overview of each of the monitoring programs. Where required by the Permit, additional detail is included in the appendices.

Table 4-1. Elements of the Monitoring Program

Monitoring Programs			Condition	Monitoring Element	Permit Schedule [a] 2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Monitoring to Assess Goals and Schedules			Dry and Wet	Varies by goal and jurisdiction	–	–	●	●	●
Receiving Water Monitoring	Long-Term Receiving Water		Dry	Conventionals, bacteria, nutrients, metals, pesticides, toxicity (chronic), possible TIE/TREs, visual observations, field measurements	–	●[b]	–	–	–
Receiving Water Monitoring	Long-Term Receiving Water		Dry	Hydromodification (channel conditions, discharge points, habitat integrity, evidence and estimate of erosion and habitat impacts)	–	●[b]	–	–	–
Receiving Water Monitoring	Long-Term Receiving Water		Dry	Bioassessment (BMI taxonomy, algae taxonomy, physical habitat characteristics)	–	●[b]	–	–	–
Receiving Water Monitoring	Long-Term Receiving Water		Wet	Conventionals, bacteria, nutrients, metals, pesticides, toxicity (chronic), possible TIE/TREs, field measurements	–	●[b]	–	–	–
Receiving Water Monitoring	Regional Monitoring Participation	Bight	Dry	Chemistry, toxicity, benthic infauna	●	●	–	–	●[c]
Receiving Water Monitoring	Regional Monitoring Participation	SMC	Dry	Bioassessment	●	●	●	●	●
Receiving Water Monitoring	Regional Monitoring Participation	2011 Hydromod-ification Monitoring Program (HMP)	Wet	Channel assessments; flow monitoring; sediment transport monitoring	●	●	●		

Monitoring Programs		Condition	Monitoring Element	Permit Schedule [a]				
				2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
TMDL Monitoring	Bacteria TMDL for San Luis Rey River	Dry	Bacteria	•	•	•	•	•
		Wet	Bacteria	•	•	•	•	•
Storm Drain Monitoring	Storm Drain Field Screening	Dry	Visual: flow condition, presence and assessment of trash in and around the station, IC/IDs, descriptions	•	•	•	•	•
	Storm Drain Outfall	Dry	Field parameters, conventionals, bacteria, nutrients, metals	-	-	•	•	•
		Wet	Field parameters, conventionals, bacteria, nutrients, metals	•	•	•	•	•
Special Studies	San Diego Regional Reference Streams and Beaches	Dry	Field parameters, conventionals, bacteria instantaneous flow	2012-2014	–	–	–	–
			Streams only: nutrients, metals, bioassessment, including physical habitat and chlorophyll a	2012-2014	–	–	–	–
		Wet	Field parameters, conventionals, bacteria	2012-2014	•	–	–	–
			Streams only: nutrients, metals, toxicity, flow and precipitation (duration of storm)	2012-2014	–	–	–	–

Monitoring Programs		Condition	Monitoring Element	Permit Schedule [a]				
				2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Special Studies	San Luis Rey River Microbial Source Tracking Study	Dry	GIS analysis, visual surveys, flow monitoring, bacteria, chemistry, host-specific MST markers, source investigations using CCTV, dye testing, smoke testing					
IDDE Program	IDDE Program	Dry	Visual surveys, field parameter testing, analytical testing and follow up investigations, if warranted	–	–	●	●	●

BMI=Benthic macroinvertebrates; IC/ID = illicit connection and/or illicit discharge; NA = not applicable; bacteria = fecal indicator; SMC = Southern California Stormwater Monitoring Coalition; Bight = Southern California Bight Regional Monitoring Program; TIE=Toxicity Identification Evaluation; TRE=Toxicity Reduction Evaluation

a. The Permit was adopted on May 8, 2013; the Permit became effective on June 27, 2013.

b. Completed under the Transitional Monitoring Program according to Permit Provisions D.1.a and D.2.a.

c. The 2018 Southern California Bight Regional Monitoring will occur during the summer of 2018 or 2019.

4.1.1 Monitoring to Assess Progress Toward Achieving Goals and Schedules

The purpose of this section is to summarize monitoring and assess progress toward achieving goals related to the HPWQC, which is bacteria for the Lower San Luis Rey Watershed, as described in Chapters 2 and 3. As outlined in **Section 3.1**, watershed goals are presented for the San Luis Rey River mouth and for the Lower San Luis Rey River.

4.1.1.1 Watershed Goals for the San Luis Rey River Mouth

The watershed goals at the River mouth are based on the multiple compliance pathways set forth for the Bacteria TMDL in Attachment E.6 of the Permit. Compliance with the TMDL may be demonstrated via one of the compliance pathways identified in the Permit. The proposed compliance dates for both the TMDL's interim and final goals are set outside of this Permit cycle, as presented in Permit Provision B.3. **Table 4-2** presents the TMDL related goals for the current permit term and for the interim TMDL targets and the monitoring that may be used to track progress toward achieving these goals.

Table 4-2. Monitoring Related to Permit Term and Interim Bacteria TMDL Goals

<table>
<tr><th colspan="2" rowspan="2">Compliance Pathway</th><th colspan="2">Dry Weather</th><th colspan="2">Wet Weather</th><th rowspan="2">Monitoring Elements</th></tr>
<tr><th>1st Permit Term (2013-2018)</th><th>Interim (April 4, 2020 [a])</th><th>1st Permit Term (2013-2018)</th><th>Interim (April 4, 2028 [a])</th></tr>
<tr><td>1
OR</td><td>No Discharge from Storm Drain Outfall(s)</td><td>Flow eliminated from 25% of outfalls or cumulative flow from storm drain outfalls reduced by 25%.</td><td>Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50%.</td><td>Flow eliminated from 10% of outfalls or cumulative flow from storm drain outfalls reduced by 10%.</td><td>Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50%.</td><td>Visual observation or measurements of flow from storm drain outfalls to receiving waters as described in Section 4.1.3 Storm Drain Monitoring Program.</td></tr>
<tr><td>2
OR</td><td>Meet TMDL Limits in Receiving Water</td><td>None</td><td rowspan="2">Bacteria concentrations at the compliance point identified in the Monitoring and Assessment Plan are below the applicable WQO (e.g., 400 MPN/100mL single sample maximum for Fecal Coliform)[i] or TMDL allowed exceedance percentage [b] of 4.7% for Total Coliform; 4% for Fecal Coliform; 16% for Enterococcus</td><td rowspan="2">None</td><td rowspan="2">Bacteria concentrations are below the applicable WQO (e.g., 400 MPN/100mL single sample maximum for Fecal Coliform) or TMDL allowed exceedance percentage [c] of 45% for Total Coliform; 44% for Fecal Coliform; 47% for Enterococcus</td><td rowspan="2">Bacteria data collected at compliance points as described in Section 4.1.2.4 Bacteria TMDL monitoring Program and/or data collected from storm drain outfalls as described in Section 4.1.3 Storm Drain Monitoring Program, as applicable</td></tr>
<tr><td>3
OR</td><td>Storm Drain Discharge Meets TMDL Limits</td><td>None</td></tr>
<tr><td>4
OR</td><td>Load Reductions in Discharges from Storm Drain Outfalls</td><td>Loads [d] are reduced by 9.5% for Total Coliform; 9.8% for Fecal Coliform; 21.8% for Enterococcus from MS4 outfalls</td><td>Loads [e] are reduced by 19.07% for Total Coliform (TC), 19.55% for Fecal Coliform (FC), 43.69% for Enterococcus (Ent) from the MS4 outfalls</td><td>Loads [f] are reduced by 0.70% for Total Coliform; 0.39% for Fecal Coliform; 1.5% for Enterococcus from MS4 outfalls</td><td>Loads [g] are reduced by 2.81% for Total Coliform; 1.56% for Fecal Coliform; 5.85% for Enterococcus from MS4 outfalls</td><td>Bacteria and flow data collected at storm drain outfalls as described in as described in Section 4.1.3 Storm Drain Monitoring Program.</td></tr>
<tr><td>5
OR</td><td>Exceedance due to Natural Sources</td><td>Number of storm drain outfalls with human fecal markers detected are reduced by 25%</td><td>Number of storm drain outfalls with anthropogenic fecal markers detected are reduced by 50%</td><td>Number of storm drain outfalls with human fecal markers detected are reduced by 10%</td><td>Number of storm drain outfalls with anthropogenic fecal markers detected are reduced by 50%</td><td>Data from Storm Drain Outfall Monitoring as described in Section 4.1.3, Special Studies as described in Section 4.1.4, and IDDE related data as described in Section 4.1.5.</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Water Quality Improvement Plan[h]</td><td colspan="4">Submit and fully implement WQIP, accepted by the San Diego Water Board, which provides reasonable assurance that interim TMDL compliance requirements will be achieved by the interim compliance dates</td><td rowspan="3">Data from monitoring and Jurisdictional Runoff Management Programs</td></tr>
<tr><td rowspan="2">Reduce by 20% the aggregate flow or the number of persistently flowing outfalls.</td><td rowspan="2">Reduce by 75% the aggregate flow or the number of persistently flowing outfalls.</td><td>Implement programmatic (non-structural) BMPs to achieve source reduction of bacteria loads from the storm drain outfalls.</td><td>Reduce bacteria loads by an additional 4% (total 6%) from the storm drain outfalls by continued implementation of programmatic BMPs.</td></tr>
<tr><td>Reduce by 0.3% the baseline bacteria loads from distributed BMPs constructed between 2003 and 2009 during redevelopment.</td><td>Reduce bacteria loads by an additional 0.6% (total 1.4%) through additional participation in the public private partnership program and reduction through BMPs required through redevelopment (3.2 %); Continue planning & permitting for long-term structural BMPs[i].</td></tr>
</table>

a. Request moving Interim TMDL Compliance Date from April 4, 2017 (per Attachment E, 6.c(1)) to April 4, 2020 to allow adequate time to investigate and mitigate bacteria sources, and monitor progress and adjust implementation through the adaptive management process.

b. Interim dry weather Allowable Exceedance Percentages were calculated based on half the value of the existing 30-day Geometric Mean of exceedance percentages based on beach sample data from 2004 through 2010: ; Annual Bacteria TMDL Monitoring Report is included in Appendix I of the Transitional Monitoring and Assessment Report for the San Luis Rey River Watershed Management Area (2012-2014). From this report, the San Luis Rey River watershed compliance reduction milestones/existing and interim and final exceedance frequencies are provided in Table 1–2 on page 1 – 8 (specifically, footnote "a" under the table). The interim and existing exceedance frequency calculation methodology is summarized in section 2.4 on page 2-6 of the document.

c. Interim wet weather Allowable Exceedance Percentages are from Tables 6.5 of Attachment E to Order No.R9-2013-0001.

d. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 43.69%.

e. Values taken from Table 6.3 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 87.38%.

f. Values calculated as half of the 2nd Permit Term goals, which are equal to half of the interim goals.

g. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* is the controlling indicator.

h. To meet the final wet weather target load reduction of 11.69% for Fecal Coliform, the County through quantitative modeling has demonstrated a 10% reduction from programmatic BMPs and a 1.7% reduction from structural BMPs. Progress will be monitored and adjustments through adaptive management will be used to update the plan.

i. The County of San Diego is concerned that a long-term funding source is not identified for constructing and maintaining structural BMPs, if structural BMPs are needed to meet compliance. The implementation of strategies to achieve goals will depend upon approval of funding in future annual budgets.

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4.1.1.2 Watershed Goals for the Lower San Luis Rey River

The Participating Agencies have also established wet and dry weather watershed goals for bacteria, the HPWQC, in the Lower San Luis Rey River. Goals were established for this Permit term to demonstrate improvement in water quality in the Lower San Luis Rey River, indicative of progress towards compliance with the TMDL requirements. Under dry conditions, the goals address a reduction in anthropogenic dry weather flow in storm drain outfalls. Wet weather goals for the Lower San Luis Rey River are aimed at reducing bacteria loading at key outfalls consistent with TMDL load reduction options at storm drain outfalls. Participating Agencies have established dry and wet weather goals for the 2013-2018 Permit term.

Table 4-3 summarizes the goals for the Permit term and data that will be collected to assess these goals. Details related to the goals are provided in Chapter 3.

Table 4-3. Monitoring Related to Watershed Goals for the Lower San Luis Rey River [a]

Jurisdiction	Condition	First Permit Term Numeric Goals 2013-2018 (Chapter 3)	Assessment Metric	Monitoring Elements
City of Oceanside, City of Vista, County of San Diego	Dry Weather	Effectively eliminate flow from 20% of persistently flowing outfalls.	Presence/absence of dry weather flow at persistent flowing outfalls [b]	Flow data collected during Dry Weather Storm Drain Outfall Monitoring per Provision D.2.
		Reduce by 20% the aggregate flow from persistently flowing outfalls.	Dry weather flow at persistent flowing outfalls [b]	
	Wet Weather	Identify five key drainage areas [c] with the Lower SLR River HA; develop baseline loading estimates at these five outfalls.	Develop baseline used to estimate bacteria load reductions at storm drain outfalls.	Combination of bacteria and flow data from the transitional wet weather outfall monitoring program [d], historical storm drain monitoring, and/or Storm Drain Outfall Monitoring per Provision D.2.

a. West of Interstate 15

b. Flow is defined as all dry weather flows except groundwater and other exempt or permitted non-stormwater flows.

c. Key drainage areas may be identified based on factors such as loading estimates, microbial source tracking data, source identification, size of pipe, proximity to receiving water, or other appropriate methods.

d. *Transitional Monitoring and Assessment Program Report for the San Luis Rey River Watershed Management Area (2012 – 2014). Appendix K - Five-Year Assessment of Random and Targeted MS4 Outfall Discharge Data Collected under NPDES Permit Order No. R9-2007-0001 in San Diego County Watersheds.* 2015. Prepared for the County of San Diego City of Oceanside and City of Vista by Weston Solutions Inc. http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=44&Itemid=34

4.1.2 *RECEIVING WATER MONITORING*

The purpose of the receiving water monitoring program is to characterize trends in the chemical, physical, and biological conditions of a receiving water to determine whether beneficial uses are protected, maintained, or enhanced. Additionally, the receiving water monitoring component helps inform the Participating Agencies of the nexus between the health of receiving waters and the quality of discharges from their storm drain outfall. This program is designed to meet the requirements set forth in Provision D.1 of the Permit. Long-term monitoring occurs during both wet and dry weather conditions for water quality, along with physical and biological integrity. Sediment quality monitoring, if appropriate, and participation in regional monitoring occurs as well. Attachment E of the Permit stipulates how TMDL monitoring requirements are to be incorporated into the receiving water monitoring program. Receiving water monitoring comprises the following programs:

- Long-term receiving water monitoring,
- Regional monitoring participation,
- Toxicity identification evaluation/toxicity reduction evaluation, if appropriate,
- Sediment quality monitoring, if appropriate, and
- TMDL monitoring.

The receiving water programs are designed to answer one or more of the following questions:

- Are conditions in the receiving water protective, or likely protective, of beneficial uses?
- What are the extent and magnitude of the current or potential receiving water problems?
- Are the conditions in the receiving water getting better or worse?

4.1.2.1 *LONG-TERM RECEIVING WATER MONITORING*

Long-term receiving water monitoring will track the overall health of the receiving waters. Dry and wet weather monitoring will continue at the historical mass loading station (SLR-MLS) located on the San Luis Rey River. Participating Agencies have monitored SLR-MLS since 2001 to meet the requirements of previous Permits and this site is co-located with the United States Geological Survey (USGS) monitoring station. This mass loading station is at the end of the watershed and captures water draining the majority of the watershed. The mass loading station location is listed in **Table 4-4**.

Table 4-4. San Luis Rey Watershed Long-term Receiving Water Station

Station ID	Latitude	Longitude	Cross Street Description	Channel Type	Jurisdiction
SLR-MLS	33.2206476	-117.35825	Benet Road Bridge over San Luis Rey River	Natural Channel	City of Oceanside

Source: Transitional Receiving Water Monitoring Plan (Weston, 2014a)

Additional details of the monitoring requirements are in the Monitoring and Assessment Plan provided in Appendix 4A. Detailed proposed monitoring methods and procedures are presented in the Receiving Water Monitoring Plan as Attachment 4A-1 to Appendix 4A. These methods and procedures may be modified based on site-specific environmental conditions and updated analytical methodologies.

4.1.2.2 *Regional Monitoring Participation*

Regional monitoring includes separate studies that will evaluate various aspects of receiving water health on a regional scale. Participating Agencies will participate in the following regional programs to meet the requirements of Permit Provision D.1.e (1).

Bight Regional Monitoring

The Bight regional monitoring program is a multi-agency collaborative effort to assess the ecological condition of the Southern California Bight from a regional perspective. The core program consists of monitoring of sediment chemistry, sediment toxicity, and benthic infauna. The goals of past Bight programs are to answer three primary questions:

- What are the extent and magnitude of direct impact from sediment contaminants?
- How do the extent and magnitude of the environmental impact vary by habitat?
- What is the trend in extent and magnitude of direct impacts from sediment contaminants?

The Regional Harbor Monitoring Program (RHMP) was conducted under the Bight program to characterize the sediment quality. These locations included Oceanside Harbor, Mission Bay, and San Diego Bay. Oceanside Harbor is not hydraulically connected to the watershed and therefore this program will not be described in detail in the Plan.

Stormwater Monitoring Coalition (SMC) Regional Monitoring

Since 2001, Participating Agencies have partnered with regulated storm water municipalities in Southern California, the Regional Boards of Southern California and the Southern California Coastal Water Research Project (SCCWRP) to form the Southern California Stormwater Monitoring Coalition (SMC). The goals of the SMC are to standardize monitoring, improve understanding of storm water mechanics, and identify receiving water impacts from storm water (SCCWRP, 2002). According to its 2014 Research Agenda, the SMC has identified 21 potential projects and is in the process of prioritizing projects on the basis of need and availability of funding (SMC, 2014). The Participating Agencies have elected to participate in the projects that are relevant to the watershed. The Participating Agencies will continue participation in the SMC Regional Bioassessment Program. Additional information is included in the Monitoring and Assessment Plan in Appendix 4A.

Hydromodification Regional Monitoring Program

Copermittees have developed a regional Hydromodification Management Plan (HMP) to address impacts to beneficial uses and stream habitat from increased erosive force potentially caused by a rise in runoff discharge rates and volume from Priority Development Projects (County of San Diego, 2011). The HMP was initially developed to meet the requirements of the 2007 Permit. The Monitoring Plan is defined in Chapter 8 of the HMP, and was updated by the Copermittees and accepted by the Regional Board in February of 2014. The HMP requires monitoring with a final report due to the Regional Board in December of 2016. Monitoring consists of channel sediment transport assessments, and continuous flow monitoring of pre-project, post-project, and reference conditions. Additional monitoring is required per Provision D.1.a (2).

4.1.2.3 *Sediment Quality Monitoring*

Sediment quality monitoring is designed to assess compliance with the sediment quality receiving water limits applicable to enclosed bays and estuaries in accordance with the State Board's Water Quality Control

Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality (Sediment Control Plan). Part I of the State Board's Sediment Quality Control Plan provides sediment quality objectives for enclosed bays and estuaries and does not apply to ocean waters or inland surface waters. The California Sediment Quality Objective (SQO) multiple-line-of evidence approach is based on criteria developed for euhaline environments specified in Sediment Control Plan Section V. Euhaline is defined as waters ranging from 25–31 practical salinity units (State, 2009).

Based on historical data, during the index period (June through September), the San Luis Rey Estuary recorded average salinity ranging between 15 and 20 parts per thousand and, therefore, does not meet the required salinity to be evaluated for the current SQOs. Because of the removal of an Arizona crossing and the construction of a permanent bridge, the river mouth has returned to its natural condition. Since 2011, a year-round, naturally-occurring sand bar has obstructed tidal flow into the river mouth, resulting in a predominantly freshwater environment. The Participating Agencies will continue to periodically monitor the situation and will update the Regional Board of the status of the estuary prior to the California Bight 2018 Study. A Sediment Sampling Plan which will be used if the estuary qualifies for sampling as part of the California Bight 2018 Study is attached in Appendix 4A.

4.1.2.4 TMDL Monitoring

TMDL provisions, schedules, and monitoring requirements are provided in Attachment E of the Permit. The purpose of the monitoring program is to track progress toward achieving compliance with interim and final TMDL numeric targets. The Bacteria TMDL in Attachment E.6 is applicable to the watershed. Monitoring is designed to meet compliance with the receiving water monitoring requirements of the TMDL. Wet and dry weather sampling will be conducted each year at the compliance point located at the historical California Assembly Bill 411 (AB411) monitoring location (FM-010) along the Pacific Ocean shoreline (25 yards down current of where ocean currents meet river discharge in ankle to knee deep water). The data generated will be used to address the following questions:

- Are TMDL numeric targets for indicators being met at the compliance monitoring locations?
- Are levels of bacteria decreasing at the compliance monitoring locations?

Additional details of the monitoring requirements per Permit Attachment E.6 are in the Monitoring and Assessment Plan provided in Appendix 4A. The proposed Bacteria TMDL Monitoring Plan describes detailed monitoring procedures and analytical methods that are illustrative and may be revised based on site-specific environmental conditions and updated methodology. It is presented in Attachment 4A-3.

4.1.2.5 Toxicity Identification Evaluation/Toxicity Reduction Evaluation

Provision D.1.c(4)(f) of the Permit requires that the Copermittees discuss the need for conducting a Toxicity Identification Evaluation (TIE)/Toxicity Reduction Evaluation (TRE) if chronic toxicity is detected in receiving waters. A TIE is a set of procedures to identify specific chemicals or conditions responsible for toxicity; a TRE is a study designed to identify causative agents of effluent or ambient toxicity, isolate its sources, evaluate effectiveness of toxicity control options, and confirm reduction of toxicity. A work plan that outlines the process to identify chronic toxicity and prioritize the need to implement a TIE/TRE based on the magnitude and persistence of chronic toxicity is included in the Monitoring and Assessment Plan in Appendix 4A.

4.1.3 STORM DRAIN OUTFALL MONITORING

The purpose of the Storm Drain Outfall Monitoring Program is to evaluate the potential impact from storm drain discharges on the beneficial uses of the waterbody. This program is designed to meet requirements set forth in Provision D.2 of the Permit and seeks to answer the following question:

- Do non-stormwater or stormwater discharges from the storm drain outfalls contribute to receiving water quality problems?

Table 4-5 provides the number of major storm drain outfalls to be monitored under each component of the Storm Drain Outfall Monitoring Program by each Participating Agency. Additional details of the monitoring requirements are in the Monitoring and Assessment Plan provided in Appendix 4A. Detailed proposed monitoring methods and procedures as presented in the Storm Drain Outfall Monitoring Plan (Attachment 4A-5 to Appendix 4A). These methods and procedures may be modified based on site-specific environmental conditions and updated analytical methodologies. Additionally, the number of major storm drain outfalls monitored per year as shown in **Table 4-5** are subject to change based on new information, updates to the Participating Agency's storm drain outfall inventories, changes in transient or persistent flow classifications, and/or changes or updates to the priority water quality conditions over the life of the Plan.

Table 4-5. Number of Major Storm Drain Outfalls per Jurisdiction

Jurisdiction	Number of Storm Drain Outfalls Monitored Per Year		
	Field Screening[a]	Dry Weather Monitoring	Wet Weather Monitoring
City of Oceanside	19	5	2
County of San Diego	15	5	2
City of Vista	4	2	1

[a] For Participating Agencies with fewer than 125 major storm drain outfalls in the watershed, 80% of major storm drain outfalls must be screened twice per year.

4.1.3.1 STORM DRAIN OUTFALL DRY WEATHER MONITORING

The purpose of the Storm Drain Outfall Dry Weather Monitoring Program is to evaluate the potential contribution from storm drain discharges on receiving water quality during dry weather conditions and to assess the ability of programs to effectively eliminate non-storm water discharges to waterbodies or waterways. Each Participating Agency has established a number of major storm drain outfalls that are prioritized based on non-stormwater flow status and threat to receiving water quality, and will be screened once or twice annually based on this prioritization. Additionally, the highest priority major storm drain outfalls have been selected for further water quality testing to facilitate source investigations of these storm drain outfalls with persistent dry weather flows.

4.1.3.2 STORM DRAIN OUTFALL WET WEATHER MONITORING

The purpose of this program is to identify pollutants in storm water discharges from the storm drain conveyance system, guide pollutant source identification efforts, and track progress in achieving the goals set forth in Chapter 3. The Participating Agencies' five monitoring locations for the wet weather storm drain outfall discharge monitoring component were to be representative of the residential, commercial, industrial, and mixed-use land uses within the watershed, as presented in **Table 4-5**.

4.1.4 SPECIAL STUDIES

Special studies have been selected to further investigate the HPWQC to meet requirements of Provision D.3 of the Permit. Per Provision D.3, the purpose of the special studies is to "*address pollutant and/or stressor data gaps and/or develop information necessary to more effectively address the pollutants and/or stressors that cause or contribute to Highest Priority Water Quality Conditions identified in the Water Quality Improvement Plan.*" The special studies will include a regional special study and a special study specific to the watershed. Both special studies selected for the watershed will provide additional information on the HPWQC selected by the Participating Agencies. Additional details of the monitoring requirements are in the Monitoring and Assessment Plan provided in Appendix 4A.

4.1.4.1 SAN DIEGO REGIONAL REFERENCE STREAMS AND BEACHES STUDIES

Participating Agencies have elected to participate in the San Diego Regional Reference Streams and Beaches Study currently being conducted by the San Diego and Orange County Participating Agencies. These two regional studies fulfill the requirements for special studies per Permit Provisions D.3.a(2) and D.3.a(3). The studies will develop reasonable and accurate TMDL numeric targets that account for "natural sources" to establish the concentrations or loads from streams minimally disturbed by anthropogenic activities or "reference" conditions. The Reference Stream Study also collected nutrients, metals, and toxicity data as secondary constituents. This study will provide a scientific basis for updating the reference conditions to be considered in evaluating compliance levels in the Bacteria TMDL. The results of this study will be used to support the forthcoming re-evaluation of the recently adopted Bacteria TMDL and to support numeric target development in future TMDLs or alternative regulatory approaches for nutrients and metals.

The San Diego Regional Stream Reference Study will address the following questions (SCCWRP, 2013) in streams minimally influenced by anthropogenic activities:

- How does the Water Quality Objective (WQO) exceedance frequency vary between summer dry weather, winter dry weather, and wet weather?
- How does the WQO exceedance frequency vary by hydrologic factors?
- How does the WQO exceedance frequency vary by input factors?
- How does the WQO exceedance frequency vary by biotic and abiotic factors?

The San Diego Regional Reference Beaches Study will address the following questions (SCCWRP, 2013) in beaches minimally influenced by anthropogenic activities:

- How does the WQO exceedance frequency vary between summer dry weather, winter dry weather, and wet weather?
- How does the WQO exceedance frequency vary by hydrologic factors, including:
- Discharge flow rate (wet and dry weather)
- Status of estuary mouth (open/closed; dry weather only)
- What are the wet and dry weather exceedance frequencies of bacteria in estuaries?

4.1.4.2 San Luis Rey River Microbial Source Tracking Study

This dry weather Microbial Source Tracking (MST) Work Plan has been prepared to facilitate the following objectives:

1) Identify sources of dry weather flow into the County of San Diego's (County) stormwater conveyance system (consistent with the non-structural best management practices [BMPs] identified in the San Luis Rey and San Diego River Watersheds' Comprehensive Load Reduction Plan).
2) Identify dry weather sources of human waste in the County's stormwater conveyance system by sampling storm drain outfalls for bacteria, sewage indicators, and human source markers.
3) Identify dry weather sources of non-human waste in the County's stormwater conveyance system by sampling storm drain outfalls for bacteria and non-human fecal source markers (e.g., cattle, equestrian, canine, etc.).
4) Prioritize locations for implementation of remedies to eliminate dry weather flows and fecal waste sources.

This MST study plan began with gathering data including discussions with City and County staff, review of existing monitoring data, and GIS analysis of the stormwater conveyance system and infrastructure throughout the watershed. Storm drain outfall investigations are planned to characterize human versus non-human inputs using bacteria analyses, chemistry, host-specific MST markers, and other source tracking tools. A detailed storm drain network (stormwater conveyance system) investigation will be employed based on the storm drain outfall results to further investigate sources. Additional details of the MST Study are summarized in the Monitoring and Assessment Plan provided in Appendix 4A. The MST Monitoring Plan describes detailed monitoring methods and procedures that are illustrative and may be revised if site conditions change as presented in Attachment 4A-6.

4.1.4.3 Lower San Luis Rey River Bacteria Source Identification Study (Phase II)

In 2007, the City of Oceanside was awarded a Clean Beaches Initiative grant to conduct a microbial source tracking study in the lower section of the river and the river mouth. The Lower San Luis Rey River Bacterial Source Identification Project (Phase II MST Study) was designed as the initial phase of a source investigation to provide a broad characterization of bacterial concentrations throughout the lower sections of the river and river mouth. This study focused on assessing the potential of anthropogenic (human-specific) and non-anthropogenic (gull) bacteria sources within the watershed. The results indicate that both types of sources are present. To focus on the anthropogenic sources, follow-up investigations targeting human sources on a smaller scale are required.

As a follow-up to the Phase II MST Study, and as a requirement of NPDES Permit Order No. R9-2013-0001, the City of Oceanside will develop and initiate a Phase II Study. This study will further focus on a drainage area that was identified during the MST study that showed exceedances of bacteria above water quality objectives. A special study related to the HPQWC for the watershed, i.e., bacteria, will be developed during the 2015–2016 fiscal year. The study will include a monitoring plan that meets Permit requirements of Provision D.3 and the assessment requirements of Provision D.4. Additional details of the Phase II MST Study are summarized in the Monitoring and Assessment Plan provided in Appendix 4A.

4.1.5 *Illicit Discharge Detection and Elimination Program*

Each Participating Agency is required to develop an Illicit Discharge Detection and Elimination (IDDE) Program to address the potential contribution of pollutants from non-storm water and storm water discharges and to establish and enforce pollutant discharge prohibitions in compliance with Provision E.2 of the Permit. The outline of an IDDE Program is included to establish a consistent framework for all Jurisdictional Runoff Management Programs (JRMP) within the watershed and to describe the data that may be generated to support assessments described in **Section 4.2**. The IDDE Program will be designed to have the following goals:

- Control the contribution of pollutants to and the discharges from the storm drains within its jurisdiction.
- Effectively prohibit non-storm water discharges to the storm drain.
- Reduce the discharge of pollutants in storm water to the maximum extent practicable.

Additional details of the IDDE program are summarized in the Monitoring and Assessment Plan provided in Appendix 4A. Participating Agencies may choose to further enhance the program in their jurisdictions.

4.1.6 *Regional Clearinghouse*

Participating Agencies will use existing data-sharing templates to facilitate compilation of watershed-wide datasets for assessment and reporting purposes. To support reporting under previous permit cycles, regional data-sharing templates were developed for receiving water monitoring, storm drain outfall monitoring, field screening, and IDDE reporting. Participating Agencies must make the following data and documentation available to the public on the Project Clean Water website:

- San Luis Rey Watershed Water Quality Improvement Plan and all updated versions with date of update;
- Annual Reports for the watershed;
- Jurisdictional Runoff Management Program document for each Participating Agency within the watershed and all updated versions with date of update;
- BMP Design Manual for each Participating Agency within the watershed and all updated versions with date of update;
- Reports from special studies conducted in the watershed;
- Monitoring data uploaded to the California Environmental Data Exchange Network (CEDEN) with links to the uploaded data; and
- Geographic information system (GIS) data, layers, and/or shape files that are available for distribution and used to develop the maps to support the Plan, Annual Reports, and Jurisdictional Runoff Management Programs.

> Project Clean Water is a web-based portal that functions as a regional clearinghouse for San Diego County watersheds. It is used as a centralized point of access to share educational materials, water quality information, and Permit-required reports with the public.
>
> (www.projectcleanwater.org)

4.2 ASSESSMENT PROGRAM

The assessment portion of the Monitoring and Assessment Program will evaluate the data collected under the monitoring programs described in **Section 4.1**, as well as the information collected as part of the Jurisdictional Runoff Management Programs. The data collected from these two programs will be used to assess the progress toward achieving the numeric goals and schedules and to measure the progress toward addressing the HPQWC. **Figure 4-1** depicts how the watershed monitoring activities will support the assessments required by the Permit.

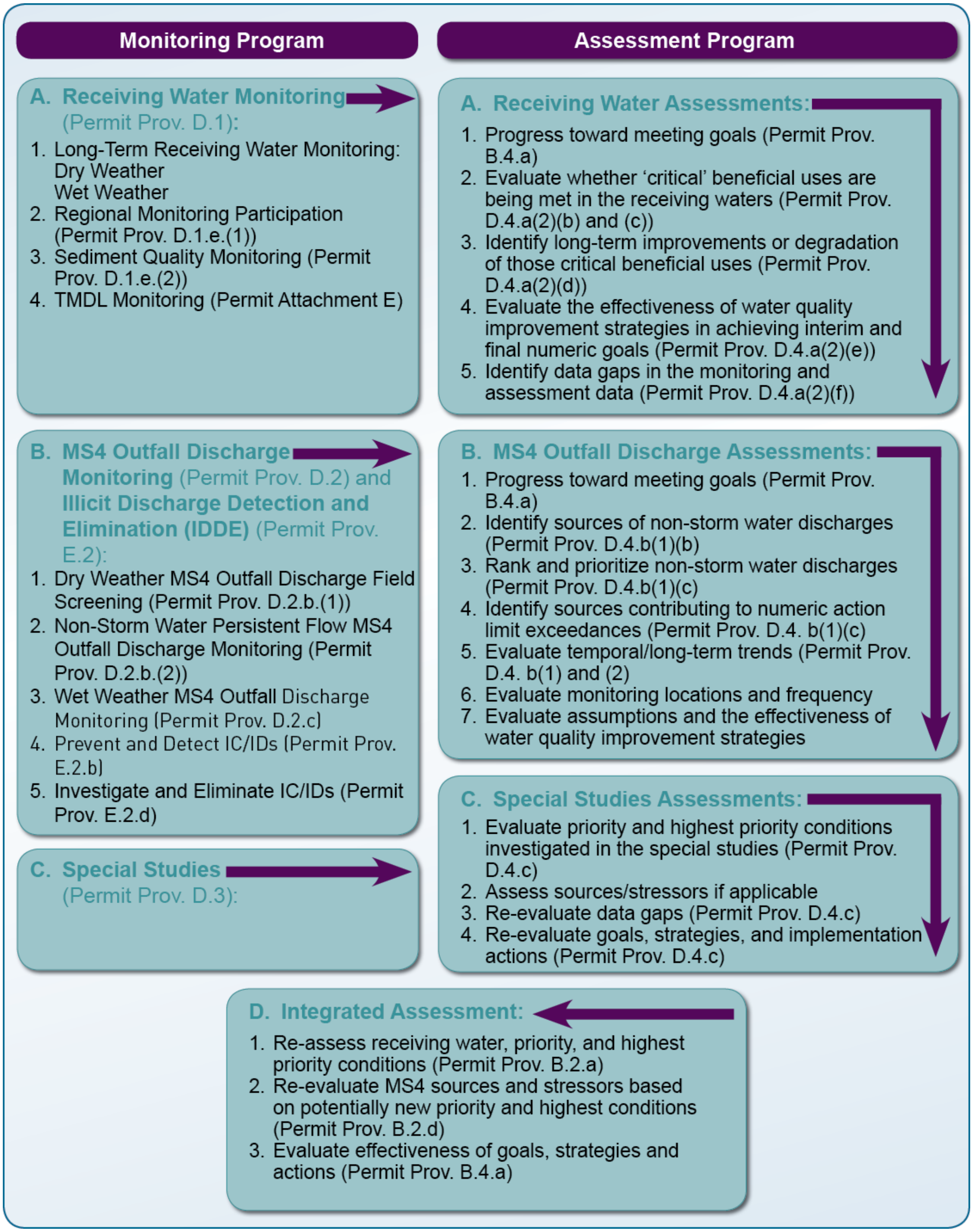

Figure 4-1. Monitoring and Assessment Program Components for the San Luis Rey Watershed

Table 4-6 summarizes the reporting and assessment requirements of the Permit. Some assessments will be reported annually, as part of the Annual Report, while others will be included in the Report of Waste Discharge that the Participating Agency must submit 180 days prior to the end of this Permit. Additional detail on the contents of the reports is presented in the Monitoring and Assessment Plan in Appendix 4A.

The Monitoring and Assessment Program will be evaluated and adapted in the context of the Annual Reporting and the Report of Waste Discharge. The re-evaluation will consider data gaps and the results of all monitoring program elements. Modifications may be made to the program, but the core elements required by the Permit and described in **Section** 4.1 must be maintained. This limits the amount of adaptation that is possible. Potential changes could be to modify the frequency of sampling, add a new analyte of concern, or move a monitoring location.

Table 4-6. Annual Report Requirements

Assessment and Documentation	Detailed Data and Information
Summary of data collected, findings, interpretations, and conclusions from the assessments required per Permit Provisions F.b.(3)(a), (b), and (c)	• Receiving Water Assessments per Provision D.4.a. • Sediment Quality Assessments per Provision D.1.e(2) • TMDL Assessments per Provision E.6 • Storm Drain Outfall Discharge Assessments D.4.b • IDDE relevant information and findings • Special studies: findings and progress per Provision D.4.c • Re-evaluation of the Priority Water Quality Conditions, numeric goals, strategies, schedules, and/or monitoring and assessment, as needed per Provision D.4.d.[a]
Progress of implementing the Water Quality Improvement Plan per Provision F.b.(3)(d)	• Progress towards interim and final numeric goals for the HPQWC for the watershed • Status of water quality improvement strategies by each Participating Agency • Proposed modifications to water quality improvement strategies and supporting rationale • Water quality improvement strategies planned for implementation during the next reporting period • Proposed modifications to the Plan and/or each Participating Agency's jurisdictional runoff management program document • Previous modifications or updates incorporated into the Plan and/or each Participating Agency's jurisdictional runoff management program document

Assessment and Documentation	Detailed Data and Information
A completed Jurisdictional Runoff Management Program Annual Report Form for each Participating Agency in the watershed, certified by a Principal Executive Officer, Ranking Elected Official, or Duly Authorized Representative per Provision F.b.(3)(e)	• City of Oceanside • City of Vista • County of San Diego
Any data or documentation utilized in developing the Annual Report for each Participating Agency, upon request by the Regional Board. Monitoring data must be uploaded to the California Environmental Data Exchange Network (CEDEN) and available for access on the Regional Clearinghouse per Provision F.b.(3)(f)	• Receiving water and data collected per Provision D.1 • Storm drain outfall discharge monitoring data collected per Provision D.2 • Special Study data • IC/ID investigation data

a. This re-evaluation is not required annually; at minimum, it must be completed as part of the Report of Waste Discharge.

5 Iterative Approach and Adaptive Management Process

This section presents the iterative approach of the adaptive management process that will be used to evaluate and adapt the Water Quality Improvement Plan (Plan) for the San Luis Rey Watershed. The adaptive management process is the framework to evaluate progress toward compliance with the Bacteria TMDL. It will be used, in conjunction with data collected as part of the Monitoring and Assessment Program, to evaluate whether modifications to goals, schedules, and/or strategies are necessary to meet the interim and final TMDL compliance options in Attachment E of the Permit. **Figure 5-1** summarizes the framework of the adaptive management process.

Adaptive Management Highlights

The iterative approach will facilitate the adaptive management process for the San Luis Rey Watershed.

The iterative approach will be used to re-evaluate the following based on the requirements of the Permit:

- Conditions and priorities
- Goals, strategies and schedules
- Monitoring and assessment

The adaptive management process explains how the Water Quality Improvement Plan will be revised when:

- New priorities and/or highest priorities are developed
- Goals are adjusted or new goals are added
- Strategies are modified to meet the latest goals or to be more effective

The Plan will be adapted in response to triggers identified in the Permit. Triggers that may warrant program adaptation include exceedances of water quality standards in receiving waters, new information, Regional Board recommendations, and input received during the public participation process. Effectiveness assessments of JRMP programs and strategies may also trigger adaptations to the Plan. The diagram below outlines the process for the development of the Plan and includes the iterative approach and adaptive management process steps.

Each trigger calls for specific responses within timeframes specified in the Permit. While the adaptive management process would typically be implemented annually or at the end of the Permit term, other adaptations, especially those driven by TMDLs, could occur on a different schedule.

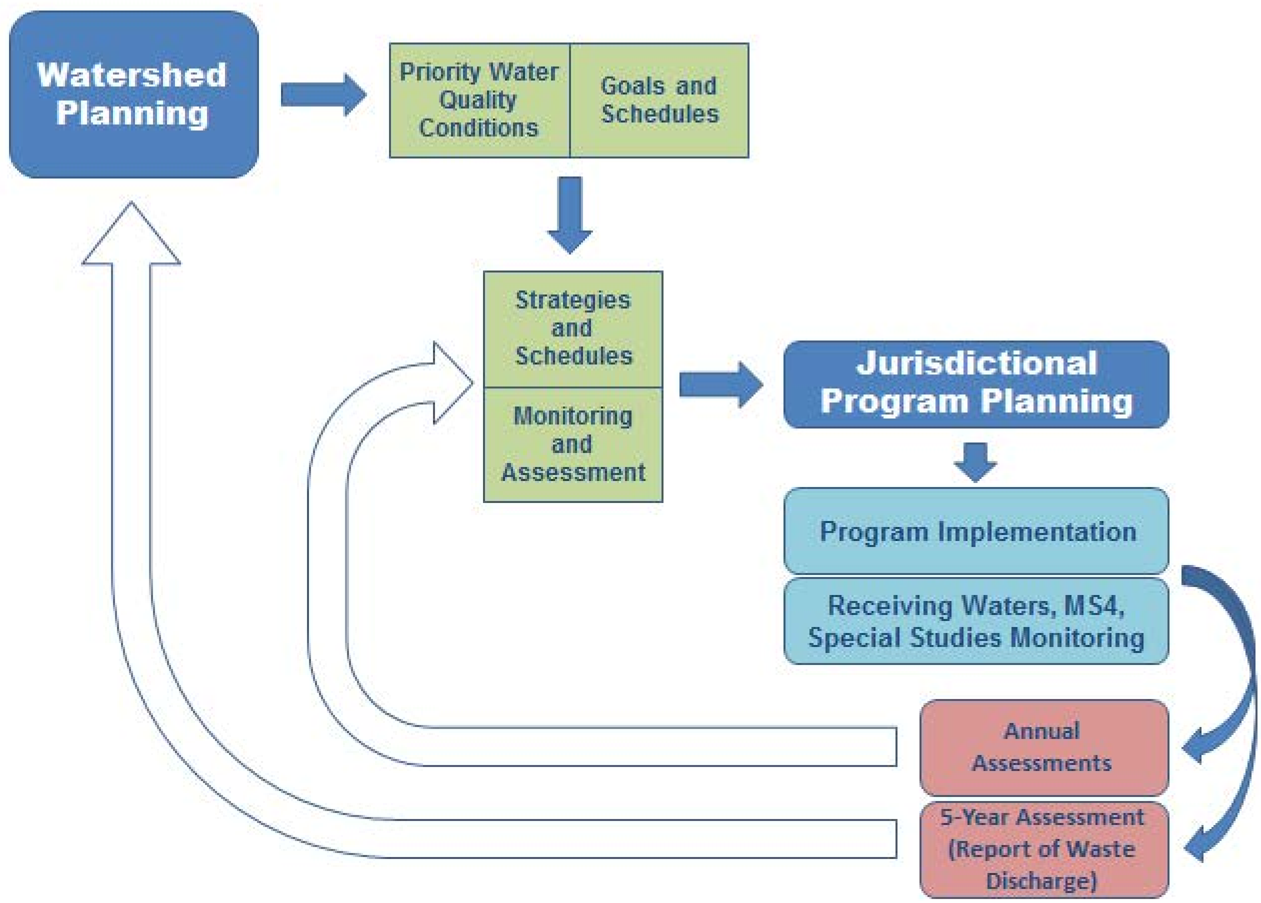

Figure 5-1. Water Quality Improvement Plan Assessment Adaptive Management Framework

5.1 Permit Requirements: Iterative Approach and Adaptive Management

Multiple provisions of the Permit contain requirements for adaptive management. These include Provisions A.4, B.5, D.4.d, and F.2.c, which are summarized below.

Provision A.4 requires the Plan to be designed and adapted to ultimately achieve compliance with the discharge prohibitions (Provisions A.1.a and A.1.c) and receiving water limitations (Provision A.2.a) specified in the Permit.

Provision B.5 contains specific considerations that must be included in the adaptive management process, whether performed as part of the Annual Report or as part of the Report of Waste Discharge. This includes the re-evaluation of priority water quality conditions; adaptation of goals, strategies, and schedules; and adaptation of the Monitoring and Assessment Program. The specific considerations in Provision B.5 are covered in detail in the following sections.

Provision D.4.d contains the processes for the assessments and adaptive management that must occur as part of the Report of Waste Discharge preparations.

Provision F.2.c describes the requirements for updates to the Water Quality Improvement Plan that could result from implementation of the adaptive management requirements.

5.2 Re-evaluation of Priority Water Quality Conditions

The process for selecting the highest priority water quality condition(s) is documented in Chapter 2. Given the relatively short duration of the remainder of this Permit term after expected approval of the Plan, the priority water quality conditions selected during the development of the Plan will remain for the duration of the Permit term. They will be modified only on the basis of new information assessed as part of the Report of Waste Discharge. Data collected during the Permit term will be used to update the analysis of the priority water quality conditions on the basis of the methodology described in Chapter 2. **Table 5-1** lists the considerations that must be included when Participating Agencies re-evaluate the Priority Water Quality Conditions for the watershed.

Table 5-1. Re-evaluation of Priority Water Quality Conditions

Frequency	Trigger[a]	Considerations
Permit Term	Report of Waste Discharge (B.5.a, D.4.d.(1))	***Provision B.5.a Iterative Approach and Adaptive Management Considerations*** Achievement of the outcome of improved water quality through the implementation of strategies identified in the Plan New information developed in the re-assessment of receiving water conditions, impacts from storm drain discharges, and subsequent re-evaluation of priorities Spatial and temporal accuracy of monitoring data Availability of new information and data from sources outside the JRMP programs that inform the effectiveness of strategies and actions Recommendations from the Regional Board Recommendations received through a public participation process ***Provision D.4.d(1) Integrated Assessment Considerations*** Re-evaluation of the receiving water conditions and the impacts of storm drain discharges on receiving waters per the process developed in Chapter 2. This includes the identification of beneficial uses in receiving waters that are protected per the Monitoring and Assessment Program. Re-evaluation of the identification of stormwater conveyance system sources and/or stressors if corresponding to elevation of a new highest priority condition.

a. Following approval of a TMDL with wasteload allocations by OAL and the USEPA, Participating Agencies must initiate an update of the Plan within six months.

5.3 Adaptation of Goals, Strategies, and Schedules

The adaptation of goals, strategies, and schedules must occur as part of the Report of Waste Discharge, and may occur on an annual basis under certain conditions. The two conditions that would warrant annual adaptation of goals and schedules are: (1) where a new TMDL is approved by the State of California Office of Administrative Law (OAL) and the United States Environmental Protection Agency (USEPA) or (2) where annual evaluations of receiving water and storm drain outfall monitoring data provide new information impacting the goals. The three conditions that would warrant annual adaptation of strategies and schedules are: (1) where a new TMDL is approved by OAL and USEPA, (2) where annual evaluations of receiving water and storm drain outfall monitoring data provide new information impacting the schedules, or (3) where program effectiveness assessments provide information adequate to justify modification.

5.3.1 Adaptation of Goals and Schedules

As part of the preparation of the Report of Waste Discharge, the Participating Agencies will evaluate the progress toward achieving the watershed goals established in Chapter 3. This evaluation may be performed using programmatic or water quality data collected as Plan implementation matures. The watershed goals that will be assessed as part of the Report of Waste Discharge are provided in **Table 5-2** and **Table 5-3**. More detail related to these goals is included in **Section 3.1**.

Assessment of the watershed goals and compliance pathways will be performed using data collected per the Monitoring and Assessment Program and JRMP, along with the schedules developed in conjunction with each goal. Depending on the results of the assessment, it may be appropriate to adjust either or both the numeric goals and/or the schedules associated with each goal. The exception is where the interim and/or final numeric goals and schedules are based on approved Bacteria TMDL compliance schedules. In this case, interim schedules may be modified. However, numeric targets (interim and final) and final schedules cannot be modified without changes to the Bacteria TMDL. **Table 5-4** lists the considerations that will be included in the process of evaluating progress towards defined goals and schedules.

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Table 5-2. First Permit Term and Interim Bacteria TMDL Goals

Compliance Pathway		Dry Weather		Wet Weather	
		1st Permit Term (2013-2018)	Interim (April 4, 2020 [a])	1st Permit Term (2013-2018)	Interim (April 4, 2028 [a])
1 OR	No Discharge from Storm Drain Outfall(s)	Flow eliminated from 25% of outfalls or cumulative flow from storm drain outfalls reduced by 25%.	Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50%.	Flow eliminated from 10% of outfalls or cumulative flow from storm drain outfalls reduced by 10%.	Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50%.
2 OR	Meet TMDL Limits in Receiving Water	None	Bacteria concentrations at the compliance point identified in the Monitoring and Assessment Plan are below the applicable WQO (e.g., 400 MPN/100mL single sample maximum for Fecal Coliform)[j] or TMDL allowed exceedance percentage [b] of 4.7% for Total Coliform; 4% for Fecal Coliform; 16% for *Enterococcus*	None	Bacteria concentrations are below the applicable WQO (e.g., 400 MPN/100mL single sample maximum for Fecal Coliform) or TMDL allowed exceedance percentage [c] of 45% for Total Coliform; 44% for Fecal Coliform; 47% for *Enterococcus*
3 OR	Storm Drain Discharge Meets TMDL Limits	None			
4 OR	Load Reductions in Discharges from Storm Drain Outfalls	Loads [d] are reduced by 9.5% for Total Coliform; 9.8% for Fecal Coliform; 21.8% for Enterococcus from MS4 outfalls	Loads [e] are reduced by 19.07% for Total Coliform (TC), 19.55% for Fecal Coliform (FC), 43.69% for *Enterococcus (Ent)* from the MS4 outfalls	Loads [f] are reduced by 0.70% for Total Coliform; 0.39% for Fecal Coliform; 1.5% for Enterococcus from MS4 outfalls	Loads [g] are reduced by 2.81% for Total Coliform; 1.56% for Fecal Coliform; 5.85% for Enterococcus from MS4 outfalls
5 OR	Exceedance due to Natural Sources	Number of storm drain outfalls with human fecal markers detected are reduced by 25%	Number of storm drain outfalls with anthropogenic fecal markers detected are reduced by 50%	Number of storm drain outfalls with human fecal markers detected are reduced by 10%	Number of storm drain outfalls with anthropogenic fecal markers detected are reduced by 50%
6	Water Quality Improvement Plan[h]	Submit and fully implement WQIP, accepted by the San Diego Water Board, which provides reasonable assurance that interim TMDL compliance requirements will be achieved by the interim compliance dates			
		Reduce by 20% the aggregate flow or the number of persistently flowing outfalls.	Reduce by 75% the aggregate flow or the number of persistently flowing outfalls.	Implement programmatic (non-structural) BMPs to achieve source reduction of bacteria loads from the storm drain outfalls.	Reduce bacteria loads by an additional 4% (total 6%) from the storm drain outfalls by continued implementation of programmatic BMPs.
				Reduce by 0.3% the baseline bacteria loads from distributed BMPs constructed between 2003 and 2009 during redevelopment.	Reduce bacteria loads by an additional 0.6% (total 1.4%) through additional participation in the public private partnership program and reduction through BMPs required through redevelopment (3.2 %); Continue planning & permitting for long-term structural BMPs[i].

a. Request moving Interim TMDL Compliance Date from April 4, 2017 (per Attachment E, 6.c(1)) to April 4, 2020 to allow adequate time to investigate and mitigate bacteria sources, and monitor progress and adjust implementation through the adaptive management process.
b. Interim dry weather Allowable Exceedance Percentages were calculated based on half the value of the existing 30-day Geometric Mean of exceedance percentages based on beach sample data from 2004 through 2010: ; Annual Bacteria TMDL Monitoring Report is included in Appendix I of the Transitional Monitoring and Assessment Report for the San Luis Rey River Watershed Management Area (2012-2014). From this report, the San Luis Rey River watershed compliance reduction milestones/existing and interim and final exceedance frequencies are provided in Table 1–2 on page 1 – 8 (specifically, footnote "a" under the table). The interim and existing exceedance frequency calculation methodology is summarized in section 2.4 on page 2-6 of the document.
c. Interim wet weather Allowable Exceedance Percentages are from Tables 6.5 of Attachment E to Order No.R9-2013-0001.
d. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 43.69%.
e. Values taken from Table 6.3 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 87.38%.
f. Values calculated as half of the 2nd Permit Term goals, which are equal to half of the interim goals.
g. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* is the controlling indicator.
h. To meet the final wet weather target load reduction of 11.69% for Fecal Coliform, the County through quantitative modeling has demonstrated a 10% reduction from programmatic BMPs and a 1.7% reduction from structural BMPs. Progress will be monitored and adjustments through adaptive management will be used to update the plan.
i. The County of San Diego is concerned that a long-term funding source is not identified for constructing and maintaining structural BMPs, if structural BMPs are needed to meet compliance. The implementation of strategies to achieve goals will depend upon approval of funding in future annual budgets.

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Table 5-3. Monitoring Related to Watershed Goals for the Lower San Luis Rey River [a]

Jurisdiction	Condition	First Permit Term Numeric Goals 2013-2018 (Chapter 3)	Assessment Metric
City of Oceanside, City of Vista, County of San Diego	Dry Weather	Effectively eliminate flow from 20% of persistently flowing outfalls.	Presence/absence of dry weather flow at persistent flowing outfalls [b]
		Reduce by 20% the aggregate flow from persistently flowing outfalls.	Dry weather flow at persistent flowing outfalls [b]
	Wet Weather	Identify five key drainage areas [c] with the Lower SLR River HA; develop baseline loading estimates at these five outfalls.	Develop baseline used to estimate bacteria load reductions at storm drain outfalls.

a. West of Interstate 15

b. Flow is defined as all dry weather flows except groundwater and other exempt or permitted non-stormwater flows.

c. Key drainage areas may be identified based on factors such as loading estimates, microbial source tracking data, source identification, size of pipe, proximity to receiving water, or other appropriate methods.

d. *Transitional Monitoring and Assessment Program Report for the San Luis Rey River Watershed Management Area (2012 – 2014). Appendix K - Five-Year Assessment of Random and Targeted MS4 Outfall Discharge Data Collected under NPDES Permit Order No. R9-2007-0001 in San Diego County Watersheds.* 2015. Prepared for the County of San Diego City of Oceanside and City of Vista by Weston Solutions Inc. http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=44&Itemid=34

Table 5-4. Adaptation of Goals and Schedules for the HPWQC

Frequency	Trigger[a]	Considerations
Permit Term	Report of Waste Discharge (B.5.b, D.4.d.(1))	***Provision B.5.b Iterative Approach and Adaptive Management Considerations*** Modifications to the PWQCs based on Provision B.5.a Progress toward achieving numeric goals for the highest priority water quality conditions Progress in meeting established schedules New policies or regulations that may affect goals Reductions of non-storm water discharges Reductions of pollutants in storm water discharges from the stormwater conveyance system to the MEP New information resulting from the re-evaluation of impacts from storm drain discharges and/or pollutants and stressors Efficiency in implementing the Plan Recommendations from the Regional Board Recommendations received through a public participation process ***Provision D.4.d(1) Integrated Assessment Considerations*** Evaluation of the progress toward achieving interim and final numeric goals for protecting impacted beneficial uses in receiving waters

a. Following approval of a TMDL with wasteload allocations by OAL and the USEPA, Participating Agencies must initiate an update of the Plan within six months.

5.3.2 *ADAPTATION OF STRATEGIES AND SCHEDULES*

The strategies and implementation schedules developed to address the highest priority water quality condition in the watershed will be re-evaluated as part of the preparation of the Report of Waste Discharge. Ultimately, the effectiveness of the strategies will be based on the progress toward achieving the interim and final numeric goals. However, an evaluation of strategies based on the achievement of the interim and final numeric goals may take many years of implementation and monitoring to assess. To supplement the "goal-based" assessments, water quality and programmatic data collected over the Permit term will be incorporated into the assessment and adaptive process to modify strategies and implementation schedules as appropriate.

5.3.2.1 Water Quality Data Evaluation and Linkage to Strategies

Receiving water data will be assessed as described in **Section 5.5**. The assessment will indicate progress toward longer term goals and protection of beneficial uses. These data may be used to evaluate the collective effectiveness of the strategies. This information will provide a "big picture" assessment of the success of the strategies over the long term. The data evaluation also has the potential to trigger mandatory updates to the Plan per Provision A.4 where exceedances of water quality standards persist in receiving waters. This part of the adaptive management process is described further in **Section 5.5** and detailed in **Figure 5-2**.

Storm drain outfall visual observations, water quality data, and special studies results may provide information that is more directly linked to the implementation of individual strategies. Where possible, this information will be used to modify, eliminate, and/or develop new strategies to address the highest priority water quality condition in the watershed. Where appropriate, these assessments will include a comparison of the data with the non-stormwater action levels (NALs) and stormwater action levels (SALs) as required per Provision C of the Permit. These data will provide the foundation for the storm drain outfall discharge assessments described in Chapter 4, which will examine the results of Participating Agency Illicit Discharge Detection and Elimination Programs and Storm Drain Outfall Discharge Monitoring Programs. Where strategies can be linked to measurable or demonstrable reductions of non-storm water discharges or of pollutants in storm water, appropriate modifications will be made.

5.3.2.2 Program Assessments

Where available, the results of program effectiveness assessments performed at the jurisdictional or watershed scale may also factor into the adaptation of specific strategies. The level of information will vary by jurisdiction and by program, as these types of assessments are not explicitly required under the Permit. However, in many cases, the jurisdictions are performing programmatic assessments to ensure the most effective use of available resources. These assessments have the potential to provide information to determine the effectiveness of specific strategies that is more relevant than water quality data collected at storm drain outfalls or in receiving waters and may be a key driver in adapting strategies. In some cases, modifications to strategies may also be the result of internal jurisdictional opportunities or constraints such as increases or decreases in available funding or staffing. Modifications to strategies based on program effectiveness assessment may occur annually or on a Permit term.

Table 5-5 lists the considerations that will be evaluated when adapting strategies and schedules, whether on an annual timeframe or the Permit term (i.e., Report of Waste Discharge).

Table 5-5. Adaptation of Water Quality Strategies and Schedules

Frequency	Trigger[a]	Considerations
Annual Report	Persistent Exceedances Not Addressed (A.4.a.(2))	***Provision A.4.a(2) Integrated Assessment Considerations (Summarized in Figure 5-2)***[b] Water quality standard exceedances for pollutants that are addressed by the Plan; implementation of the accepted plan continues and is updated as necessary. If storm drain discharges are causing or contributing to a new exceedance of an applicable water quality standard for pollutants that are not addressed by the Plan, the Plan will be updated as part of the Annual Report (unless directed to update it earlier by the Regional Board). Following Regional Board approval of modifications to the Plan, the Participating Agencies must update their JRMPs accordingly.
Annual Report	New Information (B.5.b)	***Provision B.5.b Iterative Approach and Adaptive Management Considerations*** Modifications to the priority water quality conditions Progress toward achieving numeric goals for the highest priority water quality conditions Progress in meeting established schedules New policies or regulations that may affect goals Reductions of non-storm water discharges Reductions of pollutants in storm water discharges from the stormwater conveyance system to the maximum extent practicable (MEP) New information resulting from the re-evaluation of impacts from storm drain discharges and/or pollutants and stressors Efficiency in implementing the Plan Recommendations from the Regional Board Recommendations received through a public participation process
Permit Term	Report of Waste Discharge (D.4.d.(2))	***Provision D.4.d(2) Integrated Assessment Considerations*** Identification of the non-storm water and storm water pollutant loads from the storm drain outfalls per Provision D.4.b Identification of the non-storm water and storm water pollutant load reductions, or other improvements that are necessary to attain the interim and final numeric goals Identification of the non-storm water and storm water pollutant load reductions, or other improvements, that are necessary to demonstrate that non-storm water and storm water discharges are not causing or contributing to exceedances of receiving water limitations Evaluation of the progress of the strategies toward achieving interim and final numeric goals for protecting beneficial uses in receiving waters

a. Following approval of a TMDL with wasteload allocations by OAL and the USEPA, Participating Agencies must initiate an update of the Plan within six months.

b. The procedure does need not be repeated for continuing or recurring exceedances of the same water quality standard(s) once scheduled strategies are implemented unless directed to do so by the Regional Board.

5.4 Adaptation of Monitoring and Assessment Program

As part of the Report of Waste Discharge, the Participating Agencies will consider modifications to the Monitoring and Assessment Program, consistent with the requirements in Provision D.4.d.(3). During the Permit term, modifications must be consistent with the requirements of Provisions D.1, D.2, and D.3 (receiving water, storm drain outfall, and special study monitoring requirements, respectively), which limit the amount of adaptation that is possible. However, recommendations within the Report of Waste Discharge provide an opportunity to make more meaningful modifications to the Monitoring and Assessment Program. Examples of modifications to the Monitoring and Assessment Program include the following adjustments:

- Determine whether discharges from the storm drain outfalls are linked to exceedances in the receiving water;
- Address data gaps via re-assessment of monitoring locations and frequencies; and/or
- Address results of special studies.

Table 5-6 lists considerations that will be evaluated when adapting the Monitoring and Assessment Program.

Table 5-6. Adaptation of Monitoring and Assessment Program

Frequency	Trigger[a]	Considerations
Annual Report	Persistent Exceedances Not Addressed (A.4.a.(2))	***Provision A.4.a(2) Integrated Assessment Considerations (Summarized in Figure 5-2)***[b] May include modifying the monitoring program to fill data gaps. Modifications could include moving monitoring locations, adding additional sample collection, or changing type of sample collected.
Annual Report	New Information (B.5.c)	***Provision B.5.c Iterative Approach and Adaptive Management Considerations*** Re-evaluation based on new information such as modified priority water quality conditions, goals, strategies, or schedules New information, including new regulations Must include information gained from Permit required monitoring
Permit Term	Report of Waste Discharge (B.5.c)	***Provision B.5.c Iterative Approach and Adaptive Management Considerations*** Review of Program based on the requirements in Provision D Adjustment of the monitoring program to determine whether discharges from the stormwater conveyance system are causing/contributing to exceedances in the receiving water when new exceedances persist; identification and addressing of data gaps via re-assessment of monitoring locations and frequencies; adjustment of monitoring program to address results of special studies.

a. Following approval of a TMDL with wasteload allocations by OAL and the USEPA, Participating Agencies must initiate an update of the Plan within six months.

b. The procedure does need not be repeated for continuing or recurring exceedances of the same water quality standard(s) once scheduled strategies are implemented unless directed to do so by the Regional Board.

5.5 Timing of Adaptive Management Requirements

Based on the permit required evaluations described previously, adaptive management via the iterative process will be integral to the success of the Plans. However, the Participating Agencies will adapt different facets of the Plans at different rates, depending on a variety of factors. In most cases, annual modifications will consist of relatively minor updates to strategies or timelines, reflective of information gained through implementation. Significant updates to the Plan will be required as part of the Report of Waste Discharge, performed once per Permit term. For parts of the Plan (e.g., priority water quality conditions, goals) a longer timeline is appropriate for evaluation, as accurate and more robust information is necessary to change the course of the Plan. The following sections provide more insight and details related to the timing of the adaptive management process and the impacts on revisions to the Plan.

5.5.1 Annual Assessments and Adaptive Management

The Permit contains two conditions that may trigger adaptation annually:

1) Exceedances of water quality standards in receiving waters, and
2) New information.

In either case, modifications may be appropriate for the water quality goals, strategies, schedules, and/or Monitoring and Assessment Program. The priority water quality conditions may be modified *as needed* during the Permit term, but would likely be modified only as a result of assessments conducted for the Report of Waste Discharge.

5.5.1.1 Receiving Waters Assessments

Evaluation of receiving water and storm drain outfall discharge data will be performed annually as part of the Annual Report and is described in Chapter 4. More comprehensive evaluations of receiving water data will be performed for the Transitional Monitoring and Assessment Program Report and for the Report of Waste Discharge (Provision D.4.a.(1)). These evaluations will summarize receiving water data collected within the watershed and provide information with the potential to trigger the adaptive management process to achieve compliance with Permit discharge prohibitions and receiving water limitations as required in Provision A.

Provision A.4 describes adaptive management procedures that the Participating Agencies must implement "if exceedance(s) of water quality standards persist in receiving waters." If the adaptive management process is triggered under this provision, the process will include the following assessments:

- Whether the storm drain outfall is a source of pollutants causing the exceedances to persist in the receiving waters, and
- Whether or not the exceedances are addressed by the Plan.

If the receiving water exceedances are addressed under the Plan, the Participating Agencies will continue implementation. If the receiving water exceedances are not addressed, the Participating

Agencies will update the plan to address the exceedances as described in Provision A.4.a.(2) and submit the updates with the Annual Report. The updates will include, as applicable:

- A description of strategies that are currently being implemented, are effective, and will continue,
- A description of strategies that will be implemented to reduce or eliminate pollutants or conditions that are a source of the receiving water exceedances,
- Updates to the implementation schedules for existing, revised, or additional strategies, and
- Updates to the Monitoring and Assessment Program to track progress toward achieving compliance with Provisions A.1.a, A.1.c, and A.2.a.

The adaptive management process as required under Provision A.4 is illustrated in **Figure 5-2**.

5.5.1.2 Annual Evaluation of New Information

The adaptive management process may also be triggered as new information becomes available as discussed in the following subsections. Where appropriate, modifications may be made to goals, strategies, schedules, and/or the Monitoring and Assessment Program and reported in the Annual Report.

5.5.1.2.1 Regulatory Drivers

Where new regulations or policies are adopted that impact watershed planning and implementation processes in the near term, modifications to the goals, strategies, schedules, and/or Monitoring and Assessment Program may be warranted, and, in some cases, required. For example, an update will be initiated no later than six months following approval of a TMDL Basin Plan Amendment by OAL and the USEPA. The trigger applies to TMDLs containing wasteload allocations assigned to Participating Agencies within the watershed during the term of the Order (Provision F.2.c.(2)). Other examples of regulatory drivers that may trigger modifications include new state policies or plans (e.g., trash, toxicity, biological objectives, bacteria standards update) and changes resulting from modifications to existing Permit requirements (e.g., as a result of revising a TMDL).

5.5.1.2.2 Special Study Results

As part of the Monitoring and Assessment Program, Participating Agencies will perform special studies related to the highest priority water quality condition for the watershed. The special studies are designed to provide information related to sources of the highest priority water quality conditions within the watershed, will be implemented during the Permit term, and are typically performed over multiple years. As relevant data, conclusions, and lessons learned become available from these studies, the Plan may be modified. The study results may impact the goals, strategies, schedules, and the Monitoring and Assessment Program. Additionally, lessons learned and study results from outside the watershed, especially those related to the bacteria impairments, may also be incorporated into the Plan.

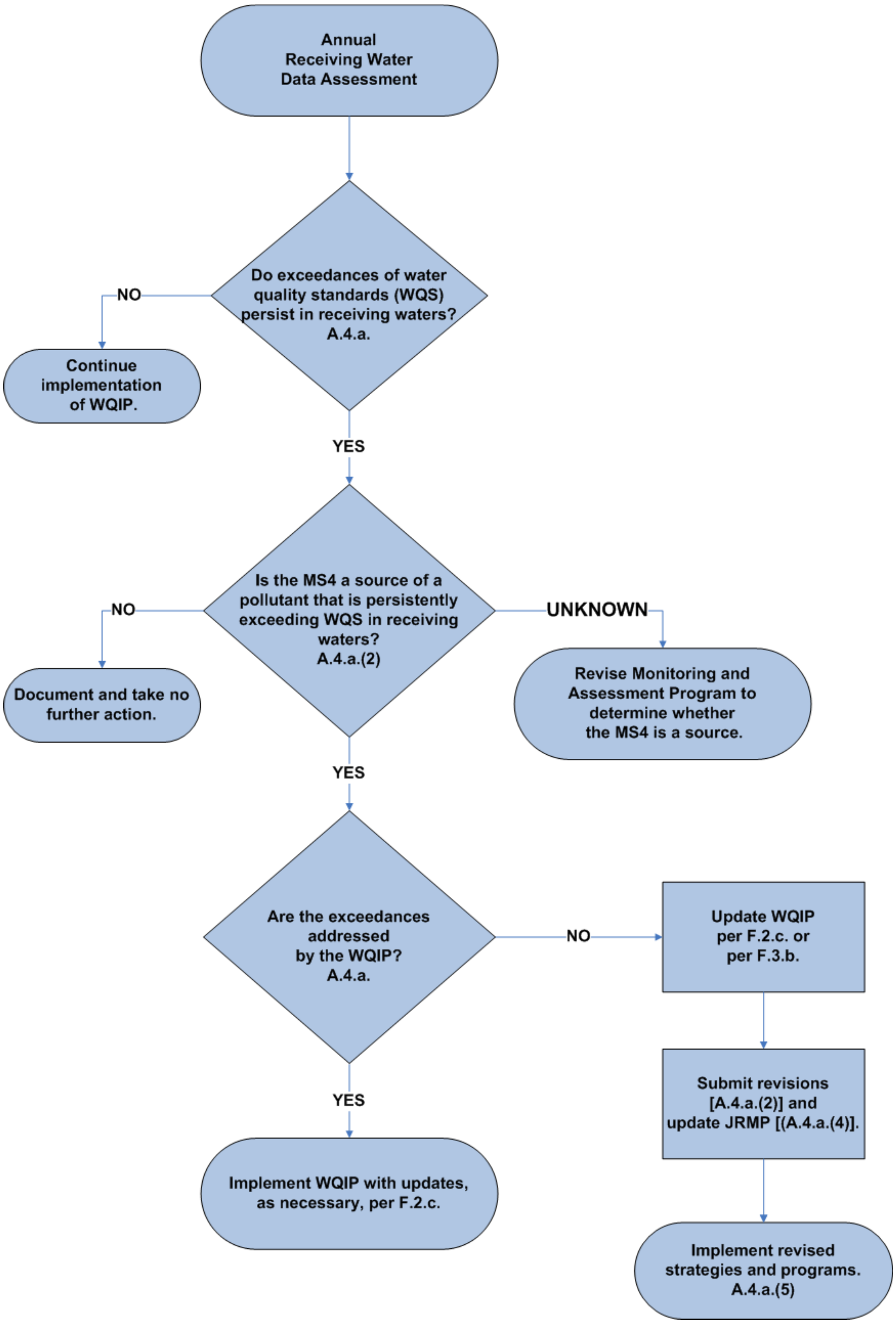

Figure 5-2. Receiving Waters Water Quality Standards Exceedance Process

5.5.1.2.3 Program Assessments

Plan strategies will be incorporated into individual Participating Agency's JRMPs. The Participating Agencies will implement program refinements to increase focus on the particular water quality issues identified in the Plan, and utilize various assessment methods to determine which program refinements are effective and which are not. The program effectiveness assessment results would provide useful information that may lead to adaptation of goals, strategies, schedules, and the Monitoring and Assessment Program.

5.5.1.2.4 Regional Board Recommendations

Adaptation of the Plan may also be required on the basis of recommendations from the Regional Board. The Regional Board's recommendations could be a result of the public participation process, Consultation Panel input, review of submitted reports, or other Regional Board interests.

5.5.2 Permit Term Assessments and Adaptive Management

The Permit also contains specific assessments to be performed during preparation of the Report of Waste Discharge. These assessments are longer term in nature, occurring only once during the Permit cycle. During Report of Waste Discharge preparation, all elements of the Plan are eligible for modifications through the required adaptive management processes. Elements that could be evaluated include the water quality conditions (i.e., priorities), goals and accompanying schedules, strategies and accompanying schedules, and the Monitoring and Assessment Program.

5.6 Water Quality Improvement Plan Updates and Reporting

Updates to the Plan will include a public participation process as required by Provision F of the Permit. Annual updates will likely include a more abbreviated public process unless substantial modifications are envisioned. A full public process will be implemented as part of updates associated with the Report of Waste Discharge. Updates will include a process to obtain data from the public, participation by the Consultation Panel, and submittal for approval. As applicable, updates to the Plan will be initiated within six months following OAL and USEPA approval of any TMDLs with Waste Load Allocations (WLAs) assigned to the Participating Agencies. Updates will be deemed appropriate for inclusion in the Plan 90 days following submission to the Regional Board unless otherwise directed by the Regional Board Executive Officer. Updates to the Plan will also be made available to the public via the Regional Clearinghouse (i.e., Project Clean Water website) following acceptance by the Regional Board.

Figure 5-3 provides a tentative timeline for the adaptive management process, including implementation schedules for the Plan, JRMPs, and Monitoring and Assessment Programs. Key reporting dates are also included. The timeline assumes that the Plan will be approved by the Regional Board during fall 2015, with implementation beginning in October 2015. The first Annual Report is scheduled to be submitted by the Participating Agencies in January 2017. It will include an abbreviated monitoring and JRMP implementation period because the Monitoring and Assessment Program and JRMP will not be effective until after the approval of the Plan. The second Annual Report for current Permit cycle will be submitted in January 2018. This submittal will be after the submittal of the Report of Waste Discharge that is due to the Regional Board by December 2017.

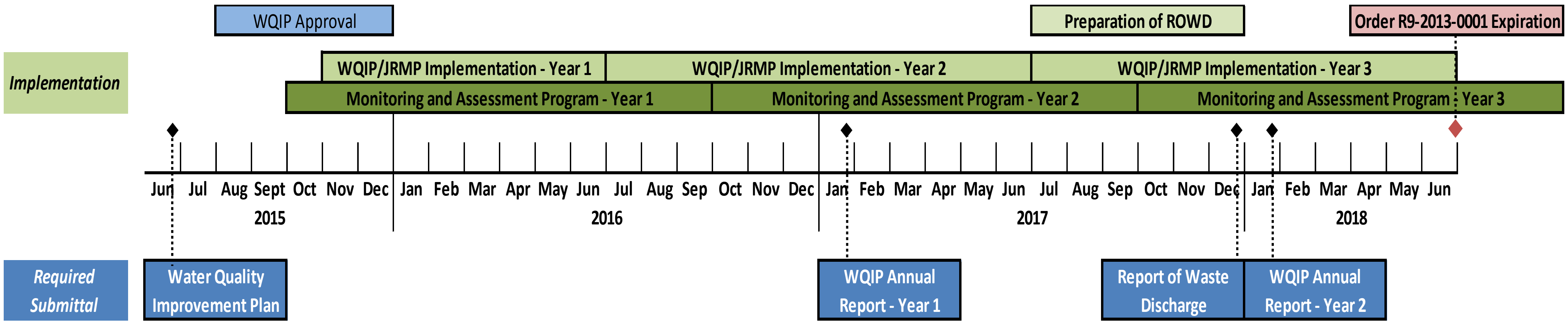

Figure 5-3. Water Quality Improvement Plan Assessment and Reporting Timeline

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CHAPTER 1 – APPENDIX A: DOCUMENT CROSSWALK

As part of the WQIP Development, the Participating Agencies have collaboratively crafted this document "crosswalk" to provide permit provision references to the corresponding WQIP document sections. This crosswalk is intended to ease the review process.

Permit Provision		Corresponding WQIP Document Section	
A.4 and B	Compliance with Discharge Prohibitions and Receiving Water Limitations	1.3.1	WQIP Requirements
		5.1	MS4 Permit Requirements: Iterative Approach and Adaptive Management
B.2	Priority Water Quality Conditions	2.	Priority Water Quality Conditions
B.2.a.	Assessment of Receiving Water Conditions	2.1	Assessment of Receiving Water Conditions
B.2.a.(1)	Receiving water listed as impaired…	2.1.1	CWA Section 303(d) List of Water Quality Limited Segments
B.2.a.(2)	TMDLs adopted and under development…	2.1.2	TMDLs Adopted and Under Development
B.2.a.(3)	Receiving water recognized as sensitive or highly valued…	2.1.3	Sensitive or Highly Valued Receiving Waters
B.2.a.(4)	The receiving water limitations…	2.1.4	Receiving Water Limitations of Provision A.2
B.2.a.(5)	Known historical versus current physical, chemical, and biological…	2.1.5	Known Historical Versus Current Physical, Chemical, and Biological Water Quality Conditions
B.2.a.(6)	Available, relevant, and appropriately collected and analyzed…receiving water monitoring data…	2.1.6	Physical, Chemical, and Biological Receiving Water Monitoring Data
B.2.a.(7)	Available evidence of erosional impacts…	2.1.7	Hydromodification
B.2.a.(8)	Available evidence of adverse impacts to…receiving waters…	2.1.8	Available Evidence of Adverse Impacts to the Chemical, Physical, and Biological Integrity of Receiving Waters
B.2.a.(9)	The potential improvements in the overall condition of the Watershed Management Area…	2.1.9	Potential Improvements That Can be Achieved in the WMA
B.2.b	Assessment of Impacts From MS4 Discharges	2.2	Assessment of Impacts from MS4 Discharges
B.2.b.(1)	The discharge prohibitions of Provision A.1 and ….Provision A.3…	2.2.1	Prohibitions and Limitations of Provisions A.1 and A.3
B.2.b.(2)	Available, relevant, and appropriately collected and analyzed stormwater monitoring data…	2.2.2	Available Monitoring Data from MS4 Outfalls
B.2.b.(3)	Locations of each Copermittee's MS4 outfalls…	2.2.3	MS4 Outfall Locations that Discharge to Receiving Waters
B.2.b.(4)	Locations of outfalls that are known to persistently discharge non-stormwater…	2.2.4	MS4 Outfalls with Persistent Non-Stormwater Flow
B.2.b.(5)	Locations of outfalls that are known to discharge pollutants in stormwater…	2.2.5	MS4 Outfalls with Stormwater Known to Discharge Pollutants Causing or Contributing to Impacts on Receiving Water Beneficial Uses

Permit Provision		Corresponding WQIP Document Section	
B.2.b.(6)	The potential improvements in the quality of discharges from the MS4…	2.2.6	Potential Improvements That Can be Achieved in MS4 Discharges
B.2.c.	Identification of Priority Water Quality Conditions	2.3	Identification of Priority Water Quality Conditions
		2.3.1	Process to Identify Priority and High Priority Water Quality Conditions
B.2.c.(1)	The Copermittees must use the information…to develop a list of priority water quality conditions…	2.3.2	Priority Water Quality Conditions
B.2.c.(2)	The Copermittees must identify the highest priority water quality conditions…	2.3.3	Highest Priority Water Quality Conditions
B.2.d.	Identification of MS4 Sources of Pollutants and/or Stressors	2.4	Identification of MS4 Sources of Pollutants and/or Stressors
B.2.d.(1)	Pollutant generating facilities, areas, and/or activities…	2.4.1	Pollutant Generating Facilities, Areas, and/or Activities
B.2.d.(2)	Locations of Copermittees' MS4…	2.4.2	Location of the Participating Agencies' MS4s
B.2.d.(3)	Other known and suspected sources of non-stormwater or pollutants in stormwater discharges…	2.4.3	Other Potential Sources
B.2.d.(4)	Review of available data...	2.4.4	Review of Available Data
B.2.d.(5)	The adequacy of available data to identify and prioritize sources…	2.4.5	Data Adequacy
B.2.e.	Identification of Potential Water Quality Improvement Strategies	App 3A	
B.2.e.(1)	Structural BMPs, non-structural BMPs, incentives, or programs…		
B.2.e.(2)	Retrofitting projects in areas of existing development…		
B.2.e.(3)	Stream, channel, and/or habitat rehabilitation projects…		
B.3.a	Water Quality Improvement Goals and Schedules	3.1	Water Quality Improvement Goals and Schedules
B.3.a.(1)	Numeric Goals	3.1.1 3.1.2 3.1.3 3.1.4	Compliance Pathways, TMDL Interim Goals Compliance Pathways, TMDL Final Goals Watershed Management Area Goals Goals for Caltrans
B.3.a.(2)	Schedules for Achieving Numeric Goals	3.1.5	Schedule for Compliance with Interim and Final Watershed Goals
B.3.b	Water Quality Improvement Strategies and Schedules	3.2	Water Quality Improvement Strategies
B.3.b.(1)	Jurisdictional Strategies	3.2.2 App 3B	Jurisdictional Strategies
B.3.b.(2)	Watershed Management Area Strategies	3.2.2.3	Optional Watershed Management Area Strategies
B.3.b.(3)	Schedules for Implementing Strategies	3.2.7	Schedules for Implementing Strategies
B.3.b.(4)	Optional Watershed Management Area Analysis	3.3	Optional Watershed Management Area Analysis

Permit Provision		Corresponding WQIP Document Section	
B.4.a	Water Quality Improvement Plan, Monitoring and Assessment Program	4.1.1	Monitoring to Assess Goals and Schedules
B.4.b	Incorporate the monitoring and assessment requirements of Provision D	4.1	Water Quality Improvement Plan Monitoring Program
B.4.c and Attachment E.6	TMDL Monitoring Revised TMDL for Indicator Bacteria, Project I – Twenty Beaches and Creeks in the San Diego Region (including Tecolote)	4.1.2.4	TMDL Monitoring
B.5	Iterative Approach and Adaptive Management Process	5	Iterative Approach and Adaptive Management Process
B.5.a	Re-Evaluation of Priority Water Quality Conditions, considering provisions B.5.a.(1)-B.5.a.(6)	5.2	Re-evaluation of Priority Water Quality Conditions (B.5.a)
B.5.b	Adaptation of Goals, Strategies and Schedules, considering provisions B.5.b.(1)-B.5.b.(10)	5.3	Adaptation of Goals, Strategies and Schedules
B.5.c	Adaptation of Monitoring and Assessment Program	5.4	Adaptation of Monitoring and Assessment Program
D	Monitoring and Assessment Program Requirements	4.1	Water Quality Improvement Plan Monitoring Program
D.1	Receiving Water Monitoring Requirements	4.1.2	Receiving Water Monitoring
D.1.(b)	Long-Term Receiving Water Monitoring Stations	4.1.2.1	Long-term Receiving Water Monitoring
D.1.(c)	Dry Weather Receiving Water Monitoring	4.1.2.1	Long-term Receiving Water Monitoring
D.1.(d)	Wet Weather Receiving Water Monitoring	4.1.2.1	Long-term Receiving Water Monitoring
D.1.(e)(1)	Regional Monitoring	4.1.2.2	Regional Monitoring Participation
D.1.(e)(2)	Sediment Quality Monitoring	4.1.2.3	Sediment Quality Monitoring
D.2	MS4 Outfall Discharge Monitoring	4.1.3	Storm Drain Outfall Monitoring
D.2.(b)	Dry Weather MS4 Outfall Monitoring	4.1.3.1	Storm Drain Outfall Dry Weather Monitoring
D.2.(c)	Wet Weather MS4 Outfall Monitoring	4.1.3.2	Storm Drain Outfall Wet Weather Monitoring
D.3	Special Studies, with requirements D.3.(a)-D.3.(f)	4.1.4	Special Studies
D.4	Assessment Requirements	4.2	Water Quality Improvement Plan Assessment Program
D.4.(a)	Receiving Waters Assessments	4.2	Water Quality Improvement Plan Assessment Program
D.4.(b)	MS4 Outfall Discharges Assessments	4.2	Water Quality Improvement Plan Assessment Program
D.4.(c)	Special Studies Assessments	4.2	Water Quality Improvement Plan Assessment Program
D.4.(d)	Integrated Assessment of Water Quality Improvement Plan	4.2	Water Quality Improvement Plan Assessment Program

Permit Provision		Corresponding WQIP Document Section	
E.2	Illicit Discharge Detection and Elimination (IDDE)	4.1.5	IDDE Program
F.1	Water Quality Improvement Plans Reporting	1.3.2	Reporting Requirements
F.1.a.(1)	Public Participation Process	1.4.2	Public Participation
F.1.a.(2)	Priority Water Quality Conditions	1.4.2.1	Public Participation
F.1.a.(3)	Water Quality Improvement Goals, Strategies and Schedules	1.4.2.2	Public Participation
F.3	Progress Reporting	4.2	Water Quality Improvement Plan Assessment Program
F.4	Regional Clearinghouse	4.1.6	Regional Clearinghouse

Chapter 2 – Appendix A: San Luis Rey River Watershed, CWA Section 303(d) Listings

LIST OF APPENDICES FOR CHAPTER 2

Chapter 2 – Appendix A: 303(d) List of Water Quality Limited Segments in the San Luis Rey River Watershed

Table 2A- 1. Section 303(d) List of Water Quality Limited Segments in the SLR WMA

Sub Watershed	Waterbody Name (* Urban Runoff is listed as a Potential Source)	Water body Type	Estimated Extent Affected	Unit	Pollutant	Potential Sources	Source Category	Impacted Beneficial Use based on 2010 Integrated Report Line of Evidence	Existing Beneficial Uses for the waterbody from the Basin Plan
Lower San Luis HA (903.1)	Guajome Lake	Lake & Reservoir	33	Acres	Eutrophic	Point Source	Unspecified Point Source	Warm Freshwater Habitat	--
						Nonpoint Source	Unspecified Nonpoint Source		
Lower San Luis HA (903.1)	Keys Creek	River & Stream	13	Miles	Selenium	Source Unknown	Source Unknown	Warm Freshwater Habitat	MUN; AGR; IND; REC1; REC2; WARM; WILD
Lower San Luis HA (903.1)	Pacific Ocean Shoreline, San Luis Rey HU, at San Luis Rey River mouth*	Coastal & Bay Shoreline	0	Miles	Enterococcus	Unknown Point Source	Unspecified Point Source	Water Contact Recreation	REC1; REC2; WILD; RARE; MAR; MIGR
						Unknown Nonpoint Source	Unspecified Nonpoint Source		
						Urban Runoff/Storm Sewers	Urban Runoff		
					Total Coliform	Urban Runoff/Storm Sewers	Urban Runoff	Water Contact Recreation	
						Unknown Nonpoint Source	Unspecified Nonpoint Source		
						Unknown Point Source	Unspecified Point Source		
Lower San Luis HA (903.1)	San Luis Rey River, Lower (west of Interstate 15)*	River & Stream	19	Miles	Chloride	Unknown Nonpoint Source	Unspecified Nonpoint Source	Municipal & Domestic Supply	MUN; AGR; IND; REC1; WARM; WILD; RARE
						Unknown Point Source	Unspecified Point Source		
						Urban Runoff/Storm Sewers	Urban Runoff		

Sub Watershed	Waterbody Name (* Urban Runoff is listed as a Potential Source)	Water body Type	Estimated Extent Affected	Unit	Pollutant	Potential Sources	Source Category	Impacted Beneficial Use based on 2010 Integrated Report Line of Evidence	Existing Beneficial Uses for the waterbody from the Basin Plan
					Enterococcus	Unknown Nonpoint Source	Unspecified Nonpoint Source	Water Contact Recreation	
						Source Unknown	Source Unknown		
						Unknown Point Source	Unspecified Point Source		
					Fecal Coliform	Unknown Nonpoint Source	Unspecified Nonpoint Source	Water Contact Recreation	
						Unknown Point Source	Unspecified Point Source		
						Urban Runoff/Storm Sewers	Urban Runoff		
					Phosphorus	Urban Runoff/Storm Sewers	Urban Runoff	Warm Freshwater Habitat	
						Unknown Nonpoint Source	Unspecified Nonpoint Source		
						Unknown Point Source	Unspecified Point Source		
					Total Dissolved Solids	Unknown Point Source	Unspecified Point Source	Agricultural Supply	
						Flow Regulation/Modification	Hydromodification		
						Unknown Nonpoint Source	Unspecified Nonpoint Source		
						Urban Runoff/Storm Sewers	Urban Runoff		

Sub Watershed	Waterbody Name (* Urban Runoff is listed as a Potential Source)	Water body Type	Estimated Extent Affected	Unit	Pollutant	Potential Sources	Source Category	Impacted Beneficial Use based on 2010 Integrated Report Line of Evidence	Existing Beneficial Uses for the waterbody from the Basin Plan
						Surface Mining	Resource Extraction		
						Natural Sources	Natural Sources		
						Golf course activities	Recreation Areas And Activities		
						Agriculture-storm runoff	Agriculture		
						Industrial Point Sources	Industrial Wastewater		
					Total Nitrogen as N	Urban Runoff/Storm Sewers	Urban Runoff	Warm Freshwater Habitat	
						Unknown Nonpoint Source	Unspecified Nonpoint Source		
						Unknown Point Source	Unspecified Point Source		
					Toxicity	Unknown Nonpoint Source	Unspecified Nonpoint Source	Warm Freshwater Habitat	
						Unknown Point Source	Unspecified Point Source		
						Urban Runoff/Storm Sewers	Urban Runoff		
Lower San Luis HA (903.1)	San Luis Rey River, Upper (east of Interstate 15)	River & Stream	7	Miles	Total Nitrogen as N	Unknown Nonpoint Source	Unspecified Nonpoint Source	Warm Freshwater Habitat	AGR; IND; REC1; REC2; WARM; WILD

Sub Watershed	Waterbody Name (* Urban Runoff is listed as a Potential Source)	Water body Type	Estimated Extent Affected	Unit	Pollutant	Potential Sources	Source Category	Impacted Beneficial Use based on 2010 Integrated Report Line of Evidence	Existing Beneficial Uses for the waterbody from the Basin Plan
Monserate HA (903.2)	San Luis Rey River, Upper (east of Interstate 15)	River & Stream	28	Miles	Total Nitrogen as N	Unknown Nonpoint Source	Unspecified Nonpoint Source	Warm Freshwater Habitat	MUN; AGR; IND; POW; REC1; REC2; WARM; COLD; WILD; SPWN

Chapter 2 – Appendix B: TMDL WQBELS for the San Luis Rey River Watershed

Table 2B-1. (Order No. R9-2013-0001, Attachment E, Table 6.2c) Final Effluent Limitations Expressed as Bacteria Densities and Allowable Exceedance Frequencies in MS4 Discharges to the Water Body

Constituent	Concentration-Based Effluent Limitations			
	Single Sample Maximum[a,b] (MPN/100ml)	Single Sample Maximum Allowable Exceedance Frequency[c]	30-Day Geometric Mean[b] (MPN/100mL)	30-Day Geometric Mean Allowable Exceedance Frequency
Total Coliform[d]	10,000	22%	1,000	0%
Fecal Coliform	400	22%	200	0%
Enterococcus	104[e] / 61[f]	22%	35[e] / 33[f]	0%

Notes:

a. During wet weather days, only the single sample maximum effluent limitations are required to be achieved.

b. During dry weather days, the single sample maximum and 30-day geometric mean effluent limitations are required to be achieved.

c. The 22% single sample maximum allowable exceedance frequency only applies to wet weather days. For dry weather days, the dry weather bacteria densities must be consistent with the single sample maximum REC-1 water quality objectives in the Ocean Plan for discharges to beaches, and the Basin Plan for discharges to creeks and creek mouths.

d. Total coliform effluent limitations only apply to MS4 outfalls that discharge to the Pacific Ocean Shorelines and creek mouths listed in Table 6.0.

e. This Enterococcus effluent limitation applies to MS4 discharges to segments of areas of Pacific Ocean Shoreline listed in Table 6.0.

f. This Enterococcus effluent limitation applies to MS4 discharges to segments or areas of creeks or creek mouths listed in Table 6.0.

Table 2B-2. (Order No. R9-2013-0001, Attachment E, Table 6.3) Final Effluent Limitations Expressed as Percent Load Reductions* in MS4 Discharges to the Water Body

Watershed Management Areas	Watershed and Water Bodies	Load-Based Effluent Limitations					
		Dry Weather			Wet Weather		
		Total Coliform	Fecal Coliform	Enterococcus	Total Coliform	Fecal Coliform	Enterococcus
San Luis Rey River	San Luis Rey HU (903.00) - Pacific Ocean Shoreline	38.13%	39.09%	87.38%	5.62%	3.12%	11.69%

Table 2B-3. (Order No. R9-2013-0001, Attachment E, Table 6.5) Interim Wet Weather Receiving Water Limitations Expressed as Interim Wet Weather Allowable Exceedance Frequencies

Watershed Management Area and Watershed	Water Body	Segment or Area	Interim Wet Weather Allowable Exceedance Frequencies		
			Total Coliform	Fecal Coliform	Enterococcus
San Luis Rey River San Luis Rey HU (903.00)	Pacific Ocean Shoreline	at San Luis Rey River mouth	45%	44%	47%

Chapter 2 – Appendix C: Detailed MS4 Summary Data Tables

Table 2C-1. Dry Weather MS4 Outfall Data Summary (LTEA AND RMRs)

WMA				San Luis Rey River Watershed Management Area																																				
HA				Lower San Luis Rey (903.1)																												Monserate (903.2)							Warner Valley (903.3)	
Subwatershed				Mission (903.11)						Bonsall (903.12)						Moosa (903.13)						Valley Center (903.14)					Woods (903.15)	Rincon (903.16)				Pala (903.21)					Pauma (903.22)	La Jolla Amago (903.23)	Warner (903.31)	Combs (903.32)
Data Source				2010 LTEA		2011 RMR		2012 RMR		2010 LTEA		2011 RMR		2012 RMR		2010 LTEA		2011 RMR		2012 RMR		2010 LTEA	2011 RMR		2012 RMR		NA	2010 LTEA	2011 RMR		2012 RMR	2010 LTEA		2011 RMR		2012 RMR	NA	NA	NA	NA
Parameter	Units	Dry Weather Water Quality Benchmark	Benchmark Source	n	% > Criteria	n	% > Criteria	n	% > Criteria	n	% > Criteria	n	% > Criteria	n	% > Criteria	n	% > Criteria	n	% > Criteria	n	% > Criteria	% > Criteria	n	% > Criteria	n	% > Criteria	NA	NA	n	% > Criteria	NA	n	% > Criteria	n	% > Criteria	NA	NA	NA	NA	NA
pH	pH units	6.5-9.0	1. Basin Plan	7	0%	5	0%	6	0%	4	0%	5	0%	5	0%	2	0%	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	0	0%	NA	1	0%	0	NA	NA	NA	NA	NA	NA
Nitrate as N	mg/L	10	1. Basin Plan	3	0%	5	20%	6	17%	22	14%	19	21%	9	**33%**	6	17%	6	0%	3	0%	NA	1	0%	1	0%	NA	NA	1	**100%**	NA	3	**100%**	1	**100%**	NA	NA	NA	NA	NA
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	1	0%	0	NA	0	NA	4	25%	5	**40%**	10	**30%**	2	0%	0	NA	3	0%	NA	0	NA	1	0%	NA	NA	0	**100%**	NA	1	**100%**	0	NA	NA	NA	NA	NA	NA
Nitrite as N	mg/L	1	1. Basin Plan	3	0%	5	0%	6	0%	22	0%	19	0%	10	10%	6	0%	6	0%	3	0%	NA	1	0%	1	0%	NA	NA	1	0%	NA	3	0%	1	0%	NA	NA	NA	NA	NA
Total Nitrogen	mg/L	NA	1. Basin Plan	7	**100%**	5	**100%**	6	**67%**	22	**91%**	19	**95%**	10	**90%**	6	**100%**	6	**83%**	3	**100%**	NA	1	**100%**	1	**100%**	NA	NA	1	**100%**	NA	3	**100%**	1	**100%**	NA	NA	NA	NA	NA
Total Phosphorus	mg/L	2	1. Basin Plan 2. MSGP	7	**100%**	5	**60%**	6	**83%**	22	**68%**	19	**84%**	10	**90%**	6	**50%**	6	**100%**	3	**100%**	NA	1	**100%**	1	**100%**	NA	NA	1	**100%**	NA	3	**67%**	1	**100%**	NA	NA	NA	NA	NA
Dissolved Phosphorous	mg/L	0.1	1. Basin Plan 2. MSGP	0	NA	0	NA	0	NA	0	NA	14	**64%**	4	**100%**	0	NA	6	**67%**	3	**100%**	NA	1	**100%**	1	**100%**	NA	NA	0	NA	NA	0	NA	1	0%	NA	NA	NA	NA	NA
Total Suspended Solids	mg/L	100	2. MSGP, 5. NSQD	1	0%	0	NA	0	NA	5	20%	5	20%	6	17%	4	25%	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	1	0%	NA	1	0%	1	**100%**	NA	NA	NA	NA	NA
Total Dissolved Solids	mg/L	500	1. Basin Plan	7	**100%**	5	**100%**	6	**100%**	22	**100%**	19	**100%**	9	**100%**	6	**100%**	6	**100%**	3	**100%**	NA	1	**100%**	1	**100%**	NA	NA	1	**100%**	NA	3	**100%**	1	**100%**	NA	NA	NA	NA	NA
Fecal Coliform	MPN/100 mL	400	1. Basin Plan	7	**71%**	5	**80%**	6	**100%**	22	**36%**	19	**37%**	10	**80%**	6	**33%**	6	**67%**	3	33%	NA	1	**100%**	1	0%	NA	NA	1	0%	NA	3	**33%**	1	**100%**	NA	NA	NA	NA	NA
Enterococcus	MPN/100 mL	151	1. Basin Plan	7	**100%**	5	**100%**	6	**100%**	22	**68%**	19	**84%**	10	**100%**	6	**50%**	6	**83%**	3	**100%**	NA	1	**100%**	1	0%	NA	NA	1	**100%**	NA	3	**100%**	1	**100%**	NA	NA	NA	NA	NA
Total Coliform	MPN/100 mL	NA	1. Basin Plan	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	0	NA	NA	0	NA	0	NA	NA	NA	NA	NA	NA
Ammonia-N	mg/L	CCC (Salmonids Absent)	3. U.S. EPA Water Quality Criteria (Freshwater)	2	0%	5	**60%**	6	17%	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	0	NA	NA	0	NA	0	NA	NA	NA	NA	NA	NA
Turbidity	NTU	20	1. Basin Plan	6	0%	5	0%	6	0%	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	0	NA	NA	0	NA	0	NA	NA	NA	NA	NA	NA
Chloride	mg/L	250	1. Basin Plan	6	**67%**	5	**60%**	6	**50%**	18	**78%**	14	**79%**	4	**75%**	4	25%	6	**67%**	3	**100%**	NA	1	**100%**	1	0%	NA	NA	0	NA	NA	2	0%	1	**100%**	NA	NA	NA	NA	NA
Total Selenium	mg/L	0.005	4. 40 CFR 131.38	0	NA	0	NA	0	NA	1	0%	1	0%	0	NA	2	0%	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	0	NA	NA	0	NA	0	NA	NA	NA	NA	NA	NA
Oil & Grease	mg/L	10	1 Basin Plan, 2. MSGP	0	NA	0	NA	0	NA	3	0%	1	0%	0	NA	0	NA	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	0	NA	NA	0	NA	0	NA	NA	NA	NA	NA	NA
Dissolved Oxygen	mg/L	<5	1. Basin Plan	6	0%	5	20%	6	17%	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	NA	0	NA	0	NA	NA	NA	0	NA	NA	0	NA	0	NA	NA	NA	NA	NA	NA

Notes:

NA - No criteria or published value was available or applicable to the matrix or program.

*One station was used in the summary

Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

100%	Bold with gray shading indicates high priority conditions (greater than 50% of results above benchmark)
40%	Gray shading alone indicates medium priority (between 25% and 50% of results above benchmark).
0%	No shading indicates low priority (less than 25% of results above benchmark).

Sources:

1. San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
2. Multisector General Permit for Industrial Activities, Section 2, October 2000.
3. CCC - Criteria Continuous Concentration (chronic benchmark); water quality benchmark is based on CCC (early life stages present) using pH described in the USEPA Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
4. 40 CFR 131.38
5. Research Progress Report, Findings from the National Stormwater Quality Database, January, 2004.

Table 2C-2. Wet Weather MS4 Outfall Data Summary (LTEA AND RMRs)

WMA				San Luis Rey River Watershed Management Area																	San Luis Rey River Watershed Management Area							
HA				Lower San Luis Rey (903.1)																	Monserate (903.2)						Warner Valley (903.3)	
Subwatershed				Mission (903.11)					Bonsall (903.12)						Moosa (903.13)				Valley Center (903.14)		Pala (903.21)				Pauma (903.22)	La Jolla Amago (903.23)	Warner (903.31)	Combs (903.32)
Data Source				2010 LTEA		2011 RMR		2012 RMR	2010 LTEA		2011 RMR		2012 RMR		2010 LTEA	2011 RMR		2012 RMR	2010 LTEA	2011 RMR	2010 LTEA		2012 RMR	2011 RMR	NA	NA	NA	NA
Parameter	Units	Wet Weather Water Quality Benchmark	Source	n	% > Criteria	n	% > Criteria	% > Criteria	n	% > Criteria	n	% > Criteria	n	% > Criteria	% > Criteria	n	% > Criteria	% > Criteria	% > Criteria	% > Criteria	n	% > Criteria	% > Criteria	% > Criteria	% > Criteria	% > Criteria	% > Criteria	% > Criteria
pH	pH units	6.5-9.0	1. Basin Plan	2	**50%**	2	0%	NA	6	33%	4	0%	6	17%	NA	1	0%	NA	NA	NA	1	0%	NA	NA	NA	NA	NA	NA
Nitrate as N	mg/L	10	1. Basin Plan	2	0%	2	**50%**	NA	4	0%	4	25%	6	0%	NA	1	0%	NA	NA	NA	1	**100%**	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	2	0%	2	**50%**	NA	5	0%	4	25%	6	0%	NA	1	0%	NA	NA	NA	1	**100%**	NA	NA	NA	NA	NA	NA
Nitrite as N	mg/L	1	1. Basin Plan	2	0%	2	0%	NA	4	0%	4	0%	6	0%	**NA**	1	0%	NA	NA	NA	1	0%	NA	NA	NA	NA	NA	NA
Total Nitrogen	mg/L	NA	1. Basin Plan	0	NA	0	NA	NA	0	NA	0	NA	0	NA	NA	0	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA
Total Phosphorus	mg/L	2	1. Basin Plan 2. MSGP	2	0%	2	0%	NA	6	0%	4	0%	6	0%	NA	1	0%	NA	NA	NA	1	0%	NA	NA	NA	NA	NA	NA
Dissolved Phosphorous	mg/L	2	1. Basin Plan, 2. MSGP	0	NA	1	0%	NA	0	NA	4	NA	0	NA	NA	1	NA	NA	NA	NA	1	0%	NA	NA	NA	NA	NA	NA
Total Suspended Solids	mg/L	100	2. MSGP, 3. NSQD	2	0%	2	**50%**	NA	6	**50%**	4	25%	6	**33%**	NA	1	0%	NA	NA	NA	1	0%	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (calculated	mg/L	500	1. Basin Plan	2	0%	2	**100%**	NA	6	**33%**	4	**100%**	6	**33%**	NA	1	**100%**	NA	NA	NA	1	**100%**	NA	NA	NA	NA	NA	NA
Fecal Coliform	MPN/100 mL	400	1. Basin Plan	2	**100%**	2	**50%**	NA	6	**83%**	4	**50%**	6	**100%**	NA	1	**100%**	NA	NA	NA	1	**100%**	NA	NA	NA	NA	NA	NA

Notes:

NA - No criteria or published value was available or applicable to the matrix or program.

*One station was used in the summary

Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

100%	Bold with gray shading indicates high priority conditions (greater than 50% of results above benchmark)
40%	Gray shading alone indicates medium priority (between 25% and 50% of results above benchmark).
0%	No shading indicates low priority (less than 25% of results above benchmark).

Sources:

1. San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
2. Multisector General Permit for Industrial Activities, Section 2, October 2000.
3. Research Progress Report, Findings from the National Stormwater Quality Database, January, 2004.

Chapter 2 – Appendix D: Priority and Highest Priority Water Quality Conditions

Table 2D-1. Priority and Highest Priority Water Quality Conditions Table for Dry Weather

Priority Conditions Assessment - Step 3

1 Sub Watershed	2 Extent (water body name) B.2.C.(1)(b)	3 Condition or Pollutant	4 Condition observed in SLR WMA Yes - 1 No - 0	Criterion Score	5 Impaired Beneficial Use B.2.c.(1)(a) Yes - 1 No - 0	Criterion Score	6 Exceeds LTEA/RMR Benchmarks Yes - 1 No - 0	Criterion Score	7 Potential sources (2010 Integrated Report)	8 MS4 Discharge that may contribute to condition B.2.c.(1)(d) Yes - 1 No - 0	Criterion Score	9 Monitoring data and data gaps B.2.c(1)(e)/Other Rationale Yes - 1 No - 0	Criterion Score	Criteria Tally 4 - PWQC 5 - Potential HPWQC	10 PWQC?
Lower San Luis HA	Guajome Lake	Eutrophic	Yes	1	Warm Freshwater Habitat	1	Yes	1	Point Source; Nonpoint Source	Yes. Based on Guajome Lake Water Quality Monitoring Report (2005-2012)	1	Eutrophic - priority condition based Guajome Lake Water Quality Monitoring Report (2005-2012)	1	5	Yes
Lower San Luis HA	Keys Creek	Selenium	Yes	1	Warm Freshwater Habitat	1	No	0	Source Unknown	No Evidence	0	Inconclusive monitoring data to link MS4 outfall data to receiving water condition	0	2	No
Lower San Luis HA	Pacific Ocean Shoreline, San Luis Rey HU, at San Luis Rey River mouth	Enterococcus	Yes	1	Water Contact Recreation	1	Yes	1	Unknown Point Source; Unknown Nonpoint Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Indicator Bacteria TMDL, effective 4/2011	1	5	Yes
Lower San Luis HA	Pacific Ocean Shoreline, San Luis Rey HU, at San Luis Rey River mouth	Total Coliform	Yes	1	Water Contact Recreation	1	Yes	1	Urban Runoff/Storm Sewers; Unknown Nonpoint Source; Unknown Point Source	Yes. Urban runoff/storm sewers listed as a source	1	Indicator Bacteria TMDL, effective 4/2011	1	5	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Chloride	Yes	1	Municipal & Domestic Supply	1	Yes	1	Unknown Nonpoint Source; Unknown Point Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Chloride - Priority condition common to both MS4 outfall and receiving waters, based on data from SMC program	1	5	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Enterococcus	Yes	1	Water Contact Recreation	1	Yes	1	Unknown Nonpoint Source; Source Unknown; Unknown Point Source	Yes. Enterococcus is a priority condition in monitoring data from MS4 outfalls based on FY10-11 Regional Monitoring Report	1	Enterococcus - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-MLS and SLR-TWAS2 (NPDES Program; Third-Party Data)	1	5	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Fecal Coliform	Yes	1	Water Contact Recreation	1	Yes	1	Unknown Nonpoint Source; Unknown Point Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Fecal coliform - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-MLS and SLR-TWAS-2 (NPDES Program)	1	5	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Phosphorus	Yes	1	Warm Freshwater Habitat	1	Yes	1	Urban Runoff/Storm Sewers; Unknown Nonpoint Source; Unknown Point Source	Yes. Urban runoff/storm sewers listed as a source	1	Phosphorous - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-MLS and SLR-TWAS-2 (NPDES Program; SMC Program)	1	5	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Total Dissolved Solids	Yes	1	Agricultural Supply	1	Yes	1	Unknown Point Source; Flow Regulation/Modification; Unknown Nonpoint Source; Urban Runoff/Storm Sewers; Surface Mining; Natural Sources; Golf course activities; Agriculture-storm runoff; Industrial Point Sources	Yes. Urban runoff/storm sewers listed as a source	1	TDS - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-MLS and SLR-TWAS-2 (NPDES Program; SMC Program)	1	5	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Total Nitrogen as N	Yes	1	Warm Freshwater Habitat	1	Yes	1	Urban Runoff/Storm Sewers; Unknown Nonpoint Source; Unknown Point Source	Yes. Urban runoff/storm sewers listed as a source	1	Total Nitrogen - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-MLS and SLR-TWAS-2 (NPDES Program; SMC Program)	1	5	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Toxicity	Yes	1	Warm Freshwater Habitat	1	Yes	1	Unknown Nonpoint Source; Unknown Point Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Toxicity was not observed to be a priority condition in the monitoring data	0	4	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	IBI	Yes	1	N/A	0	Yes	1	N/A	Yes. Urban runoff/storm sewers as source of Flow Regulation/Modification	1	Poor IBI scores noted in LTEA and RMR	1	4	Yes
Lower San Luis HA	San Luis Rey River, Upper (east of Interstate 15)	Total Nitrogen as N	Yes	1	Warm Freshwater Habitat	1	Yes	1	Unknown Nonpoint Source	Yes. Total Nitrogen is a priority condition in monitoring data from MS4 outfalls based on FY10-11 Regional Monitoring Report	1	Total Nitrogen - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-TWAS-1 (NPDES Program; SMC Program)	1	5	Yes
Monserate HA	San Luis Rey River, Upper (east of Interstate 15)	Total Nitrogen as N	Yes	1	Warm Freshwater Habitat	1	Yes	1	Unknown Nonpoint Source	Yes. Total Nitrogen is a priority condition in monitoring data from MS4 outfalls based on FY10-11 Regional Monitoring Report	1	Total Nitrogen - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-TWAS-1 (NPDES Program; SMC Program)	1	5	Yes

Highest Priority Conditions Assessment - Step 4

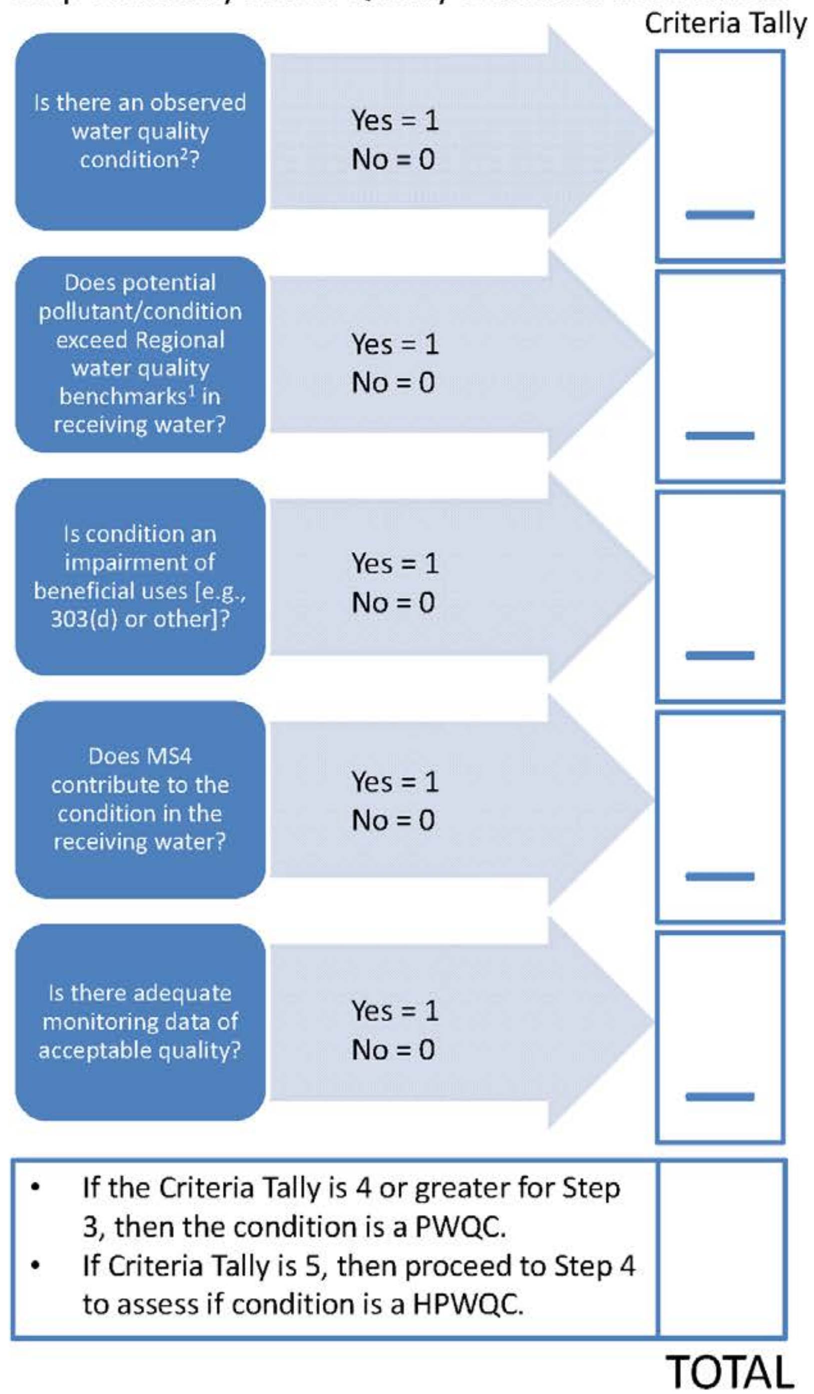
1 Sub Watershed	2 Extent (water body name) B.2.C.(1)(b)	3 Condition or Pollutant	11 Approved TMDL Yes - HPWQC No - Continue	12 Spatially Appropriate and Robust Dataset Yes -1 No -0	Criterion Score	13 Non-storm water as predominant source Yes - 1 No - 0	Criterion Score	14 Sources controllable by MS4 Agency Yes - 1 No -1	Criterion Score	Criteria Tally 3- HPWQC	15 HPWQC?
Lower San Luis HA	Guajome Lake	Eutrophic	No	Yes	1	No	0	No	0	1	No
Lower San Luis HA	Keys Creek	Selenium	No	--	--	--	--	--	--	--	No
Lower San Luis HA	Pacific Ocean Shoreline, San Luis Rey HU, at San Luis Rey River mouth	Enterococcus	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	Pacific Ocean Shoreline, San Luis Rey HU, at San Luis Rey River mouth	Total Coliform	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Chloride	No	No	0	No	0	No	0	0	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Enterococcus	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Fecal Coliform	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Phosphorus	No	Yes	1	No	0	No	0	1	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Total Dissolved Solids	No	Yes	1	No	0	No	0	1	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Total Nitrogen as N	No	Yes	1	No	0	No	0	1	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Toxicity	No	--	--	--	--	--	--	--	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	IBI	No	--	--	--	--	--	--	--	No
Lower San Luis HA	San Luis Rey River, Upper (east of Interstate 15)	Total Nitrogen as N	No	Yes	1	No	0	No	0	1	No
Monserate HA	San Luis Rey River, Upper (east of Interstate 15)	Total Nitrogen as N	No	Yes	1	No	0	No	0	1	No

Table 2D-2. Priority and Highest Priority Water Quality Conditions Table for Wet Weather

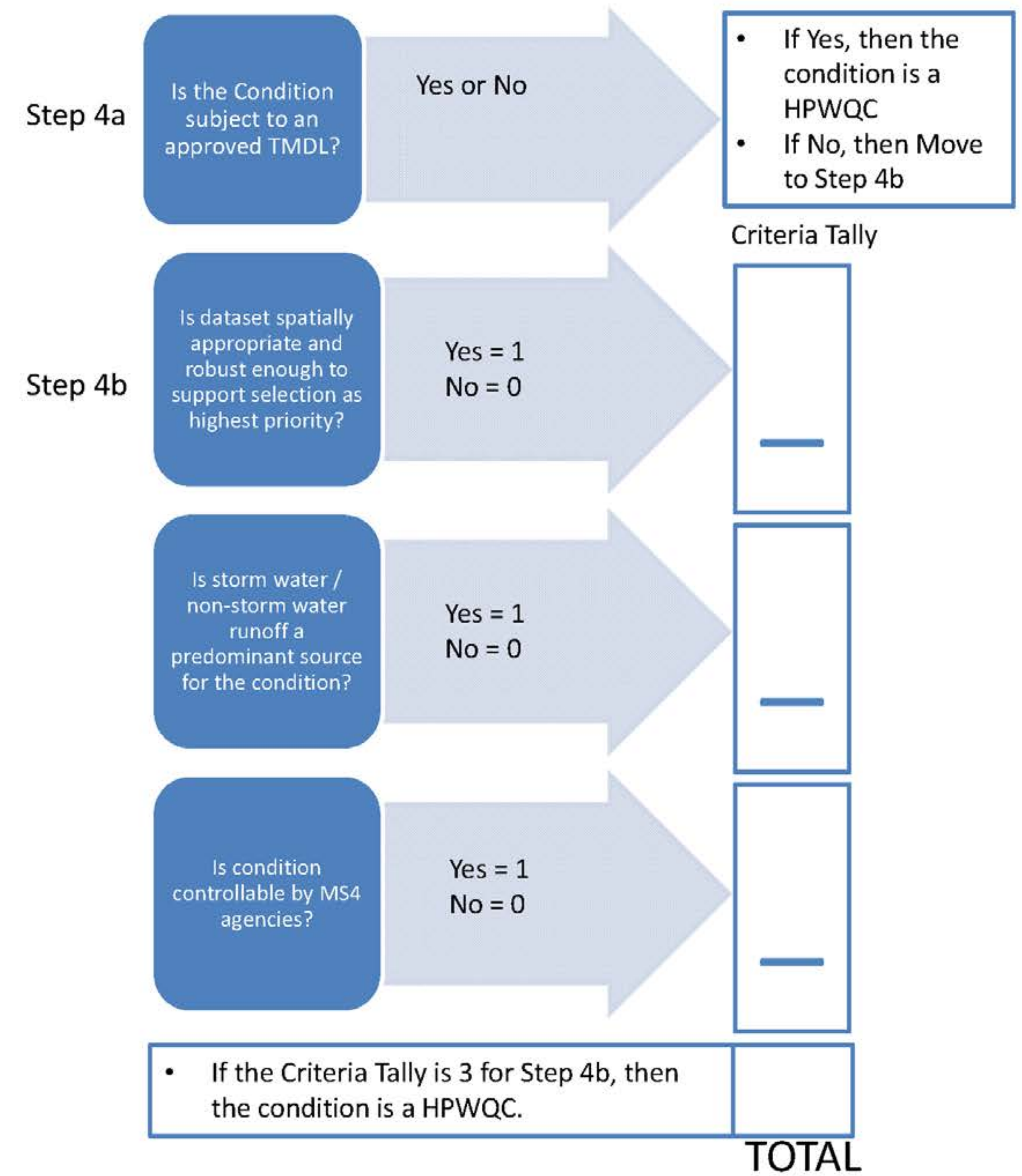
Priority Conditions Assessment - Step 3																Highest Priority Conditions Assessment - Step 4								
1	2	3	4		5		6		7	8		9			10	11	12		13		14			15
Sub Watershed	Extent (water body name) B.2.C.(1)(b)	Condition or Pollutant	Condition observed in SLR WMA Yes - 1 No - 0	Criterion Score	Impaired Beneficial Use B.2.c.(1)(a) Yes - 1 No - 0	Criterion Score	Exceeds LTEA/RMR Benchmarks Yes - 1 No - 0	Criterion Score	Potential sources (2010 Integrated Report)	MS4 Discharge that may contribute to condition B.2.c.(1)(d) Yes - 1 No - 0	Criterion Score	Monitoring data and data gaps B.2.c(1)(e)/Other Rationale Yes - 1 No - 0	Criterion Score	Criteria Tally 4 - PWQC 5 - Potential HPWQC	PWQC?	Approved TMDL Yes - HPWQC No - Continue	Spatially Appropriate and Robust Dataset Yes -1 No -0	Criterion Score	Storm water as predominant source Yes - 1 No - 0	Criterion Score	Sources controllable by MS4 Agency Yes - 1 No -1	Criterion Score	Criteria Tally 3 - HPWQC	HPWQC?
Lower San Luis HA	Guajome Lake	Eutrophic	Yes	1	Warm Freshwater Habitat	1	Yes	1	Point Source; Nonpoint Source	No Evidence	0	Did not equal or exceed Regional Monitoring Workgroup benchmarks	0	3	No	--	--	--	--	--	--	--	--	No
Lower San Luis HA	Keys Creek	Selenium	Yes	1	Warm Freshwater Habitat	1	Yes	1	Source Unknown	No Evidence	0	Inconclusive monitoring data to link MS4 outfall data to receiving water condition	0	3	No	--	--	--	--	--	--	--	--	No
Lower San Luis HA	Pacific Ocean Shoreline, San Luis Rey HU, at San Luis Rey River mouth	Enterococcus	Yes	1	Water Contact Recreation	1	Yes	1	Unknown Point Source; Unknown Nonpoint Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Indicator Bacteria TMDL, effective 4/2011	1	5	Yes	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	Pacific Ocean Shoreline, San Luis Rey HU, at San Luis Rey River mouth	Total Coliform	Yes	1	Water Contact Recreation	1	Yes	1	Urban Runoff/Storm Sewers; Unknown Nonpoint Source; Unknown Point Source	Yes. Urban runoff/storm sewers listed as a source	1	Indicator Bacteria TMDL, effective 4/2011	1	5	Yes	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Chloride	Yes	1	Municipal & Domestic Supply	1	No	0	Unknown Nonpoint Source; Unknown Point Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Inconclusive monitoring data to link MS4 outfall data to receiving water condition	0	3	No	--	--	--	--	--	--	--	--	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Enterococcus	Yes	1	Water Contact Recreation	1	Yes	1	Unknown Nonpoint Source; Source Unknown; Unknown Point Source	Yes. Urban runoff/storm sewers implicated as a source	1	Random MS4 monitoring data indicates condition present	1	5	Yes	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Fecal Coliform	Yes	1	Water Contact Recreation	1	Yes	1	Unknown Nonpoint Source; Unknown Point Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Fecal coliform - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-MLS and SLR-TWAS-2 (NPDES Program)	1	5	Yes	Yes	--	--	--	--	--	--	--	Yes
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Phosphorus	Yes	1	Warm Freshwater Habitat	1	Yes	1	Urban Runoff/Storm Sewers; Unknown Nonpoint Source; Unknown Point Source	Yes. Urban runoff/storm sewers listed as a source	1	Did not equal or exceed Regional Monitoring Workgroup benchmarks	0	4	Yes	--	--	--	--	--	--	--	--	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Total Dissolved Solids	Yes	1	Agricultural Supply	1	Yes	1	Unknown Point Source; Flow Regulation/Modification; Unknown Nonpoint Source; Urban Runoff/Storm Sewers; Surface Mining; Natural Sources; Golf course activities; Agriculture-storm runoff; Industrial Point Sources	Yes. Urban runoff/storm sewers listed as a source	1	TDS - Priority condition common to both MS4 outfall and receiving waters, based on FY10-11 Regional Monitoring Report from SLR-MLS and SLR-TWAS-2 (NPDES Program)	1	5	Yes	No	Yes	1	Yes	1	No	0	2	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Total Nitrogen as N	Yes	1	Warm Freshwater Habitat	1	Yes	1	Urban Runoff/Storm Sewers; Unknown Nonpoint Source; Unknown Point Source	Yes. Urban runoff/storm sewers listed as a source	1	Did not equal or exceed Regional Monitoring Workgroup benchmarks	0	4	Yes	--	--	--	--	--	--	--	--	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Toxicity	Yes	1	Warm Freshwater Habitat	1	Yes	1	Unknown Nonpoint Source; Unknown Point Source; Urban Runoff/Storm Sewers	Yes. Urban runoff/storm sewers listed as a source	1	Inconclusive monitoring data to link MS4 outfall data to receiving water condition	0	4	Yes	--	--	--	--	--	--	--	--	No
Lower San Luis HA	San Luis Rey River, Lower (west of Interstate 15)	Trash	Yes	1	N/A	0	N/A	0	Urban Runoff/Storm Sewers	Yes. Urban Runoff/Storm Sewers	1	Trash monitoring data not available	0	2	No	--	--	--	--	--	--	--	--	No
Lower San Luis HA	San Luis Rey River, Upper (east of Interstate 15)	Total Nitrogen as N	Yes	1	Warm Freshwater Habitat	1	Yes	1	Unknown Nonpoint Source	No Evidence	0	Did not equal or exceed Regional Monitoring Workgroup benchmarks	0	3	No	--	--	--	--	--	--	--	--	No
Monserate HA	San Luis Rey River, Upper (east of Interstate 15)	Total Nitrogen as N	Yes	1	Warm Freshwater Habitat	1	Yes	1	Unknown Nonpoint Source	No Evidence	0	Did not equal or exceed Regional Monitoring Workgroup benchmarks	0	3	No	--	--	--	--	--	--	--	--	No
Monserate HA	San Luis Rey River, Upper (east of Interstate 15)	Hydromodification	Yes	1	N/A	0	N/A	0	Urban Runoff/Storm Sewers	Yes. Urban Runoff/Storm Sewers	1	Evidence of impacts from urban storm water discharges	1	3	No	--	--	--	--	--	--	--	--	No

CHAPTER 2 – APPENDIX E: PRIORITIZATION METHODOLOGY

Step 3: Priority Water Quality Condition Assessment[3]

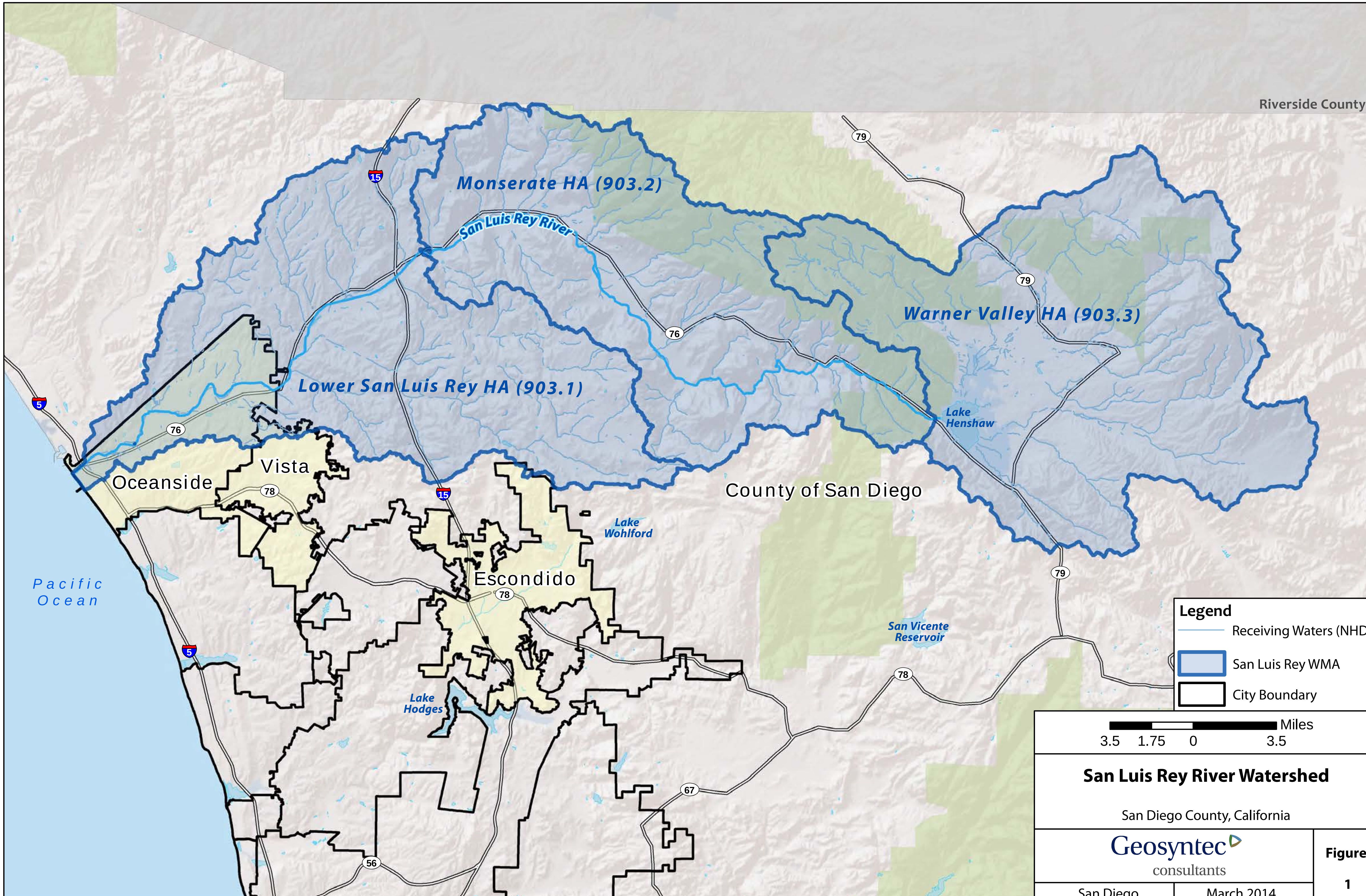


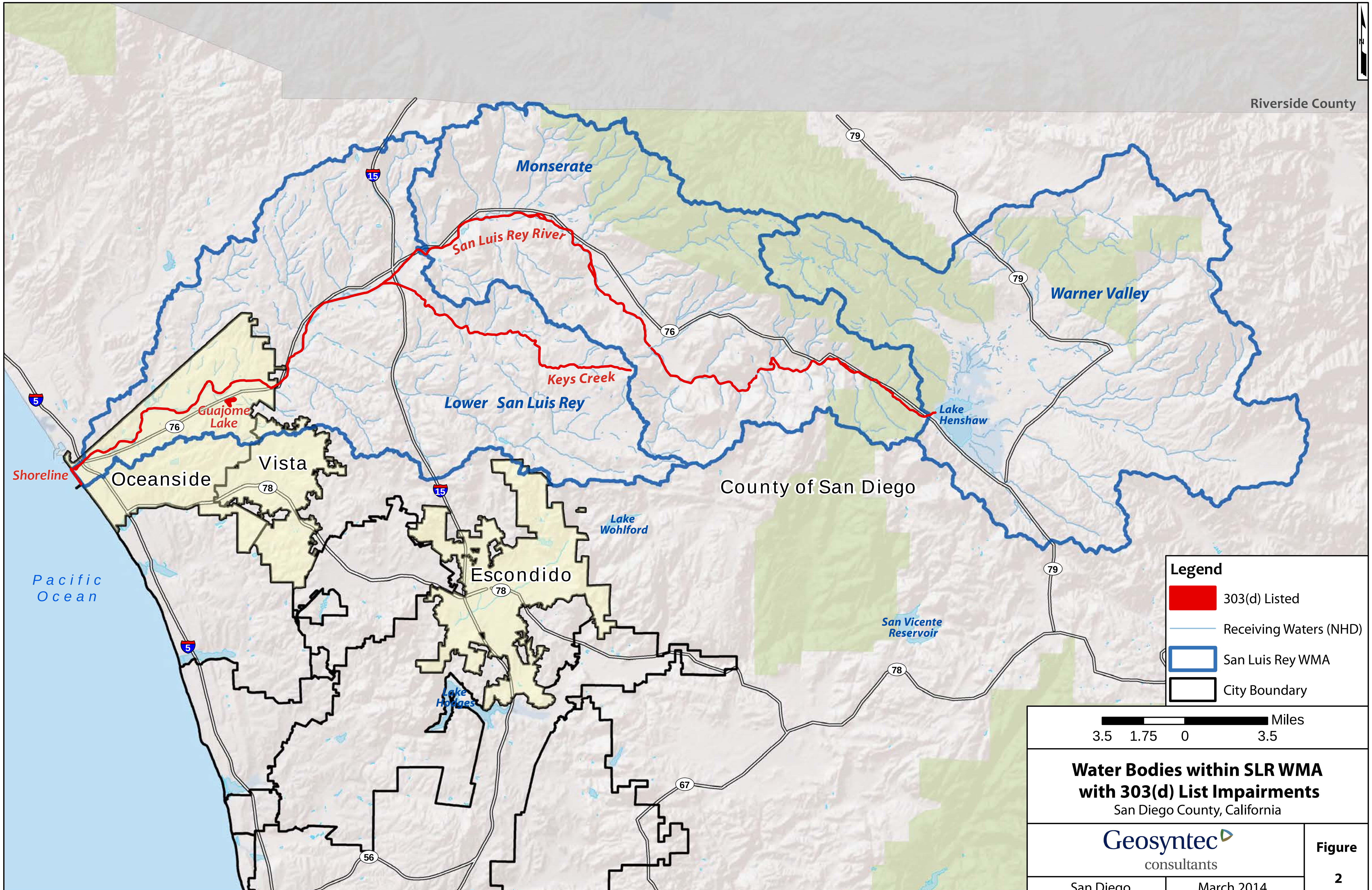
Step 4: Highest Priority Water Quality Condition (HPWQC) Assessment[3]



Footnotes:
[1] Regional water quality benchmarks were developed by the San Diego Regional Monitoring Workgroup for use in assessing the regional monitoring program results.
[2] In addition to monitoring data, public input was collected to aid in identifying priorities.
[3] Stormwater managers use Best Professional Judgment (BPJ) to aid in prioritization of programs and projects. Factors to be included limit the number of HPWQCs, and are based on consideration of multiple benefit effects of current BMPs and other jurisdictional programs, as well as the cost effectiveness of new strategies.

CHAPTER 2 – APPENDIX F: MAP FIGURES IN 11X17 FORMAT


Riverside County
Monserate HA (903.2)
San Luis Rey River
Warner Valley HA (903.3)
Lower San Luis Rey HA (903.1)
Lake Henshaw
Vista
Oceanside
County of San Diego
Lake Wohlford
Escondido
Pacific Ocean
San Vicente Reservoir
Lake Hodges
Legend
Receiving Waters (NHD)
San Luis Rey WMA
City Boundary
Miles
3.5 1.75 0 3.5
San Luis Rey River Watershed
San Diego County, California
Geosyntec consultants
San Diego
March 2014
Figure
1



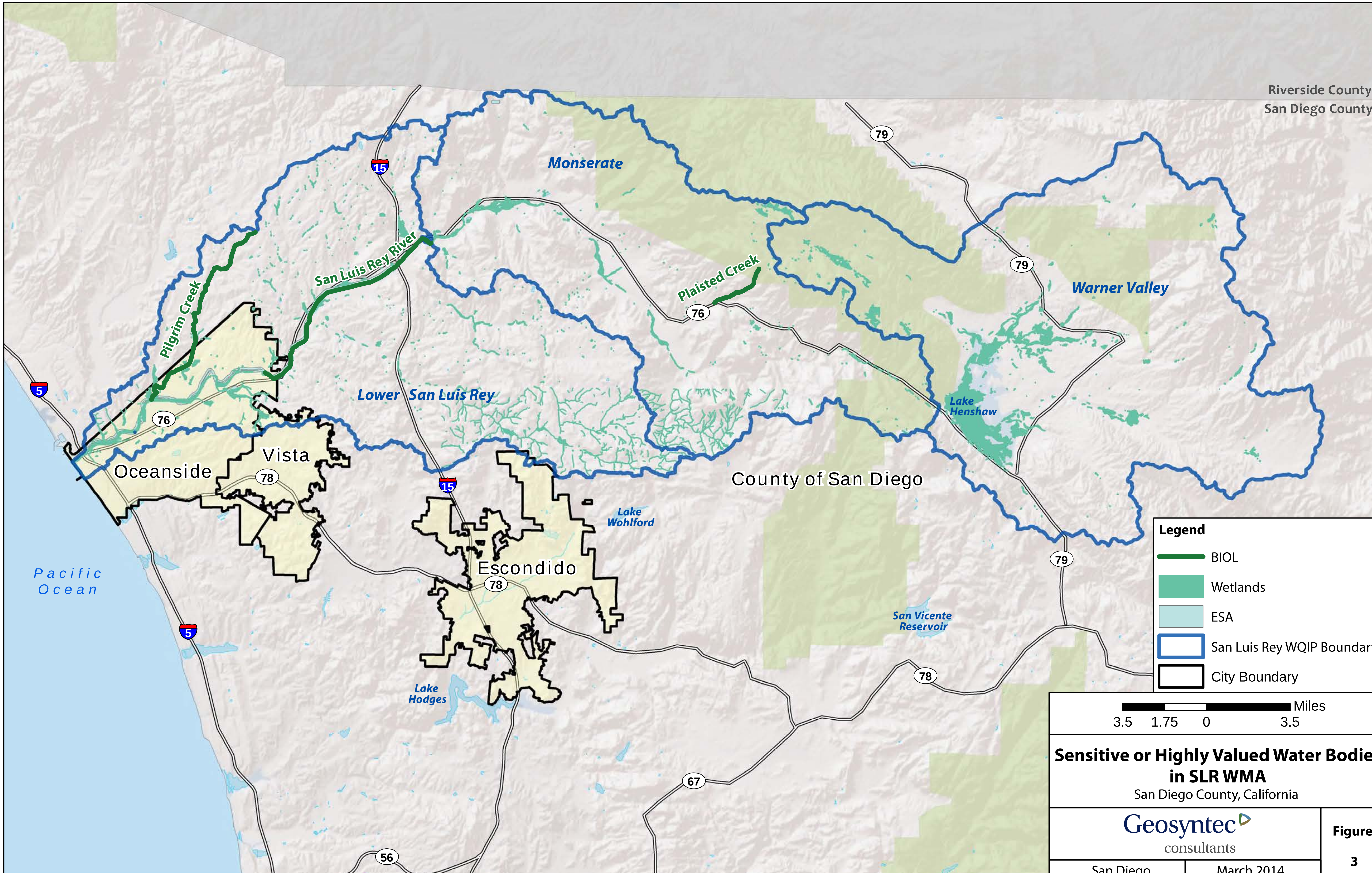
Water Bodies within SLR WMA with 303(d) List Impairments

San Diego County, California

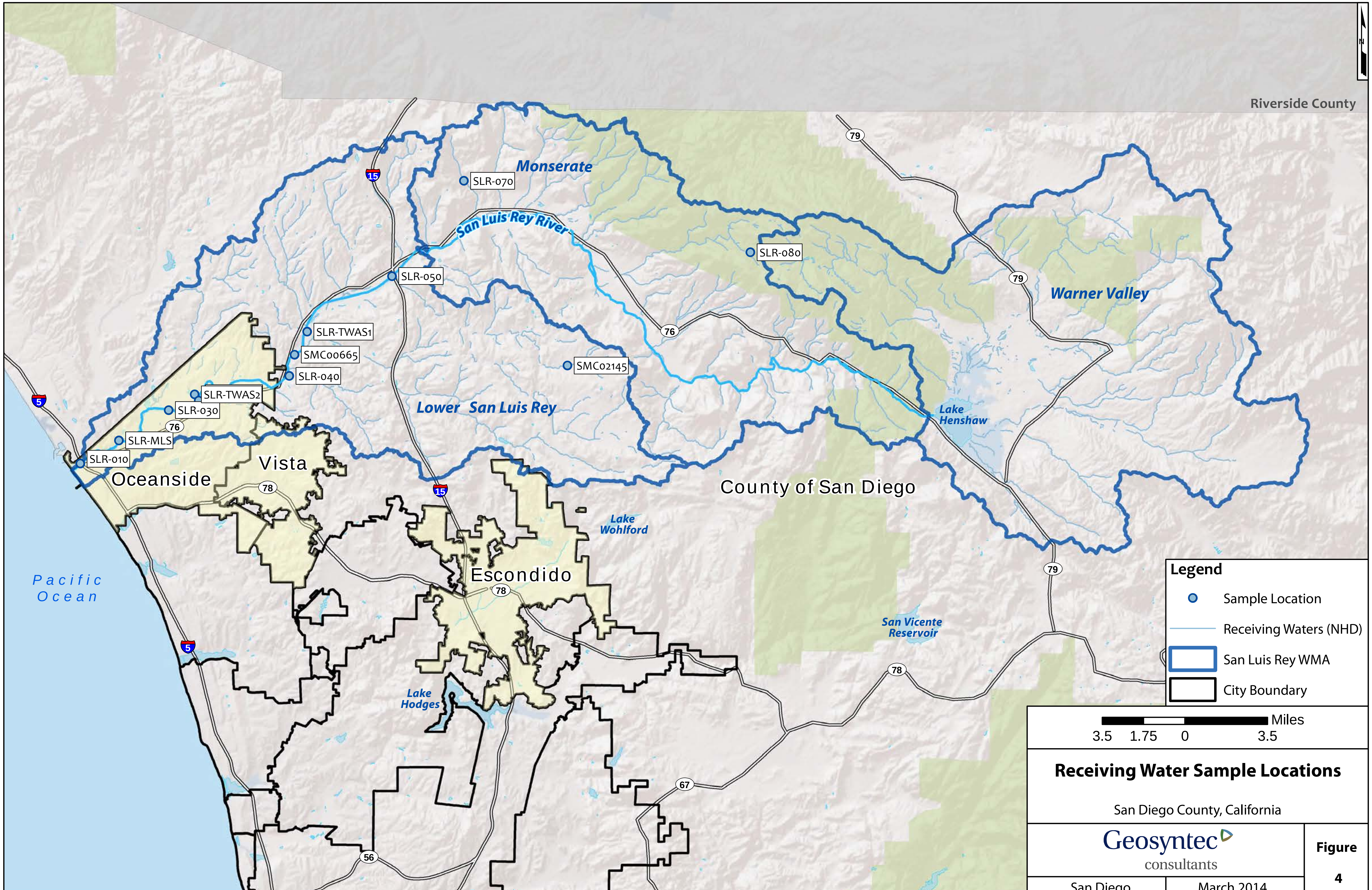
Geosyntec consultants

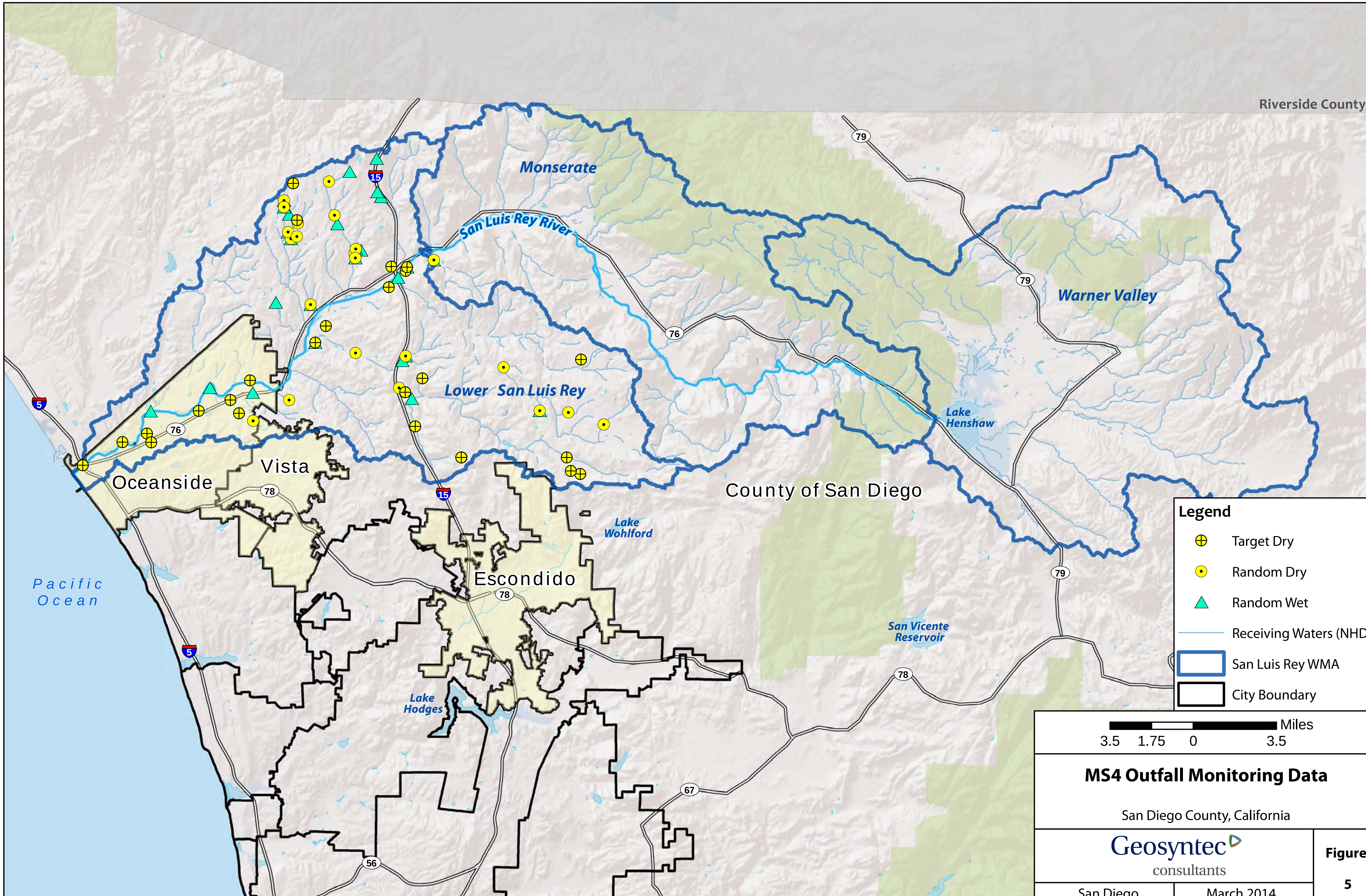
San Diego | March 2014

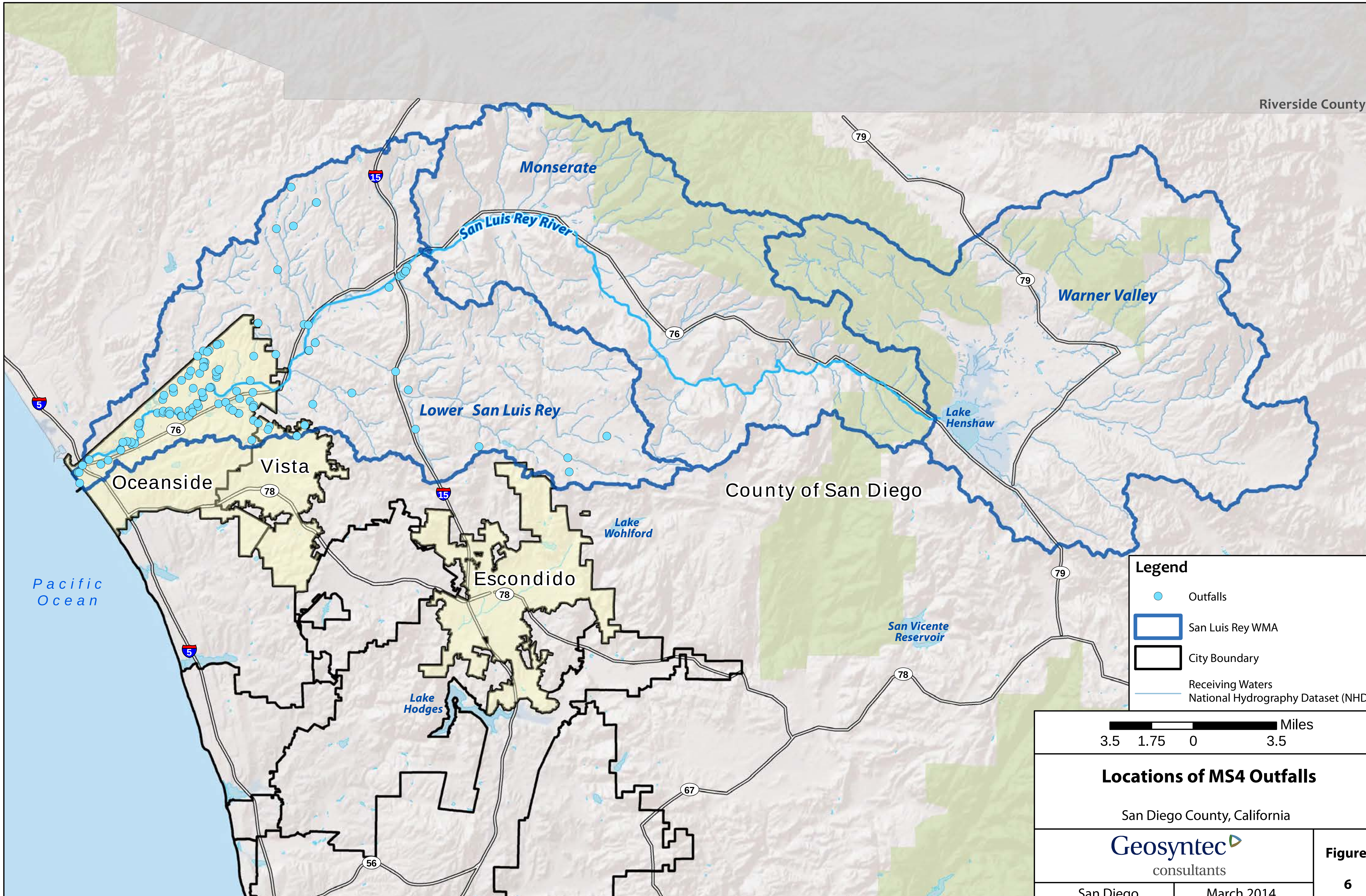
Figure 2



Riverside County
San Diego County
Monserate
San Luis Rey River
Pilgrim Creek
Plaisted Creek
Warner Valley
Lower San Luis Rey
Lake Henshaw
Oceanside
Vista
County of San Diego
Lake Wohlford
Escondido
Pacific Ocean
San Vicente Reservoir
Lake Hodges
Legend
BIOL
Wetlands
ESA
San Luis Rey WQIP Boundary
City Boundary
Miles
3.5 1.75 0 3.5
Sensitive or Highly Valued Water Bodies in SLR WMA
San Diego County, California
Geosyntec consultants
San Diego
March 2014
Figure 3


Riverside County
Monserate
SLR-070
San Luis Rey River
SLR-080
SLR-050
Warner Valley
SLR-TWAS1
SMC00665
SLR-040
SMC02145
SLR-TWAS2
SLR-030
Lower San Luis Rey
Lake Henshaw
SLR-MLS
SLR-010
Vista
Oceanside
County of San Diego
Lake Wohlford
Escondido
Pacific Ocean
San Vicente Reservoir
Lake Hodges
Legend
Sample Location
Receiving Waters (NHD)
San Luis Rey WMA
City Boundary
Miles
3.5 1.75 0 3.5
Receiving Water Sample Locations
San Diego County, California
Geosyntec consultants
Figure
4
San Diego
March 2014


Riverside County
Monserate
San Luis Rey River
Warner Valley
Lower San Luis Rey
Lake Henshaw
Oceanside
Vista
County of San Diego
Lake Wohlford
Escondido
Pacific Ocean
San Vicente Reservoir
Lake Hodges
Legend
Target Dry
Random Dry
Random Wet
Receiving Waters (NHD)
San Luis Rey WMA
City Boundary
3.5 1.75 0 3.5 Miles
MS4 Outfall Monitoring Data
San Diego County, California
Geosyntec consultants
San Diego
March 2014
Figure 5



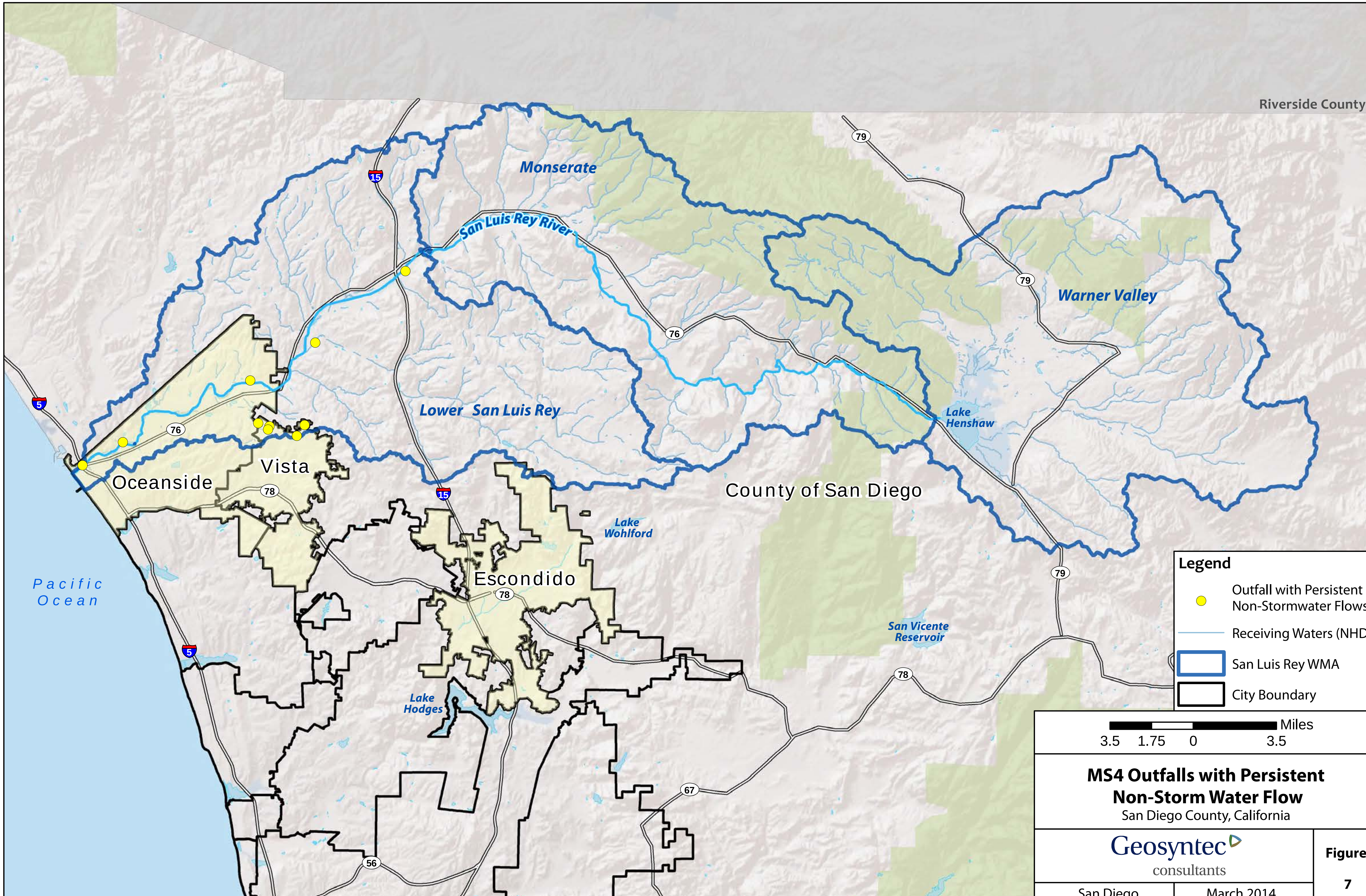
Locations of MS4 Outfalls

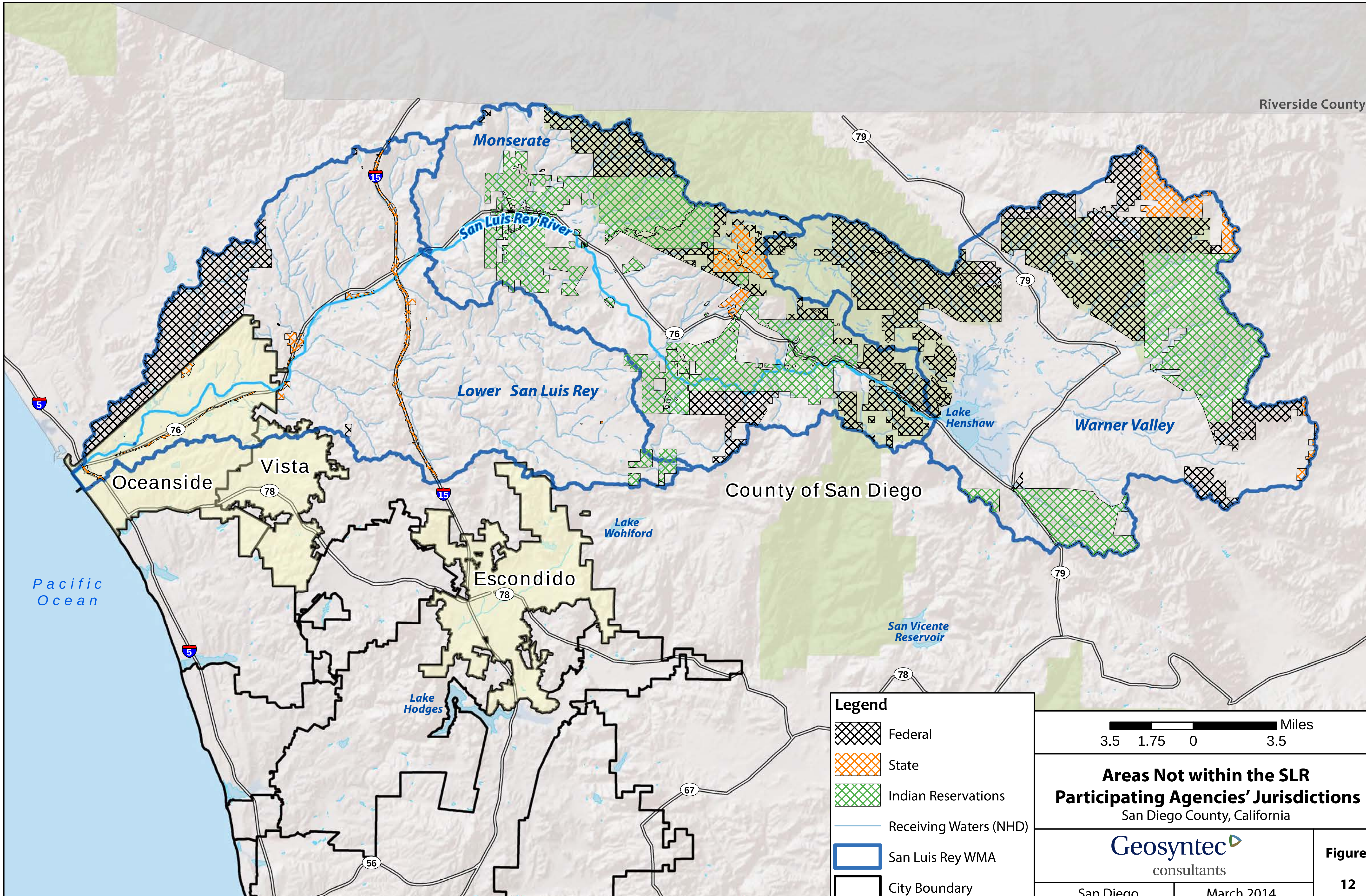
San Diego County, California

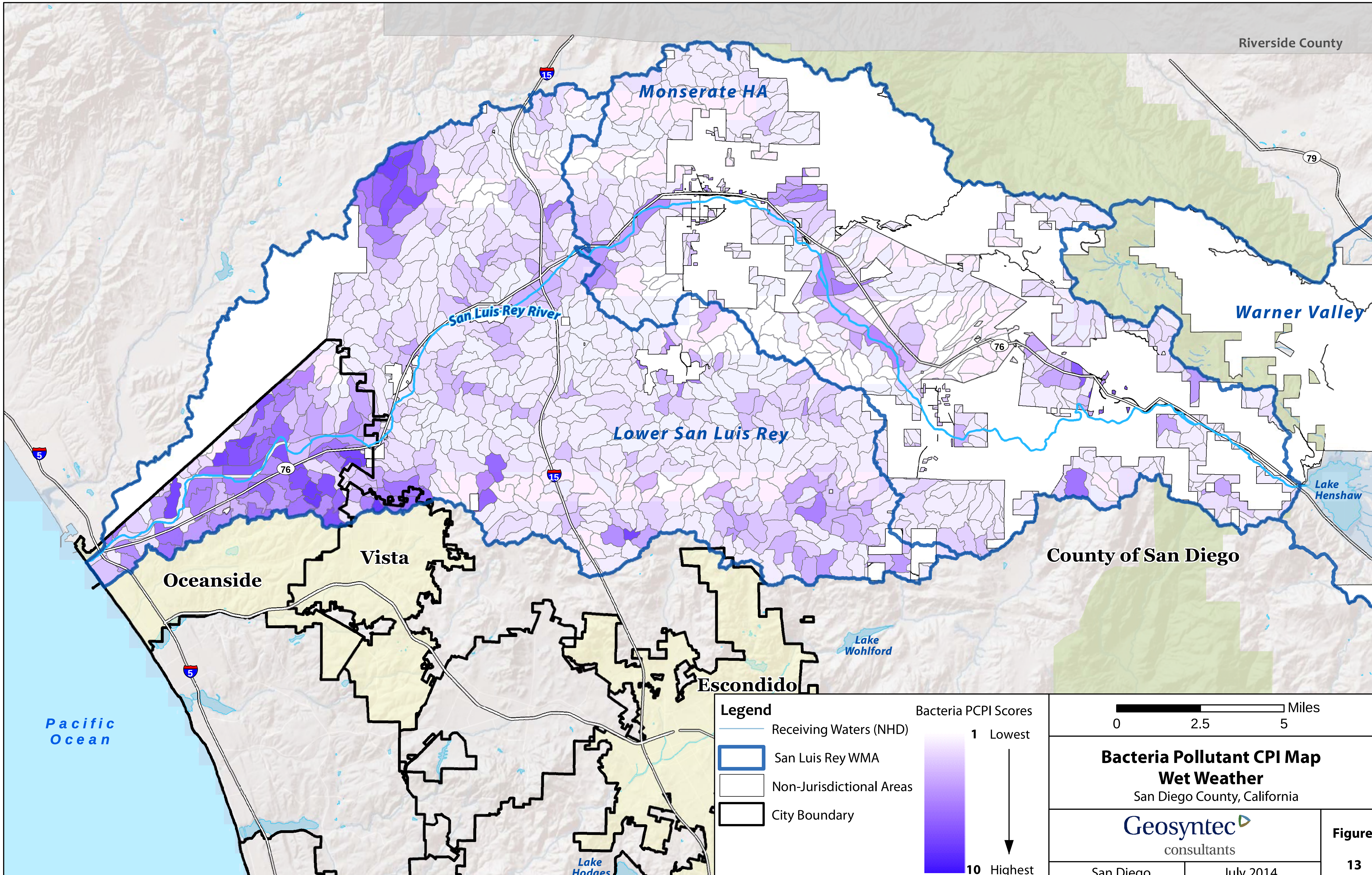
Geosyntec consultants

San Diego | March 2014

Figure 6


Riverside County
Monserate
San Luis Rey River
Warner Valley
Lower San Luis Rey
Lake Henshaw
Oceanside
Vista
County of San Diego
Lake Wohlford
Escondido
Pacific Ocean
Lake Hodges
San Vicente Reservoir
Legend
Outfall with Persistent Non-Stormwater Flows
Receiving Waters (NHD)
San Luis Rey WMA
City Boundary
Miles
3.5 1.75 0 3.5
MS4 Outfalls with Persistent Non-Storm Water Flow
San Diego County, California
Geosyntec consultants
San Diego
March 2014
Figure 7


Riverside County
Monserate
San Luis Rey River
Lower San Luis Rey
Lake Henshaw
Warner Valley
Oceanside
Vista
County of San Diego
Lake Wohlford
Escondido
Pacific Ocean
San Vicente Reservoir
Lake Hodges
Legend
Federal
State
Indian Reservations
Receiving Waters (NHD)
San Luis Rey WMA
City Boundary
Miles
3.5 1.75 0 3.5
Areas Not within the SLR Participating Agencies' Jurisdictions
San Diego County, California
Geosyntec consultants
San Diego
March 2014
Figure
12


Riverside County
Monserate HA
San Luis Rey River
Lower San Luis Rey
Warner Valley
Lake Henshaw
County of San Diego
Vista
Oceanside
Escondido
Lake Wohlford
Lake Hodges
Pacific Ocean
15
5
76
79
Legend
Receiving Waters (NHD)
San Luis Rey WMA
Non-Jurisdictional Areas
City Boundary
Bacteria PCPI Scores
1 Lowest
10 Highest
0 2.5 5 Miles
Bacteria Pollutant CPI Map
Wet Weather
San Diego County, California
Geosyntec
consultants
San Diego
July 2014
Figure
13

List of Appendices for Chapter 3

Chapter 3 – Appendix A: Identification of Potential Water Quality Improvement Strategies

APPENDIX 3A: IDENTIFICATION OF POTENTIAL WATER QUALITY IMPROVEMENT STRATEGIES

As required by Provisions B.2.a through B.2.d, the Participating Agencies identified potential strategies that may result in improvements to water quality in storm drain discharges and/or receiving waters within the watershed. A list of the potential strategies were included in the first deliverable to the Regional Water Board, and during public review of the first deliverable (May 17 through June 17, 2014), additional potential strategies were identified. The Participating Agencies used these potential strategies as a stepping stone to the development of their jurisdictional strategies discussed in Chapter 3 and listed in detail in Appendix 3B. This appendix contains the potential water quality improvement strategies and associated discussions that were included in that first deliverable.

These potential strategies include nonstructural and structural BMPs, retrofits, and stream restoration projects, as well as those included in the Participating Agencies' robust jurisdictional programs that include management measures and baseline programs to minimize effects of urban runoff from the jurisdictions' stormwater conveyance systems on receiving waters to the maximum extent practicable. Shifts of current resources and/or enhancement of existing jurisdictional programs will focus on areas and/or activities to be most effective at targeting bacteria. These extensive jurisdictional baseline programs include, but are not limited to:

- Development and redevelopment planning, including the BMP Design Manual, as well as BMP and LID implementation;
- Construction management and inspection program;
- Existing development management, including inspection of municipal, industrial, commercial, and residential (2013 Permit) land uses, as well as implementation of BMP operation and maintenance;
- Illicit Discharge Detection and Elimination (IDDE) program, including the elimination of dry weather flows;
- Education of municipal, industrial, commercial, and residential audiences;
- Public outreach and participation activities; and
- Stormwater conveyance cleaning and street sweeping.

Caltrans is not party to the Municipal Stormwater Permit. Caltrans maintains a Statewide Stormwater Management Plan to reduce the discharge of pollutants in compliance with State Board Order No. 2012-0011-DWQ which became effective July 1, 2013. Caltrans also submits Annual Reports to the State Board.

Based on jurisdiction size, types of activities, and land uses within the jurisdictions, not all agencies implement BMPs on the same scale. Jurisdictional programs are highly tailored to the conditions within the jurisdiction that may contribute to water quality impairments.

In addition to the implementation of the strong jurisdictional programs, the Participating Agencies have evaluated the findings identified under Provisions B.2.a through B.2.d, and identified strategies to improve water quality in storm drain discharges, and thereby improve water quality of receiving waters. Input received during the public workshop, as well as from the Consultation Panel, was taken into account during the development of these strategies.

The strategy categories below were considered and used to create the lists of activities to be implemented by each Participating Agency; no commitment is made with regard to each strategy described below. The County of San Diego has concerns as funding sources for implementation of structural BMPs have not been identified. By reason of constraints in California law and the California constitution, Caltrans funds are subject to legislative appropriation and availability of funds. Each Participating Agency considered the proposed strategies during development of the numeric goals, strategies and schedules presented in Chapter 3. Categories of water quality improvement strategies described below include nonstructural and structural BMPs, retrofits, and stream restoration projects to complement existing and future jurisdictional efforts.

Generally speaking, non-structural and structural strategies that reduce total runoff volume (e.g., irrigation runoff prevention programs) would also address any and all pollutants in the discharge; and measures that address human waste (e.g., sewage discharge prevention) would also address nutrients and total dissolved solids.

Nonstructural BMPs

Nonstructural BMPs considered for inclusion in the Participating Agencies' jurisdictional strategies to address the HPWQC include:

Identification and Control of Sewage Discharge to Participating Agency Storm Drain Systems

Identification and control of sewage discharge to the storm drain system may include water quality monitoring for indicators of human sewage constituents, stormwater conveyance system inspections to identify locations with persistent dry weather flows, an illicit discharge detection and elimination hotline for citizens to report spills or suspicious discharges, or the use of cameras or continuous automated flowmeters in sewers and storm drains to identify or measure infiltration and/or illicit connections. Finally, special studies such as dye tracing, canine source tracking, and/or microbial source tracking may be employed to answer specific, targeted questions. Additionally, an effective fat oil and grease inspection program to reduce sanitary sewer overflows is recognized as an important nonstructural BMP.

If human sources are determined to be a significant source of pollutant loading within the watershed, accelerated repair or upgrade of sanitary sewer and storm drain systems would encourage proactive mitigation of bacteria and nutrient pollution resulting from the sanitary sewer system and/or groundwater. To increase the effectiveness of illicit discharge detection and elimination, current programs could be expanded to include a tiered dry weather source investigation including: (1) visual surveys of storm drain discharges to identify dry weather flow locations, (2) Geographic Information System-based prioritization where aging sewer laterals are above and near storm drains that are observed to occasionally flow during dry weather, (3) video survey of the storm drains to identify leaks from the top of the pipe and/or sewer dye tracing studies, and (4) fecal source tracking studies that use canine scent tracking and/or microbial source tracking.

Homelessness Waste Management Program

In areas of the watershed where homeless encampments are determined to be a significant pollutant source, efforts may include establishing ordinances that reduce encampments, enhancing efforts to reduce the number of homeless people in encampments, and enforcing new and existing laws to decrease the negative impact on water quality. Options to reduce water quality impacts of homeless encampments can also be combined with efforts to reduce homelessness. For example, partnering with non-profit organizations to inspect and remove trash generated by encampments leverages existing social programs, watershed volunteer programs, and water quality programs to address a common concern. Homeless waste management programs have not only targeted pollutant reduction benefits, there is the potential for these programs to support larger socio-economic issues.

Onsite Wastewater Treatment Source Reduction

In 2012, the State Board adopted a State Policy for Water Quality Control for Siting, Design, and Operation and Management of Onsite Wastewater Treatment Systems (OWTS). The policy established a statewide, risk-based, five tiered approach for the management of OWTS installations and replacements and set a level of performance and protection expected from OWTS. OWTS fall into Tier 3 if they are located near (within 600 feet) an impaired water body or a water body addressed by a TMDL implementation plan. Currently, there are no Tier 3 OWTS identified in the watershed that would require an Advanced Protection Management Program including additional inspection, and possibly advanced treatment upgrades. Additionally, an effective OWTS inspection program is recognized as an important nonstructural BMP.

Irrigation Runoff Reduction and Good Landscaping Practices

Effective methods to reduce irrigation runoff could include development of educational outreach, increased inspections, punitive measures for overwatering, tiered water rates, or distribution of smart irrigation controllers and/or other financial incentive programs that decrease watering volume. Irrigation runoff reduction programs can also be integrated with BMPs that encourage landscaping and smart gardening practices that reduce the load of fertilizers and chemicals that end up in stormwater, such as integrated pest management, reducing fertilizer and pesticide use, xeriscaping, and turf conversion. To facilitate the use of these natural approaches, ordinances, education and outreach, and financial incentives can be implemented. Based on studies, it is believed that increased irrigation runoff controls, such as inspection, enforcement, and incentives in commercial and residential land uses will generate pollutant load reductions.

Commercial, Industrial, and Residential Good Housekeeping

Requiring good housekeeping practices involves establishing and enforcing ordinances for commercial and industrial facilities, and residential areas. Programs that address wet weather load reductions may include increased inspection and enforcement of grease removal equipment for restaurants, monitoring trash enclosures for proper waste disposal, and cleaning of private catch basins and drain inlets. Dry weather controls can also include discouraging vehicle washing, appropriate pool draining, power washing and other wash down activities that produce nuisance flows to storm drains.

Pet Waste Program

BMPs for pet waste pick-up and disposal could include both educational outreach and enforcement to encourage residents and pet owners to clean up after their pets. Examples include park signage, waste bag distribution stations, receptacles for pet waste, designated dog parks, strict ordinances to regulate pet waste clean-up, and educational outreach at pet stores, animal shelters, veterinary offices, and other sites frequented by pet owners. Pet waste management practices may also include BMPs relating to horseback riding activities.

Animal Facilities Management

An effective source control program could include an inventory and frequent inspection of horse ranches, livestock areas, kennels and other pet service areas. Community outreach tools would include education materials that stress manure and wash water management, directing drainage away from and/or around exposed stalls, horse health, and watershed awareness. These BMPs would address both commercial and private facilities.

Redevelopment and LID Implementation

The Participating Agencies' require advanced stormwater treatment through Low Impact Development implementation for all development and redevelopment according the BMP Design Manual. The BMP Design Manual requirements apply to residential, commercial, industrial, educational, and transportation land uses. The manual guides applicants through the design and submittal process to ensure the necessary stormwater features are being implemented. Project designs must show runoff being infiltrated or else treated by structural BMPs, such as bioretention facilities, planter boxes, filters, settling ponds, or constructed wetlands.

Low Impact Development implementation provides water quality benefits for multiple pollutants of concern through hydrologic source load mitigation and the removal of multiple pollutants.

Street and Median Sweeping

Street and median sweeping is a common practice for reducing street sediment and therefore urban runoff pollutant loads from transportation land uses. High-efficiency street sweeping equipment, such as regenerative air sweepers or vacuum assisted sweepers can significantly increase the amount of sediment removed from roadways. The street and median sweeping within the watershed appears to be an effective program for managing the sediment transport of bacteria into the storm drain system. Street sweeping BMPs provide water quality benefits for multiple pollutants of concern through transportation-related source load mitigation and the removal of multiple associated pollutants.

Storm Drain Cleaning

Cleaning sediment and trash from storm drain inlets and conveyance systems can reduce pollutant loads of bacteria, nutrients, trash, metals, and sediments in receiving waters. Load reductions that can be gained by the cleaning of drain inlets and storm drains will depend on the extent, timing and frequency of cleaning. As technology continues to advance, high efficiency storm drain cleaning equipment allows for improved bacteria load reductions and therefore could be phased in to replace older equipment. Storm drain cleaning BMPs provide water quality benefits for multiple pollutants of concern through composite source load mitigation and the removal of multiple associated pollutants of concern.

STRUCTURAL BMPS

Structural BMPs considered for inclusion in the Participating Agencies' jurisdictional strategies to address the HPWQC include:

Residential/Small-Scale Low Impact Development Incentive Program

This wet weather small-structural control is an incentive program that encourages residents and businesses to capture or redirect runoff from roofs using Low Impact Development principles to reduce flow to storm drains. A comprehensive residential rain barrel and downspout retrofit program could include public education and outreach, as well as financial incentives. Examples of such incentives could include offering rain barrels at no or reduced cost, rebate programs for downspout retrofits, and financial assistance for conversion to sustainable landscapes.

Infiltration BMPs

Infiltration BMPs may include infiltration basins, trenches, and galleries, bioretention systems, dry wells, hybrid bioretention/dry wells, or permeable pavements. With the exception of permeable pavements, which are solely distributed, all of these may be centralized or distributed systems. These systems involve capture and filtration of stormwater into pervious soils. Distributed structural BMPs are treatment or volume mitigation BMPs implemented at the neighborhood, parcel or site scale. Distributed structural BMPs include green streets, rainwater harvesting, and other Low Impact Development type solutions.

Capture and Use, or Rainwater Harvesting

This refers to a type of distributed BMP that works by capturing stormwater runoff and storing it to maximize efficient use of the water. By reducing the amount of stormwater runoff that flows overland into a storm drain system, loads of bacteria and other pollutants are reduced. Onsite use of the harvested water for non-potable domestic purposes conserves potable water and, where directed to unpaved surfaces, has potential to recharge groundwater in local aquifers.

Natural Treatment of Filtration

Biofiltration BMPs are vegetated facilities that utilize natural treatment systems to capture and treat stormwater runoff through a variety of physical and biological treatment processes. Runoff that passes through a biofiltration system is treated by the natural adsorption and filtration characteristics of the plants, soils, and microbes. Biofiltration BMPs include constructed wetlands, subsurface flow wetlands, biofiltration or bioinfiltration facilities with underdrains, planter boxes, and green streets.

Advanced Treatment and Proprietary Devices

Advanced treatment, such as low flow diversions to disinfection/treatment plants, and proprietary devices, such as prefabricated, modular infiltration galleries, are additional options for stormwater treatment for bacteria and other pollutants. There are many options for proprietary devices that would fit into, combine, or expand on the BMP types listed above.

In areas where the HPWQC is a challenging pollutant such as bacteria, advanced treatment BMPs provide water quality benefits for multiple pollutants of concern (not just PWQCs or the HPWQC) as a result of required pretreatment or the removal of flows from the flow stream.

Infrastructure Improvement and Ancillary/Source Control BMPs

This option could include retrofitting sewer lines and repairing storm drains. Though these are structural BMPs, identification of locations for improvements would be performed as part of a nonstructural BMP, for instance illicit discharge detection and elimination programs or special bacteria source tracking studies.

Pretreatment BMPs

These systems may be used as part of a treatment train to enhance the performance of other structural BMPs. Examples of pretreatment BMP types include gross solids removal (e.g., hydrodynamic devices, trash racks), biofiltration (e.g., vegetated filter strips, vegetated swales), and settling and storage (e.g., extended detention basins). Pretreated stormwater is then conveyed to an infiltration, biofiltration, or other structural BMP.

Pretreatment BMPs provide water quality benefits for multiple pollutants of concern as they remove pollutants necessary to condition water so that HPWQCs that are pollutants can be effectively treated.

Retrofits for Priority Conditions

Retrofitting projects in areas of existing development within the watershed can potentially be implemented to reduce stormwater conveyance system sources of pollutants or stressors identified under Provision B.2.d causing or contributing to the HPWQC identified under Provision B.2.c.

Watercourse Rehabilitation

Stream restoration/enhancement projects are designed to add or replace impacted habitat with habitat having similar functions of equal or greater ecological value. These projects are expected to result in net pollutant load reduction through the following mechanisms: volume reductions; increased hydraulic residence time; increased settleable solids; and increase in decay coefficient to account for plant assimilative capacity. These projects also potentially increase infiltration capacity (and associated benefits) and have the ability to improve benthic scores.

Potential Strategies Identified During Public Process

During the public process, the Participating Agencies requested suggestions for and input on potential strategies that could be implemented within the watershed to address the HPWQC, bacteria. The following are potential strategies, identified during the October 7, 2013 public workshop, the January 29, 2014 Consultation Panel meeting, and the public review period for the first interim deliverable to the Regional Water Board (May 17 – June 17, 2014) that were considered for inclusion in this Plan.

From the public workshop (October 7, 2013):

- Recognize organic farming as a solution: encourage less polluting agriculture practices and recognize people practicing organic farming
- Upgrade sewer system and onsite wastewater treatment, both septic and stormwater
- Consider river restoration strategies: removal of certain sediments and utilize sediment on construction projects
- Improve forest management practices: Preventative measures include thinning out dead trees before they burn; identify trees with problems for immediate treatment to prevent spreading
- Collaborate with US Army Corps of Engineers to streamline permitting process
- Partner with California Urban Forest Association to increase the number of trees (soak up water)
- Evaluate permits currently in process rather than waiting for future to look for green streets and LID implementation; get in the land use permit process and encourage people applying for permits to implement green streets and LID rather than 5 – 10 years from now
- Remove invasive non-native plants – Arundo donax (giant reed)

- Consider collaborating or overlapping with Steelhead Recovery Plan
- Develop an incentive program to encourage retrofitting of existing development (e.g. existing structures/parking lots)
- Consider stormwater capture and redistribution systems for the treatment/retention of stormwater
- Use portable toilets and trash cans for public trail system
- Regulate and enforce water conservation efforts
- Control runoff from residential, municipal and agriculture land uses
- Increase public education and outreach
- Implement aggressive rain water harvesting
- Maximize distributed stormwater capture across development sites
- Supplement water supply with direct potable re-use as 50% of water supply in Oceanside comes from San Luis Rey
- Recharge shallow groundwater via stormwater capture
- Consider recharging groundwater with percolation ponds in riverbed

From the Consultation Panel meeting (January 29, 2014) and submitted comments:

- Reduce failing onsite wastewater systems
- Consider adding off-set and water quality trading for pollutants as a strategy
- Consider San Luis Rey as a resource for construction aggregates
- Recognize potential strategies may also overlap with alternative compliance strategies
- Consider manufactured devices for stormwater treatment
- Consider reduction of homeless encampments
- Consider benefit of highly treated wastewater discharges

From Public Review of the first deliverable to the Regional Water Board:

- Incentivization and regulation of private actors to implement BMPs on private property
- Implementation of a Stormwater Utility to fund stormwater plans and requirements
- Public-private partnerships aimed at BMP implementation
- Increased enforcement against polluters and dischargers
- Additional regulation and/or enforcement of pollutants in water bodies
- Green infrastructure projects
- Multi-use treatment area BMPs

- Coordination towards enforcement actions between NGOs and the Board
- Capture and use stormwater to augment imported water supplies
- Restoration projects to restore physical stream channel conditions and ecosystem services
- Implement multi-benefit BMPs
- Strengthen JRMPs and implementation
- Strategies that address multiple PWQCs
- Strategies to maintain open space and natural functions

Chapter 3 – Appendix B: Jurisdictional Strategies

Pollutant reductions identified

●	Primary Pollutants
◗	Secondary Pollutants
○	Pollutants that the strategy does not address

B.1 City of Oceanside

Table 3B.1-1. City of Oceanside, Illicit Discharge Detection and Elimination Program Strategies

Number	Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Engage the public, jurisdictional staff, and other agency staff to proactively identify and report illicit discharges.																																		
IDDE 1	*Utilize municipal personnel to identify and report illicit discharges and connections.*	Current	Daily	●	●	●	●	●	●	●	●	●	●	●	○	○	Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●	●	●		●					●	●
IDDE 2	*Utilize municipal personnel and contractors to monitor stormwater outfalls for discharges of potential illicit discharges and connections.*	Ongoing	Annual	●	●	●	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●		●	●	●						●		●	●		●
IDDE 3	*Utilize water department meter readers to document irrigation runoff, with a focus on residential areas.*	Current	Daily	●	●	●	●	●	●	●	●	●	●	●	○	○	Residential						●					●						
IDDE 4	*Facilitate public reporting of illicit discharges and connections via telephone and email.*	Current	N/A	●	●	●	●	●	●	●	●	●	●	●	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●
IDDE 5	*Educate the public regarding illegal discharges/ dumping.*	Current	Continuous	●	●	●	●	●	●	●	●	●	●	●	○	○	Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●		●		●			●	●	●	●
IDDE 6	*Coordinate with upstream entities to prevent illicit discharges from upstream sources from entering the MS4.*	Current	As Needed	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●			●	●	●		●				●					
Develop and implement approaches to reduce the impacts of public and private sanitary sewer systems within the watershed.																																		
IDDE 7	*Implement practices and procedures to prevent and address spills with the potential to enter the MS4.*	Current	Continuous	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●	●				●			●	●	

Number	Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
IDDE 8	*Slip line sewer pipes to prevent exfiltration from sanitary sewers to the MS4.*	Current	Continuous	●	○	○	○	○	○	○	○	○	○	○	○	○	Residential	●	●										●					
IDDE 9	*CCTV 100% of City VCP sewer lines to identify infiltration, exfiltration, and needed pipe repair or replacement.*	FYs 14-15 and 15-16	Continuous during these two years	●	○	○	○	○	○	○	○	○	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●				●											
Actively enforce prohibitions related to illicit discharges and connections.																																		
IDDE 10	*Investigate and eliminate illicit discharges and connections.*	Current	As Needed	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●	●	●		●	●		●	●	●	●
IDDE 11	*Enforce legal authority to ensure all illicit discharges and connections identified are eliminated within timeframes established in the MS4 Permit.*	Current	As Needed	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●	●	●		●	●		●	●	●	●

Table 3B.1-2. City of Oceanside, Development Planning Program Strategies

Number	Development Planning Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Implement a post construction BMP compliance program to ensure proper construction and maintenance.																																		
DP 1	*Implement a program that ensures that all structural BMPs are designed, constructed, and maintained on PDPs.*	Current	Continuous	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●				●	●										●
DP 2	*Inspect all high priority structural BMPs annually (prior to the rainy season).*	Current	Annual	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●				●			●	●	●	●

Table 3B.1-4. City of Oceanside, Existing Development Management Program Strategies

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Develop and implement approaches to address the impacts of improper water use and irrigation runoff.																																		
ED 1	*Promote rain barrel incentive programs.*	Current	Continuous	○	○	○	○	○	○	○	○	○	○	○	○	○	Residential and Commercial						●	●				●	●					
ED 2	*Continued enforcement of drought-related restrictions on landscape irrigation frequency*	Current	Ongoing	●	●	●	●	●	●	●	●	●	○	○	○	○							●	●				●	●					
ED 3	*Relay information to residents, businesses and municipal staff regarding water agency-sponsored turf replacement programs*	Current	Ongoing when programs are available	●	●	●	●	●	●	●	○	●	○	○	○	○	Residential, Commercial, and Municipal						●	●				●	●					
Improve and/or continue existing pet waste programs.																																		
ED 4	*Install and maintain SLR Bike Trail Pet Waste Dispensers.*	Current	Continuous	●	○	○	○	○	○	○	○	○	○	○	○	○	Residential, Municipal						●	●				●						
Improve trash management strategies within the watershed.																																		
ED 5	*Coordinate Trash Collection Events (public outreach/ participation).*	Current	Multiple per Year	●	●	●	○	○	○	●	○	●	○	○	○	○	Residential, Commercial, Municipal			●			●	●		●	●	●		●				●
Improve and implement existing outreach programs to target key sources and pollutants.																																		
ED 6	*Distribute watershed based outreach posters.*	Current	Continuous	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction			●	●	●	●	●				●	●		●	●	●	●
ED 7	*Provide pollution prevention and water conservation presentations at elementary schools.*	Current	Continuous	○	○	○	○	○	○	○	○	○	○	○	○	○	Residential						●	●				●	●					●
ED 8	*Educational Workshops (e.g., landscape irrigation and maintenance, agricultural).*	Current	Biennial	●	●	●	●	●	●	●	●	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction		●			●	●	●				●	●	●	●	●	●	●
Develop and implement targeted programs to address issues in residential areas.																																		
ED 9	*Implement residential irrigation runoff study.*	FY 15-16	One Time	●	○	○	○	●	●	○	●	○	●	●	○	○	Residential					●	●											
ED 10	*Conduct residential management area focused inspections.*	FY 15-16	Per JRMP	●	○	●	●	●	●	●	●	●	●	●	○	○			●			●	●	●				●	●	●	●			●

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Improve existing inspections programs to more efficiently target key sources.																																		
ED 11	*Conduct inspections of inventoried existing development including residential areas to ensure compliance. Each area/site is inspected once every five years (minimum) and 20% of all industrial, commercial, and municipal sites are inspected on-site annually.*	Current	Per JRMP	●	●	●	●	●	●	●	●	●	●	●	●	●	Residential, Municipal, Commercial, Industrial	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Other BMPs/Activities																																		
ED 12	*Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties.*	Current	Continuous	○	●	●	○	●	●	○	●	●	○	○	●	●	Municipal, Commercial, Industrial,						●	●										

B.2 City of Vista

Table 3B.2-1. City of Vista, Illicit Discharge Detection and Elimination Program Strategies

Number	Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Engage the public, jurisdictional staff, and other agency staff to proactively identify and report illicit discharges.																																		
IDDE 1	*Utilize municipal personnel and contractors to identify and report illicit discharges and connections.*	Current	Daily	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●		●		●	●				●	●
IDDE 2	*Coordinate with Vista Irrigation District to identify and report ICIDs (e.g., over-irrigation).*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction			●	●	●	●	●			●	●	●	●				●
IDDE 3	*Facilitate public reporting of illicit discharges and connections via Water Quality Hotline (i.e., telephone and email).*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction			●	●	●	●	●				●	●	●	●		●	●
IDDE 4	*Educate the public regarding illegal discharges/ dumping.*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction			●	●		●	●			●	●	●	●	●		●	●
IDDE 5	*Coordinate with adjacent entities to prevent illicit discharges from upstream sources from entering the MS4.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IDDE 6	*Coordinate with neighboring jurisdictions to investigate results of outfall inspections.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Develop and implement approaches to address the impacts of septic systems within the watershed.																																		
IDDE 7	*Investigate and eliminate identified sources of illicit discharges and connections.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IDDE 8	*Develop inventory of septic systems within Vista's portion of the SLR watershed.*	FY 16-17	Once for initial inventory and then once per permit term for updates	●	●	●	●	●	●	●	●	●					Residential, Municipal		●	●	●	●	●			●								

Number	Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Develop and implement approaches to reduce the impacts of public and private sanitary sewer systems within the watershed.																																		
IDDE 9	*Implement practices and procedures to address spills with the potential to enter the MS4.*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IDDE 10	*Investigate and eliminate identified sources of illicit discharges and connections.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●		●		●	●	●	●		●	●
IDDE 11	*Update Sanitary Sewer Overflow Response Plan (SSORP) and reporting procedures.*	FY 15-16	One Time	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial	●																
IDDE 12	*Increase coordination between storm water and sanitary sewer programs.*	FY 15-16	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●			●								
IDDE 13	*Implement public sanitary sewer system maintenance consistent with current Sewer System Management Plan.*	Current	Continuous	●		●			●								Residential, Municipal, Commercial, Industrial	●	●			●	●			●								
Implement monitoring programs to provide new information to refine the prioritization of drainage areas.																																		
IDDE 14	*Special Study #1: Conduct assessment of baseline flows at select outfalls with persistent flows.*[a]	FY 15-16	One Time										●				Residential, Commercial, Industrial,																	
IDDE 15	*Special Study #2: Assess hydraulic connectivity to lower San Luis Rey River*[b]	FY 16-17	One Time	●			●		●				●				Residential, Commercial, Industrial,		●	●	●	●	●	●				●	●	●				●
Actively enforce prohibitions related to illicit discharges and connections.																																		
IDDE 16	*Investigate and eliminate identified sources of illicit discharges and connections.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction		●	●	●	●	●	●				●	●	●				●
IDDE 17	*Implement Enforcement Response Plan to require minimum BMPs to prevent and/or eliminate illicit discharges*	Continuous	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●				●	●	●				●
Other Related Programs and Activities.																																		
IDDE 18	*Maintain MS4 map to facilitate implementation of the IDDE program.*	Current	Annual	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●		●								

a. Conduct assessment of baseline flow and bacteria discharges during dry weather at 3 major outfalls with persistent flow. Collect flow and water chemistry data. Outfall sites include: 1) Carlsbad Watershed, Agua Hedionda Focus Area Site #AH-01 ; 2) Carlsbad Watershed, Buena Vista Focus Area Site #BV-12 ; 3) San Luis Rey Watershed, Site #SLR-03

b. Conduct assessment of hydraulic connectivity between Vista's existing development discharges in San Luis Rey. Assess discharges in context of Guajome Lake and adjacent wetlands, and connectivity to Lower San Luis Rey River during both wet and dry weather conditions.

Table 3B.2-2. City of Vista, Development Planning Program Strategies

Number	Development Planning Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Provide updated materials and enhanced outreach to convey land development requirements.																																		
DP 1	*Establish criteria designating priority development projects for new and redevelopment consistent with the Permit.*	FY 15-16	One Time	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●		●			●					●
DP 2	*Update BMP design manual procedures to specify storm water requirements applicable to development and redevelopment projects, identify and design appropriate BMPs, establish maintenance criteria.*	Current	One Time	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●		●			●					●
DP 3	*Internal staff training on updated BMP design manual.*	FY 15-16	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●				●	●		●			●					●
DP 4	*Educate developers /applicants regarding new requirements.*	FY 15-16	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●				●	●		●			●					●
Implement a Watershed Management Area Analysis to develop watershed specific requirements for structural BMP implementation and identify a list of candidate projects that could be used as alternative compliance options for Priority Development Projects.																																		
DP 5	*Develop and implement a Watershed Management Area Analysis to develop watershed specific requirements for structural BMP implementation*	FY 15-16	One Time	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●					●					●
Implement a post construction BMP compliance program to ensure proper construction and maintenance.																																		
DP 6	*Implement a program that ensures that all structural BMPs are designed, constructed, and maintained on PDPs.*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●				●	●										●
DP 7	*Inspect all high-priority structural BMPs annually prior to the rainy season.*	Current	Annual	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●				●			●	●	●	●

Number	Development Planning Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Enforce post construction requirements related to new and redevelopment.																																		
DP 8	*Require implementation of source control, LID, and on-site structural controls for all priority development projects.*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●				●			●	●	●	●
DP 9	*Enforce legal authority to ensure all development projects are in compliance with all post construction requirements.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●	●			●			●	●	●	●
DP 10	*Update codes, ordinances, and stormwater design standards consistent with permit and BMP Manual.*	Current	One Time	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●			●	●	●	●			●			●	●	●	●

Table 3B.2-3. City of Vista, Construction Management Program Strategies

Number	Construction Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Water Chemistry Benefits (Pollutants)	Physical and Biological Benefits									Water Chemistry Benefits (Pollutants)							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Improve data tracking methods for construction inventories and inspections where necessary.																																		
CM 1	*Maintain, update, and prioritize a watershed-based inventory of all projects issued local permits that allow soil disturbing activities.*	*Current*	*Quarterly*				●			●	●	●					*Construction*	●					●	●		●	●		●					
CM 2	*Maintain and update a watershed-GIS-based inventory of construction sites and associated site inspection documentation.*	*FY 16-17*	*Continuous*				●			●	●	●					*Construction*						●	●		●			●					●
Ensure that minimum BMPs are designated and required for construction projects.																																		
CM 3	*Require submittal of pollution control plan, construction BMP plan, and/or erosion and sediment control plan for projects requiring local permits involving soil disturbance activities.*	*Current*	*Continuous*				●			●	●	●					*Construction*						●	●		●	●		●					
CM 4	*Review and confirm that the submitted plan is in compliance.*	*Current*	*Continuous*				●			●	●	●					*Construction*						●	●		●	●		●					
CM 5	*Implement or require implementation of BMPs that are site-specific, seasonally appropriate, and appropriate to the construction phase year round.*	*Current*	*Continuous*				●			●	●	●					*Construction*	●					●	●		●	●		●					
CM 6	*Inspect construction sites at an appropriate frequency to require and confirm compliance with local permits and ordinances, as well as the MS4 Permit requirements.*	*Current*	*Per JRMP* [a]				●			●	●	●					*Construction*	●					●	●		●	●		●					
CM 7	*Enforce legal authority to ensure inventoried construction projects are in compliance with all requirements.*	*Current*	*As Needed*				●			●	●	●					*Construction*	●					●	●		●	●		●					

a. Wet Season = Minimum Weekly, Dry Season = Minimum Monthly

Table 3B.2-4. City of Vista, Existing Development Management Program Strategies

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Improve data tracking methods for existing development inventories where necessary.																																		
ED 1	*Maintain and update a watershed-based inventory of existing development (i.e., commercial, industrial, and municipal facilities and residential areas).*	Current	Annual	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●				●	●	●	●				●		●	●		●
Develop and implement approaches to address the impacts of improper water use and irrigation runoff.																																		
ED 2	*Develop and distribute outreach materials targeting over-irrigation.*	FY 15-16	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial						●											
ED 3	*Promote inter- and/or multi-agency water conservation and incentive programs.*	FY 15-16	Continuous	●	●	●	●	●	●	●	●	●											●											
Improve and/or continue existing pet waste programs.																																		
ED 4	*Expand pet waste program based on municipal and residential area inspections.*	FY 16-17	Continuous	●					●			●					Residential, Municipal											●						
Improve trash management strategies within the watershed.																																		
ED 5	*Sponsor Trash Collection Events (public outreach/part).*	Current	Annual	●			●					●					Residential, Municipal, Commercial, Industrial, Construction			●			●	●			●			●				
Develop and implement approaches to address the impacts of septic systems within the watershed.																																		
ED 6	*Develop and distribute outreach materials targeting septic system maintenance.*	FY 16-17	One Time, On Going	●		●			●	●	●	●					Residential					●	●											
ED 7	*Develop inventory of septic systems within Vista's portion of the SLR Watershed (see also IDDE 8).*	FY 16-17	Once for initial inventory and then once per permit term for updates	●		●			●	●	●	●										●	●											

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Develop and implement approaches to reduce the impacts of public and private sanitary sewer systems within the watershed.																																		
ED 8	*Develop and distribute outreach materials targeting sewer lateral maintenance.*	FY 16-17	One Time, On Going	●		●			●	●	●	●					Residential, Municipal, Commercial, Industrial	●	●				●						●					
ED 9	*Undertake next phase of sewer exfiltration study.*	FY 16-17	One Time	●		●			●	●	●	●							●				●											
ED 10	*Continue citywide sanitary sewer rehabilitation and repair programs.*	FY 15-16	Continuous	●		●			●	●	●	●					Residential, Municipal, Commercial, Industrial	●	●				●						●					
ED 11	*Conduct FOG inspections to decrease private lateral spills.*	Current	Continuous	●					●	●		●					Commercial	●					●	●			●		●					●
Improve and implement existing outreach programs to target key sources and pollutants.																																		
ED 12	*Develop, improve, and distribute outreach materials.*	FY 15-16	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial	●				●	●	●		●			●					●
ED 13	*Implement outreach per JRMP (see Table 10-2)*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential	●	●		●	●	●	●		●	●	●	●				●	●
ED 14	*Educational Workshops (e.g., IPM, manure management).*	Current	TBD	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial														●	●	●	
Enhance existing MS4 maintenance programs.																																		
ED 15	*Implement a schedule of operation and maintenance activities for the MS4 and related structures.*	Current	Per JRMP (e.g., High Priority streets swept twice per month minimum).	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial						●	●					●					
Develop and implement targeted programs to address issues in residential areas.																																		
ED 16	*Implement an oversight program to promote designated BMPs in residential areas.*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential	●	●			●	●	●			●	●	●		●		●	

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
ED 17	*Develop targeted outreach materials for priority residential issues and BMPs.*	FY 16-17	Continuous	●	●	●	●	●	●	●	●	●					Residential	●	●			●	●	●		●		●	●		●		●	●
ED 18	*Outreach to and coordination with homeowners associations.*	FY 16-17	Continuous	●	●	●	●	●	●	●	●	●					Residential	●	●			●	●	●		●		●	●		●		●	●
Improve existing inspections programs to more efficiently target key sources.																																		
ED 19	*Implement a schedule of operation and maintenance for public streets, unpaved roads, paved roads, and paved highways.*	Current	Per JRMP (e.g., sweep high priority streets at least twice monthly)	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction							●										
ED 20	*Conduct inspections of inventoried existing development to ensure compliance. Each area/activity inspected once every five years.*	Current	Per JRMP (i.e., at least 20% of inventory inspected annually)	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial	●	●			●	●	●	●	●	●	●	●	●	●	●	●	●
Actively enforce stormwater and urban runoff requirements for existing development.																																		
ED 21	*Designate and require minimum BMPs for all inventoried existing development.*	Current	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial	●	●			●	●	●	●	●		●	●	●	●	●	●	●
ED 22	*Enforce legal authority to ensure inventoried existing development facilities and/or areas are in compliance with all minimum BMP requirements.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial	●	●			●	●	●	●	●		●	●	●	●	●	●	●
Develop and implement a strategy to identify and facilitate retrofit opportunities in areas of existing development.																																		
ED 23	*As an optional strategy, develop retrofit projects in areas of existing development.*	FY 16-17	One Time	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial						●	●					●					

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
ED 33	*Evaluate MS4 maintenance program for target areas and potential retrofit opportunities.*	FY 15-16	One Time	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial						●	●					●					
ED 34	*Investigate incentives for BMP retrofits, such as weather-based irrigation controllers, in partnership with water agency(ies).*	FY 15-16	Continuous	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial						●											
Improve coordination between agencies. See strategies ED 3, ED5.																																		
Other BMPs/Activities																																		
ED 24	*Develop and distribute outreach materials targeting sediment control.*	FY 16-17	Continuous		●	●	●	●			●	●					Residential, Municipal, Commercial, Industrial						●								●	●	●	

B.3 County of San Diego

Pollutant reductions identified

- ● Primary Pollutants
- ◗ Secondary Pollutants
- ○ Pollutants that the strategy does not address

Table 3B.3-1. County of San Diego, Illicit Discharge Detection and Elimination Program Strategies

Number	Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Engage the public, jurisdictional staff, and other agency staff to proactively identify and report illicit discharges.																																		
IDDE 1	*Utilize municipal personnel and contractors to identify and report illicit connections and discharges.*	Ongoing	Ongoing	●	●	●	●	●	●	●	◗	●	○	○	○	○	IC/IDs	●	●		●	●	●	●	●	●			●				●	●
IDDE 2	*Utilize municipal personnel and contractors to monitor stormwater outfalls for discharges of potential illicit discharges and connections.*	Ongoing	Annual	●	●	●	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●		●	●	●						●					●
IDDE 3	*Updated, focused training for field staff.*	FY 15-16	Annual	●	●	◗	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●		●	●	●	●		●			●				●	●
IDDE 4	*Facilitate public reporting of illicit discharges and connections via telephone and email.*	Ongoing	Ongoing	●	●	●	●	●	●	●	◗	●	○	○	○	○	IC/IDs	●		●	●	●	●	●		●		●	●					●
IDDE 5	*Bilingual hotline answered by live operator (I Love a Clean San Diego) providing better customer service.*	FY 15-16	Ongoing	●	●	●	●	●	●	●	◗	●	○	○	○	○	IC/IDs	●		●	●	●	●	●		●		●	●					●
IDDE 6	*Coordinate with upstream entities to prevent upstream- sourced illicit discharges from entering the storm drain system.*	Ongoing	Ongoing	●	●	●	●	●	●	●	●	●	○	○	●	●	IC/IDs	●					●											
IDDE 7	*Refer homeless issue complaints to Sheriff or appropriate agencies.*	Ongoing	Ongoing	●	○	○	○	○	◗	○	○	●	○	○	●	◗	Human sources			●			●											
Develop and implement approaches to address the impacts of septic systems, and public and private sanitary sewer systems within the watershed.																																		
IDDE 8	*Address septic system failures where observed.*	Ongoing	Ongoing	●	●	●	●	●	●	●	●	●	●	●	●	●	Human sources					●	●											
IDDE 9	*Implement practices and procedures to address spills with the potential to enter the storm drain system.*	Ongoing	Ongoing	●	●	●	●	●	●	●	◗	●	○	○	○	○	IC/IDs	●	●		●	●	●						●					

Number	Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
IDDE 10	*Coordinate spill response with responsible sewer agencies.*	FY 15-16	Ongoing	●	●	●	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●		●	●	●						●					
IDDE 11	*Implement practices and procedures to prevent/ limit infiltration of seepage from sanitary sewers to the storm drain system.*	Ongoing	Ongoing	◗	○	○	●	◗	◗	○	○	○	○	○	○	◗	Sewer infrastructure	●	●				●						●					
IDDE 12	*Collect effluent on the ground (EOG), sanitary sewer overflow (SSO) data*	Ongoing	Ongoing	●	●	●	●	●	●	●	●	●	●	●	●	●	OWTS/SSO	●				●	●											
Enforce prohibitions related to illicit discharges and connections.																																		
IDDE 13	*Develop and implement a strategy for Investigating and addressing illicit discharges and connections.*	FY 14-15	One time	●	●	●	●	●	●	●	◗	●	○	○	○	○	IC/IDs	●	●		●	●	●	●		●		●	●				●	●
IDDE 14	*Impose legal authority to ensure all illicit discharges and connections that are identified are eliminated.*	Current	As Needed	●	●	●	●	●	●	●	●	●					Residential, Municipal, Commercial, Industrial, Construction	●	●		●	●	●	●		●		●	●				●	●
Other Related Programs and Activities.																																		
IDDE 15	*Maintain stormwater conveyance system map to facilitate implementation of the IDDE program.*	FY 14-15	Annual	●	●	●	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial, Construction	●	●	●	●	●	●	●	●	●		●	●		●	●	●	●

Table 3B.3-2. County of San Diego, Development Planning Program Strategies

				Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits					Human Sources									Anthropogenic, Non-human Sources							
Number	Development Planning Program Strategies	Implementation Timeframe	Frequency	Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life	Sources	SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Provide updated materials and enhanced outreach to convey land development requirements.																																		
DP 1	*Update BMP design manual procedures to specify stormwater requirements applicable to development and redevelopment projects, identify and design appropriate BMPs, establish maintenance criteria, and establish alternative compliance options (where implemented).*	FY 15-16	In development	●	●	◗	●	●	●	●	◗	●	●	●	●	●	New and redevelopment					●		●	●	●	●			●				●
DP 2	*Conduct internal staff training on updated BMP design manual.*	FY 15-16	One time	●	●	◗	●	●	●	●	◗	●	○	○	○	○	New and redevelopment					●		●	●	●	●			●				●
DP 3	*Hold external land development workshops targeting the development community.*	FY 15-16	One time	●	●	◗	●	●	●	●	◗	●	○	○	○	○	New and redevelopment					●		●	●	●	●			●				●
DP 4	*Update codes, ordinances, and stormwater design standards consistent with permit and BMP Manual.*	FY 14-15	One Time	◗	◗	◗	◗	◗	◗	◗	◗	◗	○	○	○	○	New and redevelopment					●		●	●	●	●			●				●
Implement a BMP compliance program to ensure proper design and maintenance planning.																																		
DP 5	*Implement a program that ensures that all structural BMPs are designed, constructed, and maintained on Priority Development and Redevelopment Projects.*	Ongoing	Ongoing	●	●	◗	●	●	●	●	◗	●	●	●	◗	◗	New and redevelopment						●	●										●
Enforce post construction requirements related to new and redevelopment.																																		
DP 6	*In addition to requirement for all development projects, implement or require implementation of onsite structural BMPs to control pollutants and manage hydromodification for PDPs.*	Ongoing	Ongoing	●	●	◗	●	●	●	●	◗	●	●	●	◗	◗	New and redevelopment						●	●										●
DP 7	*Impose legal authority to ensure all development projects are in compliance with all post construction requirements.*	Ongoing	Ongoing	◗	◗	◗	●	◗	◗	◗	◗	●	●	●	◗	◗	New and redevelopment						●	●	●		●		●	●				●

Table 3B.3-3. County of San Diego, Construction Management Program Strategies

Number	Construction Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Improve data tracking methods for construction inventories and inspections where necessary.																																		
CM 1	*Maintain, update, and prioritize a watershed based inventory of all projects issued local permits that allow soil disturbing activities.*	FY 15-16	Quarterly	◗	◗	◗	●	◗	◗	●	◗	●	●	●	◗	◗	Construction: waste management, portable toilets									●								
Ensure that minimum BMPs are designated and required for construction projects.																																		
CM 2	*Require implementation of BMPs that are site specific, seasonally appropriate, and appropriate to the construction phase year round.*	Ongoing	TBD/In Development	○	○	○	●	○	○	◗	○	◗	●	●	○	●	Construction: waste management, portable toilets	●					●	●		●	●		●					
CM 3	*Make updates to ordinance related to construction; reference to existing grading ordinance.*	FY 15-16	One Time	●	●	●	●	●	●	●	◗	●	●	●	○	●	Construction: waste management, portable toilets	●					●	●		●	●		●					
Enforce Construction Management Requirements																																		
CM 4	*Impose legal authority to ensure inventoried construction projects are in compliance with all requirements.*	Ongoing	As Necessary	◗	◗	◗	●	◗	◗	◗	◗	●	●	●	◗	◗	Construction: waste management, portable toilets	●					●	●		●	●		●					
CM 5	*Notify the SDWB by email (Nonfilers_R9waterboards.ca.gov) within five (5) calendar days of issuing escalated enforcement to a construction site that poses a significant threat to water quality as a result of violations or other noncompliance*	FY 15-16	Ongoing	●	●	●	●	●	●	●	◗	●	○	○	○	○	Construction	●					●	●		●	●		●					
Provide enhanced outreach and coordination to convey construction requirements.																																		
CM 6	*Provide internal staff training related to construction stormwater management.*	Ongoing	Annual	●	●	◗	●	●	●	●	◗	●	○	○	○	○	Construction: waste management, portable toilets	●					●	●		●	●		●					

Table 3B.3-4. County of San Diego, Existing Development Management Program Strategies

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Improve data tracking methods for existing development inventories where necessary.																																		
ED 1	*Maintain and update a watershed based inventory of existing development (i.e., commercial, industrial, and municipal facilities and residential areas).*	Current	Annual	●	●	●	●	●	●	●	●	●	●	●	○	○	Residential, Municipal, Commercial, Industrial	●				●	●	●	●		●	●	●		●	●		●
ED 2	*Make improvements to tracking watershed based inventories via consolidated database.*	FY 15-16	One time	●	●	●	●	●	●	●	●	●	●	●	○	○	Residential, Municipal, Commercial, Industrial	●				●	●	●	●				●		●	●		●
Develop and implement approaches to address the impacts of improper water use and irrigation runoff.																																		
ED 3	*Collaborate with Partner Agencies and groups to promote non-County sponsored incentive programs for BMP retrofits, including rain barrels, smart controllers, soil sensors, turf replacement, etc..*	Ongoing	Ongoing	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	○	◗	Residential, Municipal, Commercial						●											
ED 4	*Promote incentive programs for BMP retrofits (e.g., water smart irrigation controllers, turf replacement program, residential landscape evaluation program).*	FY 14-15	On-going	◗	●	○	●	○	◗	○	○	○	○	○	○	◗	Municipal areas						●											
Improve and/or continue existing pet waste programs.																																		
ED 5	*Pet waste management and outreach in County Parks.*	Ongoing	Ongoing	●	○	◗	●	○	●	○	○	●	○	○	○	○	Municipal parks						●	●				●						
Improve trash management strategies within the watershed.																																		
ED 6	*Sponsor Trash Collection Events (public outreach and participation).*	Ongoing	Ongoing	◗	◗	◗	○	◗	○	◗	○	●	○	○	●	◗	Residential, Municipal, Commercial, Industrial			●			●	●										
Improve and implement existing outreach programs to target key sources and pollutants.																																		
ED 7	*Develop, improve, and distribute outreach materials.*	Ongoing	Ongoing	●	●	◗	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial					●	●	●		●		●	●					●
ED 8	*Give outreach presentations to elementary, middle, and high schools.*	Ongoing	Ongoing	●	●	◗	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial	●				●	●	●				●	●					

				Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits					Human Sources									Anthropogenic, Non-human Sources							
Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life	Sources	SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
ED 9	*Outreach to mobile landscaping service providers.*	Ongoing	Ongoing	●	●	◗	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial						●	●					●				●	
ED 10	*Educational Workshops (e.g., integrated pest management, manure management).*	Ongoing	Ongoing	●	○	○	◗	○	◗	○	○	○	○	○	○	◗	Residential						●					●	●				●	
ED 11	*Education & Outreach Effectiveness Survey.*	Ongoing	Annual	●	○	○	◗	○	◗	○	○	○	○	○	○	◗	Residential, Municipal, Commercial, Industrial																	
ED 12	*Create an Equestrian BMP Handbook*	FY 15-16	One time	●	◗	●	●	●	●	◗	◗	●	◗	◗	○	○	Equestrian Land Uses											●			●		●	
ED 13	*Conduct over irrigation outreach pilot study.*	Ongoing	Ongoing	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	○	◗	Residential						●											
ED 14	*Conduct Homeowners Associations Outreach and Coordination Pilot Study*	FY 15-16	Ongoing	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	○	◗	Residential/HOAs						●											
ED 15	*Implement a public education and participation program to promote and encourage development of programs, management practices and behaviors that reduce the discharge of pollutants in storm water prioritized by high risk behaviors, pollutants of concern, and target audiences.*	Ongoing	Ongoing	●	●	●	●	●	●	●	●	●	○	○	○	○	Storm drain sources	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●
Enhance existing stormwater conveyance system maintenance programs.																																		
ED 16	*Implement a schedule of operation and maintenance activities for the stormwater conveyance system and related structures.*	Ongoing	Annual	◗	●	○	●	○	◗	○	○	○	○	○	○	◗	Storm drain system			●			●	●										
Develop and implement targeted programs to address issues in residential areas.																																		
ED 17	*Promote and encourage implementation of designated BMPs in residential areas.*	FY 15-16	Ongoing	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	◗	◗	Residential	●			●	●	●	●				●	●				●	
ED 18	*Conduct focused residential inspections based on strategic assessments.*	FY 15-16	20% per year, all within 5 years	●	●	●	●	●	●	●	◗	●	○	○	○	○	Residential	●			●	●	●	●			●	●	●		●		●	

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
Improve existing inspections programs to more efficiently target key sources.																																		
ED 19	*Implement a schedule of operation and maintenance for County paved and unpaved roads.*	Ongoing	Per JRMP	◗	●	◗	●	○	●	○	◗	●	○	○	○	◗	Residential, Municipal, Commercial, Industrial, Construction						●											
ED 20	*Conduct inspections of inventoried existing development to ensure compliance.*	FY 15-16	20% per year, all within 5 years	●	●	●	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial	●	●			●	●	●	●	●	●	●	●	●	●		●	●
ED 21	*Improve inspections data tracking through mobile phone applications*	FY 15-16	One time	●	●	●	●	●	●	●	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial																	
Additional strategies to address Existing Development																																		
ED 22	*Designate a minimum set of BMPs required for all existing development inventories, including special event venues. The designated minimum BMPs must be specific to facility or area types and pollutant generating activities, as appropriate.*	Ongoing	One time	●	◗	◗	●	●	●	●	◗	●	●	●	◗	◗	Residential, Municipal, Commercial, Industrial	●	●			●	●	●	●	●			●		●		●	●
ED 23	*Require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types and pollutant generating activities, as appropriate.*	Ongoing	Ongoing	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	Residential, Municipal, Commercial, Industrial	●	●			●	●	●	●	●			●		●		●	●
ED 24	*Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications.*	Ongoing	Ongoing	○	○	●	○	●	●	○	○	○	○	○	◗	●	Residential, Municipal, Commercial, Industrial						●	●									●	
ED 25	*Enforce legal authority established for all inventoried existing development to achieve compliance.*	Ongoing	Ongoing	◗	◗	◗	●	◗	◗	◗	◗	●	○	○	○	○	Residential, Municipal, Commercial, Industrial	●	●		●	●	●	●	●	●			●		●		●	●
ED 26	*Update county ordinance related to existing development; reference to existing guidance documents.*	FY 14-15	One time	●	●	●	●	●	●	●	◗	●	●	●	○	●	Residential, Municipal, Commercial, Industrial	●	●		●	●	●	●	●	●			●		●		●	●

Number	Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Water Chemistry Benefits (Pollutants)									Physical and Biological Benefits				Sources	Human Sources									Anthropogenic, Non-human Sources							
				Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life		SSOs	Sewer Infrastructure	Homeless Encampments	RVs	Septic Systems	ICIDs	Trash Cans/Dumpsters	Landfills	Porta-potties	Birds	Pets	Washwater	Rodents	Livestock (domestic)	Livestock (agricultural)	Manure Re-use	Outdoor Dining
ED 27	*Identify candidate areas of existing development for stream, channel, and/or habitat rehabilitation projects and facilitate implementation of such projects.*	FY 15	Ongoing	◗	●	○	●	○	◗	○	○	○	○	○	○	◗	Municipal																	
ED 28	*Implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Enforcement Response Plan.*	Ongoing	Ongoing	●	●	●	●	●	●	●	◗	●	○	○	○	○	All storm drain related sources.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
ED 29	*Notify the SDWB by email (Nonfilers_R9waterboards.ca.gov) any persons required to obtain coverage under the statewide Industrial General Permit and Construction General Permit and failing to do so, within five (5) calendar days from the time the Copermittee become aware of the circumstances.*	Ongoing	FY 15-16	●	●	●	●	●	●	●	◗	●	○	○	○	○	Industrial																	

Table 3B.3-5. County of San Diego, Optional Jurisdictional Runoff Management Programs Strategies

					Water Chemistry Benefits (Pollutants)									Physical & Biological Benefits			
Number	Optional Strategy	Trigger	Resources	Implementation Timeframe	Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life
Provision B.3.b.(1)(b)(i) - BMPs, incentives, or programs that may be implemented that are in addition to requirements of Provision B.3.b.(1)(a)																	
CoSD Opt-1	Implement a program that provides rebates or incentives for pumping septic systems, with a focus in high risk areas adjacent to waterways (within 600 feet).	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) pilot program success; and (4) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Incentive items	Once triggered, Pilot program 1 -2 years, as needed there after	●	●	●	●	●	●	●	●	●				
CoSD Opt-2	Identify where sewer and stormwater infrastructure are in close proximity and subsequently, confirm the absence of flow at nearby storm drain outfall during dry weather.	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Partnerships	Once triggered, 2-3 years; one-time	●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-3	Implement a program for on-site wastewater treatment (septic) systems. May include mapping and risk assessment, inspection, or maintenance practices.	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) septic systems have been determined to be a pollutant sources to the MS4; and (4) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Partnerships	Once triggered, 2-3 years; as needed, as resources allow	●	●	●	●	●	●	●	●	●				
CoSD Opt-4	Divert persistent dry weather flows from storm drains to sewer	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) permission is granted from sewer agency; and (4) ground water or permitted discharges have been ruled out; and (5) all of the necessary resources have	• Staff resources • Grant funding or alternative source • Contractor funding • Engineering design • Environmental review • Permits • Ongoing funding for operation/maintenance	Once triggered, 3-6 years per project	●	●	●	●	●	●	●	●	●	●	●	●	●

					Water Chemistry Benefits (Pollutants)									Physical & Biological Benefits			
Number	Optional Strategy	Trigger	Resources	Implementation Timeframe	Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life
		been secured.															
Provision B.3.b.(1)(b)(ii) - Incentives or programs that may be implemented to encourage or implement projects to retrofit areas of existing development																	
CoSD Opt-5	Implement Sustainable Landscapes Program to encourage landscape retrofits.	Implementation of this strategy may be triggered if (1) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (2) all of the necessary resources have been secured.	• Staff resources • Grant funding • Incentive items • Partnerships	FY 2016-17; Continuous until grant funding and incentives are depleted Continue implementation when the funding and incentives items are secured.			●		●	●		●		●	●	●	●
CoSD Opt-6	Implement an incentive program for BMP Retrofits (Public-Private Partnerships - a County sponsored program to offer incentives for rain barrel installation, downspout disconnects from the stormwater system, etc.)	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) pilot program success; and (4) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Incentive items • Partnerships	FY 2015-16 Continuous, as resources allow	●	●	●	●	●	●	●	●	●	●	●		●
CoSD Opt-7	Implement trash capture program (e.g., retrofit storm drain intakes with trash capture devices)	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) baseline study completion and success; and (4) focus areas identification; and (5) detailed inlet inventory of focus areas; and (6) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Equipment • Permits • Ongoing funding for operation/maintenance	Baseline study 2-3 years; FY 15-16 implementation as needed and as resources allow	●								●			●	●

Number	Optional Strategy	Trigger	Resources	Implementation Timeframe	Water Chemistry Benefits (Pollutants)									Physical & Biological Benefits			
					Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life
CoSD Opt-8	Implement a Green Streets Retrofits Program	Implementation of this strategy may be triggered on a project-by-project basis if (1) a specified interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) pilot program success; and (4) all of the necessary resources have been secured.	Each green street retrofit project is preliminary estimated to cost an average of $5,500,000 per linear mile of retrofit for construction. Resources include: • Staff resources • Grant funding or alternative source • Contractor funding • Engineering or landscaping design • Permits • Environmental review • Right of way acquisition • Ongoing funding for operation/maintenance	Once triggered, 3-7 years per project; ongoing operation & maintenance thereafter	●	●	●	●	●	●	●	●	●	●	●		
CoSD Opt-9	Construct Treatment Control BMPs (retrofits projects)	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding CoSD Opt-6• Engineering or landscaping design • Permits • Environmental review • Ongoing funding for operation/maintenance	Once triggered, 4-7 years per project; ongoing operation & maintenance thereafter	●		●	●					●	●			
CoSD Opt-10	Implement an alternative compliance program to enable "offsite" compliance for new and redevelopment projects.	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Engineering design • Permits • Environmental review • Right of way acquisition, if needed • Ongoing funding for operation/maintenance	Once triggered, 3-6 years per project	●	●	●	●	●	●	●	●	●	●	●	●	●

Number	Optional Strategy	Trigger	Resources	Implementation Timeframe	Water Chemistry Benefits (Pollutants)									Physical & Biological Benefits			
					Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life
Provision B.3.b.(1)(b)(iii) - Incentives or programs that may be implemented to encourage or implement projects that will rehabilitate the conditions of channels or habitats																	
CoSD Opt-11	Flood Control Channel Rehabilitation Projects (e.g., removal of impervious lining in flood control channel and replacement with earthen or vegetated surface)	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (4) engineering design, monitoring, and outreach plans are approved; and (5) all of the necessary resources have been secured.	Project costs vary by size and complexity. Resources include: • Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Engineering design • Permits • Environmental review • Right of way acquisition, if needed • Ongoing funding for operation/maintenance	Once triggered, 4-7 years per project; ongoing operation & maintenance thereafter	●	●	●	●	●	●	●	●	●				
CoSD Opt-12	Implement a program to remove invasive non-native plants (i.e. Arundo) upstream areas rivers or tributaries.	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) community support and partnerships established; and (4) it has been determined that invasive plants have been found to have an impact on water quality; and (5) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Permits • Partnerships	Once triggered, 1-2 years per project	●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-13	Habitat Restoration and rehabilitation projects in County Parks	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	• Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Restoration / Rehabilitation Designs Approved • Environmental Permits issued • CEQA / NEPA Environmental review • Ongoing funding for maintenance and monitoring	Once triggered 4-7 years per project; ongoing operation & maintenance thereafter	●	●	●	●	●	●	●	●	●	●	●	●	●

Number	Optional Strategy	Trigger	Resources	Implementation Timeframe	Water Chemistry Benefits (Pollutants)									Physical & Biological Benefits			
					Bacteria	Metals	Organics	Sediment	Pesticides	Nutrients	Oil & Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat/Wildlife	Aquatic Life
Structural BMPs Identified in WQIPs																	
CoSD Opt-14	Construct structural BMPs to reduce bacteria and other priority pollutants, as needed	Implementation of this strategy may be triggered if (1) an interim goal has not been met; and (2) it has been determined by the County of San Diego through adaptive management that implementation is necessary; and (3) all of the necessary resources have been secured.	Each structural BMP project will require the following resources: • Staff resources • Grant funding or alternative source • Contractor funding • Partnerships • Engineering design • Permits • Environmental review • Right of way acquisition, if needed • Ongoing funding for operation/maintenance	Once triggered, 4-7 years per project; ongoing operation & maintenance thereafter	●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-15	SLR WQIP - SDCo-R-01, infiltration basin				●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-16	SLR WQIP - SDCo-R-02, subsurface flow wetland				●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-17	SLR WQIP - SDCo-R-03, subsurface flow wetland				●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-18	SLR WQIP - SDCo-R-04, subsurface flow wetland				●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-19	SLR WQIP - MJ-R-01, subsurface flow wetland				●	●	●	●	●	●	●	●	●	●	●	●	●
CoSD Opt-20	SLR WQIP - MJ-R-02, subsurface flow wetland				●	●	●	●	●	●	●	●	●	●	●	●	●

B.4 Caltrans

Table 3B.4-1. Caltrans, Illicit Discharge Detection and Elimination Program Strategies

Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency
Engage the public, jurisdictional staff, and other agency staff to proactively identify and report illicit discharges.		
• *Utilize municipal personnel and contractors to identify and report illicit discharges and connections.*	Current	Continuous
• *Facilitate public reporting of illicit discharges and connections via telephone and email.*	Current	Continuous
• *Educate the public regarding illegal discharges/dumping.*	Current	Continuous
• *Coordinate with upstream entities to prevent illicit discharges from upstream sources from entering the MS4.*	Current	As Needed
• *Annual training for appropriate staff on implementation of ICID and Illegal Dumping Response Plan.*	Current	Annual
• *Develop and implement procedures for educating the public with respect to ICIDs and illegal dumping.*	Current	Continuous
Develop and implement approaches to address the impacts of septic systems within the watershed.		
• *Investigate and eliminate illicit discharges and connections.*	Current	As Needed
Develop and implement approaches to reduce the impacts of public and private sanitary sewer systems within the watershed.		
• *Implement practices and procedures to address spills with the potential to enter the MS4.*	Current	Continuous
• *Investigate and eliminate illicit discharges and connections.*	Current	As Needed
Implement monitoring programs to provide new information to refine the prioritization of drainage areas.		
• *Develop Comprehensive TMDL Monitoring Plan.*	FY 16-17	One Time
• *TMDL Reach Prioritization*	FY 15-16	One Time
• *Perform Tier 1 Monitoring.*	Current	Annual
Actively enforce prohibitions related to illicit discharges and connections.		
• *Investigate and eliminate illicit discharges and connections.*	Current	As Needed
Other Related Programs and Activities.		
• *Develop and Implement an ICID and Illegal Dumping Response Plan.*	FY 15-16	Continuous
• *Develop and implement procedures for investigating, remediating, and eliminating illicit connections and discharges.*	Current	Continuous
• *Develop and implement procedures for the prevention of illegal dumping.*	Current	Continuous

Table 3B.4-2. Caltrans, Development Planning Program Strategies

Development Planning Program Strategies	Implementation Timeframe	Frequency
Implement a post construction BMP compliance program to ensure proper construction and maintenance.		
• *Implement a program that ensures that all structural BMPs are designed, constructed, and maintained.*	Current	Continuous
• *Inspect all high priority structural BMPs annually.*	Current	Annual
• *Maintain an inventory of structural BMPs.*	Current	Rolling Updates
• *Stormwater Treatment BMP Technology Report and Stormwater Monitoring and BMP Development Status Report in Annual Report.*	FY 15-16	One Time/ Annual
Enforce post construction requirements related to new and redevelopment.		
• *Enforce legal authority to ensure all development projects are in compliance with all post construction requirements.*	Current	As Needed

Table 3B.4-3. Caltrans, Construction Management Program Strategies

Construction Management Program Strategies	Implementation Timeframe	Frequency
Ensure that minimum BMPs are designated and required for construction projects.		
• *Implement or require implementation of BMPs that are site specific, seasonally appropriate, and appropriate to the construction phase year round.*	Current	Continuous
• *Develop and implement new construction guidance as needed to comply with new Statewide Construction General Permit (CGP).*	FY 15-16	One Time
Provide enhanced outreach and coordination to convey construction requirements.		
• *Provide internal staff training related to construction storm water management.*	Current	As Needed
• *Provide public education and outreach targeting the construction industry.*	Current	Continuous

Table 3B.4-4. Caltrans, Existing Development Management Program Strategies

Existing Development Management Program Strategies	Implementation Timeframe	Frequency
Improve data tracking methods for existing development inventories where necessary.		
Improve trash management strategies within the watershed.		
• *Implement "Don't Trash California" campaign.*	Current	Continuous
• *Implementation of Adopt-A-Highway Statewide Program through coordination with local organizations.*	Current	Continuous
• *Report and evaluate trash and litter activities.*	Current	Annual
Improve and implement existing outreach programs to target key sources and pollutants.		
• *Implement and annually evaluate public education program.*	Current	Continuous
• *Implement "Don't Trash California" campaign.*	Current	Continuous
• *Co-sponsor CASQA's Water Quality Newsflash.*	Current	Continuous
• *Implementation of Adopt-A-Highway Statewide Program through coordination with local organizations.*	Current	Continuous
• *Implementation of Statewide Storm Drain Stenciling Program.*	Current	Continuous
Enhance existing MS4 maintenance programs.		
• *Implement a schedule of operation and maintenance activities.*	FY 15-16	Continuous
Improve existing inspections programs to more efficiently target key sources.		
• *Implement a schedule of operation and maintenance for highways.*	Current	Continuous
• *Implement highway maintenance activities as required.*	Current	Continuous
Actively enforce stormwater and urban runoff requirements for existing development.		
• *Develop and implement Facility Pollution Prevention Plans.*	Current	One Time, On Going
Develop and implement a strategy to identify and facilitate retrofit opportunities in areas of existing development.		
• *Develop a strategy to identify opportunities and facilitate the implementation of retrofit projects in areas of existing development.*	FY 15-16	One Time
Improve coordination between agencies.		
• *Develop and implement a Municipal Coordination Plan.*	FY 15-16	One Time, On Going
Other BMPs/Activities		
• *Implement and evaluate the Vegetation Controls Program.*	Current	Continuous

CHAPTER 3- APPENDIX C: WET WEATHER BASELINE LOADS QUANTIFICATION METHODS & VALUES

The modeling that was performed to obtain load reduction estimates for this WQIP is consistent with what was done for the SLR Comprehensive Load Reduction Plan (CLRP), as is required by the Permit.

Wet weather baseline loads for fecal coliform[1], as well as total nitrogen (nitrate + total kjeldahl nitrogen; nitrite is assumed to be negligible) and total phosphorus were established using Structural BMP Prioritization and Analysis Tool (SBPAT); a GIS-based water quality analysis tool used to quantify benefits, costs, uncertainties and potential risks associated with storm water quality projects. The quantification/analysis module utilizes a stochastic Monte Carlo method to model water quality based on land use Event Mean Concentrations (EMCs)[2] coupled with continuous hydrologic simulations (produced using the USEPA SWMM model) to calculate annual loads. See the SBPAT Guidance Manual for further information (Geosyntec, 2008). In order to maintain consistency with the TMDL, which bases load reduction calculations on Water Year (WY) 1993, the WQIP analysis was also developed using rainfall from WY 1993.

Land use EMCs for modeled pollutants selected for WQIP analysis were originally developed for the SLR CLRP using storm water monitoring data collected by 1) the City of San Diego solely, and 2) the County of San Diego and the Copermittees of the San Diego Municipal Stormwater Permit as a group. The mean statistics were evaluated using San Diego County datasets, but in order to capture variability and spread, the standard deviation statistics were also evaluated using the coefficients of variation[3] from the Los Angeles County SBPAT default datasets. For pollutants where no San Diego County specific EMC data were available, SBPAT default EMC statistics were used.

Since the San Diego County EMC datasets were based on fewer storms, smaller drainage areas (and therefore a smaller diversity of sites within each land use category) and were collected over a three month period of time within a single season, they may not adequately capture the full variability across multiple storm sizes, antecedent conditions, and wet seasons. In order to address this issue for the WQIP analysis, fecal coliform (FC) land use EMCs used in the CLRP were compared with the FC land use EMCs developed for other Southern California-based TMDL compliance plans (Beach Cities WMG 2014). When arithmetic estimates of the log mean differed by more than an order of magnitude, they were compared with arithmetic mean land use concentrations from the LSPC model calibrated for the San Diego Region, and the EMC statistics from the two datasets that were closer to LSPC's arithmetic means (calculated based on land use loads divided by runoff volumes) were selected for use in this WQIP analysis. This resulted in changes to commercial and open space FC EMCs. **Table 3C- 1** below provides the CLRP and the updated WQIP arithmetic estimates of log

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[1] Fecal coliform is utilized as a surrogate for all FIB since there is an acceptable database of both land use-based storm water concentrations and structural BMP performance for this constituent.

[2] EMC is a method for characterizing pollutant concentrations from a homogenous land use to a receiving water from a runoff event often chosen for its practicality. The value is determined by compositing (in proportion to flow rate) a set of samples, taken at various points in time during a runoff event, into a single sample for analysis.

[3] Coefficient of Variation (COV) = standard deviations divided by the means

mean and log standard deviation for the two land uses. **Table 3C-2** provides the EMCs for all land uses and pollutants used in the WQIP analysis.

Table 3C- 1. Updated FC land use EMCs – Arithmetic Estimates of the Lognormal Summary Statistics (means with standard deviations in parentheses)

Land Use	CLRP EMC	WQIP EMC
Commercial	791 [22,846]	51,600[1] [173,400]
Open Space	6,310 [1,310]	484[2] [806]

[1] Commercial fecal coliform EMC based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007a). This EMC dataset is summarized in the SBPAT User's Guide (Geosyntec, 2012).
[2] Open space fecal coliform EMC statistics based on E. *coli* data (divided by 0.85 to adjust to fecal coliform) for Arroyo Sequit reference watershed, or 11 samples collected between December 2004 and April 2006. Data used by LA Regional Board for Santa Clara Bacterial TMDL and taken from (SCCWRP, 2005) and (SCCWRP, 2007b)

Baseline loads in the WQIP included loads from development that occurred between the TMDL year (2003) and 2009, since the WQIP baseline load was developed using 2009 land use data. As such, structural BMPs that were implemented between the TMDL year (2003) and 2009 as mitigation to this anticipated development were considered as part of the overall pollutant load reduction to be achieved by the WQIP. Appendix E presents a list of these projects, a map with their locations, and describes how these features were modeled. It should be noted that no credit is given in the WQIP for BMPs to be implemented as mitigation to new development after 2009 as it is assumed that the loads mitigated by the BMPs will offset the additional loads generated by new development (i.e., no net decrease in pollutant load).

Table 3C-2. Proposed SBPAT EMCs for SLR and SDR Watersheds – Arithmetic Estimates of the Lognormal Summary Statistics (means with standard deviations in parentheses)

Land Use	TSS	TP	DP	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	#/100 mL
Rural Residential	2,523.76 (3,757.19)	1.59 (1.19)	0.12 (0.08)	0.11 (0.14)	1.50 (3.40)	2.65 (2.45)	4.20 (4.02)	8.36 (5.99)[1]	21.38 (31.41)	14.99 (30.63)	39.19 (34.01)[1]	6,684 (20,245)
Orchard	252.64 (163.89)	0.36 (0.16)	0.13 (0.10)	0.04 (0.04)	26.11 (88.27)	2.31 (1.09)	22.50 (17.50)	100.10 (74.8)	30.20 (34.30)	40.10 (49.10)	274.80 (147.30)	1,344 (3,410)
Single Family Residential	123.41 (183.72)	0.49 (0.37)	0.45 (0.29)	0.49 (0.64)	1.58 (3.59)	2.51 (2.33)	11.42 (10.93)	25.96 (18.6)	13.03 (19.15)	50.02 (102.22)	153.29 (133.04)	35,557 (107,700)
Commercial	127.68 (89.75)	0.32 (0.27)	0.29 (0.25)	1.21 (4.18)	0.55 (0.55)	3.44 (4.78)	16.62 (13.78)	54.84 (44.88)	14.40 (39.60)	224.40 (140.58)	483.7 (306.62)	51,600 (173,400)
Industrial	125.18 (118.15)	0.45 (0.47)	0.26 (0.25)	0.6 (0.95)	0.87 (0.96)	2.87 (2.33)	21.35 (20.78)	53.54 (56.95)	20.52 (58.92)	214.58 (271.47)	428.39 (388.85)	26,703 (34,515)
Education (Municipal)	132.11 (162.75)	0.46 (0.26)	0.26 (0.2)	0.4 (0.99)	0.61 (0.67)	1.71 (1.13)	5.58 (5.03)	12.02 (8.21)	7.43 (10.11)	73.13 (50.73)	174.1 (123.02)	2,148 (6,506)[2]
Transportation	77.80 (83.80)	0.68 (0.94)	0.56 (0.82)	0.37 (0.68)	0.74 (1.05)	1.84 (1.44)	32.40 (25.5)	52.20 (37.5)	9.20 (14.5)	222 (201.7)	292.90 (215.8)	1,680 (456)
Multi-family Residential	39.90 (51.3)	0.23 (0.21)	0.20 (0.19)	0.50 (0.74)	1.51 (3.06)	1.80 (1.24)	7.40 (5.70)	12.10 (5.60)	4.50 (7.80)	77.5 (84.1)	125.10 (101.10)	11,800 (23,700)
Agriculture (row crop)	999.2 (648.2)	3.34 (1.53)	1.41 (1.04)	1.65 (1.67)	34.40 (116.30)	7.32 (3.44)	22.50 (17.50)	100.10 (74.8)	30.20 (34.3)	40.10 (49.10)	274.80 (147.30)	60,300 (153,000)
Vacant / Open Space	216.60 (1482.8)	0.12 (0.31)	0.09 (0.27)	0.11 (0.25)	1.17 (0.79)	0.96 (0.9)	0.60 (1.90)	10.60 (24.4)	3.00 (13.10)	28.10 (12.90)	26.30 (69.50)	484 (806)

[1] SBPAT default SFR dissolved:total concentration ratio was applied to the Blossom Valley dissolved mean value to estimate Blossom Valley total mean value

[2] FC EMC COV is based on SFR SCCWRP datasets

Mean EMCs in shaded area are based on LA region default SBPAT datasets due to a lack of available San Diego data

Mean EMCs shaded in orange are updated for this WQIP

The datasets and assumptions used to calculate wet weather baseline loads differ somewhat between the 2002 TMDL modeling analysis – which established the required load reductions in the Permit – and the SBPAT analysis presented in this WQIP. In general, while the two models perform the same overall functions (i.e., watershed hydrologic and pollutant load estimation), they incorporate slightly different watershed land surface data (e.g., land use, soil, and imperviousness data), hydrologic input data (e.g., soil infiltration rates, rain gauge datasets), and water quality input data (e.g., land use EMCs or buildup/wash off rates), and they apply slightly different formulas that are used to calculate runoff volumes and pollutant load outputs. For example, SBPAT used new land use monitoring data that was available after the TMDL modeling analysis was performed and used 2009 land use data whereas the TMDL model used 2001 land use data. In addition, the TMDL model estimates the pollutant load using a buildup/washoff equation whereas SBPAT used land use based event mean concentrations to estimate the pollutant load from the watershed. In order to evaluate the appropriateness of using SBPAT for comparison with the Permit's required load reductions, the annual baseline loads estimated by SBPAT were compared to those presented in the TMDL. As shown in **Figure 3C-** 1, the estimates are within the same order of magnitude, thereby supporting the proposed WQIP modeling approach and input datasets, and thus the expected comparability of SBPAT's load reductions and the TMDL model's load reductions.

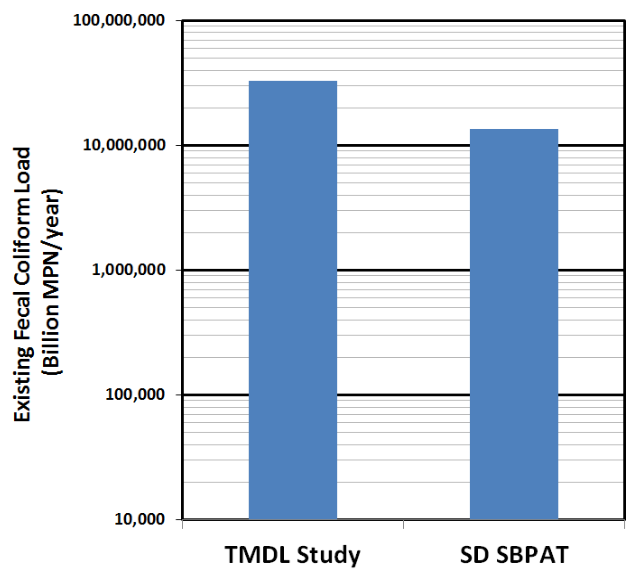


Figure 3C- 1. Comparison of baseline loads for SLR watershed for WY 1993 calculated by TMDL model versus SBPAT method

SBPAT's predicted annual FC load was divided by the SBPAT predicted annual volume to determine the corresponding average FC EMC at the watershed outlet to the ocean, which was estimated to be 10,760 MPN/100 ml. This value was compared to the arithmetic mean of measured concentration data from SLR mass loading monitoring station (n=23, Period of Record = 2001-11) which was 5,160 MPN/100 ml.[4] SBPAT's average concentration is expected to be above the average measured

[4] One outlier, defined as a value greater than two times the standard deviation of the average, was removed from this dataset.

concentration at the watershed outlet given that SBPAT does not include in-stream die-off losses. Therefore, this comparison with receiving water monitoring results further supports the proposed WQIP modeling approach and input datasets (particularly the EMC values) because the model provides more conservative values than the expected measured results would be.

Figure 3C-2 shows the estimated modeled percentage breakdown of SLR wet weather watershed FC baseline loads by jurisdiction. Modeled baseline FC loads by jurisdiction are also summarized in **Table 3C-3**. For the purposes of the baseline loading analysis, as well as subsequent BMP implementation analyses presented in this WQIP, land use loads attributable to federal land ownership are not considered part of the Participating Agencies' load since the Participating Agencies do not have jurisdiction over these lands. Similarly, loading from agricultural land uses is not considered part of the Participating Agencies' load because the TMDL identifies Conditional Waivers of Waste Discharge Requirements as the mechanism to address discharges from controllable non-point sources (SDRWQCB 2010, p. A47). Open space loading is also shown as a separate category here, consistent with the TMDL. However, it should be noted that this general land use category includes parks and other undeveloped areas that are located within the Participating Agencies' jurisdictional areas and that drain to or through the MS4s.

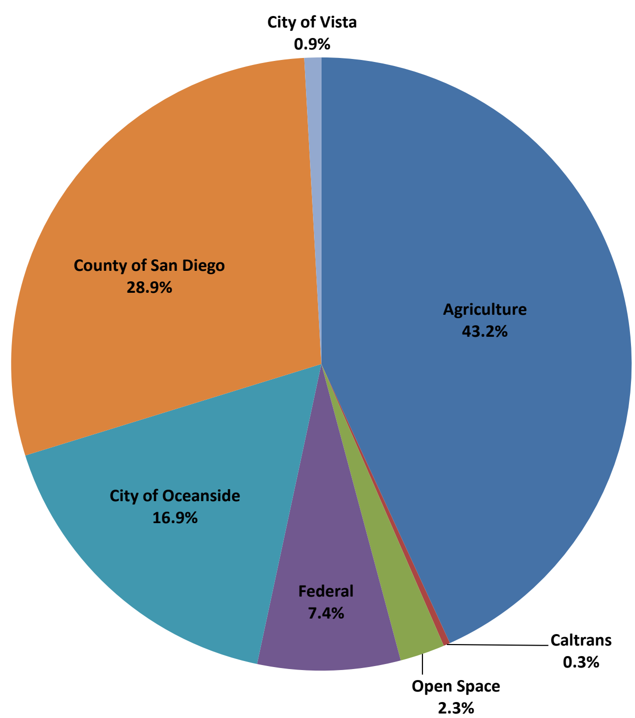


Figure 3C-2. Wet weather Baseline FC modeled loads in the SLR Watershed, by land use/ownership category, water year 1993

Table 3C-3. Breakdown of Baseline Wet Weather Fecal Coliform Loads by Jurisdiction, Water Year 1993

Jurisdiction	WY1993 FC Loads (10^{12} MPN)
Agriculture	5,725
Caltrans	45
Open Space	310
Federal	986
City of Oceanside	2,234
County of San Diego	3,835
City of Vista	117

Figure 3C-2 shows the estimated modeled percentage breakdown of SLR wet weather watershed nitrate baseline loads by jurisdiction. Modeled baseline Total Nitrogen loads by jurisdiction are also summarized in **Table 3C-3**.

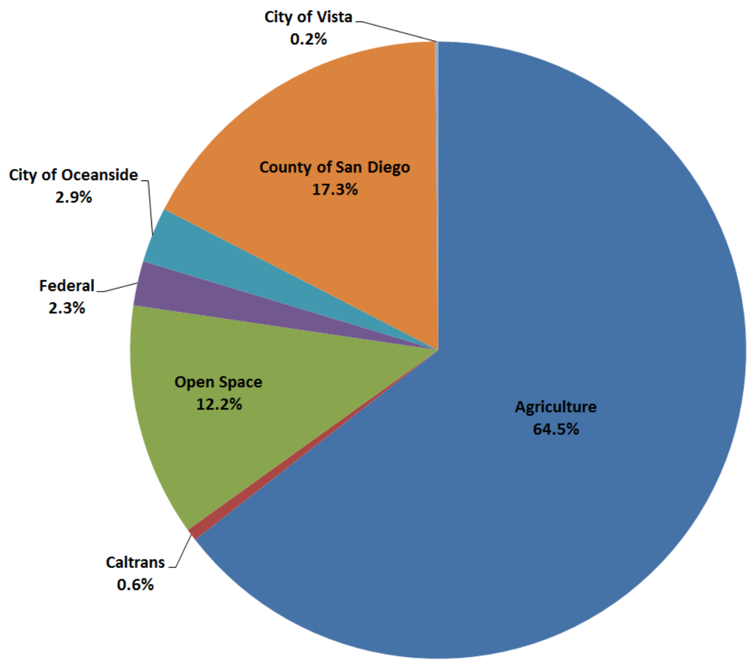


Figure 3C-3. Wet weather Baseline Total Nitrogen modeled loads in the SLR Watershed, by land use/ownership category, water year 1993

Table 3C-4. Breakdown of Baseline Wet Weather Nitrate Loads by Jurisdiction, Water Year 1993

Jurisdiction	WY1993 Total Nitrogen Loads (lbs)
Agriculture	1,596,721
Caltrans	15,487
Open Space	302,683
Federal	57,751
City of Oceanside	71,694
County of San Diego	428,423
City of Vista	3,752

Figure 3C-2 shows the estimated modeled percentage breakdown of SLR wet weather watershed total phosphorous baseline loads by jurisdiction. Modeled baseline total phosphorous loads by jurisdiction are also summarized in **Table 3C-3**.

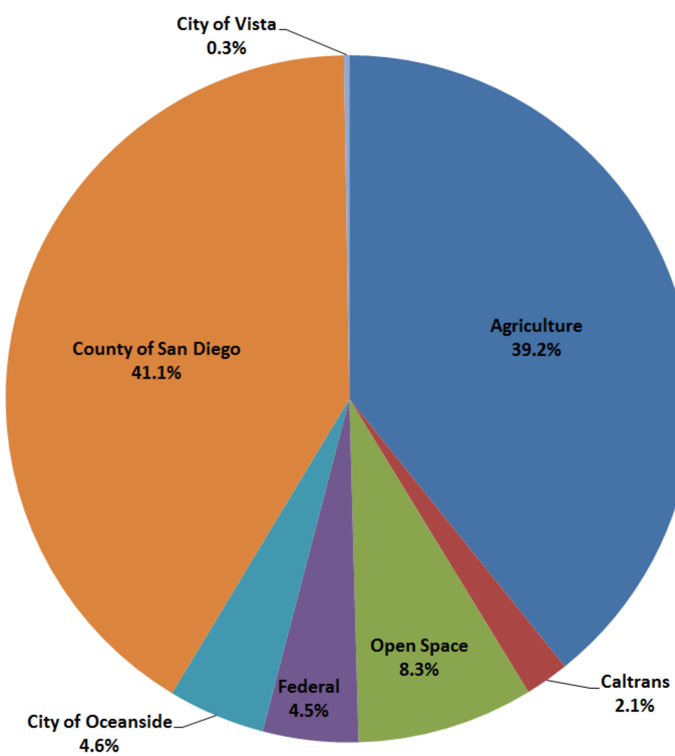


Figure 3C-4. Wet weather Baseline Total Phosphorous modeled loads in the SLR Watershed, by land use/ownership category, water year 1993

Table 3C-5. Breakdown of Baseline Wet Weather Total Phosphorous Loads by Jurisdiction, Water Year 1993

Jurisdiction	WY1993 Total Phosphorous Loads (lbs)
Agriculture	77,474
Caltrans	4,088
Open Space	16,394
Federal	8,874
City of Oceanside	9,025
County of San Diego	81,243
City of Vista	501

For the purposes of the baseline loading analysis, as well as subsequent BMP implementation analyses presented in this WQIP, land use loads attributable to federal land ownership are not considered part of the Participating Agencies' load since the Participating Agencies do not have jurisdiction over these lands. Similarly, loading from agricultural land uses is not considered part of the Participating Agencies' load because the TMDL identifies Conditional Waivers of Waste Discharge Requirements as the mechanism to address discharges from controllable non-point sources (SDRWQCB 2010, p. A47). Open space loading is also shown as a separate category here, consistent with the TMDL. However, it should be noted that this general land use category includes parks and other undeveloped areas that are located within the Participating Agencies' jurisdictional areas and that drain to or through the MS4s.

Chapter 3- Appendix D: Wet Weather Non-structural BMP Descriptions and Load Reduction Quantifications, Methods, and Calculations

The modeling performed to obtain load reduction estimates for this WQIP is consistent with what was done for the SLR Comprehensive Load Reduction Plan (CLRP), as required by the MS4 Permit.

Non-structural BMPs are management programs or activities designed to reduce or eliminate pollutant loading by addressing its source. To ensure that non-structural BMPs target the most significant sources of bacteria, the following factors were considered: (1) a sources' magnitude, prevalence, potential threat to public health and proximity to receiving water; (2) results from microbial source tracking studies conducted in the watershed and region (Weston Solutions, 2009); and (3) best professional judgment.

The wet weather load reduction quantification approach involves the following steps for each of the non-structural strategies included in this WQIP. The first step was to identify the source addressed by the program (e.g., bacteria in rooftop runoff). The next step was to calculate the targeted pollutant source area that the BMP will address (e.g., acres of rooftop). Once the targeted pollutant source area was calculated, the unit effectiveness of the selected BMP was modeled in SBPAT for a standard design (e.g., reduction of bacteria and nutrient load per acre as a result of the installation of rain barrels). The potential load reduction benefit was then calculated by multiplying the unit effectiveness of the selected BMP by the targeted pollutant source area addressed. The following sections provide a brief description of the specific quantification approach for each wet weather non-structural strategy, along with relevant assumptions and assumption explanations.

Figure 3D-1. Residential Rain Barrel

Private-Public Partnership Program

The intent of this program is to partner with the community to encourage practices that manage runoff at its source with incentives to install residential rain barrels and disconnect downspouts. These two low impact development (LID) practices were evaluated to determine the potential load reduction that may be accomplished in the Watershed. The average performance, during wet weather, of these programs per rooftop acre was modeled in SBPAT for the TMDL Critical Water Year (1993), consistent with the baseline load calculations (see Appendix 3C). Performance was modeled for bacteria, nitrogen, and phosphorous reductions. The area of implementation was based on land use information and a preliminary assessment of rooftops in the Watershed. The extent of single-family residential areas that will be converted to rain barrels was estimated to be 2.5-10% and amount that will disconnect their downspouts was estimated at 7.5-30% of all residences in the Watershed over a 16 year period, based on the expected effectiveness of the given incentives programFor the rain barrel portion of the program, this equates to one 55 gallon barrel for each 500 sq. ft. of roof area and a 10-day drain time. Quantifications for this program are shown in **Table** 3D-1. Additional load reduction benefit may be achieved by expanding the LID incentive program to commercial areas as well.

Redevelopment through Permit-required LID Implementation

This WQIP assumes that a portion of already developed areas in the Watershed has been and will be redeveloped from when the TMDL was initiated to the end of the compliance period. This redevelopment is subject to the post-construction treatment requirements contained in the San Diego MS4 Permit (Provision E.3.b) and will therefore result in load reduction benefits. A Standard Urban Stormwater Management Plan (SUSMP)-sized bioretention system with underdrains was modeled in SBPAT for residential, commercial, industrial, education, and transportation land uses during the TMDL Critical Water Year (1993) to give the bacteria, nitrogen, and phosphorous load reductions per acre converted. The rate of redevelopment requiring SUMSP LID implementation for each of these land uses was extrapolated based on the rate analysis done for the Ballona Creek Implementation Plan. During the 20 year compliance timeline this rate will result in redevelopment of approximately 6% of the MS4 area in aggregate for all the land uses evaluated. For each land use, the load reductions per acre was multiplied by the land use specific redevelopment rate, the number of land use acres, and the number of years from when the TMDL was initiated to the end of the compliance period. The annual redevelopment rates for the land uses evaluated are as follows:

- Residential Land Use Redevlopment Rate = 0.18%
- Commercial Land Use Redevelopment Rate = 0.15%
- Industrial Land Use Redevelopment Rate = 0.34%
- Education Land Use Redevelopment Rate = 0.16%
- Transportation Land Use Redevelopment Rate = 2.7%

Quantifications for this program are shown in **Table 3D-1**.

Programmatic BMPs

There are many other nonstructural BMPs implemented by the PA's that are programmatic in nature, including practices, activities, and program implementation. Due to limited data quantifying effectiveness, wet weather load reductions of programmatic BMPs identified in Chapter 2 are not as readily modeled as those described above, including:

- Identification and control of sewage discharge to Participating Agencies' MS4s,
- Trash cleanups,
- Onsite wastewater treatment source reduction,
- Good landscaping practices,
- Commercial/industrial good housekeeping,
- Pet waste controls,
- Animal facilities management,
- Erosion monitoring and repair,
- Street and median sweeping,
- MS4 cleaning, and
- Education and outreach.

However, best professional judgment and the results of studies reinforce the qualitative effectiveness of these programmatic BMPs. (HDR, 2014) To account for the expected pollutant load reduction from these other non-modeled nonstructural BMPs, an additional ten percent reduction is included in the quantification. The inclusion of these programmatic BMPs in the WQIP and the assumed ten percent reduction could be evaluated and updated throughout the implementation period as pollutant loading and BMP performance data is collected.

Figure 3D-2. City of San Diego Pet Waste Dispenser

Table 3D-1. San Luis Rey Summary of Wet Weather Non-Structural BMP Water Quality Benefits

BMP Name	Wet or Dry Weather	Land Use Targeted	Pollutant Generating Activity	Quantification Assumptions			Quantification Method	Expected Annual Reduction of MS4 Baseline Load[1] by 2031					
				Load Assumption	Units	Citation/Assumptions		Fecal Coliform (10 ^12 MPN and percent)		Nitrogen (lbs)		Phosphorus (lbs)	
								Low Range	High Range	Low Range	High Range	Low Range	High Range
Potential Public Private Partnership Program	Wet Weather	Single Family Residential (SFR)	Residential Roofs	28,374	Parcels of Single Family Residential in Watershed	SANDAG Land Use and Parcel Data	(residential parcels in watershed) * (SFR rooftop area) * [(expected percent of residential area converted to rain barrels) * (annual load reduction per acre conversion to rain barrels) + (expected percent of SFR disconnected to lawns) * (annual load reduction per acre from disconnection to lawn)]	84 1.4%	1,100 18%	1,600 0.32%	20,000 4.0%	130 0.14%	1,700 1.9%
				1200 - 5700	Single Family Residential Rooftop Size	Range developed on a GIS assessment of 20 parcels per jurisdiction							
				0.095	10 ^12 MPN of fecal coliform reduced per impervious acre treated by rain barrels	Modeled in SBPAT using Fallbrook rainfall data, assumed 0.2 inch design storm (equates to one 55 gallon barrel for each 500 sq.-ft. roof area), 10-day drain time.							
				2.470	lbs of total nitrogen reduced per impervious acre treated by rain barrels								
				0.286	lbs of total phosphorus reduced per impervious acre treated by rain barrels								
				1.11	10 ^12 MPN of fecal coliform reduced per impervious acre treated by disconnection	Modeled in SBPAT using Fallbrook rainfall data, assumed area receiving flow would have an infiltration rate of 0.15 in/hr. (C/B soils) and effective depression storage (including root zone) of 0.7 inches, and would be 1/4 the area of contributing flow							
				21.2	lbs of total nitrogen reduced per impervious acre treated by disconnection								
				1.69	lbs of total phosphorus reduced per impervious acre treated by disconnection								
				2.5-10%	Percent of Residential Area Converted to rain barrels	Conversion over 15 years, based on expected effectiveness of incentives program.							
				7.5-30%	Percent of Residential Area Converted to disconnected to pervious area.	Conversion over 15 years, based on expected effectiveness of incentives program.							
Redevelopment through Permit-Required LID Implementation	Wet Weather	All Land Uses covered under SUSMP	Urban development	0.398	10^12 MPN of fecal coliform reduced per Residential Acre Converted	Modeled in SBPAT using Fallbrook rainfall data; Applied standard SUSMP-sized bioretention with underdrains to unit areas of various land uses.	Sum for all land uses of (Load Reduction per Acre Converted) * (Acres Converted per Year) * (Years to 2031) * (+ or - 20%)	200	310	6200	9200	960	1400
				0.643	10^12 MPN of fecal coliform reduced per Commercial Acre Converted								

BMP Name	Wet or Dry Weather	Land Use Targeted	Pollutant Generating Activity	Quantification Assumptions			Quantification Method	Expected Annual Reduction of MS4 Baseline Load[1] by 2031					
				Load Assumption	Units	Citation/Assumptions		Fecal Coliform (10 ^12 MPN and percent)		Nitrogen (lbs)		Phosphorus (lbs)	
								Low Range	High Range	Low Range	High Range	Low Range	High Range
				0.330	10^12 MPN of fecal coliform reduced per Industrial Acre Converted								
				0.005	10^12 MPN of fecal coliform reduced per Education Acre Converted								
				0.010	10^12 MPN of fecal coliform reduced per Transportation Acre Converted								
				6.200	lbs of total nitrogen reduced per Residential Acre Converted								
				8.140	lbs of total nitrogen reduced per Commercial Acre Converted								
				7.100	lbs of total nitrogen reduced per Industrial Acre Converted								
				0.800	lbs of total nitrogen reduced per Education Acre Converted								
				0.420	lbs of total nitrogen reduced per Transportation Acre Converted								
				0.340	lbs of total phosphorus reduced per Residential Acre Converted			3.2%	5.0%	1.2%	1.8%	1.1%	1.5%
				0.290	lbs of total phosphorus reduced per Commercial Acre Converted								
				0.500	lbs of total phosphorus reduced per Industrial Acre Converted								
				0.110	lbs of total phosphorus reduced per Education Acre Converted								
				0.880	lbs of total phosphorus reduced per Transportation Acre Converted								
				49	Acres Residential Converted per year (Land Use Redev. Rate = 0.18%)	Calculated by Extrapolating City of LA Redevelopment Rate From Ballona IP (rate shown in							

BMP Name	Wet or Dry Weather	Land Use Targeted	Pollutant Generating Activity	Quantification Assumptions			Quantification Method	Expected Annual Reduction of MS4 Baseline Load[1] by 2031					
				Load Assumption	Units	Citation/Assumptions		Fecal Coliform (10 ^12 MPN and percent)		Nitrogen (lbs)		Phosphorus (lbs)	
								Low Range	High Range	Low Range	High Range	Low Range	High Range
				5.1	Acres Commercial Converted per year (Land Use Redev. Rate = 0.15%)	parentheses) to watershed area by land use							
				12	Acres Industrial Converted per year (Land Use Redev. Rate = 0.34%)								
				3.9	Acres Education Converted per year (Land Use Redev. Rate = 0.16%)								
				370	Acres Transportation Converted per year (Land Use Redev. Rate = 2.7%)								
Wet Weather Total							**Total expected load reduction**	**284**	**1410**	**7800**	**29200**	**1090**	**3100**
							% of average MS4 total load	**4.6%**	**23%**	**1.5%**	**5.8%**	**1.2%**	**3.4%**

1. The MS4 baseline load for wet weather was calculated in SBPAT and the 25th and 75th Percentiles of the annual load was used to create these ranges.

Chapter 3- Appendix E: Wet Weather Structural BMP Descriptions and Load Reduction Quantifications, Methods, and Calculations

The modeling performed to obtain load reduction estimates for this WQIP is consistent with the modeling performed for the SLR Comprehensive Load Reduction Plan (CLRP), as required by the MS4 Permit.

Structural BMPs are engineered systems designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological update, media absorption, or any other physical, biological or chemical process. Two types of structural BMPs have been proposed for implementation and modeled for this WQIP: distributed and regional. Distributed structural BMPs are implemented at the neighborhood, parcel or site scale and can include green streets, rainwater harvesting and other low impact development solutions. Regional structural BMPs are implemented to treat sub-watershed or catchment scale drainage areas and include structures such as subsurface flow wetlands, infiltration basins and constructed wetlands.

Load Reduction Methods Information for all Wet Weather Structural BMPs

Load reductions for structural BMPs during wet weather were calculated using SBPAT. In general, design criteria for each selected BMP were first defined considering site constraints (in particular, acreage available for each BMP footprint), BMP performance data, and local regulations. For example, for regional BMPs, if there was not adequate space to provide full SUSMP-level treatment, estimated load reductions were based on available area (publicly owned) and benefits were calculated accordingly. Once a BMP was identified and design criteria defined for each feasible BMP opportunity site, SBPAT was used to evaluate the impact of implementing this suite of BMPs on water quality in the region. Details of the methodology and specific design criteria for regional versus distributed BMPs are discussed in the following sections.

Locations for distributed and regional BMPs were identified using the SBPAT catchment prioritization step, which orders catchments within the WMA based on their potential to generate the highest pollutant loads during wet weather events. This allows identification of locations within the WMA that offer the greatest potential benefits in terms of load reductions through implementation of BMPs. Consistent with the goal of prioritizing strategies with a multi-pollutant benefit, this catchment prioritization analysis was conducted considering nitrogen and phosphorus (using total suspended solids as a proxy)[1], in addition to the HPWQC.

E.1 Implemented Distributed Structural BMPs

Implemented BMPs include those that were implemented between 2003 and 2009 as part of private land development projects. The Permit authorizes the Participating Agencies to take credit for these, and as such structural BMPs that were implemented between the 2003 and 2009 as mitigation to this anticipated development were considered as part of the overall pollutant load reduction to be achieved by the WQIP. Refer to Appendix B where the role of implemented structural BMPs in the WQIP's baseline load calculations is discussed. No credit is given in the

[1] The SBPAT catchment prioritization step does not include an option for phosphorus. Because of this, TSS was used as a proxy for phosphorus, since the majority of phosphorus is associated with solids. The load reduction analysis step in SBPAT does include phosphorus, so no proxy was necessary for this portion of the analysis.

WQIP for BMPs to be implemented as mitigation to new development after 2009 as it is assumed that the loads mitigated by the BMPs will offset the additional loads generated by new development (i.e. no net decrease in pollutant load).

Load Reduction Quantification Methods – Specific Design Criteria

- Distributed BMPs were modeled as bioretention and bioretention swales with under drains[2] according to their infiltration capacity. Design criteria for quantifying the distributed parameters were developed using the following assumptions:
- Distributed BMPs within a catchment would be implemented to treat 25 percent of the MS4 area within a given catchment;
- Four (4) percent of the contributing area would be required for treating full SUSMP rainfall depth of 0.75 inches from the contributing area with distributed BMPs. This assumption was based on previous experiences with implementation of similar distributed BMPs;
- For catchments where sufficient land was not available, the design storm was taken to be a fraction of this 0.75 inch storm according to what percent of the contributing area was potentially available for BMP installation;
- Other design criteria for bioretention:
  - Design Volume: governed by available space and contributing area
  - Retention Depth: 12 inches
  - Infiltration Rate: governed by soil type.
- Other design criteria for bioretention swale with under drains:
  - Design Flow Rate: governed by available space and contributing area
  - Hydraulic Residence Time: 10 min
  - Longitudinal Slope: 0.03 ft./ft.
  - Manning's Roughness Coefficient: 0.25
- Water Quality Flow Depth: 4 inches
- Retention Depth: 2 inches
- Infiltration Rate: governed by soil type.

The locations of the implemented distributed BMPs are identified in **Figure 3E-1** and associated descriptions are provided in **Table 3E-1**. A summary of the estimated load reductions for these implemented distributed structural BMPs appear in **Table 3E-2**. These BMPs were quantified using

[2] Bioretention-type BMPs are landscaped shallow depressions that capture and filter storm water runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, plantings, and, optionally, a subsurface gravel reservoir layer.

unit area quantification results based on an assumption that these BMPs were designed to meet the SUSMP criteria.

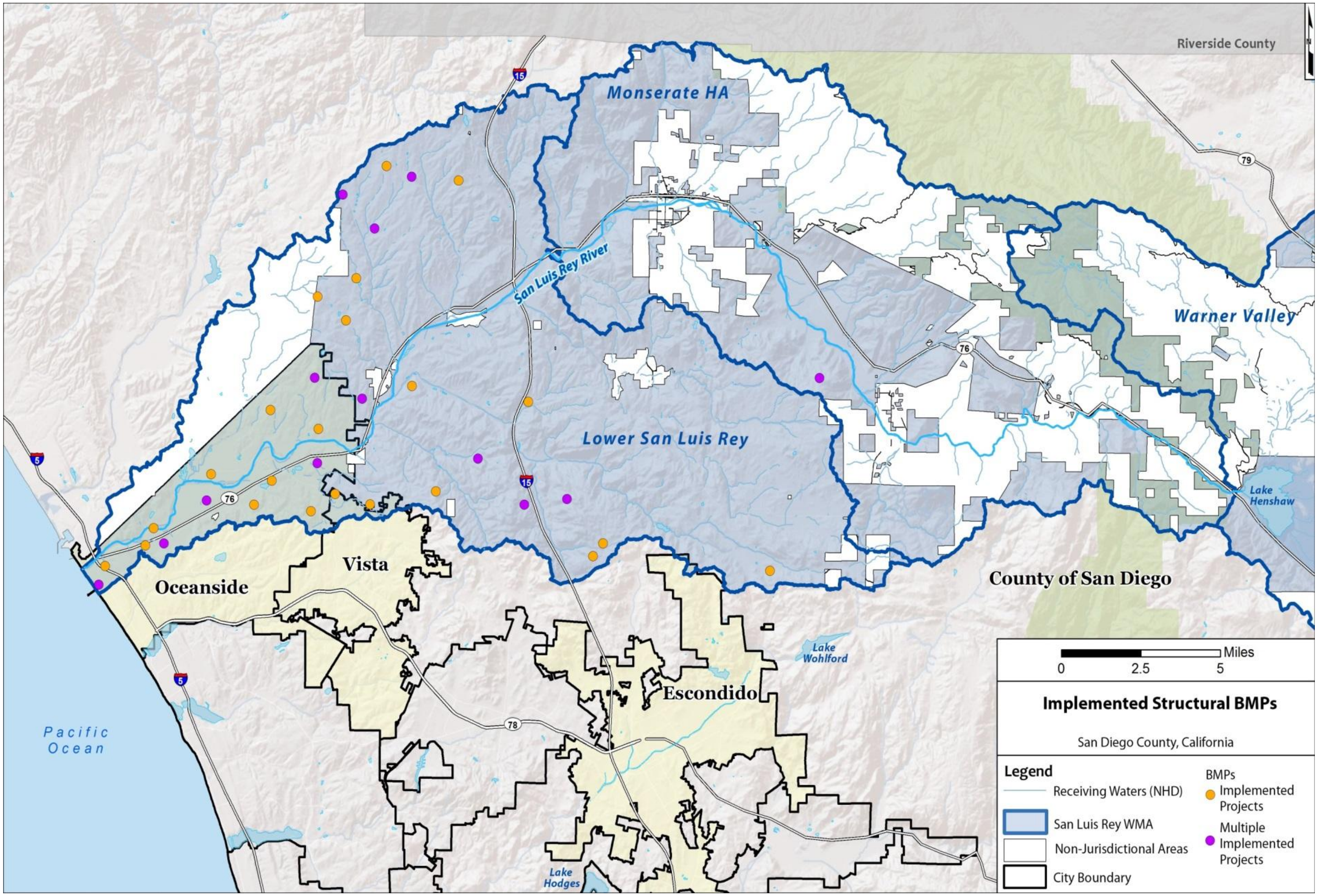


Figure 3E-1. Locations of Implemented Distributed BMPs

Table 3E-1. Descriptions of Implemented Distributed Structural BMPs

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
County of San Diego	10308 Meadow Glen Way East, Escondido	Bioretention Swale	0.5	1961	Commercial
County of San Diego	Lake Vista Dr, Bonsall	Biofilters	2.6	1525	Rural Residential
County of San Diego	Ridge Creek Drive/Via Montevina, Fallbrook	Grass Swale	2.6	1148	Rural Residential
County of San Diego	14442 Woods Valley Rd, Escondido	Bioretention Swale	15	1982	Rural Residential
County of San Diego	260 Rockycrest Road, Fallbrook	Bioretention Swale	2.1	1170	SF Residential
County of San Diego	27717 High Vista Drive, Escondido	Natural Swale	2.6	1964	Rural Residential
County of San Diego	3508 Olive Hill Road, Fallbrook	Bioretention Swale	2.1	1365	Rural Residential
County of San Diego	4747 Caminito de los Cepillos, Bonsall	Vegetated Filter Strip	2.4	1696	Rural Residential
County of San Diego	883 Burma Rd, Fallbrook	Biofilters	8.6	1341	Rural Residential
County of San Diego	28565 Cole Grade Road, Valley Center	Extended Detention Basin	13	1887	Institutional/ Education
County of San Diego	210 Sky Country Court, Fallbrook	Vegetated Filter Strip	0.5	1170	SF Residential
County of San Diego	211 Sky Country Court, Fallbrook	Vegetated Filter Strip	0.5	1170	SF Residential
County of San Diego	222 Sky Country Court, Fallbrook	Vegetated Filter Strip	0.5	1170	SF Residential
County of San Diego	223 Sky Country Court, Fallbrook	Vegetated Filter Strip	0.5	1170	SF Residential
County of San Diego	234 Sky Country Court, Fallbrook	Vegetated Filter Strip	0.5	1170	SF Residential
County of San Diego	235 Sky Country Court, Fallbrook	Vegetated Filter Strip	0.5	1170	SF Residential
County of San Diego	2351 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.5	1215	SF Residential
County of San Diego	2352 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.5	1165	SF Residential

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
County of San Diego	246 Sky Country Court, Fallbrook	Bioretention Swale	0.5	1170	SF Residential
County of San Diego	247 Sky Country Court, Fallbrook	Vegetated Filter Strip	0.5	1170	SF Residential
County of San Diego	8310 Nelson Way, Escondido	Bioretention Swale	28.1	1606	MF Residential
County of San Diego	1425 E. Fallbrook St, Fallbrook	Vegetated Filter Strip	0.2	1126	Transportation
County of San Diego	Dallas Road, Fallbrook	Bioretention	0.8	1143	SF Residential
County of San Diego	1110 Dallas Road, Fallbrook	Bioretention	0.7	1143	SF Residential
County of San Diego	1111 Dallas Road, Fallbrook	Vegetated Filter Strip	1.9	1143	SF Residential
County of San Diego	1117 Dallas Road, Fallbrook	Bioretention	0.8	1143	SF Residential
County of San Diego	1122 Dallas Road, Fallbrook	Bioretention	1	1143	SF Residential
County of San Diego	15513 Choufa Ct, Valley Center	Bioretention Swale	4.2	1495	Rural Residential
County of San Diego	15521 Choufa Ct, Valley Center	Bioretention Swale	4.2	1495	Rural Residential
County of San Diego	15533 Choufa Ct, Valley Center	Bioretention Swale	2.6	1495	Rural Residential
County of San Diego	229572 Meadow Glen Way, Escondido	Swales	1.6	1881	Rural Residential
County of San Diego	2303 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.7	1165	SF Residential
County of San Diego	2315 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.9	1165	SF Residential
County of San Diego	2316 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.7	1165	SF Residential
County of San Diego	2327 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.5	1165	SF Residential
County of San Diego	2339 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.7	1165	SF Residential
County of San Diego	2340 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.6	1165	SF Residential
County of San Diego	2363 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.5	1215	SF Residential
County of San Diego	2364 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.5	1215	SF Residential

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
County of San Diego	2375 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.5	1215	SF Residential
County of San Diego	2387 Clearcrest Lane, Fallbrook	Vegetated Filter Strip	0.5	1215	SF Residential
County of San Diego	2548 Panoramic Drive, Vista	Grass Swale	5.2	1744	Rural Residential
County of San Diego	28513 Lawrence Welk Court, Escondido	Bioretention Swale	8.9	1879	Rural Residential
County of San Diego	28547 Lawrence Welk Court, Escondido	Bioretention Swale	8.9	1879	Rural Residential
County of San Diego	28585 Lawrence Welk Court, Escondido	Vegetated Filter Strip	4.7	1879	Rural Residential
County of San Diego	28613 Lawrence Welk Court, Escondido	Vegetated Filter Strip	5.3	1879	Rural Residential
County of San Diego	28627 Lawrence Welk Court, Escondido	Vegetated Filter Strip	4.6	1879	Rural Residential
County of San Diego	29623 Valley of the King Road, Vista	Vegetated Swale	2.1	1766	Rural Residential
County of San Diego	29777 Reza Court, Vista	Grass Swale	2.1	1766	Rural Residential
County of San Diego	29780 Reza Court, Vista	Grass Swale	2.1	1766	Rural Residential
County of San Diego	4335 Via De Los Cepillos, Bonsall	Vegetated Filter Strip	2.4	1696	Rural Residential
County of San Diego	4343 Via De Los Cepillos, Bonsall	Vegetated Filter Strip	2.4	1696	Rural Residential
County of San Diego	4509 Highland Oaks St., Fallbrook	Bioretention Swale	2.8	1403	Rural Residential
County of San Diego	4780 Caminito de los Cepillos, Bonsall	Vegetated Filter Strip	2.3	1696	Rural Residential

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
County of San Diego	5605 Hidden Grove Way, Bonsall	Bioretention Swale	2	1696	Rural Residential
County of San Diego	5630 Hidden Grove Way, Bonsall	Bioretention Swale	2	1696	Rural Residential
County of San Diego	9504 Welk View Ct., Escondido	Bioretention Swale	1.1	1856	Rural Residential
County of San Diego	9516 Welk View Ct., Escondido	Bioretention Swale	3.9	1856	Rural Residential
County of San Diego	9517 Welk View Ct., Escondido	Bioretention Swale	3.9	1856	Rural Residential
County of San Diego	9528 Welk View Ct., Escondido	Vegetated Filter Strip	3.9	1856	Rural Residential
County of San Diego	9540 Welk View Ct., Escondido	Bioretention Swale	3.9	1856	Rural Residential
County of San Diego	9541 Welk View Ct., Escondido	Vegetated Filter Strip	3.9	1856	Rural Residential
County of San Diego	9552 Welk View Ct., Escondido	Vegetated Filter Strip	1.7	1856	Rural Residential
County of San Diego	9572 Welk View Ct., Escondido	Vegetated Filter Strip	1.3	1856	Rural Residential
City of Oceanside	3204 Mission Avenue, Oceanside	Vegetative Swale	0.5	3019	Commercial
City of Oceanside	3220 Mission Avenue, Oceanside	Vegetative Swale	2.9	3019	MF Residential
City of Oceanside	5570 Old Ranch Road, Oceanside	Vegetative Swale	2.5	3084	Institutional/ Education
City of Oceanside	250 Eddie Jones Way, Oceanside	Infiltration Facility	10.3	3057	Industrial
City of Oceanside	607 & 609 North Pacific Street, Oceanside	Infiltration Facility	0.1	3012	SF Residential
City of Oceanside	Valley Heights Drive, Oceanside	Media Filter	1.1	3065	SF Residential
City of Oceanside	Franciscan Way, Oceanside	Vegetated Buffer Strip	14.5	3061	SF Residential

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of Oceanside	705 College Boulevard, Oceanside	Media Filter	2	3071	Transportation
City of Oceanside	Sunridge Drive, Oceanside	Bioretention Facility	15.6	3077	SF Residential
City of Oceanside	301 Mission Avenue, Oceanside	Vegetated Buffer Strip	0.8	3012	SF Residential
City of Oceanside	308 Island way, Oceanside	Media Filter	5.5	3060	MF Residential
City of Oceanside	475 Sleeping Indian Road, Oceanside	Vegetative Swale	5.5	3039	Rural Residential
City of Oceanside	5501 Old Ranch Road, Oceanside	Bioretention Facility/Media (Sand) Filter/Vegetated Swale	6.5	3084	SF Residential
City of Oceanside	607 North Douglas Drive, Oceanside	Water Quality Inlet	0.8	3049	Commercial
City of Oceanside	649 Benet Road, Oceanside	Vegetative Swale	2.1	3015	Industrial
City of Oceanside	6638 Morro Heights Road, Oceanside	Water Quality Inlet	2.6	3003	Rural Residential
City of Oceanside	6638 Morro Heights Road, Oceanside	Bioretention	2.5	3003	Rural Residential
City of Oceanside	800 Harbor Cliff, Oceanside	Bioretention Facility/Media (Sand) Filter	11.4	3011	MF Residential
City of Oceanside	Breakaway Drive and Treetop Road, Oceanside	Bioretention	32.4	3029	SF Residential
City of Vista	Fortuna Avenue, Vista	Extended Detention basin with Infiltration	44	1899	SF Residential; Rural Residential
City of Vista	North Coast Church, Vista	Filter Inserts, Pervious Pavement/Sand Filters, Swales and 2 Detention Basins	40	1820, 1872, 4002	Institutional/ Education

Load Reduction Quantifications

The estimated load reductions for the modeled implemented distributed BMPs are presented in **Table 3E-2**.

Table 3E-2. Estimated Load Reductions from Implemented Distributed BMPs

Location/Name	Water Quality (FC Load) Benefits (10^{12} MPN reduction/year)	Water Quality (Total Nitrogen Load) Benefits (lb reduction/year)	Water Quality (Total Phosphorus Load) Benefits (lb reduction/year)
	WY 1993 [Low - High]	WY 1993 [Low - High]	WY 1993 [Low - High]
Implemented Distributed	41 [22 - 47]	1,300 [800 – 1,500]	170 [110 - 220]
Totals[a]	**41 [22 - 47]**	**1,300 [800 – 1,500]**	**170 [110 - 220]**

[a.] Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits of multiple BMPs addressing the same areas. Additionally, results for WY 1993 include all load reductions estimated for that WY, not only the fraction of load reductions that are considered effective for reducing exceedance days.

E.2 Proposed Distributed Structural BMPs

Model Assumptions and Design Criteria

The proposed distributed structural BMPs were modeled as bioretention and bioretention swales with under drains[3] according to their infiltration capacity. Design criteria for quantifying the distributed parameters were developed using the following assumptions:

- Distributed BMPs within a catchment would be implemented to treat 25 percent of the MS4 area within a given catchment;
- Four percent of the contributing area would be required for treating full SUSMP rainfall depth of 0.75 inches from the contributing area with distributed BMPs. This assumption was based on previous experiences with implementation of similar distributed BMPs;
- For catchments where sufficient land was not available, the design storm was taken to be a fraction of this 0.75 inch storm according to what percent of the contributing area was potentially available for BMP installation;
- Other design criteria for bioretention:
    - Design Volume: governed by available space and contributing area
    - Retention Depth: 12 inches

[3] Bioretention-type BMPs are landscaped shallow depressions that capture and filter storm water runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, plantings, and, optionally, a subsurface gravel reservoir layer.

    - Infiltration Rate: governed by soil type.
- Other design criteria for bioretention swale with under drains:
    - Design Flow Rate: governed by available space and contributing area
    - Hydraulic Residence Time: 10 min
    - Longitudinal Slope: 0.03 ft./ft.
    - Manning's Roughness Coefficient: 0.25
    - Water Quality Flow Depth: 4 inches
    - Retention Depth: 2 inches
    - Infiltration Rate: governed by soil type.

Distributed BMPs were grouped according to ranges in sizing criteria, and each group was modeled once using the mean sizing criteria for the group to limit the number of runs in SBPAT. Model results, including pollutant removal and costs, were summed to determine the overall impact of the distributed BMPs.

Location Selection

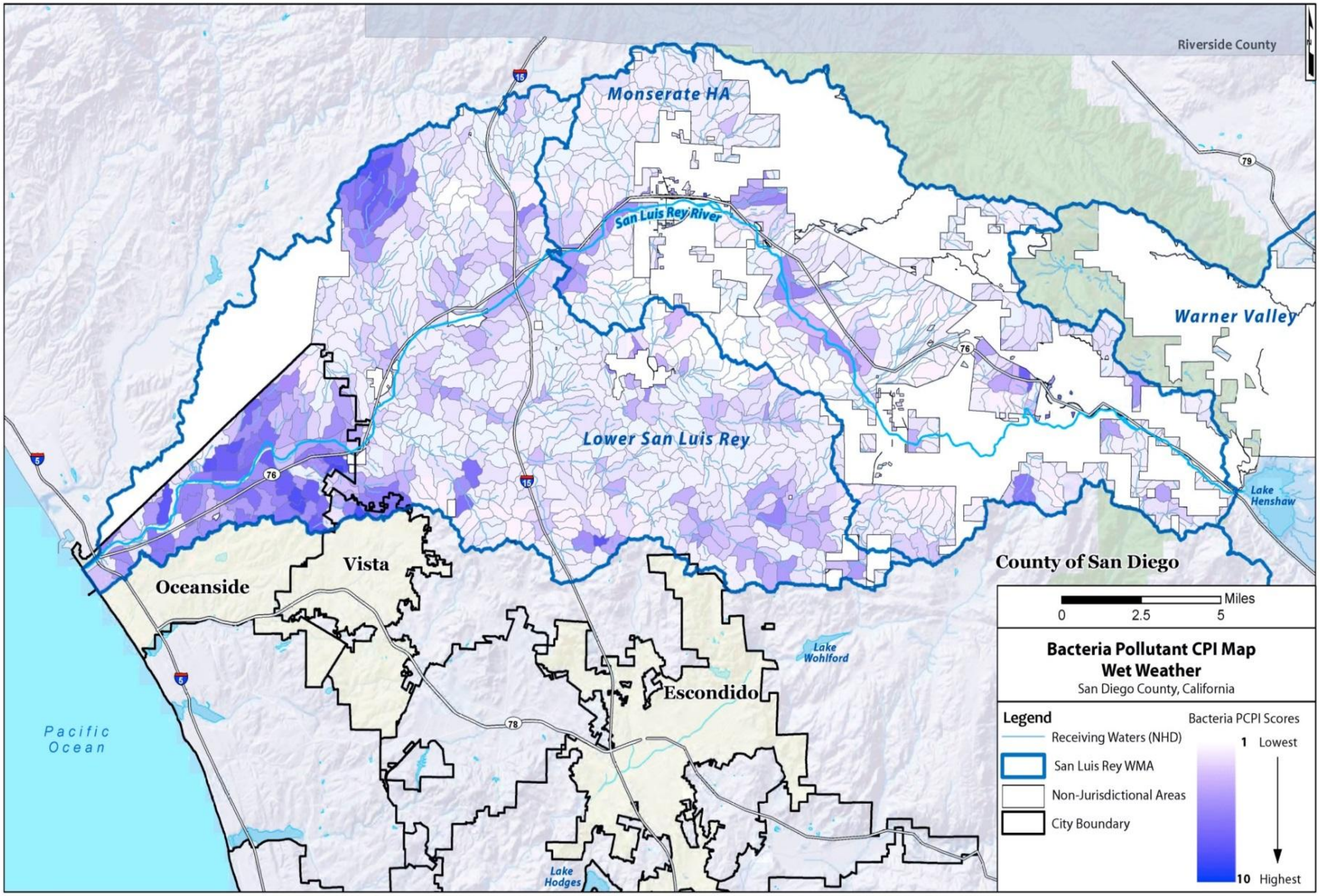
Specific catchments within the watershed were identified as preferred locations for distributed structural BMPs. The lower SLR watershed, downstream of Lake Henshaw, was divided into 1,210 catchments. Using SBPAT, a catchment prioritization index (CPI) score was calculated for each catchment in the lower SLR watershed. This score is based on the potential for each catchment to contribute pollutant loads, and can therefore be used to focus BMP efforts. The end result is a map of the entire watershed, highlighting the locations where BMPs can be installed with the greatest likelihood to improve water quality or reduce bacteria discharges

Each catchment was given a normalized, unit-less CPI score between 1 and 5, with 5 representing the highest priority. For a more detailed explanation of the CPI calculation, see Step 1 of the SBPAT User's Guide (Geosyntec 2008). The following is a brief summary of the key elements of this step:

- Pollutant-specific CPI scores were calculated for each land use within a catchment as the product of land use specific pollutant EMCs, 85th-percentile precipitation, and runoff coefficients. These scores were then weighted by the area of each land use category within the catchment. Data used for each land use type is included in Appendix B.
- Individual pollutant CPI scores for each catchment were combined into an integrated CPI score using the weights listed in **Table 3E-3. Pollutant Group Weights for Normalized Pollutant CPI Calculation**
- CPI scores were then further refined based on whether a catchment drained to an impaired water body, or a water body with an assigned TMDL. Weights of two and three, respectively, were assigned for catchments draining to impaired water bodies and water bodies with assigned TMDLs. Results of the CPI analysis for the HPWQC and a combination of the HPWQC and nutrients are shown in **Table 3E-2** and **Table 3E-3.**

Table 3E-3. Pollutant Group Weights for Normalized Pollutant CPI Calculation

Pollutant	Weight
Nitrogen (Nitrate)	10
Bacteria (Fecal Coliform)	20
Total Suspended Solids (representing Phosphorus)	10



Riverside County
Monserate HA
San Luis Rey River
Warner Valley
Lower San Luis Rey
Lake Henshaw
County of San Diego
Oceanside
Vista
Escondido
Lake Wohlford
Pacific Ocean
Lake Hodges
Miles
0
2.5
5
Bacteria Pollutant CPI Map
Wet Weather
San Diego County, California
Legend
Receiving Waters (NHD)
San Luis Rey WMA
Non-Jurisdictional Areas
City Boundary
Bacteria PCPI Scores
1 Lowest
10 Highest

Figure 3E-2. CPI Map for Bacteria (HPWQC)

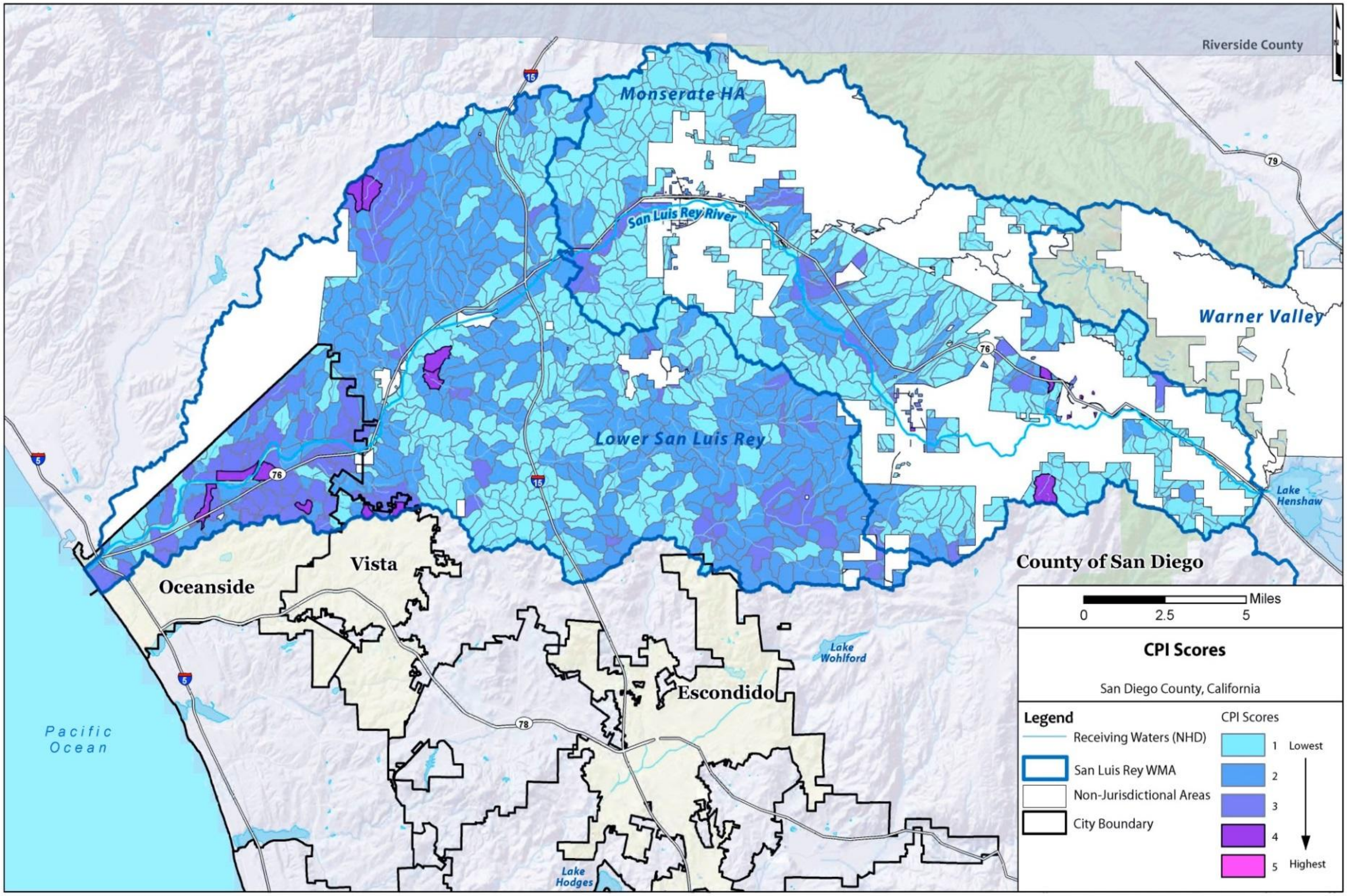


Figure 3E-3. Integrated CPI Map for Bacteria (HPWQC) and Nutrients (PWQCs)

Catchments were selected as potential locations for future distributed structural BMPs if they had a CPI score of 3 or higher and had greater than 50 percent of Participating Agency area within the catchment. These catchments were then screened for potential distributed BMP opportunities, based on the presence of non-travelled public rights of ways (ROWs) within the high priority catchments. Based on random sampling of ROWs within the high priority catchments, and using best professional judgment, 40 percent of each sampled individual ROW was identified to be non-travelled and 10 percent of the non-travelled ROW area was assumed, on average, to be suitable for a BMP retrofit. Given the above two findings, four percent of the ROW area within high priority catchments was assumed to be suitable for a distributed BMP retrofit.

Distributed BMP types for retrofits within high priority catchments were selected based on the feasibility of infiltration within the retrofit area. Retrofit area is considered feasible for infiltration if more than 50 percent of the retrofit area is categorized as NRCS A, B, or C type soils. The following guidelines were used for identifying candidate distributed BMPs:

- *Infiltration feasible*: Assumed that 50 percent of the drainage area would be treated with infiltration BMPs and the remaining 50 percent would be treated with a non-infiltration BMP.

- *Infiltration infeasible*: Treated with non-infiltration BMPs.

This WQIP assumes that bioretention type BMPs will be implemented for infiltration feasible sites and bioretention swales with underdrain type BMPs will be implemented for infiltration infeasible sites. While designing and implementing site specific distributed BMPs as part of the implementation plan, different BMPs may be selected provided the pollutant reductions achieved through the implemented projects will be equal to or greater than those modeled in this report. A map showing proposed catchments for distributed structural BMPs is shown in **Figure 3E-4**.

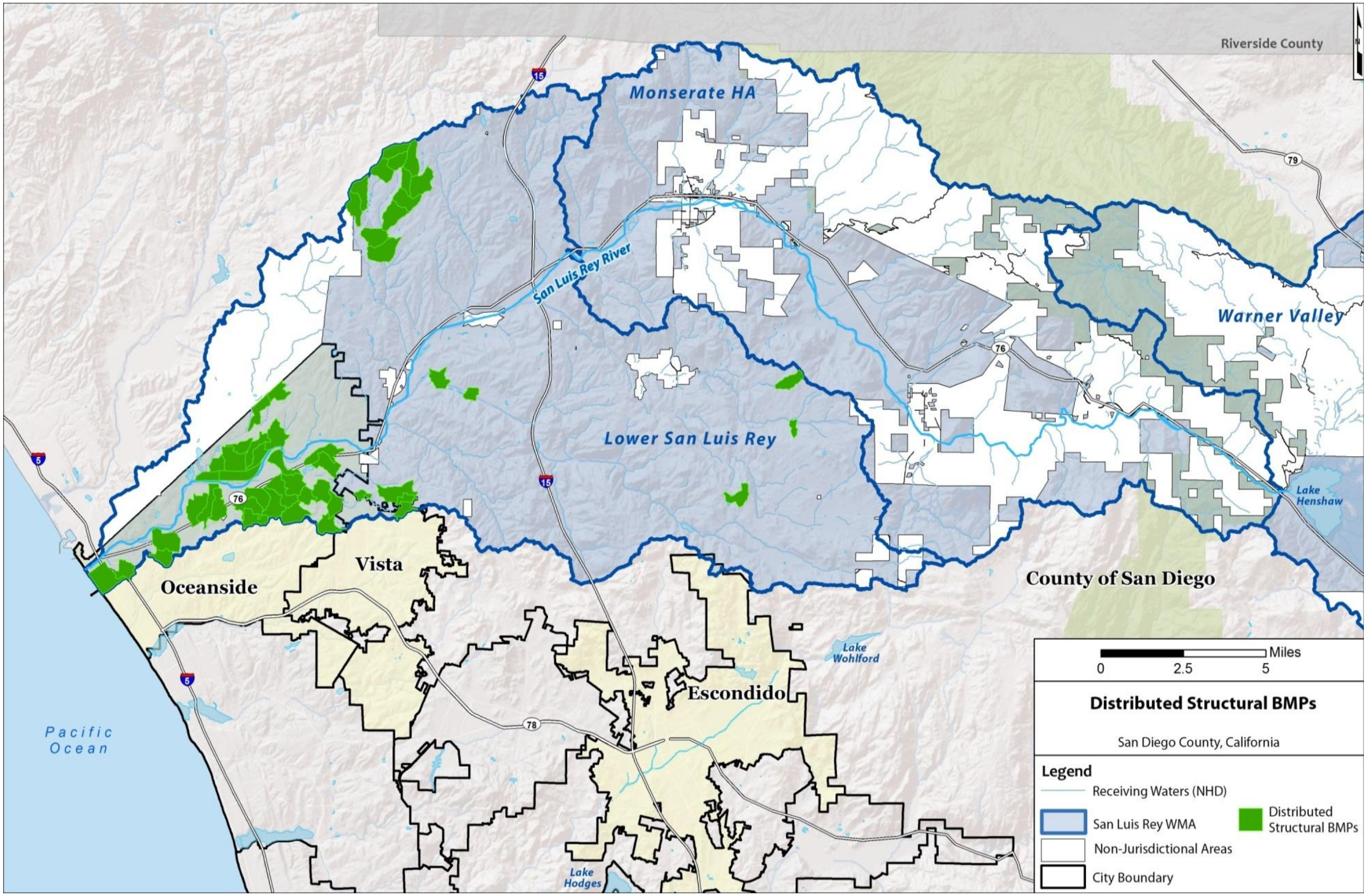


Figure 3E-4. Proposed Catchments for Implementation of Distributed Structural BMPs

Load Reduction Quantifications

The estimated load reductions for the proposed distributed structural BMPs are presented in **Table** 3E-4.

Table 3E-4. Estimated Load Reductions from Proposed Distributed BMPs

Location/Name	Water Quality (FC Load) Benefits (10^12 MPN reduction/year)	Water Quality (Total Nitrogen Load) Benefits (lb reduction/year)	Water Quality (Total Phosphorous Load) Benefits (lb reduction/year)
	WY 1993 [Low - High]	WY 1993 [Low - High]	WY 1993 [Low - High]
Proposed Distributed	151 [86 - 174]	2,700 [1,800 – 3,100]	170 [150 - 180]
Totals[1]	**151 [86 - 174]**	**2,700 [1,800 – 3,100]**	**170 [150 - 180]**

[1] Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits of multiple BMPs addressing the same areas. Additionally, results for WY 1993 include all load reductions estimated for that WY, not only the fraction of load reductions that are considered effective for reducing exceedance days.

E.3 Proposed Regional Structural BMPs

In addition to the proposed distributed structural BMPs, the following regional structural BMPs were identified and evaluated to achieve the required load reductions. Regional BMPs treat subwatershed-scale areas, and in some cases treat water diverted from adjacent rivers that yields higher cost efficiency for amount of area treated and resulting load reductions.

Design Criteria

BMP design criteria for each specific project were developed using the following generalized design criteria:

Infiltration Basin Design Criteria:

- Drawdown time: 48 hours
- Infiltration rate: Per San Diego County treatment BMP design guidelines (County 2011), typical soil infiltration rates based on the NRCS soil texture were used with a factor of safety of two (2)
- Design volume: determined by space available for the BMP
- Depth: governed by the drawdown time and infiltration rate.

Subsurface Flow (SSF) Wetland Design Criteria:

- Hydraulic residence time: 24 hours
- Depth of wetland: 3-4 feet
- Porosity: 0.35-0.4

- Target equalization basin drawdown time: 48 hours
- Design volume: governed by the design depth and space available
- Treatment flow rate: governed by volume and hydraulic residence time.

Wetland/Wet Pond Design Criteria:

- Permanent pool hydraulic residence time: 24 hours
- Permanent pool depth: 4-5 feet
- Permanent pool volume: governed by space available and depth.

Once design criteria were established, SBPAT was used to determine the pollutant reduction that could be achieved through the implementation of these BMPs. This modeling analysis includes continuous hydrologic simulation of runoff quantities and BMP volume capture, as well as stochastic Monte Carlo calculation of pollutant load reduction based on BMP effluent concentrations. See the SBPAT Guidance Manual for further information (Geosyntec 2008).

Location Selection

A "nodal" catchment prioritization index, or NCPI, is an area-weighted CPI that is based on upstream catchment CPI scores. In other words, use of NCPI allows identification of catchments that are downstream of multiple, hydrologically linked high-priority catchments that may be utilized for potential regional BMP implementation. Using the downstream catchment attribute, an NCPI score for each catchment was computed using an area-weighted average of the CPI scores for tributary catchments. Results of the NCPI analysis are shown in **Figure 3E-5**.

Site specific regional BMPs for the screened parcels were selected considering the following criteria:

- *BMP Performance*: Which BMP type is most effective at reducing concentrations of bacteria, nitrogen (nitrate), and phosphorous at this parcel?
- *Site-specific Constraints*: Which BMP type is feasible on the parcel given the location, parcel ownership, and physical characteristics of the site?
- *Costs*: Which BMP type is most cost-effective, both in capital expenditures and expected annual operations and maintenance costs?

The BMPs selected for pollutant removal modeling and cost estimation included subsurface flow wetlands, wetland/wet ponds, and infiltration basins, since these are the only structural BMP technologies capable of removing significant loads of FIB, nitrogen (nitrate), and phosphorous. **Figure 3E-6** shows a map of locations for the candidate regional structural BMPs.

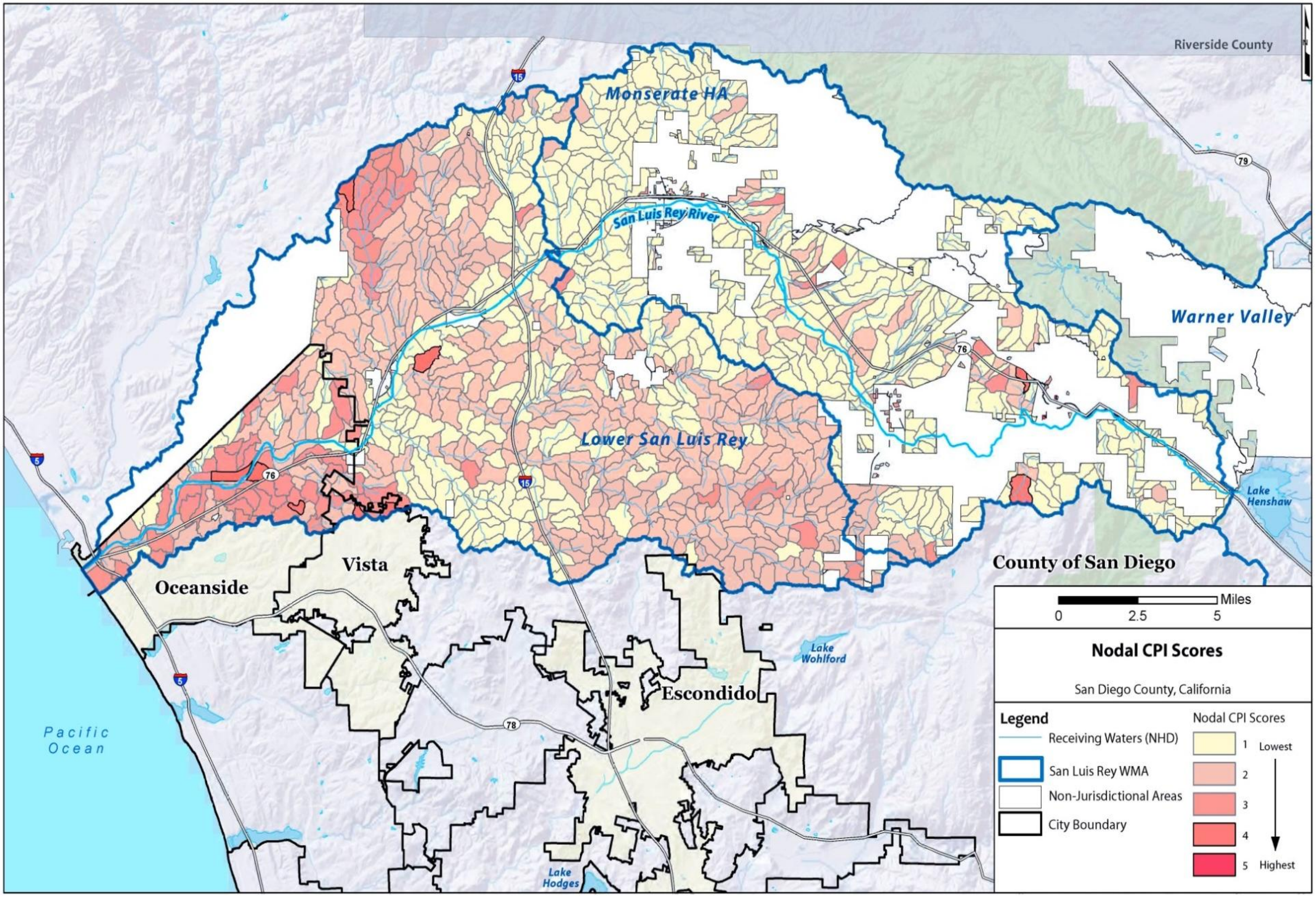

Riverside County
Monserate HA
San Luis Rey River
Warner Valley
Lower San Luis Rey
Lake Henshaw
County of San Diego
Oceanside
Vista
Escondido
Lake Wohlford
Pacific Ocean
Lake Hodges
Miles
0
2.5
5
Nodal CPI Scores
San Diego County, California
Legend
Receiving Waters (NHD)
San Luis Rey WMA
Non-Jurisdictional Areas
City Boundary
Nodal CPI Scores
1 Lowest
2
3
4
5 Highest

Figure 3E-5. Integrated NCPI Map for Bacteria and Nutrients

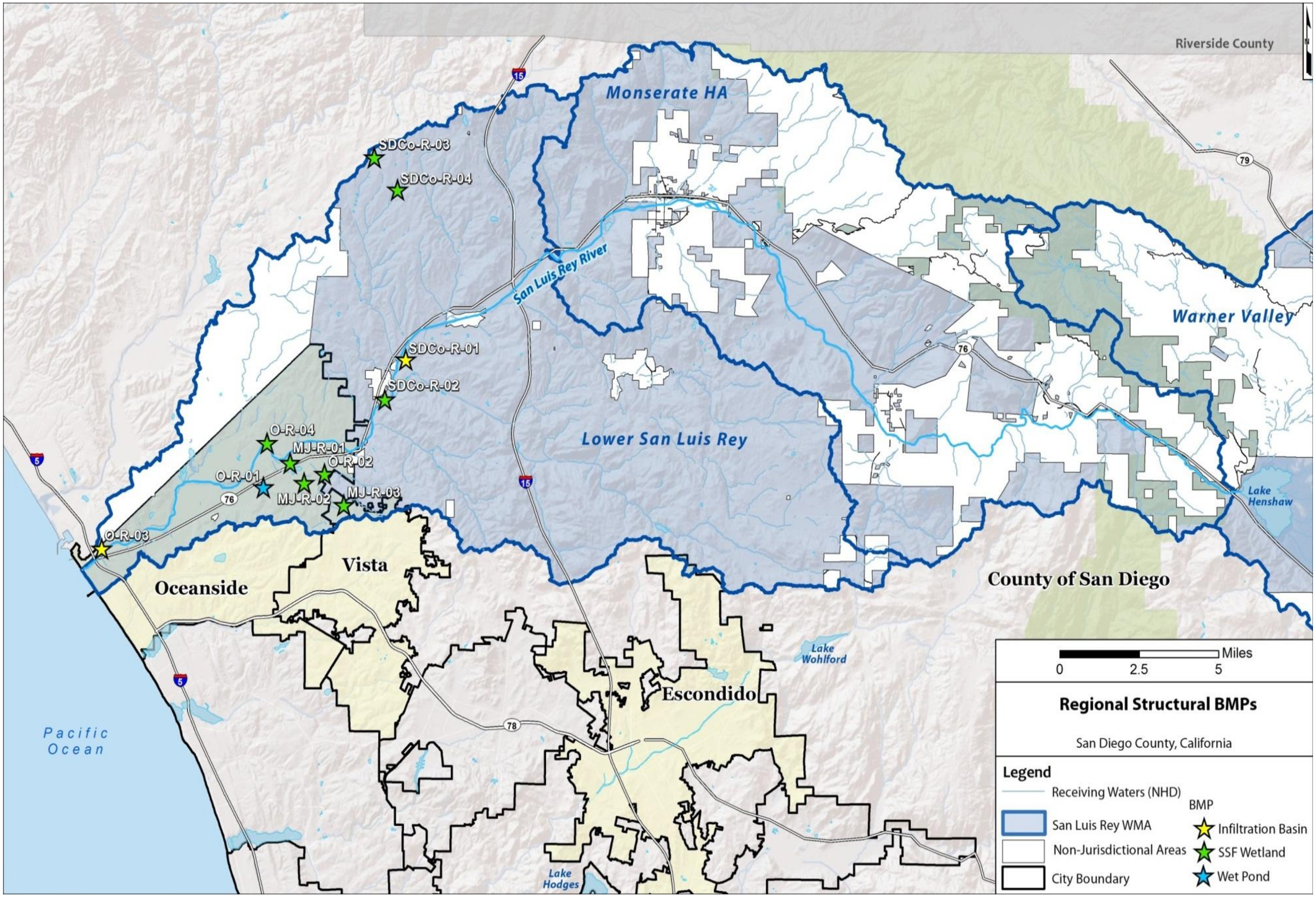

Riverside County
Monserate HA
SDCo-R-03
SDCo-R-04
San Luis Rey River
SDCo-R-01
SDCo-R-02
O-R-04
MJ-R-01
O-R-02
O-R-01
MJ-R-02
MJ-R-03
O-R-03
Lower San Luis Rey
Warner Valley
Lake Henshaw
Oceanside
Vista
County of San Diego
Lake Wohlford
Escondido
Pacific Ocean
Lake Hodges
Miles
0
2.5
5
Regional Structural BMPs
San Diego County, California
Legend
Receiving Waters (NHD)
San Luis Rey WMA
Non-Jurisdictional Areas
City Boundary
BMP
Infiltration Basin
SSF Wetland
Wet Pond

Figure 3E-6. Locations of Proposed Regional Structural BMPs

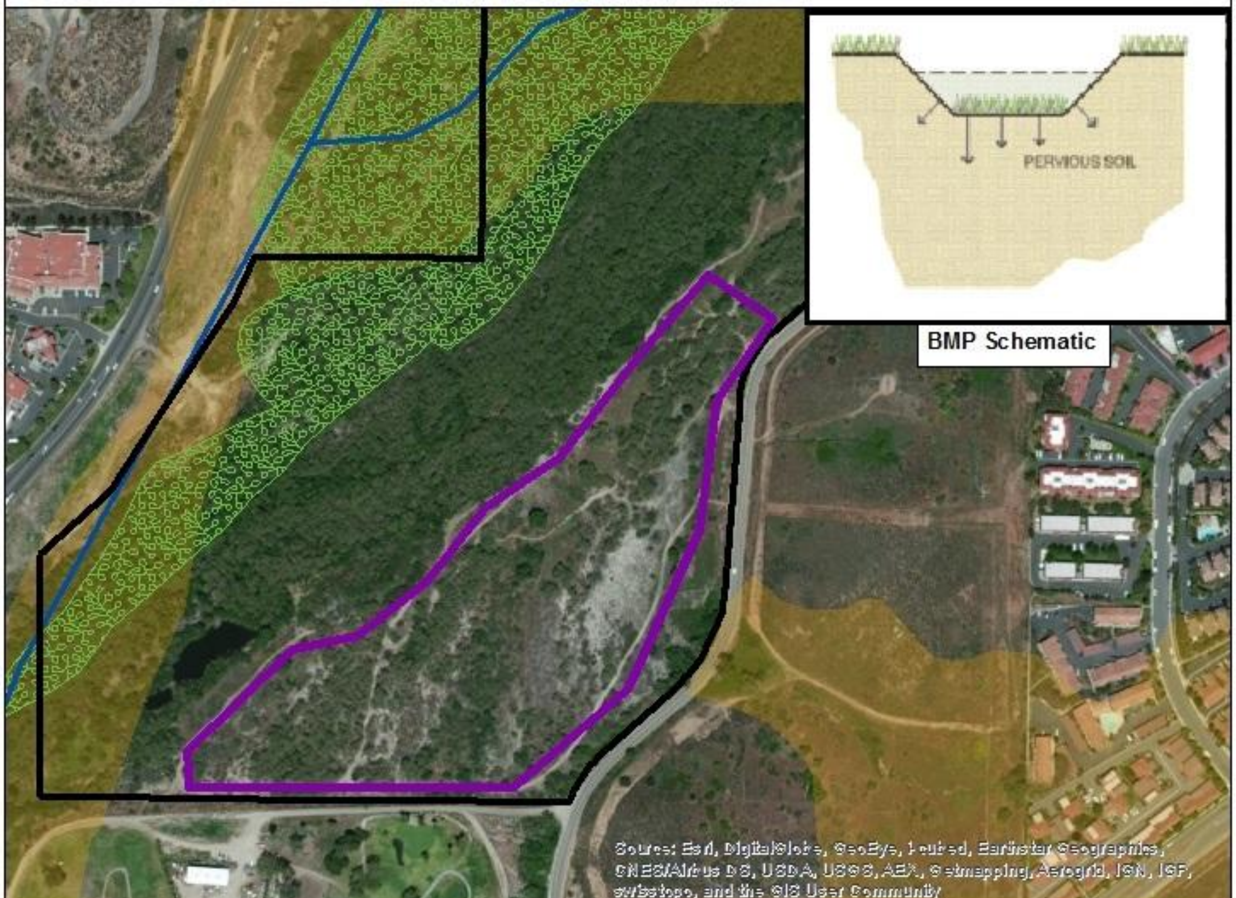
The proposed regional structural BMPs are listed in **Table 3E-5**, and design criteria specific to each project is presented in their respective BMP sheets, included as **Figure 3E-7** through **Figure 3E-17**.

Table 3E-5. List of Proposed Regional Structural BMPs

Figure #	Name	BMP Type
D-7	SDCo-R-01	Infiltration basin
D-8	SDCo-R-02	Subsurface flow wetland
D-9	SDCo-R-03	Subsurface flow wetland
D-10	SDCo-R-04	Subsurface flow wetland
D-11	O-R-01	Wetlands/wet pond
D-12	O-R-02	Subsurface flow wetland
D-13	O-R-03	Subsurface infiltration basin
D-14	O-R-04	Subsurface flow wetland
D-15	MJ-R-01	Subsurface flow wetland
D-16	MJ-R-02	Subsurface flow wetland
D-17	MJ-R-03	Subsurface flow wetland

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

SDCo-R-01 October 2014



Parcel Information

Owner: Bonsall Land Group LLC
Jurisdiction: County of San Diego
Constraints in Parcel: Wetland
Current Land Use: Open Space

Project Name: TBD

BMP Information

BMP Proposed: Infiltration Basin
Tributary Area: ~ 151,000 acres;
Diversion from San Luis Rey River: Yes
BMP Footprint Area: ~15.7 acres
Average Water Quality Depth: 4 feet
Water Quality Volume: 24 acre-feet
Infiltration rate ~ 1 in/hr

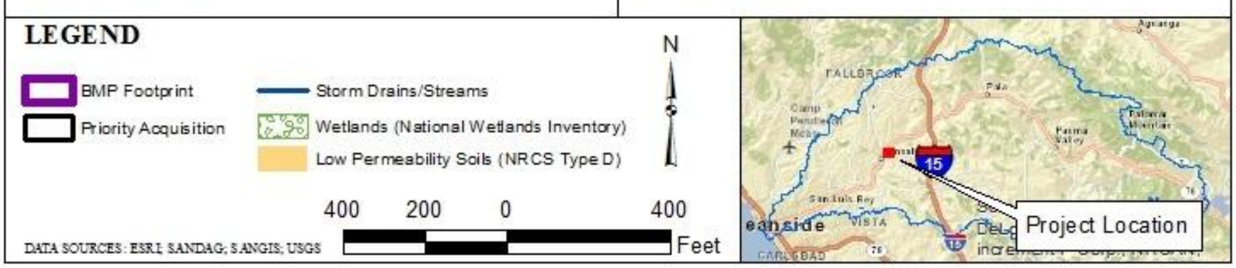
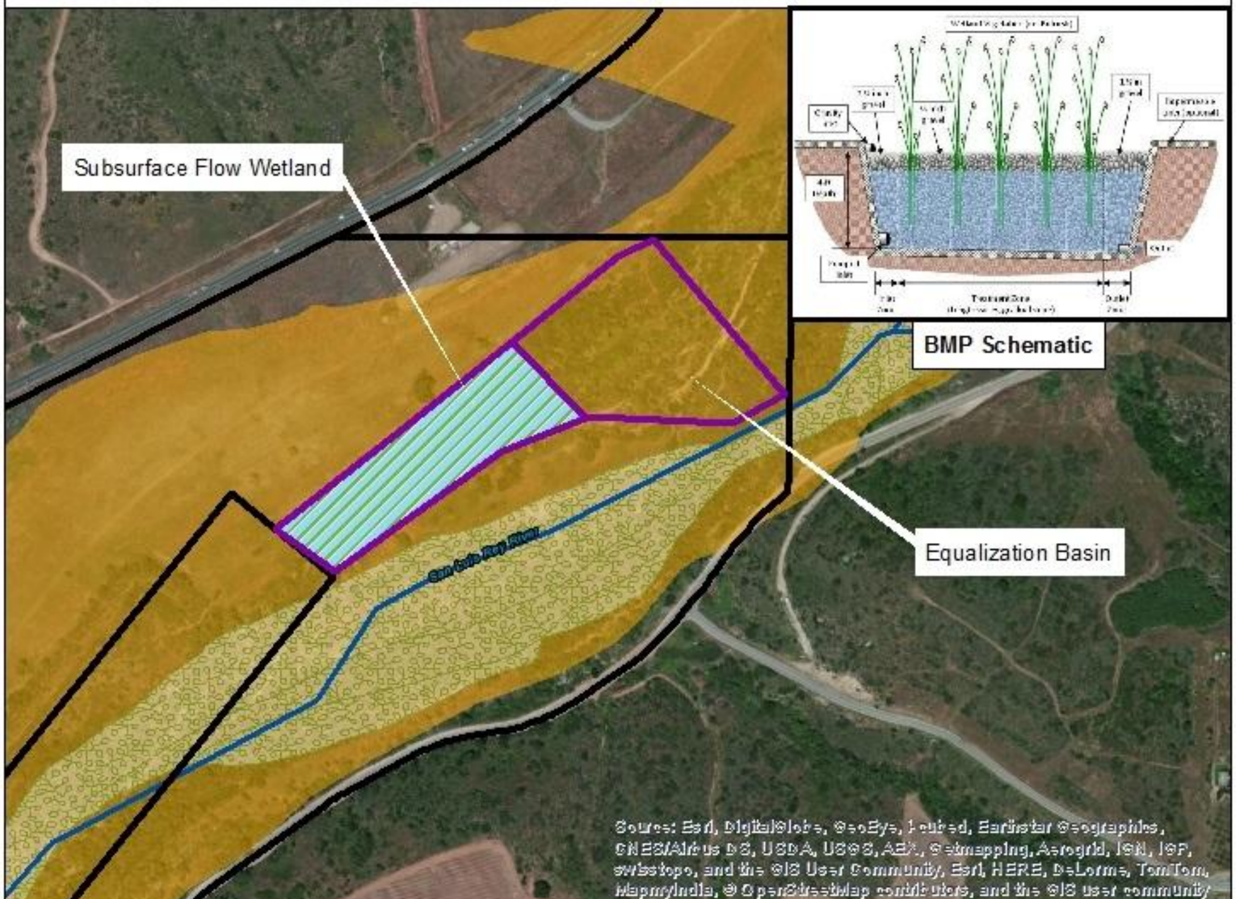


Figure 3E-7. SDCo-R-01

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

SDCo-R-02 — **October 2014**



Parcel Information

Owner: County of San Diego
Jurisdiction: County of San Diego
Constraints in Parcel: Low Permeability Soils, Floodplain, Wetland
Current Land Use: Park

Project Name: San Luis Rey River Park

BMP Information

BMP Proposed: Subsurface Flow Wetland
Constraints in Footprint: Low Permeability Soils, Floodplain
Diversion from San Luis Rey River: Yes
BMP Footprint Area: ~ 11 acres
Equalization Basin: Volume: 518,500 cubic feet;
Treatment Flow Rate: 3 cfs; Hydraulic Residence Time: 24 hours

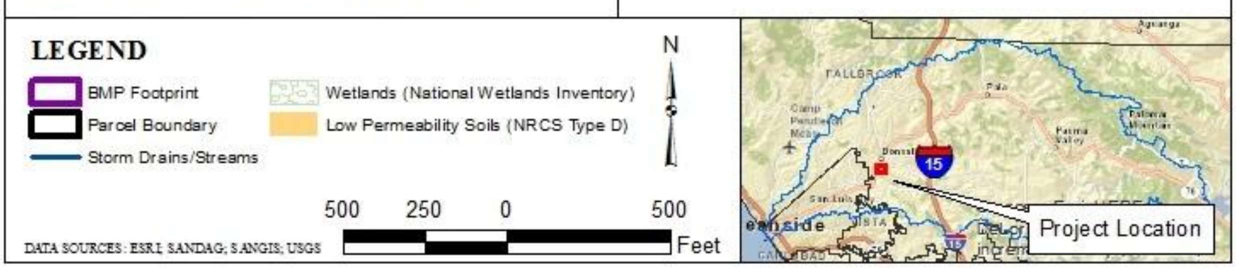


Figure 3E-8. SDCo-R-02

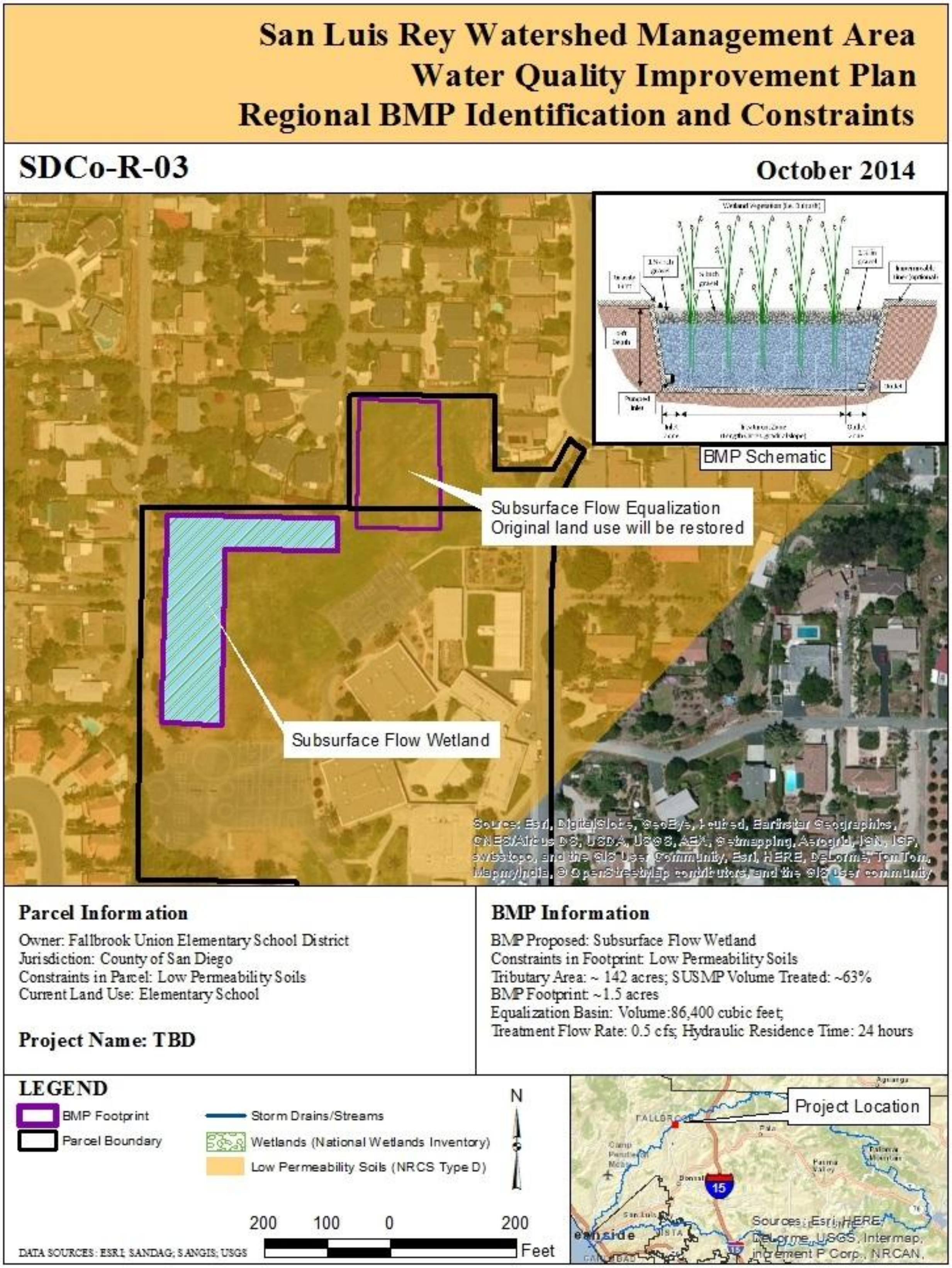
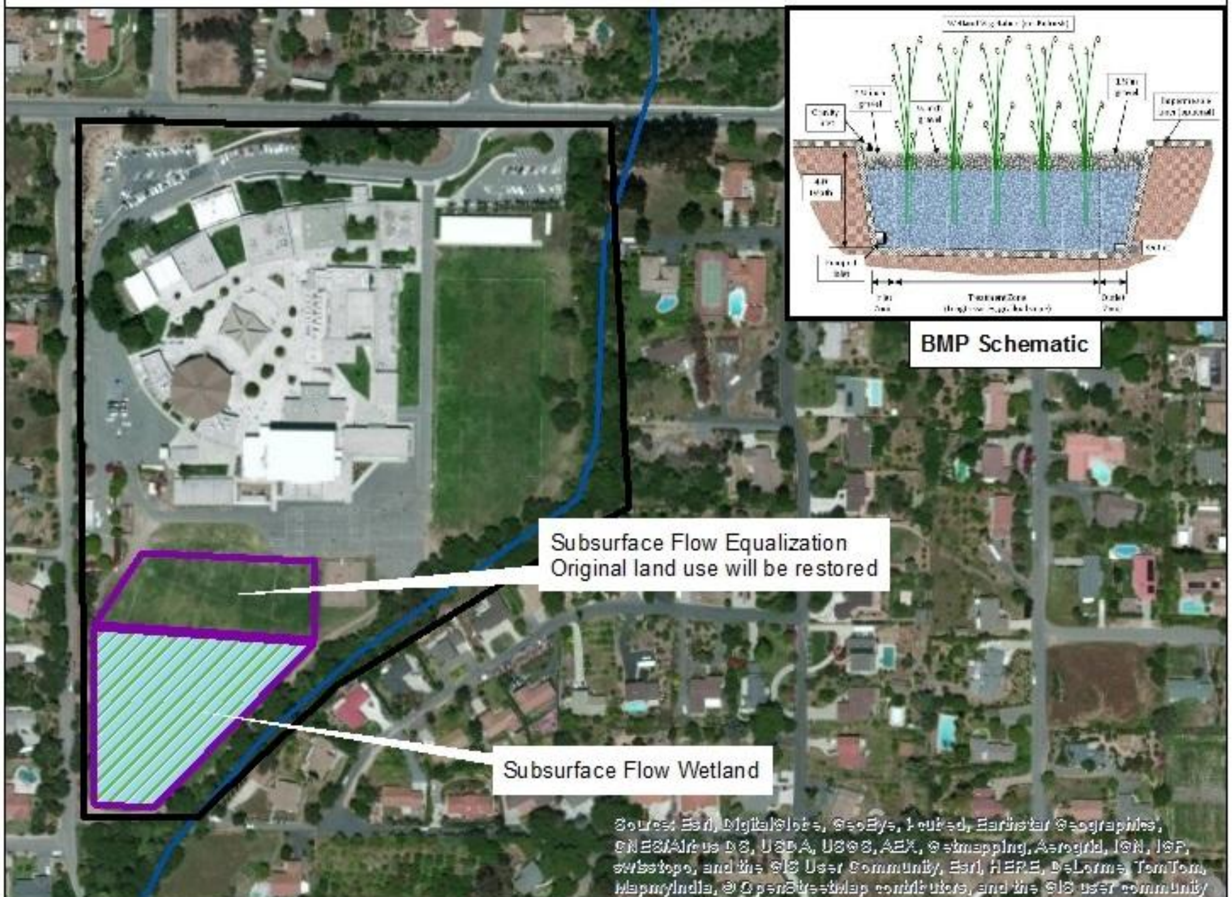


Figure 3E-9. SDCo-R-03

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

SDCo-R-04 — **October 2014**



Parcel Information

Owner: Fallbrook Union High School District
Jurisdiction: County of San Diego
Constraints in Parcel: Low Permeability Soils
Current Land Use: Middle School

Project Name: TBD

BMP Information

BMP Proposed: Subsurface Flow Wetland
Constraints in Footprint: Low Permeability Soils
Tributary Area: ~ 640 acres; SUSMP Volume Treated: ~35%
Diversion: Yes
BMP Footprint Area: ~ 3.1 acres
Equalization Basin: Volume: 172,800 cubic feet;
Treatment Flow Rate: 1 cfs; Hydraulic Residence Time: 24 hours

LEGEND

- BMP Footprint
- Parcel Boundary
- Storm Drains/Streams
- Wetlands (National Wetlands Inventory)
- Low Permeability Soils (NRCS Type D)

N

300 150 0 300 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

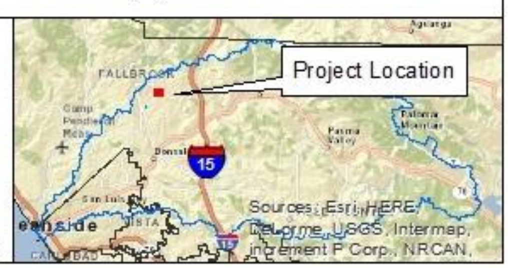


Figure 3E-10. SDCo-R-04

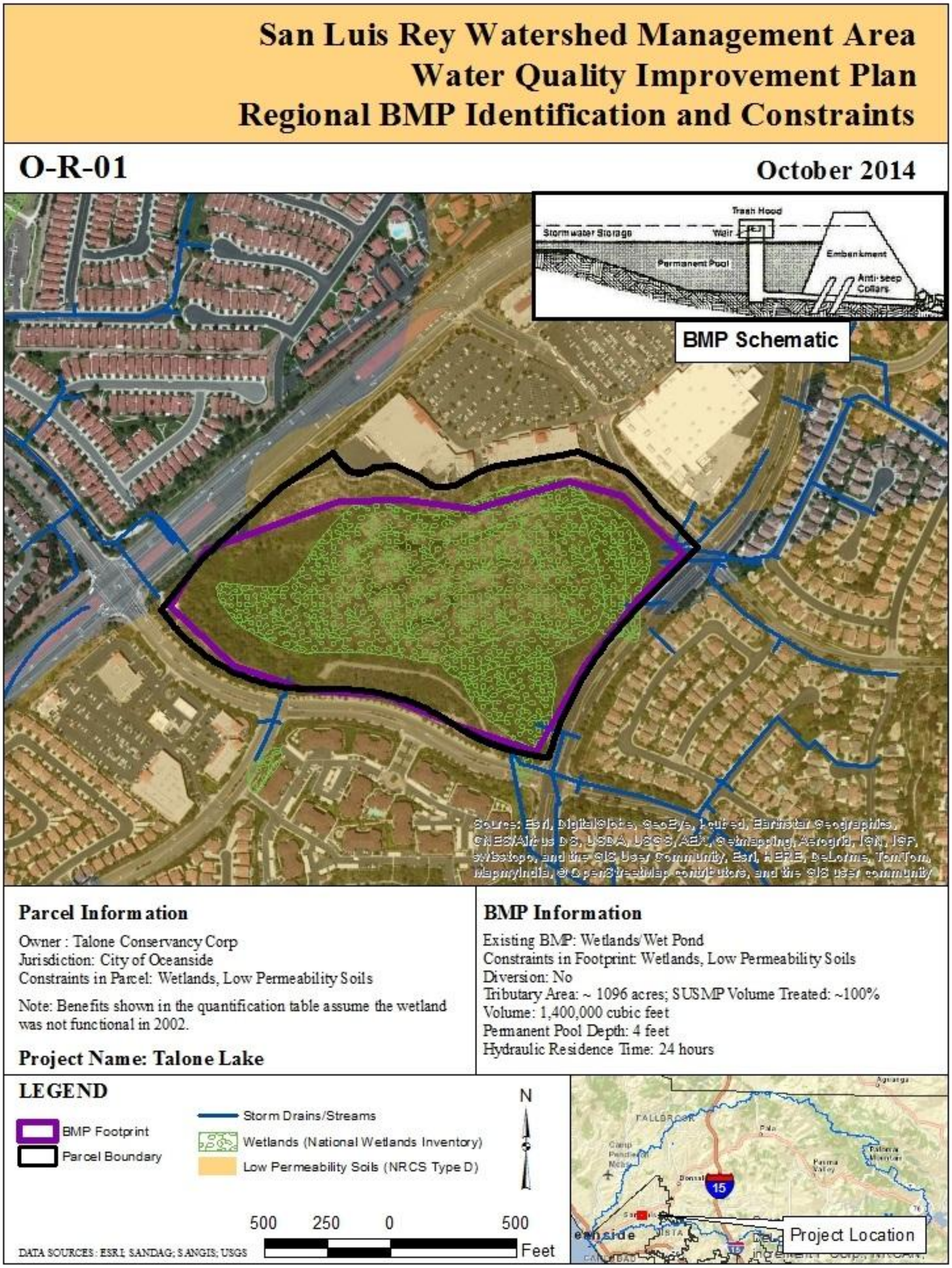
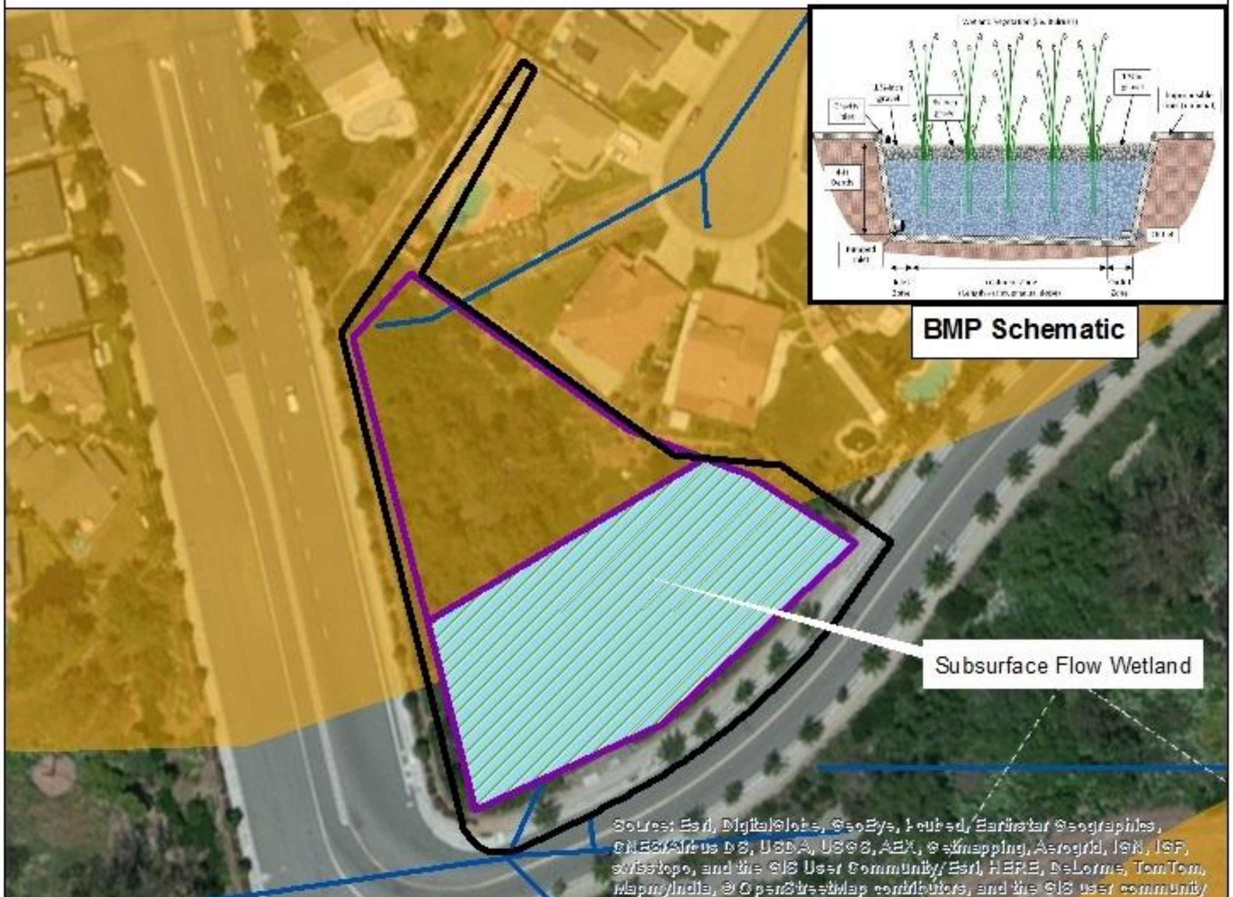


Figure 3E-11. O-R-01

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

O-R-02 **October 2014**



Parcel Information

Owner : City of Oceanside
Jurisdiction: City of Oceanside
Constraints in Parcel: Low Permeability Soils
Current Land Use: Open Space

Project Name: TBD

BMP Information

BMP Proposed: Subsurface Flow Wetland
Constraints in Footprint: Low Permeability Soils
Tributary Area: ~ 72 acres; SUSMP Volume Treated: ~73%
Diversion of stream: No
BMP Footprint Area: ~ 1.2 acres
Equalization Basin: Volume: 60,500 cubic feet,
Treatment Flow Rate: 0.35 cfs; Hydraulic Residence Time: 24 hours

LEGEND

BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

100 50 0 100 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

Figure 3E-12. O-R-02

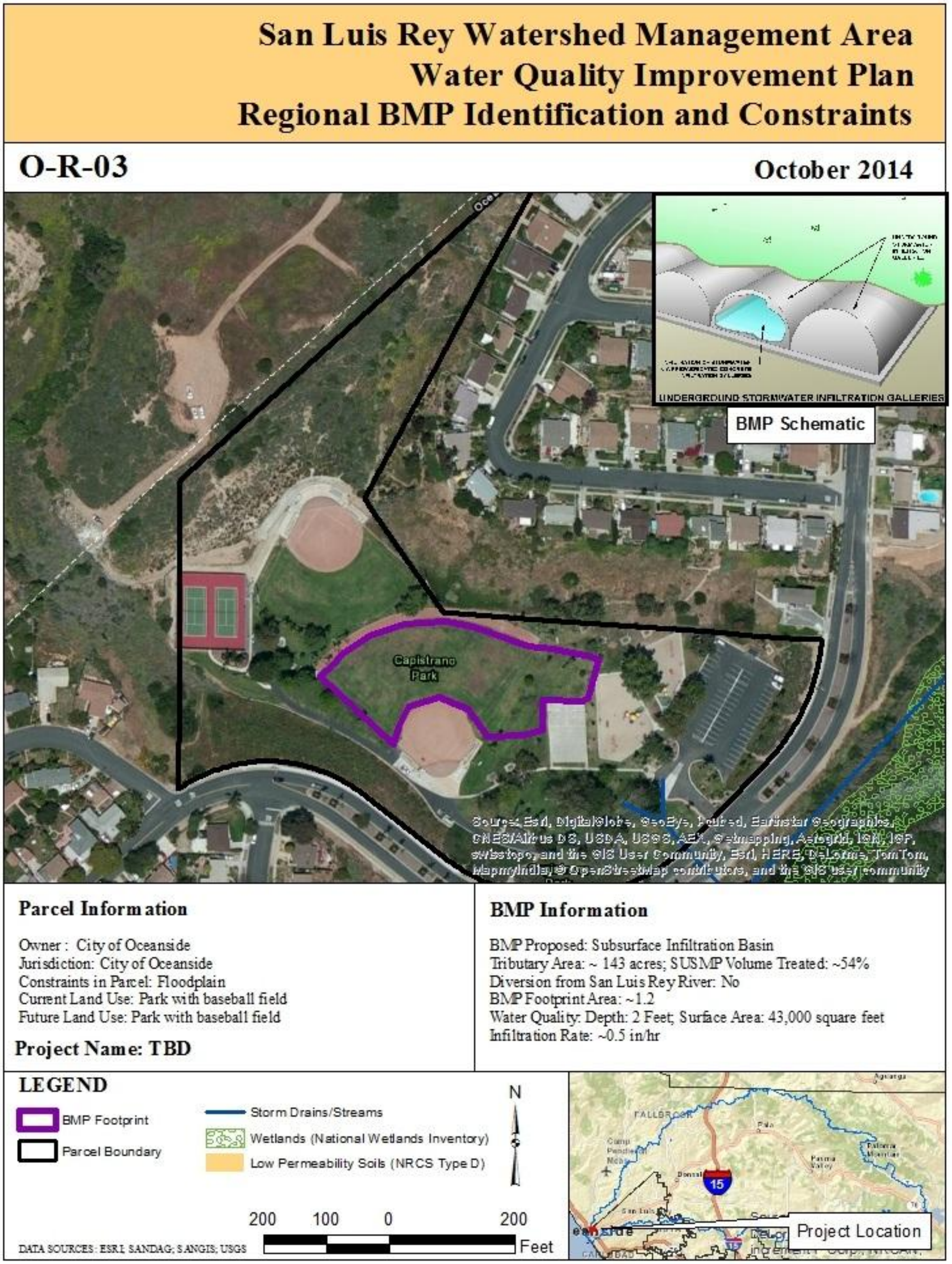


Figure 3E-13. O-R-03

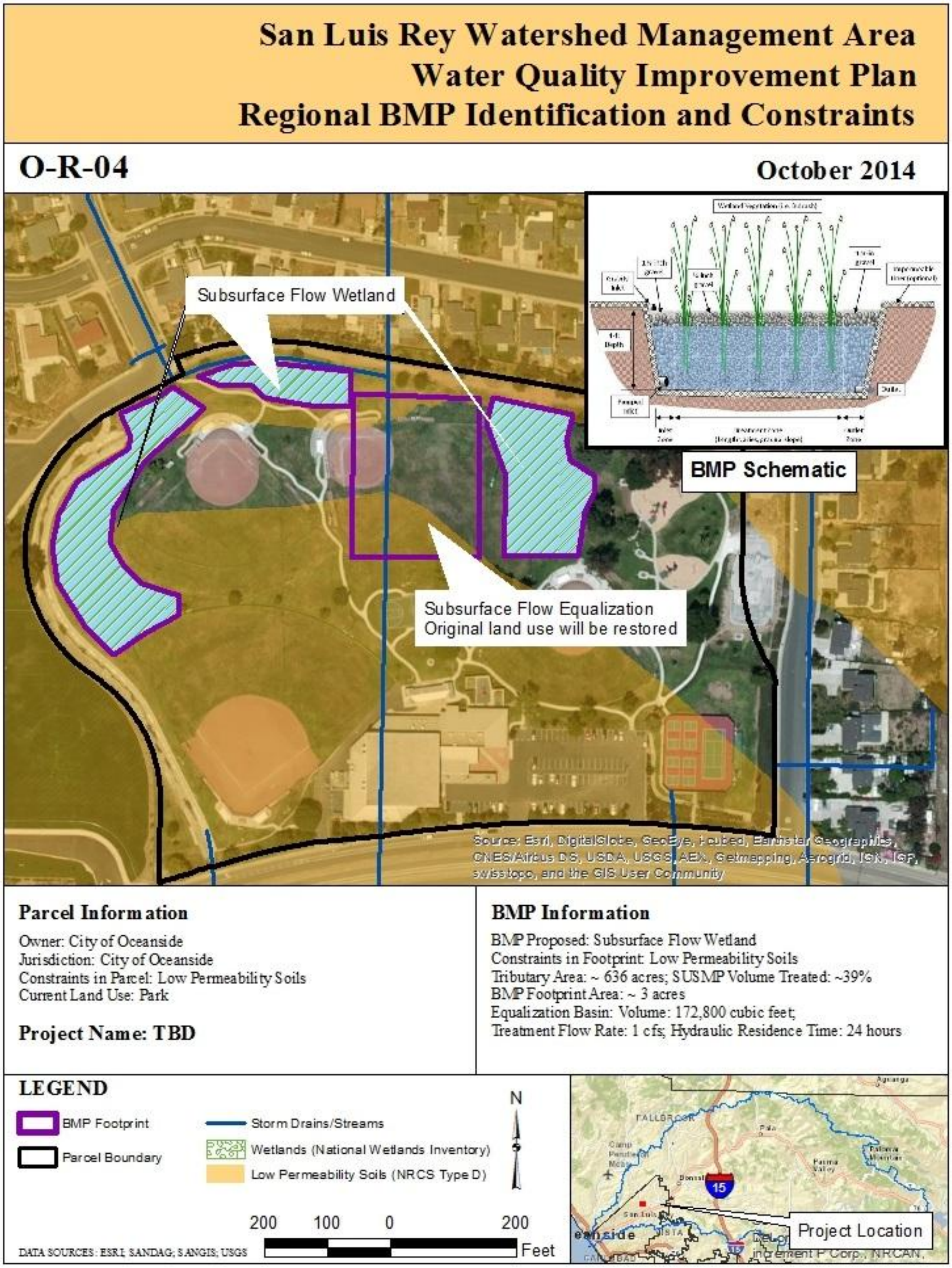
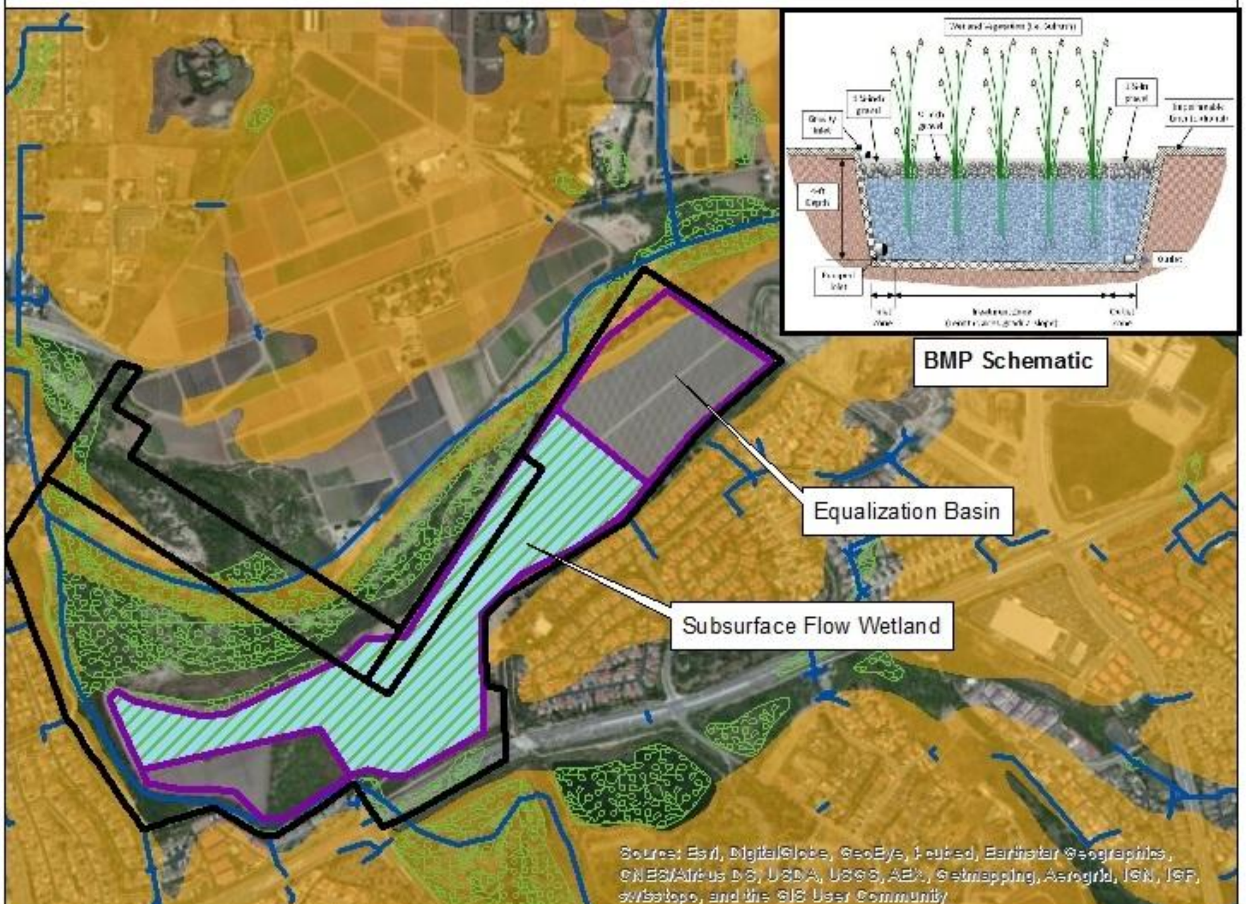


Figure 3E-14. O-R-04

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

MJ-R-01 October 2014



Parcel Information

Owner: County of San Diego and City of Oceanside
Jurisdiction: City of Oceanside
Constraints in Parcel: Wetland, Low Permiability Soils
Current Land Use: Vacant, Row Crop

Project Name: SLR Guajome

BMP Information

BMP Proposed: Subsurface Flow Wetland
Tributary Area: ~203,000 acres;
Diversion from San Luis Rey River: Yes
BMP Footprint Area: ~105 acres
Equalization Basin: Volume: 5,500,000 cubic feet;
Treatment Flow Rate: 32 cfs; Hydraulic Residence Time: 24 hours

LEGEND

BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

1,200 600 0 1,200 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

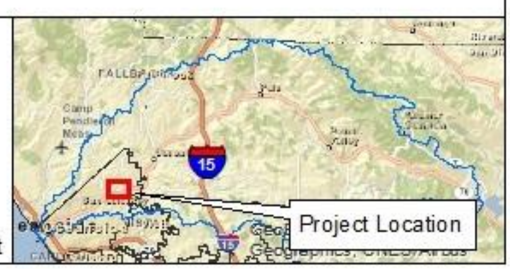


Figure 3E-15. MJ-R-01

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

MJ-R-02 — **October 2014**

Parcel Information

Owner: County of San Diego
Jurisdiction: City of Oceanside
Constraints in Parcel: Wetland, Floodplain, Low Permeability Soils
Current Land Use: Planned Sports Facility

Project Name: TBD

BMP Information

BMP Proposed: Subsurface Flow Wetland
Constraints in Footprint: Low Permeability Soils
Diversion from Guajome Creek: No
Tributary Area: ~ 345 acres; SUSMP Volume Treated: ~ 28%
BMP Footprint Area: ~1.5 acres
Equalization Basin: Volume: 86,400 cubic feet,
Treatment Flow Rate: 0.5 cfs; Hydraulic Residence Time: 24 hours

LEGEND

BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

200 100 0 200 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

Figure 3E-16. MJ-R-02

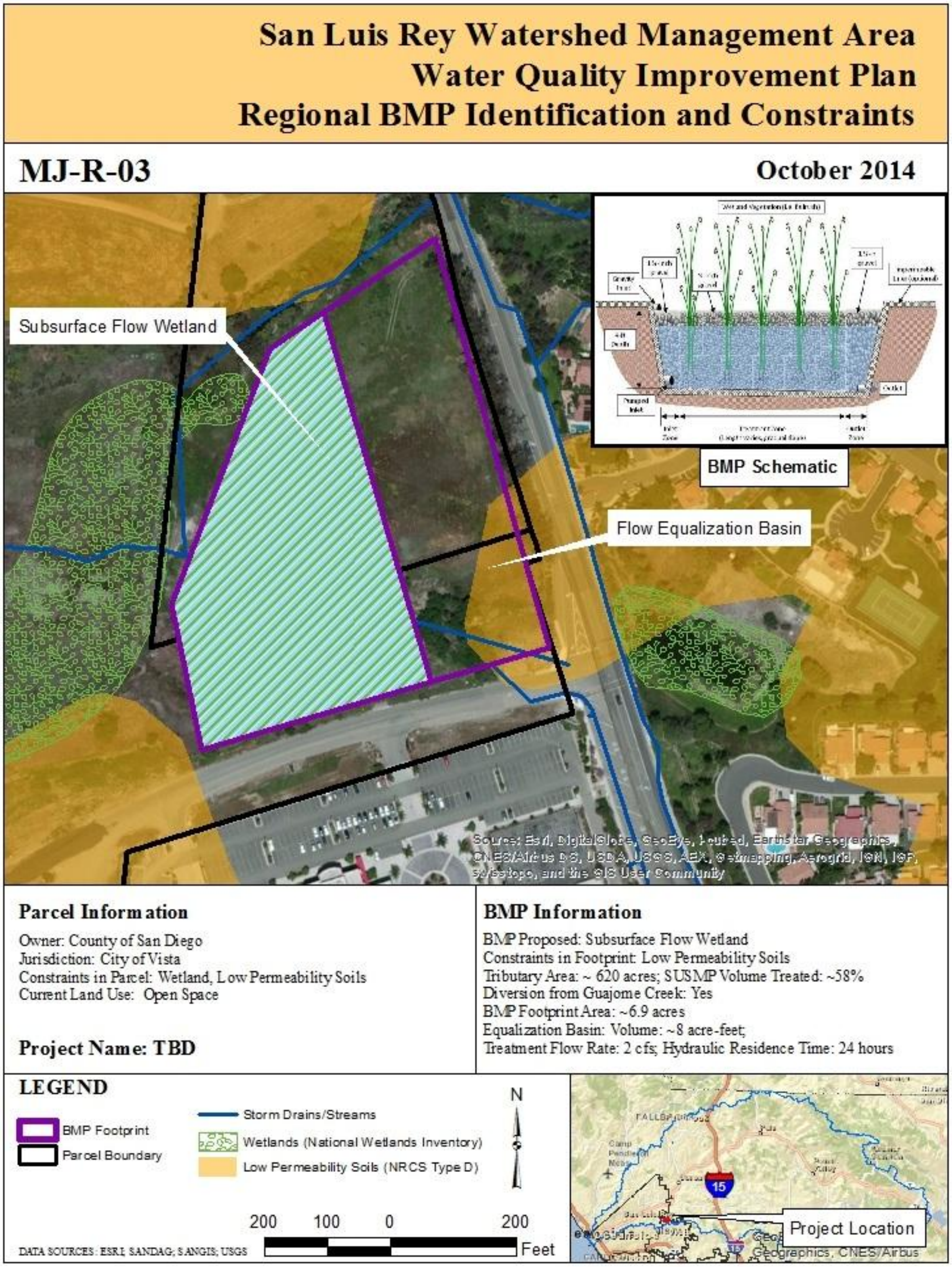


Figure 3E-17. MJ-R-03

Load Reduction Quantifications

The estimated load reductions for the proposed regional structural BMPs are presented in **Table** 3E-6**.**

Table 3E-6. Estimated Load Reductions from Proposed Regional Structural BMPs

Location/Name	Water Quality (FIB-FC Load) Benefits (10^12 MPN reduction/year)	Water Quality (Total Nitrogen Load) Benefits (lb reduction/year)	Water Quality (TP Load) Benefits (lb reduction/year)
	WY 1993 [Low - High]	WY 1993 [Low - High Years]	WY 1993 [Low - High Years]
County Unincorporated			
SDCo-R-01	53 [42 - 59]	10,720 [8,410 – 11,490]	910 [840 - 970]
SDCo-R-02	26 [20 - 29]	3,460 [2,310 – 3,530]	300 [280 - 340]
SDCo-R-03	16 [10 - 18]	340 [260 - 410]	50 [40 - 50]
SDCo-R-04	29 [20 - 34]	870 [670 - 990]	140 [130 - 150]
City of Oceanside			
O-R-01	75 [47 - 87]	1,320 [910 – 1,580]	170 [130 - 190]
O-R-02	11 [7 - 13]	210 [160 - 250]	30 [30 - 30]
O-R-03	19 [12 - 22]	500 [410 - 560]	60 [60 - 70]
O-R-04	33 [24 - 37]	1,760 [1,260 – 1,990]	180 [160 - 190]
Multi-Jurisdictional Projects			
MJ-R-01	493 [404 - 551]	62,780 [48,510 – 71,080]	5,860 [5,370 - 6,280]
MJ-R-02	18 [12 - 21]	330 [240 - 390]	50 [40 - 50]
MJ-R-03	61 [43 - 70]	1,320 [1,020 – 1,520]	190 [170 - 210]
Totals[a]	**834 [641 - 942]**	**83,600 [64,200 – 93,800]**	**7,900 [7,300 – 8,500]**

[a]. Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits of multiple BMPs addressing the same areas. Additionally, results for WY 1993 include all load reductions estimated for that WY, not only the fraction of load reductions that are considered effective for reducing exceedance days.

CHAPTER 3- APPENDIX F: DRY WEATHER LOAD REDUCTIONS

Dry weather load reductions were calculated using a tiered approach. First, the quantifiable nonstructural BMP load reductions were estimated then the gap between these aggressive source control programs and the TMDL required reduction level was filled using dry weather structural solutions when necessary.

The dry weather load reduction quantification approach involves similar steps for the suite of dry weather nonstructural BMPs included in this WQIP (including irrigation runoff reduction and commercial/industrial good housekeeping). The first step was to calculate the load generated by the targeted pollutant source that the BMP will address, by using a percentage of the total Participating Agency pollutant baseline load[1] which was taken from source tracking studies. Once the targeted pollutant source load was calculated, the potential load reduction benefit was calculated using the estimated effectiveness of the selected BMP. These values were based on literature when available, and if not, on best professional judgment. In both cases, predicted levels of uncertainty are high. The following sections provide a brief description of the specific quantification approach for each dry weather nonstructural BMP, along with relevant assumptions and assumption explanations.

Additionally, some dry weather structural controls may also be implemented to achieve the TMDL required reduction levels. These dry weather structural BMPs may include but are not limited to: low flow diversions to sewers, storm drain lining, catch basin dry wells, street gutter permeable pavement, bioretention swales, regional BMPs, etc.

Table 3F-1 provides a summary of the dry weather quantification results and corresponding assumptions and references. The following sections provide a brief description of the specific quantification approach for each dry weather nonstructural BMP, along with relevant assumptions and assumption explanations.

Irrigation Runoff Reduction and Good Landscaping Practices

The portion of the average dry weather FIB load resulting from commercial and residential runoff was estimated using the best professional judgment of Geosyntec Consultants. Based on findings from the San Diego River source tracking study (Weston, 2009), 59-80 percent of commercial and residential dry weather runoff is from irrigation. The implementation of this BMP is estimated to reduce irrigation runoff from commercial and residential areas by 25 to 50 percent as found by Berg et al. (2009) in a study in Orange County.

[1] The baseline load was assumed to be proportional to the flow (i.e. if x% of the flow was from irrigation runoff than, x% of the load was from irrigation runoff).

Commercial/Industrial Good Housekeeping

The dry weather loading of fecal coliform from commercial activities runoff was determined using the same approach as for irrigation runoff. The runoff load attributed to commercial areas was estimated using the best professional judgment of Geosyntec Consultants. The San Diego River study found that 15-27 percent of commercial flows are from commercial activities targeted by good housekeeping, such as dumpster leaks and dumpster wash-down. The reduction achieved through enhancements was based on the current rate of inspection coverage and effectiveness found in the San Diego County JURMP annual report.

Additional Dry Weather Benefits

In addition to the non-storm water flow reduction strategies described above, various pollutant source control BMPs that are being used for wet weather compliance will also have pollutant reduction benefits during dry weather. These BMPs will include the following program enhancements (i.e., beyond the Permit minimum), with an emphasis on those BMPs that most effectively target urban storm water bacteria sources:

- Street and median sweeping;
- MS4 cleaning;
- Education/outreach and inspection/enforcement to target specific known sources of bacteria and fecal waste, such as:
    - Commercial and food outlets (wash down practices, dumpster and grease trap management, etc.),
    - Pet owners,
    - Equestrian owners and recreation and owners of rural farm animals, and
    - Septic owners; and
    - Good landscaping practices.

Table 3F-1. San Luis Rey Summary of Dry Weather Water Quality Benefits

BMP Name	Wet or Dry Weather	Land Use Targeted	Pollutant Generating Activity	Quantification Assumptions			Quantification Method	Expected Annual Reduction of MS4 Baseline Load by 2021	
				Load Assumption	Units	Citation/Assumptions		Fecal Coliform (10 ^12 MPN and percent)	
								Low Range	High Range
Irrigation Runoff Reduction Enhancements (Incentatives, outreach, and education)	Dry Weather	Residential and Commercial	Irrigation runoff, fertilizers/compost, soil and decaying plant matter, green waste	1.7	10 ^12 Monthly Average MS4 FIB-FC dry-weather load in watershed	Calculated by TMDL model, which was calibrated to monitoring data	(monthly bacteria load) * (12 months per year) * (percent bacteria from runoff) * (percent of runoff from irrigation) * (expected behavior change)	1.5 7.4%	6.5 32%
				50-80%	Percent of MS4 dry-weather flows (and fecal bacteria loads) from commercial and residential runoff	Best Professional Judgement			
				59-80%	Percent of commercial and residential runoff load generated residential and commercial from irrigation	San Diego River Source ID study, 2009			
				25-50%	Percent reduction in irrigation runoff from irrigation control incentives	Orange County irrigation runoff study, 2004			
Commercial/Industrial Good Housekeeping Enhancements (Inspection, enforcement, outreach)	Dry Weather and Wet Weather	Commerical and Industrial	Dumpsters, outdoor garbage areas, garbage trucks, grease bins, outdoor dining/fast food, outside surface wash water	1.7	10 ^12 Monthly Average MS4 FIB-FC dry-weather load in watershed	Calculated by TMDL model, which was calibrated to monitoring data	(monthly bacteria load) * (12 months per year) * (percent bacteria from runoff) * (percent of runoff from commercial activities) * (increase in inspection) * (expected behavior change)	0.14 0.7%	1.1 5.4%
				25-40%	Percent of MS4 dry-weather flows (and fecal bacteria loads) from commercial and industrial runoff	Best Professional Judgement			
				15-27%	Percent of commercial and industrial runoff load generated from commercial and industrial activities	San Diego River Source ID study, 2009			
				25-50%	Percent of commercial and industrial area covered by increased inspection	San Diego County JURMP			
				75-100%	Percent reduction in bacteria loads from enhanced inspections	San Diego County JURMP			
Dry Weather Structural BMPs (low flow diversions to sewers, stormdrain lining, catch basin dry wells, street gutter permeable pavement, bioretention swales, regional BMPs)	Dry Weather and Wet Weather	All Land uses	All Nonstormwater Flows	39.1%	Percent reduction of MS4 FIB-FC dry-weather load to comply with the MS4 permit	San Diego MS4 Permit, Attachment E	(MS4 required percent reduction) - (estimated percent reduction achieved by nonstructural BMPs)	6.3 31%	0.38 1.8%
Dry Weather Total							**% of average MS4 total load (58.5 10^12 MPN)**	**8.0** **39.1%**	**8.0** **39.1%**

Chapter 3- Appendix G: BMP Adjusted Load Reductions and Water Quality Benefits

G.1 Adjustment Calculations for Structural BMPs

Load Reduction Adjustment Analysis

To improve the reliability of load reduction estimates relative to target load reduction, an analysis was performed to account for overlapping load reductions between structural BMPs. For example, if a given area has both distributed and regional structural BMPs proposed, the estimated load reductions were not assumed to be additive, but rather limited to the lowest effluent concentrations achieved by any structural BMP. Each BMP in the proposed plan was evaluated to identify overlapping load reductions, which were then removed from the total reported benefits to allow a comparison with the target load reduction.

The following assumptions were used for performing the load reduction adjustment analysis:

- Load reductions are uniformly distributed based on the ratio of baseline uncontrolled load.
- Structural BMPs were either categorized as an effluent-based BMP (i.e., BMPs that provide load reduction via treatment only, not volume reduction) or as a volume- reduction BMP (i.e., BMPs that operate on volume reduction primarily).
- For volume-reduction BMPs the overlapping benefits in the captured runoff volume were estimated using the upstream non-overlapping benefits in the captured runoff and the percent load reduction achieved by the BMP.
- For effluent-based BMPs the overlapping benefits in the captured runoff volume were estimated using the upstream non-overlapping benefits in the captured runoff and the total load reduction achieved by the BMP.
- Non-overlapping benefits associated with upstream BMPs in the bypass runoff volume (runoff that exceeds upstream structural BMP design criteria) were considered non-overlapping benefits for the BMP being analyzed.

This load reduction adjustment analysis is an approximate process intended to improve the interpretation of load reduction estimates for use in planning-level assessment of the likelihood of compliance. The degree of precision is intended to be consistent with the degrees of uncertainty relative to sources of loading, BMP performance, ultimate BMP design, interim versus ultimate condition and other factors.

Load Reduction Effective Fraction

BMPs provide load reductions at varying levels across the full range of storm events. Calculations of the total load reduction achieved by the suite of proposed BMPs for WY 1993, therefore, include load reductions achieved during the AEDs (the 18 highest loading days; AEDs were estimated using an AEF of 22%) as well as the remaining loading days, potentially leading to an overestimate of the ability of the proposed BMPs to achieve the Total Load Reduction (TLR), since TLRs do not include AED loads. Hence a “load reduction effective fraction” was developed to estimate the load reductions specifically useful for reducing the number of ‘non-allowable’ exceedance days. These adjusted loads were compared to the TLR.

For the purpose of developing an appropriate effective fraction, WY 1993 loading events were binned into three categories:

- *Effective load reductions*: These are load reductions that occur during the standard loading days, generally occurring beyond the 18 largest days. The load reductions achieved in these days are considered to be nearly completely effective for reducing exceedance days.
- *Partially effective load reductions*: These are defined as load reductions that occur in the 18 highest loading days that are followed by a non-allowable exceedance day at some point in the next three days. While an exceedance may still be registered in the allowable exceedance day, the load reductions estimated for that day are anticipated to have a residual effect on concentrations in the overall watershed system and at the receiving water monitoring point. The residual response in load reductions is expected to potentially provide some partial effectiveness in reducing the loads in the non-allowable exceedance days.
- *Ineffective load reductions*: This category includes load reductions from the 18 highest loading days that do not have non-allowable exceedance days within 3 days. Load reductions provided in BMPs during these events were considered to be minimally effective in reducing exceedance days.

To develop an effective fraction for use in this WQIP, four case study analyses were conducted that evaluated the timing and magnitude of loading and load reduction events for BMPs in WY 1993. Based on review of these case studies and best professional judgment, a range of effective fractions was developed. From this analysis, it was determined that for typical wet weather structural BMPs proposed as part of this WQIP, approximately 39 to 65 percent, with an average of 51 percent, of load reduction would be expected to be "effective load reductions" (defined for this study as events beyond the 18th largest baseline watershed loading event). These load reductions are considered to be nearly completely effective in reducing exceedance days. Partially effective load reductions have not been claimed in estimating the effective fraction at this time. This may be considered a conservative assumption. Based on this data, an effective fraction of 0.51 was used for the load reduction analysis for this WQIP.

G.2 Water Quality Benefits and Summary of Estimated Load Reductions

The following sections describe the benefits expected to result from implementation of the proposed BMPs, including the results of load reduction analyses for the HPWQC and other constituents.

Estimated Load Reductions for HPWQC

Table 3G-1 below shows the summary of predicted wet weather load reductions from each BMP type proposed for implementation within the SLR watershed by 2031 as well as the estimated target load reduction (TLR) to meet the HPWQC final numeric goal. The table presents the average, low, and high ranges of estimated load reduction. Ranges reflect variability in baseline pollutant loading (e.g., land use EMCs) as well as variability in BMP effectiveness and are represented by the 25th (low) and 75th percentile (high) prediction estimates. In order to compare the load reductions to the target, the sum of benefits is first adjusted for overlap (as indicated above) and then multiplied by the effective fraction (as indicated above). As shown in

Table 3G-1., both the high and average of the range of effective load reductions achieved by 2031 for the TMDL Critical Water Year (1993) are greater than the TLR. Based on these results, the suite of candidate BMPs are sufficient to achieve the TMDL requirements.

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

Table 3G-1. Summary of Wet Weather Load Reductions for Bacteria

BMP Category	FC Load Reduction (10^{12} MPN/Year) 1993 WY Load[a] [Low-High Range]	% of Avg 1993 WY MS4 Load[a]
Programmatic BMPs	619 [569 – 676]	10% [9.2% - 11%]
Public-Private Partnership Program	570 [84 – 1057]	9.2% [1.4% - 17%]
Redevelopment through Permit-Required LID Implementation	265 [222 – 319]	4.3% [3.4% - 5.2%]
Implemented Distributed BMPs	41 [22 – 47]	0.7% [0.4% - 0.8%]
Proposed Distributed Structural BMPs	151 [86 – 174]	2.4% [1.4% - 2.8%]
Proposed Regional Structural BMPs	834 [641 - 942]	13% [10% - 15%]
Load Reduction Adjustment[b]	-186 [-94 - -305]	-3.0% [-1.5% - -4.9%]
Load Reduction Effective Fraction[c]	0.51	NA
Structural Total	855 [485 – 1,139]	14% [7.8% - 18%]
Load Reduction Sum	**1,473** **[1,054 – 1,815]**	**24%** **[17% - 29%]**

a. 1993 WY MS4 loading is estimated at 6,186 x 10 12 MPN/year (47% of total watershed load).

b. Adjustment made to avoid double counting of overlapping load reductions between structural BMPs; improves reliability of results.

c. Adjustment made to account for fraction of load reduction that is considered to be "effective" for reducing likelihood of exceedance in non-AEDs, therefore more improves reliability for comparing with TLR.

Estimated Load Reductions for Other PWQCs

Table 3G-2. Summary of Wet Weather Load Reductions for Nutrients

BMP Category	Total Nitrogen Load Reduction (lbs/year) 1993 WY Load [Low-High Range]	% of Avg 1993 WY MS4 Load[a]	Total Phosphorous Load Reduction (lbs/year) 1993 WY Load [Low-High Range]	% of Avg 1993 WY MS4 Load[a]
Programmatic BMPs	50,400 [34,800 – 55,900]	10% [7% - 11%]	9,100 [7,900 – 9,800]	10% [9% - 11%]
Potential Public-Private Partnership BMPs	10,800 [1,600 – 20,000]	2.1% [0.3% - 4%]	900 [100 – 1,700]	1% [0.1% - 2%]
Redevelopment through Permit-Required LID Implementation	7,700 [6,200 – 9,200]	1.5% [1.2% - 1.8%]	1,200 [1,000– 1,400]	1.3% [1.1% - 1.5%]
Distributed Structural BMPs	4,000 [2,600 – 4,600]	0.8% [0.5% - 0.9%]	340 [260 – 400]	0.4% [0.3% - 0.4%]
Regional Structural BMPs	83,600 [64,200 – 93,800]	17% [13% - 19%]	7,900 [7,300 – 8,500]	9% [8% - 9%]
Load Reduction Adjustment[b]				
Load Reduction Effective Fraction[c]				
Structural Total				
Load Reduction Sum	**156,500 [109,400 – 183,500]**	**31% [22% - 36%]**	**19,400 [16,600 – 21,800]**	**21% [18% - 24%]**

[a.] 1993 WY MS4 loading is estimated at 503,869 lbs/year (20.3% of total watershed load) for total nitrogen and 90,769 lbs/year (45.9% of total watershed load) for total phosphorous.

[b.] Adjustment made to avoid double counting of overlapping load reductions between structural BMPs; improves reliability of results.

[c.] Adjustment made to account for fraction of load reduction that is considered to be "effective" for reducing likelihood of exceedance in non-AEDs, therefore more improves reliability for comparing with TLR.

Other Water Resources Benefits

In addition to the reductions in loading of the HPWQC and other PWQCs shown in

Table 3G-1**,** and **Table 3G-2**, the strategies proposed in this WQIP are expected to provide a number of other water resource benefits, including mitigation of physical and biological impairments. More specifically, these benefits include:

- Beneficial Use of Urban Runoff: Water that is captured and stored in BMPs has the potential to be beneficially harvested and used and thus offset demand for potable water, a critical need within San Diego County.
- Recreation: Larger regional BMPs have the potential to include multi-use elements. In final design of these BMPs there is the opportunity to include features such as trails and bike paths, based on community needs, project partnerships, and site appropriateness that are mutually beneficial to water quality. Distributed BMPs proposed in this WQIP were envisioned as “green streets”, which can enhance the vitality of a commercial or residential avenue and improve the overall quality of life in a neighborhood.
- Wildlife Habitat: In addition to their water quality benefits, BMPs such as regional subsurface flow wetlands may provide additional wetland habitat throughout the SLR WMA that may attract native species.
- Urban Heat Islands: Distributed green streets BMPs may mitigate urban heat island effects (i.e., increased runoff temperatures) by increasing pervious, vegetated areas within heavily urbanized portions of the WMA.
- Educational Opportunities: Non-structural BMP programs such as Irrigation Runoff Reduction, the Pet Waste Program, and Animal Facilities Management provide the opportunity for public outreach and educational programs that will target behavioral changes, sustainable control at (and avoidance of) the “source”, as well as increased public awareness of and investment in water quality improvement projects.

Chapter 3- Appendix H: San Luis Rey Watershed Management Area Analysis

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San Luis Rey River
Watershed Management Area Analysis

Lake Henshaw

October 3, 2014

Prepared for:
San Diego County Copermittees

Prepared by:

Geosyntec consultants
engineers | scientists | innovators

RICK ENGINEERING COMPANY

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ACRONYMS AND ABBREVIATIONS

%	percent
>	greater than
<	less than
BMP	Best Management Practice
CB	Coarse Bedrock
CEG	Certified Engineering Geologist
CIP	Capital Improvement Project
CLRP	Comprehensive Load Reduction Plan
CSI	Coarse Sedimentary Impermeable
CSP	Coarse Sedimentary Permeable
E_P	Erosion Potential
ET	Evapotranspiration
FB	Fine Bedrock
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
FSI	Fine Sedimentary Impermeable
FSP	Fine Sedimentary Permeable
GIS	Geographic Information System
GLU	Geomorphic Landscape Unit
HA	Hydrologic Area
HCP	Hydromodification Control Plan
HMP	Hydromodification Management Plan
HRU	Hydrologic Response Unit
HSA	Hydrologic Sub Area
HSG	Hydrologic Soil Group
IRWM	Integrated Regional Water Management
JURMP	Jurisdictional Urban Runoff Management Plan
LDW	Land Development Workgroup
LID	Low Impact Development
MAP	Mean Annual Precipitation

ACRONYMS AND ABBREVIATIONS continued

MHPA	Multiple Habitat Planning Area
MS4	Municipal Separate Storm Sewer System
MSCP	Multiple Species Conservation Program
NED	National Elevation Dataset
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
PDP	Priority Development Project
RCB	Reinforced Concrete Box
RCP	Reinforced Concrete Pipe
SCAMP	Southern California Aerial Mapping Project
SCCWRP	Southern California Coastal Water Research Project
SD	San Diego
SDRWQCB	San Diego Regional Water Quality Control Board
S_P	Sediment Supply Potential
SSURGO	Soil Survey Geographic Database
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WMA	Watershed Management Area
WMAA	Watershed Management Area Analysis
WQIP	Water Quality Improvement Plan
WURMP	Watershed Urban Runoff Management Plan

1. Introduction

1.1. Background

On May 8, 2013 the California Regional Water Quality Control Board, San Diego Region adopted Order No. R9-2013-0001; NPDES No. CAS 0109266, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region (Regional MS4 Permit). The Regional MS4 Permit, which became effective on June 27, 2013, replaces the previous MS4 Permits that covered portions of the Counties of San Diego, Orange, and Riverside within the San Diego Region. There were two main goals for the Regional MS4 Permit:

1. To have more consistent implementation, as well as improve inter-agency communication (particularly in the case of watersheds that cross jurisdictional boundaries), and minimize resources spent on the permit renewal process.
2. To establish requirements that focused on the achievement of water quality improvement goals and outcomes rather than completing specific actions, thereby giving the Copermittees more control over how their water quality programs are implemented.

To achieve the second goal, the Regional MS4 Permit requires that Water Quality Improvement Plans (WQIPs) be developed for each Watershed Management Area (WMA) within the San Diego Region. As part of the development of WQIPs, the Regional MS4 Permit provides Copermittees an option to perform a Watershed Management Area Analysis (WMAA) through which watershed-specific requirements for structural BMP implementation for Priority Development Projects can be developed for each WMA. This report presents the Copermittees' approach and results for the regional elements of the WMAA developed for the San Diego County area.

1.2. Watershed Management Area Analysis (WMAA)

The Regional MS4 Permit, through inclusion of the WMAA, provides an optional pathway for Copermittees to develop an integrated approach for their land development programs by promoting evaluation of multiple strategies for water quality improvement and development of watershed-scale solutions for improving overall water quality in the watershed. The WMAA comprises the following three components as indicated in the Regional MS4 Permit:

1. Perform analysis and develop Geographic Information System (GIS) layers (maps) by gathering information pertaining to the physical characteristics of the WMA (referred to herein as WMA Characterization). This includes, for example, identifying potential areas of coarse sediment supply, present and anticipated future land uses, and locations of physical structures within receiving streams and upland areas that affect the watershed hydrology (such as bridges, culverts, and flood management basins).
2. Using the WMA Characterization results, compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects. Such projects may include, for example, opportunities for stream or riparian area

rehabilitation, opportunities for retrofitting existing infrastructure to incorporate storm water retention or treatment, or opportunities for regional BMPs, among others. Prior to implementing these candidate projects the Copermittees must demonstrate that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of the onsite structural BMPs. Note, compilation or evaluation of potential projects was not performed as part of this regional effort. Identification and listing of candidate projects will be performed for each WMA through the WQIP process for WMAs that elect to submit the optional WMAA as part of the WQIP.

3. Additionally, using the WMA Characterization maps, identify areas within the watershed management area where it is appropriate to allow for exemptions from hydromodification management requirements that are in addition to those already allowed by the Regional MS4 Permit for Priority Development Projects. The Copermittees shall identify such cases on a watershed basis and include them in the WMAA with supporting rationale to support claims for exemptions.

1.3. Scope of Work for Regional WMAA

In July 2013, the Copermittees elected to fund a regional effort to develop elements of the regional WMAA for the 9 San Diego-area WMAs within the County of San Diego that are currently subject to the Regional MS4 Permit, which include:

- Santa Margarita River (for portion in San Diego County)
- San Luis Rey River
- Carlsbad
- San Dieguito River
- Los Peñasquitos
- Mission Bay & La Jolla Watershed
- San Diego River
- San Diego Bay
- Tijuana River (for portion in San Diego County)

The regional-level information developed through this effort is intended to provide consistency across WMAs and serve as the foundation for developing watershed-specific information for each WMA to be developed through the WQIP process. The regional effort scope of work included:

1. Development of GIS map layers that characterize the WMAs using data previously collected, readily available, and provided by the Copermittees, including:
    a. Description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
    b. Description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral;

c. Current and anticipated future land uses;

d. Potential coarse sediment yield areas; and

e. Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.

2. Development of a Microsoft® Excel (Excel) template for use by Copermittees to compile lists of candidate projects for an optional alternative compliance program.

3. Development of additional criteria and analyses to support reinstating the following proposed exemptions that were originally developed in the approved 2011 Final Hydromodification Management Plan but not included in the Regional MS4 Permit unless provided by the Copermittees in the WMAA. In addition, development of the associated Hydromodification Applicability/Exemption Mapping.

    a. Exempt River Reaches including:

        i. San Diego River;

        ii. Otay River;

        iii. San Dieguito River;

        iv. San Luis Rey River; and

        v. Sweetwater River

    b. Stabilized Conveyance Systems Draining to Exempt Water Bodies

    c. Highly Impervious/Highly Urbanized Watersheds and Urban Infill, and

    d. Tidally Influenced Lagoons (where data/study provided)

The scope of work for the regional effort excluded performing analysis within the following areas unless data was readily available, as Copermittees do not have jurisdiction over these areas:

1. State Lands;
2. U.S. Departments of Defense land;
3. U.S. National Forest land;
4. U.S. Department of Interior land and
5. Tribal land

Additional description of excluded areas, for the purposes of the Regional WMAA, is indicated in Section 2.3 Land Uses.

1.4. Project Process

The process for developing the Regional WMAA included close coordination with the Land Development Workgroup (LDW) at key points during the project. The LDW is composed of the 21 San Diego-area Copermittees and serves to develop and implement regional land development plans and programs necessary to support the requirements of the Regional MS4 Permit. The consultant team (Geosyntec Consultants and Rick Engineering Company) presented preliminary project assumptions and methodologies proposed to be used to develop the Regional WMAA to meet the requirements of the Regional MS4 Permit in December 2013. The consultant team incorporated workgroup feedback from this meeting and subsequently presented the preliminary Regional WMAA project results to the LDW in March 2014, again to receive direction and incorporate input on the preliminary results. Subsequently, the draft report was released to the public in July 2014, by a public workshop that included Consultation Panel members from each of the WMAs on July 29, 2014. This version of the report including all of the input described above is being issued for optional inclusion into the respective WQIP Provision B.3 submittals to the SDRWQCB in December 2014.

1.5. Report Organization

This report is organized as follows:

- Chapter 1 provides the project background and purpose;
- Chapter 2 describes the technical basis for characterizing the WMA;
- Chapter 3 describes the template that can be used by Copermittees to compile the list of candidate projects;
- Chapter 4 summarizes the analyses performed to support reinstating select exemptions from hydromodification control requirements for PDPs;
- Chapter 5 presents the WMAA conclusions;
- Chapter 6 presents the references used for the WMAA;
- Attachment A presents the exhibits and additional supporting information for watershed management area characterization;
- Attachment B presents the exhibits and additional supporting information for hydromodification management applicability/exemptions;
- Attachment C expands on the structure of the geodatabase that hosts the GIS data developed by the WMAA; and
- Attachment D provides a crosswalk between the Regional MS4 Permit requirements for WMAA and this report.

1.6.Terms of Reference

The work described in this report was conducted by Geosyntec Consultants (Geosyntec) and Rick Engineering Company (RICK) on behalf of the County of San Diego and the regional Copermittees.

2. Watershed Management Area Characterization

Watershed health and function are strongly influenced by hydrological and geomorphological processes occurring in the watershed. Both hydrological response and geomorphological response of the watershed are dependent on a variety of physical characteristics of the watershed. To this end, the Regional MS4 Permit specifies a set of data that is required to adequately characterize overall watershed processes as a foundation to enhancing integration and effectiveness of watershed management and water quality programs. The following GIS map layers were developed to characterize the hydrological and geomorphological processes within the San Luis Rey WMA:

- Dominant Hydrologic Processes: A description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
- Stream Characterization: A description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral;
- Land Uses: Current and anticipated future land uses;
- Potential Critical Coarse Sediment Yield Areas; and
- Physical Structures: Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.

These GIS layers can be used to:

- Identify the nature and distribution of key macro-scale watershed processes;
- Identify potential opportunities and constraints for regional and sub-regional storm water management facilities that can play a critical role in meeting water quality, hydromodification, water supply, and/or habitat goals within the watershed;
- Assist with determining the most appropriate management actions for specific portions of the watershed; and
- Suggest where further study is appropriate.

2.1.Dominant Hydrologic Processes

The Regional MS4 Permit identifies in the provisions related to the WMAA that a description of dominant hydrologic processes within the watershed must be developed, with GIS layers (maps) as output. The Permit specifically calls for processes "*such as areas where infiltration or overland flow likely dominates*." These particular aspects of the hydrological mechanics of watersheds are particularly important when attempting to understand the macro-scale opportunities for locating projects that take advantage of either capturing overland flow for treatment or for infiltration.

Investigation of the dominant hydrologic processes in the San Diego-area watersheds indicates that evapotranspiration (ET) is the most dominant hydrologic process for the region based on review of a published study (Sanford and Selnick, 2013). ET is the sum of evaporation and plant transpiration in the hydrologic cycle that transports water from land surfaces to the atmosphere. This is conclusion is supported by comparing the 30-year average annual rainfall for the study area (San Diego County east of the peninsular divide) of between 15 and 18 inches per year (San Diego County, 2005) to the average annual ET rates. According to the California Irrigation Management Information System (CIMIS) Reference Evapotranspiration Map (CIMIS, 1999), the study area (within Zones 4, 6, and 9) experiences annual reference ET of 46.6, 49.7 and 59.9 inches, respectively. Therefore, theoretically, if all of the annual precipitation for the San Diego-area watersheds remained stationary where it fell and did not either infiltrate or runoff to local waterbodies where it would be conveyed downstream ultimately to the ocean, it all would be consumed by ET. As such, the effect of ET on the overall hydrologic processes within the San Diego watersheds is a function of the temporal scale over which it acts. Precipitation events often produce runoff in these watersheds, particularly in the urbanized portions, based on the topography and land cover that tend to accelerate the conveyance of runoff downstream rather than collecting, storing, or spreading out that then would maximize the effect of ET.

Because this study is focused on developing information and mapping for the portion of the hydrologic process that informs watershed management decisions, i.e., locating beneficial projects in areas of greatest opportunity, the next tier of dominant hydrologic processes are studied and mapped by this project. As such, the study area was characterized, based on the methodology described in the following section, according to the predicted fate of runoff within the watersheds being either overland flow or infiltration after considering the effects of ET (as well as an intermediate category of interflow). Areas that were mapped as overland flow do not necessarily preclude infiltration but rather indicate the dominant expected process that runoff would experience if not intercepted for the express purpose of infiltrating storm water runoff. The Model BMP Design Manual will provide more detailed guidance and procedures for determining the potential for infiltrating captured storm water at the project level irrespective of the mapping produced in the WMAA. To reiterate, the WMAA mapping is to provide macro-scale processes for high-level analysis and to inform decisions affecting regional scales. Furthermore, the Model BMP Design Manual will indicate the degree to which site-scale BMPs can expect to benefit from ET or how ET is considered in the sizing of BMPs. In brief, typical storm water BMPs only store water for a few days and therefore are not really capable of significant volume disposal through ET. However, pervious area dispersion (i.e., directing storm water runoff to flat areas for spreading and infiltration) has appreciable benefits with regard to ET and is a practice promoted in the BMP Design Manual.

The processes of interest are further defined as follows:

Overland flow: This process can be thought of as the inverse of infiltration; precipitation reaching the ground surface that does not immediately soak in must run over the land surface (thus, "overland" flow). It reflects the relative rates of rainfall intensity and the soil's infiltration capacity: wherever and whenever the rainfall intensity exceeds the soil's infiltration capacity, some overland flow will occur. Most uncompacted, vegetated soils have infiltration capacities of one to several inches per hour at the ground surface, which exceeds the rainfall intensity of even unusually intense storms. In contrast, pavement and hard surfaces reduce the effective infiltration capacity of the ground surface to zero, ensuring overland flow regardless of the meteorological attributes of a storm, together with a much faster rate of runoff relative to vegetated surfaces.

Infiltration and groundwater recharge: These closely linked hydrologic processes are most apparent near ephemeral and perennial conveyances in the San Diego region. Their widespread occurrence is expressed by the common absence of surface-water channels on even steep (undisturbed) hillslopes. Thus, on virtually any geologic material on all but the steepest slopes (or bare rock), infiltration of rainfall into the soil is inferred to be widespread, if not ubiquitous. With urbanization, changes to the process of infiltration are also quite simple to characterize: some (typically large) fraction of that once infiltrating water is now converted to overland flow.

Interflow: Interflow takes place following storm events as shallow subsurface flow (usually within 3 to 6 feet of the surface) occurring in a more permeable soil layer above a less permeable substrate. In the storm response of a stream, interflow provides a transition between the rapid response from surface runoff and much slower stream discharge from deeper groundwater. In some geologic settings, the distinction between "interflow" and "deep groundwater" is artificial and largely meaningless; in others, however, there is a strong physical discrimination between "shallow" and "deep" groundwater movement. Development reduces infiltration and thus interflow as discussed previously, as well as reducing the footprint of the area supporting interflow volume.

The datasets used, methodology for creating the dominant hydrologic processes maps, and the results are described in the sections below.

2.1.1. Datasets Used for identifying dominant hydrologic processes

The following datasets were used in the analysis:

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3rd Arc Second (~10 meter cells) digital elevation model for San Diego County
Soils Data	SanGIS	2013	NRCS (SSURGO) Database for San Diego County downloaded from SanGIS
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS

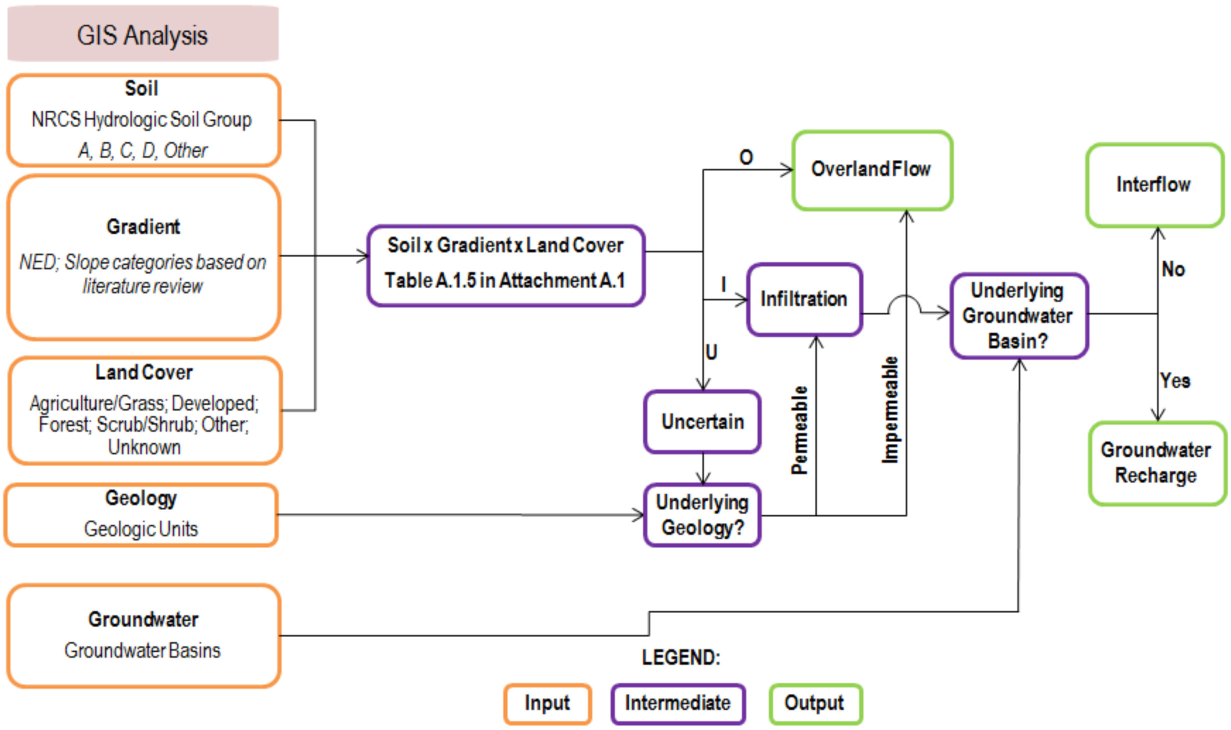
Dataset	Source	Year	Description
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30'x60' Quadrangle, Southern California, United States Geological Survey, Southern California Aerial Mapping Project (SCAMP), Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	"Geologic Map of California," California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale
Groundwater Basins	SanGIS	2013	Groundwater Basins in San Diego County downloaded from SanGIS

2.1.2. Methodology/Assumptions/Criteria for identifying dominant hydrologic processes

The methodology used to describe dominant hydrologic processes is based on recommendations included in the Southern California Coastal Water Research Project's (SCCWRP) Technical Report 605 titled "Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge" (SCCWRP, 2010). The foundation for this analysis was to incorporate the Report's concept of grouping common hydrologic attributes into Hydrologic Response Units (HRUs). The report states the following:

> *"Grouping common hydrologic attributes across a watershed into a tractable number of Hydrologic Response Units (HRUs: a term first used by England and Holtan 1969) has become a well-established approach for condensing the near-infinite variability of a natural watershed into a tractable number of different elements. The normal procedure for developing HRUs is to identify presumptively similar rainfall–runoff characteristics across a watershed by combining spatially distributed climate, geology, soils, land use, and topographic data into areas that are approximately homogeneous in their hydrologic properties (Green and Cruise 1995, Becker and Braun 1999, Beven 2001, Haverkamp et al. 2005). As noted by Beighley et al (2005), this process of merging the landscape into discrete HRUs is a common and effective method for reducing model complexity and data requirements. Using watershed characteristics to predict runoff is the explicit task of hydrologic models, and there is a host of such models available for application to hydromodification evaluation. For purposes of "screening," however, the goal is simplicity and ease of application even if the precision of the resulting analysis is crude."*

The following process describes the methodology used to define Hydrologic Response Units (HRUs) and then relate the HRUs to the dominant hydrologic processes (i.e., overland flow, interflow, and groundwater recharge) in the San Luis Rey WMA.



The first step is to define the HRUs. Once these are defined, the remaining steps determine the dominant hydrologic process.

1. **Integrate data sets used to determine HRU**: Categories for soil type, gradient, and land cover were defined based on readily available GIS datasets for the region and classifications found in relevant literature, as indicated below. The different combinations of these three categories comprise the distinct HRUs.

    - **Soil Categories**: based on National Resource Conservation Service (NRCS) Hydrologic Soil Group (HSG) classifications, which are commonly used to describe runoff/infiltration potential of soils on a regional scale. These categories include: A, B, C, and D. HSG A soils have the lowest runoff potential, while HSG D soils have the highest runoff potential.

    - **Gradient Categories**: based on slope ranges found in a review of relevant literature identified in Chapter 6. The spatial processing of the slope categories utilized the United States Geologic Survey (USGS) National Elevation Dataset (NED). Slopes were grouped (bins) into the following ranges: 0% to 2%; 2% to 6%; 6% to 10%; and greater than 10%. The 2% and 6% slope thresholds were based on slope ranges included in Table A.1.1 (McCuen, 2005) presented in Attachment A.1. This table provides runoff coefficients as a function of slope, soil group, land cover, and return period and was used for subsequent steps in the mapping effort. The 10% slope threshold was used in SCCWRP's Technical

Report 605 (SCCWRP, 2010) and is a logical cutoff since slopes steeper than 10% are assumed to be dominated by overland flow.

- **Land Cover Categories**: were defined using the Ecology Vegetation GIS map layer developed by the City of San Diego, the County of San Diego and SANDAG and downloaded from SanGIS (2013). The vegetation categories in the GIS layer were grouped (Table A.1.2 in Attachment A.1) to match the following categories used in SCCWRP's Technical Report 605 (SCCWRP, 2010): Agriculture/Grass; Developed; Forest; Scrub/Shrub, Other (Water), and Unknown.

2. **Evaluate Land Cover**: Land cover categories for Agriculture/Grass, Forest, Scrub/Shrub and Other were related to land use categories defined in Table A.1.1 as shown in Table A.1.3 in Attachment A.1. Relating a land use category for the Developed land cover category was not necessary because all Developed cover was assumed to have overland flow as its dominant hydrologic process.

3. **Determine Hydrology Characteristics for Land Covers**: For each of the land cover/land use categories listed in Table A.1.3, the ratio of precipitation lost to evapotranspiration (i.e. an evapotranspiration coefficient) was estimated using Table A.1.1 using the process described below. Since precipitation is considered to be the sum of the resulting runoff, infiltration, and evapotranspiration, the coefficients for these three hydrologic pathways sum to one, as indicated below.

   Runoff Coefficient + Infiltration Coefficient + Evapotranspiration Coefficient = 1

   i) **Estimate Evapotranspiration**: To estimate the evapotranspiration (ET) coefficient for each land cover, first the runoff coefficient was identified in Table A.1.1 for the highest runoff potential (i.e., Group D soil and 6%+ slope) and most common storm conditions (i.e., storm recurrence intervals less than 25 years). The infiltration for these high runoff conditions was assumed to be negligible, resulting in an infiltration coefficient of zero. Since the sum of the three coefficients should sum to one, the ET coefficient was assumed to be the remaining difference (i.e., ET Coefficient = 1 – Runoff Coefficient). The ET coefficient calculated for the highest runoff potential was then applied to all soil types and slopes within that land use category. The calculated ET coefficient for each applicable HRU is provided in Table A.1.4 in Attachment A.1. The ET coefficient for HRUs that have a Developed land cover or a gradient greater than 10% were not calculated since these HRUs were assumed to have overland flow as the dominant hydrologic process.

   ii) **Estimate Infiltration**: The infiltration coefficient for each applicable HRU (i.e., combination of soil, gradient, and land cover) was estimated by subtracting both the runoff coefficient, provided in Table A.1.1, and the ET coefficient, calculated in step 3(i), from one (i.e., Infiltration Coefficient = 1 – Runoff Coefficient – ET Coefficient). The calculated infiltration coefficient for each applicable HRU is provided in Table A.1.4 in Attachment A.1.

   iii) **Estimate Runoff**: For each applicable HRU, the runoff coefficient was divided by the infiltration coefficient to obtain a ratio representing the potential for runoff or infiltration. The higher the ratio, the greater the potential for runoff to be a more dominant hydrologic process than infiltration. Similarly, the lower the ratio, the greater the potential for infiltration to be a more dominant hydrologic process than runoff. The calculated runoff to infiltration ratios are provided in Table A.1.4 in Attachment A.1.

4. **Associate Runoff and Infiltration to HRUs**: The following designations were assigned to each applicable HRU based on the runoff to infiltration ratio (i.e., runoff coefficient/infiltration coefficient). These designations were based on best engineering judgment with the underlying assumption that if a runoff or infiltration coefficient is more than 50% greater than its counterpart, then the prevailing process is considered dominant.

    - HRUs with runoff to infiltration ratios greater than 1.5 (3:2 ratio) were assumed to have relatively high runoff and overland flow was considered its dominant hydrologic process. These HRUs are designated by the letter "O" (Overland flow is dominant process) in Tables A.1.4 and A.1.5 in Attachment A.1.

    - HRUs with runoff to infiltration ratios less than 0.67 (2:3 ratio) were assumed to have relatively high infiltration and its dominant hydrologic process was either interflow or groundwater recharge, based on analysis described in subsequent steps. These HRUs are designated by the letter "I" (Interflow is dominant process) in Tables A.1.4 and A.1.5.

    - For HRUs with runoff to infiltration ratios between, and including, 1.5 and 0.67 it was uncertain whether it was dominated by overland flow or infiltration. These HRUs are designated by the letter "U" (Dominant process is uncertain) in Tables A.1.4 and A.1.5.

    - For HRUs that have a Developed land cover or a gradient greater than 10%, the runoff to infiltration ratios were not calculated because these HRUs were assumed to have overland flow as the dominant hydrologic process. These HRUs are designated by the letter "O" (Overland flow is dominant process) in Table A.1.5.

5. **Uncertain HRUs Assignment**: For HRUs with an uncertain designation ("U") in Table A.1.5 in Attachment A.1, the underlying regional geology (Kennedy and Tan, 2002 & 2008; Todd, 2004 and Jennings et al., 2010) was used to evaluate whether overland flow or infiltration were dominant. If the underlying geology was considered impermeable, then these uncertain areas were considered to have overland flow as its dominant hydrologic process. If the underlying geology was considered permeable, then these uncertain areas were considered to be dominated by infiltration. The determination of whether a geologic unit is impermeable or permeable was based on desktop evaluation and the best professional judgment of a Certified Engineering Geologist (CEG). This analysis was performed in GIS and is illustrated in the flowchart above.

6. **Associate Infiltration HRUs with Known Groundwater Basins**: For HRUs with relatively high infiltration and have a designation of "I" in Table A.1.5 in Attachment A.1, the presence or absence of a regional groundwater basin (SanGIS, 2013) underlying these areas determined whether the dominant hydrologic process was designated as interflow or groundwater recharge. The groundwater recharge hydrologic process was assigned as dominant for those applicable areas which had an underlying groundwater basin. The interflow hydrologic process was assigned as dominant for those applicable areas which did not have an underlying groundwater basin directly below it. This analysis was performed in GIS and is illustrated in the flowchart above.

7. **Resulting HRU Data:** The resulting GIS map of dominant hydrologic processes was reviewed by engineering professionals familiar with the hydrology in the County of San Diego to confirm that the mapping is consistent with their experience working in the region.

2.1.3. Results for identifying dominant hydrologic processes

The resulting GIS map showing the spatial distribution of dominant hydrologic processes (i.e., overland flow, interflow, and groundwater recharge) within the San Luis Rey WMA is provided in Attachment A.1. An ArcMap document which presents the results from each step of the methodology is included in Attachment C, as well as Google Earth KMZ file. Based on this analysis, overland flow is the predominant hydrologic process in this WMA, which is consistent with the experience of engineering professionals familiar with the hydrology of the County of San Diego.

Summary of Deliverables for Dominant Hydrologic Processes

Format	Item	Description	Location
Report	Figure	"Dominant Hydrologic Processes"	Attachment A.1
GIS	Map Group Title	Hydrologic Processes	Attachment C
	Map Layer Title	Soil Land Cover Slope Hydrologic Response Unit Initial Rating Permeability Groundwater Basin Dominant Hydrologic Processes	
	Geodatabase Feature Dataset	HydrologicProcesses	
	Geodatabase Feature Class	HRUAnalysis	
	Geodatabase Geometry Type	Polygon	
KMZ [1]	KMZ File Name	Dominant Hydrologic Processes	Attachment C

[1] To enhance the utilization of this data, the Dominant Hydrological Processes map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).

2.1.4. Limitations for identifying dominant hydrologic processes

The resulting GIS map layer only lists the dominant hydrological process (i.e., an HRU assigned a dominant process of overland flow can also experience small amounts of infiltration) and provides a useful, rapid framework to perform screening-level analysis that is appropriate for watershed-scale planning studies. When more precise estimates are required for a particular site and subarea it is recommended that this analysis be augmented with site-specific analysis.

2.2. Stream Characterization

For the purpose of WMAA, the Regional MS4 Permit requires a description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral. Under the Regional WMAA, this analysis was prepared for 27 streams throughout the San Diego Region agreed upon by the consultant team and Copermittees. Within the San Luis Rey River WMA, stream characterization and detailed mapping is provided for San Luis Rey River as shown on the exhibit titled "Watershed Management Area Streams" located in Attachment A.2.

2.2.1. Datasets Used for stream characterization

The following data were referenced for the purpose of stream characterization:

- USGS National Hydrography Dataset, downloaded from USGS November 2013
- USGS 7.5-minute quadrangles, compiled image of quadrangles covering San Diego County, various dates
- Floodplains: "National Flood Hazard Layer," provided by Federal Emergency Management Agency October 2012
- Various datasets provided by Copermittees depicting existing storm water conveyance infrastructure within their jurisdictions.
- Aerial photography by Digital Globe dated 2012

2.2.2. Methodology/Assumptions/Criteria for stream characterization

The analysis was prepared by digitizing each of the 27 streams based on review of data listed above. Within the pre-existing datasets depicting streams, floodplains, or infrastructure, no single dataset included a complete, accurate alignment of each stream. Digitizing the streams based on review of all of the data listed above allowed creation of GIS linework with a continuous corrected alignment for each stream. The following data were recorded as GIS attributes for each stream as the stream was digitized:

- River name
- Reach type (engineered or natural, constrained or un-constrained)
- Bed material
- Bank material
- Hydrographic category (perennial or intermittent)

The attributes listed above were collected manually based on interpretation of the reference data. Assumptions used in making the interpretations are listed below. The ***Hydrographic Category*** section below will provide the rationale as to why perennial and intermittent were the hydrographic categories chosen for this WMAA and not perennial and ephemeral.

Note that stream classification was not prepared within areas of Federal/State/Indian lands unless data was readily available. Stream lines were prepared within these areas for continuity, but some data fields were not populated within these areas.

Reach Type

Streams were classified as either engineered or natural, and either constrained or un-constrained. See the exhibit titled, " Watershed Management Area Streams by Reach Type" in Attachment A.2. The purpose of this exercise was to identify whether the stream has been modified by human activity within the stream itself, which may include addition of crossing structures, stabilization of banks, dredging, or any other human activity. This aids the identification of physical structures including stream armoring, constrictions, grade control, and other modifications as required by the Regional MS4 Permit.

Classification of the streams as either "**engineered"** or **"natural"** was based on the following criteria:

Engineered

- A classification of "engineered" was assigned where the stream itself has been modified by human activity.
- All culvert/bridge/pipe crossings either provided in the Copermittes' storm water conveyance system data or clearly visible on the aerial photo have been assigned as engineered within the limits of the crossing.
- If the Copermittees did not provide storm water conveyance system data for the dirt road crossings/dip sections the streams have been assigned as engineered within the limits of the crossing. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, they were assigned as engineered.
- Golf courses have been assigned as engineered.
- If aerial photography showed large water bodies (lake, pond, irrigation pond, etc.) they were assigned as engineered.
- If the storm water conveyance system data provided by the Copermittees has identified the stream as "rockbs", the assumption has been made that these streams have rocks on their bottom and the sides ("bs"), and have been assigned as engineered.
- Sand mining operations have been assigned as engineered. Sand mining is an operation that is in continuous flux and does not typically result in a discrete, engineered geometry in any given channel cross section until restoration is implemented at the conclusion of the sand mining operation. It is assigned as engineered to acknowledge human alteration of the stream.

Natural

- Streams that have no apparent alteration within the stream itself by human activity have been assigned as natural.

Classification of the streams as either **"constrained"** or **"un-constrained"** was based on the following criteria:

Constrained

- All culvers/bridge/pipe crossings either provided in the Copermittes' storm water conveyance system data or clearly visible on the aerial photo have been assigned as constrained.
- If the Copermittees did not provide storm water conveyance system data for the dirt road crossings/dip sections the streams have been assigned as constrained. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, they were assigned as constrained.
- Golf courses have been assigned as constrained if located within the Federal Emergency Management Agency (FEMA) floodway based on the "National Flood Hazard Layer" data.
- The USGS National Hydrographic Dataset in their hydrographic category had assigned some reaches as artificial paths. In these situations and if the aerial photography shows large water bodies (lake, pond, irrigation pond, etc.) these streams have been assigned as constrained.
- Sand mining operations located within the FEMA floodway based on the "National Flood Hazard Layer" have been assigned as constrained.

<u>Un-constrained</u>

- Golf courses have been assigned as un-constrained if not located within the FEMA floodway based on the "National Flood Hazard Layer" data.
- Sand mining operations not located within the FEMA floodway based on the "National Flood Hazard Layer" data have been assigned un-constrained.
- If the stream is located within the FEMA floodway based on the "National Flood Hazard Layer" and there is available land in the floodway fringe (the area between the floodway and the 100-yeaer floodplain) the area has been assigned un-constrained. Note that there may be only one side or both sides of the stream with available land in the floodway fringe therefore a note was added as to which side of the stream is constrained and un-constrained.
- If the stream is located within a FEMA 100-year floodplain based on the "National Flood Hazard Layer" data with no floodway and the FEMA floodplain width is not within an existing development or bordered by roads have been assigned as un-constrained.

Bed Material and Bank Material

The following bed and bank materials were identified:

- Concrete
- Riprap
- Pipe / culvert
- Earth

The assumptions made to identify the streams bed and bank materials were based on the following criteria:

- If the data provided by the Copermittees provided information about the stream bed and bank material, the provided data was used for the bed and bank material.
- Generally the data provided by the Copermittees did not identify the crossing type (pipe, box culvert, bridge with or without piers, etc.) or the material (RCP, RCB, earth, riprap, concrete, etc.). In that case, all culvert/bridge/pipe crossings were assigned as pipe/culvert for the bed and bank material.
- If the Copermittees did not provide data for the dirt road crossings/dip sections the bed and bank material have been assigned as pipe/culvert. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, the bed and bank material have been assigned as earth.
- If aerial photography showed large water bodies (lake, pond, irrigation pond, etc.) they were assigned as earth bed and bank material. The USGS National Hydrographic Dataset in their hydrographic category had assigned some of these types of reaches as artificial paths.
- Sand mining operations within the stream have been assigned as earth for bed and bank material.
- If the Copermittees did not provide data for the stream material the bed and bank material have been assigned based on the aerial photography.

See exhibits titled, "Watershed Management Area Streams by Bed Material" in Attachment A.2.

After stream bed and bank material was classified, earthen reaches were further classified by geologic group. This was accomplished by intersecting the streams with the geologic group layer that had been prepared for use in the dominant hydrologic process and potential coarse sediment yield analyses. The result is displayed in exhibits titled, "Watershed Management Area Streams by Geologic Group" in Attachment A.2.

Hydrographic Category

Streams were classified as "perennial" or "intermittent." See exhibits titled, "Watershed Management Area Streams by Hydrographic Category" in Attachment A.2. Classification was obtained from the USGS National Hydrography Dataset (NHD). The definitions of these categories in the USGS National Hydrography Dataset are:

- **Perennial**: Contains water throughout the year, except for infrequent periods of severe drought.
- **Intermittent**: Contains water for only part of the year, but more than just after rainstorms and at snowmelt.

While the specific Regional MS4 Permit language requested classification of perennial or ephemeral, rather than perennial or intermittent, the data that was referenced in order to classify streams did not include "ephemeral" streams. For reference, the USGS National Hydrography Dataset definition of "ephemeral" is: "contains water only during or after a local rainstorm or heavy snowmelt." None of the stream reaches in the study were classified as ephemeral in the NHD dataset, therefore none are classified as ephemeral in the WMAA product. The City of San Diego provided a map titled "City of San Diego Stream Survey" dated April 3, 2013 prepared by AMEC that shows streams that are "dry" and streams that are "flowing". This information in conjunction with the other parameters listed in this section was used to determine if a stream was perennial or intermittent.

USGS NHD includes hydrographic category classification for many of the streams. However data was not available for all reaches of all streams. In order to classify reaches of streams that did not already contain this data in NHD, these assumptions were made:

- The USGS NHD information for the stream hydrographic category has been used when available.
- When USGS NHD has "artificial paths" for portions of the stream, the hydrographic category of the upstream portion of the stream have been assigned to the stream unless other assumptions took precedence.
- If aerial photography shows large waterbody (lake, pond, irrigation pond, etc.) perennial has been assumed for the hydrographic category.
- For ponded areas shown on the aerial photography and if the USGS 7.5-minute quadrangles shows cross hatching for the area, intermittent has been assigned unless the upstream portion of the stream was assigned as perennial pursuant to the USGS National Hydrography Dataset then assigned perennial for the ponded area.
- USGS has a dashed line for intermittent streams. USGS has a solid line for perennial streams. In some situations this information was used to assist in the determination of assigning perennial or intermittent to a stream.

2.2.3. Results for stream characterization

The 27 streams and data are contained in a GIS file titled "SD_Regional_WMAA_Streams" located in Attachment C. The streams are shown in watershed maps included in Attachment A.2.

Summary of Deliverables for Stream Characterization

Format	Item	Description	Location
Report	Title of Figures	• "Watershed Management Area Streams" • "Watershed Management Area Streams by Hydrographic Category" • "Watershed Management Area Streams by Bed Material" • "Watershed Management Area Streams by Geologic Group" • "Watershed Management Area Streams by Reach	Attachment A.2

		Type"	
GIS	Map Group Title	Not Grouped	Attachment C
	Map Layer Title	SD_Regional_WMAA_Streams	
	Geodatabase Feature Dataset	Streams	
	Geodatabase Feature Class	SD_Regional_WMAA_Streams	
	Geodatabase Geometry Type	Line	
KMZ [1]	KMZ File Name	SD_Regional_WMAA_Streams	Attachment C
[1] To enhance the utilization of this data, the Stream Characterization map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).			

In addition to the 27 streams that were subject of detailed analysis, NHD streams have been included on maps and within the geodatabase for reference. The NHD stream alignments have not been corrected and in some cases may be inconsistent with the existing infrastructure. The NHD streams are contained in a GIS file titled, "SD_NHD_Streams."

2.2.4. Limitations for stream characterization

- Only a desktop analysis was performed and no field verification was conducted.
- Infrastructure is only based on storm water conveyance system data provided by Copermittees or clearly visible on aerial photography. If the Copermittee used a numbering or lettering system for describing bed and bank material for example, since the metadata was not provided the bed and bank material could not be verified.
- In some instances concrete channels cannot be identified on aerial photography if it is filled with sediment and/ or vegetation.

2.3. Land Uses

For the purpose of the WMAA, the Regional MS4 Permit requires a description of current and anticipated future land uses. This is presented in the final GIS deliverable as "Land Use Planning" and includes the following representations of land uses in the watersheds: existing land uses, planned land uses, developable lands, redevelopment and infill areas, floodplains, Multiple Species Conservation Program (MSCP) designated areas, and areas not within the Copermittees' jurisdictions (tribal lands, state lands, and federal lands).

2.3.1. Datasets Used for land uses

The following existing regional datasets were referenced to meet this requirement:

- Municipal boundaries: "Municipal_Boundaries" dated August 2012, available from SanGIS/SANDAG
- Ownership: "Parcels" dated December 2013, available from SanGIS/SANDAG
- Existing land use: "SANGIS.LANDUSE_CURRENT" dated December 2012, available from SanGIS/SANDAG (existing land use)
- Planned land use: "PLANLU" (Planned Land Use for the Series 12 Regional Growth Forecast (2050)), dated December 2010, available from SanGIS/SANDAG
- Developable land: "DEVABLE" (Land available for potential development for the Series 12 Regional Growth Forecast), dated December 2010, available from SanGIS/SANDAG
- Redevelopment and infill areas: "REDEVINF" (Redevelopment and infill areas for the Series 12 Regional Growth Forecast), dated December 2010, available from SanGIS/SANDAG
- Floodplains: "National Flood Hazard Layer" provided by Federal Emergency Management Agency October 2012
- Multiple Species Conservation Program (MSCP), total of four datasets available from SanGIS/SANDAG: "MHPA_SD," dated 2012, (Multiple Habitat Planning Areas for City of San Diego); "MSCP_CN," dated 2009 (designations of the County of San Diego's Multiple Species Conservation Program South County Subregional Plan); "MSCP_EAST_DRAFT_CN," dated 2009 (draft East County MSCP Plan); and "Draft_North_County_MSCP_Version_8.0_Categories," dated 2008 (draft North County MSCP Plan)

2.3.2. Methodology/Assumptions/Criteria for land uses

The existing regional datasets for existing land use, planned land use, developable land, redevelopment and infill areas, floodplains, and MSCP designated areas were referenced with no modifications. Areas not within the Copermittees' jurisdictions (tribal lands, state lands, and federal lands) were compiled from SanGIS parcel data (December 2013) based on the "ownership" value. The owners listed below were excluded from the Copermittees jurisdictions and represent the "Federal/State/Indian" layer, which is displayed on various maps included in Attachment A.2.

- Bureau of Land Management
- California Department of Fish and Game
- Indian Reservations
- Military Reservations

- Other Federal
- State
- State of California Land Commission
- State Parks
- U.S. Fish and Wildlife Service
- U.S. Forest Service

When available, relevant data from these areas was included in analyses (e.g., developable land areas within Federal/State/Indian areas). Stream lines were prepared within these areas for continuity. However, stream classification (e.g., bed and bank material) was not prepared within these areas unless data was readily available (e.g., hydrographic category data available from NHD)

2.3.3. Results for land uses

The existing regional datasets are compiled into the Geodatabase in a group titled, "Land Use Planning." Current and anticipated future land uses are depicted in watershed maps included in Attachment C. Federal/State/Indian Lands are also referenced on all other map exhibits included in Attachment A.2.

Summary of Deliverables for Land Uses

Format	Item	Description	Location
Report	Title of Figures	• "Existing Land Use" • "Planned Land Use" • "Developable Land" • "Redevelopment and Infill Areas"	Attachment A.3
GIS	Map Group Title	Land Use Planning	Attachment C
	Map Layer Title	Municipal Boundaries Federal/State/Indian Lands SanGIS_ExistingLandUse SanGIS_PlannedLandUse SanGIS_DevelopableLand SanGIS_RedevelopmentandInfill FEMA Floodplain MHPA_SD MSCP_CN MSCP_EAST_DRAFT_CN Draft_North_County_MSCP_Version_8_Categories	
	Geodatabase Feature Dataset	LandUsePlanning	
	Geodatabase Feature Class	SanGIS_MunicipalBoundaries Federal_State_Indian_Lands SanGIS_ExistingLandUse SanGIS_PlannedLandUse	

		SanGIS_DevelopableLand SanGIS_RedevelopmentandInfill FEMA_NFHL SanGIS_MHPA_SD SanGIS_MSCP_CN SanGIS_MSCP_EAST_DRAFT_CN SanGIS_Draft_North_County_MSCP_Version_8_Categories	
	Geodatabase Geometry Type	Polygon	
KMZ [1]	KMZ File Name	Municipal Boundaries Federal/State/Indian Lands Floodplains Due to file size limitations, SanGIS land use datasets were not converted to KMZ.	Attachment C
[1] To enhance the utilization of this data, the Land Uses map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).			

2.3.4. Limitations

Some jurisdictions may have compiled GIS land use layers that include more detailed or more current information than the regional datasets available from SanGIS. SanGIS layers were selected for the Regional WMAA to provide consistent land use characterization region-wide, and to provide for repeatability of GIS analyses when a land use layer is required for input data. The definition of non-Copermittee areas identified in this document as "Federal/State/Indian Lands" is for the Regional WMAA. Some WQIPs may define non-Copermittee areas differently.

2.4. Potential Critical Coarse Sediment Yield Areas

The Regional MS4 Permit identifies in the provisions related to the WMAA that potential coarse sediment yield areas within the watershed be identified, with GIS layers (maps) as output. With regard to the function and importance of coarse sediment, SCCWRP Technical Report 667 titled "Hydromodification Assessment and Management in California" states the following:

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

This report identifies the potential critical coarse sediment yield areas for the San Luis Rey WMA in compliance with this permit provision. The applied datasets and methodologies for identifying the coarse sediment yield areas, along with their respective results, are described in the sections below.

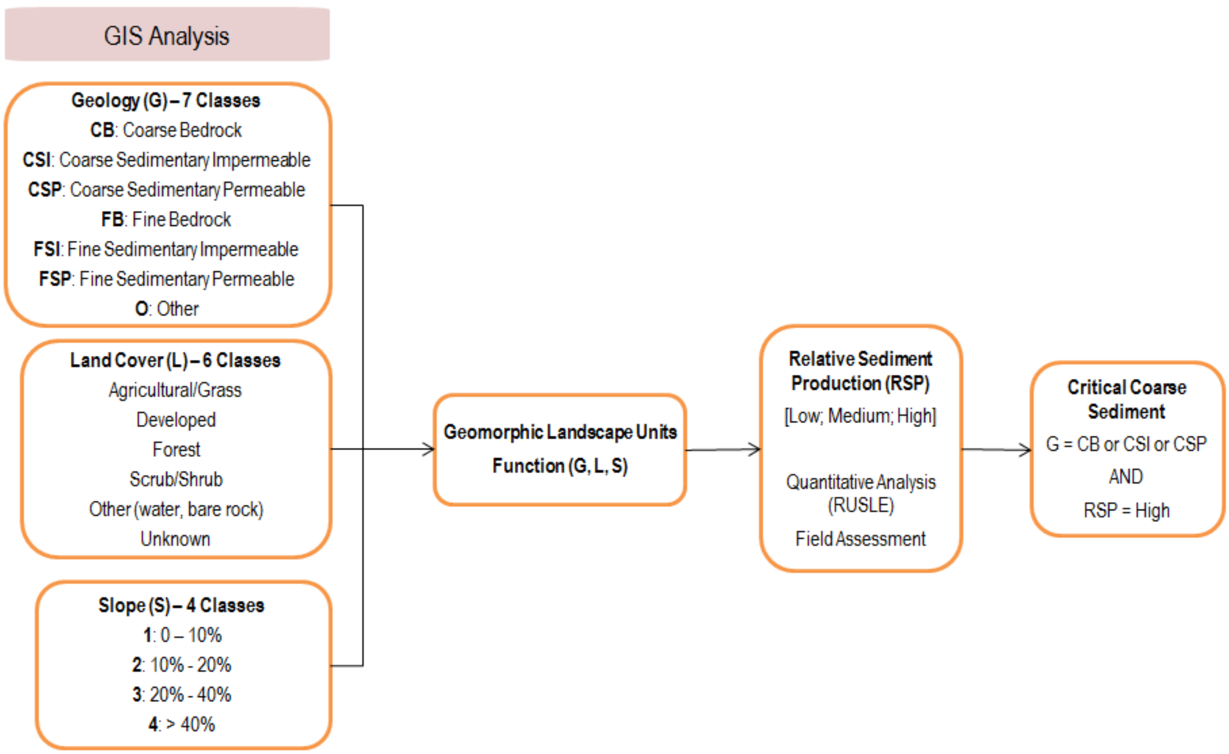
2.4.1. Datasets Used for identifying potential critical coarse sediment yield areas

The following datasets were used in the analysis

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3rd Arc Second (~10 meter cells) digital elevation model for San Diego County
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30'x60' Quadrangle, Southern California, United States Geological Survey, Southern California Areal Mapping Project (SCAMP), Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	"Geologic Map of California," California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale

2.4.2. Methodology/Assumptions/Criteria for identifying potential critical coarse sediment yield areas

The methodology used to identify coarse sediment yield areas is based on Geomorphic Landscape Unit (GLU) methodology presented in the SCCWRP Technical Report 605 titled "Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge" (SCCWRP, 2010). Geomorphic Landscape Units characterize the magnitude of sediment production from areas through three factors judged to exert the greatest influence on the variability on sediment-production rates: geology types, hillslope gradient, and land cover. The GLU approach provides a useful, rapid framework to identify sediment-delivery attributes of the watershed. The process to integrate these factors into GLUs is indicated in the flow chart below.



The following steps were used to define Geomorphic Landscape Units (GLUs), which were then related to the coarse sediment and critical coarse sediment yield areas in the San Luis Rey WMA.

1. **Integrate data sets used to determine GLU:** Categories for geology, gradient, and land cover were defined based on readily available GIS datasets for the region and classifications found in relevant literature listed in Chapter 6. The different combinations of these categories make up distinct GLUs.

    - **Geologic Categories**: based on methodology listed in Attachment A.4.1 of Attachment A.4. Resulting geologic categories from this analysis are: Coarse Bedrock (CB), Coarse Sedimentary Impermeable (CSI), Coarse Sedimentary Permeable (CSP), Fine Bedrock (FB), Fine Sedimentary Impermeable (FSI), Fine Sedimentary

Permeable (FSP), and Other (O). An exhibit showing the regional geology groupings is presented in Attachment A.4.

- **Land cover categories**: defined using the Ecology Vegetation GIS map layer developed by the City of San Diego, the County of San Diego and SANDAG which were downloaded from SanGIS (2013). The vegetation categories in the GIS layer were grouped (Table A.1.2 in Attachment A.1) to match the following categories used in SCCWRP's Technical Report 605 (SCCWRP, 2010): Agriculture/Grass; Developed; Forest; Scrub/Shrub, Other (Water) and Unknown.

- **Gradient Categories**: based on slope ranges found in a review of relevant literature (GLU methodology applied in California) listed in Chapter 6. The spatial processing of the slope categories utilized the USGS National Elevation Dataset (NED). Slope ranges used include: 0% to 10%, 10% to 20%, 20% to 40%, and greater than 40%.

2. **GLU Union Results**: GIS mapping exercise for the study area resulted in 166 GLUs within the 9 WMAs in San Diego County. Table A.4.2 in Attachment A.4 provides the list of the 166 GLUs.

For implementing hydromodification management performance standards in the Regional MS4 Permit, the Copermittees need to identify Critical Coarse Sediment Yield areas in the study region. To provide information on the identification of Critical Coarse Sediment yield, the study assumed that critical coarse sediment would be generated from GLUs that are composed of geologic units likely to generate coarse sediment (based on the methodology listed in Step 3) and have the potential for high relative sediment production (as estimated using the methodology listed in Step 4).

3. **Define Pertinent Geologic groups**: the geologic groups (Attachment A.4.1) considered in this study to have the potential to generate coarse sediment are Coarse Bedrock (CB), Coarse Sedimentary Impermeable (CSI), and Coarse Sedimentary Permeable (CSP). An exhibit showing the regional geologic grouping is presented in Attachment A.4.

4. **Relate GLU to Sediment Production**: For assigning GLUs with a relative sediment production, the following methodology was utilized:

    - Conducted quantitative analysis to assign relative sediment production. Analysis was performed based on the assumption that sediment production from an area is proportional to the soil loss from the area, as evaluated using standard soil loss equation. Detailed analysis steps are documented in Attachment A.4.2;

    - To validate the quantitative assignment above, a qualitative field assessment was conducted for 40 sites. Site selection and findings from the field assessment is documented in Attachment A.4.3.

    - The result of the field assessment indicated a 65% match between field conditions and the quantitative assignments. The mismatches are attributed to differences in percent land cover as assumed for the quantitative analysis and those observed in the field. As such, the quantitative assignments were considered to be valid for the purposes of assigning relative sediment production.

2.4.3. Results for identifying potential critical coarse sediment yield areas

The resulting GIS maps showing the spatial distribution of geologic grouping and critical coarse sediment yield areas within the San Luis Rey WMA are provided in Attachment A.4. An ArcMap document which presents the results from each step of the methodology is included in Attachment C. Based on this analysis it was estimated that 32.3% of the study area is a potential critical coarse sediment yield area.

As a result of the regional-scale datasets, and commensurate data resolution, used to map the potential critical coarse sediment yield areas, some areas may have been mapped that in reality do not produce critical coarse sediment as they are existing developed areas. As such, an opportunity for jurisdictions to incorporate more refined data into the preliminary WMAA GIS dataset based on local knowledge and review of current aerial images was provided. The County of San Diego provided augmented data in the San Luis Rey WMA within the unincorporated jurisdictional area.

Summary of Deliverables for Potential Critical Coarse Sediment Yield Areas

Format	Item	Description	Location
Report	Figures	“Geologic Grouping” "Potential Critical Coarse Sediment Yield Areas"	Attachment A.4
GIS	Map Group Layer Name	Potential Coarse Sediment Yield	Attachment C
	Map Layer Title	Geologic Grouping Land Cover Slope Category Geomorphic Landscape Unit Potential Coarse Sediment Yield Area Relative Sediment Production Potential Critical Coarse Sediment Yield Area	
	Geodatabase Feature Dataset	PotentialCoarseSedimentYield	
	Geodatabase Feature Class	GLUAnalysis PotentialCoarseSedimentYieldAreas PotentialCriticalCoarseSedimentYieldAreas	
	Geodatabase Geometry Type	Polygon	
KMZ [1]	KMZ File Name	Potential Critical Coarse Sediment Yield Areas	Attachment C

[1] To enhance the utilization of this data, the Geomorphic Landscape Unit Analysis is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).

2.4.4. Limitations for identifying potential critical coarse sediment yield areas

The resulting GIS layers were developed using regional datasets and provide a useful, rapid framework to perform screening-level analysis that is appropriate for watershed-scale planning studies. The methodology used to identify potential coarse sediment yield areas does not account for instream sediment supply and sediment production from mass failures like landslides which are difficult to estimate on a regional scale without performing extensive field investigation. This data set also does not account for potential existing impediments that may hinder delivery of coarse sediment to receiving waters or downstream locations within the watershed as this was beyond the scope of a regional study. Where more precise estimates are required for a particular site or subarea it is recommended that this analysis be augmented with site-specific analysis. It is also recognized that this regional data set is a function of the inherent data resolution and therefore may not conform to all site conditions, or does not reflect changes to particular areas that have occurred since the underlying data was developed. As such, the WMAA data for the potential critical coarse sediment yield areas should be verified in the field according to the procedures outlined in the Model BMP Design Manual and/or jurisdiction specific BMP Design Manual.

2.5. Physical Structures

The Regional MS4 Permit requires the Copermittees to identify information regarding locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins with GIS layers (maps) as output, for each WMA being analyzed for the purpose of developing watershed-specific requirements for structural BMP implementation. This study identified the physical structures using a desktop-level analysis for the stream(s) identified in Section 2.2 in compliance with this permit provision.

2.5.1. Approach for identifying physical structures

The intent of this portion of the WMAA project was to provide an initial assessment of the structures of interest for the stream(s) identified in Section 2.2. This desktop-level analysis was conducted primarily as a visual survey of aerial imagery and FEMA flood insurance study (FIS) profiles where available. The collected information was entered into a GIS layer for inclusion into the overall WMAA geodatabase containing the characterization layers required by the Regional MS4 Permit. To support overall WMA characterization, the information derived in this task provides insight into water and sediment movement through the watershed (SCCWRP, 2012), the opportunities and limitations for infrastructure retrofits and also informs efforts to identify appropriate locations for habitat or riparian area rehabilitation in relation to proximate infrastructure. Specific information regarding how the survey was performed and the attributes of the generated data is presented in Attachment A.5. Note that concrete channels, pipes/culverts, riprap or other artificial stream armoring, and basins have also been identified in the linework generated for the streams (see Section 2.2).

2.5.2. Results for identifying physical structures

The resulting GIS mapping provided in Attachment A.5 shows the spatial locations of the physical structures within the mapped stream(s).

Summary of Deliverables for Physical Structures

Format	Item	Description	Location
Report	Figure	Watershed Management Area Streams by Reach Type with Channel Structures	Attachment A.5
GIS	Map Group Layer Name	Channel Structures	Attachment C
	Map Layer Title	Channel Structures	
	Geodatabase Feature Dataset	ChannelStructures	
	Geodatabase Feature Class	ChannelStructures	
	Geodatabase Geometry Type	Point	
KMZ [1]	Kmz File Name	ChannelStructures	Attachment C

[1] To enhance the utilization of this data, the Physical Structures map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).

3. Template for Candidate Project List

The Regional MS4 Permit requires each WMA to use the results from the WMA characterization to compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects should an agency or jurisdiction opt to develop an alternative compliance program. Copermittees must first conclude that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of structural BMPs onsite prior to implementing these candidate projects as alternative compliance projects.

The Copermittees elected to identify potential candidate projects as a separate effort from this regional project, and therefore the process for identifying candidate projects is not documented in this report. Instead, this project only developed a template, in a spreadsheet format, for use by the Copermittees to compile lists of potential candidate projects. The template is intended to enhance regional consistency of the information that is gathered for candidate projects. The template spreadsheet file was distributed to the Copermittees on January 28, 2014. A table of the template components is indicated below:

Column	Primary Heading	Secondary Heading	Guidance for Completing the Project List
A	Project Identifier	-	Unique identifier for the project.
B	Watershed Management Area	-	Dropdown menu to select the watershed management area the project is located in
C	Hydrologic Area (HA)	-	Dropdown menu to select the hydrologic area the project is located in Select a WMA in column B for HA (Column C) dropdown menu to activate.
D	Hydrologic Subarea (HSA)	-	Dropdown menu to select the hydrologic subarea the project is located in. Select a HA in column C for HSA (Column D) dropdown menu to activate.
E	Jurisdiction	-	Dropdown menu to select the jurisdiction the project is located in. Select a HSA in column D for Jurisdiction (Column E) dropdown menu to activate.
F	Project Name	-	Indicate the name of the project.
G	Ownership	Type	Dropdown menu to select if the project is a public project, private project, or public-private partnership.
H	Ownership	Ownership Information	List the details for the owner.
I	Project Location	Address	List the address of the project site.
J	Project Location	APN	List the APN of the parcel.
K	Project Location	Latitude	List the latitude of the project site.
L	Project Location	Longitude	List the longitude of the project site.

Column	Primary Heading	Secondary Heading	Guidance for Completing the Project List
M	Project Origination/ Originator	Name	List the name of the report/organization/individual that provided the idea for the project. Potential origination sources: WQIP, WMAA, JURMPs, WURMPs, CLRPs, IRWM, MSCP, MHPA, Other.
N	Project Origination/ Originator	Contact Information	Link or report title if the proposed project is from a report [or] contact information if from an organization/individual.
O	Project Category	-	Drop Down menu to select the project category; In addition to the 6 project categories explicitly listed in the Regional MS4 Permit, the drop down menu also has a category "Other project types allowed by the MS4 Permit". Example for “Other” project types are agency CIP programs such as Green Streets, LID conversions (medians, parks), agency filter installation, etc.
P	Specific Project Type	-	List the subcategory of the project; for example, list Regional BMP type (i.e. infiltration basin, wetland, etc.).
Q	Potential Pollutant	-	Identify the potential pollutant(s) that can be treated by the proposed project.
R	Project Size & Parameters	Contributing Drainage Area (acres)	List the contributing drainage area to the project.
S	Project Size & Parameters	Parcel Size (acres)	List the size of the parcel the project is located on.
T	Project Size & Parameters	Project Footprint (acres)	List the size of the project footprint.
U	Project Size & Parameters	Parameters (with units as necessary)	Parameters needed to quantify benefits from the project; i.e. for an infiltration basin, list the water quality volume, long-term infiltration rate, depth of the basin, etc.
V	Regulatory Requirement	-	Indicate if the project is proposed to meet particular regulatory requirement such as TMDL, etc.
W	Project Timeline	-	Indicate if a project must be implemented by certain date to meet a grant deadline or other time commitment.
X	Other Notes	-	List any other relevant notes; for example, when retrofitting existing infrastructure project category is selected, input parameters needed to quantify benefits from existing infrastructure into this column as these will be needed to estimate additional benefits that can be used for alternative compliance. If N/A is selected in any dropdown menus, add additional explanation in here

4. Hydromodification Management Applicability/Exemptions

Hydromodification, which is caused by both altered storm water flow and altered sediment flow regimes, is largely responsible for degradation of creeks, streams, and associated habitats in the San Diego Region. The purpose of the hydromodification management requirements in the Regional MS4 Permit is to maintain or restore more natural hydrologic flow regimes to prevent accelerated, unnatural erosion in downstream receiving waters.

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

The March 2011 Final Hydromodification Management Plan (HMP) identified certain exemptions from hydromodification management requirements by presenting "HMP applicability criteria." The Regional MS4 Permit maintains some of these HMP applicability criteria. However, some of the applicability criteria are not included under the Regional MS4 Permit unless the area or receiving water is mapped in the WMAA. The intent of this Section is to provide mapping of areas exempt from hydromodification management requirements, and provide supporting technical analyses for exemptions that are recommended by the WMAA.

4.1. Additional Analysis for Hydromodification Management Exemptions

This section documents additional analysis performed to further evaluate the following exemptions that were already approved by the San Diego Regional Board with the 2011 Final HMP. This study only provides additional analysis, data, and rationale for supporting or eliminating the following existing exemptions and does not propose or study any new exemptions.

- Exempt River Reaches
- Stabilized Conveyance Systems Draining to Exempt Water Bodies
- Highly Impervious Watersheds and Urban Infill and
- Tidally Influenced Lagoons

4.1.1. Exempt River Reaches

4.1.1.1. History

The March 2011 Final HMP, approved by the SDRWQCB under the 2007 MS4 Permit, provides the following exemption from hydromodification management requirements under Section 6.1, HMP Applicability Requirements:

- *Figure 6-1, Node 5 – Potential exemptions may be granted for projects discharging runoff directly to an exempt receiving water, such as the Pacific Ocean, San Diego Bay, an exempt river system (detailed in Table 6-1), or an exempt reservoir system (detailed in Table 6-2).*

Exempt river system/reach from the 2011 Final HMP:

River	Downstream Limit	Upstream Limit
San Luis Rey River	Outfall to Pacific Ocean	Upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15

Exemptions related to runoff discharging directly to the above river reach was based on the flow duration analysis performed for the San Diego River in the Final HMP and the Technical Advisory Committee (for the development Final HMP) members' opinion (based on field observations and years of historical perspective) that the above river reach have very low gradients, were depositional (aggrading), have very wide floodplain areas when in the natural condition and that the effects of cumulative watershed impacts to this reach is minimal provided that properly sized energy dissipation is provided at outfalls to the river.

4.1.1.2. Status under 2013 Regional MS4 Permit

Under the Regional MS4 Permit, exempt river reaches would not qualify for exemption from hydromodification management controls unless the optional WMAA is developed with additional rationale/analyses to support reinstating exemptions to these river reaches. Additional analysis performed as part of the WMAA to evaluate hydromodification management control exemptions to the previously exempt reaches is presented below.

4.1.1.3. Research, Approach and Results

Hydromodification impacts can be caused due to increase in flows, changes in sediment transport capacity and changes in sediment supply to the streams (SCCWRP, 2012). In order to evaluate the cumulative impacts due to development and determine if hydromodification management exemptions can be reinstated for the river reach that was exempt in the previous permit term erosion potential (Ep) analysis was used to evaluate the increase in flows and changes in sediment transport capacity. In addition, sediment supply potential (Sp) analysis was used to evaluate the changes in sediment supply in this study. In regards to Ep analysis SCCWRP Technical Report 667 "Hydromodification Assessment and Management in California" states:

> *"The underlying premise of the erosion potential approach advances the concept of flow duration control by addressing in-stream processes related to sediment transport. An erosion potential calculation combines flow parameters with stream geometry to assess*

long term (decadal) changes in the sediment transport capacity. The cumulative distribution of shear stress, specific stream power and sediment transport capacity across the entire range of relevant flows can be calculated and expressed using an erosion potential metric, Ep (e.g., Bledsoe, 2002).”

The approach used in this study is explained in detail in Attachment B.1.1.1. The following WMA characterization maps developed in Section 2 were used to select inputs for the exempt river reach analysis:

- Planning land use layers from Section 2.3 were used to estimate the existing impervious area and identify the developable parcels in each watershed. A GIS exercise was performed to identify the developable parcels in each watershed that will be exempt from hydromodification management requirements if the exemption is granted.
- Stream type classification analysis from Section 2.2 was used to select a conservative cross section (segments that are assigned naturally constrained) to be used in analysis for each watershed.
- GLU analysis and its associated quantitative analysis described in Section 2.4 were used to determine Sp metric for each watershed. In this study coarse sediment supply changes were limited to changes in hill slope erosion between existing condition and final build out condition (for parcels that are proposed to be exempt from hydromodification management) of the watershed. It was assumed that the changes in instream sediment supply between existing and final build out condition for these large depositional river systems are very minimal.

Selection of inputs for the analysis is explained in detail in Attachment B.1.1.2 and results from the analysis are presented in Attachment B.1.1.3 in tabular format. The Ep analysis performed in this study does not account for the following Regional MS4 permit requirements as a conservative assumption. If accounted for, it will result in a smaller Ep than what is currently reported in Attachment B.1.1.3:

- New development priority development projects including projects that are proposed to be exempt from hydromodification management requirements through this WMAA study must implement retention BMPs to the extent feasible if alternative compliance option is not selected or not available.
- Redevelopment priority development projects must mitigate to the pre-developed condition.

4.1.1.4. Recommendation

Based on the results from this study reported in Attachment B.1.1.3, the flow duration analysis performed in the Final HMP, and the Technical Advisory Committee (TAC) recommendations provided during the Final HMP development, it is recommended that hydromodification management exemption be reinstated for projects discharging runoff directly to the following exempt river reach:

River	Downstream Limit	Upstream Limit
San Luis Rey River	Outfall to Pacific Ocean	Upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15

Each municipality must define/approve "direct discharge" based on the project site conditions. To qualify for the potential exemption, the outlet elevation must be between the river bottom elevation and the 100-year floodplain elevation and properly designed energy dissipation must be provided. Mapping of these exempt river reaches is presented in Attachment B.2.

4.1.1.5. Limitations

The analysis and associated recommendations as presented above were based on instream erosion as the primary consideration to support reinstatement of exemptions from hydromodification management controls for discharges directly to these river reaches. While it is recognized that other factors contribute to adverse impacts (e.g., salinity imbalance, pollutants) to instream habitat and resulting biotic integrity, hydromodification management control has traditionally been considered an "umbrella process" that encompasses most of the highest risk stressors (percent sands and fines present, channel alteration, and riparian disturbance) to physical habitat. Beyond demonstrating that instream erosion is not anticipated as a result of reinstating hydromodification management control exemptions for discharges to these river reaches, a focused method for correlating physical and biotic integrity to modified hydrological conditions has not been performed in this analysis, as an assessment method has not yet been developed.

The current assessment methods may yield inconclusive results when attempting to identify causal relationships between degraded instream habitat solely due to increased flows and erosive force from hydromodification. A causal assessment recently conducted in the lower reaches of the San Diego River, conducted as a partnership between the Southern California Coastal Water Research Project (SCCWRP), the City of San Diego, the County of San Diego, and the San Diego RWQCB, focused on stressors potentially responsible for known biological impairment of the river. Once the data of the causal assessment become available, it may be useful in classifying the potential stressors such as altered physical habitat as likely, unlikely, or an uncertain cause to biological impairment.

With respect to adverse impacts to habitat as a result of pollutants entrained in storm water discharges, these areas will still be subject over time to the pollutant control requirements of the Regional MS4 Permit as areas develop or redevelop. The current requirements obligate development to maximize retention of the design storm volume which will mitigate a portion of the volume that would otherwise be controlled with hydromodification management BMPs. In some cases, this offsetting of volume reduction through pollutant control BMPs may exceed the HMP volumes. In addition, the development that occurs within the exempted watershed areas is still required to provide any applicable flood control measures. Risk of flooding as a result of exemption from hydromodification controls is unlikely as the control thresholds are significantly lower (order of magnitude) than flood control requirements implemented to protect life and property.

4.1.2. Stabilized Conveyance Systems Draining to Exempt Water Bodies

There are no stabilized conveyance systems currently recommended for exemption from hydromodification management requirements in the San Luis Rey River WMA. If engineered conveyance systems that are stabilized with materials other than concrete, such as riprap, turf reinforcement mat, or vegetation, including rehabilitated stream systems, are identified as potential candidates for exemption, they may be studied and may be recommended exempt if they meet specific criteria presented in the Regional WMAA for this exemption. Refer to the Regional WMAA for the criteria and an example study that was prepared for Forester Creek in the San Diego River WMA. However, any future proposed HMP exemptions would need to be approved through the WQIP Annual Update process (Regional MS4 Permit Section F.1.2.c.).

4.1.3. Highly Impervious/Highly Urbanized Watersheds and Urban Infill

Based on evaluation of the highly impervious/highly urbanized watershed and urban infill exemptions presented in the March 2011 Final HMP, and comparison with more recent research prepared for the Ventura County Hydromodification Control Plan (Ventura County HCP) (Final Draft dated September 2013), resurrection of these exemptions from the March 2011 Final HMP was not recommended by the Regional WMAA. The research prepared in support of the Ventura County HCP determined lower thresholds of additional impervious area (ranging from 0.44% to 1.65%) than the limit presented in the San Diego County Final HMP dated March 2011 (3%). No areas within the San Luis Rey River WMA are currently recommended for highly impervious/highly urbanized watershed or urban infill exemption.

4.1.4. Tidally Influenced Lagoons

There are no tidally influenced lagoons recommended for exemption from hydromodification management requirements in the San Luis Rey River WMA. Refer to the Regional WMAA for further information regarding this exemption.

5. Conclusions

5.1. Watershed Management Area Characterization

The WMA Characterization data was developed using available regional data to further understand the macro-scale watershed characteristics and processes in the San Luis Rey WMA. The Regional MS4 Permit allows for flexibility in complying with land development requirements when using the information developed in the WMAA to improve water quality planning and implementation associated with land development. This dataset will assist with identifying the opportunities and constraints for projects and management decisions based on a watershed-scale (rather than piecemeal project identification without context within the watershed) and provides Copermittees the ability to exercise the option to create an alternative compliance program that offers the opportunity to develop watershed-specific alternatives to universal onsite structural BMP implementation. The characterization data includes:

Characterization Data	Utilization Potential
Dominant Hydrologic Process: • Overland flow • Infiltration • Interflow	• Identify areas for enhanced infiltration or collection of storm water for treatment • Implement management measures that correspond to pre-development conditions – promotes long-term channel stability and health • Increases understanding of the natural functioning of the watershed and what has been (or is at risk of being) altered by urbanization.
Stream Characterization: • Reach type • Bed material • Bank material • Hydrographic category • Channel infrastructure	• Preliminary dataset that can be used to conduct stream power evaluations • Identify channel systems for preservation or restoration • Identification of appropriate space for channel processes to occur (e.g., flood plain connectivity) • Insight to sensitivity of receiving stream reach • Indicates the features within channels that affect water and sediment movement through the watershed

Characterization Data	Utilization Potential
Land Use: • Existing • Future	• Foresight (identifies relative risks, opportunities, or constraints) in comparing future to existing land uses, i.e., areas that may be more/less vulnerable to adverse impacts to changes in storm water runoff associated with development • Encourage infill development
Potential Critical Coarse Sediment Yield Areas	• Preservation of areas or function that contributes critical sediment within the watershed to stream armoring/stability • Assist with identifying potentially susceptible stream reaches that require uninterrupted coarse sediment supplies to remain stable • Dual goal of open space conservation

Regarding the identification of the potential critical coarse sediment yield areas in the WMAA using readily available regional datasets, it is anticipated that when more precise estimates for potential critical coarse sediment yield areas are required for a particular site or subarea that this regional study will be augmented with site-specific analysis. Development projects must avoid critical sediment yield areas or implement measures that allow critical coarse sediment to be discharged to receiving waters, such that there is no net impact to the receiving water to meet the requirements of the Regional MS4 permit. As such, projects should consult the Model BMP Design Manual and/or jurisdiction specific BMP Design manual for options to meet the Regional MS4 permit requirements. It is anticipated that the data will not be static but will be enhanced over time through future studies or field assessments that will refine what is currently a macro-level data set.

5.2. Template for Candidate Project List

It is anticipated the Copermittees that elect to develop alternative compliance programs will conduct a separate exercise to nominate potential candidate projects for inclusion into the WQIPs using the template developed for this project.

5.3. Hydromodification Management Exemptions

Attachment B.2 presents hydromodification management applicability/exemption mapping for the San Luis Rey River WMA. The mapping includes receiving waters that are exempt based on the Regional MS4 Permit or recommended exempt based on studies.

Receiving waters that are **exempt** based on the Regional MS4 Permit include:

- The Pacific Ocean
- Lakes and Reservoirs
- Existing underground storm drains or concrete-lined channels draining directly to the ocean

Receiving waters or conveyance systems that are **recommended exempt** in the San Luis Rey River WMA based on studies that were prepared as part of the Regional WMAA include:

- San Luis Rey River from Pacific Ocean to upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15
- Existing underground storm drains or concrete-lined channels discharging directly to the recommended exempt reach of the San Luis Rey River. These systems were identified based on MS4 data provided by the Copermittees via the data call. These systems may not represent all discharges to exempt bodies or rivers. Additional systems may be considered exempt if there is no evidence of erosion at the outfall of the conveyance system, and any other criteria determined by the local jurisdiction.

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San Luis Rey
Watershed Management Area Analysis
ATTACHMENTS

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October 3, 2014

Prepared for:
San Diego County Copermittees

Prepared by:

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ATTACHMENT A

WATERSHED MANAGEMENT AREA CHARACTERIZATION

ATTACHMENT A.1

DOMINANT HYDROLOGICAL PROCESS

A.1 Dominant Hydrological Process

Table A.1.1: Runoff Coefficients versus Land Use, Hydrologic Soil Group (A, B, C, D), and Slope Range

	A			B			C			D		
Land Use	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+
Cultivated land	0.08[a]	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14[b]	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential lot	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
size 1/8 acre	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Residential lot	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
size 1/4 acre	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Residential lot	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
size 1/3 acre	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Residential lot	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
size 1/2 acre	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Residential lot	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
size 1 acre	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

[a] Runoff coefficients for storm recurrence intervals less than 25 years.

[b] Runoff coefficients for storm recurrence intervals of 25 years or longer.

Source: Table 7-9 in *Hydrologic Analysis and Design* (McCuen, 2005)

Table A.1.2: Land Cover Grouping

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
1	42000 Valley and Foothill Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
2	42100 Native Grassland		Agricultural/Grass
3	42110 Valley Needlegrass Grassland		Agricultural/Grass
4	42120 Valley Sacaton Grassland		Agricultural/Grass

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
5	42200 Non-Native Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
6	42300 Wildflower Field		Agriculture/Grass
7	42400 Foothill/Mountain Perennial Grassland		Agriculture/Grass
8	42470 Transmontane Dropseed Grassland		Agriculture/Grass
9	45000 Meadow and Seep		Agriculture/Grass
10	45100 Montane Meadow		Agriculture/Grass
11	45110 Wet Montane Meadow		Agriculture/Grass
12	45120 Dry Montane Meadows		Agriculture/Grass
13	45300 Alkali Meadows and Seeps		Agriculture/Grass
14	45320 Alkali Seep		Agriculture/Grass
15	45400 Freshwater Seep		Agriculture/Grass
16	46000 Alkali Playa Community		Agriculture/Grass
17	46100 Badlands/Mudhill Forbs		Agriculture/Grass
18	Non-Native Grassland		Agriculture/Grass
19	18000 General Agriculture	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Agriculture/Grass
20	18100 Orchards and Vineyards		Agriculture/Grass
21	18200 Intensive Agriculture		Agriculture/Grass
22	18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches		Agriculture/Grass
23	18300 Extensive Agriculture - Field/Pasture, Row Crops		Agriculture/Grass
24	18310 Field/Pasture		Agriculture/Grass
25	18310 Pasture		Agriculture/Grass
26	18320 Row Crops		Agriculture/Grass
27	12000 Urban/Developed		Developed
28	12000 Urban/Develpoed		Developed
29	81100 Mixed Evergreen Forest	Forest	Forest
30	81300 Oak Forest		Forest
31	81310 Coast Live Oak Forest		Forest
32	81320 Canyon Live Oak Forest		Forest
33	81340 Black Oak Forest		Forest
34	83140 Torrey Pine Forest		Forest
35	83230 Southern Interior Cypress Forest		Forest
36	84000 Lower Montane Coniferous Forest		Forest
37	84100 Coast Range, Klamath and Peninsular Coniferous Forest		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
38	84140 Coulter Pine Forest	Forest	Forest
39	84150 Bigcone Spruce (Bigcone Douglas Fir)-Canyon Oak Forest		Forest
40	84230 Sierran Mixed Coniferous Forest		Forest
41	84500 Mixed Oak/Coniferous/Bigcone/Coulter		Forest
42	85100 Jeffrey Pine Forest		Forest
43	11100 Eucalyptus Woodland	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Forest
44	60000 RIPARIAN AND BOTTOMLAND HABITAT	Riparian and Bottomland Habitat	Forest
45	61000 Riparian Forests		Forest
46	61300 Southern Riparian Forest		Forest
47	61310 Southern Coast Live Oak Riparian Forest		Forest
48	61320 Southern Arroyo Willow Riparian Forest		Forest
49	61330 Southern Cottonwood-willow Riparian Forest		Forest
50	61510 White Alder Riparian Forest		Forest
51	61810 Sonoran Cottonwood-willow Riparian Forest		Forest
52	61820 Mesquite Bosque		Forest
53	62000 Riparian Woodlands		Forest
54	62200 Desert Dry Wash Woodland		Forest
55	62300 Desert Fan Palm Oasis Woodland		Forest
56	62400 Southern Sycamore-alder Riparian Woodland		Forest
57	70000 WOODLAND	Woodland	Forest
58	71000 Cismontane Woodland		Forest
59	71100 Oak Woodland		Forest
60	71120 Black Oak Woodland		Forest
61	71160 Coast Live Oak Woodland		Forest
62	71161 Open Coast Live Oak Woodland		Forest
63	71162 Dense Coast Live Oak Woodland		Forest
64	71162 Dense Coast Love Oak Woodland		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
65	71180 Engelmann Oak Woodland	Woodland	Forest
66	71181 Open Engelmann Oak Woodland		Forest
67	71182 Dense Engelmann Oak Woodland		Forest
68	72300 Peninsular Pinon and Juniper Woodlands		Forest
69	72310 Peninsular Pinon Woodland		Forest
70	72320 Peninsular Juniper Woodland and Scrub		Forest
71	75100 Elephant Tree Woodland		Forest
72	77000 Mixed Oak Woodland		Forest
73	78000 Undifferentiated Open Woodland		Forest
74	79000 Undifferentiated Dense Woodland		Forest
75	Engelmann Oak Woodland		Forest
76	52120 Southern Coastal Salt Marsh	Bog and Marsh	Other
77	52300 Alkali Marsh		Other
78	52310 Cismontane Alkali Marsh		Other
79	52400 Freshwater Marsh		Other
80	52410 Coastal and Valley Freshwater Marsh		Other
81	52420 Transmontane Freshwater Marsh		Other
82	52440 Emergent Wetland		Other
83	44000 Vernal Pool	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Other
84	44320 San Diego Mesa Vernal Pool		Other
85	44322 San Diego Mesa Claypan Vernal Pool (southern mesas)		Other
86	13100 Open Water	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
87	13110 Marine		Other
88	13111 Subtidal		Other
89	13112 Intertidal		Other
90	13121 Deep Bay		Other
91	13122 Intermediate Bay		Other
92	13123 Shallow Bay		Other
93	13130 Estuarine		Other
94	13131 Subtidal		Other
95	13133 Brackishwater		Other

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
96	13140 Freshwater	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
97	13200 Non-Vegetated Channel, Floodway, Lakeshore Fringe		Other
98	13300 Saltpan/Mudflats		Other
99	13400 Beach		Other
100	21230 Southern Foredunes	Dune Community	Scrub/Shrub
101	22100 Active Desert Dunes		Scrub/Shrub
102	22300 Stabilized and Partially-Stabilized Desert Sand Field		Scrub/Shrub
103	24000 Stabilized Alkaline Dunes		Scrub/Shrub
104	29000 ACACIA SCRUB		Scrub/Shrub
105	63000 Riparian Scrubs	Riparian and Bottomland Habitat	Scrub/Shrub
106	63300 Southern Riparian Scrub		Scrub/Shrub
107	63310 Mule Fat Scrub		Scrub/Shrub
108	63310 Mulefat Scrub		Scrub/Shrub
109	63320 Southern Willow Scrub		Scrub/Shrub
110	63321 Arundo donnax Dominant/Southern Willow Scrub		Scrub/Shrub
111	63330 Southern Riparian Scrub		Scrub/Shrub
112	63400 Great Valley Scrub		Scrub/Shrub
113	63410 Great Valley Willow Scrub		Scrub/Shrub
114	63800 Colorado Riparian Scrub		Scrub/Shrub
115	63810 Tamarisk Scrub		Scrub/Shrub
116	63820 Arrowweed Scrub		Scrub/Shrub
117	31200 Southern Coastal Bluff Scrub	Scrub and Chaparral	Scrub/Shrub
118	32000 Coastal Scrub		Scrub/Shrub
119	32400 Maritime Succulent Scrub		Scrub/Shrub
120	32500 Diegan Coastal Sage Scrub		Scrub/Shrub
121	32510 Coastal form		Scrub/Shrub
122	32520 Inland form (> 1,000 ft. elevation)		Scrub/Shrub
123	32700 Riversidian Sage Scrub		Scrub/Shrub
124	32710 Riversidian Upland Sage Scrub		Scrub/Shrub
125	32720 Alluvial Fan Scrub		Scrub/Shrub
126	33000 Sonoran Desert Scrub		Scrub/Shrub
127	33100 Sonoran Creosote Bush Scrub		Scrub/Shrub
128	33200 Sonoran Desert Mixed Scrub		Scrub/Shrub
129	33210 Sonoran Mixed Woody Scrub		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
130	33220 Sonoran Mixed Woody and Succulent Scrub	Scrub and Chaparral	Scrub/Shrub
131	33230 Sonoran Wash Scrub		Scrub/Shrub
132	33300 Colorado Desert Wash Scrub		Scrub/Shrub
133	33600 Encelia Scrub		Scrub/Shrub
134	34000 Mojavean Desert Scrub		Scrub/Shrub
135	34300 Blackbush Scrub		Scrub/Shrub
136	35000 Great Basin Scrub		Scrub/Shrub
137	35200 Sagebrush Scrub		Scrub/Shrub
138	35210 Big Sagebrush Scrub		Scrub/Shrub
139	35210 Sagebrush Scrub		Scrub/Shrub
140	36110 Desert Saltbush Scrub		Scrub/Shrub
141	36120 Desert Sink Scrub		Scrub/Shrub
142	37000 Chaparral		Scrub/Shrub
143	37120 Southern Mixed Chaparral		Scrub/Shrub
144	37120 Southern Mixed Chapparal		Scrub/Shrub
145	37121 Granitic Southern Mixed Chaparral		Scrub/Shrub
146	37121 Southern Mixed Chaparral		Scrub/Shrub
147	37122 Mafic Southern Mixed Chaparral		Scrub/Shrub
148	37130 Northern Mixed Chaparral		Scrub/Shrub
149	37131 Granitic Northern Mixed Chaparral		Scrub/Shrub
150	37132 Mafic Northern Mixed Chaparral		Scrub/Shrub
151	37200 Chamise Chaparral		Scrub/Shrub
152	37210 Granitic Chamise Chaparral		Scrub/Shrub
153	37220 Mafic Chamise Chaparral		Scrub/Shrub
154	37300 Red Shank Chaparral		Scrub/Shrub
155	37400 Semi-Desert Chaparral		Scrub/Shrub
156	37500 Montane Chaparral		Scrub/Shrub
157	37510 Mixed Montane Chaparral		Scrub/Shrub
158	37520 Montane Manzanita Chaparral		Scrub/Shrub
159	37530 Montane Ceanothus Chaparral		Scrub/Shrub
160	37540 Montane Scrub Oak Chaparral		Scrub/Shrub
161	37800 Upper Sonoran Ceanothus Chaparral		Scrub/Shrub
162	37830 Ceanothus crassifolius Chaparral		Scrub/Shrub
163	37900 Scrub Oak Chaparral		Scrub/Shrub
164	37A00 Interior Live Oak Chaparral		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
165	37C30 Southern Maritime Chaparral	Scrub and Chaparral	Scrub/Shrub
166	37G00 Coastal Sage-Chaparral Scrub		Scrub/Shrub
167	37K00 Flat-topped Buckwheat		Scrub/Shrub
168	39000 Upper Sonoran Subshrub Scrub		Scrub/Shrub
169	Diegan Coastal Sage Scrub		Scrub/Shrub
170	Granitic Northern Mixed Chaparral		Scrub/Shrub
171	Southern Mixed Chaparral		Scrub/Shrub
172	11000 Non-Native Vegetation	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Unknown
173	11000 Non-Native VegetionVegetation		Unknown
174	11200 Disturbed Wetland		Unknown
175	11300 Disturbed Habitat		Unknown
176	13000 Unvegetated Habitat		Unknown
177	Disturbed Habitat		Unknown

Table A.1.3: Related Land Cover and Land Use Categories

Land Cover per San Diego County	Land Use per Table A.1.1
Agriculture/Grass	Meadow
Forest	Forest
Scrub/Shrub	Average (Meadow, Forest)
Unknown/Other	Meadow

Table A.1.4: Applicable Hydrologic Response Unit Calculations

Land Cover	Soil	Gradient	Runoff Coeff.	ET Coeff.	Infiltration Coeff.	Runoff/ Infiltration Ratio	Hydrologic Process Designation
Agriculture/Grass	A	0-2%	0.10	0.60	0.30	0.33	I
Agriculture/Grass	A	2-6%	0.16	0.60	0.24	0.67	U
Agriculture/Grass	A	6-10%	0.25	0.60	0.15	1.67	O
Agriculture/Grass	B	0-2%	0.14	0.60	0.26	0.54	I
Agriculture/Grass	B	2-6%	0.22	0.60	0.18	1.22	U
Agriculture/Grass	B	6-10%	0.30	0.60	0.10	3.00	O
Agriculture/Grass	C	0-2%	0.20	0.60	0.20	1.00	U
Agriculture/Grass	C	2-6%	0.28	0.60	0.12	2.33	O
Agriculture/Grass	C	6-10%	0.36	0.60	0.04	9.00	O
Agriculture/Grass	D	0-2%	0.24	0.60	0.16	1.50	U
Agriculture/Grass	D	2-6%	0.30	0.60	0.10	3.00	O
Agriculture/Grass	D	6-10%	0.40	0.60	0.00	infinite	O

Land Cover	Soil	Gradient	Runoff Coeff.	ET Coeff.	Infiltration Coeff.	Runoff/ Infiltration Ratio	Hydrologic Process Designation
Forest	A	0-2%	0.05	0.80	0.15	0.33	I
Forest	A	2-6%	0.08	0.80	0.12	0.67	U
Forest	A	6-10%	0.11	0.80	0.09	1.22	U
Forest	B	0-2%	0.08	0.80	0.12	0.67	U
Forest	B	2-6%	0.11	0.80	0.09	1.22	U
Forest	B	6-10%	0.14	0.80	0.06	2.33	O
Forest	C	0-2%	0.10	0.80	0.10	1.00	U
Forest	C	2-6%	0.13	0.80	0.07	1.86	O
Forest	C	6-10%	0.16	0.80	0.04	4.00	O
Forest	D	0-2%	0.12	0.80	0.08	1.50	U
Forest	D	2-6%	0.16	0.80	0.04	4.00	O
Forest	D	6-10%	0.20	0.80	0.00	infinite	O
Scrub/Shrub	A	0-2%	0.08	0.70	0.23	0.33	I
Scrub/Shrub	A	2-6%	0.12	0.70	0.18	0.67	U
Scrub/Shrub	A	6-10%	0.18	0.70	0.12	1.50	U
Scrub/Shrub	B	0-2%	0.11	0.70	0.19	0.58	I
Scrub/Shrub	B	2-6%	0.17	0.70	0.14	1.22	U
Scrub/Shrub	B	6-10%	0.22	0.70	0.08	2.75	O
Scrub/Shrub	C	0-2%	0.15	0.70	0.15	1.00	U
Scrub/Shrub	C	2-6%	0.21	0.70	0.10	2.16	O
Scrub/Shrub	C	6-10%	0.26	0.70	0.04	6.50	O
Scrub/Shrub	D	0-2%	0.19	0.70	0.12	1.50	U
Scrub/Shrub	D	2-6%	0.23	0.70	0.07	3.29	O
Scrub/Shrub	D	6-10%	0.30	0.70	0.00	infinite	O

Hydrologic Process Designation: I = Interflow; O = Overland Flow; U = Uncertain

Table A.1.5: Hydrologic Response Unit Designations

Land Cover	Slope	Soil Type				
		A	B	C	D	Other (fill/water)
Agriculture/ Grass/Unknown/ Other	0-2%	I	I	U	U	U
	2-6%	U	U	O	O	U
	6-10%	O	O	O	O	O
	>10%	O	O	O	O	O
Developed	0-2%	O	O	O	O	O
	2-6%	O	O	O	O	O
	6-10%	O	O	O	O	O
	>10%	O	O	O	O	O
Forest	0-2%	I	U	U	U	U
	2-6%	U	U	O	O	U
	6-10%	U	O	O	O	U
	>10%	O	O	O	O	O
Scrub/Shrub	0-2%	I	I	U	U	U
	2-6%	U	U	O	O	U
	6-10%	U	O	O	O	U
	>10%	O	O	O	O	O

Hydrologic Process Designation: I = Interflow; O = Overland Flow; U = Uncertain

Exhibit Showing Dominant Hydrologic Processes

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

ATTACHMENT A.2

STREAM CHARACTERIZATION

Miles 0 25 50 100 150

Watershed Management Area Streams

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

Watershed Management Area Streams by Hydrographic Category

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

Watershed Management Area Streams by Bed Material

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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Watershed Management Area Streams by Geologic Group

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

Watershed Management Area Streams by Reach Type

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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ATTACHMENT A.3

LAND USES

Existing Land Use

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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Planned Land Use

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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Miles 0 25 50 100 150

Developable Land

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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Redevelopment and Infill Areas

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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ATTACHMENT A.4

POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS

A.4.1 Geology Grouping

Geologic grouping was based on the mapped geologic unit as determined by published geologic mapping information. The following describes the methodology utilized to determine bedrock or sedimentary characteristics, anticipated grain size, and suitability for infiltration. A complete list of the various geologic maps used in this evaluation is listed in Chapter 6.

Due to the various mapped scales of the published data and differing mapped unit names, the geologic units were initially compiled into similar categories where possible. For example, the Lindavista Formation is mapped as unit Ql on geologic maps at a scale of 1:24,000 but correlates to the same unit Qvop8 on geologic maps at a scale of 1:100,000. Following the compilation of geologic unit names, the units were differentiated between crystalline bedrock and sedimentary formations based on geologic characterization and material behavior. The Point Loma Formation for example, is a Cretaceous-age sandstone, but it was classified as a “coarse bedrock” unit due to its indurated and resistant nature.

For each site location, the predominant geologic units were then described as “coarse” or “fine” based on typical weathering characteristics of the bedrock units, or primary grain size of the sedimentary units. For example, granodiorite or tonalite crystalline rock typically weathers to a coarse material such as a silty sand and therefore was classified as “coarse,” compared to a gabbro which generally weathers to a sandy clay and was characterized as “fine.” Sedimentary formations can be more variable, such as the Mission Valley Formation. In this case, the Mission Valley Formation was characterized as “coarse” since the unit is predominantly comprised of sandstone even if it does contain localities of siltstone and claystone within the unit.

To further characterize the sedimentary formations, these units were evaluated for suitability of infiltration. Since no field investigations were performed for this evaluation to determine permeability, the differentiation between impermeable and permeable were based on the age of the geologic unit with the assumption that relatively younger sedimentary units of Pleistocene-age or younger (<1.6 mya) would be more susceptible to surface water infiltration. Geology grouping of different map units is presented in Table A.4.1

Table A.4.1 Geologic grouping for different map units

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
gr-m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
grMz	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Jcr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jhc	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jsp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ka	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kdl	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgbf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgdf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgh	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm1	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm2	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm3	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm4	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgu	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Khg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ki	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kis	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJem	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJld	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Klb	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klh	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Km	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmgp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpa	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kqbd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kt	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ktr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kvc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwsr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Mzd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzq	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzs	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
sch	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Kp	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ql	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
QTf	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ec	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
K	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
Kccg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kcs	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kl	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ku	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvof	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tp	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tpm	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tscu	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsd	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdcg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsm	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tso	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tst	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tt	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tta	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmv	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsi	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa11	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa12	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa13	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoc	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop1	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvop11a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop12	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop13	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop2	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop3	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop4	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop5	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop6	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsa	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qof	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Q	Jennings; CA	Coarse	Sedimentary	Permeable	CSP
Qa	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qd	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qmb	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qw	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qt	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa1-2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa2-6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa5	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa7	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qoc	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qc	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qu	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop2-4	San Diego 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop3	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop4	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop6	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qya	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyc	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Mzu	San Diego & Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
gb	Jennings; CA	Fine	Bedrock	Impermeable	FB
JTRm	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kat	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kc	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgb	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
KJvs	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kmv	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Ksp	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kvsp	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kwmt	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Qv	Jennings; CA	Fine	Bedrock	Impermeable	FB
Tba	San Diego 30' x 60'	Fine	Bedrock	Impermeable	FB
Tda	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tv	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tvsr	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgdfg	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Ta	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tcs	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Td	San Diego & Oceanside	Fine	Sedimentary	Impermeable	FSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
	30' x 60'				
Td+Tf	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qls	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tm	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tf	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tfr	El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
To	San Diego & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qpe	San Diego & Oceanside 30' x 60'	Fine	Sedimentary	Permeable	FSP
Mexico	San Diego 30' x 60'	NA	NA	Permeable	Other
Kuo	San Diego 30' x 60'	NA (Offshore)	NA	Permeable	Other
Teo	San Diego & Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Tmo	Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Qmo	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
QTso	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
af	San Diego & Oceanside 30' x 60'	Variable, dependent on source material	Sedimentary		Other

A.4.2 Quantitative Analysis

Soil loss estimates for each Geomorphic Landscape Unit were estimated using the Revised Universal Soil Loss Equation (RUSLE; Renard et al. 1997) listed below:

$$A = R \times K \times LS \times C \times P$$

Where

A = estimated average soil loss in tons/acre/year

R = rainfall-runoff erosivity factor

K = soil erodibility factor

LS = slope length and steepness factor

C = cover-management factor

P = support practice factor; assumed 1 for this analysis

Regional datasets used to estimate the inputs required to estimate the soil loss from each GLU are listed in table below:

Dataset	Source	Download year	Description
RUSLE – R Factor	SWRCB	2014	Regional R factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_R_Factor/
RUSLE – K Factor	SWRCB	2014	Regional K factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_K_Factor/
RUSLE – LS Factor	SWRCB	2014	Regional LS factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_LS_Factor/
RUSLE – C Factor	USEPA	2014	Regional C factor map was downloaded from http://www.epa.gov/esd/land-sci/emap_west_browser/pages/wemap_mm_sl_rusle_c_qt.htm#mapnav

GIS analysis was used to calculate the area weighted estimate of R, K, LS and C factors using the regional datasets listed in the table above. For the developed land cover the C factor was then adjusted to 0 from the regional estimate to account for management actions implemented on developed sites (e.g. impervious surfaces). Soil loss estimates ranged from 0 to 15.2 tons/acre/year.

For evaluating the degree of relative risk to a stream solely arising from changes in sediment and/or water delivery SCCWRP Technical Report 605, 2010 states:

> *"The challenge in implementing this step is that presently we have insufficient basis to defensibly identify either low-risk or high-risk conditions using these metrics. For example, channels that are close to a threshold for geomorphic change may display significant morphological changes under nothing more than natural year-to-year variability in flow or sediment load.*

- *Acknowledging this caveat, we nonetheless anticipate that changes of less than 10% in either driver are unlikely to instigate, on their own, significant channel changes. This value is a conservative estimate of the year-to-year variability in either discharge or sediment flux that can be accommodated by a channel system in a state of dynamic equilibrium. It does not "guarantee," however, that channel change may not occur—either in response to yet modest alterations in water or sediment delivery, or because of other urbanization impacts (e.g., point discharge of runoff or the trapping of the upstream sediment flux; see Booth 1990) that are not represented with this analysis.*
- *In contrast, recognizing a condition of undisputed "high risk" must await broader collection of regionally relevant data. We note that >60% reductions in predicted sediment production have resulted in both minimal (McGonigle) and dramatic (Agua Hedionda) channel changes, indicating that "more data" may never provide absolute guidance. At present, we suggest using predicted watershed changes of 50% or more in either runoff (as indexed by change in impervious area) or sediment production as provisional criteria for requiring a more detailed evaluation of both the drivers and the resisting factors for channel change, regardless of other screening-level assessments. Clearly, however, only more experience with the application of such "thresholds," and the actual channel conditions that accompany them, will provide a defensible basis for setting numeric standards."*

The following criterion was developed using the suggestions listed above and then used to assign relative sediment production rating to each GLU:

- Low: Soil Loss < 5.6 tons/acre/year [GLUs that have a soil loss of 0 to 5.6 tons/acre/year produces around 10% of the total coarse sediment soil loss from the study area]
- Medium: 5.6 tons/acre/year < Soil Loss < 8.4 tons/acre/year
- High: > 8.4 tons/acre/year [GLUs that have a soil loss greater than 8.4 tons/acre/year produces around 42% of the total coarse sediment soil loss from the study area]

Results from the quantitative analysis are summarized in Table A.4.2.

Table A.4.2 Relative Sediment Production for different Geomorphic Landscape Units

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CB-Agricultural/Grass-1	52883	0.20	4.67	0.14	50	6.5	Medium	No
CB-Agricultural/Grass-2	40633	0.21	5.19	0.14	56	8.3	Medium	No
CB-Agricultural/Grass-3	32617	0.22	6.04	0.14	57	10.6	High	Yes
CB-Agricultural/Grass-4	11066	0.23	7.38	0.14	57	13.5	High	Yes
CB-Developed-1	39746	0.22	3.77	0	49	0	Low	No
CB-Developed-2	32614	0.22	4.28	0	50	0	Low	No
CB-Developed-3	15841	0.22	4.86	0	49	0	Low	No
CB-Developed-4	1805	0.22	5.63	0	48	0	Low	No
CB-Forest-1	32231	0.20	6.38	0.14	39	6.8	Medium	No
CB-Forest-2	38507	0.20	7.20	0.13	45	8.8	High	Yes
CB-Forest-3	55303	0.20	8.14	0.13	48	10.6	High	Yes
CB-Forest-4	38217	0.20	9.95	0.14	50	13.6	High	Yes
CB-Other-1	1036	0.20	5.52	0.13	45	6.5	Medium	No
CB-Other-2	317	0.20	6.46	0.13	45	7.9	Medium	No
CB-Other-3	296	0.20	6.96	0.14	43	8.3	Medium	No
CB-Other-4	111	0.21	6.84	0.14	41	8.2	Medium	No
CB-Scrub/Shrub-1	88135	0.20	5.66	0.14	33	5.3	Low	No
CB-Scrub/Shrub-2	143694	0.20	6.51	0.14	37	6.8	Medium	No
CB-Scrub/Shrub-3	246703	0.21	7.33	0.14	41	8.4	Medium	No
CB-Scrub/Shrub-4	191150	0.21	8.28	0.14	42	9.8	High	No
CB-Unknown-1	1727	0.21	5.32	0.13	44	6.3	Medium	No
CB-Unknown-2	1935	0.21	5.95	0.13	44	7.1	Medium	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CB-Unknown-3	1539	0.22	6.21	0.13	44	7.7	Medium	No
CB-Unknown-4	278	0.22	6.61	0.13	44	8.4	High	Yes
CSI-Agricultural/Grass-1	14609	0.34	2.72	0.14	39	4.8	Low	No
CSI-Agricultural/Grass-2	9059	0.37	3.61	0.14	47	8.7	High	Yes
CSI-Agricultural/Grass-3	10096	0.38	3.99	0.14	47	9.8	High	Yes
CSI-Agricultural/Grass-4	2498	0.37	4.33	0.14	47	10.5	High	Yes
CSI-Developed-1	82371	0.28	2.51	0	39	0	Low	No
CSI-Developed-2	22570	0.30	2.66	0	41	0	Low	No
CSI-Developed-3	13675	0.30	2.89	0	40	0	Low	No
CSI-Developed-4	3064	0.27	3.20	0	39	0	Low	No
CSI-Forest-1	449	0.27	4.26	0.13	43	6.6	Medium	No
CSI-Forest-2	611	0.25	5.11	0.13	44	7.5	Medium	No
CSI-Forest-3	716	0.29	4.43	0.13	44	7.4	Medium	No
CSI-Forest-4	348	0.30	4.49	0.13	43	7.6	Medium	No
CSI-Other-1	319	0.31	2.50	0.13	32	3.2	Low	No
CSI-Other-2	83	0.27	3.01	0.13	39	4.3	Low	No
CSI-Other-3	45	0.28	3.03	0.13	39	4.5	Low	No
CSI-Other-4	13	0.24	4.01	0.14	39	5.2	Low	No
CSI-Scrub/Shrub-1	9051	0.26	3.53	0.13	39	4.7	Low	No
CSI-Scrub/Shrub-2	10802	0.27	4.36	0.13	41	6.3	Medium	No
CSI-Scrub/Shrub-3	28220	0.26	4.82	0.13	41	6.7	Medium	No
CSI-Scrub/Shrub-4	20510	0.26	5.52	0.13	41	7.8	Medium	No
CSI-Unknown-1	5292	0.28	2.38	0.13	36	3.1	Low	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CSI-Unknown-2	2074	0.29	2.98	0.13	40	4.5	Low	No
CSI-Unknown-3	2171	0.27	3.04	0.13	39	4.2	Low	No
CSI-Unknown-4	676	0.26	3.04	0.13	38	3.8	Low	No
CSP-Agricultural/Grass-1	59327	0.22	3.01	0.14	44	4.0	Low	No
CSP-Agricultural/Grass-2	8426	0.23	3.81	0.14	42	5.2	Low	No
CSP-Agricultural/Grass-3	2377	0.24	4.05	0.14	41	5.6	Low	No
CSP-Agricultural/Grass-4	291	0.22	6.28	0.14	52	10.1	High	Yes
CSP-Developed-1	85283	0.27	2.10	0	42	0	Low	No
CSP-Developed-2	7513	0.26	2.77	0	42	0	Low	No
CSP-Developed-3	2317	0.27	2.70	0	40	0	Low	No
CSP-Developed-4	272	0.27	2.76	0	38	0	Low	No
CSP-Forest-1	14738	0.22	4.52	0.14	44	6.0	Medium	No
CSP-Forest-2	3737	0.22	5.99	0.14	45	8.2	Medium	No
CSP-Forest-3	1858	0.21	6.42	0.14	45	8.5	High	Yes
CSP-Forest-4	484	0.21	7.62	0.14	48	10.2	High	Yes
CSP-Other-1	7404	0.23	2.61	0.14	39	3.2	Low	No
CSP-Other-2	343	0.24	3.68	0.13	40	4.8	Low	No
CSP-Other-3	126	0.24	3.76	0.13	40	4.9	Low	No
CSP-Other-4	17	0.24	4.19	0.13	39	5.3	Low	No
CSP-Scrub/Shrub-1	22583	0.23	3.75	0.14	41	4.8	Low	No
CSP-Scrub/Shrub-2	8938	0.24	5.63	0.14	40	7.1	Medium	No
CSP-Scrub/Shrub-3	7186	0.23	6.15	0.13	39	7.5	Medium	No
CSP-Scrub/Shrub-4	2609	0.22	7.16	0.14	43	9.3	High	Yes

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CSP-Unknown-1	6186	0.25	2.63	0.13	40	3.4	Low	No
CSP-Unknown-2	744	0.27	3.49	0.13	39	4.8	Low	No
CSP-Unknown-3	350	0.28	3.32	0.13	38	4.5	Low	No
CSP-Unknown-4	78	0.28	3.26	0.13	40	4.5	Low	No
FB-Agricultural/Grass-1	6103	0.25	5.49	0.14	49	9.2	High	No
FB-Agricultural/Grass-2	7205	0.25	5.87	0.14	51	10.1	High	No
FB-Agricultural/Grass-3	6730	0.24	6.43	0.14	53	11.3	High	No
FB-Agricultural/Grass-4	2586	0.22	8.62	0.14	57	15.2	High	No
FB-Developed-1	10116	0.28	3.94	0	46	0	Low	No
FB-Developed-2	9075	0.28	4.41	0	45	0	Low	No
FB-Developed-3	5499	0.27	4.72	0	44	0	Low	No
FB-Developed-4	785	0.27	5.08	0	43	0	Low	No
FB-Forest-1	3780	0.21	7.24	0.13	39	8.0	Medium	No
FB-Forest-2	7059	0.21	7.53	0.13	43	8.8	High	No
FB-Forest-3	13753	0.22	8.02	0.13	43	9.7	High	No
FB-Forest-4	8899	0.26	9.63	0.13	35	11.5	High	No
FB-Other-1	172	0.26	5.72	0.13	44	8.6	High	No
FB-Other-2	75	0.26	5.97	0.13	38	7.7	Medium	No
FB-Other-3	76	0.28	6.27	0.13	34	7.6	Medium	No
FB-Other-4	36	0.31	6.70	0.13	33	8.6	High	No
FB-Scrub/Shrub-1	10297	0.24	6.94	0.14	36	8.3	Medium	No
FB-Scrub/Shrub-2	25150	0.25	7.24	0.14	38	9.0	High	No
FB-Scrub/Shrub-3	70895	0.25	7.89	0.13	38	10.0	High	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FB-Scrub/Shrub-4	70679	0.26	9.05	0.14	39	12.1	High	No
FB-Unknown-1	654	0.30	5.33	0.13	37	7.6	Medium	No
FB-Unknown-2	829	0.29	5.26	0.13	40	7.9	Medium	No
FB-Unknown-3	1062	0.29	5.54	0.13	39	8.2	Medium	No
FB-Unknown-4	299	0.28	6.02	0.13	38	8.4	High	No
FSI-Agricultural/Grass-1	8462	0.32	3.91	0.13	24	3.9	Low	No
FSI-Agricultural/Grass-2	4979	0.33	4.29	0.13	31	5.7	Medium	No
FSI-Agricultural/Grass-3	4808	0.34	4.26	0.13	34	6.3	Medium	No
FSI-Agricultural/Grass-4	1055	0.35	4.11	0.13	36	6.7	Medium	No
FSI-Developed-1	9953	0.29	3.09	0	34	0	Low	No
FSI-Developed-2	4972	0.31	3.22	0	37	0	Low	No
FSI-Developed-3	3350	0.29	3.30	0	36	0	Low	No
FSI-Developed-4	763	0.28	3.31	0	37	0	Low	No
FSI-Forest-1	186	0.33	4.62	0.13	37	7.2	Medium	No
FSI-Forest-2	217	0.35	4.47	0.13	39	7.9	Medium	No
FSI-Forest-3	262	0.37	4.71	0.13	40	9.2	High	No
FSI-Forest-4	111	0.36	4.73	0.13	40	9.2	High	No
FSI-Other-1	266	0.31	3.11	0.13	24	2.9	Low	No
FSI-Other-2	81	0.30	3.29	0.13	25	3.1	Low	No
FSI-Other-3	56	0.31	3.04	0.13	27	3.2	Low	No
FSI-Other-4	15	0.29	3.57	0.13	33	4.4	Low	No
FSI-Scrub/Shrub-1	2241	0.27	4.46	0.13	29	4.5	Low	No
FSI-Scrub/Shrub-2	3911	0.28	4.96	0.13	31	5.7	Medium	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FSI-Scrub/Shrub-3	7590	0.29	5.05	0.13	34	6.3	Medium	No
FSI-Scrub/Shrub-4	3502	0.30	5.14	0.13	37	7.5	Medium	No
FSI-Unknown-1	1117	0.29	2.83	0.13	27	3.0	Low	No
FSI-Unknown-2	780	0.30	3.44	0.13	32	4.3	Low	No
FSI-Unknown-3	855	0.29	3.41	0.13	31	4.0	Low	No
FSI-Unknown-4	285	0.28	3.21	0.13	32	3.7	Low	No
FSP-Agricultural/Grass-1	13	0.22	2.22	0.13	40	2.5	Low	No
FSP-Agricultural/Grass-2	3	0.22	2.59	0.13	40	3.0	Low	No
FSP-Agricultural/Grass-3	2	0.22	2.69	0.13	40	3.2	Low	No
FSP-Agricultural/Grass-4	0	0.20	2.94	0.12	40	2.9	Low	No
FSP-Developed-1	180	0.26	2.85	0	40	0	Low	No
FSP-Developed-2	13	0.25	2.69	0	40	0	Low	No
FSP-Developed-3	8	0.21	2.25	0	40	0	Low	No
FSP-Developed-4	0	0.21	2.29	0	40	0	Low	No
FSP-Forest-1	8	0.22	2.29	0.14	40	2.9	Low	No
FSP-Forest-2	5	0.20	2.22	0.14	40	2.5	Low	No
FSP-Forest-3	0	0.20	2.22	0.14	40	2.5	Low	No
FSP-Other-1	1307	0.20	2.38	0.14	40	2.7	Low	No
FSP-Other-2	34	0.21	2.36	0.14	40	2.7	Low	No
FSP-Other-3	8	0.22	2.56	0.13	40	3.0	Low	No
FSP-Other-4	0	0.43	4.35	0.12	40	9.3	High	No
FSP-Scrub/Shrub-1	147	0.23	2.68	0.14	40	3.3	Low	No
FSP-Scrub/Shrub-2	18	0.23	2.55	0.14	40	3.3	Low	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FSP-Scrub/Shrub-3	4	0.20	2.23	0.14	40	2.6	Low	No
FSP-Scrub/Shrub-4	0	0.20	1.70	0.12	40	1.7	Low	No
FSP-Unknown-1	40	0.20	1.87	0.13	40	1.9	Low	No
FSP-Unknown-2	5	0.20	1.99	0.12	40	2.0	Low	No
FSP-Unknown-3	1	0.20	2.39	0.12	40	2.4	Low	No
O-Agricultural/Grass-1	2433	0.20	2.93	0.14	34	2.8	Low	No
O-Agricultural/Grass-2	112	0.21	3.44	0.14	32	3.2	Low	No
O-Agricultural/Grass-3	30	0.23	3.89	0.13	32	3.8	Low	No
O-Agricultural/Grass-4	1	0.26	6.47	0.13	37	7.9	Medium	No
O-Developed-1	8327	0.27	1.37	0	39	0	Low	No
O-Developed-2	474	0.25	2.12	0	40	0	Low	No
O-Developed-3	157	0.26	3.07	0	41	0	Low	No
O-Developed-4	26	0.24	3.89	0	41	0	Low	No
O-Forest-1	235	0.22	6.15	0.13	43	7.6	Medium	No
O-Forest-2	67	0.21	5.07	0.13	45	6.6	Medium	No
O-Forest-3	45	0.21	5.43	0.13	47	7.3	Medium	No
O-Forest-4	20	0.20	5.95	0.13	59	9.0	High	No
O-Other-1	9362	0.25	3.86	0.13	36	4.3	Low	No
O-Other-2	344	0.24	3.32	0.13	35	3.5	Low	No
O-Other-3	120	0.23	4.86	0.13	35	5.0	Low	No
O-Other-4	37	0.22	5.64	0.13	39	6.6	Medium	No
O-Scrub/Shrub-1	688	0.22	4.83	0.13	40	5.7	Medium	No
O-Scrub/Shrub-2	224	0.22	5.80	0.13	36	6.3	Medium	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
O-Scrub/Shrub-3	209	0.22	6.47	0.13	41	7.5	Medium	No
O-Scrub/Shrub-4	96	0.22	6.62	0.13	44	8.2	Medium	No
O-Unknown-1	1236	0.28	1.60	0.12	26	1.5	Low	No
O-Unknown-2	62	0.27	1.48	0.13	36	1.8	Low	No
O-Unknown-3	15	0.29	3.52	0.13	38	4.9	Low	No
O-Unknown-4	7	0.34	3.87	0.12	40	6.6	Medium	No

GLU Nomenclature: Geology – Land Cover – Slope Category

Geology Categories:

CB Coarse Bedrock

CSI Coarse Sedimentary Impermeable

CSP Coarse Sedimentary Permeable

FB Fine Bedrock

FSI Fine Sedimentary Impermeable

FSP Fine Sedimentary Permeable

O Other

Slope Categories:

1 0%-10%

2 10% - 20%

3 20% - 40%

4 > 40%

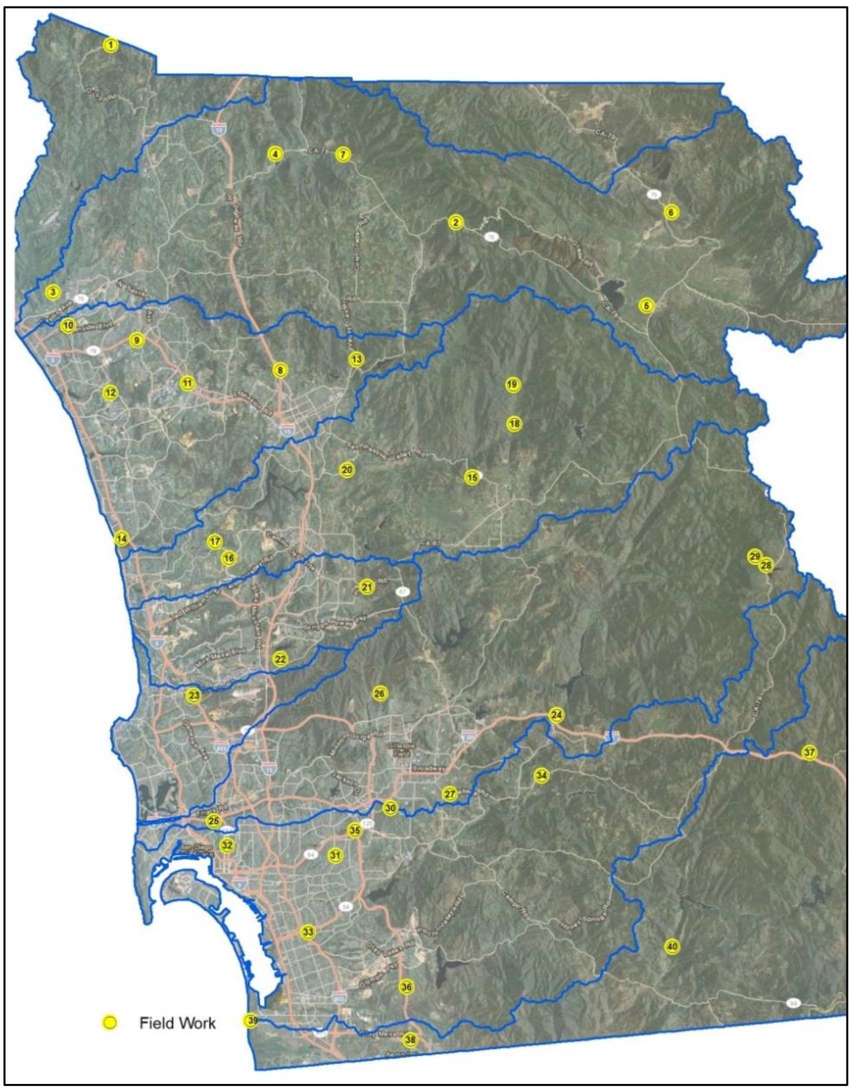
A4.3 Field Assessment

Site Selection:

Forty locations were selected from the study region for field assessment. Sites were selected such that they are accessible by existing road network based on review of satellite imagery and are uniformly distributed considering the following criteria:

- Geologic grouping
- Land cover
- Slope category
- WMA
- Jurisdiction

Yellow circles in the figure below shows the 40 locations for which field assessment was performed.



Pre-Field Activities

Prior to conducting field activities, the consultant team reviewed available published geologic information at each site location and prepared satellite imagery of each site using Google Earth™. Pre-field activities consisted of evaluating site access at each location using aerial imagery and logistics were coordinated based on regional site location to maximize field efficiency.

Site Reconnaissance

Site reconnaissance was performed at forty locations between 22 January and 7 February 2014 by a team of geologists. The reconnaissance consisted of:

- Visual soil classification,
- Assessing existing vegetative cover (0-100%),
- Qualitative assignment of existing sediment production (low, medium, and high) [based on existing vegetative cover],
- Qualitative assignment of potential sediment production (low, medium, and high)[assuming there is 0% vegetative cover], and
- Identifying existing erosional features.

Descriptions and visual classifications of the surficial materials were based on the Unified Soil Classification System (USCS). Underlying geologic units were confirmed where exposed formations were observed within the individual site limits.

SITE AND GEOLOGIC CONDTIONS

Our knowledge of the site conditions has been developed from a review of available geologic literature, previous geologic and geotechnical investigations by the consultant team in the study region, professional experience, site reconnaissance, and field investigations performed for this study.

Surface Conditions

Site locations were sited in open space with the exception of sites ID-27, -30, and -31 which were situated within developed areas with paved streets and sidewalks. The surface conditions at the site locations were characterized by sloping terrain varying from relatively flat (< 5%) to very steep slopes (> 40%). At the time of our reconnaissance the natural hillsides along the areas of interest were covered by varying degrees of moderate to dense growth scrub brush, low grasses, and scattered trees.

Existing erosional and geomorphic features at each site location were identified where possible. The observed erosional features included notable drainages, rilling, scour, and sediment accumulation. Observed geomorphic features included areas of minor slope instability and surficial slumping. Several sources of ground disturbance were identified during the site reconnaissance included active grading operations and bioturbation.

An evaluation of the existing and potential sediment production for each site was determined based on surface conditions. Sediment production was assigned as “high, medium, or low” based on the existing conditions and consultant team’s professional experience.

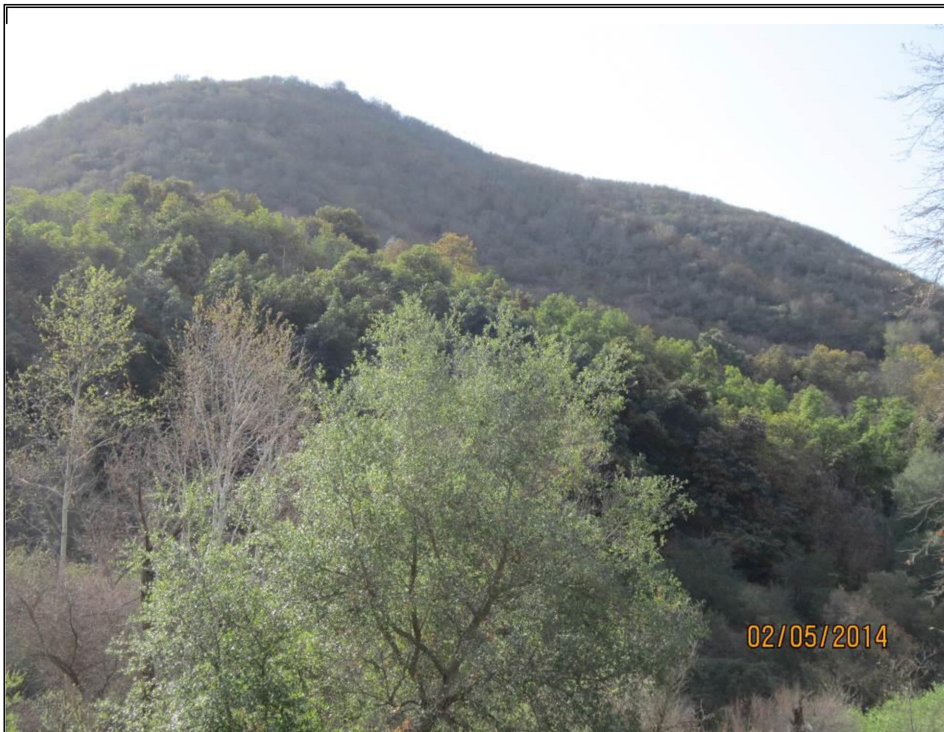
Surficial Deposits

Surficial deposits, including topsoil, alluvium, colluvium, slopewash, and residual soils are present in portions of the study area within the natural drainages and mantling the slope areas. The composition and grain size of these materials are variable depending on the age, parent sources, and mode of deposition.

Geologic Conditions

Our knowledge of the subsurface conditions at the site locations is based on a review of available published geologic information, professional experience, site reconnaissance, previous explorations and geotechnical investigations performed by the consultant team in the study region.

Field Assessment Photo Log



Field Visit ID-1

GLU: CB-Scrub/Shrub-4

View: Looking southwest

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 90%

Field Visit ID-2

GLU: CB-Forest-4

View: Looking north

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 95%

Field Visit ID-3

GLU: CSI-Agricultural/ Grass-3

View: Looking southwest

Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover:

95-100%

Field Visit ID-4

GLU: CSI-Scrub/Shrub-2

View: Looking north

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 70%

Field Visit ID-5

GLU: CSP-Agricultural/ Grass-1

View: Looking southwest

Existing sediment production: Low to Med

Potential sediment production: Med

Existing veg. cover: 90%

Field Visit ID-6

GLU: CSP-Agricultural/ Grass-3

View: Looking east

Existing sediment production: Low to Med

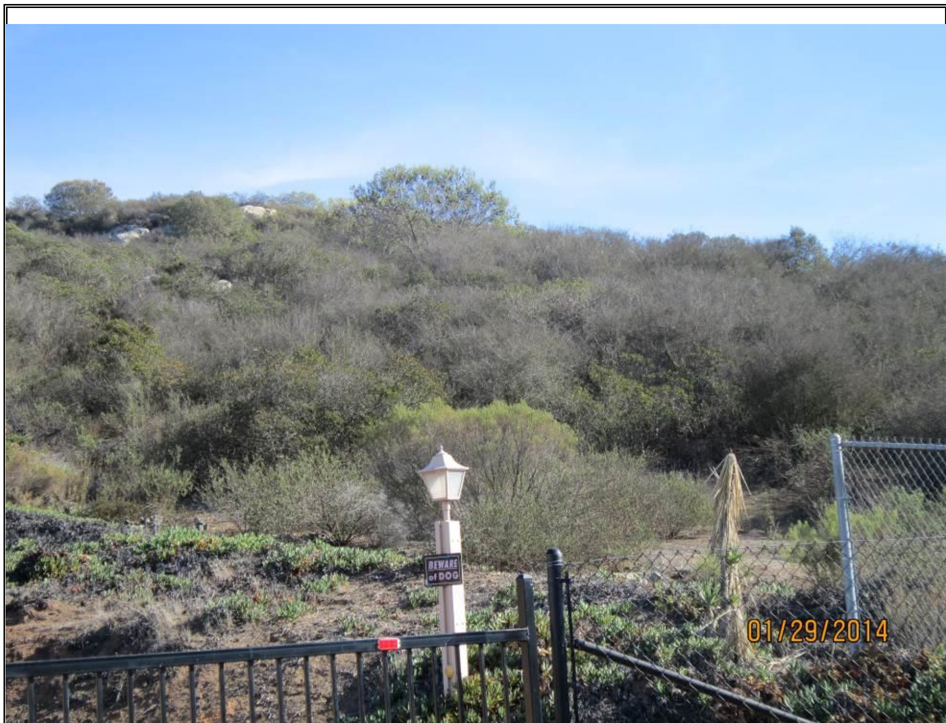
Potential sediment production:

Low to Med

Existing veg. cover:
Southeast slope ~50%

Northeast slope ~70%

	**Field Visit ID-7** **GLU: CSP-Forest-3** View: Looking east Existing sediment production: Med to High Potential sediment production: High Existing veg. cover: 75-80%

	**Field Visit ID-8** **GLU: CB-Scrub/Shrub-3** View: Looking southeast Existing sediment production: Low to Med Potential sediment production: Med to High Existing veg. cover: 90-95%

<table>
<tr><td>
</td><td>

Field Visit ID-9

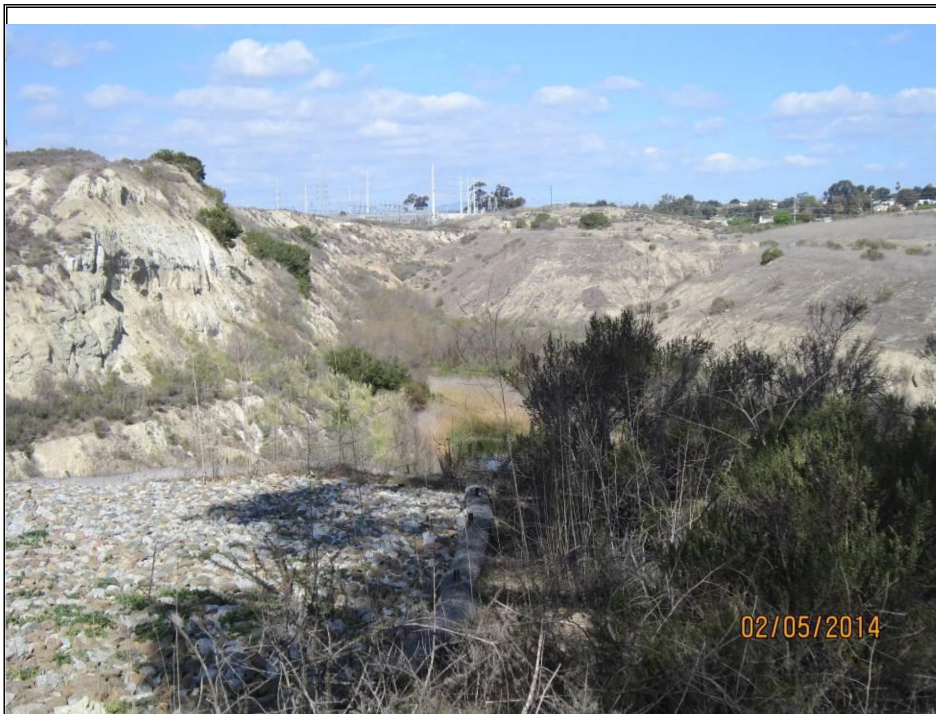
GLU: CB-Agricultural/ Grass-2

View: Looking northwest

Existing sediment production: Low to Med

Potential sediment production: Med

Existing veg. cover: 70%
</td></tr>
</table>

<table>
<tr><td>
</td><td>

Field Visit ID-10

GLU: CSI-Unknown-2

View: Looking north

Existing sediment production: Med to High

Potential sediment production: High

Existing veg. cover: 75%
</td></tr>
</table>

Field Visit ID-11

GLU: CSI-Agricultural/ Grass-2

View: Looking east

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 85%

Field Visit ID-12

GLU: CSP-Unknown-2

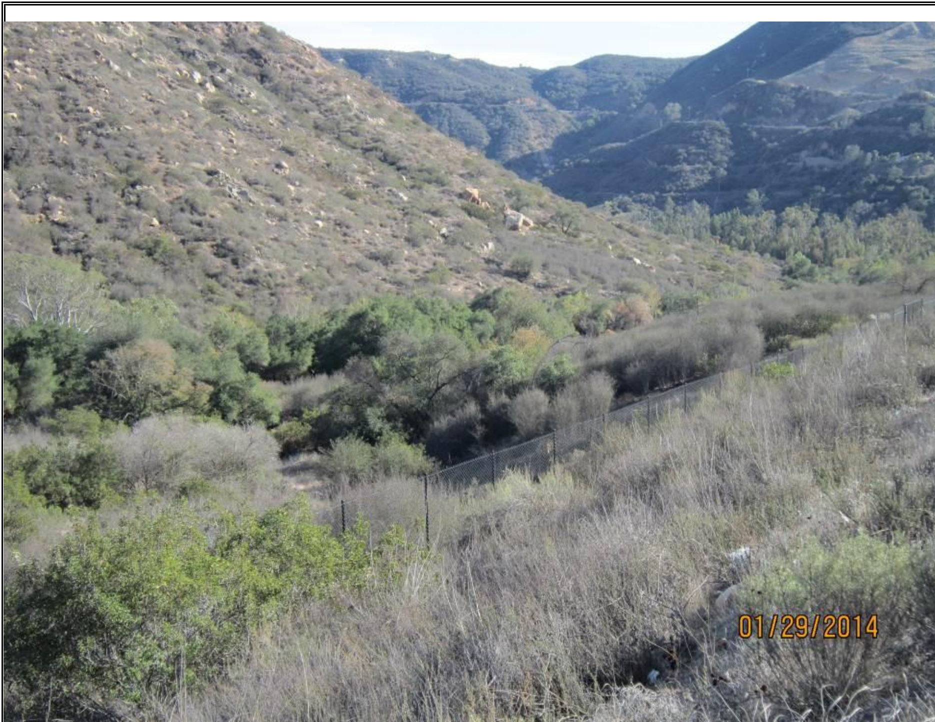
View: Looking southwest

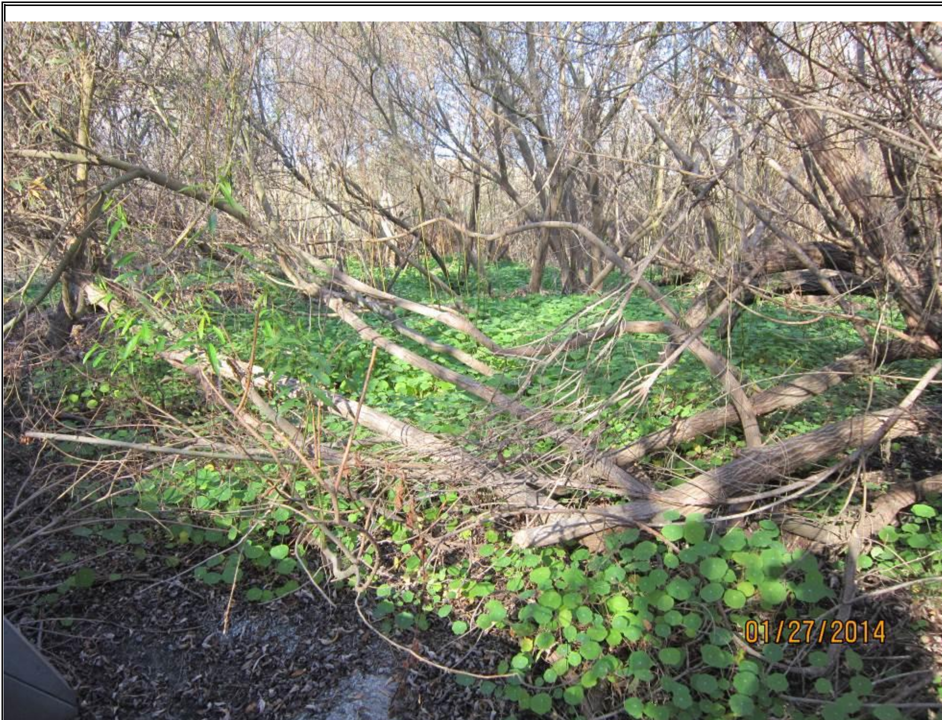
Existing sediment production: Low

Potential sediment production:

Low to Med

Existing veg. cover: 50%

	**Field Visit ID-13** **GLU: CSP-Scrub/Shrub-2** View: Looking southeast Existing sediment production: Med Potential sediment production: Med to High Existing veg. cover: 80-85%

	Field Visit ID-14 GLU: FSP-Scrub/Shrub-1 View: Looking northeast Existing sediment production: Low Potential sediment production: Low to Med Existing veg. cover: 95-100%

	**Field Visit ID-15** **GLU: CB-Agricultural/ Grass-4** View: Looking west Existing sediment production: Med Potential sediment production: High Existing veg. cover: 95% .

	**Field Visit ID-16** **GLU: CB-Agricultural/ Grass-3** View: Looking south Existing sediment production: High* Potential sediment production: High Existing veg. cover: 90-95% * Area was burned in 2014 fires after the field assessment so existing sediment production was adjusted to High (based on potential sediment production) from Medium

Field Visit ID-17

GLU: CSI-Scrub/Shrub-4

View: Looking west

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 95%

Field Visit ID-18

GLU: CSP-Forest-1

View: Looking southwest

Existing sediment production: Low to Med

Potential sediment production: Med

Existing veg. cover: 80%

	**Field Visit ID-19** **GLU: CSP-Scrub/Shrub-3** View: Looking southwest Existing sediment production: Low to Med Potential sediment production: Med to High Existing veg. cover: 60%

	**Field Visit ID-20** **GLU: CSP-Unknown-1** View: Looking southeast Existing sediment production: Low Potential sediment production: Med Existing veg. cover: 95%

Field Visit ID-21

GLU: CB-Unknown-3

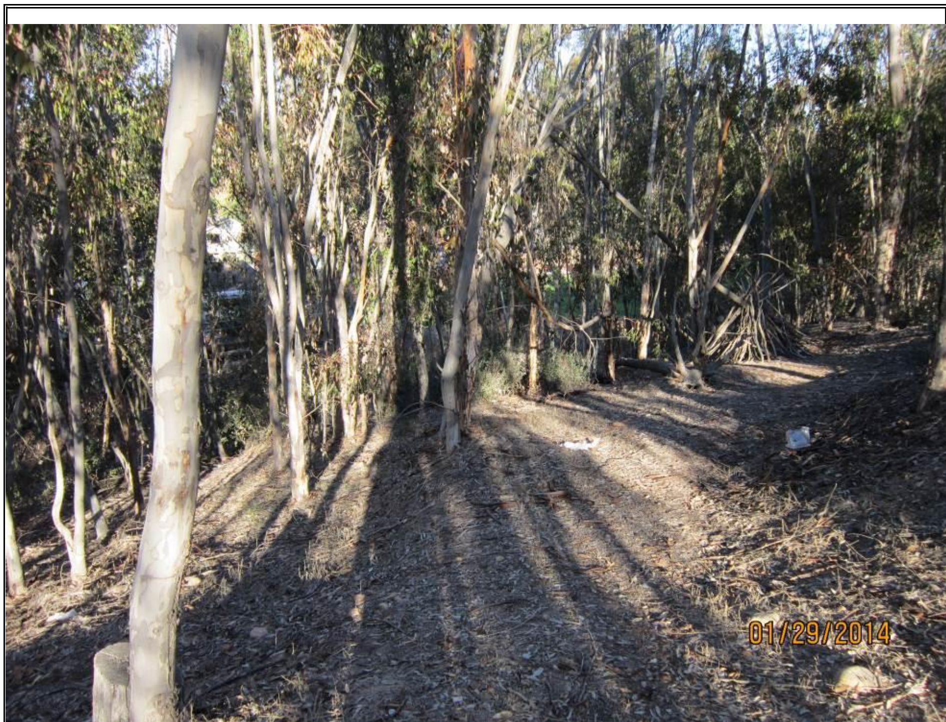
View: Looking northwest

Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover: 50-60%



Field Visit ID-22

GLU: CSI-Forest-3

View: Looking east

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 60%

Field Visit ID-23

GLU: CSI-Scrub/Shrub-1

View: Looking north

Existing sediment production: Low

Potential sediment production: Low

Existing veg. cover: 80%

Field Visit ID-24

GLU: CB-Unknown-4

View: Looking northeast

Existing sediment production: Low to Med

Potential sediment production: High

Existing veg. cover: 80%

Field Visit ID-25

GLU: CSI-Agricultural/ Grass-4

View: Looking east

Existing sediment production: Low

Potential sediment production: Med-High

Existing veg. cover: 95%

Field Visit ID-26

GLU: CSI-Scrub/Shrub-3

View: Looking east

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 100%

.

Field Visit ID-27

GLU: CSP-Developed-2

View: Looking north

Existing sediment production: Low

Potential sediment production: Low

Existing veg. cover: 30-35%

.

Field Visit ID-28

GLU: CSP-Agricultural/ Grass-2

View: Looking north

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 90-95%

.

Field Visit ID-29

GLU: FB-Forest-3

View: Looking northwest

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 80-85%

Field Visit ID-30

GLU: CB-Developed-4

View: Looking northeast

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 70%

.

Field Visit ID-31

GLU: CSI-Developed-3

View: Looking north

Existing sediment production: Low

Potential sediment production: Low

Existing veg. cover: 30-35%

Field Visit ID-32

GLU: CSI-Unknown-3

View: Looking west

Existing sediment production: Low to Med

Potential sediment production: Med

Existing veg. cover: 70-75%

	**Field Visit ID-33** **GLU: CSP-Scrub/Shrub-1** View: Looking northeast Existing sediment production: Low to Med Potential sediment production: Med to High Existing veg. cover: 70%

	**Field Visit ID-34** **GLU: CSP-Developed-2** View: Looking south Existing sediment production: Low Potential sediment production: Low Existing veg. cover: 95%

	**Field Visit ID-35** **GLU: FB-Scrub/Shrub-3** View: Looking northeast Existing sediment production: Low Potential sediment production: Med Existing veg. cover: 90-95%

	**Field Visit ID-36** **GLU: FSI-Agricultural/ Grass-2** View: Looking northeast Existing sediment production: Low Potential sediment production: Med Existing veg. cover: 95%

Field Visit ID-37

GLU: CB-Forest-3

View: Looking southeast

Existing sediment production: Med-High

Potential sediment production: High

Existing veg. cover: 75-80%

Field Visit ID-38

GLU: CSI-Agricultural/ Grass-1

View: Looking northeast

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 85%

	**Field Visit ID-39** **GLU: CSP-Developed-1** View: Looking west Existing sediment production: Low Potential sediment production: Low Existing veg. cover: 30-35%

	**Field Visit ID-40** **GLU: CSP-Scrub/Shrub-4** View: Looking south Existing sediment production: Med Potential sediment production: High Existing veg. cover: 90-95%

Geologic Group

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

Miles 0 25 50 100 150

Potential Critical Coarse Sediment Yield Areas

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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ATTACHMENT A.5

PHYSICAL STRUCTURES

A.5 Physical Structures

The desktop-level analysis to identify existing physical structures within the nine watershed management areas within the San Diego region utilized the following GIS data sources:

- ESRI ArcMap, Google Earth, and Google Maps products
- Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) Flood Profiles and FEMA Flood Insurance Rate Map (FIRM)
- National Flood Hazard Layer (NFHL)
- Municipal master drainage plans (as provided)
- San Diego Geographic Information Source (SanGIS) Municipal Boundaries and Hydrologic Basins
- United States Geological Survey (USGS) National Hydrography Dataset (NHD) California data
- Stream data generated as indicated in Section 2.2

The following documents the process used to identify the physical structures along the reaches and the resulting GIS data:

- The process began by importing the data sources indicated above into a single ArcMap document that served as a master map file from which all further analysis proceeded.
- The data were screened and selected for inclusion as appropriate to the project scope.
- Point features were placed along river reach line segments to coincide with visually identified structures, utilizing different feature symbols according to the type of infrastructure.
- In the case of levees, the point was placed at the downstream-most end of the FEMA NFHL Shapefile. All point features generated in this task appear in the GIS shapefile.
- Municipal boundaries intersecting river reaches were identified to identify the applicable municipal drainage plan data.
- Point feature attributes and associated information for Physical Structures GIS shapefile is indicated in Table A.5.1 below.

Table A.5.1: Structure Identification Point Feature Attribute Development and Information

Attribute	Description
Struct_ID	The Structure ID field provides a six-digit identification number based upon the structure's specific location within a watershed. The first three digits in the code reflect the structure's Hydrologic Unit (HU) Basin number (ranging between 902-911 for Region 9, as defined in the Water Quality Control Plan for the San Diego Basin). The subsequent three digits reflect the structure's location along the reach, ascending along the channel from the headwaters to tailwaters (ranging between 001-999, beginning at the confluence and increasing in the upstream direction).

Attribute	Description
WMA	The Watershed Management Area field provides the name of the watershed in which the structure exists. The WMA corresponds with the HU identified in the first three digits in the Struct_ID (e.g., 911, Tijuana Watershed).
Channel_ID	The Channel ID field provides the name of the channel in which the structure exists.
Struct_Typ	The Structure Type field classifies known structures as one of the following types:, Bridge, Culvert, Dam, Energy Dissipater, Flood Management Basin, Flood Wall, Grade Control, Levee, Pipeline, Weir.
Struct_Dtl	The Structure Detail field provides known quantitative information for multi-section culverts.
Struct_Mtl	The Structure Material field provides known qualitative information for structure material composition.
Struct_Shp	The Structure Shape field provides known geometric information for culvert shapes, and is classified as one of the following types: Arch, Box, Pipe.
Jurisd_ID	The Jurisdiction ID field, when applicable, provides the known separate structure identification number developed and utilized by the jurisdiction or entity responsible for creating and distributing the coinciding structure Shapefile data used for this analysis. This number was copied from the coinciding external Shapefile data attribute field best representing a unique jurisdiction or entity-based identification number (external Shapefile data received from regional WMAA data call; for jurisdictional information, see "Other" attribute field). Coinciding external Shapefile data was used to determine various structure attributes.
Plan_ID	The Plan ID field, when applicable, provides the known structure plan number corresponding with the Jurisdiction ID. This number was copied from the coinciding external Shapefile data attribute field best representing a unique plan number received from the regional WMAA data call (external Shapefile data received from regional WMAA data call; for jurisdictional information, see "Other" field). Coinciding external Shapefile data was used to determine various structure attributes.
Diameter	The Diameter field, when applicable, provides the known diameter (in US feet) for culverts.
Length	The Length field, when applicable, provides the known length (in US feet) for select structure types. When lengths were determined using FEMA FIS Flood Profiles, the scaled horizontal distances along the indicated roadway or channel slope were used.
Width	The Width field, when applicable, provides the known width (in US feet) for select structure types.
Height	The Height field, when applicable, provides the known height (in US feet) for select structure types. When heights were determined using FEMA FIS Flood Profiles, the scaled vertical distances from channel bed to indicated roadway bottom were used.
US_Invert	The Upstream Invert field, when applicable, provides the known upstream invert elevation (in US feet) for select structure types.
DS_Invert	The Downstream Invert field, when applicable, provides the known downstream invert elevation (in US feet) for select structure types.

Attribute	Description
RD_EL_NAVD	The Roadway Elevation (NAVD) field, when applicable, provides the known roadway elevation (in US feet, NAVD) for select structure types. When roadway elevations were determined using FEMA FIS Flood Profiles, the horizontal projection onto the vertical grid scales were used.
Loc_Descr	The Location Description field, when applicable, provides information for structures crossing a known roadway. In nearly all cases, Google Earth imagery was used to determine the roadway name.
Other	The Other field is used to convey any information not present within the preceding fields. Typically, "other" information includes jurisdictional, plan, and supplemental dimensions for a given structure.

Example Structure Identification

The following example demonstrates the structure identification process for a discrete structure (ID 907029) along the San Diego River. The San Diego River is located in the San Diego River watershed (WMA 907). Scanning the river from lower to higher reached, a new point feature was placed at the road crossing over the San Diego River as indicated in Figure A.5.1. Select attributes of this particular structure were available from the FEMA NFHL as displayed in the highlighted boxes in Figure A.5.1. Additional attributes such as the culvert height, length, roadway elevation, and name were also determined from the FIS Flood Profile as indicated in Figure A.5.2. Satellite imagery (e.g., Google) was used to verify the existence of structure. In this case, the most current Google Map data indicated that the culvert still exists and that the roadway name has been changed to Qualcomm Way. When structures could not be verified with satellite imagery, the structure identification was based solely upon the information provided or readily available and was not physically verified in the field. Figure A.5.3 displays an example of imagery used to identify structures.

Figure A.5.1: Typical ArcMap Window

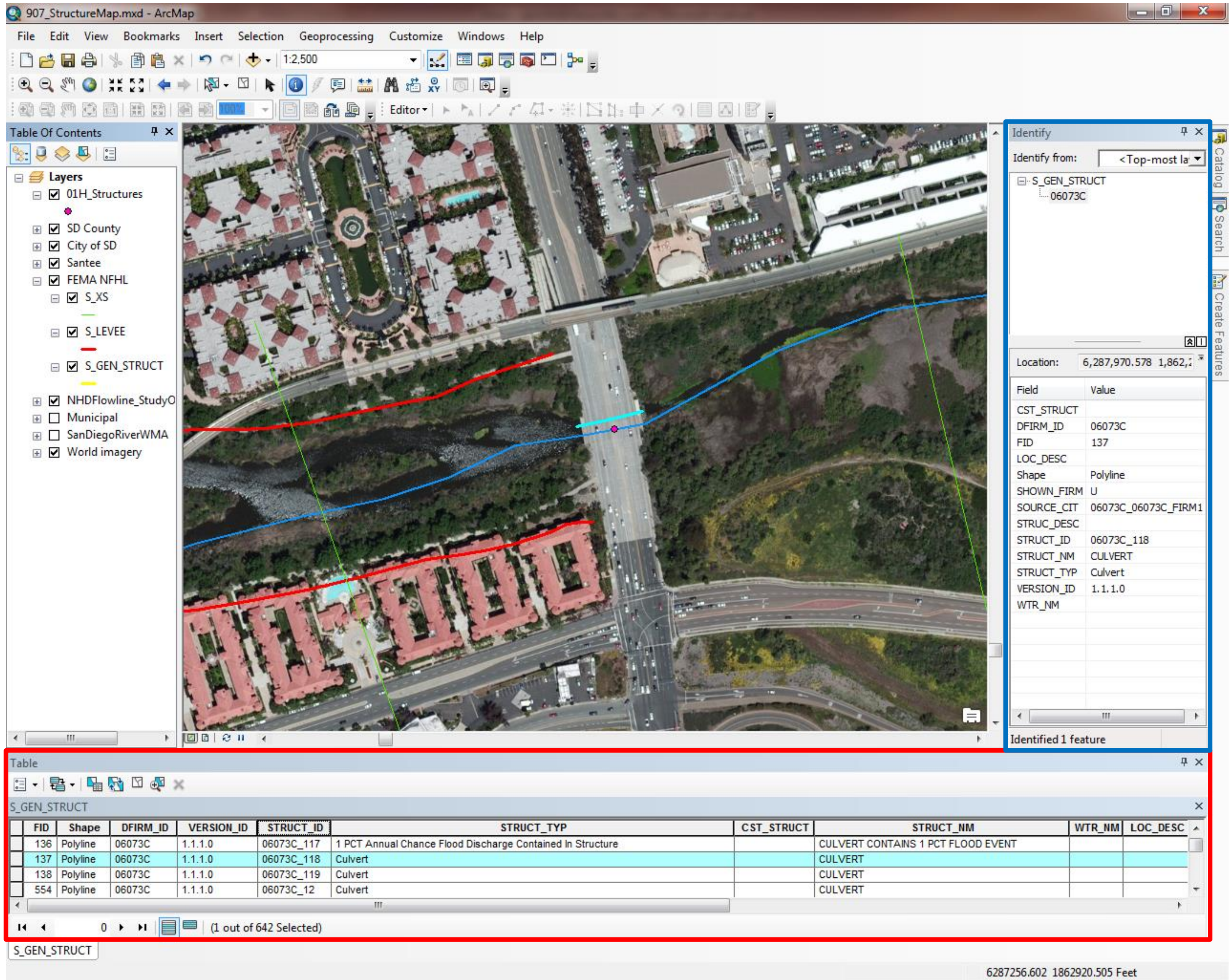
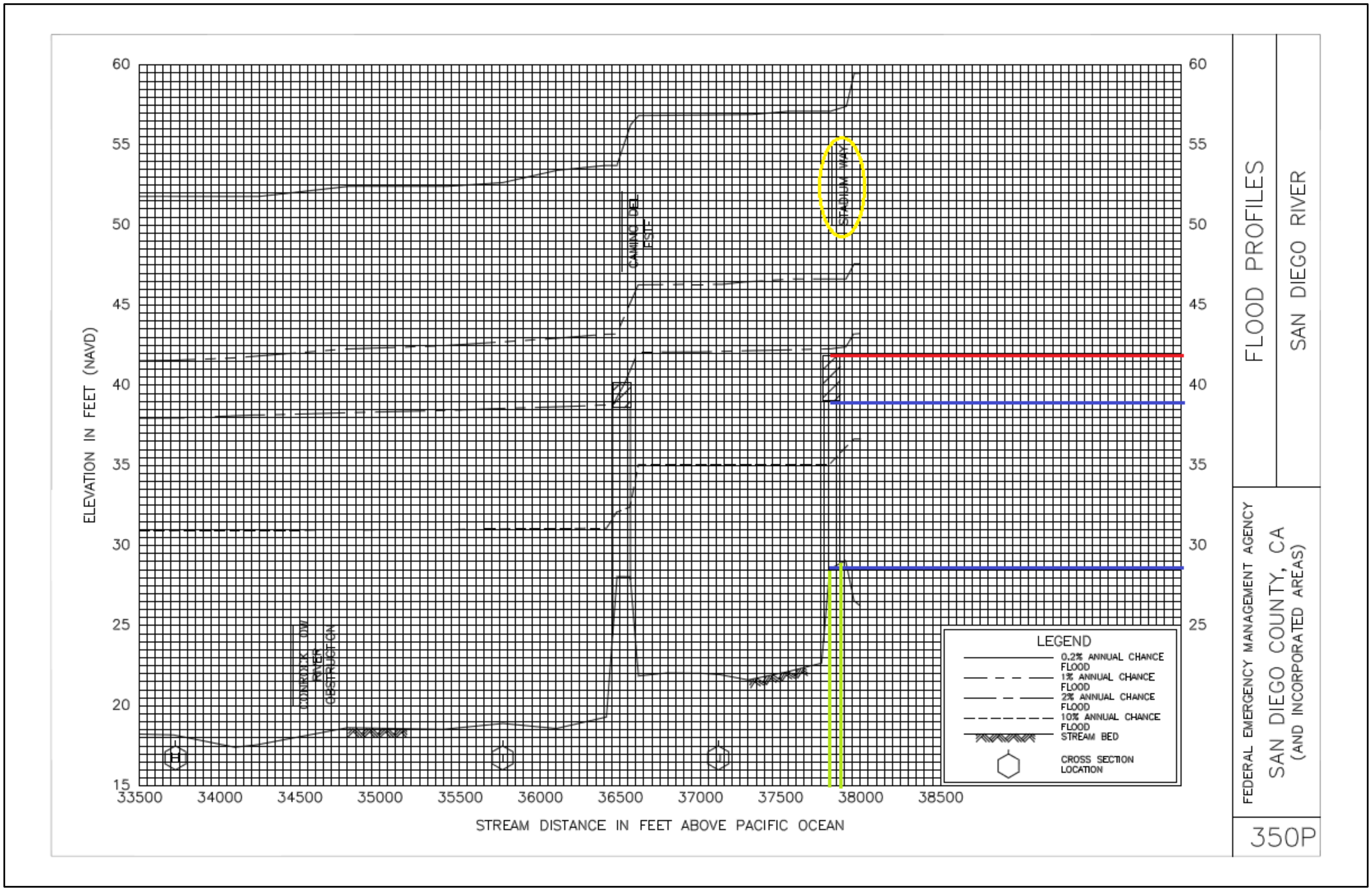


Figure A.5.2: Typical FEMA FIS Flood Profile



Legend: roadway elevation (red), roadway name (yellow), culvert height (blue), culvert width (green)

Figure A.5.3: Google Map Imagery for Structure Identification

The following bridge structure dimensional attributes were included in the point feature attributes:

- length 110 feet
- height 10 feet
- roadway elevation 41.9 feet

The attribute table associated with the identified structure included in the GIS shapefile is indicated in Table A.5.2.

Table A.5.2: Structure 907029 Attribute Table

Attribute	Description
Struct_ID	907029
WMA	San Diego
Channel_ID	San Diego River
Struct_Typ	Culvert
Struct_Dtl	
Struct_Mtl	
Struct_Shp	
Jurisd_ID	06073C_118
Plan_ID	06073C_06073C_FIRM1
Diameter	0
Length	110
Width	0
Height	10
US_Invert	0
DS_Invert	0
RD_EL_NAVD	41.9
Loc_Descr	Qualcomm Way
Other	Info from FEMA NFHL shapefile data/FIS FP V.9-350P

Miles 0 25 50 100 150

Watershed Management Area Streams with Channel Structures

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

ATTACHMENT B
HYDROMODIFICATION MANAGEMENT APPLICABILITY/EXEMPTIONS

ATTACHMENT B.1
EXEMPT RIVER REACH

B.1.1 Exempt River Reaches

B.1.1.1 Approach for Exempt River Reach Analysis

The approach selected in this cumulative hydromodification impacts study accounts for: (1) hydrology, (2) channel geometry, (3) bed and bank material, and (4) sediment supply. The selected approach compares long-term changes in sediment transport capacity, or in-stream work, and sediment supply for the existing and future development conditions. The ratio of future/existing condition transport capacity, or work, is termed Erosion Potential (Ep). The ratio of future/existing condition bed sediment supply is termed Sediment Supply Potential (Sp). To calculate Ep, the hydrology, channel geometry, and bed/bank materials are characterized for the existing and future conditions. To calculate Sp, the sediment supply factor is characterized for the existing and future conditions.

The findings in this study propose exemption for a given river reach if the analysis satisfies the following criteria:

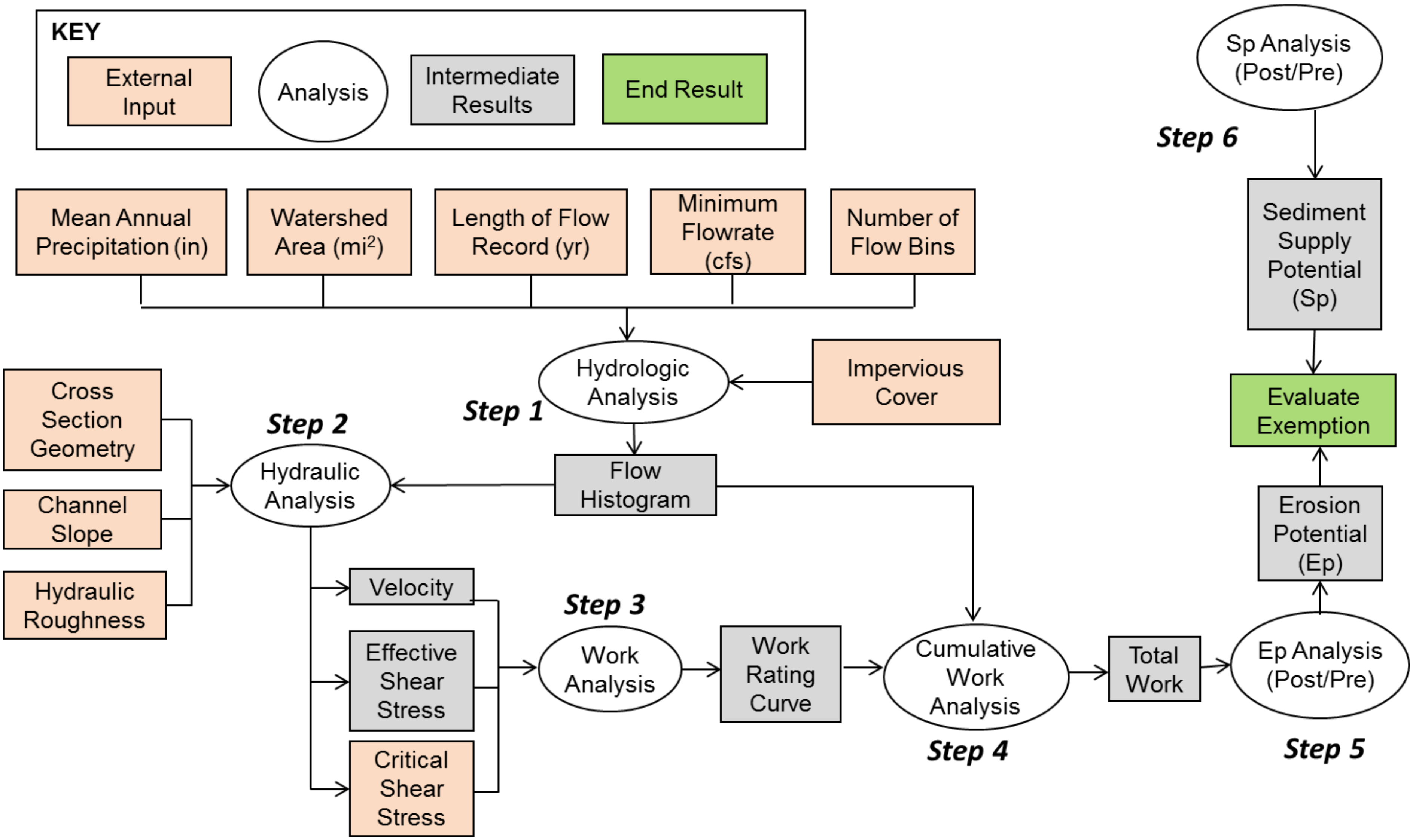
- Ep < 1.05 when d50 < 16 mm or Ep < 1.20 when d50 > 16 mm, and;
- Sp > 0.90

The following bullet points provide basis for the criteria listed above:

- For Ep
    - According to the Journal of Hydrology article titled Channel Enlargement in Semiarid Suburbanizing Watersheds: A Southern California Case Study (Hawley and Bledsoe, 2013): "*The threshold corresponding to the presence/absence of headcutting varied based on substrate type, and was roughly quantified as a sediment-transport ratio greater than ~1.20 in systems with a median grain size > 16mm, and [Ep] ~ 1.05 when d_{50} < 16 mm*"
- For Sp
    - Soar and Thorne (2001) indicate that a greater than 10% reduction in sediment supply can have potentially significant effects on stream stability.
    - SCCWRP Technical Report 605, 2010 states that changes of less than 10% in either driver (Water delivery and sediment are the drivers in this report) are unlikely to instigate, on their own, significant channel changes.

The flow chart summarizing the analysis procedure is presented below.

Flowchart for Exempt River Reach Analysis



B.1.1.2 Selection of Inputs for Exempt River Reach Analysis

The following steps were implemented for each river reach:

- Step 1 – Hydrologic Analysis:
  - Due to limited flow data, a flow duration equation developed for Southern California (Hawley and Bledsoe, 2011) was used to estimate existing and future flow histograms for each watershed.
  - The change in impervious cover between existing and future development conditions was estimated using the developable land use layer from Section 2.3.
  - A desktop-level GIS exercise was performed to manually assign land use classifications if the parcel in the developable land use layer directly discharges into the analyzed reach. Results are summarized in Section B.1.13.
  - Assumptions for percent imperviousness for each land use type were based on the information provided in the San Diego County Imperviousness Study (County of San Diego, 2010).
  - The table below presents the input parameters used to construct flow histograms, as well as the estimated channel slope at the critical cross section.

Exempt River Reach	Area (sq. miles)	Mean Annual Precipitation (in)	Length of Daily Flow Record (Years)	Channel Slope (ft/ft)
San Luis Rey River	353	20	30	0.0019

- Step 2 – Hydraulic Analysis: The reach type classification from Section 2.2 was used to identify the critical cross section along the reach for Ep analysis. A critical flow rate of $0.5Q_2$ was assigned to estimate the critical shear stress for the analyzed cross section. Flow rates below $0.5Q_2$ were assumed to perform no work on the reach.
- Step 3 – Work Analysis: The simplified effective work equation shown below is used to calculate the work done for each flow bin.

$$W = (\tau - \tau_c)^{1.5} V$$

  Where

  W = Work (dimensionless)
  τ = effective Shear Stress [lb/ft^2]
  τ_c = Critical Shear Stress [lb/ft^2]
  V = Flow Velocity [ft/s]

- Step 4 – Cumulative Work Analysis: Cumulative work is a measure of the long-term total work or sediment transport capacity performed at a given stream location. Cumulative work incorporates both discharge magnitude and flow duration distributions for the full range of simulated flow rates. Cumulative work is calculated by multiplying work and duration for each bin. Total work is calculated through summation of work from all flow bins.
- Step 5 – Ep Analysis: Ep is calculated by dividing the total work of the future condition by that of the existing condition. The existing river reaches analyzed appear relatively stable and have not experienced excessive geomorphic instability due to the alteration of

the drainage areas. Given the stable condition of the existing channels, the existing condition was used as the baseline condition instead of natural. Results from the Ep analysis are presented in Section B.1.1.3.

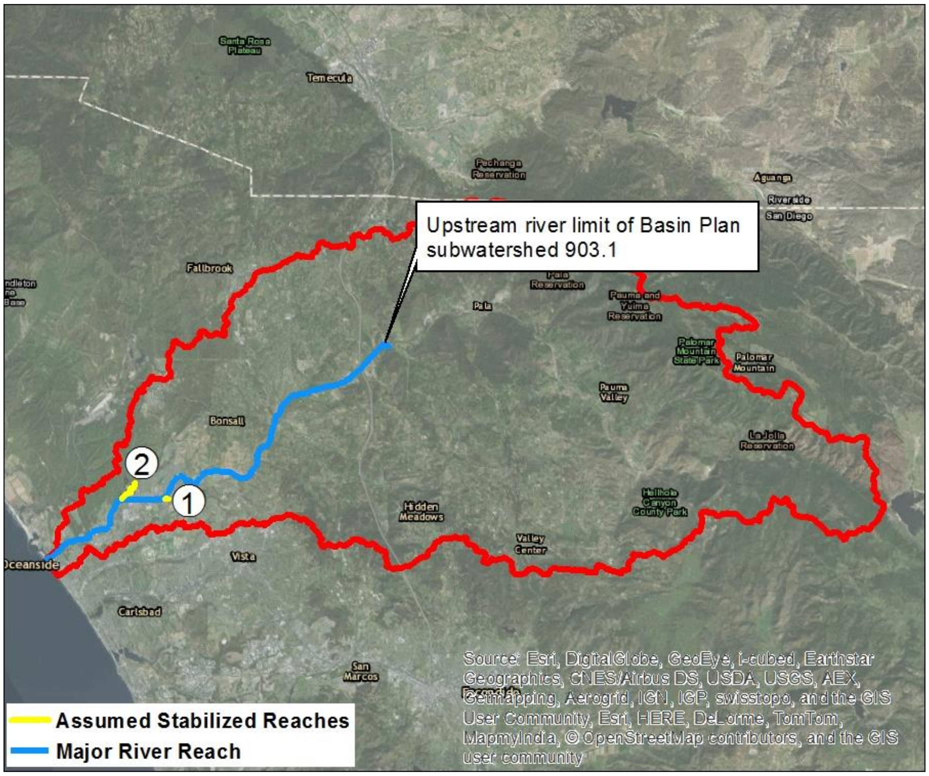
- Step 6 – Sp Analysis: Coarse Sediment Supply Potential for each watershed was estimated using the quantitative results from Section 2.4. First, the watershed coarse sediment soil loss was estimated for all GLUs producing coarse sediment. Then, the future-condition coarse sediment soil loss was estimated by subtracting the approximate exempt parcel soil loss from the existing soil loss. Sp is ultimately calculated by dividing the future coarse sediment soil loss by the existing coarse sediment soil loss. Results from Sp analysis are presented in Section B.1.1.3.

Steps 1 to 5 were performed in Excel and Steps 1 and 6 were executed in GIS. Ep estimates for the exempt river reaches are included in this attachment.

Exempt river reach extents are shown in the figure below. Figure also indicate the tributaries assumed to be stable for performing the erosion potential analysis as a conservative approach to approximate potential HMP exempt flows that may enter the river reach being analyzed.

For a PDP draining to one of the assumed stable tributaries shown in the following exempt reach figure, the PDP applicant shall verify and document that the assumed stable tributary is a stabilized conveyance system by using the methodology presented in section 4.1.2 prior to claiming exemption from hydromodification management requirements.

For a PDP draining to a tributary not shown in the figure below to be considered for exemption, a stability analysis using the section 4.1.2 methodology is to be conducted for the given tributary. If the stability analysis determines the tributary is stable, then the exempt river reach analysis indicated in section 4.1.1 shall be performed by adding the additional stabilized tributary to the current list of tributaries shown in the figure below to confirm that the reach satisfies the Ep and Sp criteria.



Extents of San Luis Rey River and extents of assumed Stabilized Reaches: 1) Frazee Road Channel and 2) Pilgrim Creek

The table below presents the summary of the developable land in each of the five watersheds with the exempt river reach and the estimated developable area that will be exempted from hydromodification management area requirements if the exempt river reach exemption is reinstated. This area will still be subject to the pollutant control requirements from the regional MS4 permit.

Exempt River Reach	Developable Land		
	Total (acres)	Area exempt (acres)	Exempt (%)
San Luis Rey River	77,418	4,223	5%

B.1.1.3 Results from Exempt River Reach Analysis

Results from Erosion potential analysis are presented below:

Exempt River Reach	Area (acres)	Impervious Area (acres) [%]			Ep (Post/Pre) [Criteria<1.05]
		Pre	Post	Increase	
San Luis Rey River	225,768	26,216[11.6]	26,803[11.9]	587[0.3]	1.01

Results from coarse sediment supply potential analysis are presented below:

Exempt River Reach	Soil Loss (tons/yr.)			Sp (Post/Pre) [Criteria>0.90]
	Pre	Exempt Parcels	Post [Pre – Exempt Parcels]	
San Luis Rey River	1,503,964	27,072	1,476,892	0.98

Based on the results from the analysis it is recommended that exemption be reinstated for San Luis Rey River.

Erosion Potential Analysis for San Luis Rey River

Erosion Potential (Ep)	1.01

Channel Slope	0.0019	ft/ft
Estimated Q_2	1225	cfs
$0.5Q_2$	612.5	cfs
Critical Shear	0.077	lb/sq. ft
γ	62.4	lb/ft^3

			Existing Condition	Future Condition
Tributary Area	*A*	sq mi	353	353
Mean Annual Precip	*MAP*	in/yr	20.0	20.0
Length of Daily Flow Record	*Yr*	yr	30	30
Imperviousness	*Impav*	mi^2/mi^2	0.1161	0.1187
Maximum Flow of Record	*Qmax*	cfs	22579.2	22579.2
Minimum Flow of Record	*Qmin*	cfs	0.01	0.01
10-year peak flow	*Q10*	cfs	29414.3	29414.3
Coefficient of DDF	*day1*	days & cfs	23720.72	24587.28
Exponent of DDF	*day2*	days & cfs	-0.76	-0.76
Number of Bins	N_B	--	25	25
Bin Size	$H_{B\text{-}log}$	--	0.610	0.610

Bin Number	Lower Bound of Bin Number	Upper Bound of Bin Number	Flow	Hydraulic Radius	Flow Velocity	Shear Stress	Work	Duration	Cumulative Work	Duration	Cumulative Work
B	$B_{lwr\text{-}log\ (cfs)}$	$B_{upr\text{-}log\ (cfs)}$	*Q (cfs)*	*R (ft)*	*v (ft/s)*	τ (psf)	*W*		*W*duration*		*W*duration*
1	0.01	0.01	0.01	0.00	0.02	0.000	0.000	955692	0.00	1005555	0.00
2	0.01	0.02	0.01	0.00	0.02	0.000	0.000	601390	0.00	631581	0.00
3	0.02	0.03	0.03	0.00	0.03	0.000	0.000	378438	0.00	396691	0.00
4	0.03	0.06	0.05	0.00	0.03	0.000	0.000	238140	0.00	249158	0.00
5	0.06	0.11	0.09	0.00	0.04	0.000	0.000	149855	0.00	156494	0.00
6	0.11	0.21	0.16	0.01	0.05	0.001	0.000	94299	0.00	98293	0.00
7	0.21	0.39	0.30	0.01	0.07	0.001	0.000	59340	0.00	61737	0.00
8	0.39	0.71	0.55	0.01	0.08	0.001	0.000	37341	0.00	38776	0.00
9	0.71	1.31	1.0	0.02	0.11	0.002	0.000	23498	0.00	24355	0.00
10	1.3	2.4	1.9	0.02	0.14	0.002	0.000	14786	0.00	15297	0.00
11	2.4	4.4	3.4	0.03	0.17	0.004	0.000	9305	0.00	9608	0.00
12	4.4	8.2	6.3	0.05	0.22	0.006	0.000	5855	0.00	6035	0.00
13	8.2	15.0	11.6	0.07	0.27	0.008	0.000	3684	0.00	3790	0.00
14	15.0	27.6	21.3	0.10	0.35	0.012	0.000	2319	0.00	2381	0.00
15	27.6	50.9	39.2	0.14	0.44	0.017	0.000	1459	0.00	1495	0.00
16	50.9	93.6	72.2	0.20	0.55	0.024	0.000	918	0.00	939	0.00
17	93.6	172.1	132.8	0.28	0.70	0.033	0.000	578	0.00	590	0.00
18	172.1	316.6	244.4	0.40	0.87	0.047	0.000	364	0.00	371	0.00
19	316.6	582.5	449.6	0.55	1.09	0.065	0.000	229	0.00	233	0.00
20	582.5	1071.6	827.0	0.76	1.35	0.090	0.002	144	0.29	146	0.29
21	1071.6	1971.3	1521.4	1.07	1.69	0.127	0.019	91	1.70	92	1.72
22	1971.3	3626.6	2798.9	1.50	2.12	0.178	0.068	57	3.87	58	3.91
23	3626.6	6671.6	5149.1	2.09	2.65	0.248	0.187	36	6.71	36	6.77
24	6671.6	12273.5	9472.6	2.92	3.31	0.346	0.462	23	10.43	23	10.51
25	12273.5	22579.2	17426.3	4.06	4.12	0.481	1.059	14	15.04	14	15.13

ATTACHMENT B.2

HYDROMODIFICATION MANAGEMENT EXEMPTION MAPPING

Receiving Waters and Conveyance Systems Exempt from Hydromodification Management Requirements

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

ATTACHMENT C
ELECTRONIC FILES

Electronic Folder titled "San Luis Rey_WMAA_Attachment C Electronic_Data.zip" Contents:

1. ArcMap 10.0 and 10.1 map files created for purpose of viewing Regional WMAA data
   - WMAA_02_SanLuisRey_Data_2014_0908_v10.mxd
   - WMAA_02_SanLuisRey_Data_2014_0908_v101.mxd
2. ESRI Geodatabase titled " WMAA_02_SanLuisRey_Data_2014_0908_v10.gdb" containing the following data:
   - WatershedBoundaries
     - Watershed_Boundaries
   - HydrologicProcesses
     - HRUAnalysis
   - Streams – description of existing streams in the watershed
     - SD_Regional_WMAA_Streams (streams selected for detailed analysis)
     - SD_NHD_Streams (portion of NHD dataset included for reference)
   - LandUsePlanning
     - SanGIS_ExistingLandUse
     - SanGIS_PlannedLandUse
     - SanGIS_DevelopableLands
     - SanGIS_RedevelopmentandInfill
     - SanGIS_MunicipalBoundaries
     - Federal_State_Indian_Lands
     - SanGIS_MHPA_SD
     - SanGIS_MSCP_CN
     - SanGIS_MSCP_EAST_DRAFT_CN
     - SanGIS_Draft_North_County_MSCP_Version_8_Categories
   - PotentialCoarseSedimentYield
     - GLUAnalysis
     - PotentialCoarseSedimentYieldAreas
     - MacroLevelPotentialCriticalAreas
     - PotentialCriticalCoarseSedimentYieldAreas
   - ChannelStructures
     - ChannelStructures
   - HydromodExemptions
     - Exempt_Systems
     - Exempt_Bodies
   - Floodplains: included for reference
     - FEMA_NFHL
   - Baselayers: included for reference
     - SanGIS_Lakes
     - link to ESRI World Imagery (internet connection is required to access ESRI World Imagery basemap)

Electronic Folder titled "San Luis Rey_WMAA_Attachment C Electronic_Data.zip" Contents, continued:

3. Google Earth – KMZ file titled: "WMAA_02_SanLuisRey_Data_2014_0908_GoogleEarth.kmz"**,** containing the following data:
   - WatershedBoundaries
   - Streams
     - SD Regional WMAA Streams (streams selected for detailed analysis)
     - SD NHD Streams (portion of NHD dataset included for reference)
   - LandUsePlanning
     - Municipal Boundaries
     - Federal/State/Indian Lands
   - ChannelStructures
   - HydromodExemptions
     - Exempt_Systems
     - Exempt_Bodies
   - Floodplains: included for reference
     - FEMA Floodplain
   - Dominant Hydrologic Processes
   - Potential Critical Coarse Sediment Yield Areas

Notes:

- Open a map file (with extension .mxd) using ArcMap to view the data.
- All data contained in the geodatabase is loaded into the map.

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ATTACHMENT D
REGIONAL MS4 PERMIT CROSSWALK

Table below provides a linkage between the Regional MS4 Permit requirements for WMAA and this report.

Regional MS4 Permit Provision	Regional WMAA Report
B.3.b.(4)(a)	Chapter 2; Section 5.1; Attachment A and Attachment C
B.3.b.(4)(a)(i)	Section 2.1; Attachment A.1 and Attachment C
B.3.b.(4)(a)(ii)	Section 2.2; Attachment A.2 and Attachment C
B.3.b.(4)(a)(iii)	Section 2.3; Attachment A.3 and Attachment C
B.3.b.(4)(a)(iv)	Section 2.4; Attachment A.4 and Attachment C
B.3.b.(4)(a)(v)	Section 2.5; Attachment A.5 and Attachment C
B.3.b.(4)(b)	Chapter 3 and Section 5.2
B.3.b.(4)(c)	Chapter 4; Section 5.3; Attachment B and Attachment C

CHAPTER 3 – APPENDIX I: OPTIONAL WATERSHED MANAGEMENT AREA ANALYSIS (WMAA) CANDIDATE PROJECTS

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Table 3I. WMAA Candidate Projects

Project Identifier	Watershed Management Area	Jurisdiction	Project Name	Ownership		Project Location				Project Category	Specific Project Type
				Type	Owner Information	Address	APN	Latitude	Longitude		
SLR-1	San Luis Rey	S.D. COUNTY	SAN LUIS REY RIVER PARK	Public	S.D. COUNTY	ALONG SAN LUIS REY RIVER, WEST OF I-15	1233810700	2053571.303	6269764.897	Floodplain Preservation	FLOODPLAIN PRESERVATION, INFILTRATION OPPORTUNITIES
SLR-2	San Luis Rey	S.D. COUNTY	SDCO-R-4	Public	S.D. COUNTY	HEALD LANE, FALLBROOK	1055207900	2082204.476	6260839.022	Regional BMP's	SUBSURFACE TREATMENT WETLANDS
SLR-3	San Luis Rey	S.D. COUNTY	SDCO-R-5	Public	FALLBROOK UNION ELEMENTARY SCHOOL DISTRICT	CALLE DE LA PALOMA, FALLBROOK	1055207700	2083225.821	6260682.635	Regional BMP's	SUBSURFACE TREATMENT WETLANDS
SLR-4	San Luis Rey	S.D. COUNTY	SDCO-R-6	Public	FALLBROOK UNION HIGH SCHOOL DISTRICT	CALMIN DR. FALLBROOK	1063511000	2078264.594	6264674.446	Regional BMP's	SUBSURFACE TREATMENT WETLANDS
SLR-5	San Luis Rey	OCEANSIDE	MJ-R-01	Public	S.D. COUNTY AND CITY OF OCEANSIDE	MISSION AVE, OCEANSIDE	1571004200	2036588.835	6247055.098	Regional BMP's	SUBSURFACE TREATMENT WETLANDS
SLR-6	San Luis Rey	OCEANSIDE	MJ-R-02	Public	S.D. COUNTY	SANTA FE AVE., OCEANSIDE	1590603800	2033046.819	6249259.356	Regional BMP's	SUBSURFACE TREATMENT WETLANDS
SLR-7	San Luis Rey	VISTA	MJ-R-04	Public	S.D. COUNTY	MUSEUM WY AND N. SANTA FE AVE., VISTA	1592402100	2029297.785	6255687.602	Regional BMP's	SUBSURFACE TREATMENT WETLANDS
SLR-8	San Luis Rey	S.D. COUNTY	CAMINO DEL REY AND OLD RIVER ROAD INLET FILTERS	Public	S.D. COUNTY	CAMINO DEL REY AND OLD RIVER ROAD, BONSALL	1260701000	2049659.613	6264877.414	Regional BMP's	CURB INLET FILTERS
SLR-9	San Luis Rey	S.D. COUNTY	Cole Grade Road	Public	ARMSTRONG FARMS INC	COLE GRADE RD	1881201000	2038485.034	6325305.842	Stream Rehabilitation	CIP Project

CHAPTER 3 – APPENDIX J: MINIMUM BEST MANAGEMENT PRACTICES

Table 3J-1. City of Oceanside Minimum Best Management Practices [a]

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
1. Eliminate illicit connections to the storm drain system.	•	•	•	•	•	•	•	•	•	•	•
2. Eliminate illicit non-storm water discharges.	•	•	•	•	•	•	•	•	•	•	•
3. Properly dispose of process and wash water.	•	•	•	•	•	•	•	•	•	•	•
4. Properly dispose of vehicle and equipment wash water/Eliminate the discharge of vehicle and equipment wash water.	•	•	•	•	•			•	•		•
5. Properly dispose of water from fire sprinkler maintenance activities.	•	•	•	•	•			•	•	•	•
6. Eliminate irrigation runoff.	•	•	•	•		•	•	•	•	•	•
7. Eliminate nursery irrigation discharges.	•	•	•	•		•	•	•	•	•	•
8. Properly prepare and dispose of water from swimming pools, spas, fountains, reflective pools, ponds, and filter backwash.	•	•	•	•		•	•	•	•	•	•
9. Control air conditioning condensation discharges.	•	•	•	•				•			
10. Eliminate pumped groundwater, foundation and footing drain discharges.	•	•	•	•	•		•	•		•	
11. Eliminate floor mat cleaning discharges.	•	•	•	•		•	•	•	•		
12. Regularly clean and maintain structural BMPs and LID installations to ensure proper performance.	•	•	•	•		•	•				
13. Protect unpaved areas, including landscaping, from erosion using vegetation or physical stabilization.	•	•	•	•	•	•	•				
14. Regularly clean parking lots.	•	•	•	•	•			•			•

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
15. Keep storm drain inlets and under drains free of sediment, trash, and debris. Regularly clean and maintain storm drain inlets and under drains.	•	•	•	•		•	•				
16. Implement good housekeeping to regularly remove trash and debris from site.	•	•	•	•	•	•	•				
17. Provide and maintain secondary containment to catch spills when storing potential liquid pollutants in outdoor areas.	•	•	•	•	•	•	•	•	•		•
18. Properly store and dispose of hazardous substances.	•	•	•	•	•	•	•	•	•	•	•
19. Cover, contain, and/or elevate materials stored outside that may become a source of pollutants in storm water or non-storm water.	•	•	•	•	•	•	•	•	•	•	•
20. Label containers to prevent mishandling of hazardous materials and other potential pollutants.	•	•	•	•	•						
21. Properly manage and apply pesticides and fertilizers.	•	•	•	•		•	•		•		•
22. Develop a written plan that identifies appropriate BMPs, including spill response, and includes procedures for proper implementation.		•	•	•	•	•	•	•	•	•	•
23. Implement controls to prevent pollution from exposed outdoor work areas.	•	•	•	•			•		•		•
24. Prevent or capture liquid leaks from vehicles and equipment.	•	•	•	•	•			•	•		•
25. Maintain a readily accessible spill cleanup kit that is appropriate for the type of material stored.		•	•	•	•	•	•	•	•	•	•
26. Drain fluids from inoperable vehicles and store or dispose of appropriately.	•	•	•	•				•	•		•
27. Immediately clean up spills.	•	•	•	•	•	•	•	•	•	•	•

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
28. Temporarily protect storm drains from non-storm water discharges while conducting activities that have the potential to result in a discharge.		•	•	•	•	•	•	•	•	•	•
29. Provide pollution prevention signage for storm drains.	•	•	•	•		•	•	•	•	•	•
30. Implement a pollution prevention system for uncovered outdoor sources of pollutants.	•	•	•	•	•	•	•	•	•		•
31. Train appropriate employees on storm water pollution prevention.		•	•	•	•	•	•	•	•	•	•
32. Keep trash/waste storage areas free of exposed trash, sediment, and debris.	•	•	•	•	•	•	•				•
33. Properly store and dispose of green waste.	•	•	•	•		•	•				
34. Manage animal waste and animal washing in a manner that prevents transport of wastes and wash water off-site.	•	•	•	•		•	•				
35. Protect waste storage areas from contact with storm water and non-storm water flows on to the property.	•	•	•	•	•	•	•		•		•
36. Cooking oil waste shall be managed to prevent illicit discharges.	•	•	•	•		•					

a. For more detailed descriptions of each BMP, see the Jurisdictional Runoff Management Plan for each the City of Oceanside, available online at http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=243&Itemid=211.

Table 3J-2. County of San Diego Best Management Practices [a]

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
1. Eliminate illicit connections to the municipal separate storm sewer system (MS4; Hereafter, "storm drain system").	•	•	•	•	•	•	•	•	•	•	•
2. Eliminate illicit non-storm water discharges.	•	•	•	•	•	•	•	•	•	•	•
3. Properly dispose of process and wash water.	•	•	•	•	•	•	•	•	•	•	•
4. Properly dispose of vehicle and equipment wash water/Eliminate the discharge of vehicle and equipment wash water.	•	•	•	•	•			•	•		•
5. Properly dispose of water from fire sprinkler maintenance activities.	•	•	•	•	•			•	•	•	•
6. Eliminate pumped groundwater, foundation and footing drain discharges.	•	•	•	•	•	•	•	•			
7. Minimize rising groundwater, diverted stream flows, uncontaminated groundwater infiltration, springs, riparian habitat/wetland flows, potable water sources, and foundation/ footing drain discharges.	•	•	•	•	•		•	•		•	
8. Protect unpaved areas, including landscaping, from erosion using vegetation or physical stabilization.	•	•	•	•	•	•	•				
9. Regularly clean parking lots.	•	•	•	•	•			•			•
10. Implement good housekeeping to keep site free of trash and debris.	•	•	•	•	•		•	•	•	•	
11. Provide and maintain secondary containment to catch spills when storing potential liquid pollutants in outdoor areas.	•	•	•	•	•	•	•	•	•		•
12. Properly store and dispose of hazardous substances.	•	•	•	•	•	•	•	•	•	•	•

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
13. Cover, contain, and/or elevate materials stored outside that may become a source of pollutants in storm water or non-storm water.	•	•	•	•	•	•	•	•	•	•	•
14. Label containers to prevent mishandling of hazardous materials and other potential pollutants.	•	•	•	•	•	•	•	•	•		
15. Develop a written plan that identifies appropriate BMPs, including spill response, and includes procedures for proper implementation.	•	•	•	•	•	•	•	•	•	•	•
16. Prevent or capture liquid leaks from vehicles and equipment.	•	•	•	•	•			•	•		•
17. Maintain a readily accessible spill cleanup kit that is appropriate for the type of material stored.	•	•	•	•	•	•	•	•	•	•	•
18. Immediately clean up spills.	•	•	•	•	•	•	•	•	•	•	•
19. Temporarily protect storm drains from non-storm water discharges while conducting activities that have the potential to result in a discharge.	•	•	•	•	•	•	•	•	•	•	•
20. Implement a pollution prevention system for uncovered outdoor sources of pollutants.	•	•	•	•	•	•	•	•	•		•
21. Train appropriate employees on storm water pollution prevention.	•	•	•	•	•	•	•	•	•	•	•
22. Keep trash/waste storage areas free of exposed trash, sediment, and debris.	•	•	•	•	•	•	•				•
23. Protect waste storage areas from contact with storm water and non-storm water flows on to the property.		•	•	•	•	•	•		•		•
24. Eliminate irrigation runoff.	•		•	•		•	•	•	•	•	•
25. Eliminate nursery irrigation discharges.	•		•	•		•	•	•	•	•	•
26. Properly dispose of discharges from swimming pools, spas, fountains, reflective pools, ponds, and filter backwash.	•		•	•		•	•	•	•	•	•

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
27. Control air conditioning condensation discharges.	•		•	•				•			
28. Eliminate floor mat cleaning discharges.	•		•	•		•	•	•	•		
29. Regularly clean and maintain structural BMPs and LID installations to ensure proper performance.	•		•	•		•	•	•	•		
30. Keep storm drain inlets and under drains free of sediment, trash, and debris.	•		•	•		•	•				
31. Properly manage pesticides and fertilizers.	•		•	•		•	•		•		•
32. Implement controls to prevent pollution from exposed outdoor work areas.	•		•	•		•	•	•	•	•	
33. Drain fluids from inoperable vehicles and store or dispose of appropriately.	•		•	•				•	•		•
34. Provide pollution prevention signage for storm drains.	•		•	•		•	•	•	•	•	•
35. Properly store and dispose of green waste.	•		•	•		•	•				
36. Manage animal waste and animal washing in a manner that prevents transport of wastes and wash water off-site.	•		•	•		•	•				

a. For more detailed descriptions of each BMP, see the respective Jurisdictional Runoff Management Plan for each agency, available online at http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=243&Itemid=211.

Table 3J-3. Caltrans Minimum Best Management Practices [a]

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
1. Eliminate illicit connections to the storm drain system.	•	•	•	•	•	•	•	•	•	•	•
2. Eliminate illicit non-storm water discharges.	•	•	•	•	•	•	•	•	•	•	•
3. Properly dispose of process and wash water.	•	•	•	•	•	•	•	•	•	•	•
4. Properly dispose of vehicle and equipment wash water/Eliminate the discharge of vehicle and equipment wash water.	•	•	•	•	•			•	•		•
5. Eliminate irrigation runoff.	•	•	•	•		•	•	•	•	•	•
6. Minimize rising groundwater, diverted stream flows, uncontaminated groundwater infiltration, springs, riparian habitat/wetland flows, potable water sources, and foundation/ footing drain discharges.	•	•	•	•	•		•	•		•	
7. Regularly clean and maintain structural BMPs and LID installations to ensure proper performance.	•	•	•	•		•	•				
8. Protect unpaved areas, including landscaping, from erosion using vegetation or physical stabilization.	•	•	•	•	•	•	•				
9. Keep storm drain inlets and under drains free of sediment, trash, and debris.	•	•	•	•		•	•				
10. Implement good housekeeping to keep site free of trash and debris.	•	•	•	•	•	•	•				
11. Provide and maintain secondary containment to catch spills when storing potential liquid pollutants in outdoor areas.	•	•	•	•	•	•	•	•	•		•
12. Properly store and dispose of hazardous substances.	•	•	•	•	•	•	•	•	•	•	•
13. Cover, contain, and/or elevate materials stored outside that may become a source of pollutants in storm water or non-storm water.	•	•	•	•	•	•	•	•	•	•	•

Minimum Best Management Practices Supporting Watershed Strategies	Pollutant Sources					HPWQC	PWQC				
	Residential	Municipal	Commercial	Industrial	Construction	Bacteria	Nutrients	Total Dissolved Solids	Index of Biotic Integrity	Chloride	Toxicity
14. Label containers to prevent mishandling of hazardous materials and other potential pollutants.	•	•	•	•	•						
15. Properly manage pesticides and fertilizers.	•	•	•	•		•	•		•		•
16. Develop a written plan that identifies appropriate BMPs, including spill response, and includes procedures for proper implementation.	•	•	•	•	•	•	•	•	•	•	•
17. Prevent or capture liquid leaks from vehicles and equipment.	•	•	•	•	•			•	•		•
18. Maintain a readily accessible spill cleanup kit that is appropriate for the type of material stored.	•	•	•	•	•	•	•	•	•	•	•
19. Drain fluids from inoperable vehicles and store or dispose of appropriately.	•	•	•	•				•	•		•
20. Immediately clean up spills.	•	•	•	•	•	•					
21. Temporarily protect storm drains from non-storm water discharges while conducting activities that have the potential to result in a discharge.	•	•	•	•	•	•	•	•	•	•	•
22. Provide pollution prevention signage for storm drains.	•	•	•	•		•	•	•	•	•	•
23. Implement a pollution prevention system for uncovered outdoor sources of pollutants.	•	•	•	•	•		•		•		•
24. Train appropriate employees on storm water pollution prevention.	•	•	•	•	•	•	•				
25. Keep trash/waste storage areas free of exposed trash, sediment, and debris.	•	•	•	•	•	•					
26. Properly store and dispose of green waste.	•	•	•	•		•	•				
27. Protect waste storage areas from contact with storm water and non-storm water flows on to the property.	•	•	•	•	•	•					

a. For more detailed descriptions of Caltrans BMPs, see Caltrans 2003 Stormwater Management Plan 2003 (July 2012 revision) at http://www.dot.ca.gov/hq/env/stormwater/index.htm.

Minimum Best Management Practices for the City of Vista are presented in the attached City of Vista Stormwater Standards Manual, June 2015.

City of Vista

Stormwater Standards Manual

June 2015

CITY OF VISTA
CALIFORNIA

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1 Introduction

1.1 Stormwater Standards Manual

This Stormwater Standards Manual (hereafter, "Manual") supports the City of Vista's (City) Stormwater Management and Discharge Control Program Ordinance (Stormwater Ordinance), codified as Vista Municipal Code (VMC) Chapter 13.18. The Manual also supports the water quality protection provisions of the Grading and Erosion Control Ordinance, codified as VMC Chapter 17.56. Moreover, the Manual is not a stand-alone document but must be read with applicable parts of the Stormwater Ordinance and the Grading and Erosion Control Ordinance (collectively, "Ordinances"). In general, this Manual categorically and explicitly establishes what Dischargers must do to comply with the Ordinances and to receive permits for projects and activities that are subject to them. The Manual and the Ordinances have been prepared to provide the City with the respective legal authority and administrative actions necessary to comply with the requirements of California Regional Water Quality Control Board, San Diego Region (RWQCB) Order No. R9-2013-0001, as amended by Order No. R9-2015-0001 (MS4 Permit).

1.2 Purposes and Use

The Manual establishes minimum stormwater management requirements and controls to address the highest priority water quality conditions in the Water Quality Improvement Plans (WQIPs) for the San Luis Rey and Carlsbad Watershed Management Areas (WMAs). Further, the Manual supports the following objectives stated in Section 13.18.020 of the Stormwater Ordinance:

- To establish requirements for discharges into the Municipal Separate Storm Sewer System (MS4), receiving waters, and the environment;
- To protect, to the maximum extent practicable (MEP), life, property, receiving waters, aquatic life, and the environment from loss, injury, degradation, or damage by discharges from within the City's jurisdiction;
- To protect the MS4 from damage; and
- To meet the requirements of state and federal law.

In both the San Luis Rey and Carlsbad WMAs, bacteria has been identified as the highest priority water quality condition. During dry weather conditions, non-stormwater flows transport bacteria and other pollutants. For this reason, the City has minimum requirements to effectively prohibit non-stormwater discharges and will implement activities to reduce them. Because sediment transports bacteria, the City has also designed program activities to reduce discharges of sediment, primarily during wet weather conditions. Efforts to reduce sediment discharges are intended to reduce bacteria levels in stormwater discharges. These efforts are anticipated to reduce sediment loading in nearby receiving waters.

The Manual describes best management practices (BMPs), which are required activities to be implemented to reduce the amount of pollutants discharged to the City's MS4 (hereafter, "storm drain system"[1]). The Manual informs residents, businesses, contractors, developers, and City staff about what is necessary to meet the City's stormwater requirements. All terms used in the Manual have the same meaning as defined in VMC Chapter 13.18, unless otherwise noted.

[1] Throughout the Manual, the term "storm drain system" is typically used in place of "MS4.".

2 Other Potentially Applicable Regulations

The Manual describes stormwater BMPs required by the City of Vista. Some actions and activities associated with stormwater BMP requirements may be subject to additional requirements or approvals, such as other City departments or non-municipal agencies. The legally responsible person must identify all other applicable requirements and obtain the necessary permits or approvals. Some of the more common regulations to consider are discussed in this section; however, this discussion is not meant to be exhaustive.

2.1 Other City of Vista Requirements

Discharges to the sanitary sewer system may require approval from the City's Engineering Department. Call (760) 639-6111 for more information.

Structural improvements to properties, such as building an overhead canopy, may require City permits. Contact Development Services at (760) 639-6108 for more information.

2.2 Requirements of Other Agencies

Work in and around natural drainages, wetlands, and other water resources may require permits from multiple agencies, including the following:

- US Army Corps of Engineers (USACE)
- California Department of Fish and Wildlife
- US Fish and Wildlife Service
- RWQCB

The RWQCB and State Water Resources Control Board (SWRCB) issue permits and conditional waivers for a number of activities that have potential to impact stormwater discharges. Consideration may be given to the following permits and waivers:

- State of California Industrial General Permit, SWRCB Order No. 2014-0057-DWQ
- State of California Construction General Permit, SWRCB Order No. 2009-0009-DWQ
- Groundwater Dewatering Permit, RWQCB Order No. R9-2010-003[2]
- Permit for Discharges of Hydrostatic Test Water or Potable Water, RWQCB Order No. R9-2010-003
- Utility Vault Dewatering Permit, SWRCB Order No. 2014-0174-DWQ
- Conditional Waiver No. 1, Discharges from On-site Disposal Systems
- Conditional Waiver No. 2, "Low Threat" Discharges to Land

[2] This order is expected to be replaced by a new order in 2015. The most recent version is Tentative Order No. R9-2015-0013. The RWQCB's proposed schedule would result in the new order going into effect on October 1, 2015.

- Conditional Waiver No. 3, Discharges from Animal Operations
- Conditional Waiver No. 4, Discharges from Agricultural and Nursery Operations
- Conditional Waiver No. 5, Discharges from Silvicultural Operations
- Conditional Waiver No. 6, Discharges of Dredged or Fill Materials Nearby or Within Surface Waters
- Conditional Waiver No. 7, Discharges of Solid Wastes to Land
- Conditional Waiver No. 8, Discharges of Solid Wastes to Land
- Conditional Waiver No. 9, Discharges of Slurries to Land
- Conditional Waiver No. 10, Discharges of Emergency/Disaster Related Wastes
- Conditional Waiver No. 11, Aerially Discharged Wastes Over Land

Information on the most current requirements for RWQCB and SWRCB permitting and waivers can be obtained from the following website: http://www.waterboards.ca.gov/sandiego/

3 Minimum BMP Requirements

This section presents minimum BMP requirements for the following land uses, activities, and projects within the City:

- Industrial, commercial and municipal facilities or areas
- Residential properties
- Construction sites
- Development projects (post-construction BMPs)

These are the minimum BMP requirements that must be implemented for applicable activities. However, additional consideration should be given to the following:

- Due to site-specific conditions, some BMP requirements reference terms such as "where applicable" or "where feasible." These terms require that BMPs be implemented at the discretion and with the final determination made by Authorized Enforcement Staff. Vista Municipal Code Chapter 13.18 defines "Authorized Enforcement Staff" as follows: "any City employee or contractor hired by the City who is assigned to duties involving permits and other City approvals, inspections, or enforcement related to this chapter."
- Authorized Enforcement Staff also have the authority to require additional BMPs, if necessary, to comply with the Stormwater Ordinance and/or the MS4 Permit.
- References to "CASQA Factsheets" refer to factsheets in manuals prepared by the California Stormwater Quality Association (CASQA). CASQA materials can be accessed at www.casqa.org. Some materials may not be viewable without a paid subscription.

3.1 Industrial, Commercial, and Municipal

Minimum BMP requirements for industrial, commercial and municipal sites and activities are provided in Table 1. These BMPs have been developed, and are supported by, factsheets adopted by the California Stormwater Quality Association (CASQA)[3]. City exceptions to the procedures described in the CASQA factsheets are identified in footnotes. Where any conflict may exist between CASQA factsheets and requirements in the Manual or the Municipal Code, the requirements of the Manual and the Municipal Code shall prevail. Complying with the BMPs described in the Manual does not ensure compliance with all other regulatory requirements, including requirements of other agencies. See Section 2 for more information about other potentially applicable requirements.

[3] CASQA (2015). *Stormwater Best Management Practice Portal: Industrial and Commercial*. www.casqa.org.

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Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
Discharge Control											
1	Eliminate illicit discharges to the storm drain system.	Do not allow any material (solid or liquid) or pollutant, except uncontaminated stormwater, to enter the City's storm drain system. Conditional exceptions apply, as described in Vista Municipal Code Chapter 13.18. Additional activity-specific BMPs related to illicit discharges are described in BMP No.'s 3 through 10 (below). Report any suspected or active illicit discharges to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-11, SC-44	x	x	x	x		x	x	x
2	Eliminate illicit connections to the storm drain system.	Illicit connections are any drain or connection that allows for an illegal discharge to enter the storm drain system. Find and abate all illicit connections to the storm drain system through properly approved procedures, permits, and protocols. Report any suspected or active illicit connections to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-44	x	x	x	x		x	x	x
3	Properly dispose of water used to clean outdoor areas.	All water used to clean outdoor areas (e.g., power washing) shall be contained, captured, and reused, or properly disposed of to the sanitary sewer, an appropriate waste hauler, or to landscaping or other pervious surfaces.	SC-10, SC-41[4], BG-62	x	x	x	x	x	x	x	x

[4] Exception to guidance in factsheet: Factsheet SC-41, Building & Grounds Maintenance, states (in regards to pressure washing), "If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff." However, non-stormwater discharges of this nature, even if filtered, are not allowed to enter the City's storm drain system. Wash water must be contained, collected, and disposed of properly.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
4	Eliminate the discharge of vehicle and equipment wash water.	Water associated with vehicle or equipment-washing activities shall not be allowed to enter the storm drain system. Uncovered designated wash areas must either drain to the sanitary sewer, or all wash water must be contained, captured, and disposed of appropriately. Wash water containing pollutants such as oil, grease, paint, or other hazardous waste must be disposed in accordance with applicable regulations. If approved by the City, drains located in vehicle or equipment washing areas may be connected to the sanitary sewer system. Contact the Engineering Department at (760) 639-6111 for approval.	SC-10, SC-21, BG-64[5]		x	x			x	x	x
5	Properly dispose of water from fire sprinkler maintenance activities.	Fire sprinkler system discharges shall be discharged to the sanitary sewer system when permitted by the City. For approval, contact the Engineering Department at (760) 639-6111. When not practicable or allowed to discharge to the sanitary sewer system due to the presence of prohibited contaminants, the water shall be collected and disposed of by an appropriately certified party. Fire sprinkler system discharges without corrosion inhibitors, fire suppressants, or antifreeze may be discharged to landscaping or other pervious surfaces. Fire sprinkler system discharges may be directed to the storm drain system if the following are implemented: (1) prior to entering the storm drain system, the discharge must be clear, odorless, and pH neutral, and (2) the flow path must be cleaned to ensure that pollutants such as trash and debris are not conveyed to the storm drain system. Discharges shall not result in erosion or in runoff to any adjacent property.	SC-10, SC-41		x	x			x		x

[5] Exception to guidance in factsheet: Factsheet BG-64, Mobile Cleaning – Vehicle and Equipment Washing, states that water used to rinse new cars "May discharge to storm drain." However, water used to rinse new cars is not allowed to be discharged to the City's storm drain system.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
6	Eliminate irrigation runoff.	Irrigation runoff to the storm drain system shall be eliminated. For example, irrigation water and associated pollutants (e.g., sediment, fertilizer, pesticides) from businesses and facilities such as landscape areas, nurseries, and garden centers, shall be prevented from reaching the storm drain system.	SC-10[6], SC-41	x		x	x				
7	Properly dispose of discharges from swimming pools, spas, or water features.	Water from swimming pools, spas, and water features shall be properly disposed of to prevent pollutants from entering the storm drain system. Such discharges to the storm drain system are allowed only if the water is: 1) dechlorinated, 2) has a pH level in the 7-8 range, 3) is near or at ambient temperature, 4) does not have algae or suspended solids, and 5) is not saline. Other related discharges, such as from filter backwash or saline pools, are prohibited from entering the storm drain system. At the discretion of the City, discharges of saline water to the sanitary sewer system may be allowed. Contact the Engineering Department at (760) 639-6111 for approval.	SC-10, BG-63[7]			x					
8	Control air conditioning condensation discharges.	Air conditioning condensation shall be directed to landscaped areas or other pervious surfaces where feasible.	SC-10, SC-42			x			x		

[6] Exception to guidance in factsheet: Factsheet SC-10, Non-Stormwater Discharges, states that "landscape irrigation drainage and landscape watering" may be discharged to the storm drain with conditions; however, in accordance with the MS4 Permit and the City's Stormwater Ordinance, no irrigation runoff may be discharged to the City's storm drain system.

[7] Exception to guidance in factsheet: Factsheet BG-63, Mobile Cleaning – Swimming Pools & Spas, states that discharges from swimming pools and spas to the storm drain system are not permitted; however, discharges of this nature are permitted if the conditions described in BMP 7 are met.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
9	Eliminate discharges from cleaning indoor areas.	Water used to clean indoor areas, such as during floor mopping or mat washing, shall not be discharged to the storm drain system. Indoor wash areas, mop sinks, or indoor floor drains may be utilized if they drain to the sanitary sewer system. Alternatively, such waste water may be suitable for collection, recovery, and discharge to landscape.	SC-10, SC-21, BG-30	x		x				x	x
10	Eliminate pumped groundwater, foundation, and footing drain discharges.	Unless approved by a National Pollutant Discharge Elimination System (NPDES) permit, or the RWQCB has determined in writing that no permit is needed, the following discharges are not allowed: 1) pumped groundwater, such as water from crawl space or sump pumps, 2) discharges from foundation and footing drains that are at or below groundwater elevation.	SC-10			x					
BMP and Storm Drain Conveyance and Structure Maintenance											
11	Regularly inspect and maintain storm drain structures to retain designed functionality.	Storm drain conveyances and structures for which the property owner is responsible for maintenance shall be inspected, maintained, and cleaned to maintain design functionality. All structural BMPs (e.g., treatment and flow control facilities) shall be maintained in accordance with recorded maintenance agreements, and where applicable, structural BMPs shall demonstrate compliance with the City's certification program.	SC-44	x	x		x	x	x	x	x
Erosion and Sediment Control											
12	Protect unpaved and landscaped areas from erosion.	Exposed soils that are eroding or are likely to erode shall be stabilized to prevent sediment from mobilizing in stormwater and entering the storm drain system. Mulch, vegetation, and other stabilization techniques for erosion and sediment control may be implemented. Significant accumulations of eroded soil shall be removed or contained to prevent discharge to the storm drain system.	SC-40, SC-42	x	x		x				

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
Good Housekeeping											
13	Regularly clean parking areas, driveways, and hardscape.	Paved parking lots, private roads, and other hardscape, shall be inspected and cleaned as necessary to remove trash, debris, and pollutants that may enter the storm drain system. Sweeping is the preferred method of cleaning. Wet-cleaning methods, such as mopping or power washing, may be conducted if all wash water is contained, captured, and disposed of appropriately.	SC-41, SC-43, BG-62[8]		x			x	x	x	x
14	Implement good housekeeping in outdoor areas.	Outdoor areas shall be inspected and cleaned as necessary to keep them free of trash, sediment, litter, and other debris. Additional attention shall be given to areas such as trash enclosures, loading docks, compactors, and material storage locations.	SC-41	x	x			x	x		

[8] Exception to guidance in factsheet: Factsheet BG-62, Mobile Cleaning – Surface Cleaning, states (in regards to pressure washing) that screened, or filtered, wash water can be discharged to a gutter, street, or storm drain. Non-stormwater discharges of this nature, even if filtered, are not allowed to enter the storm drain system, which includes the streets and gutters. Wash water must be contained, collected, and disposed of properly.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
Material Storage and Handling											
15	Provide and maintain secondary containment to catch spills if storing potential stormwater pollutants.	To prevent leaks and spills from discharging to the storm drain system, effective secondary containment shall be provided and maintained for all containers of material (liquid or solid) with the potential to discharge onto outdoor areas. Drums and other containers shall be kept in good condition and securely closed when not in use. Secondary containment shall also be provided for all liquids during transport to prevent spills due to leaks or punctures. Spills, liquids, and precipitation that accumulates within secondary containment devices shall be regularly removed and disposed of appropriately. Other applicable regulations will apply to the use of secondary containment, as appropriate, especially for hazardous materials, which are regulated by the County of San Diego Department of Environmental Health.	SC-20, SC-31						x	x	x
16	Cover, contain, and/or elevate materials stored outside that may become a source of pollutants in stormwater or non-stormwater.	Materials stored outdoors shall be covered, contained, and/or elevated to prevent stormwater and non-stormwater from contacting and/or transporting materials to the storm drain system. Cover types may include roofs, awnings, and the use of tarps. Where coverage is not feasible or is cost-prohibitive, alternative approaches to pollution prevention may be allowed, such as installing berms around the stored materials, directing runoff to pervious areas, or installing treatment devices. The installation of structural overhead cover may require obtaining City-issued permits. Contact Development Services at (760) 639-6108 for information.	SC-20, SC-33		x		x	x	x	x	x

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
17	Properly store and dispose of hazardous materials.	Hazardous materials and wastes shall be stored, managed, and disposed in accordance with federal, state, and local laws and regulations—notably, but not limited to, County of San Diego Department of Environmental Health regulations. Hazardous materials and their primary storage containers shall be stored such that they will not come into contact with stormwater, even if leaks or spills occur (e.g., secondary containment and appropriately covered). Disposal of hazardous wastes requires the use of authorized hazardous waste collection services. See BMPs 16 and 17 for additional details regarding storage.	SC-20, SC-31, SC-33						x		x
Pesticide and Fertilizer Management											
18	Properly manage pesticides and fertilizers.	Pesticides and fertilizers shall be used in strict accordance with manufacturer's labels, as authorized by the U.S. Environmental Protection Agency. See BMPs No.'s 15 and 16 for secondary containment and cover requirements. Waste products shall be disposed in accordance with the manufacturer's label and applicable hazardous waste regulations. The use of integrated pest management (IPM) principles is encouraged to reduce or eliminate use of chemicals. For more information about integrated pest management, see the University of California Statewide IPM Program at: http://www.ipm.ucdavis.edu	SC-35, SC-41, BG-40				x				x

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted							
				Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
Outdoor Work Areas											
19	Implement controls to minimize pollution from exposed outdoor work areas.	Activities that may generate pollutants shall be conducted in covered, contained areas; alternatively, adequate measures shall be implemented to prevent the discharge of activity-sourced pollutants. Outdoor work areas shall consider and implement the following, as appropriate: (1) conduct activities indoors; (2) when it is raining, do not conduct outdoor activities that may generate pollutants; (3) prevent runoff from upstream areas from flowing through the work area ; (4) contain the work area to prevent spills or by-products from escaping; (5) install cover or use canopies in areas where outdoor activities are performed; (6) protect storm drain inlets and ensure adequate spill response materials are readily available; and, (7) regularly clean outdoor work areas to remove accumulated debris, materials, and pollutants. Structural BMPs (stormwater treatment devices) may be prescribed if these measures are determined to be ineffective at preventing stormwater pollution from outdoor work activities.	SC-20, SC-30, SC-32, SC-34, SC-42		x		x	x	x	x	x
Spill Prevention and Response											
20	Prevent or capture liquid leaks from vehicles or equipment.	Leaking vehicles or equipment shall be repaired promptly. Drip pans or other equivalent means shall be used to capture spills or leaks from vehicles and equipment. Captured fluids shall be disposed of in accordance with applicable hazardous materials regulations.	SC-11, SC-22						x	x	x
21	Immediately clean up spills.	Spills shall be cleaned up immediately and prevented from entering the storm drain system. Dry-cleaning methods of cleanup are recommended, such as the use of a broom, absorbent, or shop-vac. Consistent with BMP No. 1, uncontained spills must be reported to the City's Stormwater Hotline at (760) 643-2804.	SC-11						x	x	x

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
22	Maintain readily accessible and appropriately supplied spill cleanup materials (or kit).	Spill cleanup materials and equipment shall be kept on-site and, appropriately supplied for the type and quantity of spills that may occur. One or more designated 'spill cleanup kits' are recommended. Spill cleanup materials shall be stored in close proximity to where a spill may occur.	SC-11, SC-22						x	x	x
Waste Management											
23	Keep waste storage and dumpster areas free of exposed trash, sediment, and debris.	Waste storage and dumpster areas shall be cleaned to keep them free of uncontained trash, debris, or other potential pollutants. Liquid waste, hazardous waste, medical waste, universal waste, and other items prohibited by current regulations shall not be placed in solid waste dumpsters. Dry-cleaning methods such as sweeping are preferred. If wet cleaning methods are used, all wash water must be contained, captured, and disposed of appropriately. See BMP 3 for information on appropriate wet cleaning practices.	SC-34, SC-41, BG-30	x	x			x			
24	Protect waste storage and dumpster areas from contact with stormwater and non-stormwater flows onto the property.	Waste storage and dumpster areas shall be protected from contact with stormwater and non-stormwater flows. Waste storage lids shall be closed at all times. Dumpsters, compactors, or storage containers that leak shall be promptly repaired or replaced. Overhead structural cover of waste storage areas is recommended.	SC-34	x				x			

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted							
				Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
25	Cooking oil waste shall be managed to prevent illicit discharges.	Waste containers for fats, oils, and grease (FOG) shall be kept indoors where feasible. Where not feasible, the waste containers shall be kept in an area with secondary containment. FOG waste containers shall be maintained to prevent spills and discharges to the storm drain system. Documentation of this maintenance shall be available to City inspectors upon request.	SC-34, BG-30	x						x	
26	Manage animal waste and animal washing in a manner that prevents transport of pollutants.	Animals and animal waste shall be managed and stored in a manner that prevents waste and wash water from entering the storm drain system. Collect animal waste and dispose of it to the trash or sanitary sewer, as approved and appropriate.	SC-34, BG-10	x	x		x				

3.2 Residential

Table 2 below presents the minimum required BMPs for residential sites and sources. The City's BMP standards are based on the California Stormwater Quality Association (CASQA) BMP factsheets. City exceptions to the procedures described in the factsheets are identified in footnotes. Where any conflict may exist between CASQA factsheets and requirements in the Manual or the Municipal Code, the requirements of the Manual and the Municipal Code shall prevail. Complying with the BMPs described in the Manual does not ensure compliance with all other regulatory requirements, including requirements of other agencies. See Section 2 for more information about other potentially applicable requirements.

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Table 2. Minimum BMPs for Residential Sites/Sources[9]

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[10]	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
Discharge Control											
1	Eliminate illicit discharges to the storm drain system.	Do not allow any material (solid or liquid) or pollutant, except uncontaminated stormwater, to enter the City's storm drain system. Conditional exceptions apply, as described in Vista Municipal Code Chapter 13.18. Additional activity-specific BMPs related to illicit discharges are described in BMP No.'s 3 through 10 (below). Report any suspected or active illicit discharges to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-11, SC-44	x	x	x	x		x	x	x
2	Eliminate illicit connections to the storm drain system.	Illicit connections are any drain or connection that allows for an illegal discharge to enter the storm drain system. Find and abate all illicit connections to the storm drain system through properly approved procedures, permits, and protocols. Report any suspected or active illicit connections to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-11, SC-44	x	x	x	x		x	x	x

[9] To the extent practicable, the City's established minimum BMPs for industrial, commercial, municipal sites/sources shall also be implemented for any industrial/commercial type of activities conducted at a residence where appropriate.

[10] CASQA BMP factsheet references refer to factsheets included in the *Stormwater Best Management Practice Portal: Industrial and Commercial* (2015) since CASQA has not produced a residential BMP manual. BMPs for businesses are generally applicable to residential activities as well.

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[10]	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
3	Properly dispose of water used to clean outdoor areas.	All water used to clean outdoor areas (e.g., power washing) shall be contained, captured, and reused, or properly disposed of to the sanitary sewer, an appropriate waste hauler, or to landscaping or other pervious surfaces.	SC-10, SC-41[11], BG-62	x	x	x	x	x	x	x	x
4	Properly dispose of vehicle and equipment wash water.	Wash water from individual residential vehicle washing shall be prevented from discharging to the City's storm drain system, e.g., by directing wash water to landscaped areas or other pervious surfaces, where feasible. Where it is not feasible to prevent discharges to the City's storm drain system, use of water and detergents and other vehicle wash products must be minimized. Discharges to the City's storm drain system from non-commercial car washes, such as fundraisers and other similar activities, are prohibited. For questions, contact the Stormwater Division at (760) 643-2804.	SC-10, SC-21		x	x			x	x	x

[11] Factsheet SC-41 - Building & Grounds Maintenance, states (in regards to pressure washing), "If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff." Non-stormwater discharges of this nature, even if filtered, are not allowed to enter the storm drain system. Wash water must be contained, collected, and disposed of properly.

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[10]	Pollutants or Conditions Targeted							
				Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
5	Properly dispose of water from fire sprinkler maintenance activities.	Fire sprinkler system discharges shall be discharged to the sanitary sewer system when permitted by the City. For approval, contact the Engineering Department at (760) 639-6111. When not practicable or allowed to discharge to the sanitary sewer system due to the presence of prohibited contaminants, the water shall be collected and disposed of by an appropriately certified party. Fire sprinkler system discharges without corrosion inhibitors, fire suppressants, or antifreeze may be discharged to landscaping or other pervious surfaces. Fire sprinkler system discharges may be directed to the storm drain system if the following are implemented: (1) prior to entering the storm drain system, the discharge must be clear, odorless, and pH neutral, and (2) the flow path must be cleaned to ensure that pollutants such as trash and debris are not conveyed to the storm drain system. Discharges shall not result in erosion or in runoff to any adjacent property.	SC-10, SC-41		x	x			x		x
6	Eliminate irrigation runoff.	Irrigation runoff to the storm drain system shall be eliminated. For example, irrigation water and associated pollutants (e.g., sediment, fertilizer, pesticides) from landscape areas and gardens shall be prevented from reaching the storm drain system.	SC-10[12], SC-41	x		x	x				

[12] Factsheet SC-10 – Non-Stormwater Discharges states that "landscape irrigation drainage and landscape watering" may be discharged to the storm drain with conditions; however, in accordance with the MS4 Permit and the City's Stormwater Ordinance, no irrigation runoff may be discharged to the City's storm drain system.

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[10]	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
7	Properly dispose of discharges from swimming pools, spas, or water features.	Water from swimming pools, spas, and water features shall be properly disposed of to prevent pollutants from entering the storm drain system. Such discharges to the storm drain system are allowed only if the water is: 1) dechlorinated, 2) has a pH level in the 7-8 range, 3) is near or at ambient temperature, 4) does not have algae or suspended solids, and 5) is not saline. Other related discharges, such as from filter backwash or saline pools, are prohibited from entering the storm drain system. At the discretion of the City, discharges of saline water to the sanitary sewer system may be allowed. Contact the Engineering Department at (760) 639-6111 for approval.	SC-10, BG-63[13]			x					
8	Control air conditioning condensation discharges.	Air conditioning condensation shall be directed to landscaped areas or other pervious surfaces where feasible.	SC-10, SC-42			x			x		
9	Eliminate discharges from cleaning indoor areas.	Water used to clean indoor areas, such as during floor mopping or mat washing, shall not be discharged to the storm drain system. Indoor sinks or indoor floor drains may be utilized if they drain to the sanitary sewer system. Alternatively, such waste water may be suitable for collection, recovery, and discharge to landscape.	SC-10, SC-21, BG-30	x		x				x	x

[13] Exception to guidance in factsheet: Factsheet BG-63, Mobile Cleaning – Swimming Pools & Spas, states that discharges from swimming pools and spas to the storm drain system are not permitted; however, discharges of this nature are permitted if the conditions described in BMP 7 are met.

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[10]	Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
				Pollutants or Conditions Targeted							
10	Eliminate pumped groundwater, foundation, and footing drain discharges.	Unless approved by a National Pollutant Discharge Elimination System (NPDES) permit, or the RWQCB has determined in writing that no permit is needed, the following discharges are not allowed: 1) pumped groundwater, such as water from crawl space or sump pumps, 2) discharges from foundation and footing drains that are at or below groundwater elevation.	SC-10			x					
		BMP and Storm Drain Conveyance and Structure Maintenance									
11	Regularly inspect and maintain storm drain structures to retain designed functionality.	Storm drain conveyances and structures for which the property owner is responsible for maintenance shall be inspected, maintained, and cleaned to maintain design functionality. All structural BMPs (e.g., treatment and flow control facilities) shall be maintained in accordance with recorded maintenance agreements, and where applicable, structural BMPs shall demonstrate compliance with the City's certification program.	SC-44	x	x		x	x	x	x	x
		Erosion and Sediment Control									
12	Protect unpaved and landscaped areas from erosion.	Exposed soils that are eroding or are likely to erode shall be stabilized to prevent sediment from mobilizing in stormwater and entering the storm drain system. Mulch, vegetation, and other stabilization techniques for erosion and sediment control may be implemented. Significant accumulations of eroded soil shall be removed or contained to prevent discharge to the storm drain system.	SC-40, SC-42	x	x		x				
		Good Housekeeping									
13	Implement good housekeeping in outdoor areas.	Outdoor areas shall be inspected and cleaned as necessary to keep them free of trash, sediment, litter, and other debris. Additional attention shall be given to outdoor trash storage areas and and material storage locations.	SC-41	x	x			x			

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[10]	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
Pesticide and Fertilizer Management											
14	Properly manage pesticides and fertilizers.	Pesticides and fertilizers shall be used in strict accordance with manufacturer's labels, as authorized by the U.S. Environmental Protection Agency. See BMPs No.'s 16 and 17 for secondary containment and cover requirements. Waste products shall be disposed in accordance with the manufacturer's label and applicable hazardous waste regulations. The use of integrated pest management (IPM) principles is encouraged to reduce or eliminate use of chemicals. For more information about integrated pest management, see the University of California Statewide IPM Program at: http://www.ipm.ucdavis.edu	SC-35, SC-41, BG-40				x				x
Spill Prevention and Response											
15	Prevent or capture liquid leaks from vehicles or equipment.	Leaking vehicles or equipment shall be repaired promptly. Drip pans or other equivalent means shall be used to capture spills or leaks from vehicles and equipment. Captured fluids shall be disposed of in accordance with applicable hazardous materials regulations.	SC-11, SC-22						x	x	x
16	Immediately clean up spills.	Spills shall be cleaned up immediately and prevented from entering the storm drain system. Dry-cleaning methods of cleanup are recommended, such as the use of a broom, absorbent, or shop-vac. Consistent with BMP No. 1, uncontained spills must be reported to the City's Stormwater Hotline at (760) 643-2804.	SC-11						x	x	x

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[10]	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
17	Maintain readily accessible and appropriately supplied spill cleanup materials (or kit).	Spill cleanup materials and equipment shall be kept on-site and, appropriately supplied for the type and quantity of spills that may occur. One or more designated 'spill cleanup kits' are recommended. Spill cleanup materials shall be stored in close proximity to where a spill may occur.	SC-11, SC-22						x	x	x
Waste Management											
18	Keep waste storage and dumpster areas free of exposed trash, sediment, and debris.	Waste storage and dumpster areas shall be cleaned to keep them free of uncontained trash, debris, or other potential pollutants. Liquid waste, hazardous waste, medical waste, universal waste, and other items prohibited by current regulations shall not be placed in solid waste dumpsters. Dry-cleaning methods such as sweeping are preferred. If wet cleaning methods are used, all wash water must be contained, captured, and disposed of appropriately. See BMP 3 for information on appropriate wet cleaning practices.	SC-34, SC-41, BG-30	x	x			x			
19	Protect waste storage and dumpster areas from contact with stormwater and non-stormwater flows onto the property.	Waste storage and dumpster areas shall be protected from contact with stormwater and non-stormwater flows. Waste storage lids shall be closed at all times. Dumpsters, compactors, or storage containers that leak shall be promptly repaired or replaced. Overhead structural cover of waste storage areas is recommended.	SC-34	x				x			

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
No.	**BMP Title**	**BMP Description**	**CASQA BMP Factsheet Reference**[10]	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
20	Manage animal waste and animal washing in a manner that prevents transport of pollutants.	Animals and animal waste shall be managed and stored in a manner that prevents waste and wash water from entering the storm drain system. Collect animal waste and dispose of it to the trash or sanitary sewer, as approved and appropriate.	SC-34, BG-10	x	x		x				

3.3 Construction

Table 3 below presents the minimum BMPs required for construction sites within the City's jurisdiction. The City's BMP standards are based on the California Stormwater Quality Association (CASQA) BMP factsheets. Where any conflict may exist between CASQA factsheets and requirements in the Manual or the Municipal Code, the requirements of the Manual and the Municipal Code shall prevail. Complying with the BMPs described in the Manual does not ensure compliance with all other regulatory requirements, including requirements of other agencies. See Section 2 for more information about other potentially applicable requirements. Note that Table 3 must be used as directed in Section 3.3.1, which provides direction on the interpretation and use of Table 3.

Construction site BMPs are required to be implemented in an effective combination of BMPs that are site specific, construction phase appropriate, and seasonally appropriate. Dry Season (May 1 through September 30) BMP implementation must plan for and address rain events that may occur in the Dry Season. Non-stormwater discharges from construction sites into the City's storm drain system are prohibited year-round. City inspectors have the authority to require additional BMPs to prevent discharges of pollutants and to prevent non-stormwater discharges to the City's storm drain system from construction sites year round. Construction sites also must adhere to the requirements of all applicable additional SWRCB or RWQCB general or site specific NPDES permits for construction activities (see Section 2) at the time of construction.

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Table 3. Minimum BMPs for Construction Sites

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet No. Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet No. Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
X	n/a	n/a	Training	PP,SMWM EC,SE	n/a	G, V, F						
X	✓	EC-1	Scheduling	PP, EC,SE,SMWM	Sediment, Trash	G, V, F	P	S	S	S		
X[a]	✓	EC-2	Preservation of Existing Vegetation	PP,EC	Sediment	G, V, F	P					
X[a]	n/a	EC-3	Hydraulic Mulch	PP,EC, SMWM	Sediment	G, V	P			S		
X[a]	✓	EC-4	Hydroseeding	PP,EC	Sediment	G, V	P			S		
X[a]	n/a	EC-5	Soil Binders	PP,EC	Sediment	G, V	P			S		
X[a]	n/a	EC-6	Straw Mulch	PP,EC	Sediment	G, V	P			S		
X[a]	n/a	EC-7	Geotextiles and Mats	PP,EC	Sediment	G, V, F	P			S		
X[a]	n/a	EC-8	Wood Mulching	PP,EC	Sediment	G, V, F	P			S		
X[a]	✓	EC-9	Earth Dikes and Drainage Swales	PP,EC,RUROC	Sediment	G, V	P					
X[a]	✓	EC-10	Velocity Dissipation Devices	PP,EC,RUROC	Sediment	G, V, F	P					
X[a]	✓	EC-11	Slope Drains	PP,EC,RUROC	Sediment	G, V, F	P					
X[a]	✓	EC-12	Stream Bank Stabilization	PP,EC,SE,NS	Sediment	G, V, F	P	S			S	
X[a]	n/a	EC-14	Compost Blankets	PP,EC	Sediment	G, V, F	P					
X[a]	n/a	EC-15	Soil Preparation Roughening	PP, EC, SE	Sediment	G	P	S				

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A <u>GENERAL</u> GUIDANCE DOCUMENT AND IS <u>NOT</u> A SUBSTITUTION FOR SITE SPECIFIC BMP REQUIREMENTS. Construction sites that are subject to other SWRCB or RWQCB permits <u>must also</u> adhere to the BMP Requirements of the additional permits *Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions*												
A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet No. Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet No. Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
X[a]	n/a	EC-16	Non-Vegetative Stabilization	PP, EC, SE, RUROC	Sediment	G, V, F	P	S			S	
X[b]	n/a	SE-1	Silt Fence	PP, SE, RUROC	Sediment (coarse)	G, V, F		P				
X[b, c]	✓	SE-2	Sediment Basin	PP, SE, RUROC, APS	Sediment, Trash	G, V		P				
X[b, c]	✓	SE-3	Sediment Traps	PP, EC, RUROC, APS	Sediment, Trash	G, V		P				
X[b]	n/a	SE-4	Check Dam	PP, EC, RUROC	Sediment	G, V	S	P				
X[b]	n/a	SE-5	Fiber Rolls	PP, EC, SE, RUROC	Sediment	G, V	S	P				
X[b]	n/a	SE-6	Gravel Bag Berm	PP, EC, SE, RUROC	Sediment	G, V, F	S	P				
X[b]	n/a	SE-7	Street Sweeping and Vacuuming	PP, SE	Sediment, Trash, Oil & Grease, Bacteria	G, V		S	P			
X[b]	n/a	SE-8	Sandbag Barrier (note: gravel to be used)	PP, EC, RUROC	Sediment	G, V, F	S	P				
X[b]	n/a	SE-10	Storm Drain Inlet Protection	PP, SE, RUROC	Sediment, Trash, Oil And Grease, Bacteria	G, V, F		P				
d	✓	SE-11	Active Treatment Systems	PP, APS	Sediment	G	P					

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet No. Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet No. Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
e	n/a	SE-12	Manufactured Linear Sediment Controls	PP, SE, RUROC	Sediment, Trash	G, V	S	P				P
e	n/a	SE-13	Compost Socks and Berms	PP, EC, SE, RUROC	Sediment, Metals, Bacteria, Oil & Grease	G, V	S	P				
e	n/a	SE-14	Bio Filter Bags	PP, SE, RUROC	Sediment	G, V, F		P				
X	n/a	WE-1	Wind Erosion Control	PP, SMWM, SE	Sediment	G, V		S		P		
X	n/a	TC-1	Stabilized Construction Entrance/Exit	PP, SMWM, EC, SE, RUROC	Sediment	G, V	S	S	P			
X	n/a	TC-2	Stabilized Construction Roadway	PP, SMWM, EC, SE, RUROC	Sediment	G, V	S	S	P			
X	n/a	TC-3	Tire Wash	PP, SMWM, SE	Sediment	G, V		S	P			
X	✓	NS-1	Water Conservation Practices	PP, SMWM, SE, NS	Sediment, Nutrients, Bacteria	G, V, F	S	S			P	
f	✓	NS-2	Dewatering Operations	PP, SMWM, SE, NS	Sediment, Oil & Grease	G		S			P	
X	n/a	NS-3	Paving and Grinding Operations	PP, SMWM, NS	Sediment, Oil & Grease	G, V, F					P	S

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet No. Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet No. Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
f	✓	NS-4	Temporary Stream Crossing	PP, EC, SE NS	Sediment	G, V	S	S	S		P	
f	✓	NS-5	Clear Water Diversion	PP, NS	Sediment	G					P	
X	✓	NS-6	Illicit Connection/ Discharge	SMWM, NS	Sediment, Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V, F					P	
X	✓	NS-7	Potable Water/Irrigation	SMWM, NS	Sediment, Nutrients, Metals, Organics,Bacteria	G, V, F					P	
X	n/a	NS-8	Vehicle and Equipment Cleaning	PP, SMWM, NS	Sediment, Nutrients, Oil & Grease, Organics	G, V, F					P	
X	n/a	NS-9	Vehicle and Equipment Fueling	PP, SMWM, NS	Oil & Grease	G, V, F					P	
X	n/a	NS-10	Vehicle and Equipment Maintenance	PP, SMWM, NS	Nutrients, Trash Oil & Grease, Organics	G, V, F					P	
f	n/a	NS-11	Pile Driving Operations	PP, SMWM, NS	Sediment, Oil & Grease	G, V					P	

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet No. Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet No. Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
X	n/a	NS-12	Concrete Curing	PP, SMWM, NS	Sediment, Metals, Oil & Grease	G, V, F					P	P
X	n/a	NS-13	Concrete Finishing	PP, SMWM, NS	Sediment, Metals, Oil & Grease	G, V, F					P	P
f	✓	NS-14	Material Over Water	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V, F					P	P
f	✓	NS-15	Demolition Adjacent to Water	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V						P
f	✓	NS-16	Temporary Batch Plants	PP, SMWM, NS	Sediment, Trash, Metals	G						P
X	n/a	WM-1	Material Delivery & Storage	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P
X	n/a	WM-2	Material Use	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	**Other Permits Potentially Required**	**CASQA BMP Factsheet No.**	**CASQA BMP Factsheet Name**	**MS4 Permit Compliance Category**	**CASQA BMP Factsheet No. Targeted Pollutants**	**On-Site or Off-site Work: Construction Phase**	**CASQA BMP Factsheet No. Categories & Objectives (P = Primary S= Secondary)[1]**					
							Effective Combination Required		**TC**	**WE**	**NS**	**WM**
							EC	**SE**				
X	n/a	WM-3	Stockpile Management	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F	S	S				P
X	n/a	WM-4	Spill Prevention & Control	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P
X	n/a	WM-5	Solid Waste Management	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P
X	✓	WM-6	Hazardous Waste Management	PP, SMWM, NS	Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V, F						P
f	✓	WM-7	Contaminated Soil Management	PP, SMWM, NS	Nutrients, Trash, Metals, Oil & Grease, Organics	G						P
X	n/a	WM-8	Concrete Waste Management	PP, SMWM, NS	Sediment, Metals, Trash	G, V, F					S	P

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A <u>GENERAL</u> GUIDANCE DOCUMENT AND IS <u>NOT</u> A SUBSTITUTION FOR SITE SPECIFIC BMP REQUIREMENTS. Construction sites that are subject to other SWRCB or RWQCB permits <u>must also</u> adhere to the BMP Requirements of the additional permits *Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions*												
A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet No. Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet No. Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
X	✓	WM-9	Sanitary/ Septic Waste Management	PP, SMWM, NS	Nutrients, Trash, Bacteria, Organics	G, V, F						P
X	✓	WM-10	Liquid Waste Management	PP, SMWM, NS	Sediment, Metals, Nutrients, Trash, Metals, Oil & Grease	G, V						P

Note: Table 3 must be used as directed in Section 3.3.1, Use and Guidance for Table 3.

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3.3.1 Use and Guidance for Table 3

The following discussion provides additional guidance on the application of Table 3 to construction projects, including definitions of acronyms and abbreviations used. The guidance below is organized by table column, beginning with Column A.

Column A:

This column identifies required BMPs. BMPs with an "X" are required when applicable. BMPs are required for each phase of construction on site or offsite regardless of size. Projects are required to schedule in advance which BMPs may be applicable to each phase of construction (construction phases are defined in the notes on Column G below). Footnotes "a" and "b", which are included for some required BMPs, are defined below.

a. An appropriate BMP, or combination of BMPs, by construction phase for erosion control must be selected. Typically not every erosion control BMP listed in Table 3 will be required to meet this standard. The appropriate and effective BMP selection is based on site specific characteristics, construction phase, and as listed factsheet constraints such as slope, site size or drainage area, and soils. All applicable design requirements must be met. Project owners/operators are required to adjust the BMP selection by scheduling necessary BMPs onsite for each construction phase and season to prevent pollutant discharge to the Storm Drain System. The City may require additional submittals of BMP plans prior to releasing permits for additional construction phases.
b. An appropriate BMP, or combination of BMPs, by construction phase for sediment control must be selected. Typically not every sediment control BMP listed in Table 3 will be required to meet this standard. The appropriate and effective BMP selection is based on site specific characteristics, construction phase, and as listed factsheet constraints such as slope, site size or drainage area, and soils. All applicable design requirements must be met. Project owners/operators are required to adjust the BMP selection by scheduling necessary BMPs onsite for each construction phase and season to prevent pollutant discharge to the Storm Drain System. The City may require additional submittals of BMP plans prior to releasing permits for additional construction phases.
c. Sediment Basins and Sediment Traps must be designed in accordance with the most current CASQA and City design requirements. Design must be conducted by a licensed CA professional engineer (PE). Maintenance, stabilization of slopes during construction, safety requirements, and Vector Control must be addressed in the design. Planned or future discharge or outlets must be approved by the City prior to installation.

Other BMPs that may also be required in some cases are identified using the following identifiers in column A.

d. Active Treatment Systems (ATS) may be required for Risk Level 3 Construction General Permit projects, as necessary to meet Construction General Permit requirements. The City at its discretion and based on project location, violation history, or other criteria may require ATS for projects of any Risk Level or for projects under 1 acre.
e. These BMPs may be used as part of the project's system of sediment control BMPs (described in note "b" above) if approved by City staff.
f. This BMP may require securing additional regulatory permits prior to implementing. Permits must be on site prior to implementing these BMPs, including work in drainage channels.

Column B:

This column identifies BMPs that address situations that may also require permits or approvals from other agencies or other departments or divisions within the City (see Section 2). The project owner is responsible for determining which, if any, additional permit are necessary and securing the required permits prior to starting work. Acquisition of these permits may require additional time and engineering reports or submittals. The project owner is also responsible for maintaining compliance with the permits over the duration of the project, including completing any required monitoring and reporting.

A check mark (✓) in column B indicates that a permit or approval from another agency or another department or division within the City may be required. An "n/a" means that additional permits or approvals are typically not required. However, it is possible that in specific circumstances additional permits could also be required even for the BMPs marked as "n/a." An "n/a" does not guarantee that no other permit or approval is required.

Columns C and D:

These columns present the California Stormwater Quality Association (CASQA) identification code and title for each factsheet. Unless specified differently in the Manual or the Municipal Code, the City of Vista standard for BMP installation, use, location, and maintenance schedule is CASQA. BMP codes incorporate two letter abbreviations by BMP type, as follows: EC = Erosion Control; SE = Sediment Control; TC = Tracking Control; WE= Wind Erosion; NS = Non Stormwater Controls; WM = Waste Management. For more information see the CASQA website, www.casqa.org. Note that a subscription is required to view the CASQA factsheets, and the City of Vista does not provide subscription access.

Column E:

This column identifies which of the construction BMP categories listed in MS4 Permit Section E.4 are addressed by each CASQA factsheet. The MS4 Permit BMP categories are abbreviated as follows: PP = Project Planning; SMWM = Site Management, Housekeeping, Waste Management; NS = Non-Stormwater Management; EC= Erosion Control; SE = Sediment Control; RUROC: Run-on and Runoff Control; APS = Active/Passive Sediment Treatment Systems.

Column F:

This column identifies the pollutant(s) likely to be reduced by implementing each BMP. Pollutants addressed are a combination of designations by the CASQA factsheets and other studies identifying the effect of BMPs.

Column G:

This column identifies the construction phases during which a BMP is most likely to be applicable. Construction phases are defined as follows:

- **Grading ("G")**: Demolition, ROW Work, Site Preparation and Earthmoving, Earthwork, Construction or Relocation of Above Ground and Below Ground Structures and Utilities, channels, dewatering, hydrostatic testing of utilities and fire systems
- **Vertical ("V"):** Construction of Above Ground Structures to area 5 feet from Structures, Stucco, Framing, Mechanical, Roof, Painting, drain flushing, fire system testing (hydrants, sprinklers)
- **Finish ("F"):** Roadways, Slurry Seal, Asphalt, Concrete, Walkways, Parking Lots, Landscaping, Painting, Striping, Traffic/Lighting Facilities, Architectural

Column H:

This column identifies the objectives CASQA has defined for each BMP. While the primary objective is typically identified by the two digit letter code at the beginning of the BMP factsheet number (see notes on Column E above), many BMPs also provide additional secondary benefits. A "P" indicates a primary objective, and an "S" indicates a secondary objective. The CASQA objective abbreviations and their definitions are as follows: EC = Erosion Control; SE = Sediment Control; TC = Tracking Control; WE= Wind Erosion; NS = Non Stormwater Controls; WM = Waste Management.

3.4 BMP Requirements for Development Projects

The City's BMP requirements for new and re-development projects are presented in the Standard Urban Stormwater Mitigation Plan (SUSMP), which is included as Attachment A. These BMPs include, but are not limited to, site design, source control, and post-construction structural BMPs (e.g., flow control or treatment control devices).

3.4.1 Notice of Upcoming Changes to Requirements

By 2016, the City anticipates adopting updated BMP requirements for new and re-development projects that will be consistent with the MS4 Permit adopted in 2013. The updated requirements and associated guidance document (referred to as the "BMP Design Manual" in the MS4 Permit) are being prepared cooperatively with staff from multiple San Diego County municipalities and other interested parties. The City will be publishing notices and informing the development community of these new requirements as they near coming into effect. Project proponents that anticipate acquiring City approvals for construction toward the end of 2015, or initiating construction near then, are advised to contact the City Engineering Department to evaluate applicability of the new requirements.

Attachment A

Standard Urban Stormwater Mitigation Plan

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LIST OF APPENDICES AND ATTACHMENTS FOR CHAPTER 4

CHAPTER 4 – APPENDIX A: SAN LUIS REY WATERSHED MONITORING AND ASSESSMENT PLAN

SAN LUIS REY WATERSHED MONITORING AND ASSESSMENT PLAN

Prepared For:
San Luis Rey Watershed
Participating Agencies

Prepared By:
AMEC Environment and Infrastructure, Inc.
9177 Sky Park Court
San Diego, California 92123
February 20, 2015

Updated By:
Larry Walker Associates
September 24, 2015

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4. Water Quality Improvement Plan Monitoring and Assessment Program

This appendix describes the Monitoring and Assessment Program for the San Luis Rey Watershed. The Participating Agencies in the watershed have developed an integrated Monitoring and Assessment Program to:

1) Measure the progress toward addressing the Highest Priority Water Quality Condition established in Chapter 2;
2) Assess the progress toward achieving the goals, strategies, and schedules provided in Chapter 3; and
3) Evaluate each Participating Agency's overall efforts to implement the Water Quality Improvement Plan (Plan).

The Permit supports an outcome-based approach through the Plan. Monitoring data collection and assessment provides the vehicle for determining whether intended outcomes are being realized or if adaptations of Participating Agencies' programs are necessary. Collection and assessment of monitoring data will guide future implementation of the Participating Agencies' management actions as part of the Plan implementation and adaptive management process. Monitoring during wet and dry weather is conducted to collect observational and analytical data from storm drain outfalls and the receiving water. The data are utilized to help Participating Agencies determine whether discharges from storm drain outfalls are influencing receiving water quality, and if so, whether storm drain discharges are improving or degrading receiving water conditions over time. Participating Agencies assess the data in combination with their management actions to determine what actions are improving the quality of storm drain outfall discharges and receiving water conditions and where additional actions are necessary.

This appendix provides an overview of the two main components: (1) Monitoring, and (2) Assessment. As stated in Provision D of Order R9-2013-0001(Permit):

> *"The purpose of this provision is for the Participating Agency to monitor and assess the impact on the conditions of receiving waters caused by discharges from the Participating Agency's MS4s under wet weather and dry weather conditions. The goal of the Monitoring and Assessment Program is to inform the Participating Agency about the nexus between the health of receiving waters and the water quality condition of the discharges from their MS4s. This goal will be accomplished through monitoring and assessing the conditions of the receiving waters, discharges from the storm drains, pollutant sources, and/or stressors, and effectiveness of the water quality improvement strategies implemented as part of the Water Quality Improvement Plans."*

Monitoring includes sampling, inspection, and data collection at beaches, creeks, lakes, estuaries, and storm drain outfalls to observe conditions, improve understanding, and inform the management within the watershed to improve water quality conditions.

The program incorporates monitoring to assess progress toward addressing the Highest Priority Water Quality Condition per the requirements of Permit Provision B.4. It also includes the compliance monitoring requirements of Permit Provision D, Illicit Discharge Detection and Elimination (IDDE) requirements of Permit Provision E.2, and Total Maximum Daily Load (TMDL) monitoring and assessment requirements provided in Permit Attachment E. Assessment under this program includes annual review of the monitoring data along with a comprehensive analysis of the data at the end of the Permit term.

4.1 Water Quality Improvement Plan Monitoring Program

The Monitoring Program includes five major components:

1) Monitoring to assess goals and schedules;
2) Receiving water monitoring program that measures the long-term health of the watershed during dry and wet weather conditions;
3) Storm drain outfall monitoring program that investigates the elimination of illicit dry weather flows from storm drain outfalls and the improvement in quality of the discharges from storm drains during wet weather;
4) Special studies that look further into the Highest Priority Water Quality Condition presented in Chapter 2 of the Plan, and
5) Complementary Illicit Discharge Detection and Elimination investigations and inspections of potential pollutant sources that are implemented under the Jurisdictional Runoff Management Programs.

Wet Weather is defined as a storm event of >0.1 inch of rainfall and the following 72 hours after the end of rainfall.

Dry Weather is defined as all days where the preceding 72 hours has been without measurable precipitation (>0.1 inch)

Table 4A-1 presents an overview of the planned monitoring activities for the watershed. The overview includes monitoring programs, conditions, monitoring elements, and the implementation schedule for each program during this Permit term. In Chapter 2, bacteria was identified as the Highest Priority Water Quality Condition for the watershed. As reflected in **Table 4A-1**, monitoring is being conducted to characterize bacteria levels in the discharges from storm drain outfalls, identify potential sources of bacteria, and assess the effectiveness of strategies designed to address bacteria. Additionally, these programs will generate data to track priority water quality conditions and general health and conditions within the watershed. This section provides an overview of each of the monitoring programs.

Table 4A-1. Elements of Water Quality Improvement Plan Monitoring

Monitoring Programs			Condition	Monitoring Element	Permit Schedule [a] 2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Monitoring to Assess Goals and Schedules			Dry and Wet	Varies by goal and jurisdiction	–	–	•	•	•
Receiving Water Monitoring	Long-Term Receiving Water Monitoring		Dry	Conventionals, bacteria, nutrients, metals, pesticides, toxicity (chronic), possible TIE/TREs, visual observations, field measurements	–	• [b]	–	–	–
				Hydromodification (channel conditions, discharge points, habitat integrity, evidence and estimate of erosion and habitat impacts)	–	• [b]	–	–	–
				Bioassessment (BMI taxonomy, algae taxonomy, physical habitat characteristics)	–	• [b]	–	–	–
			Wet	Conventionals, bacteria, nutrients, metals, pesticides, toxicity (chronic), possible TIE/TREs, field measurements	–	• [b]	–	–	–
	Regional Monitoring Participation	Bight	Dry	Chemistry, toxicity, benthic infauna	•	•	–	–	• [c]
		SMC	Dry	Bioassessment	•	•	•	•	•
Water Monitoring	Regional Monitoring Participation (continued)	2011 Hydromodification Monitoring Program (HMP)	Wet	Channel assessments; flow monitoring; sediment transport monitoring	•	•	•	–	–

Monitoring Programs			Condition	Monitoring Element	Permit Schedule [a] 2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
	TMDL Monitoring	Bacteria TMDL for Pacific shoreline at San Luis Rey River	Dry	Bacteria	•	•	•	•	•
	TMDL Monitoring	Bacteria TMDL for Pacific shoreline at San Luis Rey River	Wet	Bacteria	•	•	•	•	•
Storm Drain Monitoring	Storm Drain Field Screening		Dry	Visual: flow condition, presence and assessment of trash in and around the station, IC/IDs, descriptions	•	•	•	•	•
Storm Drain Monitoring	Storm Drain Outfall		Dry	Field parameters, conventionals, bacteria, nutrients, metals	-	-	•	•	•
Storm Drain Monitoring	Storm Drain Outfall		Wet	Field parameters, conventionals, bacteria, nutrients, metals	•	•	•	•	•
Special Studies	San Diego Regional Reference Streams and Beaches		Dry	Field parameters, conventionals, bacteria instantaneous flow	2012-2014	•	–	–	–
Special Studies	San Diego Regional Reference Streams and Beaches		Dry	Streams only: nutrients, metals, bioassessment, including physical habitat and chlorophyll a	2012-2014	–	–	–	–
Special Studies (continued)	San Diego Regional Reference Streams and Beaches (continued)		Wet	Field parameters, conventionals, bacteria	2012-2014	•	–	–	–
Special Studies (continued)	San Diego Regional Reference Streams and Beaches (continued)		Wet	Streams only: nutrients, metals, toxicity, flow and precipitation (duration of storm)	2012-2014	•	–	–	–

	Monitoring Programs	Condition	Monitoring Element	Permit Schedule [a]				
				2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
	San Luis Rey River Microbial Source Tracking Study	Dry	GIS analysis, visual surveys, flow monitoring, bacteria, chemistry, host-specific MST markers, source investigations using CCTV, dye testing, smoke testing	–	–	–	●	●
IDDE Program	Illicit Discharge Detection and Elimination Program	Dry	Visual surveys, field parameter testing, analytical testing and follow up investigations, if warranted	–	–	●	●	●

BMI=Benthic macroinvertebrates; CCTV = closed-circuit television; IC/ID = illicit connection and/or illicit discharge; NA = not applicable; bacteria = fecal indicator; SMC = Southern California Stormwater Monitoring Coalition; Bight = Southern California Bight Regional Monitoring Program; TIE=Toxicity Identification Evaluation; TRE=Toxicity Reduction Evaluation
a. The Permit was adopted on May 8, 2013; the Permit became effective on June 27, 2013.
b. Completed under the Transitional Monitoring Program according to Permit Provisions D.1.a and D.2.a.
c. The 2018 Southern California Bight Regional Monitoring will occur during the summer of 2018 or 2019.

4.1.1 *Monitoring to Assess Progress Toward Achieving Goals and Schedules*

This section summarizes monitoring and assesses progress toward achieving goals related to the Highest Priority Water Quality Condition, which is bacteria for the Lower San Luis Rey River Watershed, as described in Chapters 2 and 3. As outlined in Section 3.1, watershed goals for the San Luis Rey River mouth are presented for the San Luis Rey River mouth and for the Lower San Luis Rey River.

4.1.1.1 *Watershed Goals for the San Luis Rey River Mouth*

The watershed goals at the River mouth are based on the multiple compliance pathways set forth for the Bacteria TMDL (see Attachment E.6 of the Permit). Compliance with the TMDL may be demonstrated via one of the compliance pathways identified in the Permit. The proposed compliance dates for both the TMDL's interim goals and final goals are set outside of this Permit cycle, as described in Chapter 3. **Table 4A-2** presents the TMDL related goals for the current permit term and for the interim TMDL targets and the monitoring that may be used to track progress toward achieving the goals.

Table 4A-2. Monitoring Related to Permit Term and Interim Bacteria TMDL Goals

<table>
<tr><th colspan="2" rowspan="2">Compliance Pathway</th><th colspan="2">Dry Weather</th><th colspan="2">Wet Weather</th><th rowspan="2">Monitoring Elements</th></tr>
<tr><th>1st Permit Term (2013-2018)</th><th>Interim (April 4, 2020 [a])</th><th>1st Permit Term (2013-2018)</th><th>Interim (April 4, 2028 [a])</th></tr>
<tr><td>1
OR</td><td>No Discharge from Storm Drain Outfall(s)</td><td>Flow eliminated from 25% of outfalls or cumulative flow from storm drain outfalls reduced by 25%.</td><td>Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50%.</td><td>Flow eliminated from 10% of outfalls or cumulative flow from storm drain outfalls reduced by 10%.</td><td>Flow eliminated from 50% of outfalls or cumulative flow from storm drain outfalls reduced by 50%.</td><td>Visual observation or measurements of flow from storm drain outfalls to receiving waters as described in Section 4.1.3 Storm Drain Monitoring Program.</td></tr>
<tr><td>2
OR</td><td>Meet TMDL Limits in Receiving Water</td><td>None</td><td rowspan="2">Bacteria concentrations at the compliance point identified in the Monitoring and Assessment Plan are below the applicable WQO (e.g., 400 mpn/100mL single sample maximum for Fecal Coliform)[j] or TMDL allowed exceedance percentage [b] of 4.7% for Total Coliform; 4% for Fecal Coliform; 16% for Enterococcus</td><td rowspan="2">None</td><td rowspan="2">Bacteria concentrations are below the applicable WQO (e.g., 400 mpn/100mL single sample maximum for Fecal Coliform) or TMDL allowed exceedance percentage [c] of 45% for Total Coliform; 44% for Fecal Coliform; 47% for Enterococcus</td><td rowspan="2">Bacteria data collected at compliance points as described in Section 4.1.2.4 Bacteria TMDL monitoring Program and/or data collected from storm drain outfalls as described in Section 4.1.3 Storm Drain Monitoring Program, as applicable</td></tr>
<tr><td>3
OR</td><td>Storm Drain Discharge Meets TMDL Limits</td><td>None</td></tr>
<tr><td>4
OR</td><td>Load Reductions in Discharges from Storm Drain Outfalls</td><td>Loads [d] are reduced by 9.5% for Total Coliform; 9.8% for Fecal Coliform; 21.8% for Enterococcus from MS4 outfalls</td><td>Loads [e] are reduced by 19.07% for Total Coliform (TC), 19.55% for Fecal Coliform (FC), 43.69% for Enterococcus (Ent) from the MS4 outfalls</td><td>Loads [f] are reduced by 0.70% for Total Coliform; 0.39% for Fecal Coliform; 1.5% for Enterococcus from MS4 outfalls</td><td>Loads [g] are reduced by 2.81% for Total Coliform; 1.56% for Fecal Coliform; 5.85% for Enterococcus from MS4 outfalls</td><td>Bacteria and flow data collected at storm drain outfalls as described in as described in Section 4.1.3 Storm Drain Monitoring Program.</td></tr>
<tr><td>5
OR</td><td>Exceedance due to Natural Sources</td><td>Number of storm drain outfalls with human fecal markers detected are reduced by 25%</td><td>Number of storm drain outfalls with anthropogenic fecal markers detected are reduced by 50%</td><td>Number of storm drain outfalls with human fecal markers detected are reduced by 10%</td><td>Number of storm drain outfalls with anthropogenic fecal markers detected are reduced by 50%</td><td>Data from Storm Drain Outfall Monitoring as described in Section 4.1.3, Special Studies as described in Section 4.1.4, and IDDE related data as described in Section 4.1.5.</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">Compliance Pathway</th><th colspan="2">Dry Weather</th><th colspan="2">Wet Weather</th><th rowspan="2">Monitoring Elements</th></tr>
<tr><th>1st Permit Term (2013-2018)</th><th>Interim (April 4, 2020 [a])</th><th>1st Permit Term (2013-2018)</th><th>Interim (April 4, 2028 [a])</th></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Water Quality Improvement Plan[h]</td><td colspan="4">Submit and fully implement WQIP, accepted by the San Diego Water Board, which provides reasonable assurance that interim TMDL compliance requirements will be achieved by the interim compliance dates</td><td rowspan="3">Data from monitoring and Jurisdictional Runoff Management Programs</td></tr>
<tr><td rowspan="2">Reduce by 20% the aggregate flow or the number of persistently flowing outfalls.</td><td rowspan="2">Reduce by 75% the aggregate flow or the number of persistently flowing outfalls.</td><td>Implement programmatic (non-structural) BMPs to achieve source reduction of bacteria loads from the storm drain outfalls.</td><td>Reduce bacteria loads by an additional 4% (total 6%) from the storm drain outfalls by continued implementation of programmatic BMPs.</td></tr>
<tr><td>Reduce by 0.3% the baseline bacteria loads from distributed BMPs constructed between 2003 and 2009 during redevelopment.</td><td>Reduce bacteria loads by an additional 0.6% (total 1.4%) through additional participation in the public private partnership program and reduction through BMPs required through redevelopment (3.2 %); Continue planning & permitting for long-term structural BMPs[i].</td></tr>
</table>

a. Request moving Interim TMDL Compliance Date from April 4, 2017 (per Attachment E, 6.c(1)) to April 4, 2020 to allow adequate time to investigate and mitigate bacteria sources, and monitor progress and adjust implementation through the adaptive management process.
b. Interim dry weather Allowable Exceedance Percentages were calculated based on half the value of the existing 30-day Geometric Mean of exceedance percentages based on beach sample data from 2004 through 2010: ; Annual Bacteria TMDL Monitoring Report is included in Appendix I of the Transitional Monitoring and Assessment Report for the San Luis Rey River Watershed Management Area (2012-2014). From this report, the San Luis Rey River watershed compliance reduction milestones/existing and interim and final exceedance frequencies are provided in Table 1–2 on page 1 – 8 (specifically, footnote "a" under the table). The interim and existing exceedance frequency calculation methodology is summarized in section 2.4 on page 2-6 of the document.
c. Interim wet weather Allowable Exceedance Percentages are from Tables 6.5 of Attachment E to Order No.R9-2013-0001.
d. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 43.69%.
e. Values taken from Table 6.3 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* was the highest reduction at 87.38%.
f. Values calculated as half of the 2nd Permit Term goals, which are equal to half of the interim goals.
g. Values taken from Table 6.6 of Attachment E to Order R9-2013-0001: Anticipated load reductions for WQIP strategies were modeled using Fecal Coliform (FC) as a surrogate for all Fecal Indicator Bacteria as noted in WQIP Appendices 3C and 3F, therefore target FC load reductions were set according to the largest required indicator bacteria reduction (among TC, FC and *Ent*) to be conservative; *Enterococcus* is the controlling indicator.
h. To meet the final wet weather target load reduction of 11.69% for Fecal Coliform, the County through quantitative modeling has demonstrated a 10% reduction from programmatic BMPs and a 1.7% reduction from structural BMPs. Progress will be monitored and adjustments through adaptive management will be used to update the plan.
i. The County of San Diego is concerned that a long-term funding source is not identified for constructing and maintaining structural BMPs, if structural BMPs are needed to meet compliance. The implementation of strategies to achieve goals will depend upon approval of funding in future annual budgets.

4.1.1.2 *WATERSHED GOALS FOR THE LOWER SAN LUIS REY RIVER*

Participating Agencies have also established wet and dry weather goals for bacteria, the HPWQC, in the Lower San Luis Rey River. Goals were established for the 2013-2018 Permit term to demonstrate improvement in water quality in the Lower San Luis Rey River, indicative of progress towards compliance with the TMDL requirements. Under dry conditions, the goals address a reduction in anthropogenic dry weather flow in storm drain outfalls. Wet weather goals for the Lower San Luis Rey River are aimed at reducing bacteria loading at key outfalls consistent with TMDL load reduction options at storm drain outfalls. **Table 4A-3** summarizes the goals for the Permit term and data that will be collected to assess these goals. Details related to the goals are provided in Chapter 3.

Table 4A-3. Monitoring Related to Watershed Goals for the Lower San Luis Rey River [a]

Jurisdiction	Condition	First Permit Term Numeric Goals 2013-2018 (Chapter 3)	Assessment Metric	Monitoring Elements
City of Oceanside, City of Vista, County of San Diego	Dry Weather	Effectively eliminate flow from 20% of persistently flowing outfalls.	Presence/absence of dry weather flow at persistent flowing outfalls [b]	Flow data collected during Dry Weather Storm Drain Outfall Monitoring per Provision D.2.
		Reduce by 20% the aggregate flow from persistently flowing outfalls.	Dry weather flow at persistent flowing outfalls [b]	
	Wet Weather	Identify five key drainage areas [c] with the Lower SLR River HA; develop baseline loading estimates at these five outfalls.	Develop baseline used to estimate bacteria load reductions at storm drain outfalls.	Combination of bacteria and flow data from the transitional wet weather outfall monitoring program [d], historical storm drain monitoring, and/or Storm Drain Outfall Monitoring per Provision D.2.

a. West of Interstate 15

b. Flow is defined as all dry weather flows except groundwater and other exempt or permitted non-stormwater flows.

c. Key drainage areas may be identified based on factors such as loading estimates, microbial source tracking data, source identification, size of pipe, proximity to receiving water, or other appropriate methods.

d. *Transitional Monitoring and Assessment Program Report for the San Luis Rey River Watershed Management Area (2012 – 2014). Appendix K - Five-Year Assessment of Random and Targeted MS4 Outfall Discharge Data Collected under NPDES Permit Order No. R9-2007-0001 in San Diego County Watersheds.* 2015. Prepared for the County of San Diego City of Oceanside and City of Vista by Weston Solutions Inc. http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=44&Itemid=34

4.1.2 *Receiving Water Monitoring*

The purpose of the receiving water monitoring program is to characterize trends in the chemical, physical, and biological conditions of a receiving water to determine whether beneficial uses are protected, maintained, or enhanced. Additionally, the receiving water monitoring component helps inform the Participating Agencies of the nexus between the health of receiving waters and the quality of discharges from their stormwater outfall. This program is designed to meet the requirements set forth in Provision D.1 of the Permit. Long-term monitoring occurs during both wet and dry weather conditions for water quality, along with physical and biological integrity. Sediment quality monitoring, if appropriate, and participation in regional monitoring occur as well. Attachment E of the Permit stipulates how TMDL monitoring requirements are to be incorporated into the receiving water monitoring program. Receiving water monitoring comprises the following programs:

- Long-term receiving water monitoring
- Regional monitoring participation
- Toxicity identification evaluation/toxicity reduction evaluation, if appropriate
- Sediment quality monitoring, if appropriate
- TMDL monitoring

The receiving water programs are designed to answer one or more of the following questions:

- Are conditions in the receiving water protective, or likely protective, of beneficial uses?
- What are the extent and magnitude of the current or potential receiving water problems?
- Are the conditions in the receiving water getting better or worse?

4.1.2.1 *Long-Term Receiving Water Monitoring*

Long-term receiving water monitoring will track the overall health of the receiving waters. Dry and wet weather monitoring will continue at the historical mass loading station (SLR-MLS) located on the San Luis Rey River. Participating Agencies have monitored SLR-MLS since 2001 to meet the requirements of previous permits and this site is co-located with the United States Geological Survey (USGS) monitoring station. This mass loading station is at the end of the watershed and captures water draining the majority of the watershed. The mass loading station location is listed in **Table 4A-4**.

Table 4A-4. San Luis Rey Watershed Long-term Receiving Water Station

Station ID	Latitude	Longitude	Cross Street Description	Channel Type	Jurisdiction
SLR-MLS	33.2206476	-117.35825	Benet Road Bridge over San Luis Rey River	Natural Channel	City of Oceanside

Source: Transitional Receiving Water Monitoring Plan (Weston, 2014a)

This site will be monitored three times during dry weather and three times during wet weather per Permit cycle. This monitoring program is designed to monitor the Highest Priority Water Quality Conditions in the receiving water, along with a comprehensive list of constituents based on the Clean Water Act Section 303(d) List (303(d) List) impairments, Comprehensive Load Reduction Plan, non-stormwater action levels (NALs) or stormwater action levels (SALs), and Table D-3 of the Permit. During both dry and wet weather, water samples will be analyzed for constituents as shown in **Table 4A-1**. Toxicity identification evaluations (TIEs), if necessary, will be conducted in compliance with Provisions D.1.c.(4)(f) and D.1.d.(4) of the Permit and used to determine the causative agent(s) of toxicity. Once per term during dry weather, a bioassessment will be conducted to evaluate chemical, physical, and biological data, and hydromodification monitoring will record the stream conditions, habitat integrity, and impacts. The Receiving Water Monitoring Plan describes detailed monitoring methods and procedures. These methods and procedures may be modified on the basis of site-specific environmental conditions and updated analytical methodologies.

The 2013 and 2014 Transitional Monitoring Programs satisfied long-term receiving water monitoring requirements, including dry and wet weather water quality sampling, bioassessments, and hydromodification monitoring for this Permit term. Detailed proposed monitoring methods and procedures are presented in the Receiving Water Monitoring Plan as Attachment 4A-1. These methods and procedures may be modified on the basis of site-specific environmental conditions and updated analytical methodologies.

4.1.2.2 Regional Monitoring Participation

Regional monitoring includes separate studies that will evaluate various aspects of receiving water health on a regional scale. Participating Agencies will participate in the following regional programs to meet the requirements of Permit Provision D.1.e (1).

Bight Regional Monitoring

The Bight regional monitoring program is a multi-agency collaborative effort to assess the ecological condition of the Southern California Bight from a regional perspective. The core program consists of monitoring of sediment chemistry, sediment toxicity, and benthic infauna. The goals of past Bight programs are to answer three primary questions:

- What are the extent and magnitude of direct impact from sediment contaminants?
- How do the extent and magnitude of the environmental impact vary by habitat?

- What is the trend in extent and magnitude of direct impacts from sediment contaminants?

The Regional Harbor Monitoring Program (RHMP) was conducted under the Bight program to characterize the sediment quality. Program locations included Oceanside Harbor, Mission Bay, and San Diego Bay. Oceanside Harbor is not hydraulically connected to the watershed and therefore this program will not be described in detail in the Plan.

Stormwater Monitoring Coalition (SMC) Regional Monitoring

Since 2001, Participating Agencies have partnered with regulated stormwater municipalities in southern California, the Regional Boards of Southern California and the Southern California Coastal Water Research Project (SCCWRP) to form the Southern California Stormwater Monitoring Coalition (SMC). The goals of the SMC are to standardize monitoring, improve understanding of stormwater mechanics, and identify receiving water impacts from stormwater (SCCWRP, 2002). According to its 2014 Research Agenda, the SMC has identified 21 potential projects and is in the process of prioritizing projects on the basis of need and availability of funding (SMC, 2014). The Participating Agencies have elected to participate in the projects that are relevant to the watershed. The Participating Agencies will continue participation in the SMC Regional Freshwater Stream Bioassessment Monitoring Program (SMC Regional Bioassessment Program) that began as a five year program in 2008-2013 and will be implemented for another five years (2015-2019).

The 2009–2013 SMC Regional Bioassessment Program was designed to address the following monitoring questions (AMEC, 2014):

- What is the extent of impact in streams of southern California?
- What are the stressors that impact southern California streams?
- Is the extent of stream impacts changing over time?

A final monitoring report was prepared on the basis of 2009–2013 results to identify lessons learned, data gaps, and recommendations to guide the design of the 2015–2019 program. In 2015, a new five-year SMC program will extend the initial survey to answer key management questions about the impacts of stormwater on stream conditions. The program will have an added emphasis on detecting trends, including non-perennial streams and sampling sediment chemistry and toxicity.

The non-perennial stream monitoring was initiated in April 2014, with site revisits in May and June 2014. Sampling included benthic macroinvertebrates (BMI), algae, physical habitat, and California Rapid Assessment Method (CRAM). The trend site monitoring was conducted during the standard index period (i.e., from mid-May through July). Sampling for trend site monitoring included all of the parameters and constituents of the original SMC Regional Bioassessment Program (Weston, 2014b). The bioassessment monitoring was conducted at a total of 64 bioassessment stations; 30 stations were compliance stations; 28 stations were randomly placed Stormwater Monitoring Coalition (SMC) stations; and 6 stations were San Diego County reference stations (Weston, 2014b).

Hydromodification Regional Monitoring Program

Copermittees have developed a regional Hydromodification Management Plan (HMP) to address impacts to beneficial uses and stream habitat from increased erosive force potentially caused by a rise in runoff discharge rates and volume from Priority Development Projects (County of San Diego, 2011). The HMP was initially developed to meet the requirements of the 2007 Permit. The Monitoring Plan is defined in Chapter 8 of the HMP, and was updated by the Copermittees and accepted by the Regional Board in February of 2014. The HMP requires monitoring with a final report due to the Regional Board in December of 2016. Monitoring consists of channel sediment transport assessments, and continuous flow monitoring of pre-project, post-project, and reference conditions per Permit Provisions D.1.a and D.1c(6). Additional monitoring is required per Provision D.1.a(2).

4.1.2.3 Sediment Quality Monitoring

Sediment quality monitoring is designed to assess compliance with the sediment quality receiving water limits applicable to enclosed bays and estuaries in accordance with the State Board's Water Quality Control Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality (Sediment Control Plan). Part I of the State Board's Sediment Quality Control Plan provides sediment quality objectives for enclosed bays and estuaries and does not apply to ocean waters or inland surface waters. The California Sediment Quality Objective (SQO) multiple-line-of-evidence approach is based on criteria developed for euhaline environments specified in the Sediment Control Plan Section V. Euhaline is defined as waters ranging from 25–31 practical salinity units (psu) (State Board, 2009).

Based on historical data, during the index period (June through September) the San Luis Rey Estuary recorded average salinity ranging between 15 and 20 parts per thousand (ppt) and, therefore, does not meet the required salinity concentration to be evaluated for the current SQOs. Because of the removal of an Arizona crossing and the construction of a permanent bridge, the San Luis Rey River mouth has returned to its natural condition. Since 2011, a year-round, naturally occurring sand bar has obstructed tidal flow into the river mouth, resulting in predominantly freshwater environment. The Participating Agencies will continue to monitor the situation periodically and will update the Regional Board of the status of the San Luis Rey Estuary prior to California Bight 2018 Study. A Sediment Sampling Plan has been prepared and is attached in Attachment 4A-2 in the event that the estuary qualifies for sampling in Bight 18.

4.1.2.4 TMDL Monitoring

TMDL provisions, schedules, and monitoring requirements are provided in Attachment E of the Permit. The purpose of the monitoring program is to track progress toward achieving compliance with interim and final TMDL numeric targets. The Bacteria TMDL in Permit Attachment E.6 is applicable to the watershed. Monitoring is designed to meet compliance with the monitoring requirements of the TMDL. Wet and dry weather sampling will be conducted each year at the compliance point located at the existing California Assembly Bill 411 (AB411) monitoring location along the Pacific Ocean shoreline (25 yards down current of where ocean currents meet river discharge in ankle-to-knee-deep water). The data generated will be used to address the following questions:

- Are TMDL numeric targets for indicators being met at the compliance monitoring locations?
- Are levels of bacteria decreasing at the compliance monitoring locations?

The proposed Bacteria TMDL Monitoring Plan and Quality Assurance Project Plan describe detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and updated methodology. They are presented in Attachment 4A-3. Dry weather monitoring will be conducted weekly, for a minimum of 5 samples in a 30-day period during the recreation season (April 1 through October 31) to be consistent with AB411 monitoring frequencies, and monthly (at a minimum) during the wet season (October 1 through April 30) per the Permit requirements. Samples are to be collected on dry weather days, after an antecedent dry period of 72 hours with less than 0.1 inch of rainfall. Wet weather monitoring will be conducted at the compliance monitoring location during at least one storm event for each wet season, per the Permit Attachment E.6.

Fecal indicator bacteria are the target constituents for the Pacific Ocean Shoreline within the watershed, as indicated by the Permit. Grab samples will be collected in a manner consistent with the requirements of the AB411 program and analyzed for total coliform, fecal coliform, and *Enterococcus*. For details of the current approved TMDL monitoring program, refer to Attachment 4A-3.

Bacteria TMDL compliance monitoring has been conducted in the receiving water since the Permit became effective on June 27, 2013.

4.1.2.5 Toxicity Identification Evaluation/Toxicity Reduction Evaluation

Provision D.1.c(4)(f) of the Permit requires that the Copermittees discuss the need for conducting a Toxicity Identification Evaluation (TIE)/Toxicity Reduction Evaluation (TRE) if chronic toxicity is detected in receiving waters. A TIE is a set of procedures to identify specific chemicals or conditions responsible for toxicity; a TRE is a study designed to identify causative agents of effluent or ambient toxicity, isolate its sources, evaluate effectiveness of toxicity control options, and confirm reduction of toxicity. A work plan that outlines the process to identify chronic toxicity and prioritize the need to implement a TIE/TRE based on the magnitude and persistence of chronic toxicity is included as Attachment 4A-4.

4.1.3 Storm Drain Outfall Monitoring

The purpose of the Storm Drain Outfall Monitoring Program is to evaluate the potential impact from storm drain discharges on the beneficial uses of the waterbody. This program is designed to meet requirements set forth in Provision D.2 of the Permit and seeks to answer the following question:

- Do non-stormwater or stormwater discharges from the storm drain outfalls contribute to receiving water quality problems?

Table 4A-5 provides the number of major outfalls to be monitored under each component of the

Storm Drain Outfall Monitoring Program by each Participating Agency. Detailed proposed monitoring methods and procedures as presented in the Storm Drain Outfall Monitoring Plan (Attachment 4A-5). These methods and procedures may be modified on the basis of site-specific environmental conditions and updated analytical methodologies. Additionally, the number of major outfalls monitored per year as shown in **Table 4A-5** are subject to change based on new information, updates to the Participating Agency's storm drain outfall inventories, changes in transient or persistent flow classifications, and/or changes or updates to the priority water quality conditions over the life of the Plan.

Table 4A-5. Number of Major Storm Drain Outfalls per Jurisdiction

Jurisdiction	Number of Outfalls Monitored Per Year		
	Field Screening[a] (Provision D.2.b(1))	Dry Weather Monitoring (Provision D.2.b(2))	Wet Weather Monitoring (Provision D.2.c)
City of Oceanside	19	5	2
County of San Diego	15	5	2
City of Vista	4	2	1

a. For Participating Agencies with fewer than 125 major storm drain outfalls in the watershed, 80% of major outfalls must be screened twice per year.

4.1.3.1 Storm Drain Outfall Dry Weather Monitoring

The purpose of the Storm Drain Outfall Dry Weather Monitoring Program is to evaluate the potential contribution from storm drain discharges on receiving water quality during dry weather conditions and to assess the ability of programs to effectively eliminate non-stormwater discharges to waterbodies or waterways. Each Participating Agency has established a number of major storm drain outfalls that are prioritized based on non-stormwater flow status and threat to receiving water quality, and will be screened once or twice annually based on this prioritization. Additionally, the highest priority major storm drain outfalls have been selected for further water quality testing to facilitate source investigations of these outfalls with persistent dry weather flows.

Dry Weather Field Screening

Field screening is visual monitoring of storm drain outfalls to identify and effectively eliminate sources of persistently flowing non-stormwater discharges as required by Permit Provision D.2.b(1). This program assesses the effectiveness of other jurisdictional programs to effectively prohibit non-stormwater discharges. Each Participating Agency will continue to perform a field screening of a certain number of outfalls on an annual basis to maintain an up-to-date inventory of persistently flow outfalls and to initiate follow-up IC/ID investigations the identify and mitigate the source(s). The frequency of field screening will vary from once to twice per year on a jurisdictional basis and is dependent on the number of major outfalls. **Table 4A-5** presents the number of outfalls subject to field screening for each jurisdiction in the watershed.

Highest Priority Storm Drain Outfall Dry Weather Monitoring

Per Permit Provision D.2.b(2), Participating Agencies have prioritized the persistently flowing outfalls on the basis of their potential to impact receiving water quality. Highest priority storm drain outfalls with persistent non-stormwater flow will be monitored during dry weather within each jurisdiction, as presented in **Table 4A-5**. Using this prioritized list, Participating Agencies will focus resources on abating identified sources to mitigate flow at the five highest priority major outfalls within each of their respective jurisdictions, per Permit Provision D.2.b.(2)(b)(i). Each of the selected outfalls will be monitored twice per year during dry weather conditions. During each event, field observations will be recorded, and when measureable flow is present, *in-situ* field measurements and analytical data will be collected. Analytical constituents will include constituents contributing to the Highest Priority Water Quality Conditions, 303(d) List impairments, TMDLs, NALs, and Table D-7 of the Permit; a detailed analyte list is provided in Attachment 4A-5. If historical data demonstrate or justify that analysis of a constituent is not necessary for a particular waterbody or outfall, then it will be removed and noted as an update to this program in the Annual Report.

Based on the data collected at the storm drain outfalls per jurisdiction as shown in **Table 4A-5**, monitoring at these outfalls may be reprioritized to eliminate monitoring entirely or to have it be reduced to field screening activities only to address higher priority non-stormwater persistent flows. Reprioritization of outfalls may occur if one of the following conditions is met:

- Non-stormwater discharges have been effectively eliminated for three consecutive monitoring events; or
- Source(s)s of the persistent flows have been identified as not an illicit or a source of pollutants; or
- Pollutants in the persistent flow do not exceed NALs; or
- The threat to water quality has been reduced by the Participating Agency.

Each jurisdiction ranked its outfalls independently on the basis of the highest priority water quality condition, pollutant generating areas (PGAs), and available resources. Participating Agencies considered the following factors to prioritize persistently flowing outfalls:

- Potential to contribute to a Highest Priority Water Quality Condition or Priority Water Quality Condition
- Historical monitoring or inspection data
- Controllability
- Surrounding land uses/potential sources
- Flow rate

4.1.3.2 *Storm Drain Outfall Wet Weather Monitoring*

The purpose of this program is to identify pollutants in stormwater discharges from the storm drain conveyance system, guide pollutant source identification efforts, and track progress in achieving the goals set forth in Chapter 3. The Participating Agencies' five monitoring locations for the wet weather storm drain outfall discharge monitoring component were chosen to be representative of the residential, commercial, industrial, and mixed-use land uses within the watershed pursuant to Permit Provision D.2.c, as presented in **Table 4A-5**.

A minimum of five outfalls will be monitored once per year during a storm event with greater than 0.1 inch of rainfall. During each event, observational and hydrologic data will be recorded, including duration of the storm, rainfall estimates, and estimated or measured flow rates and volumes. Grab samples will be collected to analyze for pH, temperature, specific conductivity, dissolved oxygen, turbidity, hardness, and indicator bacteria. A composite sample must be collected and analyzed for constituents contributing to the Highest Priority Water Quality Conditions, 303(d) List impairments, TMDLs, and SALs; a detailed analyte list is provided in Attachment 4A-5. If historical data demonstrate or justify that analysis of a constituent is not necessary for a particular waterbody or outfall, then it will be removed and noted as an update to this program in the Annual Report.

The 2013 Transitional Monitoring Programs began implementation of the wet weather storm drain outfall monitoring requirements at the five watershed outfalls. Monitoring at selected wet and dry weather storm drain outfalls will be conducted on an annual basis as described above and in Attachment 4A-5.

4.1.4 *Special Studies*

Special studies have been selected to further investigate the Highest Priority Water Quality Conditions to meet requirements of Provision D.3 of the Permit. Per Provision D.3, the purpose of the special studies is to "address pollutant and/or stressor data gaps and/or develop information necessary to more effectively address the pollutants and/or stressors that cause or contribute to Highest Priority Water Quality Conditions identified in the Water Quality Improvement Plan." The special studies will include a regional special study and a special study specific to the watershed. Both special studies selected for the watershed will provide additional information on the Highest Priority Water Quality Condition selected by the Participating Agencies.

4.1.4.1 *San Diego Regional Reference Streams and Beaches Studies*

Participating Agencies have elected to participate in the San Diego Regional Reference Streams and Beaches Study currently being conducted by the San Diego and Orange County Participating Agencies. These two regional studies fulfill the requirements for special studies per Permit Provisions D.3.a(2) and D.3.a(3). The studies will develop reasonable and accurate TMDL numeric targets that account for "natural sources" to establish the concentrations or loads from streams minimally disturbed by anthropogenic activities or "reference" conditions. The Reference Stream Study also collected nutrients, metals, and toxicity data as secondary constituents. This study will provide a scientific basis for updating the reference conditions to be considered in evaluating compliance levels in the Bacteria TMDL. The results of this study will be used to support the forthcoming re-evaluation of the recently adopted Bacteria TMDL and to support numeric target development in future TMDLs or alternative regulatory approaches for nutrients and metals.

The San Diego Regional Stream Reference Study will address the following questions (SCCWRP, 2013) in streams minimally influenced by anthropogenic activities:

- How does the Water Quality Objective (WQO) exceedance frequency vary between summer dry weather, winter dry weather, and wet weather?
- How does the WQO exceedance frequency vary by hydrologic factors?
- How does the WQO exceedance frequency vary by input factors?
- How does the WQO exceedance frequency vary by biotic and abiotic factors?

The San Diego Regional Reference Beaches Study will address the following questions (SCCWRP, 2013) in beaches minimally influenced by anthropogenic activities:

- How does the WQO exceedance frequency vary between summer dry weather, winter dry weather, and wet weather?
- How does the WQO exceedance frequency vary by hydrologic factors, including:
- Discharge flow rate (wet and dry weather)
- Status of estuary mouth (open/closed; dry weather only)
- What are the wet and dry weather exceedance frequencies of fecal indicator bacteria in estuaries?

For the stream study, a total of 6 locations were selected for wet weather monitoring and up to 10 locations were selected for dry weather monitoring. Sites were selected to represent 95 percent undeveloped land uses (reference conditions), two major geologic settings, and the target catchment sizes. Wet weather sampling frequency at the six locations consists of three targeted events throughout the wet season (October 1 through April 31). Dry weather sampling frequency consists of weekly sampling for up to 40 weeks at flowing locations during winter and summer dry weather periods. Dry weather sampling occurs if there has been no measurable rainfall for at least 72 hours.

Water samples will be analyzed for a combination of conventional constituents, nutrients, metals, fecal indicator bacteria, microbial source testing, and algae. Of these constituents, *Enterococcus*, *E. coli*, fecal coliform, total coliform, Bacteroides, and *in-situ* parameters are of primary importance; all other analytes are considered secondary. During dry weather sampling, reference stream sites will be assessed for algal percent cover, algal biomass, ash-free biomass, and factors that control the growth of algae (stream bankful dimensions, canopy cover, and pebble count). Flow discharge rates were estimated for seven reference streams using recorded continuous water level data during both wet and dry weather conditions and measured velocity and flow during sampled wet weather events.

4.1.4.2 *San Luis Rey River Microbial Source Tracking Study*

This dry weather Microbial Source Tracking (MST) Work Plan has been prepared to facilitate the following objectives:

1) Identify sources of dry weather flow into the County of San Diego's (County) Municipal Separate Storm Sewer System (MS4) (consistent with the non-structural BMPs identified in the San Luis Rey and San Diego River watersheds' Comprehensive Load Reduction Plan.
2) Identify dry weather sources of human waste in the County's MS4 by sampling MS4 outfalls for fecal indicator bacteria (FIB), sewage indicators, and human source markers.
3) Identify dry weather sources of non-human waste in the County's MS4 by sampling MS4 outfalls for FIB and non-human fecal source markers (e.g., cattle, equestrian, canine, etc.).
4) Prioritize locations for implementation of remedies to eliminate dry weather flows and fecal waste sources.

This MST study plan began with gathering data, including discussions with City and County staff, review of existing monitoring data, and GIS analysis of the MS4 system and infrastructure throughout the watershed. Outfall investigations are planned to characterize human versus nonhuman inputs using bacteria analyses, chemistry, host-specific MST markers, and other source tracking tools. A detailed storm drain network (MS4 system) investigation will be employed on the basis of the outfall results to further investigate sources. **Table 4A-6** provides an overview of the MST Study and planned activities.

Table 4A-6. General Overview of San Luis Rey River MST Study

<table>
<tr><th>Initial Desktop Evaluation</th><th>Outfall Investigations</th><th>Storm Drain Network Investigation</th></tr>
<tr><td>

GIS analysis
Review of historical water quality data
Outfall categorization
Development of field tools and smartphone application

</td><td>

Field observations
Sample analysis, including the following:

Ammonia
Phosphate
MBAS
Caffeine
Cotinine
Sucralose
Fecal coliforms
Enterococcus
SIPP-recommended animal markers (cow [CowM2], ruminant [Rum2Bac], dog [BacCan], horse [HoF97] and pig [Pig2Bac])10
SIPP-recommended human markers (Human HF183 taqman and HumM2)

Follow-up monitoring to verify human versus non-human

</td><td>

Visual surveys
Sampling and analysis using FIB, MST markers, and chemical indicators
Source tracking using CCTV, dye testing, smoke testing, and canine scent tracking
Investigation of intermittent flows
Possible remediation

</td></tr>
</table>

4.1.4.3 Lower San Luis Rey River Bacteria Source Identification Study (Phase II)

In 2007, the City of Oceanside was awarded a Clean Beaches Initiative grant to conduct a microbial source tracking study in the lower section of the river and the river mouth. The Lower San Luis Rey River Bacterial Source Identification Project (MST Study) was designed as the initial phase of a source investigation to provide a broad characterization of bacterial concentrations throughout the lower sections of the river and river mouth. The project was designed to attain the following goals:

- Assess what sources and activities have contributed most to the bacterial impairment of the river mouth and from where those sources and activities may have originated.
- Analyze potential bacterial source elimination or reduction practices targeted at the identified sources and activities.
- Contribute to future achievement of bacterial TMDL objectives by identifying potential management measures (MMs) and follow-up studies to target sources and activities more effectively.

This study focused on assessing the potential of anthropogenic (human-specific) and non-anthropogenic (gull) bacteria sources within the watershed. The results indicate that both types of sources are present. To focus on the anthropogenic sources, follow-up investigations targeting human sources on a smaller scale are required.

As a follow-up to the MST Study and as a requirement of NPDES Permit Order No. R9-2013-0001, the City of Oceanside will develop and initiate a Phase II Study to further focus on a drainage area that was identified during the MST study that showed exceedances of bacteria above water quality objectives. A special study related to the Highest Priority Water Quality Condition for the watershed, i.e., bacteria, will be developed during the 2015–2016 fiscal year. The study will include a monitoring plan that meets Permit requirements of Permit Provision D.3 and the assessment requirements of Permit Provision D.4. Phase II of the Lower San Luis Rey River Source Identification Study will be designed to address the following goals:

- Goal 1: Assess the sources and activities (and their locations) that have contributed to bacterial impairment of the river mouth. Anthropogenic and non-anthropogenic sources were identified as contributing bacterial sources. A chart of bacterial hot spots is provided in the previously completed MST study. Additional data from the 2007 Permit monitoring programs will also be referenced.
- Goal 2: Analyze potential bacterial source elimination or reduction practices that are targeted at identified sources. A discussion of recommended follow-up source investigation studies and management measures is provided from the MST study and will help guide future source identification and elimination efforts.
- Goal 3: Contribute to future achievement of bacterial TMDL objectives by effectively targeting sources.

Sampling locations will be selected on the basis of results of the previously completed MST study and outfall monitoring results from the 2007 and 2013 Permit outfall monitoring programs. City of Oceanside staff will focus on areas where anthropogenic sources of bacteria were identified and where current monitoring programs indicate elevated levels of bacteria. The City of Oceanside plans to implement a catchment-specific approach, singling out outfalls with known high levels of indicator bacteria and/or drainage areas within the City of Oceanside that showed markers of human-specific bacteria sources. The number of sampling events and frequency will be determined at a later date as funding is secured and a more detailed work plan is provided in the Annual Reports.

4.1.5 Illicit Discharge Detection and Elimination Program

Each Participating Agency is required to develop an illicit discharge detection and elimination program (IDDE) Program to address the potential contribution of pollutants from non-stormwater and stormwater discharges and to establish and enforce pollutant discharge prohibitions in compliance with Provision E.2 of the Permit. The outline of an IDDE Program is included to establish a consistent framework for all Jurisdictional Runoff Management Programs (JRMP) within the watershed and to describe the data that may be generated to support assessments described in Section 4.2.

The IDDE Program will be designed to have the following goals:

- Control the contribution of pollutants to and the discharges from the storm drains within its jurisdiction.
- Effectively prohibit non-stormwater discharges to the storm drain.
- Reduce the discharge of pollutants in stormwater to the maximum extent practicable.

4.1.5.1 Prevent and Detect Illicit Discharges and Connections

To prevent and detect ID/ICs, Participating Agencies have implemented protocols and programs in their jurisdictions to promote good housekeeping and clean practices to prevent ID/ICs. Each Participating Agency maintains a map of its MS4 system and a detailed inventory of its outfalls as critical investigative tools to better identify potential sources and impacts. Additionally, staff and contractors will be trained and a public hotline will be made available to continue to promote reporting of potential incidents on a broader scale. The Regional Stormwater Hotline (1-888-846-0800), operated by the County of San Diego on behalf of the Copermittees, is a valuable resource for pollution reporting. The Project Clean Water website (www.projectcleanwater.org) will continue to be emphasized as a resource to disseminate water quality-related information to the public. Each Participating Agency also relies on jurisdictional public reporting methods such as websites, call centers and/or mobile smartphone reporting systems. These programs are described in more detail in Participating Agencies' Jurisdictional Runoff Management Plans. **Table 4A-7** presents three key tools of prevention implemented throughout the watershed.

Table 4A-7. ID/IC Prevention Tools

Storm Drain System Mapping (MS4 Map)	Outfall Monitoring Station Inventory	Identifying and Reporting ID/ICs
The map will identify: • All segments of the MS4 owned, operated, and maintained by the Participating Agency • Locations of all known connections with other MS4s not owned by the Participating Agency • Locations of inlets and outfalls that collect and/or discharge runoff within the MS4 • All waterbody segments within the Participating Agency's jurisdiction that receive discharges from Participating Agency MS4 outfalls • Locations of the MS4 outfalls within the Participating Agency's jurisdiction • Locations of MS4 outfalls with known persistent flows	The inventory will include: • GPS coordinates (latitude and longitude) of the MS4 outfall • Watershed Management Area • Hydrologic subarea • Outlet size • Accessibility (safety, co-location of critical habitat, presence of tidal influence, etc.) • Approximate drainage area • Historical dry weather flow classification (persistent, transient, no, or unknown flow)	Actions will include: • Training personnel and contractors to identify ID/ICs during their daily routine • Promoting and facilitating public reporting of IC/IDs. • Providing a Regional Stormwater Hotline (1-888-846-0800) • Emphasizing the Project Clean Water website (www.projectcleanwater.org) These programs are described in more detail in Participating Agencies' Jurisdictional Runoff Management Plans.

4.1.5.2 *Investigate and Eliminate Illicit Discharges and Connections*

The Participating Agencies may modify these procedures as necessary to ensure that they are reflective of their own internal policies and procedures. Participating Agencies will prioritize, conduct follow up investigations, and seek to identify sources of non-stormwater discharges on the basis of the following information:

- Field screening visual observations per Permit Provision D.2.a(1)
- Non-stormwater monitoring per Permit Provision D.2.a(2)
- Reports or notifications of illicit discharges, illicit connections, or other sources of non-stormwater from hotlines or other sources

Obvious illicit discharges (e.g., based on color, odor, or exceedance of an action level) and any discharges that pose an immediate threat to human health or the environment will be investigated immediately. Each Participating Agency will respond in accordance with its legal authority to eliminate illicit discharges and connections to the MS4 and its Enforcement Response Plan, as appropriate.

Incident reports will be assessed in a timely manner. The validity of a report or notification will be based on the inspector's best professional judgment given the information that has been obtained. Invalid reports will be noted and reported in the JRMP Annual Report Form; valid reports will be prioritized for further investigation.

Follow-up investigations may include review of information provided in the incident report, recent sample results, and review of inventories or land use data and may involve collection of additional analytical samples. Prioritization of follow up investigations will, at minimum, be based on the criteria provided in Permit Provision E.2.d(1):

1) Pollutants causing or contributing to bacteria, the Highest Priority Water Quality Condition.
2) Pollutants causing or contributing to, or threatening to cause or contribute to impairments in waterbodies on the 303(d) List and/or environmentally sensitive areas (ESAs), located within its jurisdiction;
3) Pollutants from sources or land uses known to exist within the area, drainage basin, or watershed that discharges to the portion of MS4 within its jurisdiction; or
4) Pollutants causing or contributing to an exceedance of an NAL.

A field investigation must be conducted to seek to identify the sources of non-stormwater persistent flows monitored under Permit Provision D.2.b(2). The investigation may include follow up field investigations and/or review of inventories and other land use data to identify potential sources.

4.1.5.3 Records and Reporting

With each Annual Report, each Participating Agency must summarize all IC/ID investigations and those eliminated within its jurisdiction using the IC/ID investigations data-sharing template per Permit Provision D.2d.(4). The Participating Agencies developed a data-sharing template during the transitional monitoring period 2013–2015 to include all the information listed below, per the Permit requirements. Each Participating Agency must maintain records and a database of the following information per Permit Provisions D.2.d(2)(d) and D.2.d(2)(e):

- Location of incident, hydrologic subarea (HSA), portion of the MS4 affected, and point of discharge or potential discharge to the receiving water; and
- Source of information, including dates of report, initiation of investigation, and follow-up investigation, identified or suspected source, known or suspected incident, result of the investigation, and documentation of the response.

4.1.6 Regional Clearinghouse

Participating Agencies will use existing data-sharing templates to facilitate compilation of watershed-wide datasets for assessment and reporting purposes. To support reporting under previous Permit cycles, regional data-sharing templates were developed for receiving water monitoring, storm drain outfall monitoring, field screening, and IC/ID reporting. Participating Agencies will make the following data and documentation will be available to the public on the

Project Clean Water website:

- San Luis Rey Watershed Water Quality Improvement Plan and all updated versions with date of update
- Annual Reports for the watershed
- Jurisdictional Runoff Management Programs document for each Participating Agency within the watershed and all updated versions with date of update
- BMP Design Manual for each Participating Agency within the watershed and all updated versions with date of update
- Reports from special studies conducted in the watershed
- Monitoring data uploaded to the California Environmental Data Exchange Network (CEDEN) with links to the uploaded data
- Geographic information system (GIS) data, layers, and/or shape files that are available for distribution and used to develop the maps to support the Plan, Annual Reports, and Jurisdictional Runoff Management Programs

Project Clean Water is a web-based portal that functions as a regional clearinghouse for San Diego County watersheds. It is used as a centralized point of access to share educational materials, water quality information, and Permit-required reports with the public. www.projectcleanwater.org

4.2 WATER QUALITY IMPROVEMENT PLAN ASSESSMENT PROGRAM

The assessment portion of the Monitoring and Assessment Program will evaluate the data collected under the monitoring programs described in Section 4.1, and integrate the information collected as part of the Jurisdictional Runoff Management Programs. The data collected from these two programs will be used to assess the progress toward achieving the numeric goals and schedules and to measure the progress toward addressing the Highest Priority Water Quality Conditions. **Figure 4A-1** depicts how the watershed monitoring activities will support the assessments required by the Permit.

Table 4A-8 summarizes the reporting and assessment requirements of the Permit. Some assessments will be reported annually, as part of the Annual Report, while others will be included in the Report of Waste Discharge that the Participating Agencies must submit 180 days prior to the end of this Permit.

The Monitoring and Assessment Program will be evaluated and adapted in the context of the Annual Report and the Report of Waste Discharge. The re-evaluation will consider data gaps and the results of all monitoring program elements. Modifications may be made to the program, but the core elements required by the Permit and described in Section 4.1 must be maintained. This limits the amount of adaptation that is possible. Potential changes could be to modify the frequency of sampling, add a new analyte of concern, or move a monitoring location.

4.2.1 *WATER QUALITY IMPROVEMENT PLAN ANNUAL REPORT*

The Annual Report must be submitted for each reporting period no later than January 31 of the following year. The Annual Report will evaluate data and information from JRMP and monitoring programs to present key findings related to water quality in the receiving waters and MS4 discharges, evaluate the effectiveness of these programs, and present any recommended modifications to the Plan. The JRMP Annual Reports will reflect program activities conducted between July 1 and June 30 of the year following acceptance of the Plan. The Monitoring and Assessment Annual Report will reflect program activities conducted between October 1 and September 30 of the year following acceptance of the Plan. **Table 4A-8** presents the assessments and information that must be included in each Annual Report required by the Permit.

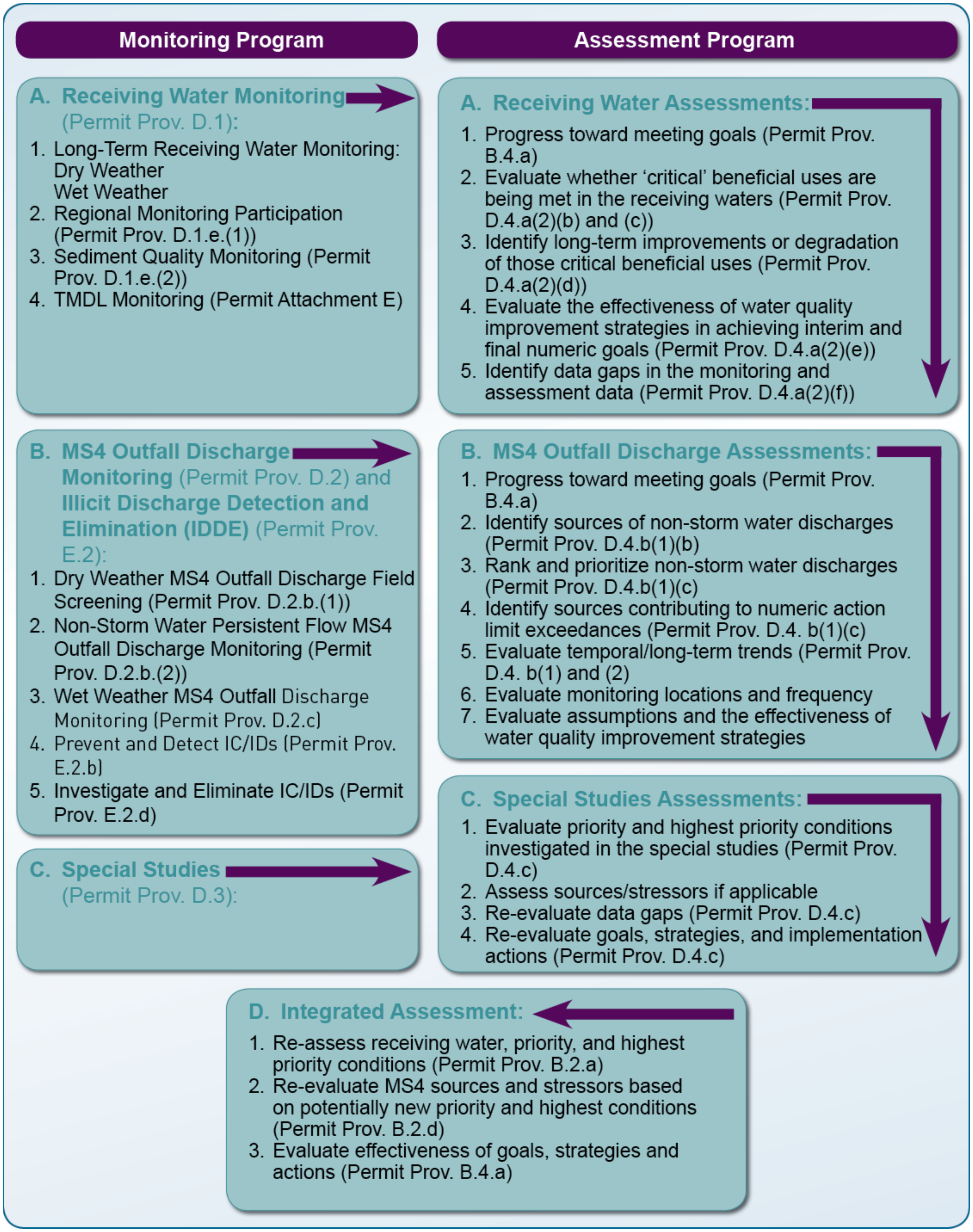

Figure 4A-1. Monitoring and Assessment Program Components for the San Luis Rey Watershed

Table 4A-8. Water Quality Improvement Plan Annual Report Requirements

Assessment and Documentation	Detailed Data and Information
Summary of data collected, findings, interpretations, and conclusions from the assessments required per Permit Provisions F.b.(3)(a), (b), and (c)	• Receiving Water Assessments per Provision D.4.a. • Sediment Quality Assessments per Provision D.1.e(2) • TMDL Assessments per Provision E.6 • MS4 Outfall Discharger Assessments D.4.b • IDDE relevant information and findings • Special studies: findings and progress per Provision D.4.c • Re-evaluation of the Priority Water Quality Conditions, numeric goals, strategies, schedules, and/or monitoring and assessment, as needed per Provision D.4.d.[a]
Progress of implementing the Plan per Provision F.b.(3)(d)	• Progress towards interim and final numeric goals for the Highest Priority Water Quality Conditions for the watershed • Status of water quality improvement strategies by each Participating Agency • Proposed modifications to water quality improvement strategies and supporting rationale • Water quality improvement strategies planned for implementation during the next reporting period • Proposed modifications to the Plan and/or each Participating Agency's jurisdictional runoff management program document • Previous modifications or updates incorporated into the Plan and/or each Participating Agency's jurisdictional runoff management program document
A completed Jurisdictional Runoff Management Program Annual Report Form for each Participating Agency in the watershed, certified by a Principal Executive Officer, Ranking Elected Official, or Duly Authorized Representative per Provision F.b.(3)(e)	• City of Oceanside • City of Vista • County of San Diego
Any data or documentation utilized in developing the Annual Report for each Participating Agency, upon request by the Regional Board. Monitoring data must be uploaded to the California Environmental Data Exchange Network (CEDEN) and available for access on the Regional Clearinghouse per Provision F.b.(3)(f)	• Receiving water and data collected per Provision D. 1 • MS4 outfall discharge monitoring data collected per Provision D.2 • Special Study data • IC/ID investigation data

a. This re-evaluation is not required annually; at minimum, it must be completed as part of the Report of Waste Discharge described in Section 4.3.

4.2.1.1 *Receiving Water Assessment*

The assessment of receiving waters involves evaluating the physical, chemical, and biological conditions of the receiving waters and sediments. The Participating Agencies must assess the status and trends of receiving water quality conditions in coastal waters, enclosed bays, estuaries, and streams in the watershed. The receiving water assessment to be presented in the Annual Report will:

- Assess whether or not the conditions of the receiving waters are meeting the numeric goals
- Identify the most critical beneficial uses that must be protected to ensure the overall health of the receiving water
- Evaluate whether or not those critical beneficial uses are being protected
- Identify short-term and/or long-term improvements or degradation of those critical beneficial uses
- Consider whether or not the strategies contribute toward progress in achieving the interim and final numeric goals of the Plan
- Identify data gaps in the monitoring data needed to assess the provisions above

4.2.1.2 *MS4 Outfall Discharge Assessments*

The MS4 outfall discharge assessments include evaluating both the dry weather monitoring data associated with the IDDE program collected as part of the JRMP and the wet weather monitoring data collected by the Participating Agencies. Details of these two separate assessments are provided below. Each Participating Agency will assess its dry weather MS4 monitoring programs individually and compile results annually as part of the Annual Report. Each Participating Agency must assess and report the progress of its IDDE program (required pursuant to Permit Provision E.2) toward effectively prohibiting non-stormwater and illicit discharges into the MS4s within its jurisdiction, including the elements in **Table 4A-9**.

Table 4A-9. Key Elements of the MS4 Discharge Assessments

Non-stormwater Assessment	Illicit Discharge	Wet Weather Outfall Assessment
• Identify sources of non-stormwater discharges on the basis of field screening data or IDDE activities • Rank and prioritize non-stormwater discharges • Identify sources contributing to numeric action limit exceedances • Estimate volumes and loads of non-stormwater discharges • Evaluate non-stormwater discharge monitoring locations • Evaluate the effectiveness of the water quality improvement strategies	• All IC/ID investigations • IC/IDs eliminated within the jurisdiction	• Estimate volumes and loads of stormwater discharges • Evaluate temporal trends • Evaluate stormwater discharge monitoring locations and frequency • Evaluate Plan analysis • Evaluate the effectiveness of water quality improvement strategies

4.2.1.3 *Special Studies Assessments*

As part of the Annual Report, the Participating Agencies will evaluate the results and findings from the special studies. They will use the resulting data to (1) assess their relevance to the Participating Agencies' characterization of receiving water conditions, (2) understand sources of pollutants and/or stressors, and (3) control and reduce the discharges of pollutants from the MS4 outfalls to receiving waters. As with the other monitoring programs, the results of the special studies assessment may warrant modifications of or updates to the Plan.

The special studies will attempt to answer questions concerning the natural "reference" concentrations of bacteria and other pollutants in the region, and to identify the current known sources in the watershed. The special studies will help guide the implementation of the strategies for the Highest Priority Water Quality Conditions.

4.2.1.4 *Modifications or Updates to Water Quality Improvement Plan Programs*

Participating Agencies may recommend modifications or updates to priorities, goals, strategies, monitoring, or JRMP program activities in the Annual Report.

4.2.2 *Report of Waste Discharge*

Submittal of the Report of Waste Discharge serves as an application for renewal of the Permit and, therefore, must be submitted by all listed Participating Agencies 180 days prior to the expiration date of the Permit. The Report of Waste Discharge will include information required for the Permit renewal process per Permit Provision F.5, an integrated assessment of Plan programs, and possibly the Regional Monitoring and Assessment Report as required under Permit Provision F.3c.

4.2.3 *Integrated Assessment*

The Participating Agencies will integrate the data collected as part of the Monitoring and

Assessment Program, along with information collected during the implementation of the JRMP. The integrated assessment will evaluate the main components of the Plan and will follow the assessment process outlined in the Permit, as summarized in **Table 4A-10**.

The integrated assessment builds on the receiving water assessment, MS4 outfall discharge assessment, and special studies assessment described in Sections 4.2.1, and includes an additional evaluation of temporal/long-term trends of wet weather MS4 outfalls. Additionally, the integrated assessment will evaluate the data collected as part of the transitional monitoring program implemented after the approval of the Permit and before the implementation of the monitoring program detailed in Section 4.1.

The integrated assessment will include all three Plan components: (1) Priority Water Quality Conditions, (2) Goals and Schedules, and (3) Strategies. The assessment will be performed during the development of the Report of Waste Discharge. The priority water quality conditions will be re-evaluated using the receiving water and MS4 outfall discharge assessments. The goals and schedules in Chapter 2 will be reviewed on the basis of the results of the receiving water and MS4 outfall discharge assessments, along with data collected as part of the JRMP. This evaluation will highlight the progress in achieving the compliance goals. Finally, both water quality monitoring data and maintenance/observational data related to BMP effectiveness will be used to assess the strategies implemented by the Participating Agencies. Strategies will be evaluated in the Annual Report on the basis of the data collected as part of the JRMP and any new relevant BMP effectiveness data collected by the Participating Agencies.

Table 4A-10. Integrated Assessment Components

Water Quality Improvement Plan Component	Permit Assessment Methodology	Evaluation Assessment
Priority Water Quality Conditions	<u>Re-assess receiving water, Priority, and Highest Priority Water Quality Conditions.</u> (1) Re-evaluate the receiving water conditions per methodology and any new methodology described in Chapter 2. (2) Re-evaluate the impacts of MS4 discharges on receiving waters, including an evaluation of temporal/long-term trends of the cumulative wet weather MS4 outfall water quality data sets (Provision D.4.b.(2)(d)). (3) Identify beneficial uses in receiving waters that must be protected per Receiving Water Assessment presented in Chapter 2. <u>Re-evaluate MS4 sources and stressors based on potentially new Priority and Highest Priority Water Quality Conditions.</u> (4) Re-evaluate the identification of MS4 sources and/or stressors performed in Chapter 2.	• Receiving Water Assessments • MS4 Outfall Discharge Assessments
Goals and Schedules	<u>Evaluate effectiveness of goals.</u> (1) Evaluate the progress toward achieving interim and final numeric goals for protecting impacted beneficial uses in receiving waters.	• Receiving Water Assessments • MS4 Outfall Discharge Assessments • JRMP Assessments
Strategies	<u>Evaluate effectiveness of strategies and actions.</u> (1) Identify the non-stormwater and stormwater pollutant loads from the MS4 outfalls on the basis of the MS4 Outfall Discharge Assessment (Section 4.2.1.2). (2) Identify the non-stormwater and stormwater pollutant load reductions, or other improvements that are necessary to attain the interim and final numeric goals. (3) Identify the non-stormwater and stormwater pollutant load reductions, or other improvements, that are necessary to demonstrate that non-stormwater and stormwater discharges are not causing or contributing to exceedances of receiving water limitations. (4) Evaluate the progress of the strategies toward achieving interim and final numeric goals for protecting beneficial uses in receiving waters.	• MS4 Outfall Discharge Assessments • Special Studies Assessments for BMP Effectiveness • JRMP Assessments

4.2.4 *REGIONAL MONITORING REPORT*

The regional monitoring and reporting requirement from Provision F.3.c of the Permit requires integration of all data on a regional scale to recommend modifications to the implementation or assessment of the Plan and jurisdictional runoff management programs. The report must assess the following:

- The beneficial uses of the receiving waters within the San Diego Region that are supported and not adversely affected by the Participating Agency's MS4 discharges
- The beneficial uses of the receiving waters within the San Diego Region that are adversely affected by the Participating Agency's MS4 discharges
- The progress toward protecting beneficial uses of the receiving waters within the San Diego Region from Participating Agency's MS4 discharges
- Pollutants or conditions of emerging concern that may impact beneficial uses of the receiving waters within the San Diego region

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ATTACHMENT 4A-1: SAN LUIS REY RIVER WATERSHED RECEIVING WATER MONITORING PLAN

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SAN LUIS REY RIVER WATERSHED RECEIVING WATER MONITORING PLAN

Prepared For:
San Luis Rey River Watershed
Participating Agencies

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January 2015

Based Upon:
Transitional Receiving Water Monitoring Work Plan
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January 2015

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LIST OF ACRONYMS AND ABBREVIATIONS

>	less than
<	greater than
AFDM	ash-free dry mass
APHA	American Public Health Association
AWWA	American Water Works Association
BMI	benthic macroinvertebrate
BOD	biochemical oxygen demand
BSA	bovine serum albumin
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
CEDEN	California Environmental Data Exchange Network
COC	chain of custody
cm^2	square centimeter
CRAM	California Rapid Assessment Method
CSBP	California Stream Bioassessment
EDD	electronic data deliverable
EDTA	ethylenediaminetetraacetic acid
ELAP	Environmental Laboratory Accreditation Program
GIS	geographic information system
GPS	Global Positioning System
IBI	Index of Biological Integrity
ID	identification
m	meter
mL	milliliter
MLS	Mass Loading Station
mm	millimeter
MS4	municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
PBO	piperonyl butoxide
Permit	San Diego Regional Water Quality Control Board Order Number R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region
pH	hydrogen ion concentration
PVC	polyvinyl chloride
O/E	observed to expected

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RWQCB	Regional Water Quality Control Board
SAFIT	Southwest Association of Freshwater Invertebrate Taxonomists
SCCWRP	Southern California’s Coastal Water Research Project
SDCRC	San Diego County Regional Copermittees
SDWQCB	San Diego Regional Water Quality Control Board
SLR-MLS	San Luis Rey River Mass Loading Station
SMC	Stormwater Monitoring Coalition
SOP	standard operating procedure
SPE	solid phase extraction
STS	sodium thiosulfate
SWAMP	Surface Water Ambient Monitoring Program
TIE	toxicity identification evaluation
TMDL	total maximum daily load
TSS	total suspended solids
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
WEF	Water Environment Federation

1 INTRODUCTION

The purpose of this Monitoring Plan is to describe the long-term receiving water monitoring, as required by the San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001, *National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges From the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region*, hereafter referred to as the Permit. The goal of the San Luis Rey River Watershed Receiving Water Monitoring Program is to characterize current conditions and assess progress in the receiving waters, and effectiveness of water quality improvement strategies implemented as part of the San Luis Rey River Watershed Water Quality Improvement Plan.

1.1 *PROGRAM OVERVIEW*

The Receiving Water Monitoring Plan includes the following monitoring to satisfy the requirements of Provision D of the Permit:

- Long-term dry and wet weather receiving water monitoring at one mass loading station (MLS) in accordance with the Permit (Provisions D.1.b, c, and d)
- Rapid stream bioassessment and in accordance with the Permit (Provision D.1.c.(5)) which includes Regional monitoring participation in the Stormwater Monitoring Coalition (SMC) Regional Monitoring Program and Southern California Bight Regional Monitoring Program (Provision D.1.e.(1))
- Continue dry weather hydromodification monitoring in accordance with the Permit (Provision D.1.c.(6))

1.2 *MONITORING LOCATIONS*

The San Luis Rey River Watershed Participating Agencies have selected the San Luis Rey River Mass Loading Station (MLS) (SLR-MLS) as the long-term receiving water monitoring location. Location details are provided in Table 1-1. A map of the location is presented in Figure 1-1.

Table 1-1. List of Receiving Water Monitoring Locations for the Permit Term

Watershed	Station ID	Latitude	Longitude	Cross Street Description	Channel Type	Jurisdiction
San Luis Rey River	SLR-MLS	33.2206476	-117.35825	Benet Road Bridge over San Luis Rey River	Natural Channel	City of Oceanside

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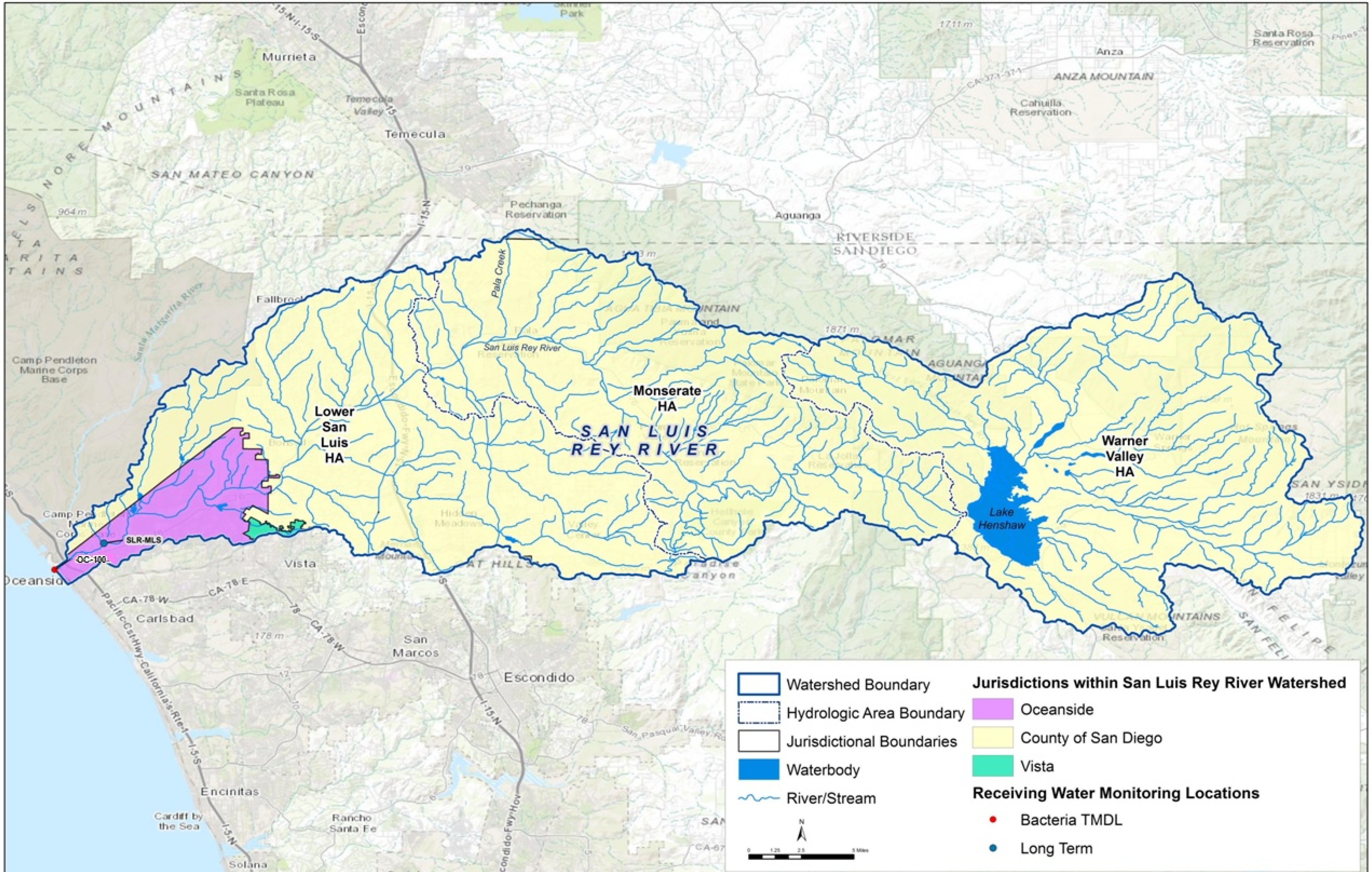

Figure 1-1. Receiving Water Monitoring Locations

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2 Monitoring Methods

This section describes monitoring methods and procedures used to implement the long-term receiving water monitoring program. Long-term receiving water monitoring will be conducted at the MLS for the San Luis Rey River Watershed, in accordance with the Permit (Provisions D.1.b, c, and d).

2.1 *Water Quality Sampling*

This section discusses the sampling procedures and analytical methods for water quality sampling. All sampling and analyses conducted for long-term receiving water monitoring locations will be in accordance with applicable United States Environmental Protection Agency (USEPA) regulations and guidance. Attachment A provides a complete list of constituents, potential methods, sample volumes, holding times, and target reporting limits for the San Luis Rey River Watershed Receiving Water Monitoring Program.

2.1.1 *Dry Weather*

Each long-term monitoring location will be monitored during three dry weather events: once during September prior to the start of the wet season, once during a dry period in the wet season, and once in May or June after the end of the wet season. Dry weather monitoring will be conducted in days with less than 0.1 inches of rainfall and 72 hours of antecedent dry conditions.

In the event that dry weather flow is not observed at a station during the September monitoring event prior to the start of the wet season, the first dry weather sampling event will occur during a qualifying event (e.g., at least 72 hours after a storm event) if dry weather flow is observed during the wet season.

2.1.2 *Wet Weather*

Each long-term station will be monitored during three wet weather events: during the first viable rainfall event of the wet season on or after October 1, during one event at least 30 days after the first rainfall event, and during one rainfall event after February 1. A flow- or time-weighted composite will be collected.

2.1.3 *Flow Monitoring*

Flow rates may be monitored using American Sigma (or comparable) flowmeters with an ultrasonic sensor, bubbler, or submerged pressure transducer as the primary measuring device. The primary sensor will continuously measure stage (i.e., stream height) and relay that information to the flowmeter. The flowmeter will continually calculate flow rates by inserting the stage information into the preprogrammed discharge equation. Using this system, the flowmeter will be able to actuate the sampler to achieve a flow-weighted composite sample, if desired. Sampling and flow equipment will be monitored remotely, and data will be transferred to a permanent data system by cellular modem or manual download.

Equipment installed and used for monitoring during dry weather will remain in place for at least the duration of the monitoring event. The monitoring year is approximately October 1 through

September 30. If collected, continual flow data will be downloaded remotely from each station once every two weeks to verify equipment functionality and to reduce data gaps, ensure accuracy, and identify maintenance and calibration needs. Flow data will be entered into the data management system. Equipment will be maintained throughout this period to ensure that it is in proper working order. Additional flow monitoring details, including example methods used for stream rating and channel surveys, are provided in Attachment B.

2.1.4 Grab Samples

Grab samples will be collected for those constituents that are not amenable to composite sampling. Per the Permit, the constituents to be collected as grab samples are indicated in Attachment A and include:

- Temperature
- Hydrogen ion concentration (pH)
- Specific conductance
- Dissolved oxygen
- Turbidity
- Total coliform
- Fecal coliform
- *Enterococcus*

Samples will be collected from the horizontal and vertical center of the channel if possible and will be kept clear of uncharacteristic floating debris.

Microbiology samples will be collected using sterile techniques. Nitrile or latex-type gloves will be worn during sample handling. During the sample event, a 100-milliliter (mL) sterile bacteria bottle will be used to collect the sample directly from the receiving water. Care will be employed to not allow contact with area structures or bottom sediments. The container will be opened only for the time needed to collect the sample and will be closed immediately following sample collection. If it is suspected that the container was compromised at any time, the sample container will be discarded, and a new sample will be collected using a new sample bottle. The sample must be filled only to the 100-mL mark on the sample bottle (not over-topped or under-filled).

Field measurements will be performed for pH, specific conductance, temperature, dissolved oxygen, and turbidity using a water quality probe or similar device. Calibration of the instruments will be conducted prior to each sampling event in accordance with the manufacturer's specifications and calibrated following each sampling event. Calibration records will be kept on file.

A field observation data sheet will be completed for each sample collected to be representative of station conditions. Field observations include trash assessments, which will be performed at each station in accordance with the *Monitoring Workplan for the Assessment of Trash in San Diego County* (San Diego County Regional Copermittees [SDCRC], 2007a).

2.2 Composite Samples

A flow- or time-weighted composite sample will be collected at each station during the dry weather and wet weather monitoring events. During the monitoring event, sample aliquots will be collected in proportion to the rate of flow (i.e., flow-weighted) using automated equipment and Teflon-lined tubing. Dry weather flow-weighted composite samples will be collected over a typical 24-hour period, with a minimum of three sample aliquots collected per hour. Wet weather flow-weighted composite samples will be collected by taking sample aliquots across the hydrograph of the storm event. Based on the anticipated size of the storm, a flow-proportioned pacing will be programmed into the automated sampling equipment. The first sample aliquot will be taken at or shortly after the time that stormwater runoff begins, and each subsequent aliquot of equal volume will be collected every time the pre-selected flow volume (flow-proportional pacing) discharges past the monitoring location. Some variation may occur depending on actual storm intensity and duration.

The flow-weighted composite samples will be analyzed for all the constituents not identified for grab sampling. The complete list of constituents for the San Luis Rey River Watershed for dry weather and wet weather is provided in Attachment A.

2.3 Sample Analysis

Samples will be analyzed for the bacteria, chemistry, toxicity, and general field parameters provided in Attachment A. Attachment A includes the methods and target reporting limits for each constituent. Chemical, toxicity, and bacterial analysis of samples will be performed by a laboratory certified for the appropriate fields of testing by the California Environmental Laboratory Accreditation Program (ELAP). The laboratory(s) will also be a participant in the SMC Intercalibration Program.

General physical and chemical constituents will be analyzed by accredited laboratories, with the exception of field-measured constituents (i.e., pH, specific conductance, temperature, turbidity, and dissolved oxygen). Field measurements will be collected by field staff during sampling activities using an YSI 6600 series water quality probe or similar type device.

2.4 Quality Assurance / Quality Control

Quality assurance (QA) and quality control (QC) for sampling processes will include proper collection of the samples to minimize the possibility of contamination. All samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample bottles. Field staff will wear powder-free nitrile or similar gloves at all times during sample collection.

QC samples will be collected to ensure that valid data are collected. Depending on the parameter, QC samples will consist of blanks and duplicate samples to remain compliant with Surface Water Ambient Monitoring Program (SWAMP) protocols. QC requirements will be reviewed and discussed with the appropriate staff to verify the proper working order of equipment, refresh monitoring personnel in monitoring techniques, and determine whether the data quality objectives are being met.

The QA objectives for analyses conducted by the participating analytical laboratories are detailed in their Laboratory QA Manuals. The objectives for accuracy and precision involve all aspects of the testing process, including the following:

- Methods and standard operating procedures (SOPs)
- Calibration methods and frequency
- Data analysis, validation, and reporting
- Internal QC
- Preventive maintenance
- Procedures to ensure data accuracy and completeness

The results of the laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology will be identified, and the corresponding data will be appropriately qualified in the final report. All QA/QC records for the various testing programs will be kept on file for review by regulatory agency personnel.

2.4.1 Training and Certification

All field personnel will have current and relevant experience in all aspects of standard field monitoring, including use of relevant field equipment such as field instruments and monitoring equipment. Field personnel will be trained and will have experience in the sample collection and handling/storage, and chain-of-custody procedures. Proper field sampling and sample-handling techniques will be reviewed prior to sampling, and only those staff with proficiency will be permitted to conduct the field work. Training will be documented in the health and safety plan for each member of the field team.

All personnel are responsible for complying with the QA/QC requirements that pertain to their organizational/technical functions. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of his or her particular function and a general knowledge of laboratory operations, test methods, QA/QC procedures, and records management.

2.4.2 Chain-of-Custody Procedures

Samples will be considered to be in custody if they are (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal such that the sample could not be reached without breaking the seal. The principal documents used to identify samples and to document possession will be chain-of-custody (COC) records, field logbooks, and field tracking forms. COC procedures will be used for samples throughout the collection, transport, and analytical process.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or group of samples. Each person who will have custody of the samples will sign the form and ensure that the samples will not be left unattended unless properly secured. Documentation of sample handling and custody includes the following:

- Sample identifier
- Sample collection date and time
- Any special notations on sample characteristics or analysis
- Initials of the person collecting the sample
- Date the sample was sent to the analytical laboratory
- Shipping company and waybill information

Completed COC forms will be placed in a plastic envelope and kept inside the cooler containing the samples. Once delivered to the analytical laboratory, the COC form will be signed by the person receiving the samples. The condition of the samples will be noted and recorded by the receiver. COC records will be included in the final reports prepared by the analytical laboratories and are considered an integral part of the report. An example chain of custody form is provided in Attachment C

2.4.3 *Field Quality Control*

For all conventional water quality analyses except field measurements performed on grab samples, field blanks and field duplicates will be analyzed in accordance with SWAMP guidelines as described in Attachment B.2.i(1) of the Permit.

For toxicity testing, only field duplicates will be collected. The use of controls and reference toxicant testing are QA/QC measures that have been put in place to identify changes in test organism sensitivity due to stress or other factors.

2.4.4 *Equipment Calibration*

All instruments used for field and laboratory analyses will be calibrated in accordance with the manufacturer's specifications. Calibration of the flow monitoring and sampling equipment will be conducted immediately prior to deployment or use and will be field verified during each data download or sampling event. The calibrations will be conducted in accordance with the manufacturer's specifications.

Field measurements for pH, specific conductance, dissolved oxygen, turbidity, and temperature will be made using a water quality probe in accordance with the manufacturer's specifications. The water quality probe will be calibrated with calibration solutions, and it will be verified that the expiration date has not been exceeded.

2.4.5 *Equipment Decontamination and Cleaning*

QA/QC for sampling processes begins with proper collection of the samples to minimize the possibility of contamination. All water samples will be collected in laboratory-certified, contaminant-free bottles. Appropriate sample containers and field measurement and sampling gear will be transported to the sampling location in clean storage containers. Field measurements will be taken and recorded using the appropriate decontaminated equipment. If sampling poles are used for collecting water samples, they will be decontaminated between sampling locations.

2.5 TOXICITY IDENTIFICATION EVALUATIONS

Toxicity identification evaluations (TIEs), if necessary, will be conducted in compliance with Provisions D.1.c.(4)(f) and D.1.d.(4) of the Permit and used to determine the causative agent(s) of toxicity. Provision D.4.a.(2) indicates the need for a TIE. As necessary, TIEs will be conducted in accordance with the guidelines for characterizing chronically toxic effluents (USEPA, 1991; USEPA, 1992; USEPA, 1993a; USEPA, 1993b).

Phase I TIE testing typically involves manipulating the sample(s) using the methods in Table 2-1.

Treatment blanks will be created for each TIE treatment to determine the effects of the manipulation on laboratory dilution water. The results of these blanks will be used to determine whether any changes in toxicity of the control (dilution water) are impacted by the chemical or physical manipulation of the sample. A baseline test, run concurrently with the TIE treatments, will be performed to assess the toxicity of the unmanipulated sample(s). Baseline tests are intended to confirm the presence of toxicity in the sample and to benchmark the toxicity for comparison to toxicity in TIE treatments.

Table 2-1. Typical Phase I TIE Manipulations

Physical and Chemical Manipulation (Test) on Water Samples	Purpose of Test
Filtration	Detects filterable compounds (e.g., total suspended solids [TSS] related)
Aeration	Detects volatile, oxidizable, sublatable, or spargeable compounds
Ethylenediaminetetraacetic acid (EDTA) addition	Detects cationic metals (e.g., cadmium)
Sodium thiosulfate (STS) addition	Detects oxidative compounds (e.g., chlorine)
Solid phase extraction (SPE) over C18 column, followed by methanol elution	Detects non-polar organics and some surfactants
Piperonyl butoxide (PBO) addition	Detects organophosphate pesticides and pyrethroids
Carboxyl esterase addition	Detects pyrethroids
Bovine serum albumin (BSA) addition	Protein BSA is used as a control for the carboxyl esterase
Temperature reduction	Increases toxicity of pyrethroid pesticides
pH reduction	Detects pH-dependent toxicants (e.g., ammonia or sulfides)

2.6 DRY WEATHER HYDROMODIFICATION MONITORING

This section describes the sampling and data collection methods for the dry weather receiving water hydromodification monitoring requirements as outlined in Provision D.1.c.(6) of the Permit.

In addition to the hydromodification monitoring conducted as part of the Participating Agencies' Hydromodification Management Plans, hydromodification monitoring for SDR-MLS is required at least once during the Permit term. The Participating Agencies must collect the following hydromodification monitoring observations and measurements within an appropriate domain of analysis during at least one dry weather monitoring event for each long-term receiving water monitoring location:

- Channel conditions, including: Channel dimensions, hydrologic and geomorphic conditions, and presence and condition of vegetation and habitat
- Location of discharge points
- Habitat integrity
- Photo documentation of existing erosion and habitat impacts, with location (i.e., latitude and longitude coordinates) where photos were taken
- Measurement or estimate of dimensions of any existing channel bed or bank eroded areas, including length, width, and depth of any incisions
- Known or suspected cause(s) of existing downstream erosion or habitat impact, including flow, soil, slope, and vegetation conditions, as well as upstream land uses and contributing new and existing development

The monitoring will coincide with the spring receiving water dry weather monitoring event in May or June and the dry weather receiving water bioassessment monitoring. The domain of analysis at each long-term monitoring location for dry weather hydromodification monitoring will be within the same reach of the channel as that used for dry weather bioassessment monitoring.

Table 2-2 provides an outline of the hydromodification monitoring requirements and the methods for each assessment category. Detailed methods for each assessment category are described in the following sections.

Table 2-2. Hydromodification Monitoring Requirements

Assessment Requirement Category	Method
Channel Conditions	
Channel Dimensions	Channel survey (cross-sectional and thalweg survey)
Hydrologic and geomorphic conditions	Southern California Coastal Water Research Project (SCCWRP) channel assessment tool
Presence and condition of vegetation and habitat	California Rapid Assessment Method (CRAM)
Location of discharge points	Table of MS4 outfalls to stream segment
Habitat integrity	CRAM
Photo documentation of existing erosion and habitat impacts, with location (i.e., latitude and longitude coordinates) where photos were taken	Channel survey and photo documentation
Measurement of estimate of dimensions of any bed or bank eroded areas, including length, width, and depth of any incisions	Channel survey
Known or suspected cause(s) of existing downstream erosion or habitat impact, including flow, soil, slope, and vegetation conditions, as well as upstream land uses and contributing new and existing development	Geographic information system (GIS) desktop analysis and SCCWRP channel assessment tool

2.6.1 *Channel Dimensions*

Channel surveys will be conducted at each monitoring location to gather basic hydraulic measurements of the receiving water channels. Channel surveys will be conducted using a DeWalt self-leveling rotary laser. The cross-section survey involves placing endpoints at the highest point of the channel on each bank. A measuring tape will be stretched between the endpoints such that the zero end of the tape is attached to the endpoint on the left bank of the channel (looking downstream). Channel depth will be measured across the channel from a stadia rod that is vertical and level from the channel bottom. The channel thalweg surveys will be conducted for the reach upstream and downstream of the cross-section. The average channel slope will be calculated from the survey data.

2.6.2 *Hydrologic and Geomorphic Conditions*

The geomorphic assessment will be conducted to characterize the susceptibility of the channel and gather basic hydraulic measurements of the receiving water channels. The geomorphic assessment comprises the channel survey and the Southern California Coastal Water Research Project (SCCWRP) channel assessment tool. The SCCWRP Field Manual (Bledsoe et al., 2010) will be used to assess the vertical and lateral susceptibility of the receiving water channels. The domain of analysis for each monitoring location is derived from the desk and field components of the screening tool and will be within reach of the channel used for dry weather bioassessment monitoring. A suite of field measurements will also be made to characterize the channel bed and banks, and overall stability state. Sediment samples will be collected to characterize bed materials. Fixed-interval pebble counts will be performed for each reach where the channel bed is composed of gravel or coarser material (Bunte and Abt, 2001), and channel beds composed of fine material will be noted as sand or cohesive materials (bed gradations are not required for channels with D50 less than (<) 2 millimeters [mm]).

2.6.3 *Presence and Condition of Vegetation and Habitat Integrity*

The presence and condition of vegetation and habitat integrity will be determined from the data collected during dry weather bioassessment monitoring. For dry weather bioassessment monitoring, the sampling will follow the protocols previously outlined in Section 2.5. Physical habitat quality assessments of the monitoring locations using the California Rapid Assessment Method (CRAM) will provide a numerical summary score of the physical conditions for each monitoring location. This method involves assessing the quality of the in-stream habitat features as well as the buffer zones (250 meters perpendicular to flow from each bank and 500 meters upstream and downstream of the monitoring reach), hydrologic source quality, and biotic structure quality. For each monitoring reach sampled, the physical habitat of the stream and its adjacent banks will be assessed to provide a record of the overall physical condition of the reach. Parameters such as substrate complexity, channel alteration and human influence, frequency of riffles, and width and quality of riparian zones will provide a more comprehensive understanding of the condition of the stream. Additionally, specific characteristics of the sampled riffles will be measured, including substrate size classes, stream depth, gradient, sinuosity, and flow volume. A final CRAM score will be calculated that can range from 25 to 100 points, with higher scores indicating higher quality conditions. CRAM ratings of good, fair, and poor are defined by the score (i.e., for the CRAM score range of 25-100, <50=low, 50-75=moderate, and >75=high).

2.6.4 *Photo Documentation*

A channel survey will be conducted and photographs will be used to document the conditions in the receiving water channels, including any existing erosion and habitat impacts. Photographs will be taken using a digital camera with a built-in Global Positioning System (GPS), altimeter, and compass. Photo documentation will be conducted using the general procedures outlined in San Diego Water Board Stream Photo Documentation Procedures for 401 Water Quality Certifications Standard Operating Procedure.

The following information will be recorded for each photograph:

- Project name
- General location
- Photographer and team members
- Photo number
- Date
- Time

At a minimum, photographs will be taken of the following:

- Long view up or down the stream (from stream level) showing changes in the stream bank and vegetation
- Long view and medium view of streambed changes (e.g., thalweg, gravel, meanders)
- Long views from a bridge or other elevated position
- Medium and close views of structures and plantings
- Medium views of bars and banks, with a person (preferably holding a stadia rod) in view for scale
- Close views of streambed with a ruler or other common object in the view for scale

2.6.5 *Dimensions of Bed or Bank Eroded Areas*

Measurements or estimates of dimensions of any bed or bank eroded areas, including length, width, and depth of any incisions, will be conducted during the channel survey. Bed or bank eroded areas will be documented with photographs as described in the channel survey section above.

2.6.6 *Location of Discharge Points/Known or Suspected Causes of Erosion or Habitat Impact*

Known or suspected cause(s) of existing downstream erosion or habitat impact, including flow, soil, slope, and vegetation conditions, as well as upstream land uses and contributing new and existing development, will be assessed during a GIS desktop exercise and the SCCWRP channel assessment tool.

2.7 Dry Weather Receiving Water Bioassessment Monitoring

Dry weather receiving water bioassessment monitoring will be conducted in accordance with the Permit (Provisions D.1.a.(1), D.1.a.(3)(a), D.1.c.(5), and D.1.e.(1)(a)). Dry weather receiving water bioassessment monitoring will include bioassessment at each long-term receiving water monitoring location and participation in the SMC Regional Monitoring Program. Bioassessment surveys will be conducted during the spring/summer dry season bioassessment index period, typically from May through July. Benthic macroinvertebrates (BMIs) and physical habitat data will be collected following the *SWAMP Bioassessment Procedures: Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California* (Ode, 2007) using the reach-wide benthos method. Benthic algae (i.e., periphyton) monitoring will be conducted in accordance with the *SWAMP Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California* (Fetscher et al., 2009). Samples will be collected and processed for ash-free dry mass (AFDM), chlorophyll-a analysis, and periphyton taxonomy. Reach-wide algal cover will be quantified as part of the SWAMP physical habitat assessment. Physical habitat quality of the monitoring locations will be quantified using CRAM for riverine wetlands (Collins et al., 2012).

The SWAMP sampling protocol includes the collection of stream BMI and also assesses the physical quality and condition of the streambed and banks in detail. (Note: A physical habitat index based on the SWAMP procedure has not been developed at the time of this report). CRAM assessments incorporate broader buffer zone and land use attributes than do SWAMP assessments, and also provide a numerical quality score for each monitoring location. BMIs reside in streams for periods ranging from a month to several years, and have varying sensitivities to the multiple stressors associated with urban runoff. Using species-specific tolerance values and community species composition, numerical biometric indices are calculated, allowing for comparison of relative habitat health among streams in a region. By assessing the invertebrate community structure of a stream, a cumulative measure of stream habitat health and ecological response is obtained.

The data include a taxonomic listing of all BMIs identified in the surveys, and calculation of the biological metrics listed in the California Stream Bioassessment Procedure (CSBP). Additionally, calculation of two indices that rate the overall BMI community quality will be performed. These include the Index of Biotic Integrity (IBI) (Ode et al., 2005) and the observed to expected (O/E) ratio of taxa (Hawkins, Western Center for Monitoring and Assessment, 2010).

2.7.1 2015 SMC Regional Monitoring Program

The 2015 SMC Regional Monitoring Program is currently being developed. The SMC Bioassessment Technical Workgroup is working to determine which components of the 2009-2013 SMC Regional Monitoring Program were effective tools for achieving the program's goals and what monitoring elements may be suspended or added for future assessments. Beginning in 2015, SMC will confirm the monitoring locations under this program.

2.7.2 *Monitoring Reach Delineation*

Using SWAMP methodology, every monitoring reach is 150 meters in length and will be sampled from downstream to upstream. If a portion of a reach is inaccessible, the reach length may be reduced to as little as 100 meters. The bioassessment reaches are placed as closely as possible to the water quality and flow monitoring locations.

2.7.3 *Macroinvertebrate Sample Collection*

BMI samples will be collected at evenly spaced 15-meter transects for a total of 11 transects in the 150-meter reach. The samples will be collected in an alternating margin-center-margin pattern. Collections will be made using a 1-foot-wide, 0.5-millimeter (mm)-mesh, D-frame kick-net. A 1-square-foot area upstream of the net will be sampled by disrupting the substrate and scrubbing the cobble and boulders, so that the organisms will be dislodged and swept into the net by the current. The duration of the sampling generally ranges from 1 to 3 minutes, depending on the substrate complexity. Every monitoring location will be sampled from downstream to upstream. The samples will be combined into a single composite sample for the reach, transferred to 1-quart jars, preserved with 95 percent ethanol, and returned to the laboratory for processing. Photographs will be taken of every monitoring location.

2.7.4 *Multihabitat Periphyton Sample Collection*

Periphyton (benthic algae) will be collected using the reach-wide procedure and within the same transects used for BMI collection, but offset 1 meter upstream to avoid disturbed substrate. Depending on the substrate type and the stream habitat, one of three sampling devices will be used to collect the substrate sample: a 12.6-square centimeter (cm^2) rubber delimiter, a 4-centimeter (cm) diameter polyvinyl chloride (PVC) delimiter, or a syringe scrubber.

After all transects are sampled, the subsamples will be composited. The macroalgae will be gathered and separated from the composited liquid. A subsample of the macroalgae will be taken for the soft-bodied taxonomic identification sample. The composite liquid volume will be recorded, and the remaining macroalgae will be finely cut up and thoroughly mixed with the composite liquid. The homogenized sample will be used for the diatom taxonomic identification sample, as well as the two filtered biomass samples. The diatom and soft-bodied algae samples will be fixed accordingly before being delivered to the laboratory for taxonomic identification. Taxonomic identification will be performed by a qualified taxonomist. The remaining homogenized portion of the composite will be filtered in the field, and the filters will be placed on ice and/or frozen until delivery to the chemistry laboratory for chlorophyll-a and ash-free dry mass analysis.

A separate soft-bodied algae sample will be collected for qualitative taxonomic identification. The qualitative sample consists of a composite of all soft-bodied algae found within the reach. The sample will be left unpreserved and put on ice or refrigerated until delivery to the laboratory for taxonomic identification. Qualitative taxonomic identifications will be performed by a qualified taxonomist for the receiving water and SMC monitoring locations.

2.7.5 *PHYSICAL HABITAT QUALITY ASSESSMENT*

For each monitoring reach sampled, the physical habitat of the stream and its adjacent banks will be assessed to provide a record of the overall physical condition of the reach. Parameters such as substrate complexity, channel alteration and human influence, frequency of riffles, and width and quality of riparian zones will provide a more comprehensive understanding of the condition of the stream. Additionally, specific characteristics of the sampled riffles will be measured, including substrate size classes, stream depth, gradient, sinuosity, and flow volume.

CRAM assessments of each monitoring location also will be performed. This method assesses the quality of the in-stream habitat features as well as the buffer zones (250 meters perpendicular to flow from each bank and 500 meters upstream and downstream of the monitoring reach), hydrologic source quality, and biotic structure quality. A final CRAM score will be calculated that can range from 25 to 100 points, with the higher scores indicating higher quality conditions.

Water quality measurements will be taken at each of the monitoring locations using a YSI Model 6600 (or comparable) data sonde. Measurements will include water temperature, specific conductance, pH, and dissolved oxygen. Samples will be collected for laboratory analysis following the protocols outlined in the SMC Regional Monitoring Program Workplan. Stream flow velocity will be measured with a Marsh-McBirney Model 2000 (or comparable) portable flowmeter, or will be visually estimated when the water is too shallow for the flowmeter.

2.7.6 *LABORATORY PROCESSING AND ANALYSIS*

Laboratory processing of BMI samples will follow the SWAMP Bioassessment Procedures: *Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrates in California* (Woodward et al., 2012). At the laboratory, samples are poured over a No. 35 standard testing sieve (0.5-mm stainless-steel mesh), and the ethanol is retained for reuse. The sample is gently rinsed with fresh water, and large debris such as wood, leaves, or rocks are removed. The sample is transferred to a tray marked with grids approximately 50 cm^2 in size. One grid is randomly selected, and the sample material contained within that grid is removed and processed. In cases where the test organisms appear extremely abundant, a fraction of the grid may be removed.

The material from the grid is examined under a stereomicroscope, and all the invertebrates are removed, sorted into major taxonomic groups, and placed in vials containing 70 percent ethanol. If there are less than 600 test organisms in the grid, another grid is selected and processed. This process is repeated until 600 organisms are removed from the sample, or until the entire sample is sorted. Organisms from a grid in excess of 600 are also removed, counted, and recorded as "remaining test organisms," so that estimated total organism abundance and density for the sample can be calculated. Terrestrial organisms, vertebrates, water-column associated organisms (e.g., copepods), and nematodes are not removed from the samples. Processed material from the sample is placed in a separate jar and labeled "sorted," and the unprocessed material is returned to the original sample container and archived. Sorted material is retained for QA purposes. All organisms are identified to Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) standard taxonomic effort Level II (SAFIT, 2006).

2.7.7 Quality Assurance/Quality Control

QA/QC procedures for the Bioassessment Monitoring and SMC Program will be consistent with those outlined in Section 2.2.4. In addition, QA of the benthic infauna sample sorting will be performed on all of the samples to ensure at least a 90 percent removal rate of organisms. Organisms removed during sorting QA also will be identified. Taxonomic QA will be performed on 10 percent of the samples.

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3 DATA MANAGEMENT, ASSESSMENT, AND REPORTING

The Monitoring and Assessment Annual Report, which will be submitted to the RWQCB on January 31 annually, will include descriptions of monitoring conducted during the applicable monitoring year.

3.1 DATA MANAGEMENT

Field Data Records and Analytical Data Reports will be sent to and kept by the Program Manager or specified contracted agency. Data will be submitted in a standardized California Environmental Data Exchange Network (CEDEN)-compatible format to the County of San Diego for their records.

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ATTACHMENT A
DRY WEATHER AND WET WEATHER CONSTITUENTS, POTENTIAL METHODS, VOLUMES, HOLDING TIMES, AND TARGET REPORTING LIMIT

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Table A-1. Analyte List for Long-Term Receiving Water Monitoring

Analyte	Volume Required	Potential Analytical Method*	Target Reporting Limit	Units	Max Holding Time	Dry Weather Receiving Water Monitoring	Wet Weather Receiving Water Monitoring
Conventional Parameters							
Chloride	250 mL	USEPA 300.0	0.5	mg/L	28D	X[4]	X[4]
Dissolved Organic Carbon	250 mL	SM 5310 C	0.50	mg/L	28D	X[7]	X[7]
Dissolved Oxygen	In field	Meter	0.01	mg/L	NA	X[1,2,6C]	X[1,2,9]
pH	In field	Meter	0.01	pH	NA	X[1,2,6B,6C]	X[1,2,9]
Specific Conductivity	In field	Meter	1	µS/cm	NA	X[1,2]	X[1,2,9]
Sulfates	250 mL	USEPA 300.0	0.5	mg/L	28D	X[7]	X[7]
Temperature	In field	Meter	0.1	°C	NA	X[1,2]	X[1,2,9]
Total Hardness	Calculation from Calcium and Manganese	SM 2340B	0.662	mg/L	NA	X[7]	X[7,9]
Total Organic Carbon	250 mL	SM 5310 C	0.30	mg/L	28D	X[7]	X[7]
Turbidity	In field or lab: 250 mL	Meter	0.1	NTU	NA or 48H	X[1,2,6B,6C,7]	X[1,2,7,8,9]
Indicator Bacteria							
Enterococcus	100 mL	SM 9230C	20	MPN/100mL	8H	X[3,4,5,6A,6B,6C,7,9]	X[3,4,5,7,9]
Fecal Coliform	100 mL	SM 9221E	20	MPN/100mL	8H	X[3,4,5,6A,6B,6C,7,9]	X[3,4,5,7,9]
Total Coliform	100 mL	SM 9221B	20	MPN/100mL	8H	X[3,4,5,6A,7,9]	X[3,4,5,7,9]

Table A-1. Analyte List for Long-Term Receiving Water Monitoring (Continued)

Analyte	Volume Required	Potential Analytical Method*	Target Reporting Limit	Units	Max Holding Time	Dry Weather Receiving Water Monitoring	Wet Weather Receiving Water Monitoring
Inorganic Analytes							
Arsenic (Dissolved)	250 mL	USEPA 200.8	0.0004	mg/L	6M	X[7]	X[7]
Arsenic (Total)	250 mL	USEPA 200.8	0.0004	mg/L	6M	X[7]	X[7]
Cadmium (Dissolved)	250 mL	USEPA 200.8	0.0001	mg/L	6M	X[6B,6C,7]	X[7]
Cadmium (Total)	250 mL	USEPA 200.8	0.0001	mg/L	6M	X[6B,6C,7]	X[7,8]
Chromium (Dissolved)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6B,6C,7,12]	X[7]
Chromium (Total)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6B,6C,7,12]	X[7]
Chromium III (Dissolved)	NA	Calculated from Chromium and Chromium VI	NA	NA	NA	X[6B,6C]	-
Chromium III (Total)	NA	Calculated from Chromium and Chromium VI	NA	NA	NA	X[6B,6C]	-
Chromium VI (Dissolved)	250 mL	USEPA 218.6	0.0003	mg/L	28D	X[6B,6C]	-
Chromium VI (Total)	250 mL	USEPA 218.6	0.0003	mg/L	28D	X[6B,6C]	-
Copper (Dissolved)	250 mL	USEPA 200.8	0.0005	mg/L	6M	X[6B,6C,7]	X[7]
Copper (Total)	250 mL	USEPA 200.8	0.0005	mg/L	6M	X[6B,6C,7]	X[7,8]
Iron (Dissolved)	250 mL	USEPA 200.7	0.01	mg/L	6M	X[6C,7]	X[7]
Iron (Total)	250 mL	USEPA 200.7	0.01	mg/L	6M	X[6C,7]	X[7]
Lead (Dissolved)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6B,6C,7]	X[7]
Lead (Total)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6B,6C,7]	X[7,8]
Manganese (Dissolved)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6C]	-
Manganese (Total)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6C]	-

Table A-1. Analyte List for Long-Term Receiving Water Monitoring (Continued)

Analyte	Volume Required	Potential Analytical Method*	Target Reporting Limit	Units	Max Holding Time	Dry Weather Receiving Water Monitoring	Wet Weather Receiving Water Monitoring
Mercury (Dissolved)	250 mL	USEPA 245.1	0.00005	mg/L	28D	X[7]	X[7]
Mercury (Total)	250 mL	USEPA 245.1	0.00005	mg/L	28D	X[7]	X[7]
Nickel (Dissolved)	250 mL	USEPA 200.8	0.0008	mg/L	6M	X[6B,6C,7]	X[7]
Nickel (Total)	250 mL	USEPA 200.8	0.0008	mg/L	6M	X[6B,6C,7]	X[7]
Selenium (Dissolved)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[4,7]	X[4,7]
Selenium (Total)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[4,7]	X[4,7]
Silver (Dissolved)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6B,6C]	-
Silver (Total)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[6B,6C]	-
Thallium (Dissolved)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[7]	X[7]
Thallium (Total)	250 mL	USEPA 200.8	0.0002	mg/L	6M	X[7]	X[7]
Zinc (Dissolved)	250 mL	USEPA 200.8	0.005	mg/L	6M	X[6B,6C,7]	X[7]
Zinc (Total)	250 mL	USEPA 200.8	0.005	mg/L	6M	X[6B,6C,7]	X[7,8]
Nutrients							
Ammonia	250 mL	USEPA 350.1	0.1	mg/L	28D	X[4,7]	X[4,7]
Dissolved Phosphorus	250 mL	USEPA 365.1	0.01	mg/L	48H	X[4]	X[4]
Nitrate	250 mL	USEPA 353.2	0.1	mg/L	48H	X[4,7,10]	X[4,7,8,11]
Nitrite	250 mL	USEPA 353.2	0.1	mg/L	48H	X[4,7,10]	X[4,7,8,11]
Orthophosphate	250 mL	USEPA 365.1	0.002	mg/L	48H	X[4,7]	X[4,7]
TKN	250 mL	USEPA 351.2	0.1	mg/L	28D	X[4,7]	X[4,7]
Total Nitrogen	Calculation	Calculated from TKN, Nitrate, and Nitrite	NA	NA	NA	X[4,5,6C]	X[4,5]
Total Phosphorus	250 mL	USEPA 365.1	0.01	mg/L	28D	X[4,5,6C,7]	X[4,5,7,8]

Table A-1. Analyte List for Long-Term Receiving Water Monitoring (Continued)

Analyte	Volume Required	Potential Analytical Method*	Target Reporting Limit	Units	Max Holding Time	Dry Weather Receiving Water Monitoring	Wet Weather Receiving Water Monitoring
Solid Parameters							
TDS	500 mL	SM 2540C	10	mg/L	7D	X[4,7]	X[4,7]
TSS	1000 mL	SM 2540D	5	mg/L	7D	X[7]	X[7]
Synthetic Organic Compounds							
MBAS	500 mL	SM 5540C	0.05	mg/L	48H	X[6C,7]	X[7]
Organophosphate Pesticides	2 L	USEPA 625M	0.01	µg/L	7/40D	X[7]	X[7]
Synthetic Pyrethroids	2 L	GC/MS NCI-SIM	2-10	ng/L	7/40D	X[7]	X[7]
Toxicity							
Larval Survival and Growth with *Pimephales promelas*	15 L	EPA-821-R-02-013	NA	Pass/Fail	36H	X[4,13]	X[4,13]
Survival and Reproduction with *Ceriodaphnia dubia*	4 L	EPA-821-R-02-013	NA	Pass/Fail	36H	X[4,13]	X[4,13]
Growth with *Selenastrum capricornutum*	4 L	EPA-821-R-02-013	NA	Pass/Fail	36H	X[4,13]	X[4,13]

Table A-1. Analyte List for Long-Term Receiving Water Monitoring (Continued)

Analyte	Volume Required	Potential Analytical Method*	Target Reporting Limit	Units	Max Holding Time	Dry Weather Receiving Water Monitoring	Wet Weather Receiving Water Monitoring

NA = Not applicable; mL = milliliter; L = liter; D = day; H = hour; M = month

* The methods presented in the table are potential methods. Other equicalent EPA-approved methods may be substituted as long as the target reporting limits are met for the corresponding constituents.

1. Parameter listed in Table D-2 of the MS4 Permit.
2. Analytes that are field measured are not required to be analyzed by a laboratory.
3. Parameter contributes to a highest priority water quality condition identified in the San Luis Rey River WMA Water Quality Improvement Plan.
4. Parameter listed as a cause for impairment of receiving waters in the San Luis Rey River WMA on the 303(d) list.
5. Parameter for CLRP developed for a TMDL in the San Luis Rey River WMA.

6A. Parameter listed in NALs for discharges from MS4s to Ocean Surf Zone (MS4 Permit Provision C.1.a(1))

6B. Parameter listed in NALs for discharges from MS4s to Bays, Harbors, and Lagoons/Estuaries (MS4 Permit Provision C.1.a(2))

6C. Parameter listed in NALs for discharges from MS4s to Inland Surface Waters (MS4 Permit Provision C.1.a(3))

7. Parameter listed in Table D-3 of the MS4 Permit.
8. Parameter listed in SALs for discharges from MS4s to receiving waters (Table C-5 of the MS4 Permit).
9. Grab samples may be collected for pH, temperature, specific conductivity, dissolved oxygen, turbidity, hardness, and indicator bacteria.
10. Nitrite and nitrate may be combined and reported as nitrite+nitrate.
11. Nitrite and nitrite will be reported as nitrite+nitrate.
12. Analysis of Chromium in MS4 discharges is not explicitly required in the MS4 permit. Chromium is analyzed to calculate Chromium III.
13. Parameter listed in Table D-4 of the MS4 Permit. SLR-MLS is located in freshwater so only freshwater constituents are represented.

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ATTACHMENT B
STREAM RATING AND CHANNEL SURVEY DETAILS

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STREAM RATINGS

Per the San Diego County Regional Copermittees' (SDCRC) Transitional Receiving Water Monitoring Program Work Plan, stream ratings may be conducted as described herein (SDCRC, 2014).

The flow rate at each of the monitoring locations will be determined by stream stage (water level) sensors that are typically secured to the bottom of the channel. To quantify flow rates on the basis of stream stage, a relationship between flow and stage will be derived using the standardized stream rating protocols developed by the U.S. Geological Survey (USGS) (Rantz, 1982; Oberg et al., 2005). Instantaneous flow measurements will be taken at various stages at each of the monitoring locations. The measurements will be combined to produce and calibrate the rating curve for each monitoring location.

To accurately measure flow in streams, the following elements are needed to develop the rating curves:

- An accurate survey of the stream channel cross-section and longitudinal slope
- Accurate level measurements based on a fixed point
- Measurements of velocity and flows at several points throughout the rating curve, including low flow, mid flow, and peak flow conditions

To measure instantaneous flows during low flow and base flow conditions, two velocity measurement instruments are typically used—a Marsh-McBirney Model 2000 Portable Flowmeter connected by a cable to an electromagnetic open channel velocity sensor and the SonTek (YSI) FlowTracker Acoustic Doppler Velocimeter. The FlowTracker is a high-precision, shallow-water flowmeter that measures velocity in three dimensions and features an automatic discharge computation.

To make an instantaneous flow measurement, a tape measure is stretched across the stream, perpendicular to flow and secured on both banks of the stream. The tape is positioned so that it is suspended approximately 1 foot above the surface of the water. The distance on the tape directly above the waterline (i.e., where the water meets the bank) is recorded as the initial point. The first measurement is made at the first point where there is adequate water depth (i.e., at least 0.2 foot) and measurable velocity. At this point, three measurements are made, including water depth, velocity, and distance from the bank (the initial point). Subsequent depth, velocity, and distance measurements are made incrementally across the entire width of the channel. Data from the field measurements are entered into a computer model that calculates the stream's cross-sectional profile from the depth and distance from bank measurements. Total flow across the channel is determined by integrating the velocity measurements over the cross-sectional surface area of the stream channel. The result is an instantaneous flow measurement in cubic feet per second.

A StreamPro Acoustic Doppler Current Profiler (ADCP) is used to measure mid- and high-stage flow conditions. The StreamPro ADCP is the USGS instrument of choice for measuring flows nationwide (Oberg et al., 2005). The instrument is pulled across the stream either by walking across a bridge or attaching the unit to a tagline. Data are collected in real time and transmitted by a wireless data link to a PC. Data can be viewed in real time and are typically post-processed following the field event in the office.

Rating curves are extended to high stream stages not measured using site-specific survey information and the Chézy–Manning formula (Linsley et al., 1982). The Chézy–Manning formula is an empirical formula for open channel flow, or flow driven by gravity, as follows:

$$Q = (1.486 / n) A R^{2/3} S^{1/2}$$

where:

- Q = flow
- n = Manning Roughness coefficient
- A = cross-sectional area
- R = hydraulic radius
- S = hydraulic slope

The hydraulic radius is derived as follows:

$$R = A/P$$

where:

- A = cross-sectional area of flow (ft2)
- P = wetted perimeter (ft)

The Chézy–Manning formula was developed for conditions of uniform flow in which the water surface profile and energy gradient are parallel to the streambed and the area, hydraulic radius, and depth remain constant throughout the reach. Field surveys of the channel geometry of each MLS will be conducted to compute the channel characteristics for each station.

CHANNEL SURVEYS

Channel surveys will be conducted at each monitoring location to gather basic hydraulic measurements of the receiving water channels and to derive stream discharge using the Chézy–Manning formula. Channel surveys will be conducted using a DeWalt self-leveling rotary laser. The cross-section survey involves placing endpoints at the highest point of the channel on each bank. A measuring tape is stretched between the endpoints such that the zero end of the tape is attached to the endpoint on the left bank of the channel (looking downstream). Channel depth is measured across the channel from a stadia rod that is vertical and level from the channel bottom. The channel thalweg surveys are conducted for the reach upstream and downstream of the cross-section. The average channel slope is calculated from the survey data.

Channel survey data are used with the Chézy–Manning formula to produce a rating curve for each sampling location. Each rating curve is calibrated using instantaneous flow measurements by adjusting the formula roughness coefficient.

UNITED STATES GEOLOGICAL SURVEY WATERSHEDS

USGS flow monitoring gauges are located in the larger watersheds, specifically Santa Margarita, San Luis Rey, Los Peñasquitos Creek, San Diego River, and Tijuana River. The USGS gauging stations are used to estimate the annual flow volumes for the watersheds. The SLR-MLS is within relative proximity to the USGS San Luis Rey River flow monitoring station. The SLR-MLS flow data will be compared with USGS data, as it will also be used to validate flow monitoring data collected at SLR-MLS.

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ATTACHMENT C
EXAMPLE CHAIN-OF-CUSTODY FORM

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EXAMPLE - CHAIN-OF-CUSTODY FORM

Date: _________ ***Page*** ____ ***of*** ____

Analyzing Laboratory: ___________________________

Project Name / Project Number					**Container Type / Volume**	**Total Number of Containers**	**Analysis / Test Requested**								**Preservation**	**Laboratory Use Only**	
Project Manager / Contact																	
Client																	
Address																	
Phone / Fax / Email																	
Site ID (Location)	**Sample ID**	**Date**	**Time**	**Matrix**												**Temp (C) Upon Receipt**	**Laboratory ID**

Sample Matrix Code: FW = Freshwater; SW = Storm Water; SLT = Saltwater; SED = Sediment; BIO = Biologic; O = Other (Specify) __________________

Container Code: G = Glass; P = Plastic; B = Bags; O = Other (Specify) ______________

Shipped By: ☐ Courier ☐ FedEx ☐ UPS ☐ USPS ☐ Client Drop-Off ☐ Other ________________

Turnaround Time: ☐ 2-day ☐ 5-day ☐ 7-day ☐ 10-day ☐ 14-day ☐ Standard ☐ Other _______________________

Reporting Requirements: ☐ PDF ☐ EDD ☐ Hard Copy ☐ Email ☐ Other _______________________

Sampled By:

Name (Print): _____________________________

Signature: _____________________________

Comments/Special Instructions:

Relinquished By				**Received By**			
Print Name	Signature	Firm	Date/Time	Print Name	Signature	Firm	Date/Time
1				1			
2				2			
3				3			
4				4			
5				5			

ATTACHMENT 4A-2: SAN LUIS REY RIVER WATERSHED SEDIMENT QUALITY MONITORING PLAN

San Luis Rey River Watershed Sediment Monitoring Plan

Prepared For:
San Luis Rey River Watershed
Participating Agencies

Prepared By: Weston
Solutions, Inc.
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September 2, 2014

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January 2015

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A Water Quality Control Plan for Enclosed Bays and Estuaries - Part 1 Sediment Quality
B Sediment Monitoring Plan QAPP

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
AVS:SEM	acid-volatile sulfides and simultaneously extracted metals
Bight	Southern California Bight Regional Monitoring Program
BRI	Benthic Response Index
CA EPA	California Environmental Protection Agency
CA LRM	California Logistic Regression Model
CEDEN	California Environmental Data Exchange Network
COC	chain-of-custody
Copermittees	San Diego Regional Copermittees
CSI	Chemical Score Index
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DGPS	Differential Global Positioning System
DO	dissolved oxygen
DTCS	Department of Toxic Substances Control
EC_{50}	median effective concentration
IBI	Index of Biotic Integrity
ID	inner diameter
LC_{50}	median lethal concentration
LOE	line of evidence
$MgSO_4$	magnesium sulfate
MLOE	multiple lines of evidence
MS4	Municipal Separate Storm Sewer System
MW	molecular weight
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls pH hydrogen ion concentration
P_{MAX}	maximum probability model
QA	quality assurance
QA/QC	quality assurance/quality control
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
QC	quality control

ACRONYMS AND ABBREVIATIONS (Continued)

RBI	Relative Benthic Index
RIVPACS	River Invertebrate Prediction and Classification System
RL	Reporting Limit
RWQCB	Regional Water Quality Control Board
SCAMIT	Southern California Association of Marine Invertebrate Taxonomists
SDRWQCB	San Diego Regional Water Quality Control Board
SOPs	Standard Operating Procedures
SPME	solid phase microextraction
SQOs	Sediment Quality Objectives
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TIE	toxicity identification evaluation
TMDL	Total Maximum Daily Load
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
WQIP	Water Quality Improvement Plan

UNITS OF MEASURE

cm	centimeter
°C	degrees Celsius
ft	feet or foot
L	liter
m^2	square meters
µg/kg	microgram per kilogram
mg	milligram
mg/kg	milligram per kilogram mg/L milligram per liter
mL	milliliter
mm	millimeter
ppt	parts per thousand
%	percent

1.0 INTRODUCTION

The San Diego County Regional Copermittees (Copermittees) are required to conduct sediment quality monitoring in accordance with the requirements of the San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001 (Permit), effective June 27, 2013. The Copermittees are required, either individually, in association with multiple Copermittees, or through participation in a water body monitoring coalition to perform sediment quality monitoring to assess compliance with the sediment quality receiving water limits applicable to MS4 discharges to enclosed bays and estuaries. Provision D.1.e.(2) of the Permit requires the Copermittees to develop a Sediment Monitoring Plan for incorporation into the Water Quality Improvement Plan (WQIP) which satisfies the requirements of the Water Quality Control Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality (Sediment Control Plan; State Water Quality Control Board [SWRCB] and California Environmental Protection Agency [CA EPA], 2009; see Appendix A).

Provision D.1.e.(1)(b) of the Permit also requires the Copermittees to participate in the Southern California Bight Regional Monitoring Program (Bight). The Bight Program can be used to simultaneously fulfill all or part of the sediment quality monitoring requirement (Provision D.1.e(2)) as long as the Bight Program utilizes the Sediment Control Plan to assess the health of San Diego County lagoons. Depending on the outcome of the sediment quality objectives (SQOs) assessments at Bight stations located in San Diego County lagoons, follow-up monitoring may be necessary to meet all of the Permit requirements.

The following Sediment Monitoring Plan describes the sediment quality sample collection and analysis activities that will be implemented by the Copermittees during the Permit term. As required by the Permit, this Sediment Monitoring Plan includes the elements listed in Sections VII.D and VII.E of the Sediment Control Plan (Receiving Water Limits Monitoring Frequency and Sediment Monitoring, respectively), a Sediment Monitoring Quality Assurance Project Plan (QAPP) (Appendix B), and a schedule for completion of monitoring and submission of the Sediment Monitoring Report. Once the sediment quality monitoring is complete, the Copermittees will incorporate a Sediment Monitoring Report into the WQIP Annual Report.

1.1 BACKGROUND

In 2003, the SWRCB initiated a program to develop SQOs for enclosed bays and estuaries. The primary objective is to protect benthic communities and aquatic life from exposure to contaminants in sediment that have been directly discharged into the water body or indirectly discharged into waters draining into the water body. The SQOs, which are outlined in the Sediment Control Plan, are based on a multiple lines of evidence (MLOE) approach in which the lines of evidence (LOE) are sediment toxicity, sediment chemistry, and benthic community condition, as described in the Sediment Control Plan (see Appendix A) and in Section 3.2. The MLOE approach evaluates the severity of biological effects and the potential for chemically mediated effects to provide a final station level assessment. The Sediment Control Plan was approved by the SWRCB and the Office of Administrative Law on September 16, 2008, and on January 5, 2009, respectively, and was subsequently approved by the United States Environmental Protection Agency (USEPA) on August 25, 2009.

1.2 MONITORING OBJECTIVE

The primary objective of the sediment monitoring program is to assess compliance with the sediment quality receiving water limits applicable to MS4 discharges to enclosed bays and estuaries of San Diego County. Sediment toxicity, chemistry, and benthic community condition will be assessed using SQOs as described in the Sediment Control Plan (Appendix A). The goals of the SQOs are to determine whether pollutants in sediments are present in quantities that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful.

The goal of the Sediment Monitoring Plan is to provide the key elements that are required to successfully conduct field sediment sampling, processing, testing, and analysis of the results. Analyses of chemistry, toxicity, and benthic community condition require that samples be collected, preserved, processed, and analyzed using proper field and laboratory equipment, methods, and techniques. Additionally, representative station locations ensure the proper characterization of benthic conditions. The Sediment Monitoring Plan and Sediment Monitoring QAPP (Appendix B) describe the collection and analysis of surface sediment samples necessary to provide representative assessments of in situ conditions for the enclosed bays and estuaries of San Diego County.

2.0 MATERIALS AND METHODS

The materials and methods described in this section are designed to meet the requirements of the Sediment Control Plan, Sections VII.D and VII.E, as required by Permit Provision D.1.e.(2)(a). The methodology is outlined in Section V of the Sediment Control Plan. If sediment quality monitoring is conducted as part of the Bight Program, the work plans and associated QA/QC documents pertaining to the Bight Program should be followed.

Quality assurance methods and procedures needed to maintain consistency in sample collection, processing, and analysis to produce scientifically defensible data are provided in the Sediment Monitoring Quality Assurance Project Plan (QAPP) (Appendix B). The QAPP provides acceptability criteria for the collection and analysis of duplicate field samples, field or equipment rinse blanks, laboratory methods, and laboratory spikes. The QAPP should be used as a reference to ensure proper methods are used consistently throughout the monitoring program.

2.1 FIELD COLLECTION PROGRAM

2.1.1 Station Selection

The Sediment Control Plan applies to subtidal surficial sediments located seaward of the intertidal zone in enclosed bays and estuaries. It does not apply to ocean waters, inland surface waters, sediments consisting of less than 5 percent (%) fines or substrates composed of gravel, cobble, or consolidated rock, or to sediment classified as a pollutant due to physical processes such as burial or sedimentation. SQOs have been fully developed for only two of California's six enclosed bay habitats: euhaline (salinity = 25 to 32 parts per thousand [ppt]) bays and coastal lagoons south of Point Conception and polyhaline (18 to 25 ppt) central San Francisco Bay. In addition, the benthic species assemblage used to calculate the benthic LOE for southern California marine bays is Habitat C (Bay et al., 2014), and one of the criteria for Habitat C is a salinity greater than 27 ppt. In order to select a sampling station applicable to the SQQ assessment using Habitat C for the benthic LOE, it is recommended to verify that a proposed sampling station is both subtidal and has salinity greater than 27 ppt. Salinity measurements should be taken at a spring high and low tide to get an estimate of the salinity range for a proposed station. If feasible, it is recommended that salinity should be monitored throughout an entire spring tidal cycle to ensure it meets the salinity criteria prior to sampling. This monitoring can be accomplished by deploying a continuous monitoring device such as an YSI water quality data sonde. Water depth should also be measured when visiting the station at a spring low tide or deploying a continuous monitoring device over a spring tidal cycle to ensure the station is subtidal.

The Sediment Control Plan does not give guidance as to how many stations should be sampled in each lagoon. The number of sampling stations may vary within based on the spatial extent of the area likely to be impacted. If the Bight Program is utilized to fulfill the Sediment Quality Monitoring requirement of the Permit, then the number of stations will be dictated by the Bight Program. For example, in the 2008 Bight Program, five stations were analyzed per lagoon; however, in the 2013 Bight Program the number of stations per lagoon varied from one to three stations. If a stressor identification study becomes necessary following the original SQO assessment of a lagoon (see Section 4.0), then the number of stations will be based on what suspected pollutants are driving the impacted scores (e.g. algae, physical factors, or chemical factors) and to have enough samples to statistically support meaningful findings.

2.1.2 Permitting

Scientific collecting permits from the California Department of Fish and Wildlife are required to collect benthic infaunal samples containing invertebrate specimens. A minimum of 24 hours (business days only) prior to collecting benthic infaunal samples in the field, a copy of the Notification of Intent to Collect for Scientific Purposes form should be faxed or emailed to the Marine Region (Monterey, CA) office of the CDFW. Additionally, written authorization may be required from state agencies or private landowners in order to gain access to water bodies that are surrounded by private land, have locked fences or gates, contain threatened or endangered species, or require the use of a private boat launch. Nesting seasons of threatened and endangered bird species may prevent sampling from being conducted or may restrict access around nesting areas during certain times of year, typically mid to late summer months.

2.1.3 Monitoring Season and Frequency

Section VII.E.6 of the Sediment Control Plan requires that samples for SQO programs be collected between June and September. Physical environments and benthic community composition and abundance within enclosed bays and estuaries are generally stable and most similar from year to year during this time (Bay et al., 2014).

According to Section VII.D of the Sediment Control Plan, sediment monitoring associated with Phase I stormwater discharges and major discharges will be conducted at least twice during the Permit cycle except at stations that have consistently been classified as unimpacted or likely unimpacted using the MLOE approach described in Section 3.2. At the unimpacted or likely unimpacted stations, monitoring may be reduced to a frequency of once during the Permit cycle. The participating agencies propose to conduct one round of sediment sampling each permit term. The second required round of sampling will be satisfied by conducting additional follow up sampling in the vicinity of potentially impacted sites identified in the first round. For the San Luis Rey River Estuary, since 2011, a year-round, naturally occurring sand bar has obstructed tidal flow into the San Luis Rey River mouth, resulting in predominantly fresh water environment. The Participating Agencies will continue to periodically monitor the situation and will update the Regional Board of the status of the San Luis Rey Estuary prior to the California Bight 2018 Study.

2.1.4 Sampling Vessels

Vessels used to collect sediment samples should be both stable and maneuverable and should have a sufficiently shallow draft to navigate into shallow waters (e.g. large inflatable boat). The vessels should be equipped with a side or rear davit from which to deploy and retrieve surface sampling equipment, and should accommodate a minimum of two persons in addition to all appropriate sampling and safety equipment.

2.1.5 Navigation

All station locations will be pre-plotted prior to sampling activities. Stations will be identified using a Differential Global Positioning System (DGPS). The system uses U.S. Coast Guard differential correction data, and is accurate within 10 feet (ft). All final station locations will be recorded in the field using positions from the DGPS.

2.1.6 Sediment Sampling and Handling

Benthic sediments will be collected as surface grabs using an appropriate sampler, such as a stainless steel Van Veen grab sampler. The size of the grab sampler to be used for sediment programs in Southern California should be 0.1 square meter (m^2) across the top of the sampler. An appropriate sampler for the collection of benthic sediments will have the following characteristics:

- Constructed of a material that does not introduce contaminants.
- Causes minimal surface sediment disturbance.
- Does not leak or mix during sample retrieval.
- Has a design that enables safe/easy sample verification that samples meet all applicable sampling criteria (e.g., collects sediments to at least 5 centimeters (cm) below the sediment surface, has access doors allowing visual inspection and removal of undisturbed surface sediment).

A sample will be determined to be acceptable if the surface of the grab is even, there is minimal surface disturbance, and there is a penetration depth of at least 5 cm. Rejected grabs will be discarded, and the station will be re-sampled. Upon retrieval, if the grab is acceptable, the overlying water will be carefully drained, and the sediment will be processed depending on analysis and use. Sediment grabs will be collected for the following analyses: benthic infauna, chemistry, grain size, and toxicity. Station location and grab event data should be written on preformatted field data sheets (hard copies or via computer). At a minimum, field data should include station identification, station location, date, time of sample collection, depth of water, depth of penetration of grab in sediment (e.g. 5 cm), sediment composition, sediment odor and color, and sample type (e.g. sediment chemistry).

In the event that a pre-plotted sample station is found to be unsuitable for collecting sediment, because of factors such as inaccessibility, the salinity does not meet the SQO criteria, disturbance to wildlife, or safety considerations, the station may be abandoned and an alternate station may be selected. Reasons for abandonment should be recorded on field data sheets.

The entire contents of a grab sample will be collected for benthic community analyses. Samples collected for benthic infaunal analysis will be rinsed through a 1.0-millimeter (mm) mesh screen. The material retained on the screen will be transferred to a labeled glass or plastic sample container. A 7% magnesium sulfate ($MgSO_4$) seawater solution will be added to the sample container to 85-90% of its volume to relax the collected specimens. The sample container will be inverted several times to distribute the relaxant solution. After 30 minutes, add enough sodium borate buffered formaldehyde to top off the sample container and gently invert the container several times to ensure the sample is mixed. This will make a 10% formalin solution.

Sediment samples for toxicity testing and chemistry will be collected from the top 5 cm of a grab sample using a pre-cleaned stainless steel scoop. Sediment within 1 cm of the sides of the grab will be avoided to prevent interaction of any contaminants and the steel sampling device. According to the Sediment Control Plan, the preferred method of collection for sediment-water interface toxicity tests (see Section 2.2.2.2) is to collect intact cores directly from the sediment sampler by pressing polycarbonate core tubes (7.3-cm inner diameter [ID] and 16 cm in length) into the top 5 cm of sediment. However, homogenizing sediment for sediment-water interface testing is also acceptable according to the Sediment Control Plan. This method is more practical to implement in the field and is consistent with previous sediment quality objective methodology (e.g., Bight protocols and previous lagoon monitoring implemented by the Copermittees). Minimum sample volumes and types of sample containers to be used in the sediment collection is provided in the Sediment Monitoring QAPP (see Appendix B)

All sampling equipment will be cleaned prior to sampling. Between sampling stations, the grab sampler will be rinsed with station water. Stainless steel scoops will be rinsed with seawater and rinsed with de-ionized water between stations. All sediment samples will be logged on a chain-of-custody (COC) form (see Section 2.1.7). Sediment chemistry and toxicity samples will be placed in a cooler on ice until delivered or shipped to the appropriate laboratories. Prior to shipping, sample containers will be placed in sealable plastic bags and securely packed inside the cooler with ice. The original signed COC forms will remain with the samples during shipment. Sediment samples will be shipped or delivered to the analytical laboratory within appropriate holding times (refer to Sediment Monitoring QAPP in Appendix B).

2.1.7 Documentation of Chain-of-Custody

This section describes the program requirements for sample handling and COC procedures. Samples are considered to be in custody if they are: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession are COC records, field log books, and field tracking forms. COC procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or sample group. Each person who has custody of the samples will sign the form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sample identification.
- Sample collection date and time.
- Any special notations on sample characteristics.
- Initials of the person collecting the sample.
- Date the sample was sent to the laboratory.
- Shipping company and waybill information.

The completed COC form will be placed in a sealable plastic envelope that will travel inside the ice chest containing the listed samples. The COC form will be signed by the person transferring custody of the samples. The condition of the samples will be recorded by the receiver. COC records will be included in the final analytical report prepared by the laboratory and will be considered an integral part of the report.

2.2 LABORATORY TESTING

All samples will be tested in accordance with USEPA or American Society for Testing and Materials (ASTM) protocols. If appropriate protocols do not exist, the Copermittees should use other methods approved by the SWRCB orSan Luis Rey RWQCB. Analytical laboratories will be certified by the California Department of Health Services in accordance with Water Code 13176. Additional information pertaining to laboratory testing is presented in the Sediment Monitoring QAPP (see Appendix B).

2.2.1 Physical and Chemical Analysis

Physical and chemical measurements of sediment were selected to comply with the Sediment Control Plan and to provide data on chemicals of potential concern in bays and estuaries located in San Diego County. The physical and chemical analyses of sediments will include, at a minimum, the constituents outlined in Table 2-2. Reporting limits (RLs) must be equal to or less than those listed in Table 2-2 in order to generate the chemistry LOE outlined in Section 2.3.3.1. Concentrations associated with the RLs in Table 2-2 are expressed in dry-weight. Physical analyses of sediment will include grain size and percent solids. Grain size will be analyzed to determine the general size classes that make up the sediment (e.g., gravel, sand, silt, and clay), whereas percent solids will be measured to convert chemical concentrations from a wet-weight to a dry-weight basis. Chemical analyses of sediment will include total organic carbon (TOC), and the select trace metals, chlorinated pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) shown in Table 2-2.

Table 2-2. Chemical and Physical Parameters for Sediment Samples

Parameter	Reporting Limit
Physical/Conventional Tests	
Grain Size	1.00 %
Percent Solids	0.10 %
Total Organic Carbon (TOC)	0.01 %
Metals	
Cadmium (Cd)	0.09 mg/kg
Copper (Cu)	52.8 mg/kg
Lead (Pb)	25.0 mg/kg
Mercury (Hg)	0.09 mg/kg
Zinc (Zn)	60.0 mg/kg
Organochlorine Pesticides	
2,4′-DDD	0.50 µ g/kg
2,4′-DDE	0.50 µ g/kg
2,4′-DDT	0.50 µ g/kg
4,4′-DDD	0.50 µ g/kg

Table 2-2. Chemical and Physical Parameters for Sediment Samples (Continued

Parameter	Reporting Limit
4,4′-DDE	0.50 μ g/kg
4,4′-DDT	0.50 μ g/kg
Chlordane-alpha	0.50 μ g/kg
Chlordane-gamma	0.54 μ g/kg
Dieldrin	2.5 μ g/kg
trans-Nonachlor	4.6 μ g/kg
PCB Congeners	
2,4'-Dichlorobiphenyl	3.0 μ g/kg
2,2',5-Trichlorobiphenyl	3.0 μ g/kg
2,4,4'-Trichlorobiphenyl	3.0 μ g/kg
2,2',3,5'-Tetrachlorobiphenyl	3.0 μ g/kg
2,2',5,5'-Tetrachlorobiphenyl	3.0 μ g/kg
2,3',4,4'-Tetrachlorobiphenyl	3.0 μ g/kg
2,2',4,5,5'-Pentachlorobiphenyl	3.0 μ g/kg
2,3,3',4,4'-Pentachlorobiphenyl	3.0 μ g/kg
2,3',4,4',5-Pentachlorobiphenyl	3.0 μ g/kg
2,2',3,3',4,4'-Hexachlorobiphenyl	3.0 μ g/kg
2,2',3,4,4',5'-Hexachlorobiphenyl	3.0 μ g/kg
2,2',4,4',5,5'-Hexachlorobiphenyl	3.0 μ g/kg
2,2',3,3',4,4',5-Heptachlorobiphenyl	3.0 μ g/kg
2,2',3,4,4',5,5'-Heptachlorobiphenyl	3.0 μ g/kg
2,2',3,4',5,5',6-Heptachlorobiphenyl	3.0 μ g/kg
2,2',3,3',4,4',5,6-Octachlorobiphenyl	3.0 μ g/kg
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	3.0 μ g/kg
Decachlorobiphenyl	3.0 μ g/kg
PAHs (low molecular weight)	
Acenaphthene	20.0 μ g/kg
Anthracene	20.0 μ g/kg
Phenanthrene	20.0 μ g/kg
Biphenyl	20.0 μ g/kg
Naphthalene	20.0 μ g/kg
2,6-Dimethylnaphthalene	20.0 μ g/kg
Fluorene	20.0 μ g/kg
1-Methylnaphthalene	20.0 μ g/kg
2-Methylnaphthalene	20.0 μ g/kg
1-Methylphenanthrene	20.0 μ g/kg
PAHs (high molecular weight)	
Benzo(a)anthracene	80.0 μ g/kg
Benzo(a)pyrene	80.0 μ g/kg
Benzo(e)pyrene	80.0 μ g/kg
Chrysene	80.0 μ g/kg
Dibenzo(a,h)anthracene	80.0 μ g/kg
Fluoranthene	80.0 μ g/kg
Perylene	80.0 μ g/kg
Pyrene	80.0 μ g/kg

Table 2-2. Chemical and Physical Parameters for Sediment Samples (Continued

Parameter	Reporting Limit

DDD Dichlorodiphenyldichloroethane; DDE dichlorodiphenyldichloroethylene;
DDT dichlorodiphenyltrichloroethane; mg/kg milligrams per kilogram;
µ g/kg micrograms per kilogram

2.2.2 Toxicity Testing

To evaluate the benthic condition of San Diego County's bays and lagoons, sediment toxicity testing will be conducted in accordance with ASTM and USEPA methods. Toxicity testing involves a short-term survival test, a sublethal endpoint test, and an assessment of sediment toxicity. For each test type, more than one specific test is acceptable. The appropriate species tested for a sample will depend on the characteristics of the sample such as grain size, salinity, and suspected toxic constituents, if any. When historical data are available for a sample location, it is recommended that the same species be used in order to make comparisons and to conduct trend analysis. In addition, when testing is conducted as part of a regional monitoring program such as the Bight program, the species selection will be dictated by the program.

If significant toxicity is observed in the solid phase or sediment-water interface test, a toxicity identification evaluation (TIE) may be conducted as part of stressor identification studies described in Section 4.0.

2.2.2.1 Short-Term Survival Testing

SQO analysis requires that at least one short-term survival test be conducted. There are three acceptable short-term survival tests, each of which is a 10-day test exposing amphipods to whole sediment. The three acceptable test organisms are Eohaustorius estuarius, Leptocheirus plumulosus, and Rhepoxynius abronius. The E. estuarius short-term survival test has been the 10-day test method used in previous San Diego County lagoon monitoring programs where the SQO analytical tool was used to assess lagoon health. These amphipod bioassays will be conducted in accordance with procedures outlined in Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods (USEPA, 1994) and ASTM method E1367-03 (ASTM, 2006) or an equivalent method. Test conditions are summarized in Table 2-3.

A water-only reference toxicity test should be conducted concurrently with the whole sediment amphipod test to assess the relative sensitivity of test organisms used in the evaluation of project sediments. Amphipod reference toxicant tests are typically conducted using cadmium. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing.

Table 2-3. Summary of Conditions for 10-Day Whole Sediment Amphipod Bioassay

Test Conditions 10-Day Whole Sediment Bioassay			
Test Species	E. estuarius	L. plumulosus	R. abronius
Test Procedures	USEPA (1994); ASTM E1367-03 (2006)		

Test Type/Duration		Static - Acute Whole Sediment/10 days		
Sample Storage Conditions		4 °C, dark, minimal head space		
Age/Size Class		3-5 mm	2-4 mm; immature	3-5 mm
Grain Size Tolerance		0.6-100% sand	0-100% sand	10-100% sand
Recommended Water Quality Parameters	Temperature	15 ± 1 °C	25 ± 1 °C	15 ± 1 °C
	Salinity	20 ± 2 ppt	20 ± 2 ppt	28 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation		
	Total Ammonia	< 60 mg/L	< 60 mg/L	< 30 mg/L
Test Chamber		1 L glass		
Exposure Volume		2 cm sediment, 800 mL seawater		
Replicates/Sample		5		
No. of Organisms/Replicate		20		
Photoperiod		Continuous light		
Feeding		None		
Water Renewal		None		
Aeration		Constant gentle aeration		
Acceptability Criteria		Mean control survival > 90%; >80% survival in each replicate		

mg/L milligram per liter

2.2.2.2 Sublethal Testing

The second type of testing required for SQO analysis is a sublethal test. Either a 48-hour development test exposing embryos of the bivalve *Mytilus galloprovincialis* to the sediment-water interface may be conducted or a 28-day survival and growth test exposing the polychaete worm *Neanthes arenaceodentata* to whole sediment. Test condition summaries for the bivalve and polychaete tests are presented in Table 2-4 and Table 2-5, respectively. The *M. galloprovincialis* sediment-water interface test has been the sublethal test method used in previous San Diego County lagoon monitoring programs where the SQO analytical tool was used to assess lagoon health.

Mytilus galloprovincialis Sediment-Water Interface Development Sublethal Test

Sediment-water interface bioassays are performed to estimate the potential toxicity of contaminants fluxing from test sediments into the overlying water. The sediments will be tested in a 48-hour sediment-water interface test using the bivalve M. galloprovincialis in accordance with procedures outlined in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms (USEPA, 1995) and Assessment of Sediment Toxicity at the Sediment-Water Interface (Anderson et al., 1996). Sediment-water interface bioassays will be tested on intact cores collected in the field or on homogenized sediment samples as described in Section 2.1.6.

A water-only reference toxicity test should be conducted concurrently with the sediment-water interface bivalve test to assess the relative sensitivity of test organisms used in the evaluation of the project sediments. Bivalve reference toxicant tests are typically conducted using copper. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing.

Table 2-4. Test Conditions for the 48-Hour M. galloprovincialis Sediment-Water Interface Bioassay

Test Conditions 10-Day Whole Sediment Bioassay		
Test Species		M. galloprovincialis
Test Procedures		USEPA (1995), Anderson et al. (1996)
Test Type/Duration		Static - Acute sediment-water interface/48 hours
Sample Storage Conditions		4 °C, dark, minimal head space
Age/Size Class		< 4 hour old larvae
Recommended Water Quality Parameters	Temperature	15 ± 1 °C
	Salinity	32 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation
	Total Ammonia	< 4 mg/L
Test Chamber		Polycarbonate core tube 7.3-cm inner diameter, 16 cm high
Exposure Volume		5 cm sediment, 300 mL water
Replicates/Sample		4
No. of Organisms/Replicate		Approximately 250 larvae
Photoperiod		16 hours light: 8 hours dark
Feeding		None
Water Renewal		None
Aeration		Constant gentle aeration
Acceptability Criteria		Mean control normal-alive > 80%

Neanthes arenaceodentata Whole Sediment Survival and Growth Sublethal Test

The N. arenaceodentata test will be conducted in accordance with ASTM method E1562 (ASTM, 2002) with modifications described in Farrar and Bridges (2011) that have been found to contribute manageability and precision to the ASTM procedure. A water-only reference toxicity test should be conducted concurrently with the whole sediment polychaete test to assess the relative sensitivity of test organisms used in the evaluation of the project sediments. Polychaete reference toxicant tests are typically conducted using cadmium. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing.

Table 2-5. Test Conditions for the 28-Day Whole Sediment N. arenaceodentata Bioassay

Test Conditions 10-Day Whole Sediment Bioassay	
Test Species	N. arenaceodentata
Test Procedures	ASTM E1562 (2002), Farrar and Bridges (2011)
Test Type/Duration	Static - Acute Whole Sediment/28 days

Sample Storage Conditions		4 °C, dark, minimal head space
Age/Size Class		≤ 7 days post-emergence
Grain Size Tolerance		5-100% sand
Recommended Water Quality Parameters	Temperature	20 ± 1 °C
	Salinity	30 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation
	Total Ammonia	< 20 mg/L
Test Chamber		300 mL glass
Exposure Volume		2 cm sediment, 125 mL seawater
Replicates/Sample		10
No. of Organisms/Replicate		1
Photoperiod		12 hours light: 12 hours dark
Feeding		Twice per week
Water Renewal		Weekly
Aeration		Constant gentle aeration
Acceptability Criteria		Mean control survival ≥ 80%; positive growth in

2.2.3 Benthic Infauna Analysis

The benthic infauna samples will be transported from the field to the laboratory and stored in a formalin solution for a minimum of 48 hours and no longer than 5 days. The samples will then be transferred from formalin to 70% ethanol for laboratory processing. The organisms will initially be sorted using a dissecting microscope into five major phyletic groups: polychaetes, crustaceans, molluscs, echinoderms, and miscellaneous minor phyla. While sorting, technicians will keep a count for quality control purposes, as described in the following paragraph. After initial sorting, samples will be distributed to qualified taxonomists who will identify each organism to species or to the lowest possible taxon. Taxonomists will use the most recent version of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) taxonomic listing for nomenclature and orthography.

A QA/QC procedure will be performed on each of the sorted samples to ensure a 95% sorting efficiency. A 10% aliquot of a sample will be re-sorted by a senior technician trained in the QA/QC procedure. The number of organisms found in the aliquot will be divided by 10% and added to the total number found in the sample. The original total will be divided by the new total to calculate the percent sorting efficiency. When the sorting efficiency of the sample is below 95%, the remainder of the sample (90%) will be re-sorted.

2.2.3.1 Quality Assurance/Quality Control

All quality assurance/quality control (QA/QC) samples must be conducted in accordance with the Quality Assurance Management Plan (QAMP) for the State of California's Surface Water Ambient Monitoring Program (SWAMP). The data quality objectives for all analyses conducted by the participating analytical laboratories will be detailed in the Sediment Monitoring QAPP (see Appendix B). The results of the laboratory quality control (QC) analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology or the Sediment Monitoring QAPP will be identified, and the corresponding data will be appropriately qualified in the final report. All QA/QC records for the various testing programs will be kept on file for review by regulatory agency personnel.

3.0 DATA REVIEW, MANAGEMENT, AND ANALYSIS

3.1 DATA REVIEW AND MANAGEMENT

All quality assurance/quality control (QA/QC) data must be conducted in accordance with the Quality Assurance Management Plan (QAMP) for the State of California's SWAMP and the data quality objectives as outlined in the Sediment Monitoring QAPP (see Appendix B). Data will be reviewed to determine that appropriate corrective actions have been taken, when necessary. The laboratories will supply analytical results in both hard copy and electronic formats. Laboratories will have the responsibility of ensuring that both formats are accurate. Monitoring data and analytical results will be uploaded into California Environmental Data Exchange Network (CEDEN).

3.2 DATA ANALYSIS

Sediment toxicity, chemistry, and benthic community condition will be assessed using California's SQOs as described in the Sediment Control Plan (Appendix A). The goals of the SQOs are to determine whether pollutants in sediments are present in quantities that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful to humans. SQOs have been fully developed for only one of Southern California's enclosed bay habitats: euhaline (salinity = 25 to 32 ppt) bays and coastal lagoons south of Point Conception. In addition, the benthic species assemblage used to calculate the benthic LOE for southern California marine bays is Habitat C (Bay et al., 2014), and one of the criteria for Habitat C is a salinity greater than 27 ppt. The data analysis methods described below should be limited to those subtidal areas of the coastal lagoons/estuaries where the for the SQO salinity criteria can be met.

The SQOs are based on a MLOE approach in which sediment toxicity, sediment chemistry, and benthic community condition are the LOE. The MLOE approach evaluates the severity of biological effects and the potential for chemically mediated effects to provide a final station level assessment. Brief descriptions of the specific methods associated with each LOE are described below. Detailed calculations and descriptions of each LOE are provided in the Sediment Control Plan (SWRCB and CA EPA, 2009) (see Appendix A).

3.2.1 Sediment Toxicity

Sediment toxicity will be assessed using two tests: a short-term survival test using one of three species of marine amphipods (E. estuarius, L. plumulosus, or R. abronius) and a sublethal test using either N. arenaceodentata (a species of polychaete worm) or M. galloprovincialis (a species of marine bivalve). Sediment toxicity test results from each station will be statistically compared to control test results; normalized to the control survival; and categorized as nontoxic, low, moderate, or high toxicity according to Table 3-1. The average of the two test response categories (nontoxic, low toxicity, moderate toxicity, and high toxicity) will be calculated to determine the final toxicity LOE category. If the average falls midway between the two categories, it will be rounded up to the higher of the two. For example, if the test response category for the short-term survival test is low toxicity, and the test response category for the sublethal test is moderate toxicity, the final category for sediment toxicity would be moderate toxicity.

Table 3-1. Sediment Toxicity Categorization Values

Test Type	Endpoint	Statistical Significance	Nontoxic[1]	Low Toxicity2	Moderate Toxicity[2]	High Toxicity[2]
Short-Term Survival Tests	E. estuaries Survival	Significant	90 to 100	82 to 89	59 to 81	<59
		Not significant	82 to 100	59 to 81	-	<59
	L. plumulosus Survival	Significant	90 to 100	78 to 89	56 to 77	<56
		Not significant	78 to 100	56 to 77	-	<56
	R. abronius Survival	Significant	90 to 100	83 to 89	70 to 82	<70
		Not significant	83 to 100	70 to 82	-	<70
Sublethal Tests	N. arenaceodentata Growth	Significant	90 to 1002	68 to 90	46 to 67	<46
		Not significant	68 to 100	46 to 67	-	<46
	M. galloprovincialis Normal-Alive	Significant	80 to 100	77 to 79	42 to 76	<42
		Not significant	77 to 79	72 to 76	-	<42

[1] Expressed as percent.
[2] Expressed as percent of control.

3.2.2 Sediment Chemistry

Sediment chemistry will be assessed using the analyte list presented in Table 3-2. Concentrations of chemicals detected in sediments will be compared to the California Logistic Regression Model (CA LRM) and the Chemical Score Index (CSI). The CA LRM is a maximum probability model (P_{max}) that uses logistic regression to predict the probability of sediment toxicity. The CSI is calculated independently of the CA LRM and is a predictive index that relates sediment chemical concentration to benthic community disturbance. Sediment chemistry results according to CA LRM and CSI are categorized as having minimal, low, moderate, and high exposure to pollutants (Table 3-2). The final sediment LOE category is the average of the two chemistry exposure categories. If the average falls midway between the two categories, it is rounded up to the higher of the two. For example, if the CA LRM is low exposure and the CSI is moderate exposure, then the final sediment LOE category is moderate exposure.

Table 3-2. Sediment Chemistry Guideline Categorization

Sediment Chemistry Guideline		Sediment LOE Category
CA LRM	CSI	
<0.33	<1.69	Minimal Exposure
0.33 - 0.49	1.69 - 2.33	Low Exposure
0.50 - 0.66	2.34 - 2.99	Moderate Exposure
>0.66	>2.99	High Exposure

3.2.3 Benthic Community Condition

Benthic community condition will be assessed using a combination of four benthic indices: the Benthic Response Index (BRI; abundance-weighted average pollution tolerance of sample organisms), the Relative Benthic Index (RBI; the weighted sum of community parameters and abundance of indicator species), the Index of Biotic Integrity (IBI; a measure that identifies benthic community characteristics outside of reference ranges), and a predictive model based on the River Invertebrate Prediction and Classification System (RIVPACS; a comparison of assemblages in a sample to expected species composition). The four indices will be calculated following the January 21, 2008, guidance provided by Southern California Coastal Water Research Project (SCCWRP) entitled Determining Benthic Invertebrate Community Condition in Embayments for Southern California marine bays. Each benthic index result is categorized according to four levels of disturbance, including reference, low, moderate, and high disturbance.

- Reference: Equivalent to a least affected or unaffected station.
- Low Disturbance: Some indication of stress is present, but is within measurement error of unaffected condition.
- Moderate Disturbance: Clear evidence of physical, chemical, natural, or anthropogenic stress.
- High Disturbance: High magnitude of stress.

Specific categorization values, which are tailored to southern California marine bays, are assigned for each index (Table 3-3), and are based on the specific taxa found within a given sample. To determine the benthic community condition, the four indices will be integrated into a single category. The median of the four benthic index response categories are computed to determine the benthic condition. If the median falls between two categories, the value is rounded to the next higher category to provide the most conservative estimate of benthic community condition.

Table 3-3. Benthic Index Categorization Values for Southern California Marine Bays

Benthic Community Guideline				Index
BRI	IBI	RBI	RIVPACS	
<39.96	0	>0.27	>0.90 to <1.10	Reference
39.96 - 49.14	1	0.17 - 0.27	0.75 - 0.90 or 1.10 - 1.25	Low Disturbance
49.15 - 73.26	2	0.09 - 0.16	0.33 - 0.74 or >1.25	Moderate Disturbance
>73.26	3 or 4	<0.09	<0.33	High Disturbance

3.2.4 Integration of Multiple Lines of Evidence

The station level assessment that indicates whether the aquatic life SQO at a station has been met will be determined by the combination of the three LOE categories to assess the severity of biological effects and the potential for chemically mediated effects. The severity of biological effects will be determined by combining the toxicity and benthic community condition LOEs (Table 3-4). The potential for chemically mediated effects will be determined by combining the toxicity and chemistry LOEs (Table 3-5).

Table 3-4. Determination of Severity of Biological Effects

Combination of Toxicity LOE and Benthic Condition LOE		Toxicity LOE: Non-toxic	Toxicity LOE: Low Toxicity	Toxicity LOE: Moderate Toxicity	Toxicity LOE: High Toxicity
Benthic Community Condition LOE	Reference	Unaffected	Unaffected	Unaffected	Low Effect
	Low Disturbance	Unaffected	Low Effect	Low Effect	Low Effect
	Moderate Disturbance	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect
	High Disturbance	Moderate Effect	High Effect	High Effect	High Effect

Table 3-5. Determination of Potential for Chemically Mediated Effects

Combination of Toxicity LOE and Sediment Chemistry LOE		Toxicity LOE: Non-toxic	Toxicity LOE: Low Toxicity	Toxicity LOE: Moderate Toxicity	Toxicity LOE: High Toxicity
Sediment Chemistry LOE	Minimal Exposure	Minimum Potential	Minimum Potential	Low Potential	Moderate Potential
	Low Exposure	Minimum Potential	Low Potential	Moderate Potential	Moderate Potential
	Moderate Exposure	Low Potential	Moderate Potential	Moderate Potential	Moderate Potential
	High Exposure	Moderate Potential	Moderate Potential	High Potential	High Potential

Based on the determinations of the severity of biological effects and the potential for chemically mediated effects, a station level assessment (Table 3-6) will be made that categorizes the station as one of the following:

- Unimpacted: Confident that sediment contamination is not causing significant adverse impacts to aquatic life living in station sediments.
- Likely unimpacted: Sediment contamination at the station is not expected to cause adverse impacts to aquatic life, but some disagreement among the LOE reduces the certainty that the station is unimpacted.
- Possibly impacted: Sediment contamination at the station may be causing adverse impacts to aquatic life, but the impacts are either small or uncertain due to disagreement among the LOE.
- Likely impacted: Evidence for a contaminant-related impact to aquatic life at the station is persuasive, even if there is some disagreement among the LOE.
- Clearly impacted: Sediment contamination at the station is causing clear and severe adverse impacts to aquatic life.

- Inconclusive: Disagreement among the LOE suggests that either the data are suspect or additional information is needed before a determination can be made.

Table 3-6. Determination of Final Station Assessment

Combination of Severity of Biological Effects and Potential for Chemically-Mediated Effects		**Severity of Biological Effects**			
		Unaffected	**Low Effect**	**Moderate Effect**	**High Effect**
Potential for Chemically-Mediated Effects	Minimal Potential	Unimpacted	Likely Unimpacted	Likely Unimpacted	Inconclusive
	Low Potential	Unimpacted	Likely Unimpacted	Possibly Impacted	Possibly Impacted
	Moderate Potential	Likely Unimpacted	Possibly Impacted or Inconclusive[1]	Likely Impacted	Likely Impacted
	High Potential	Inconclusive	Likely Impacted	Clearly Impacted	Clearly Impacted

[1] When chemistry classification is minimal exposure, benthic response is reference, and toxicity is high.

All 64 possible combinations are presented in Attachment B of the Sediment Control Plan.

If a station is consistently classified as Unimpacted or Likely Unimpacted according to the SQO assessments, then the protective condition has been achieved. In cases where segments contain stations categorized as Possibly Impacted but not Clearly Impacted or Likely Impacted, confirmation monitoring will be conducted prior to requiring stressor identification studies. If a follow-up assessment result is Unimpacted or Likely Unimpacted, the protective condition has been achieved at that location. If the final station assessment result is Possibly Impacted, Likely Impacted or Clearly Impacted, the station is considered degraded and the Copermittees may need to conduct a stressor identification study. Stations categorized as Inconclusive should not be used to evaluate whether the protective condition at a station has been met. Additional information should be gathered at stations classified as Inconclusive in order to understand why the LOE results show a level of disagreement.

If stations are categorized as Possibly Impacted within a monitored segment, reach, or water body that also contain stations that are not categorized as Clearly or Likely Impacted, then confirmation monitoring should be conducted in order to confirm the level of impact at these stations prior to initiating a stressor identification study. As stated in the Sediment Quality Assessment Technical Support Manual (Bay et al., 2014), "the Possibly Impacted station assessment is the least certain of all categorizations, and therefore requires the most caution during interpretation. Stations may be classified as Possibly Impacted due to low levels of effect for each LOE, indicating a low magnitude of impacts. Alternatively, a Possibly Impacted classification may be the result of a large disagreement between LOEs, potentially due to confounding factors or noncontaminant stressors." Following the confirmation monitoring, if the station assessment is categorized as Possibly Impacted, Likely Impacted, or Clearly Impacted then the Copermittees may need to conduct a stressor identification study. If additional monitoring or specialized studies at Possibly Impacted stations indicate that factors other than toxic pollutants in sediments are causing observed negative responses then it may be possible to designate the station as meeting the protective condition.

4.0 STRESSOR IDENTIFICATION

The highest priority for stressor identification will be assigned to those water body segments with the highest percentage of Clearly Impacted or Likely Impacted stations. In cases where segments contain sediments categorized as Possibly Impacted but not Clearly Impacted or Likely Impacted, confirmation monitoring will be conducted prior to requiring stressor identification studies. By reviewing the available data sets, deductive reasoning can be used to narrow the focus of future actions. Based on the outcome of the additional data analysis, steps forward for stressor identification should be coordinated with the San Luis Rey RWQCB. If a stressor identification study is required, the Copermittees should develop a clearly defined work plan prior to beginning work. No formal guidance is given in the Sediment Control Plan on how to conduct a stressor identification study; however, the Sediment Control Plan does give some general guidance on types of stressor identification studies that can be implemented. These studies include confirmation and characterization of pollutant-related impacts, pollutant identification, and source identification and management actions. These types of studies are summarized in the following sections.

4.1.1 Pollutant Confirmation and Characterization

When the analyses described in Section 3.2 indicate that pollutants are a likely cause of an SQO exceedance at a station, a variety of tools can be used to determine whether the reason for the narrative objective not being met is due to generic stressors other than toxic pollutants, such as physical alterations or other pollutant-related stressors. Physical disturbances, such as decreased salinity, dredging impacts, and grain size, are confounding factors that may produce conditions mimicking the effects of pollutants. In these cases, the benthic community LOE will indicate degradation, but the toxicity and chemistry LOEs may not. Pollutant-related stressors, such as ammonia, TOC, nutrients, and pathogens, may also be confounding factors. In these cases, the benthic community LOE will indicate degradation, toxicity may be indicated, and chemical concentrations will be low. To determine whether a station is impacted from toxic pollutants, one or more of the following tools may be included in the stressor identification analysis as part of the confirmation:

- Evaluate the spatial extent of the area of concern in relation to anthropogenic sources.
- Evaluate the body burden of the pollutants accumulated in the animals used for exposure testing.
- Evaluate the chemical constituent results in relation to the mechanistic benchmarks.
- Compare chemistry and biology LOE to determine whether correlations exist.
- Alternative biological assessment, such as bioaccumulation experiments, pore water toxicity, or pore water chemistry analyses, may be conducted.
- Phase I TIEs, which are often useful in determining the causative agent or class of compounds causing toxicity may be conducted.

According to the SQO guidelines, “If there is compelling evidence that the SQO exceedances contributing to a receiving water limit exceedance are not due to toxic pollutants, then the assessment area shall be designated as having achieved the receiving water limit.”

4.1.2 Pollutant Identification

Pollutant identification investigations may be conducted using one or more of the following types of data: statistical, biological, or chemical investigation data. These investigations should be station-specific and should be based on:

- Correlations between individual chemicals and biological endpoints.
- Gradient analysis of chemical concentrations and the biological responses in comparison to distance from a chemical hotspot.
- Additional TIE procedures.
- Sediment pore water investigations into the bioavailability of pollutants (e.g., acid-volatile sulfides and simultaneously extracted metals [AVS:SEM] analysis, solid phase microextraction [SPME], and/or laboratory desorption studies.
- Verification studies such as spiking or in situ toxicity and bioaccumulation studies.

In cases where stressor identification studies conducted on stations categorized as Possibly Impacted are inconclusive, the Copermittees may implement a one-time augmentation to the study or suspend stressor identification studies in favor of additional routine SQO monitoring.

4.1.3 Pollutant Source Identification and Management

Stressor identification studies should include determinations of whether sources are ongoing or legacy and determinations of the number and nature of ongoing sources. If a single or multiple dischargers are responsible for stressor pollutant discharges, the discharger(s) may need to address the SQO exceedance and to reduce the pollutant loading.

According to Section VII.H of the Sediment Control Plan, the San Luis Rey RWQCB may develop station-specific sediment management guidelines to estimate the level of the stressor pollutant in order to meet the SQOs. Guideline development should be initiated only following identification of the stressor, and should have an overall goal of establishing a relationship between the organism's exposure and the biological effect. Upon establishing this relationship, a pollutant- specific guideline may be designated that corresponds with minimum biological effects. Approaches that can be used to establish relationships between exposure and biological effect include the following: correspondence with sediment chemistry, correspondence with bioavailable pollutant concentration, correspondence with tissue residue, and literature review. Additionally, the Sediment Control Plan states that the chemistry LOE, "including the threshold values (e.g. CSI and CALRM) shall not be used for setting cleanup levels or numeric values for technical TMDLs."

5.0 REPORTING

Provision D.1.e.(2)(c) of the Permit requires incorporation of Sediment Monitoring Report into the WQIP Annual Report. The Sediment Monitoring Report will contain an evaluation, interpretation, and tabulation of monitoring data, including an assessment of whether receiving water limits outlined in the Permit were attained; a sample location map; and a statement of certification that monitoring data and results have been uploaded into CEDEN.

Based on the conclusions of the Sediment Monitoring Report, a human health risk assessment may be necessary to determine whether human health objectives have been obtained at each sample location. Provision A.2.a.(3)(b)(ii) states that "pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health." The potential risk assessments must consider any relevant information, such as guidelines set forth in the CA EPA's Office of Environmental Health Hazard Assessment (OEHHA) fish consumption policies, CA EPA's Department of Toxic Substances Control (DTSC) risk assessment, and the USEPA human health risk assessment policies.

6.0 SCHEDULE

The schedule for completing the sediment quality monitoring requirements of the Permit and for submitting the Sediment Monitoring Report is shown in Table 6-1:

Table 6-1. Sediment Monitoring Plan Schedule

Activity/Deliverable	Dates(s)
Monitoring Program	TBD
Draft Sediment Monitoring Plan	TBD
Draft Sediment Monitoring QAPP	TBD
Final Sediment Monitoring Plan	TBD
Final Sediment Monitoring QAPP	TBD
Follow-up confirmation monitoring	TBD
Final Sediment Monitoring Plan incorporated into WQIPs	TBD
Draft Sediment Monitoring Report	TBD
Final Sediment Monitoring Report incorporated into Transitional Monitoring and Assessment Report	TBD
Potential Stressor ID Studies	TBD
Potential Human health risk assessment	TBD

7.0 REFERENCES

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Appendix A

Water Quality Control Plan for Enclosed Bays and Estuaries - Part 1 Sediment Quality

Appendix B

Sediment Monitoring Plan QAPP

WATER QUALITY CONTROL PLAN
FOR ENCLOSED BAYS AND ESTUARIES
- PART 1 SEDIMENT QUALITY

Effective August 25, 2009

STATE WATER RESOURCES CONTROL BOARD

California Environmental Protection Agency

History of Plan
Adopted by the State Water Resources Control Board on September 16, 2008
Approved by the Office of Administrative Law on January 5, 2009
Approved by the U. S. Environmental Protection Agency on August 25, 2009

Prepared by
Chris Beegan, Ocean Unit, Division of Water Quality

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2008-0070

ADOPTION OF A WATER QUALITY CONTROL PLAN FOR
ENCLOSED BAYS AND ESTUARIES – PART 1 SEDIMENT QUALITY

WHEREAS:

1. California Water Code section 13393 requires the State Water Resources Control Board (State Water Board) to develop sediment quality objectives for toxic pollutants for California's enclosed bays and estuaries.

2. In 1991, the State Water Board adopted a workplan for the development of sediment quality objectives for California's enclosed bays and estuaries (1991 Workplan).

3. Due to funding constraints, the State Water Board did not implement the 1991 Workplan; consequently, litigation by environmental interests against the State Water Board ensued.

4. In August 2001, the Sacramento County Superior Court ruled against the state and ordered the State Water Board to initiate development of sediment quality objectives. On May 21, 2003, the State Water Board adopted a revised workplan.

5. Based upon the scope of work in the revised workplan, staff developed narrative sediment quality objectives to protect benthic communities, which utilize an approach based upon multiple lines of evidence.

6. Narrative sediment quality objectives have also been developed to protect human health from exposure to contaminants in fish tissue.

7. Staff also developed an implementation program for the narrative sediment quality objectives based upon input from the Scientific Steering Committee, Sediment Quality Advisory Committee, and staff of the State Water Board and the Regional Water Quality Control Boards (Regional Water Boards), and staff from other state and federal agencies. The work that has been completed, to date, is Phase 1 of the sediment quality objectives program.

8. The State Water Board recognizes this effort is an iterative process. Staff additionally have initiated a second phase of the sediment quality objectives program (Phase 2), which includes extensive sediment sampling in the Delta; further development of the estuarine chemistry, sediment toxicity, and benthic community indicators; and completion of a more prescriptive framework to address human health and exposure to contaminants in fish tissue. The tools, indicators, and framework developed under Phase 2 will be adopted into the draft plan in 2010. Phase 3 is proposed as the development, within available resources, of a

framework to protect fish and/or wildlife from the effects of pollutants in sediment. During Phases 2 and 3, staff would continue to evaluate the tools developed during the initial phase and the implementation language. As the Water Boards experience grows, the draft plan would be updated and amended as necessary to more effectively interpret and implement the narrative objectives.

9. In the process of developing SQOs, the State Water Board has identified the need to address statewide consistency in the regulation of dredging activities under the water quality certification program. While this issue is outside the scope of this plan, the State Water Board will consider initiating policy development in the future to address regulation of dredging activities under the water quality certification program.

10. The State Water Board's Clean Water Act section 303(d) listing policy was adopted prior to the development of SQOs and without the benefit of the scientific evidence supporting their development. The State Water Board recognizes the need to ensure that the listing policy and this plan are consistent. The State Water Board will, therefore, consider amending the 303(d) listing policy in the future to ensure consistency with this plan.

11. Staff has responded to significant verbal and written comments received from the public and made minor revisions to the draft plan in response to the comments.

12. In adopting this draft plan, the State Water Board has considered the requirements in Water Code section 13393. In particular, the sediment quality objectives are based on scientific information, including chemical monitoring, bioassays, and established modeling procedures; and the objectives provide adequate protection for the most sensitive aquatic organisms. In addition, sediment quality objectives for the protection of human health from contaminants in fish tissue are based on a health risk assessment.

13. As required by Water Code section 13393, the State Water Board has followed the procedures for adoption of water quality control plans in Water Code sections 13240 through 13247, in adopting this draft plan. In addition to the procedural requirements, the State Water Board has considered the substantive requirements in Water Code sections 13241 and 13242. The State Water Board has considered the past, present, and probable future beneficial uses of estuarine and bay waters that can be impacted by toxic pollutants in sediments; environmental characteristics of these waters; water quality conditions that can reasonably be achieved through the control of all factors affecting sediment quality; and economic considerations. Adoption of this draft plan is unlikely to affect housing needs or the development or use of recycled water. Further, the State Water Board has developed an implementation program to achieve the sediment quality objectives, which describes actions to be taken to achieve the objectives and monitoring to determine compliance with the objectives. Time schedules to achieve the objectives will be developed on a case-by-case basis by the appropriate Regional Water Board.

14. This draft plan is consistent with the state and federal antidegradation policies (State Water Board Resolution No. 68-16 and 40 C.F.R. Section 131.12, respectively). No lowering of water quality is anticipated to result from adoption of the draft plan. The draft plan contains scientifically-defensible sediment quality objectives for bays and estuaries, which can be consistently applied statewide to assess sediment quality, regulate waste discharges that can impact sediment quality, and provide the basis for appropriate remediation activities, where necessary. Adoption of the draft plan should result in improved sediment quality.

15. The Resources Agency has approved the State and Regional Water Boards' planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) requirements for preparing environmental documents. State Water Board staff has prepared a "substitute environmental document" for this project that contains the required environmental documentation under the State Water Board's CEQA regulations. (California Code of Regulations, title 23, section 3777.) The substitute environmental documents include the "Draft Staff Report – Water Quality Control Plan for Enclosed Bays and Estuaries, Part 1. Sediment Quality," the environmental checklist, the comments and responses to comments, the plan itself, and this resolution. The project is the adoption of sediment quality objectives and an implementation program, as Part 1 of the Water Quality Control Plan for Enclosed Bays and Estuaries.

16. CEQA scoping hearings were conducted on October 23, 2006 in San Diego, California, on November 8, 2006 in Oakland, California, and on November 28, 2006 in Rancho Cordova, California.

17. On September 26, 2007, staff circulated the draft plan – Part 1 Sediment Quality for public comment.

18. On November 19, 2007, the State Water Board conducted a public hearing on the draft plan and supporting Draft Staff Report and Substitute Environmental Document. Written comments were received through November 30, 2007.

19. The State Water Board adopted the Plan on February 19, 2008, and submitted it to the Office of Administrative Law (OAL) on February 29, 2008. Review by OAL revealed that the statutorily-required newspaper notification of the November 2007 hearing had not occurred. The State Water Board has, therefore, noticed and conducted a new public hearing for the draft plan on September 16, 2008.

20. In preparing the substitute environmental documents, the State Water Board has considered the requirements of Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and intends these documents to serve as a Tier 1 environmental review. The State Water Board has considered the reasonably foreseeable consequences of adoption of the draft plan; however, project level impacts may need to be considered in any subsequent environmental analysis performed by lead agencies, pursuant to Public Resources Code section 21159.1.

21. Consistent with CEQA, the substitute environmental documents do not engage in speculation or conjecture but, rather, analyze the reasonably foreseeable environmental impacts related to methods of compliance with the draft plan, reasonably foreseeable mitigation measures to reduce those impacts, and reasonably feasible alternatives means of compliance that would avoid or reduce the identified impacts.

22. The draft plan could have a potentially significant adverse effect on the environment. However, there are feasible alternatives or feasible mitigation measures that, if employed, would reduce the potentially significant adverse impacts identified in the substitute environmental documents to less than significant levels. These alternatives or mitigation measures are within the responsibility and jurisdiction of other public agencies. When the sediment quality objectives are implemented on a project-specific basis, the agencies responsible for the project can and should incorporate the alternatives or mitigation measures into any subsequent project or project approvals.

23. From a program-level perspective, incorporation of the mitigation measures described in the substitute environmental documents will foreseeably reduce impacts to less than significant levels.

24. The substitute environmental documents for this draft plan identify broad mitigation approaches that should be considered at the project level.

25. Pursuant to Health and Safety Code section 57400, the draft Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality has undergone external peer review through an interagency agreement with the University of California.

26. This draft plan must be submitted for review and approval to the State Office of Administrative Law (OAL) and the United States Environmental Protection Agency (USEPA). The draft plan will become effective upon approval by OAL and USEPA.

27. If, during the OAL approval process, OAL determines that minor, non-substantive modifications to the language of the draft plan are needed for clarity or consistency, the Executive Director or designee may make such changes consistent with the State Water Board's intent in adopting this draft plan, and shall inform the State Water Board of any such changes.

THEREFORE BE IT RESOLVED THAT:

The State Water Board:

1. Approves and adopts the CEQA substitute environmental documentation, including all findings contained in the documentation, which was prepared in accordance with Public Resources Code section 21159 and California Code of

Regulations, Title 14, section 15187, and directs the Executive Director or designee to sign the environmental checklist;

2. After considering the entire record, including oral testimony at the public hearing, hereby adopts the proposed Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality;

3. Directs staff to submit the administrative record to OAL for review and approval; and

4. If, during the OAL approval process, OAL determines that minor, non-substantive modifications to the language of the draft plan are needed for clarity or consistency, directs the Executive Director or designee to make such changes and inform the State Water Board of any such changes.

5. Directs staff to initiate appropriate proceedings to amend the section 303(d) listing policy by February 2009.

CERTIFICATION

The undersigned Acting Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on September 16, 2008.

AYE: Chair Tam M. Doduc
Arthur G. Baggett, Jr.
Charles R. Hoppin
Frances Spivy-Weber

NAY: None

ABSENT: Vice Chair Gary Wolff, P.E., Ph.D

ABSTAIN: None

Jeanine Townsend

Jeanine Townsend
Clerk to the Board

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ATTACHMENTS

I. INTENT AND SUMMARY

A. INTENT OF PART 1 OF THE WATER QUALITY CONTROL PLAN FOR ENCLOSED BAYS AND ESTUARIES (PART 1)

It is the goal of the State Water Resources Control Board (State Water Board) to comply with the legislative directive in Water Code §13393 to adopt sediment quality objectives (SQOs). Part 1 integrates chemical and biological measures to determine if the sediment dependent biota are protected or degraded as a result of exposure to toxic pollutants* in sediment and to protect human health. Part 1 is not intended to address low dissolved oxygen, pathogens or nutrients including ammonia. Part 1 represents the first phase of the State Water Board's SQO development effort and focuses primarily on the protection of benthic* communities in enclosed bays* and estuaries*. The State Water Board has committed in the second phase to the refinement of benthic community protection indicators for estuarine waters and the development of an improved approach to address sediment quality related human health risk associated with consumption of fish tissue.

B. SUMMARY OF PART 1

Part 1 includes**:**

1. Narrative SQOs for the protection of aquatic life and human health;
2. Identification of the beneficial uses that these objectives are intended to protect;
3. A program of implementation that contains:
   a. Specific indicators, tools and implementation provisions to determine if the sediment quality at a station or multiple stations meets the narrative objectives;
   b. A description of appropriate monitoring programs; and
   c. A sequential series of actions that shall be initiated when a sediment quality objective is not met including stressor identification and evaluation of appropriate targets.
4. A glossary that defines all terms denoted by an asterisk

II. USE AND APPLICABILITY OF SQOS

A. AMBIENT SEDIMENT QUALITY

The SQOs and supporting tools shall be utilized to assess ambient sediment quality.

B. RELATIONSHIP TO OTHER NARRATIVE OBJECTIVES

1. Except as provided in 2 below, Part 1 supersedes all applicable narrative water quality objectives and related implementation provisions in water quality control plans (basin plans) to the extent that the objectives and provisions are applied to protect bay or estuarine benthic communities from toxic pollutants in sediments.
2. The supersession provision in 1. above does not apply to existing sediment cleanup activities where a site assessment was completed and submitted to the Regional Water Board by February 19, 2008.

C. APPLICABLE WATERS

Part 1 applies to enclosed bays[1] and estuaries[2] only. Part 1 does not apply to ocean waters* including Monterey Bay and Santa Monica Bay, or inland surface waters*.

D. APPLICABLE SEDIMENTS

Part 1 applies to subtidal surficial sediments* that have been deposited or emplaced seaward of the intertidal zone. Part 1 does not apply to:

1. Sediments characterized by less than five percent of fines or substrates composed of gravels, cobbles, or consolidated rock.
2. Sediment as the physical pollutant that causes adverse biological response or community degradation related to burial, deposition, or sedimentation.

E. APPLICABLE DISCHARGES

Part 1 is applicable in its entirety to point source* discharges. Nonpoint sources* of toxic pollutants are subject to Sections II, III, IV, V, and VI of Part 1.

III. BENEFICIAL USES

Beneficial uses protected by Part 1 and corresponding target receptors are identified in Table 1.

Table 1. Beneficial Uses and Target Receptors

Beneficial Uses	Target Receptors
Estuarine Habitat	Benthic Community
Marine Habitat	Benthic Community
Commercial and Sport Fishing	Human Health
Aquaculture	Human Health
Shellfish Harvesting	Human Health

[1] ENCLOSED BAYS are indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes, but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

[2] ESTUARIES AND COASTAL LAGOONS are waters at the mouths of streams that serve as mixing zones for fresh and ocean waters during a major portion of the year. Mouths of streams that are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and salt water occurs in the open coastal waters. The waters described by this definition include, but are not limited to, the Sacramento-San Joaquin Delta as defined by Section 12220 of CWC, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

IV. SEDIMENT QUALITY OBJECTIVES

A. AQUATIC LIFE – BENTHIC COMMUNITY PROTECTION

Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California. This narrative objective shall be implemented using the integration of multiple lines of evidence (MLOE) as described in Section V of Part 1.

B. HUMAN HEALTH

Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health. This narrative objective shall be implemented as described in Section VI of Part 1.

V. BENTHIC COMMUNITY PROTECTION

A. MLOE APPROACH TO INTERPRET THE NARRATIVE OBJECTIVE

The methods and procedures described below shall be used to interpret the Narrative Objective described in Section IV.A. These tools are intended to assess the condition of benthic communities relative to potential for exposure to toxic pollutants in sediments. Exposure to toxic pollutants at harmful levels will result in some combination of a degraded benthic community, presence of toxicity, and elevated concentrations of pollutants in sediment. The assessment of sediment quality shall consist of the measurement and integration of three lines of evidence (LOE). The LOE are:

- ***Sediment Toxicity***—Sediment toxicity is a measure of the response of invertebrates exposed to surficial sediments under controlled laboratory conditions. The sediment toxicity LOE is used to assess both pollutant related biological effects and exposure. Sediment toxicity tests are of short durations and may not duplicate exposure conditions in natural systems. This LOE provides a measure of exposure to all pollutants present, including non-traditional or unmeasured chemicals.
- ***Benthic Community Condition***—Benthic community condition is a measure of the species composition, abundance and diversity of the sediment-dwelling invertebrates inhabiting surficial sediments*. The benthic community LOE is used to assess impacts to the primary receptors targeted for protection under Section IV.A. Benthic community composition is a measure of the biological effects of both natural and anthropogenic stressors.
- ***Sediment Chemistry***—Sediment chemistry is the measurement of the concentration of chemicals of concern* in surficial sediments. The chemistry LOE is used to assess the potential risk to benthic organisms from toxic pollutants in surficial sediments. The sediment chemistry LOE is intended only to evaluate overall exposure risk from chemical pollutants. This LOE does not establish causality associated with specific chemicals.

B. LIMITATIONS

None of the individual LOE is sufficiently reliable when used alone to assess sediment quality impacts due to toxic pollutants. Within a given site, the LOEs applied to assess exposure as described in Section V.A. may underestimate or overestimate the risk to benthic communities and do not indicate causality of specific chemicals. The LOEs applied to assess biological effects can respond to stresses associated with natural or physical factors, such as sediment grain size, physical disturbance, or organic enrichment.

Each LOE produces specific information that, when integrated with the other LOEs, provides a more confident assessment of sediment quality relative to the narrative objective. When the exposure and effects tools are integrated, the approach can quantify protection through effects measures and also provide predictive capability through the exposure assessment.

C. Water Bodies

1. The tools described in the Sections V.D. through V.I. are applicable to Euhaline* Bays and Coastal Lagoons* south of Point Conception and Polyhaline* San Francisco Bay that includes the Central and South Bay Areas defined in general by waters south and west of the San Rafael Bridge and north of the Dumbarton Bridge.
2. For all other bays and estuaries where LOE measurement tools are unavailable, station assessment will follow the procedure described in Section V.J.

D. Field Procedures

1. All samples shall be collected using a grab sampler.
2. Benthic samples shall be screened through:
    a. A 0.5 millimeter (mm)-mesh screen in San Francisco Bay and the Sacramento-San Joaquin Delta;
    b. A 1.0 mm-mesh screen in all other locations.
3. Surface sediment from within the upper 5 cm shall be collected for chemistry and toxicity analyses.
4. The entire contents of the grab sample, with a minimum penetration depth of 5 cm, shall be collected for benthic community analysis.
5. Bulk sediment chemical analysis will include at a minimum the pollutants identified in Attachment A.

E. Laboratory Testing

All samples will be tested in accordance with U.S. Environmental Protection Agency (USEPA) or American Society for Testing and Materials (ASTM) methodologies where such methods exist. Where no EPA or ASTM methods exist, the State Water Board or Regional Water Quality Control Boards (Regional Water Boards) (collectively Water Boards) shall approve the use of other methods. Analytical tests shall be conducted by laboratories certified by the California Department of Health Services in accordance with Water Code Section 13176.

F. Sediment Toxicity

1. Short Term Survival Tests—A minimum of one short-term survival test shall be performed on sediment collected from each station. Acceptable test organisms and methods are summarized in Table 2.

Table 2. Acceptable Short Term Survival Sediment Toxicity Test Methods

Test Organism	Exposure Type	Duration	Endpoint*
Eohaustorius estuarius	Whole Sediment	10 days	Survival
Leptocheirus plumulosus	Whole Sediment	10 days	Survival
Rhepoxynius abronius	Whole Sediment	10 days	Survival

2. Sublethal Tests—A minimum of one sublethal test shall be performed on sediment collected from each station. Acceptable test organisms and methods are summarized in Table 3.

Table 3. Acceptable Sublethal Sediment Toxicity Test Methods

Test Organism	Exposure Type	Duration	Endpoint
Neanthes arenaceodentata	Whole Sediment	28 days	Growth
Mytilus galloprovincialis	Sediment-water Interface	48 hour	Embryo Development

3. Assessment of Sediment Toxicity—Each sediment toxicity test result shall be compared and categorized according to responses in Table 4. The response categories are:
   a. Nontoxic—Response not substantially different from that expected in sediments that are uncontaminated and have optimum characteristics for the test species (e.g., control sediments).
   b. Low toxicity—A response that is of relatively low magnitude; the response may not be greater than test variability.
   c. Moderate toxicity—High confidence that a statistically significant toxic effect is present.
   d. High toxicity—High confidence that a toxic effect is present and the magnitude of response includes the strongest effects observed for the test.

Table 4. Sediment Toxicity Categorization Values

Test Species/ Endpoint	Statistical Significance	Nontoxic (Percent)	Low Toxicity (Percent of Control)	Moderate Toxicity (Percent of Control)	High Toxicity (Percent of Control)
Eohaustorius Survival	Significant	90 to 100	82 to 89	59 to 81	< 59
Eohaustorius Survival	Not Significant	82 to 100	59 to 81		<59
Leptocheirus Survival	Significant	90 to 100	78 to 89	56 to 77	<56
Leptocheirus Survival	Not Significant	78 to 100	56 to 77		<56
Rhepoxynius Survival	Significant	90 to 100	83 to 89	70 to 82	< 70
Rhepoxynius Survival	Not Significant	83 to 100	70 to 82		< 70
Neanthes Growth	Significant	90 to 100*	68 to 90	46 to 67	<46
Neanthes Growth	Not Significant	68 to 100	46 to 67		<46
Mytilus Normal	Significant	80 to 100	77 to 79	42 to 76	< 42
Mytilus Normal	Not Significant	77 to 79	42 to 76		< 42

* Expressed as a percentage of the control.

4. Integration of Sediment Toxicity Categories—The average of all test response categories shall determine the final toxicity LOE category. If the average falls midway between categories it shall be rounded up to the next higher response category.

G. BENTHIC COMMUNITY CONDITION

1. General Requirements.
   a. All benthic invertebrates in the screened sample shall be identified to the lowest possible taxon and counted.
   b. Taxonomic nomenclature shall follow current conventions established by local monitoring programs and professional organizations (e.g., master species list).
2. Benthic Indices—The benthic condition shall be assessed using the following methods:
   a. Benthic Response Index (BRI), which was originally developed for the southern California mainland shelf and extended into California's bays and estuaries. The BRI is the abundance-weighted average pollution* tolerance score of organisms occurring in a sample.
   b. Index of Biotic Integrity (IBI), which was developed for freshwater streams and adapted for California's bays and estuaries. The IBI identifies community measures that have values outside a reference range.
   c. Relative Benthic Index (RBI), which was developed for embayments in California's Bay Protection and Toxic Cleanup Program. The RBI is the weighted sum of: (a) several community parameters (total number of species, number of crustacean species, number of crustacean individuals, and number of mollusc species), and abundances of (b) three positive, and (c) two negative indicator species.
   d. River Invertebrate Prediction and Classification System (RIVPACS), which was originally developed for British freshwater streams and adapted for California's bays and estuaries. The approach compares the assemblage at a site with an expected species composition determined by a multivariate predictive model that is based on species relationships to habitat gradients.
3. Assessment of Benthic Community Condition—Each benthic index result shall be categorized according to disturbance as described in Table 5. The disturbance categories are:
   a. Reference—A community composition equivalent to a least affected or unaffected site.
   b. Low disturbance— A community that shows some indication of stress, but could be within measurement error of unaffected condition.
   c. Moderate disturbance—Confident that the community shows evidence of physical, chemical, natural, or anthropogenic stress.
   d. High disturbance—The magnitude of stress is high.
4. Integration of Benthic Community Categories—The median of all benthic index response categories shall determine the benthic condition LOE category. If the median falls between categories it shall be rounded up to the next higher effect category.

Table 5. Benthic Index Categorization Values

Index	Reference	Low Disturbance	Moderate Disturbance	High Disturbance
Southern California Marine Bays				
BRI	< 39.96	39.96 to 49.14	49.15 to 73.26	> 73.26
IBI	0	1	2	3 or 4
RBI	> 0.27	0.17 to 0.27	0.09 to 0.16	< 0.09
RIVPACS	> 0.90 to < 1.10	0.75 to 0.90 or 1.10 to 1.25	0.33 to 0.74 or > 1.25	< 0.33
Polyhaline Central San Francisco Bay				
BRI	< 22.28	22.28 to 33.37	33.38 to 82.08	> 82.08
IBI	0 or 1	2	3	4
RBI	> 0.43	0.30 to 0.43	0.20 to 0.29	< 0.20
RIVPACS	> 0.68 to < 1.32	0.33 to 0.68 or 1.32 to 1.67	0.16 to 0.32 or > 1.67	< 0.16

H. SEDIMENT CHEMISTRY

1. All samples shall be tested for the analytes identified in Attachment A—This list represents the minimum analytes required to assess exposure. In water bodies where other toxic pollutants are believed to pose risk to benthic communities, those toxic pollutants shall be included in the analysis. Inclusion of additional analytes cannot be used in the exposure assessment described below. However, the data can be used to conduct more effective stressor identification studies as described in Section VII. F.
2. Sediment Chemistry Guidelines—The sediment chemistry exposure shall be assessed using the following two methods:
   a. Chemical Score Index (CSI), that uses a series of empirical thresholds to predict the benthic community disturbance category (score) associated with the concentration of various chemicals (Table 6). The CSI is the weighted sum of the individual scores (Equation 1).

      Equation 1. $CSI = \Sigma(w_i \times cat_i)/\Sigma w$

      Where: cat_i = predicted benthic disturbance category for chemical I;
      w_i = weight factor for chemical I;
      Σw = sum of all weights.

   b. California Logistic Regression Model (CA LRM), that uses logistic regression models to predict the probability of sediment toxicity associated with the concentration of various chemicals (Table 7 and Equation 2). The CA LRM exposure value is the maximum probability of toxicity from the individual models (P_{max})

      Equation 2. $\boldsymbol{p} = e^{B0+B1\,(x)} / (1 + e^{B0+B1\,(x)})$

      Where: $\boldsymbol{p}$ = probability of observing a toxic effect;
      B0 = intercept parameter;
      B1 = slope parameter; and
      x = concentration the chemical.

Table 6. Category Score Concentration Ranges and Weighting Factors for the CSI

Chemical	Units	Weight	Score (Disturbance Category)			
			1 Reference	2 Low	3 Moderate	4 High
Copper	mg/kg	100	≤52.8	> 52.8 to 96.5	> 96.5 to 406	> 406
Lead	mg/kg	88	≤ 26.4	> 26.4 to 60.8	> 60.8 to 154	> 154
Mercury	mg/kg	30	≤ 0.09	> 0.09 to 0.45	> 0.45 to 2.18	> 2.18
Zinc	mg/kg	98	≤ 112	> 112 to 200	> 200 to 629	> 629
PAHs, total high MW	µg/kg	16	≤ 312	> 312 to 1325	> 1325 to 9320	>9320
PAHs, total low MW	µg/kg	5	≤ 85.4	> 85.4 to 312	> 312 to 2471	> 2471
Chlordane, alpha-	µg/kg	55	≤ 0.50	> 0.50 to 1.23	> 1.23 to 11.1	>11.1
Chlordane, gamma-	µg/kg	58	≤ 0.54	> 0.54 to 1.45	> 1.45 to 14.5	> 14.5
DDDs, total	µg/kg	46	≤ 0.50	> 0.50 to 2.69	> 2.69 to 117	> 117
DDEs, total	µg/kg	31	≤ 0.50	> 0.50 to 4.15	> 4.15 to 154	> 154
DDTs, total	µg/kg	16	≤ 0.50	> 0.50 to 1.52	> 1.52 to 89.3	> 89.3
PCBs, total	µg/kg	55	≤11.9	> 11.9 to 24.7	> 24.7 to 288	> 288

Table 7. CA LRM Regression Parameters

Chemical	Units	B0	B1
Cadmium	mg/kg	0.29	3.18
Copper	mg/kg	-5.59	2.59
Lead	mg/kg	-4.72	2.84
Mercury	mg/kg	-0.06	2.68
Zinc	mg/kg	-5.13	2.42
PAHs, total high MW	µg/kg	-8.19	2.00
PAHs, total low MW	µg/kg	-6.81	1.88
Chlordane, alpha	µg/kg	-3.41	4.46
Dieldrin	µg/kg	-1.83	2.59
Trans nonachlor	µg/kg	-4.26	5.31
PCBs, total	µg/kg	-4.41	1.48
p,p' DDT	µg/kg	-3.55	3.26

3. Assessment of Sediment Chemistry Exposure—Each sediment chemistry guideline result shall be categorized according to exposure as described in Table 8. The exposure categories are:
   a. Minimal exposure—Sediment-associated contamination* may be present, but exposure is unlikely to result in effects.
   b. Low exposure—Small increase in pollutant exposure that may be associated with increased effects, but magnitude or frequency of occurrence of biological impacts is low.
   c. Moderate exposure—Clear evidence of sediment pollutant exposure that is likely to result in biological effects; an intermediate category.
   d. High exposure—Pollutant exposure highly likely to result in possibly severe biological effects; generally present in a small percentage of the samples.

Table 8. Sediment Chemistry Guideline Categorization Values

Guideline	Minimal Exposure	Low Exposure	Moderate Exposure	High Exposure
CSI	< 1.69	1.69 to 2.33	2.34 to 2.99	>2.99
CA LRM	< 0.33	0.33 to 0.49	0.50 to 0.66	> 0.66

4. Integration of Sediment Chemistry Categories—The average of all chemistry exposure categories shall determine the final sediment chemistry LOE category. If the average falls midway between categories it shall be rounded up to the next higher exposure category.

I. INTERPRETATION AND INTEGRATION OF MLOE

Assessment as to whether the aquatic life sediment quality objective has been attained at a station is accomplished by the interpretation and integration of MLOE. The categories assigned to the three LOE, sediment toxicity, benthic community condition and sediment chemistry are evaluated to determine the station level assessment. The assessment category represented by each of the possible MLOE combinations reflects the presence and severity of two characteristics of the sample: severity of biological effects, and potential for chemically-mediated effects.

1. Severity of Biological Effects—The severity of biological effects present at a site shall be determined by the integration of the toxicity LOE and benthic condition LOE categories using the decision matrix presented in Table 9.
2. Potential for Chemically-Mediated Effects—The potential for effects to be chemically-mediated shall be determined by the integration of the toxicity LOE and chemistry LOE categories using the decision matrix presented in Table 10.

Table 9. Severity of Biological Effects Matrix

		Toxicity LOE Category			
		Nontoxic	Low Toxicity	Moderate Toxicity	High Toxicity
Benthic Condition LOE Category	Reference	Unaffected	Unaffected	Unaffected	Low Effect
	Low Disturbance	Unaffected	Low Effect	Low Effect	Low Effect
	Moderate Disturbance	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect
	High Disturbance	Moderate Effect	High Effect	High Effect	High Effect

Table 10. Potential for Chemically Mediated Effects Matrix

		Toxicity LOE Category			
		Nontoxic	Low Toxicity	Moderate Toxicity	High Toxicity
Sediment Chemistry LOE Category	Minimal Exposure	Minimal Potential	Minimal Potential	Low Potential	Moderate Potential
	Low Exposure	Minimal Potential	Low Potential	Moderate Potential	Moderate Potential
	Moderate Exposure	Low Potential	Moderate Potential	Moderate Potential	Moderate Potential
	High Exposure	Moderate Potential	Moderate Potential	High Potential	High Potential

3. Station Level Assessment—The station level assessment shall be determined using the decision matrix presented in Table 11. This assessment combines the intermediate classifications for severity of biological effect and potential for chemically-mediated effect to result in six categories of impact at the station level:
   a. Unimpacted—Confident that sediment contamination is not causing significant adverse impacts to aquatic life living in the sediment at the site.
   b. Likely Unimpacted—Sediment contamination at the site is not expected to cause adverse impacts to aquatic life, but some disagreement among the LOE reduces certainty in classifying the site as unimpacted.
   c. Possibly Impacted—Sediment contamination at the site may be causing adverse impacts to aquatic life, but these impacts are either small or uncertain because of disagreement among LOE.
   d. Likely Impacted—Evidence for a contaminant-related impact to aquatic life at the site is persuasive, even if there is some disagreement among LOE.
   e. Clearly Impacted—Sediment contamination at the site is causing clear and severe adverse impacts to aquatic life.
   f. Inconclusive—Disagreement among the LOE suggests that either the data are suspect or that additional information is needed before a classification can be made.

Table 11. Station Assessment Matrix

		Severity of Effect			
		Unaffected	Low Effect	Moderate Effect	High Effect
Potential For Chemically-Mediated Effects	Minimal Potential	Unimpacted	Likely Unimpacted	Likely Unimpacted	Inconclusive
	Low Potential	Unimpacted	Likely Unimpacted	Possibly Impacted	Possibly Impacted
	Moderate Potential	Likely Unimpacted	Possibly Impacted or Inconclusive[1]	Likely Impacted	Likely Impacted
	High Potential	Inconclusive	Likely Impacted	Clearly Impacted	Clearly Impacted

[1]Inconclusive category when chemistry is classified as minimal exposure, benthic response is classified as reference, and toxicity response is classified as high.

The station assessment resulting from each possible combination of the three LOEs is shown in Attachment B. As an alternative to Tables 9, 10 and 11, each LOE category can be applied to Attachment B to determine the overall condition of the station. The results will be the same regardless of the tables used.

4. Relationship to the Aquatic Life – Benthic Community Protection Narrative Objective.

   a. The categories designated as **Unimpacted** and **Likely Unimpacted** shall be considered as achieving the protective condition at the station. All other categories shall be considered as degraded except as provided in b. below.

   b. The Water Board shall designate the category **Possibly Impacted** as meeting the protective condition if the studies identified in Section VII.F demonstrate that the combination of effects and exposure measures are not responding to toxic pollutants in sediments and that other factors are causing these responses within a specific reach segment or waterbody. In this situation, the Water Board will consider only the Categories **Likely Impacted** and **Clearly Impacted** as degraded when making a determination on receiving water limits and impaired water bodies described in Section VII.

J. MLOE APPROACH TO INTERPRET THE NARRATIVE OBJECTIVE IN OTHER BAYS AND ESTUARIES

Station assessments for waterbodies identified in Section V.C.2. will be conducted using the same conceptual approach and similar tools to those described in Sections V.D-H. Each LOE will be evaluated by measuring a set of readily available indicators in accordance with Tables 12 and 13.

1. Station assessment shall be consistent with the following key principles of the assessment approach described in Sections V.D. through V.I:

   a. Results for a single LOE shall not be used as the basis for an assessment.

   b. Evidence of both elevated chemical exposure and biological effects must be present to indicate pollutant-associated impacts.

   c. The categorization of each LOE shall be based on numeric values or a statistical comparison.

2. Lines of Evidence and Measurement Tools—Sediment chemistry, toxicity, and benthic community condition shall be measured at each station. Table 12 lists the required tools for evaluation of each LOE. Each measurement shall be conducted using standardized methods (e.g., EPA or ASTM guidance) where available.

3. Categorization of LOEs—Determination of the presence of an LOE effect (i.e., biologically significant chemical exposure, toxicity, or benthic community disturbance) shall be based on a comparison to a numeric response value or a statistical comparison to reference stations. The numeric values or statistical comparisons (e.g., confidence interval) used to classify a LOE as Effected shall be comparable to those specified in Sections V.F-H. to indicate High Chemical Exposure, High Toxicity, or High Disturbance. Reference stations shall be located in an area expected to be uninfluenced by the discharge or pollutants of concern in the assessment area and shall be representative of other habitat characteristics of the assessment area (e.g., salinity, grain size). Comparison to reference shall be accomplished by compiling data for appropriate regional reference sites and determining the reference envelope using statistical methods (e.g., tolerance interval).

Table 12. Tools for Use in Evaluation of LOEs

LOE	Tools	Metrics
Chemistry	Bulk sediment chemistry to include existing list (Attachment A) plus other chemicals of concern	CA LRM P_{max} Concentration on a dry weight basis
Sediment Toxicity	10-Day amphipod survival using a species tolerant of the sample salinity and grain size characteristics. e.g., ***Hyalella azteca*** or ***Eohaustorius estuarius***	Percent of control survival
Benthic Community Condition	Invertebrate species identification and abundance	Species richness* Presence of sensitive indicator taxa Dominance by tolerant indicator taxa Presence of diverse functional and feeding groups Total abundance

Table 13. Numeric Values and Comparison Methods for LOE Categorization

Metric	Threshold value or Comparison
CA LRM	Pmax > 0.66
Chemical Concentration	Greater than reference range or interval
Percent of Control Survival	***E. estuarius***: < 59 ***H. azteca***: < 62 or SWAMP criterion
Species Richness	Less than reference range or interval
Abundance of Sensitive Indicator Taxa	Less than reference range or interval
Abundance of Tolerant Indicator Taxa	Greater than reference range or interval
Total Abundance	Outside of reference range or interval

4. Station Level Assessment—The station level assessment shall be determined using the decision matrix presented in Table 14. This assessment combines the classifications for each LOE to result in two categories of impact at the station level:
   a. Unimpacted—No conclusive evidence of both high pollutant exposure and high biological effects present at the site. Evidence of chemical exposure and biological effects may be within natural variability or measurement error.
   b. Impacted—Confident that sediment contamination present at the site is causing adverse direct impacts to aquatic life.

Table 14. Station Assessment Matrix for Other Bays and Estuaries

Chemistry LOE Category	Toxicity LOE Category	Benthic Condition LOE Category	Station Assessment
No effect	No effect	No effect	Unimpacted
No effect	No effect	Effect	Unimpacted
No effect	Effect	No effect	Unimpacted
No effect	Effect	Effect	Impacted
Effect	No effect	No effect	Unimpacted
Effect	No effect	Effect	Impacted
Effect	Effect	No effect	Impacted
Effect	Effect	Effect	Impacted

5. Relationship to the Aquatic Life – Benthic Community Protection Narrative Objective—The category designated as **Unimpacted** shall be considered as achieving the protective condition at the station.

VI. HUMAN HEALTH

The narrative human health objective in Section IV. B. of this Part 1 shall be implemented on a case-by-case basis, based upon a human health risk assessment. In conducting a risk assessment, the Water Boards shall consider any applicable and relevant information, including California Environmental Protection Agency's (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) policies for fish consumption and risk assessment, Cal/EPA's Department of Toxic Substances Control (DTSC) Risk Assessment, and USEPA Human Health Risk Assessment policies.

VII. PROGRAM OF IMPLEMENTATION

Implementation of Part 1 shall be conducted in accordance with the following provisions and consistent with the process shown in Figures 1 and 2.

A. Dredge Materials

1. Part 1 shall not apply to dredge material suitability determinations.
2. The Water Boards shall not approve a dredging project that involves the dredging of sediment that exceeds the objectives in Part 1, unless the Water Boards determine that:
   a. The polluted sediment is removed in a manner that prevents or minimizes water quality degradation.
   b. The polluted sediment is not deposited in a location that may cause significant adverse effects to aquatic life, fish, shellfish, or wildlife or may harm the beneficial uses of the receiving waters, or does not create maximum benefit to the people of the State.
   c. The activity will not cause significant adverse impacts upon a federal sanctuary, recreational area, or other waters of significant national importance.

B. NPDES Receiving Water and Effluent Limits

1. If a Water Board determines that discharge of a toxic pollutant to bay or estuarine waters has the reasonable potential to cause or contribute to an exceedance of the SQOs, the Water Board shall apply the objectives as receiving water limits.
2. The Permittee shall be in violation of such limits if it is demonstrated that the discharge is causing or contributing to the SQO exceedance as defined in Section VII.C.
3. Receiving water monitoring required by an NPDES permit may be satisfied by a Permitee's participation in a regional SQO monitoring program described in Section VII.E.
4. The sediment chemistry guidelines shall not be translated into or applied as effluent limits. Effluent limits established to protect or restore sediment quality shall be developed only after:
   a. A clear relationship has been established linking the discharge to the degradation,

b. The pollutants causing or contributing to the degradation have been identified, and

c. Appropriate loading studies have been completed to estimate the reductions in pollutant loading that will restore sediment quality.

These actions are described further in Sections VII.F and VII.G. Nothing in this section shall limit a Water Board's authority to develop and implement waste* load allocations* for Total Maximum Daily Loads. However, it is recommended that the Water Boards develop TMDL allocations using the methodology described herein, wherever possible.

C. EXCEEDANCE OF RECEIVING WATER LIMIT

Exceedance of a receiving water limit is demonstrated when:

1. Using a binomial distribution*, the total number of stations designated as not meeting the protective condition as defined in Sections V.I.4. or V.J.4. supports rejection of the null hypothesis* as presented in Table 15. The stations included in this analysis will be those located in the vicinity of the discharge and identified in the permit, and
2. It is demonstrated that the discharge is causing or contributing to the SQO exceedance, following the completion of the stressor identification studies described in Section VII.F.
3. If studies by the Permittee demonstrate that other sources may also be contributing to the degradation of sediment quality, the Regional Water Board shall, as appropriate, require the other sources to initiate studies to assess the extent to which these sources are a contributing factor.

Table 15. Minimum Number of Measured Exceedances Needed to Exceed the Direct Effects SQO as a Receiving Water Limit

Sample Size	List If the Number of Exceedances Equals or Is Greater Than
2 – 24	2*
25 – 36	3
37 – 47	4
48 – 59	5
60 – 71	6
72 – 82	7
83 – 94	8
95 – 106	9
107 – 117	10
118 – 129	11

Note: Null Hypothesis: Actual exceedance proportion $\leq$ 3 percent. Alternate Hypothesis: Actual exceedance proportion > 18 percent. The minimum effect size* is 15 percent.

*Application of the binomial test requires a minimum sample size of 16. The number of exceedances required using the binomial test at a sample size of 16 is extended to smaller sample sizes.

Exceedance will require the Permittee to perform additional studies as described in Sections VII.F and VII.G.

D. RECEIVING WATER LIMITS MONITORING FREQUENCY

1. Phase I Stormwater Discharges and Major Discharges—Sediment Monitoring shall not be required less frequently than twice per permit cycle. For Stations that are consistently classified as unimpacted or likely unimpacted the frequency may be reduced to once per permit cycle. The Water Board may limit receiving water monitoring to a subset of outfalls for Phase I Stormwater Permitees.
2. Phase II Stormwater and Minor Discharges—Sediment Monitoring shall not be required more often then twice per permit cycle or less then once per permit cycle. For stations that are consistently classified as unimpacted or likely unimpacted, the number of stations monitored may be reduced at the discretion of the Water Board. The Water Board may limit receiving water monitoring to a subset of outfalls for Phase II Stormwater Permitees.
3. Other Regulated Discharges and Waivers—The frequency of the monitoring for receiving water limits for other regulated discharges and waivers will be determined by the Water Board.

E. SEDIMENT MONITORING

1. Objective—Bedded sediments in bays contain an accumulation of pollutants from a wide variety of past and present sources discharged either directly into the bay or indirectly into waters draining into the bay. Embayments also represent highly disturbed or altered habitats as a result of dredging and physical disturbance caused by construction and maintenance of harbor works, boat and ship traffic, and development of adjacent lands. Due to the multitude of stressors and the complexity of the environment, a well-designed monitoring program is necessary to ensure that the data collected adequately characterizes the condition of sediment in these water bodies.
2. Permitted Discharges—Monitoring may be performed by individual Permitees to assess compliance with receiving water limits, or through participation in a regional or water body monitoring coalition as described under VII.E.3, or both as determined by the Water Board.
3. Monitoring Coalitions—To achieve maximum efficiency and economy of resources, the State Water Board encourages the regulated community in coordination with the Regional Water Boards to establish water body-monitoring coalitions. Monitoring coalitions enable the sharing of technical resources, trained personnel, and associated costs and create an integrated sediment-monitoring program within each major water body. Focusing resources on regional issues and developing a broader understanding of pollutants effects in these water bodies enables the development of more rapid and efficient response strategies and facilitates better management of sediment quality.
   a. If a regional monitoring coalition is established, the coalition shall be responsible for sediment quality assessment within the designated water body and for ensuring that appropriate studies are completed in a timely manner.
   b. The Water Board shall provide oversight to ensure that coalition participants are proactive and responsive to potential sediment quality related issues as they arise during monitoring and assessment.
   c. Each regional monitoring coalition shall prepare a workplan that describes the monitoring, a map of the stations, participants and a schedule that shall be submitted to the Water Board for approval.

4. Methods—Sediments collected from each station shall be tested or assessed using the methods and metrics described in Section V.

5. Design.

   a. The design of sediment monitoring programs, whether site-specific or region wide, shall be based upon a conceptual model. A conceptual model is useful for identifying the physical and chemical factors that control the fate and transport of pollutants and receptors that could be exposed to pollutants in the sediment. The conceptual model serves as the basis for assessing the appropriateness of a study design. The detail and complexity of the conceptual model is dependent upon the scope and scale of the monitoring program. A conceptual model shall consider:

      – Points of discharge into the segment of the waterbody or region of interest
      – Tidal flow and/or direction of predominant currents
      – Historic and or legacy conditions in the vicinity
      – Nearby land and marine uses or actions
      – Beneficial uses
      – Potential receptors of concern
      – Changes in grain size salinity water depth and organic matter
      – Other sources or discharges in the immediate vicinity.

   b. Sediment monitoring programs shall be designed to ensure that the aggregate stations are spatially representative of the sediment within the water body.

   c. The design shall take into consideration existing data and information of appropriate quality.

   d. Stratified random design shall be used where resources permit to assess conditions throughout a water body.

   3. Identification of appropriate strata shall consider characteristics of the water body including sediment transport, hydrodynamics, depth, salinity, land uses, inputs (both natural and anthropogenic) and other factors that could affect the physical, chemical, or biological condition of the sediment.

   f. Targeted designs shall be applied to those Permitees that are required to meet receiving water limits as described in Section VII. B.

6. Index Period—All stations shall be sampled between the months of June through September to be consistent with the benthic community condition index period.

7. Regional Monitoring Schedule and Frequency.

   a. Regional sediment quality monitoring will occur at a minimum of once every three years.

   b. Sediments identified as exceeding the narrative objective will be evaluated more frequently.

8. Evaluating Waters for placement on the Section 303(d) list —In California, water segments are placed on the section 303(d) list for sediment toxicity based either on toxicity alone or toxicity that is associated with a pollutant. The listing criteria are contained in the State Water Board’s Water Quality Control Policy for Developing California’s Clean Water Act Section 303(d) List (2004)(Listing Policy). Part 1 adds an additional listing criterion that applies only to listings for exceedances of the narrative sediment quality objective for aquatic life protection in Section IV.A. The criterion under Part 1 is described in subsection a. below and the relationship

between the sediment toxicity listing criteria under the Listing Policy and the criterion under Part 1 is described in subsections b. and c., below.

1. Water segments shall be placed on the section 303(d) list for exceedance of the narrative sediment quality objective for aquatic life protection in Section IV.A. of Part 1 only if the number of stations designated as not achieving the protective condition as defined in Sections V.I. and V.J. supports rejection of the null hypothesis, as provided in Table 3.1 of the State Water Board's Listing Policy.
2. Water segments that exhibit sediment toxicity but that are not listed for an exceedance of the narrative sediment quality objective for aquatic life protection in Section IV.A. shall continue to be listed in accordance with Section 3.6 of the Listing Policy.
3. If a water segment is listed under Section 3.6 of the Listing Policy and the Regional Water Board later determines that the applicable water quality standard that is impaired consists of the sediment quality objective in Section IV.A. of Part 1 and a bay or estuarine habitat beneficial use, the Regional Water Board shall reevaluate the listing in accordance with Sections V.I and V.J. If the Regional Water Board reevaluates the listing and determines that the water segment does not meet the criteria in subsection a. above, the Regional Water Board shall delist the water segment.

F. STRESSOR IDENTIFICATION

If sediments fail to meet the narrative SQOs in accordance with Sections V. and VI. the Water Boards shall direct the regional monitoring coalitions or Permittees to conduct stressor identification.

The Water Boards shall assign the highest priority for stressor identification to those segments or reaches with the highest percentage of sites designated as Clearly Impacted and Likely Impacted.

Where segments or reaches contain Possibly Impacted but no Clearly or Likely Impacted sites, confirmation monitoring shall be conducted prior to initiating stressor identification.

The stressor identification approach consists of development and implementation of a work plan to seek confirmation and characterization of pollutant-related impacts, pollutant identification and source identification. The workplan shall be submitted to the Water Board for approval. Stressor identification consists of the following studies:

1. Confirmation and Characterization of Pollutant Related Impacts—Exceedance of the direct effects SQO at a site indicates that pollutants in the sediment are the likely cause but does not identify the specific pollutant responsible. The MLOE assessment establishes a linkage to sediment pollutants; however, the lack of confounding factors (e.g., physical disturbance, non-pollutant constituents) must be confirmed. There are two generic stressors that are not related to toxic pollutants that may cause the narrative to be exceeded:

    a. Physical Alteration—Examples of physical stressors include reduced salinity, impacts from dredging, very fine or coarse grain size, and prop wash from passing ships. These types of stressors may produce a non-reference condition* in the benthic community that is similar to that caused by pollutants. If impacts to a site are purely due to physical disturbance, the LOE characteristics will likely show a degraded benthic community with little or no toxicity and low chemical concentrations.

b. Other Pollutant Related Stressors—These constituents, which include elevated total organic carbon, ammonia, nutrients and pathogens, may have sources similar to chemical pollutants. Chemical and microbiological analysis will be necessary to determine if these constituents are present. The LOE characteristics for this type of stressor would likely be a degraded benthic community with possibly an indication of toxicity, and low chemical concentrations.

To further assess a site that is impacted by toxic pollutants, there are several lines of investigation that may be pursued, depending on site-specific conditions. These studies may be considered and evaluated in the work plan for the confirmation effort:

a. Evaluate the spatial extent of the Area of Concern. This information can be used to evaluate the potential risk associated with the sediment, distinguish areas of known physical disturbance or pollution and evaluate the proximity to anthropogenic source gradient from such inputs as outfalls, storm drains, and industrial and agricultural activities.

b. Body burden data may be examined from animals exposed to the site's sediment to indicate if pollutants are being accumulated and to what degree.

c. Chemical specific mechanistic benchmarks* may be applied to interpret sediment chemistry concentrations.

d. Chemistry and biology data from the site should be examined to determine if there is a correlation between the two LOE.

e. Alternate biological effects data may be pursued, such as bioaccumulation* experiments and pore water toxicity or chemical analysis.

f. Other investigations that may commonly be performed as part of a Phase 1 Toxicity Identification Evaluation* (TIE).

If there is compelling evidence that the SQO exceedances contributing to a receiving water limit exceedance are not due to toxic pollutants, then the assessment area shall be designated as having achieved the receiving water limit.

2. Pollutant Identification—Methods to help determine cause may be statistical, biological, chemical or a combination. Pollutant identification studies should be structured to address site-specific conditions, and may be based upon the following:

   a. Statistical methods—Correlations between individual chemicals and biological endpoints (toxicity and benthic community).

   b. Gradient analysis—Comparisons are made between different samples taken at various distances from a chemical hotspot to examine patterns in chemical concentrations and biological responses. The concentrations of causative agents should decrease as biological effects decrease.

   c. Additional Toxicity Identification Evaluation efforts—A toxicological method for determining the cause of impairments is the use of toxicity identification evaluations (TIE). Sediment samples are manipulated chemically or physically to remove classes of chemicals or render them biologically unavailable. Following the manipulations, biological tests are performed to determine if toxicity has been removed. TIEs should be conducted at a limited number of stations, preferably those with strong biological or toxicological effects.

   d. Bioavailability*—Chemical pollutants may be present in the sediment but not biologically available to cause toxicity or degradation of the benthic community. There are several measures of bioavailability that can be made. Chemical and toxicological measurements can be made on pore water to determine the availability of sediment pollutants. Metal compounds may be naturally bound up in the sediment and rendered unavailable by the presence of sulfides. Measurement of acid volatile sulfides and simultaneously extracted metals analysis can be conducted to determine if sufficient sulfides are present to bind the observed metals. Similarly, organic compounds can be tightly bound to sediments. Measurements of sediment organic carbon and other binding phases can be conducted to determine the bioavailable fraction of organic compounds. Solid phase microextraction (SPME) or laboratory desorption experiments can also be used to identify which organics are bioavailable to benthic organisms.

e. Verification—After specific chemicals are identified as likely causes of impairment, analysis should be performed to verify the results. Sediments can be spiked with the suspected chemicals to verify that they are indeed toxic at the concentrations observed in the field. Alternately, animals can be transplanted to suspected sites for ***in situ*** toxicity and bioaccumulation testing.

When stressor Identification yields inconclusive results for sites classified as Possibly Impacted, the Water Board shall require the Permittee or regional monitoring coalition to perform a one-time augmentation to that study or, alternatively, the Water Board may suspend further stressor identification studies pending the results of future routine SQO monitoring.

3. Sources Identification and Management Actions.
   a. Determine if the sources are ongoing or legacy sources.
   b. Determine the number and nature of ongoing sources.
   c. If a single discharger is found to be responsible for discharging the stressor pollutant at a loading rate that is significant, the Regional Water Board shall require the discharger to take all necessary and appropriate steps to address exceedance of the SQO, including but not limited to reducing the pollutant loading into the sediment.
   d. When multiple sources are present in the water body that discharge the stressor pollutant at a loading rate that is significant, the Regional Water Board shall require the sources to take all necessary and appropriate steps to address exceedance of the SQO. If appropriate, the Regional Water Board may adopt a TMDL to ensure attainment of the sediment standard.

G. CLEANUP AND ABATEMENT

Cleanup and abatement actions covered by Water Code section 13304 for sediments that exceed the objectives in Chapter IV shall comply with Resolution No. 92-49 (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304), Cal. Code Regs., tit. 23, §§2907, 2911.

H. DEVELOPMENT OF SITE-SPECIFIC SEDIMENT MANAGEMENT GUIDELINES

The Regional Water Boards may develop site-specific sediment management guidelines where appropriate, for example, where toxic stressors have been identified and controllable sources of these stressors exist or remedial goals are desired.

Development of site-specific sediment management guidelines is the process to estimate the level of the stressor pollutant that will meet the narrative sediment quality objective. The guideline can serve as the basis for cleanup goals or revision of effluent limits described in B. 4

above, depending upon the situation or sources. All guidelines when applied for cleanup, must comply with 92-49.

Guideline development should only be initiated after the stressor has been identified. The goal is to establish a relationship between the organism's exposure and the biological effect. Once this relationship is established, a pollutant specific guideline may be designated that corresponds with minimum biological effects. The following approaches can be applied to establish these relationships:

1. Correspondence with sediment chemistry. An effective guideline can best be derived based upon the site-specific, or reach- specific relationship between the stressor pollutant exposure and biological response. Therefore the correspondence between the bulk sediment stressor concentration and biological effects should be examined.
2. Correspondence with bioavailable pollutant concentration. The concentration of the bioavailable fraction of the stressor pollutants is likely to show a less variable relationship to biological effects that bulk sediment chemistry. Interstitial water analysis, SPME, desorption experiments, selective extractions, or mechanistic models may indicate the bioavailable pollutant concentration. The correspondence between the bioavailable stressor concentration and biological effects should be examined.
3. Correspondence with tissue residue. The concentration of the stressor accumulated by a target organism may provide a measure of the stressor dose for some chemicals (e.g., those that are not rapidly metabolized). The tissue residue threshold concentration associated with unacceptable biological effects can be combined with a bioaccumulation factor or model to estimate the loading or sediment concentration guideline.
4. Literature review. If site-specific analyses are ambiguous or unable to determine a guideline, then the results of similar development efforts for other areas should be reviewed. Scientifically credible values from other studies can be combined with mechanistic or empirical models of bioavailability, toxic potency, and organism sensitivity to estimate guidelines for the area of interest.
5. The chemistry LOE of Section V.H.2, including the threshold values (e.g. CSI and CALRM), shall not be used for setting cleanup levels or numeric values for technical TMDLs.

VIII. GLOSSARY

BENTHIC: Living on or in bottom of the ocean, bays, and estuaries, or in the streambed.

BINOMIAL DISTRIBUTION: Mathematical distribution that describes the probabilities associated with the possible number of times particular outcomes will occur in series of observations (i.e., samples). Each observation may have only one of two possible results (e.g., standard exceeded or standard not exceeded).

BIOACCUMULATION: A process in which an organism's body burden of a pollutant exceeds that in its surrounding environment as a result of chemical uptake through all routes of chemical exposure; dietary and dermal absorption and transport across the respiratory surface.

BIOAVAILABILITY: The fraction of a pollutant that an organism is exposed to that is available for uptake through biological membranes (gut, gills).

CHEMICALS OF CONCERN (COCS): Pollutants that occur in environmental media at levels that pose a risk to ecological receptors or human health.

CONTAMINATION: An impairment of the quality of the waters of the State by waste to a degree that creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste whether or not waters of the State are affected (CWC section 13050(k)).

EFFECT SIZE: The maximum magnitude of exceedance frequency that is tolerated.

ENCLOSED BAYS: Indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes, but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

ENDPOINT: A measured response of a receptor to a stressor. An endpoint can be measured in a toxicity test or in a field survey.

ESTUARIES AND COASTAL LAGOONS: Waters at the mouths of streams that serve as mixing zones* for fresh and ocean waters during a major portion of the year. Mouths of streams that are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and salt water occurs in the open coastal waters. The waters described by this definition include, but are not limited to, the Sacramento-San Joaquin Delta as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

EUHALINE: Waters ranging in salinity from 25–32 practical salinity units (psu).

INLAND SURFACE WATERS: All surface waters of the State that do not include the ocean, enclosed bays, or estuaries.

LOAD ALLOCATION (LA): The portion of a receiving water's total maximum daily load that is allocated to one of its nonpoint sources of pollution or to natural background sources.

MECHANISTIC BENCHMARKS: Chemical guidelines developed based upon theoretical processes governing bioavailability and the relationship to biological effects.

MIXING ZONE: A limited zone within a receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body.

NONPOINT SOURCES: Sources that do not meet the definition of a point source as defined below.

NULL HYPOTHESIS: A statement used in statistical testing that has been put forward either because it is believed to be true or because it is to be used as a basis for argument, but has not been proved.

OCEAN WATERS: Territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. Discharges to ocean waters are regulated in accordance with the State Water Board's California Ocean Plan.

POINT SOURCE: Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture.

POLLUTANT: Defined in section 502(6) of the CWA as "dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water."

POLLUTION: Defined in section 502(19) of the CWA as the "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water." ***Pollution*** is also defined in CWC section 13050(1) as an alternation of the quality of the waters of the State by waste to a degree that unreasonably affects either the waters for beneficial uses or the facilities that serve these beneficial uses.

POLYHALINE: Waters ranging in salinity from 18–25 psu.

REFERENCE CONDITION: The characteristics of water body segments least impaired by human activities. As such, reference conditions can be used to describe attainable biological or habitat conditions for water body segments with common watershed/catchment characteristics within defined geographical regions.

SPECIES RICHNESS: The number of species in a sample.

SURFICIAL SEDIMENTS: Those sediments representing recent depositional materials and containing the majority of the benthic invertebrate community.

STATISTICAL SIGNIFICANCE: When it can be demonstrated that the probability of obtaining a difference by chance only is relatively low.

TOXICITY IDENTIFICATION EVALUATION (TIE): Techniques used to identify the unexplained cause(s) of toxic events. TIE involves selectively removing classes of chemicals through a series of sample manipulations, effectively reducing complex mixtures of chemicals in natural waters to simple components for analysis. Following each manipulation the toxicity of the sample is assessed to see whether the toxicant class removed was responsible for the toxicity.

WASTE: As used in this document, waste includes a discharger's total discharge, of whatever origin, i.e., gross, not net, discharge.

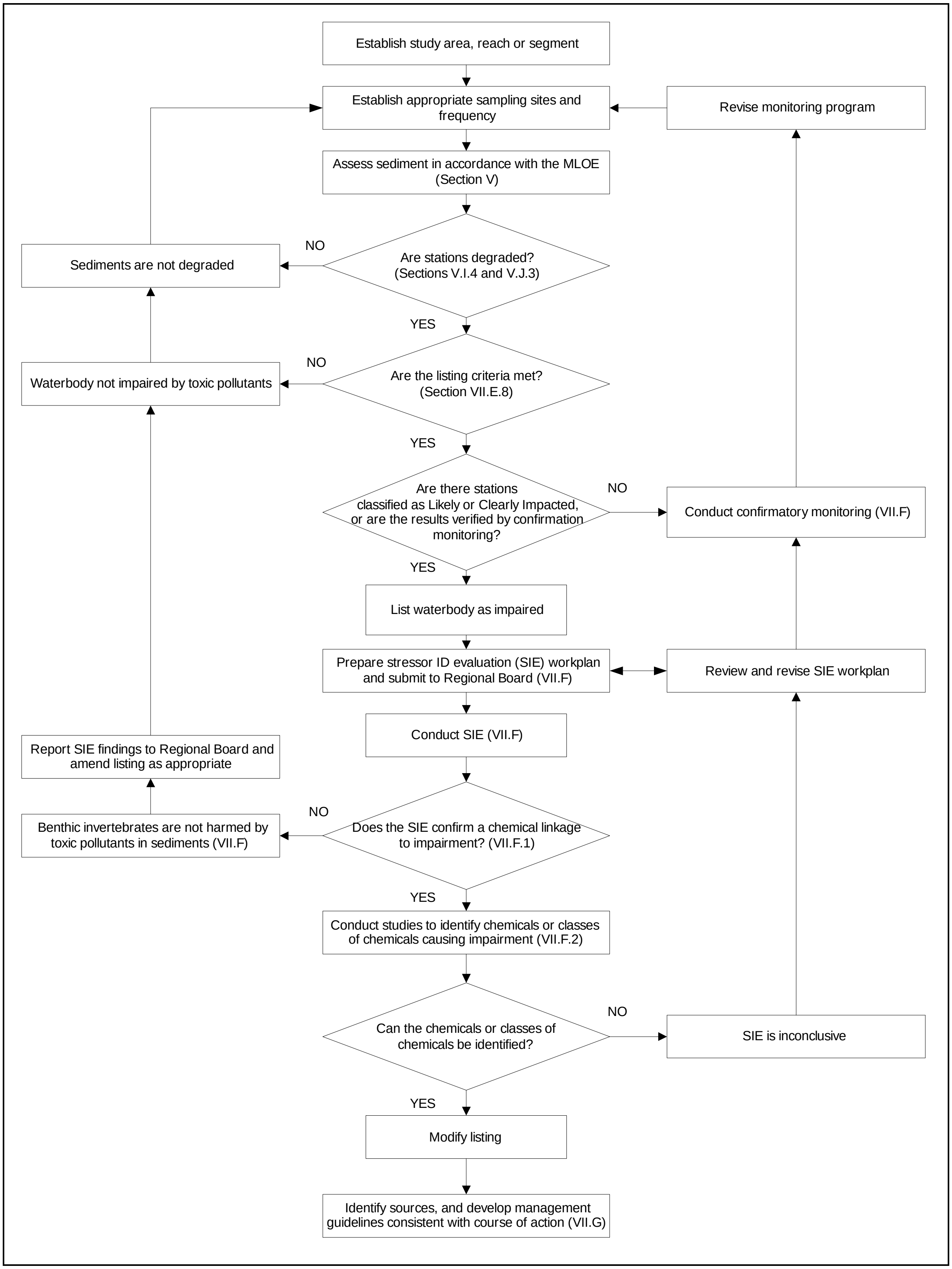

Figure 1. Waterbody Assessment Process

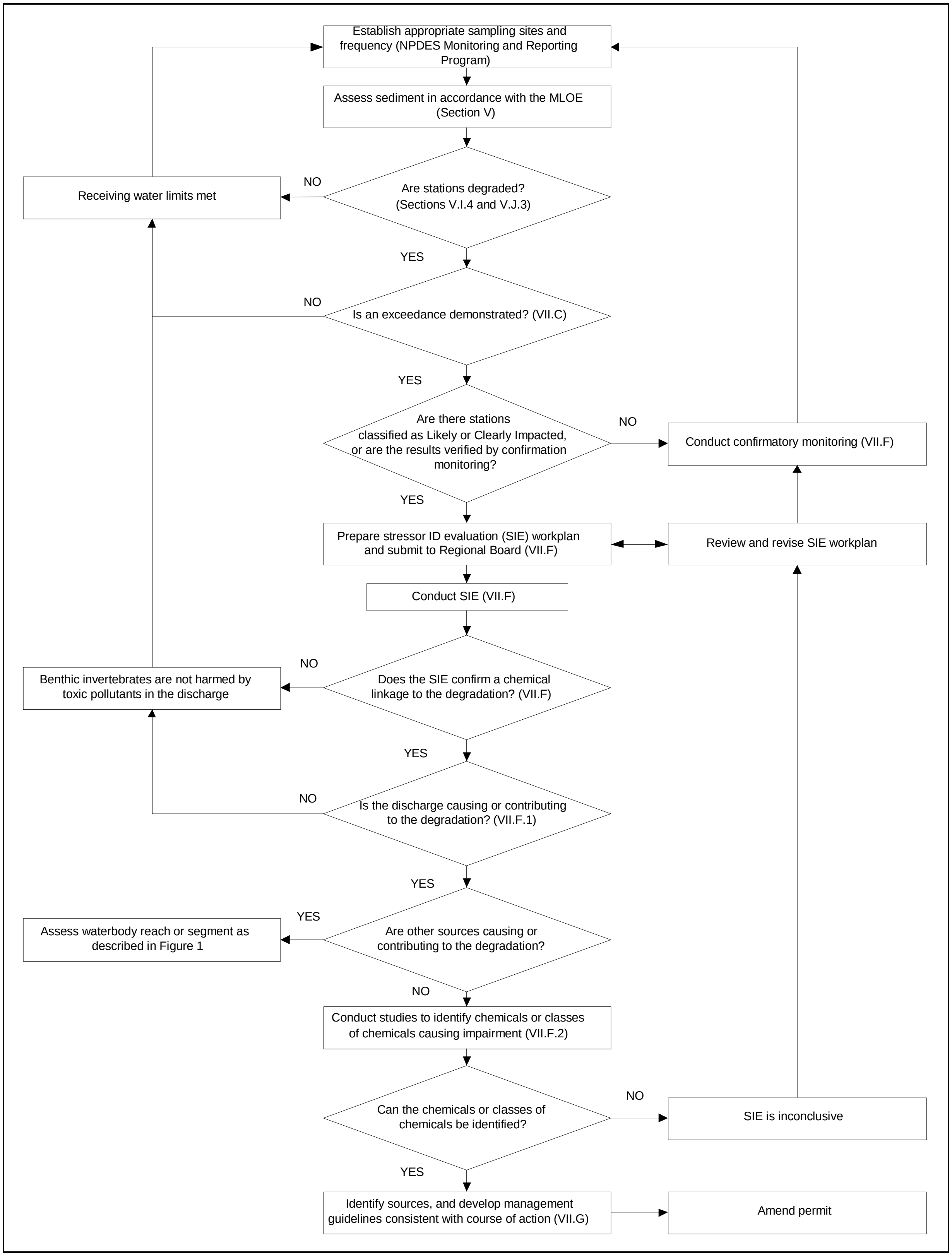

Figure 2. Point Source Assessment Process

Attachment A. List of chemical analytes needed to characterize sediment contamination exposure and effect.

Chemical Name	Chemical Group	Chemical Name	Chemical Group
Total Organic Carbon	General	Alpha Chlordane	Pesticide
Percent Fines	General	Gamma Chlordane	Pesticide
		Trans Nonachlor	Pesticide
Cadmium	Metal	Dieldrin	Pesticide
Copper	Metal	o,p’-DDE	Pesticide
Lead	Metal	o,p’-DDD	Pesticide
Mercury	Metal	o,p’-DDT	Pesticide
Zinc	Metal	p,p’-DDD	Pesticide
		p,p’-DDE	Pesticide
		p,p’-DDT	Pesticide
Acenaphthene	PAH	2,4'-Dichlorobiphenyl	PCB congener
Anthracene	PAH	2,2',5-Trichlorobiphenyl	PCB congener
Biphenyl	PAH	2,4,4'-Trichlorobiphenyl	PCB congener
Naphthalene	PAH	2,2',3,5'-Tetrachlorobiphenyl	PCB congener
2,6-dimethylnaphthalene	PAH	2,2',5,5'-Tetrachlorobiphenyl	PCB congener
Fuorene	PAH	2,3',4,4'-Tetrachlorobiphenyl	PCB congener
1-methylnaphthalene	PAH	2,2',4,5,5'-Pentachlorobiphenyl	PCB congener
2-methylnaphthalene	PAH	2,3,3',4,4'-Pentachlorobiphenyl	PCB congener
1-methylphenanthrene	PAH	2,3',4,4',5-Pentachlorobiphenyl	PCB congener
Phenanthrene	PAH	2,2',3,3',4,4'-Hexachlorobiphenyl	PCB congener
Benzo(a)anthracene	PAH	2,2',3,4,4',5'-Hexachlorobiphenyl	PCB congener
Benzo(a)pyrene	PAH	2,2',4,4',5,5'-Hexachlorobiphenyl	PCB congener
Benzo(e)pyrene	PAH	2,2',3,3',4,4',5-Heptachlorobiphenyl	PCB congener
Chrysene	PAH	2,2',3,4,4',5,5'-Heptachlorobiphenyl	PCB congener
Dibenz(a,h)anthracene	PAH	2,2',3,4',5,5',6-Heptachlorobiphenyl	PCB congener
Fluoranthene	PAH	2,2',3,3',4,4',5,6-Octachlorobiphenyl	PCB congener
Perylene	PAH	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	PCB congener
Pyrene	PAH	Decachlorobiphenyl	PCB congener

Attachment B. Station assessment category resulting from each possible MLOE combination

LOE Category Combination	Sediment Chemistry Exposure	Benthic Community Condition	Sediment Toxicity	Station Assessment
1	Minimal	Reference	Nontoxic	Unimpacted
2	Minimal	Reference	Low	Unimpacted
3	Minimal	Reference	Moderate	Unimpacted
4	Minimal	Reference	High	Inconclusive
5	Minimal	Low	Nontoxic	Unimpacted
6	Minimal	Low	Low	Likely unimpacted
7	Minimal	Low	Moderate	Likely unimpacted
8	Minimal	Low	High	Possibly impacted
9	Minimal	Moderate	Nontoxic	Likely unimpacted
10	Minimal	Moderate	Low	Likely unimpacted
11	Minimal	Moderate	Moderate	Possibly impacted
12	Minimal	Moderate	High	Likely impacted
13	Minimal	High	Nontoxic	Likely unimpacted
14	Minimal	High	Low	Inconclusive
15	Minimal	High	Moderate	Possibly impacted
16	Minimal	High	High	Likely impacted
17	Low	Reference	Nontoxic	Unimpacted
18	Low	Reference	Low	Unimpacted
19	Low	Reference	Moderate	Likely unimpacted
20	Low	Reference	High	Possibly impacted
21	Low	Low	Nontoxic	Unimpacted
22	Low	Low	Low	Likely unimpacted
23	Low	Low	Moderate	Possibly impacted
24	Low	Low	High	Possibly impacted
25	Low	Moderate	Nontoxic	Likely unimpacted
26	Low	Moderate	Low	Possibly impacted
27	Low	Moderate	Moderate	Likely impacted
28	Low	Moderate	High	Likely impacted
29	Low	High	Nontoxic	Likely unimpacted
30	Low	High	Low	Possibly impacted
31	Low	High	Moderate	Likely impacted
32	Low	High	High	Likely impacted
33	Moderate	Reference	Nontoxic	Unimpacted
34	Moderate	Reference	Low	Likely unimpacted
35	Moderate	Reference	Moderate	Likely unimpacted
36	Moderate	Reference	High	Possibly impacted
37	Moderate	Low	Nontoxic	Unimpacted
38	Moderate	Low	Low	Possibly impacted
39	Moderate	Low	Moderate	Possibly impacted
40	Moderate	Low	High	Possibly impacted
41	Moderate	Moderate	Nontoxic	Possibly impacted
42	Moderate	Moderate	Low	Likely impacted
43	Moderate	Moderate	Moderate	Likely impacted
44	Moderate	Moderate	High	Likely impacted

LOE Category Combination	Sediment Chemistry Exposure	Benthic Community Condition	Sediment Toxicity	Station Assessment
45	Moderate	High	Nontoxic	Possibly impacted
46	Moderate	High	Low	Likely impacted
47	Moderate	High	Moderate	Likely impacted
48	Moderate	High	High	Likely impacted
49	High	Reference	Nontoxic	Likely unimpacted
50	High	Reference	Low	Likely unimpacted
51	High	Reference	Moderate	Inconclusive
52	High	Reference	High	Likely impacted
53	High	Low	Nontoxic	Likely unimpacted
54	High	Low	Low	Possibly impacted
55	High	Low	Moderate	Likely impacted
56	High	Low	High	Likely impacted
57	High	Moderate	Nontoxic	Likely impacted
58	High	Moderate	Low	Likely impacted
59	High	Moderate	Moderate	Clearly impacted
60	High	Moderate	High	Clearly impacted
61	High	High	Nontoxic	Likely impacted
62	High	High	Low	Likely impacted
63	High	High	Moderate	Clearly impacted
64	High	High	High	Clearly impacted

CALIFORNIA

Water Boards

STATE WATER RESOURCES CONTROL BOARD

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Office of Legislative Affairs: (916) 341-5251
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www.waterboards.ca.gov

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CENTRAL COAST REGION (3)
www.waterboards.ca.gov/centralcoast
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401
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www.waterboards.ca.gov/centralvalley
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670
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Fresno branch office
1685 E Street, Suite 200
Fresno, CA 93706
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Redding branch office
415 Knollcrest Drive
Redding, CA 96002
(530) 224-4845 TEL • (530) 224-4857 FAX

LAHONTAN REGION (6)
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2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
E-mail: info6@waterboards.ca.gov
(530) 542-5400 TEL • (530) 544-2271 FAX

Victorville branch office
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Victorville, CA 92392
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Riverside, CA 92501-3339
E-mail: info8@waterboards.ca.gov
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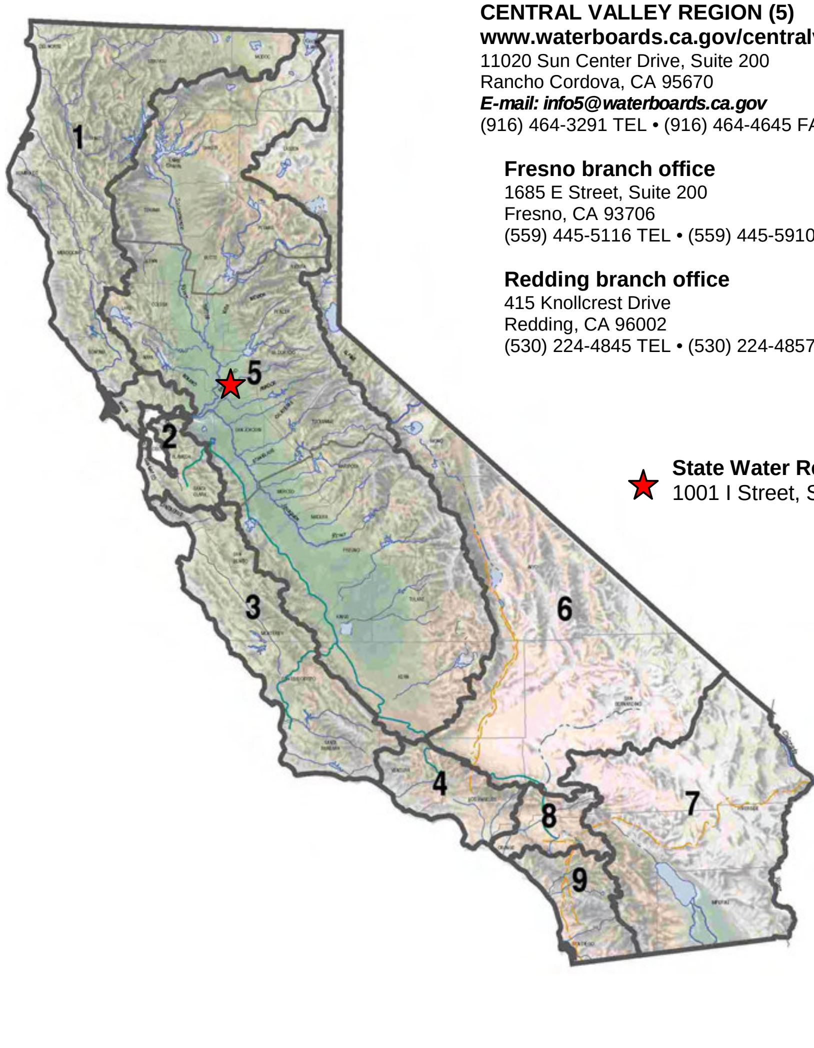
9174 Sky Park Court, Suite 100
San Diego, CA 92123
E-mail: info9@waterboards.ca.gov
(858) 467-2952 TEL • (858) 571-6972 FAX



★ **State Water Resources Control Board** (Headquarters)
1001 I Street, Sacramento, CA 95814

State of California
Arnold Schwarzenegger, Governor

California Environmental Protection Agency
Linda S. Adams, Secretary

State Water Resources Control Board
Charles R. Hoppin, Chair

APPENDIX B

SAN LUIS REY RIVER WATERSHED MANAGEMENT AREA RESPONSIBLE COPERMITTEES SEDIMENT MONITORING QUALITY ASSURANCE PROJECT PLAN

Prepared on:

November 2014
Revised in January 2015

GROUP A:
PROJECT MANAGEMENT

ELEMENT 1 TITLE AND APPROVAL SHEET

Final

Appendix B

San Luis Rey River Watershed Management Area Responsible Copermittees Sediment Monitoring Quality Assurance Project Plan

January 2015

APPROVAL SIGNATURES

San Luis Rey River Watershed Responsible Copermittes:

Title	Name	Signature	Date
Senior Project Manager			
Project Manager			

Contractor:

Title	Name	Signature	Date
Contractor Sr. Project Manager			
Contractor Project Manager			
Contractor Quality Assurance Officer			

ELEMENT 2 TABLE OF CONTENTS

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ELEMENT 2 TABLE OF CONTENTS (Continued)

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LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
Bight	Southern California Bight Regional Monitoring Program
BPJ	best professional judgement
CA EPA	California Environmental Protection Agency
CA LRM	California Logistic Regression Model
CEDEN	California Environmental Data Exchange Network
COC	chain of custody
Copermittees	San Diego County Regional Copermittees
CRM	certified reference materials
CSI	Chemical Score Index
CVAA	cold vapor atomic absorption
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DGPS	Differential Global Positioning System
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EC_{50}	median effect concentration
EPA	Environmental Protection Agency
GC/ECD	gas chromatography/ electron capture detector
GC/MS	gas chromatography/ mass spectrometry
HDPE	high density polyethylene
ICP/MS	inductively coupled mass spectrometry
ID	inner diameter
LC_{50}	median lethal concentration
LCS	laboratory control sample
LOE	line(s) of evidence
$MgSO_4$	magnesium sulfate
MLOE	multiple lines of evidence
MS/MSD	matrix spike/matrix spike duplicate
MS4	municipal separate storm sewer system
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RL	reporting limit
RCs	Responsible Copermittees
RPD	relative percent difference
RWQCB	Regional Water Quality Control Board
SCAMIT	Southern California Association of Marine Invertebrate Taxonomists
SDR	San Luis Rey River
SRM	standard reference material
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board

SIM	selective ion capture
SM	Standard Method
SOP	standard operating procedure
SP	solid phase
SQO	sediment quality objective
SWI	sediment water interface
TBD	to be determined
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan

Units of Measure

ppt	parts per thousand
ft	feet
m^2	square meters
L	liter
cm	centimeter
mm	millimeter
%	percent
mL	milliliter
^oC	degrees Celsius
kg	kilogram
mg	milligram
μg	microgram

ELEMENT 3 DISTRIBUTION LIST

Table 1 identifies those individuals who will receive one copy of the approved Sediment Monitoring Quality Assurance Project Plan (QAPP). The titles and roles listed Table 1 table can be expanded based on the monitoring and team assembled.

Table 1. Quality Assurance Project Plan Distribution List

Title	Name (Affiliation)	Telephone No.	QAPP No.
San Luis Rey River Watershed Responsible Copermittees Project Manager			01
Contractor Project Manager			02
Contractor Project Quality Assurance (QA) Officer			03
Contractor Field Task Manager			04
Laboratory Contractor Quality Assurance (QA) Officer			05

ELEMENT 4 PROJECT/TASK ORGANIZATION

Involved Parties and Roles

This section details the specific roles of key individuals who will be conducting and managing the sediment monitoring project. The titles and roles listed in Table 2 can be expanded based on the monitoring and team assembled.

Table 2. Key Personnel Responsibilities and Contact Information

Name	Organizational Affiliation	Title	Contact Information (telephone number, fax number and email address)
	San Luis Rey River Watershed Responsible Copermittees	Project Manager	
	Contractor	Project Manager	
	Contractor	Field Task Manager	
	Contractor	QA Officer	
	Laboratory Contractor	QA Officer	

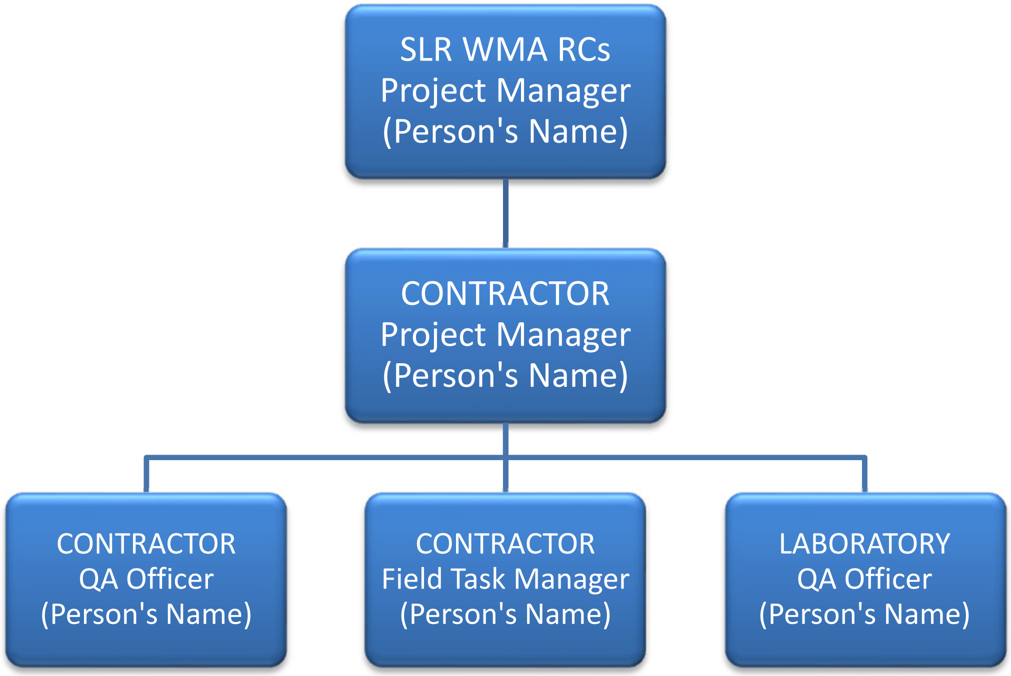

Figure 1. Organizational Chart

Quality Assurance Officer Role

The project Quality Assurance (QA) Officer will be responsible for the overall QA and quality control (QC) procedures found in this plan as part of the sampling and field analyses, laboratory analysis, and the overall quality of the data.

Persons Responsible for QAPP Update and Maintenance

Changes and updates to this QAPP may be made after a review of the evidence for change by the Contractor Project Manager and QA Officer with the concurrence of San Luis Rey River WMA Responsible Copermittees Project Manager. The Contractor Project Manager, with input from the QA Officer, will be responsible for making the changes, submitting drafts for review by the San Luis Rey River WMA Responsible Copermittees Project Manager, preparing a final amended copy, and submitting the final for signature. Project work must be halted while revisions to the QAPP are made, unless authorized by the San Luis Rey River WMA Responsible Copermittees Project Manager.

ELEMENT 5 PROBLEM DEFINITION/BACKGROUND

Problem Statement

The Copermittees are required to conduct sediment quality monitoring in accordance with the requirements of the San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001 (Permit), effective June 27, 2013. The Copermittees are required, either individually, in association with multiple Copermittees, or through participation in a water body monitoring coalition to perform sediment quality monitoring to assess compliance with the sediment quality receiving water limits applicable to municipal separate storm sewer system (MS4) discharges to enclosed bays and estuaries. Urban runoff from the MS4 poses a risk to beneficial uses in receiving waterbodies. An understanding of the quality of sediments in relation to MS4 discharges is needed to direct and prioritize management actions.

Provision D.1.e.(2) of the Permit requires the Copermittees to develop a Sediment Monitoring Plan for incorporation into the Water Quality Improvement Plan (WQIP) which satisfies the requirements of the *Water Quality Control Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality* (Sediment Control Plan; State Water Quality Control Board [SWRCB] and California Environmental Protection Agency [CA EPA], 2009; see Appendix A). This QAPP supports the Sediment Monitoring Plan by describing the sampling, analysis, and quality assurance procedures that are needed to comply with Permit-required sediment quality monitoring.

Decisions or Outcomes

The primary objective of the sediment monitoring program is to assess compliance with the sediment quality receiving water limits applicable to MS4 discharges to enclosed bays and estuaries of San Diego County. Sediment toxicity, chemistry, and benthic community condition will be assessed using SQOs as described in the Sediment Monitoring Plan. The goals of the SQOs are to determine whether pollutants in sediments are present in quantities that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful.

The goal of the Sediment Monitoring Plan and Sediment Monitoring QAPP is to provide the key elements that are required to successfully conduct field sediment sampling, processing, testing, and analysis of the results in accordance with SQO guidelines. Analyses of chemistry, toxicity, and benthic community condition require that samples be collected, preserved, processed, and analyzed using proper field and laboratory equipment, methods, and techniques. The Sediment Monitoring Plan and Sediment Monitoring QAPP describe the collection and analysis of surface sediment samples necessary to provide representative assessments of in-situ conditions for the enclosed bays and estuaries of San Diego County. By adhering to SQO protocols, sediment quality in subtidal marine and estuarine habitats can be assessed as to whether it is protective of aquatic life and human health.

ELEMENT 6 PROJECT/TASK DESCRIPTION

Work Statement and Produced Products

The San Diego County Regional Copermittees (Copermittees) are required to conduct sediment quality monitoring in accordance with the requirements of the *Water Quality Control Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality* (Sediment Control Plan; SWRCB and CA EPA, 2009; see Appendix A). The Sediment Control Plan outlines a multiple lines of evidence (MLOE) approach to determine whether pollutants in sediments are present in quantities that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful to humans. Sediment monitoring will be conducted at least twice during the Permit cycle except at stations that have consistently been classified as Unimpacted or Likely Unimpacted using the MLOE approach. At the Unimpacted or Likely Unimpacted stations, monitoring may be reduced to a frequency of once during the Permit cycle. The participating agencies propose to conduct one round of sediment sampling each permit term. The second required round of sampling will be satisfied by conducting additional follow up sampling in the vicinity of potentially impacted sites identified in the first round. For the San Luis Rey River Estuary, this requirement is met for the 2013-2018 MS4 Permit term based on sampling and assessments conducted through the participation in the Bight'13 monitoring program and the subsequent follow-up sediment sampling carried out in 2014.

Sediment samples will be analyzed for toxicity, chemistry, and benthic infauna at a designated number of stations (station selection is outlined in ELEMENT 10) within a waterbody. An SQO analysis will be conducted on each station to determine a final station assessment that indicates whether the aquatic life SQO has been met. Depending on the outcome of the SQO assessments at the designated stations located in San Diego County waterbodies, follow-up monitoring may be necessary to meet all of the Permit requirements. Upon completion of the sediment quality monitoring, a Sediment Monitoring Report will be incorporated into the WQIP Annual Report. An additional stressor identification study may be required by the San Diego RWQCB for stations not meeting SQOs.

Provision D.1.e.(1)(a) of the Permit also requires the Copermittees to participate in the Southern California Bight Regional Monitoring Program. Participation in the Bight Program can be used to simultaneously fulfill all or part of the sediment quality monitoring requirement (Provision D.1.e[2]) because sediment monitoring and SQO analyses are incorporated into the Bight Program to regionally assess the sediment quality of Southern California's waterbodies. The Copermittees can also decide to conduct the initial sediment quality monitoring of San Diego County's water bodies independently of the Bight Program. Depending upon the outcome of the initial SQO assessments, the Copermittees may need to perform follow-up monitoring to meet all of the Permit requirements.

Constituents to be Monitored and Measurement Techniques

Chemical and toxicity analyses of all sediment samples collected as part of the SQO assessment must be tested in accordance with United States Environmental Protection Agency (USEPA) or

American Society for Testing and Materials (ASTM) protocols. If appropriate protocols do not exist, the SWRCB or San Diego RWQCB may approve the use of other methods. All analytical laboratories must be certified by the California Department of Health Services in accordance with Water Code 13176.

Physical and chemical measurements of sediment were selected to comply with the Sediment Control Plan and to provide data on chemicals of potential concern in bays and estuaries located in San Diego County. The physical and chemical analyses of sediments will include, at a minimum, grain size, percent solids, total organic carbon (TOC), trace metals, organochlorine pesticides, polychlorinated biphenyl (PCBs) congeners, and polynuclear aromatic hydrocarbons (PAHs). Chemical analyses of these constituents are necessary in order to compare to the California Logistic Regression Model (CA LRM) and the Chemical Score Index (CSI) for SQO analyses. Additional physical or chemical analyses may be included in order to aid in the interpretation of the individual lines of evidence (LOEs) (e.g. pyrethroids or ammonia).

Sediment toxicity testing will be performed for each station using a minimum of one short-term survival toxicity test and one sublethal toxicity test. Acceptable short-term sediment survival tests include the *Eohaustorius estuarius* 10-day survival test, the *Leptocheirus plumulosus* 10-day survival test, or the *Rhepoxynius abronius* 10-day survival test. Acceptable sublethal sediment toxicity tests include the *Mytilus galloprovincialis* sediment-water interface (SWI) 48-hour embryo development test or the *Neanthes arenaceodentata* whole sediment 28-day growth test. The *E. estuarius* short-term survival test and the *M. galloprovincialis* sublethal toxicity test have been the test methods used in previous San Diego County bay and estuary monitoring programs including the Bight program where the SQO analytical tool was used to assess aquatic health.

Benthic community condition samples will be screened by field personnel and then sorted and identified to the lowest possible taxon by qualified taxonomists in accordance with the most recent version of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) taxonomic listing for nomenclature and orthography.

For the purposes of this QAPP, the constituent list for chemical analyses includes only those analytes that are required for compliance with SQO analyses and physical analyses that will aid in the interpretation of the SQO data. Analytical physical and chemistry methods provided in Table 3 are suggested methods that have been used in previous sediment monitoring programs within San Diego County's waterbodies (e.g. Bight), but are not the only acceptable methods. A detailed list of individual analytes is provided in Element 13.

Table 3. Analyte list and Suggested Testing Methods for SQO analyses

Analyte/ Test	Method
Physical Analyses	
Grain size	Plumb 1981 or use of a Horiba LA920 (Laser Particle Analyzer)*
Percent solids	SM 2540B*
TOC	USEPA 9060A*
Chemical Analyses	
Trace Metals	USEPA 6020A (Mercury- 7471B)*
Oganochlorine pesticides	USEPA 8081B*
PCB congeners	USEPA 8082A*
PAHs	USEPA 8270D*
Toxicity	
Short-term amphipod survival using *Eohaustorius estuarius*	USEPA (1994) *Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods*, ASTM E1367-03
Sublethal testing using *Mytilus galloprovincialis*	USEPA (1995) *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms;* Anderson et al. (1996) *Assessment of Sediment Toxicity at the Sediment-Water Interface*
Sublethal testing using *Neanthes arenaceodentata*	ASTM E1562 with modifications described in Farrar and Bridges (2011)
Benthic Infauna	
Benthic Community Condition	See Element 13

* may be substituted with equivalent methods

Short-term survival toxicity testing will be performed in accordance with procedures for amphipod testing outlined in *Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (USEPA, 1994) and ASTM method E1367-03 (ASTM, 2006). Sublethal sediment toxicity testing for *Mytilus galloprovincialis* should follow procedures outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (USEPA, 1995) and *Assessment of Sediment Toxicity at the Sediment-Water Interface* (Anderson et al., 1996), whereas sublethal sediment toxicity testing for *Neanthes arenaceodentata* should follow ASTM method E1562 (ASTM, 2002) with modifications described in Farrar and Bridges (2011) that have been found to contribute manageability and precision to the ASTM procedure. Equivalent toxicity testing methods that meet the requirements of the Sediment Control Plan may be substituted for ones described above.

SQO Analyses

Protocols for assessing sediment chemistry, toxicity, and benthic community conditions for San Diego County waterbodies using California's SQOs are described in Section 3.2 of the Sediment Monitoring Plan.

Project Schedule

The schedule for completing the sediment quality monitoring requirements of the Permit and for submitting the Sediment Monitoring Report is shown in Table 4.

Table 4. Sediment Monitoring Program Schedule

Activity/Deliverable	Dates(s)
Monitoring Program	TBD
Follow-up confirmation monitoring	TBD
Final Sediment Monitoring Plan and Sediment Monitoring QAPP incorporated into WQIPs	TBD
Draft Sediment Monitoring Report	TBD
Final Sediment Monitoring Report incorporated into Transitional Monitoring and Assessment Program Report	TBD
Potential Stressor ID Studies	TBD

Constraints

Sediment monitoring must occur in subtidal areas located within a waterbody between the months of June through September. SQOs have been fully developed for only two of California's six enclosed bay habitats: euhaline (salinity = 25 to 32 parts per thousand [ppt]) bays and estuaries south of Point Conception and polyhaline (18 to 25 ppt) central San Francisco Bay. The benthic species assemblage used to calculate the benthic LOE in San Diego bays and estuaries is Habitat C- Southern California Marine Bays, which requires a salinity greater than 27 ppt (Bay et al 2014; Ranasinghe et al 2008). In order to select a sampling station applicable to the SQO assessment using Habitat C for the benthic LOE, it is recommended to verify that a proposed sampling station is both subtidal and has salinity greater than 27 ppt. Salinity measurements should be taken near the sediment-water interface. Sediment samples will be collected with a 0.1 m^2 Van Veen grab sampler or other similar device. Certain types of benthic habitat such as hard clay, cobble, coarse sand, and areas with thick eel grass may be difficult to sample using this type of device. A slight relocation of the target sampling location may be necessary to avoid areas in which obtaining acceptable grab samples is not achievable.

Nesting periods for threatened or endangered bird species inhabiting coastal water bodies may prevent or delay sampling during certain summer months. Species of particular concern include least terns, snowy plovers, California clapper rails, and Belding's savannah sparrows. Permission from California Fish and Wildlife may be required to enter restricted areas that are known to contain these species. Additionally permission from private land owners may be necessary to gain access to private property and/or private boat launches.

ELEMENT 7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

All quality assurance/quality control (QA/QC) procedures for chemistry and toxicity samples must be employed in accordance with the QAPP for the State of California's Surface Water Ambient Monitoring Program (SWAMP) (SWAMP Quality Assurance Team, 2008). The data quality objectives (DQOs) are summarized by category in Table 5. If sediment quality monitoring is conducted as part of the Bight Program (i.e. SQO analysis as stated in the Sediment Control Plan), the work plans and associated QA/QC documents pertaining to the Bight Program should be followed in conjunction with this QAPP.

Table 5. Summary of Data Quality Objectives

Measurement or Analysis Type	Applicable Data Quality Objective
Chemistry Laboratory Analyses	Accuracy, precision, and completeness
Toxicity Laboratory Analyses	Precision and completeness
Benthic Infauna Analyses	Accuracy and completeness

Acceptance criteria will be based on the implementation of acceptable and recognized QA/QC procedures. Acceptable data must have proper sample collection and handling methods, sample preparation and analytical procedures, holding times, stability issues, and QA protocols.

Accuracy is a measure of how closely the analytical result or field measurement represents the true quantity found in the sample. Evaluation of the accuracy of laboratory samples will be achieved through the preparation and analysis of either reference materials (e.g. certified or standard reference materials [CRM/SRM]) or laboratory control samples [LCS]) with each analytical batch. For sediment toxicity samples, the accuracy of sediment toxicity tests cannot be determined since a reference material of known toxicity is not available. The accuracy of benthic infaunal sorting will be evaluated via a QA/QC procedure that ensures a 95% sorting efficiency of each sample.

Precision is the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions calculated as either the range or as the standard deviation. The precision of chemistry laboratory measurements will be controlled by comparison of the sample to either a laboratory duplicate or a laboratory matrix spike/matrix spike duplicate (MS/MSD). For toxicity samples, a water only reference toxicant test will be run with every batch of test samples in order to document organism relative sensitivity and test precision. Reference toxicant test results that fall outside of control chart limits (2 standard deviations of the mean) will trigger a review of test procedures and a possible retest of the corresponding sediment samples. A negative control will be run with each test batch for both the short term survival and sublethal toxicity tests.

Completeness is a measure of the percentage of sample results that are collected and analyzed and determined to be valid. A goal of 90% completeness exists for each measurement process.

Completeness will be assessed in all chemistry samples with qualifiers indicating the reasons for any samples that did not meet acceptance criteria. All toxicity tests will be run with toxicity control tests to assess validity of the toxicity test results. Benthic infauna samples that do not meet acceptance criteria will be re-sorted.

“Representative” is a qualitative term that expresses “the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition” (ANSI/ASQC, 1994). Best professional judgement (BPJ) will be used in the field to evaluate whether measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the environment or condition being measured or studied. Sample selection and use of approved/documented analytical methods will control to the best extent possible that the measurement data represent the conditions at the investigation site.

Quality control samples and data quality objectives for analyzing chemistry and toxicity samples collected as part of the sediment monitoring program must be conducted in accordance with the QAPP for the State of California’s SWAMP (SWAMP Quality Assurance Team, 2008) if SWAMP quality objectives are available. The quality objectives are outlined in Table 6 through Table 8. Depending on the physical or chemical analysis of the sediment samples, the following QA/QC sample types may be required to be included in the analytical run:

- A laboratory blank to determine the likelihood of contamination in the samples.
- A laboratory duplicate sample to estimate the precision of the results through the calculation of the relative percent difference (RPD) between the sample and the duplicate sample.
- A certified or standard reference material to determine the accuracy of the analyses.
- A matrix spike to determine if interference has occurred between the sample matrix and the analysis of the target analyte.
- A surrogate compound to estimate losses of the target analyte during the sample extraction phase and analysis of the sample (for organic measurements only).

SWAMP quality control measurements for toxicity testing of marine sediments are provided in Table 7. It should be noted that these SWAMP measurements currently only apply for the short term 10-day survival test using *Eohaustorius estuarius*. SWAMP is developing quality guidelines for *Mytilus galloprovincialis.* For the SQO analysis, quality assurance recommendations for toxicity testing are also provided in the Sediment Quality Assessment Technical Support Manual (Bay et al., 2014).

Table 6. Frequency of Chemistry Analysis for Laboratory Quality Assurance/Quality Control Samples

Analysis Type	Laboratory Blanks	Laboratory Duplicate	SRM or LCS[1]	Matrix Spikes	Matrix Spike Duplicates	Surrogate
Total solids	1 per analytical batch	1 per analytical batch	N/A	N/A	N/A	N/A
Total organic carbon	1 per analytical batch	1 per analytical batch	1 per 20 samples or 1 per analytical batch, whichever is more frequent	N/A	N/A	N/A
Grain size	N/A	1 per analytical batch	N/A	N/A	N/A	N/A
Trace Metals	1 per 20 samples or 1 per analytical batch, whichever is more frequent	1 per 20 samples or 1 per analytical batch, whichever is more frequent	1 per 20 samples or 1 per analytical batch, whichever is more frequent	1 per 20 samples or 1 per analytical batch, whichever is more frequent	1 per 20 samples or 1 per analytical batch, whichever is more frequent	N/A
Organochlorine Pesticides	1 per 20 samples or 1 per analytical batch, whichever is more frequent	N/A	1 per 20 samples or 1 per analytical batch	1 per 20 samples or 1 per analytical batch, whichever is more frequent	1 per 20 samples or 1 per analytical batch, whichever is more frequent	Included in all samples and all QC samples
PCB Congeners	1 per 20 samples or 1 per analytical batch, whichever is more frequent	N/A	1 per 20 samples or 1 per analytical batch	1 per 20 samples or 1 per analytical batch, whichever is more frequent	1 per 20 samples or 1 per analytical batch, whichever is more frequent	Included in all samples and all QC samples
PAHs	1 per 20 samples or 1 per analytical batch, whichever is more frequent	N/A	1 per 20 samples or 1 per analytical batch	1 per 20 samples or 1 per analytical batch, whichever is more frequent	1 per 20 samples or 1 per analytical batch, whichever is more frequent	Included in all samples and all QC samples

LCS = Laboratory control sample

N/A = not applicable

SRM = standard reference material

[1] When a Standard Reference Material is not available, an LCS will be analyzed.

Table 7. Quality Control Measurements for Sediment Toxicity Testing

QC Control	Frequency of Analysis and Control Limits
Negative Controls Laboratory Control Water	Laboratory Control water consistent with Section 7 of appropriate EPA method/manual must be tested with each analytical batch/ Laboratory control water must meet all test acceptability criteria for the species of interest.
Negative Controls Conductivity/Salinity Control Water	A conductivity or salinity control must be tested when these parameters are above or below the species tolerance/ Follow EPA guidance on interpreting data.
Negative Controls Additional Control Water	Additional method blanks are required whenever manipulations are performed on one or more of the ambient samples within each analytical batch/ There must be no statistical difference between the laboratory control water and each additional control water within an analytical batch.
Negative Controls Sediment Control	Sediment control consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch of sediment toxicity tests/ Sediment control must meet all data acceptability criteria for the species of interest.
Positive Controls Reference Toxicant Tests	Reference toxicant tests must be conducted monthly for species that are raised within a laboratory, or per analytical batch for commercially-supplied or field-collected species/ Last plotted data point (LC50 or EC50) must be within 2 SD of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. An out of control reference toxicant test result does not necessarily invalidate associated test results. More frequent and/or concurrent reference toxicant testing may be advantageous if recent problems have been identified in testing.
Sample Duplicate	5% of total project sample count/ Recommended acceptable RPD<20%

[1] SWAMP quality control measurements currently only apply for marine sediment toxicity testing for the 10-day survival *Eohaustorius estuarius* test. SWAMP is in the process of developing guidelines for the *Mytilus galloprovincialis* 48-hr SWI test.

Table 8. Data Quality Objectives for Laboratory Measurements

Group	Parameter	Accuracy	Precision	Completeness
Sediment Samples				
Laboratory analyses	Total Solids	N/A	Laboratory duplicate RPD < 25%	90%
Laboratory analyses	TOC	Laboratory Blank <RL or <30% of lowest sample; SRM or LCS with 80–120% recovery of true value	Laboratory duplicate RPD < 25%	90%
Laboratory analyses	Grain Size	N/A	Laboratory duplicate RPD < 25%	90%
Laboratory Analyses	Trace Metals	Laboratory Blank< RL for target analyte; SRM or LCS 75-125% recovery	Laboratory duplicate, MSD RPD < 25%; MS/MSD 75-125% recovery	90%
Laboratory Analyses	Organochlorine Pesticides	Laboratory Blank< RL for target analyte; SRM 70-130% recovery if certified, otherwise 50-150% recovery; if using LCS 70-130% recovery	MSD RPD < 25%; MS/MSD 50-150% recovery or based on historical laboratory control limits (average ±3SD); surrogates based on historical lab control limits (50-150% or better)	90%
Laboratory Analyses	PCB Congeners	Laboratory Blank< RL for target analyte; SRM 70-130% recovery if certified, otherwise 50-150% recovery; if using LCS 70-130% recovery	MSD RPD < 25%; MS/MSD 50-150% recovery or based on historical laboratory control limits (average ±3SD); surrogates based on historical lab control limits (50-150% or better)	90%
Laboratory Analyses	PAHs	Laboratory Blank< RL for target analyte; SRM 70-130% recovery if certified, otherwise 50-150% recovery; if using LCS 70-130% recovery	MSD RPD < 25%; MS/MSD 50-150% recovery or based on historical laboratory control limits (average ±3SD); surrogates based on historical lab control limits (50-150% or better)	90%

Table 8. Data Quality Objectives for Laboratory Measurements

Group	Parameter	Accuracy	Precision	Completeness
Toxicity Samples				
Toxcity Testing	Short-term 10-day Amphipod Survival Tests	N/A	Reference toxicity testing; test results within 2 standard deviations of the mean are re-evaluated.	90%
Toxicity Testing	Sublethal Sediment Toxicity Tests	N/A	Reference toxicity testing; test results within 2 standard deviations of the mean are re-evaluated.	90%
Benthic Infauna Samples				
Benthic Infauna	Benthic Infaunal Sorting	95% sorting efficiency	N/A	90%

ELEMENT 8 SPECIAL TRAINING NEEDS/CERTIFICATION

Specialized Training or Certifications

Field Sampling

Field personnel will have current and relevant experience in the aspects of standard field monitoring, including use of relevant field equipment such as boats, field instruments, and monitoring equipment. Field personnel will also have been trained and have experience in the collection and handling of samples, and chain-of-custody (COC) procedures. Training will be reviewed in proper field sampling and sample-handling techniques prior to sampling and only those staff with proficiency will be permitted to conduct field work.

Analytical Laboratory

All analytical tests including chemistry and toxicity will be conducted by laboratories certified by the California Department of Health Services in accordance with Water Code Section 13176.

Training and Certification Documentation

Personnel are responsible for complying with QA/QC requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, QA/QC procedures, and records management.

Field Sampling

Field personnel training will be documented and records kept in the project files at each organization's offices.

Analytical Laboratory

Training documents for each subcontracting laboratory will be detailed in the individual QAPPs for each laboratory.

Training Personnel

The Project Manager and/or Field Task Manager will provide training for field personnel in proper field sampling techniques prior to work initiation to ensure consistent and appropriate sampling, sample handling/storage, and COC procedures.

ELEMENT 9 DOCUMENTS AND RECORDS

The San Luis Rey River Watershed Responsible Copermittees or their subcontractor(s) will document and track the aspects of the sample collection process, including generating field logs at each site and COC forms for the samples collected. COC forms will accompany samples to the appropriate laboratory for analysis. Each laboratory will document and track the aspects of receipt and storage, analyses, and reporting related to their respective samples.

A database of information collected during the sediment monitoring will be maintained by each San Luis Rey River Watershed Responsible Copermittees or their subcontractor(s). The database will include field observations, data sheets, COC records, and analytical results. The original data sheets, statistical worksheets, and reports produced will be accumulated into project-specific files maintained in file cabinets following submittal of the draft report. Data from outside contractors will be kept exactly as received. Monitoring data and analytical results will be uploaded into California Environmental Data Exchange Network (CEDEN).

Persons responsible for maintaining records for this project will be specified by the project manager and will be tasked with overseeing the operations of the project, and maintaining the sample collection, sample transport, COC, field analysis forms, and laboratory data. They will also be responsible for arbitrating any issues relative to records retention and any decisions to discard records.

Copies of this QAPP will be distributed to all parties identified previously in Element 3. Updates to this QAPP will be distributed in like manner, and previous versions will be discarded from the project file. The Project Manager under the direction, supervision, and review of the QA Officer, will be responsible for distributing an updated version of the QAPP.

Copies of the final report, including laboratory results and field records, will be maintained for a minimum of five years after project completion.

GROUP B:
DATA GENERATION AND ACQUISITION

ELEMENT 10 SAMPLE PROCESS DESIGN

Station Selection

The Sediment Control Plan applies to subtidal surficial sediments located seaward of the intertidal zone in enclosed bays and estuaries. It does not apply to ocean waters, inland surface waters, sediments consisting of less than 5 percent (%) fines or substrates composed of gravel, cobble, or consolidated rock, or to sediment classified as a pollutant due to physical processes such as burial or sedimentation. SQOs have been fully developed for only two of California's six enclosed bay habitats: euhaline (salinity = 25 to 32 parts per thousand [ppt]) bays and coastal lagoons south of Point Conception and polyhaline (18 to 25 ppt) central San Francisco Bay. In addition, the benthic species assemblage used to calculate the benthic LOE for southern California marine bays is Habitat C (Bay et al., 2014), and one of the criteria for Habitat C is a salinity greater than 27 ppt. In order to select a sampling station applicable to the SQQ assessment using Habitat C for the benthic LOE, it is recommended to verify that a proposed sampling station is both subtidal and has salinity greater than 27 ppt. Salinity measurements should be taken at a spring high and low tide to get an estimate of the salinity range for a proposed station. If feasible, it is recommended that salinity should be monitored throughout an entire spring tidal cycle to ensure it meets the salinity criteria prior to sampling. This monitoring can be accomplished by deploying a continuous monitoring device such as an YSI water quality data sonde. Water depth should also be measured when visiting the station at a spring low tide or deploying a continuous monitoring device over a spring tidal cycle to ensure the station is subtidal.

The Sediment Control Plan does not give guidance as to how many stations should be sampled in each lagoon. The number of sampling stations may vary within based on the spatial extent of the area likely to be impacted. If the Bight Program is utilized to fulfill the Sediment Quality Monitoring requirement of the Permit, then the number of stations will be dictated by the Bight Program. For example, in the 2008 Bight Program, five stations were analyzed per lagoon; however, in the 2013 Bight Program the number of stations per lagoon varied from one to three stations. If a stressor identification study becomes necessary following the original SQO assessment of a lagoon (see Section 4.0), then the number of stations will be based on what suspected pollutants are driving the impacted scores (e.g. algae, physical factors, or chemical factors) and to have enough samples to statistically support meaningful findings.

Monitoring Season and Frequency

Sediment for SQO programs must be collected between June and September. Physical environments and benthic community composition and abundance within enclosed bays and estuaries are generally most stable during this time of year (Bay et al., 2014).

According to Section VII.D of the Sediment Control Plan, sediment monitoring associated with Phase I stormwater discharges and major discharges shall be conducted at least twice during the Permit cycle except at stations that have consistently been classified as Unimpacted or Likely Unimpacted using the MLOE approach described in Section 3.2 of the Sediment Monitoring Plan. At the Unimpacted or Likely Unimpacted stations, monitoring may be reduced to a frequency of once during the Permit cycle. The San Diego RWQCB may also limit receiving water monitoring to a subset of outfalls to focus where the risk to sediment quality is greatest. The participating agencies propose to conduct one round of sediment sampling each permit term. The second required round of sampling will be satisfied by conducting additional follow up sampling in the vicinity of potentially impacted sites identified in the first round. For the San Luis Rey River Estuary, this requirement is met for the 2013-2018 MS4 Permit term based on sampling and assessments conducted through the participation in the Bight'13 monitoring program and the subsequent follow up sediment sampling carried out in 2014.

ELEMENT 11 SAMPLING METHODS

Sediment Sampling

Information regarding the sampling vessel and site acceptability are provided in Sections 2.1.4 and 2.1.5 of the Sediment Monitoring Plan. Benthic sediments will be collected as surface grabs using an appropriate sampler, such as a stainless steel Van Veen grab sampler. The size of the grab sampler to be used for sediment programs in Southern California should be 0.1 m^2 across the top of the sampler. An appropriate sampler for the collection of benthic sediments will have the following characteristics:

- Constructed of a material that does not introduce contaminants.
- Causes minimal surface sediment disturbance.
- Does not leak or mix during sample retrieval.
- Has a design that enables safe/easy sample verification that samples meet all applicable sampling criteria (e.g., collects sediments to at least 5 centimeters (cm) below the sediment surface, has access doors allowing visual inspection and removal of undisturbed surface sediment).

Sediment grabs will be collected for the following analyses: benthic infauna, chemistry, grain size, and toxicity. A sample will be considered acceptable if the surface of the grab is even, there is minimal surface disturbance, and there is a penetration depth of at least 7 cm. Rejected grabs will be discarded, and the station will be re-sampled. Acceptable sediment grabs to be utilized for chemistry, grain size, and toxicity analyses will have the overlying water carefully drained from the sediment surface prior to removing the sediment to be placed in the appropriate sample containers. Overlying water will not be drained from sediment samples collected for benthic infaunal analysis. Station location and grab event data will be recorded on pre-formatted field data sheets (hard copies or via computer). At a minimum, field data will include station identification, station location, date, time of sample collection, depth of water, depth of penetration of grab in sediment (e.g. 5 cm), sediment composition, sediment odor and color, and sample type (e.g. sediment chemistry). Photographs of each sediment sample may be taken as needed and stored.

The entire contents of one grab sample will be utilized for benthic community analyses with a minimum penetration depth of 7 cm. Samples collected for benthic infaunal analysis will be rinsed through a 1.0-millimeter (mm) mesh screen. The material retained on the screen will be transferred to a labeled glass or plastic sample container. A 7% magnesium sulfate ($MgSO_4$) seawater solution will be added to the sample container to 85-90% of its volume to relax the collected specimens. The sample container will be inverted several times to distribute the relaxant solution. After 30 minutes, add enough sodium borate buffered formaldehyde to top off the sample container and gently invert the container several times to ensure the sample is mixed. This will make a 10% formalin solution.

Sediment samples for chemistry and toxicity testing will be collected from the top 5 cm of a grab sample using a pre-cleaned stainless steel scoop. Sediment within 1 cm of the sides of the grab will be avoided to prevent interaction of any contaminants and the steel sampling device. For chemistry and grain size analysis, equal portions of sediment will be aliquoted from a single grab and placed into the appropriate samples containers. The sediment aliquots will be representative of the entire 5 cm depth of the surface sediment. According to the Sediment Control Plan, the preferred method of collection for SWI toxicity tests is to collect intact cores directly from the sediment sampler by pressing polycarbonate core tubes (7.3-cm inner diameter [ID] and 16 cm in length) into the top 5 cm of sediment. However, homogenizing sediment for SWI testing is also acceptable according to the Sediment Control Plan. This method is more practical to implement in the field and is consistent with previous sediment quality objective methodology (e.g., Bight protocols and previous lagoon monitoring implemented by the Copermittees). A stainless steel scoop will be used to remove aliquots of the top 5 cm of surface sediment from two grab samples and evenly distributed into the appropriate toxicity sample container(s) until the necessary volume is reached.

All sampling equipment will be cleaned prior to sampling. Between sampling locations, grab sampling equipment will be scrubbed with a brush and rinsed with site water. Stainless steel scoops will be rinsed with seawater and rinsed with de-ionized water between stations. Clean gloves will be worn by sampling personnel at each new station.

ELEMENT 12 SAMPLE HANDLING CUSTODY

Sediment samples will be uniquely identified with sample labels in indelible ink or by equivalent method. All sample containers will be identified with the project title, appropriate identification number, date and time of sample collection, and preservation method. All samples will be kept on wet ice or equivalently chilled from the time of sample collection until delivery or transport to the analytical laboratory. All samples will be transferred to the appropriate laboratory and analyses initiated within the method specified holding time (Table 9). Sample volumes required for each analysis will be provided by the analytical laboratory conducting the analyses.

Table 9. List of Analytes with Container Type, Holding Time, and Preservation Method

Analyte	Recommended Container Type	Required Holding Time	Recommended Preservation
Field Measurements			
Salinity (conductivity & temperature if using a YSI sonde)	*In situ*		
Depth			
Sediment Chemistry			
Total Solids	Glass jar	7 days	Cool to ≤6 °C
Total Organic Carbon	Glass jar	28 days at ≤6 °C; 1 year at ≤- 20°C	Cool to ≤6 °C or freeze to ≤ -20°C
Grain Size	HDPE, Glass jar, or plastic bag	1 year	Wet ice to ≤6 °C in the field, then refrigerate at ≤6 °C
Trace Metals	Glass jar	1 year; samples must be analyzed within 14 days of collection or thawing	Cool to ≤6 °C within 24 hours, then freeze to ≤-20°C
Organochlorine Pesticides	Glass jar	1 year; samples must be extracted within 14 days of collection or thawing and analyzed within 40 days of extraction	Cool to ≤6 °C within 24 hours, then freeze to ≤-20°C
PCB Congeners	Glass jar	None	Cool to ≤6 °C within 24 hours, then freeze to ≤-20°C
PAHs	Glass jar	1 year; samples must be extracted within 14 days of collection or thawing and analyzed within 40 days of extraction	Cool to ≤6 °C within 24 hours, then freeze to ≤-20°C
Sediment Toxicity			
Toxicity Testing	10L Polyethylene bag or 1-L glass jar	1 month	Wet ice then 4°C for transport; 4°C for storage
Benthic Infauna			
Benthic Community Condition	1-L HDPE or 1-L Glass jar – sample volume will vary so may need multiple jars per sample	Formalin: 2-5 days 70% Ethanol: Indefinite- sample jars should be periodically checked for evaporation of ethanol	Initially samples are placed in 10% Buffered Formalin for 2-5 days; samples are then transferred to 70% ethanol

Chain-of-Custody Procedures

Samples will be considered to be in custody if they are (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal such that the sample could not be reached without breaking the seal. The principal documents used to identify samples and to document possession will be COC records, field logbooks, and field tracking forms. COC procedures will be used for samples throughout the collection, transport, and analytical process.

Chain of custody procedures will be initiated during sample collection. A COC record will be provided with each sample or group of samples. Each person who will have custody of the samples will sign the form and ensure the samples will not be left unattended unless properly secured. Documentation of sample handling and custody includes the following:

- Sample identifier.
- Sample collection date and time.
- Any special notations on sample characteristics or analysis.
- Initials of the person collecting the sample.
- Date the sample was sent to the analytical laboratory.
- Shipping company and waybill information.

Completed COC forms will be placed in a water proof (ex. plastic) envelope and kept inside the cooler containing the samples. Once delivered to the analytical laboratory, the COC form will be signed by the person receiving the samples. The condition of the samples will be noted and recorded by the receiver. COC records will be included in the final reports prepared by the analytical laboratories and are considered an integral part of the report.

Sampling Transport, Shipping, and Storage Procedures

Sediment samples collected in the field for chemistry and toxicity analyses will initially be placed on ice and stored in the dark. Prior to shipping or transport, sample containers will be packed inside coolers with ice. COC forms will be filled out, and the original signed COC forms will be inserted in a sealable water proof (ex. plastic) bag and placed inside the coolers. The cooler lids will be securely taped shut and then samples will be delivered or shipped on ice, or otherwise chilled, to the appropriate analytical laboratory for analysis. Sediment designated for benthic infauna analysis will be screened on location by field personnel. The material and organisms retained on the screen will be put into appropriate 1-L containers, treated with magnesium sulfate relaxant, and preserved with formalin (or relaxed and preserved using equivalent methods). Once preserved, benthic infauna samples will be delivered with accompanying COC forms to the laboratory tasked with sorting macroinvertebrates into broad taxonomic groupings. Following sorting, taxonomic samples will be shipped/ delivered to specialized taxonomists who will identify benthic macroinvertebrates to the lowest possible taxon.

ELEMENT 13 ANALYTICAL METHODS

Field Analytical Methods

A YSI water quality data sonde (e.g. YSI 6600 Multiparameter Sonde) or similar device can be utilized to take salinity measurements at each station location. Salinity measurements should be taken approximately six inches above the SWI. At a minimum, it is recommended that salinity measurements should be taken at a spring high and low tide to get an estimate of the salinity range for a proposed station. If feasible, it is recommended that salinity should be monitored throughout an entire spring tidal cycle to ensure it meets the salinity criteria prior to sampling. Water depth should also be measured when visiting the station at a spring low tide or deploying a continuous monitoring device over a spring tidal cycle to ensure the station is subtidal. Operation of field equipment will be conducted as per manufacturer instructions. Calibrations will be performed and recorded to ensure accurate functionality.

Laboratory Analytical Methods

Chemistry Samples

A list of sediment chemical constituents and maximum reporting limits (RLs) for analytes that are required for SQO analysis are provided in Table 10. Additional physical parameters including grain size and TOC are also listed. While these physical parameters are not required to calculate the chemistry LOE, they should be analyzed in order to provide additional information to aid in the interpretation of the toxicity and benthic LOEs. Percent solids must be measured to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis.

Target RLs listed in Table 10 are those that are provided in the Sediment Quality Assessment Technical Support Manual (Bay et al., 2014) for SQO analyses. The maximum RLs provided in Table 10 are based on the CSI classification ranges and are expressed on a dry weight basis. Lower RLs may be achievable depending on available analytical methods. As stated in Element 6, the analytical methods listed in Table 8 are suggested methods that have been used in previous sediment monitoring programs within San Diego County's waterbodies (e.g. Bight), but are not the only acceptable methods. Chemical analyses of all sediment samples collected as part of the SQO assessment must be tested in accordance with USEPA or ASTM protocols. If appropriate protocols do not exist, the SWRCB or San Diego RWQCB may approve the use of other methods.

Table 10. Physical and Chemical Parameters, Suggested Methods, and Maximum Reporting Limits for SQO Analysis

Parameter	Method*	Procedure*	Maximum Reporting Limit (dry weight)
Physical/ Conventional			
Grain Size	Plumb 1981	Wet sieving	1.00 %
Percent Solids	SM 2540B	Gravimetric	0.10 %
Total Organic Carbon (TOC)	USEPA 9060A	Combustion/ oxidation	0.01 %

Table 10. Physical and Chemical Parameters, Suggested Methods, and Maximum Reporting Limits for SQO Analysis

Parameter	Method*	Procedure*	Maximum Reporting Limit (dry weight)
Chemistry			
Trace Metals			
Cadmium (Cd)	USEPA 6020A	ICP/MS	0.09 mg/kg
Copper (Cu)	USEPA 6020A	ICP/MS	52.8 mg/kg
Lead (Pb)	USEPA 6020A	ICP/MS	25.0 mg/kg
Mercury (Hg)	USEPA 7471B	CVAA	0.09 mg/kg
Zinc (Zn)	USEPA 6020A	ICP/MS	60.0 mg/kg
Organochlorine Pesticides			
2,4′-DDD	USEPA 8081B	GC/MS	0.50 µg/kg
2,4′-DDE	USEPA 8081B	GC/MS	0.50 µg/kg
2,4′-DDT	USEPA 8081B	GC/MS	0.50 µg/kg
4,4′-DDD	USEPA 8081B	GC/MS	0.50 µg/kg
4,4′-DDE	USEPA 8081B	GC/MS	0.50 µg/kg
4,4′-DDT	USEPA 8081B	GC/MS	0.50 µg/kg
Chlordane-alpha	USEPA 8081B	GC/MS	0.50 µg/kg
Chlordane-gamma	USEPA 8081B	GC/MS	0.54 µg/kg
Dieldrin	USEPA 8081B	GC/MS	2.5 µg/kg
trans-Nonachlor	USEPA 8081B	GC/MS	4.6 µg/kg
PCB Congeners			
2,4'-Dichlorobiphenyl (8)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',5-Trichlorobiphenyl (18)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,4,4'-Trichlorobiphenyl (28)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,5'-Tetrachlorobiphenyl (44)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',5,5'-Tetrachlorobiphenyl (52)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,3',4,4'-Tetrachlorobiphenyl (66)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',4,5,5'-Pentachlorobiphenyl (101)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,3,3',4,4'-Pentachlorobiphenyl (105)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,3',4,4',5-Pentachlorobiphenyl (118)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,3',4,4'-Hexachlorobiphenyl (128)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
Decachlorobiphenyl (209)	USEPA 8082A	GC/MS ECD	3.0 µg/kg
Low Molecular Weight PAHs			
Acenaphthene	USEPA 8270D	GC/MS SIM	20 µg/kg
Anthracene	USEPA 8270D	GC/MS SIM	20 µg/kg
Phenanthrene	USEPA 8270D	GC/MS SIM	20 µg/kg

Table 10. Physical and Chemical Parameters, Suggested Methods, and Maximum Reporting Limits for SQO Analysis

Parameter	Method*	Procedure*	Maximum Reporting Limit (dry weight)
Biphenyl	USEPA 8270D	GC/MS SIM	20 µg/kg
Naphthalene	USEPA 8270D	GC/MS SIM	20 µg/kg
2,6-Dimethylnaphthalene	USEPA 8270D	GC/MS SIM	20 µg/kg
Fluorene	USEPA 8270D	GC/MS SIM	20 µg/kg
1-Methylnaphthalene	USEPA 8270D	GC/MS SIM	20 µg/kg
2-Methylnaphthalene	USEPA 8270D	GC/MS SIM	20 µg/kg
1-Methylphenanthrene	USEPA 8270D	GC/MS SIM	20 µg/kg
High Molecular Weight PAHs			
Benzo(a)anthracene	USEPA 8270D	GC/MS SIM	80 µg/kg
Benzo(a)pyrene	USEPA 8270D	GC/MS SIM	80 µg/kg
Benzo(e)pyrene	USEPA 8270D	GC/MS SIM	80 µg/kg
Chrysene	USEPA 8270D	GC/MS SIM	80 µg/kg
Dibenzo(a,h)anthracene	USEPA 8270D	GC/MS SIM	80 µg/kg
Fluoranthene	USEPA 8270D	GC/MS SIM	80 µg/kg
Perylene	USEPA 8270D	GC/MS SIM	80 µg/kg
Pyrene	USEPA 8270D	GC/MS SIM	80 µg/kg

DDD Dichlorodiphenyldichloroethane
DDE dichlorodiphenyldichloroethylene
DDT dichlorodiphenyltrichloroethane
mg/kg milligrams per kilogram
µg/kg micrograms per kilogram* Other equivalent methods or procedures may be used

Toxicity Samples

To evaluate the benthic condition of the San Luis Rey River Estuary, sediment toxicity testing will be conducted in accordance with ASTM and USEPA methods. Toxicity testing involves a short-term survival test, a sublethal endpoint test, and an assessment of sediment toxicity. For each test type, more than one specific test is acceptable. The appropriate species tested for a sample will depend on the characteristics of the sample such as grain size, salinity, and suspected toxic constituents, if any. When historical data are available for a sample location, it is recommended that the same species be used in order to make comparisons and to conduct trend analysis. In addition, when testing is conducted as part of a regional monitoring program such as the Bight program, the species selection will be dictated by the program.

Short-Term Survival Testing

SQO analysis requires that at least one short-term survival test be conducted. There are three acceptable short-term survival tests, each of which is a 10-day test exposing amphipods to whole sediment. The three acceptable test organisms are *Eohaustorius estuarius*, *Leptocheirus plumulosus*, and *Rhepoxynius abronius*. The *E. estuarius* short-term survival test has been the 10-day test method used in previous San Diego County enclosed bay and estuary monitoring programs, including the Bight Program, where the SQO analytical tool was used to assess aquatic health. These amphipod bioassays will be conducted in accordance with procedures outlined in *Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (USEPA, 1994) and ASTM method E1367-03 (ASTM, 2006) or equivalent methods that satisfy the requirements of the Sediment Control Plan. Test conditions are summarized in Table 11. If sediment monitoring is conducted as part of the Bight Program, then procedures and test conditions should be in accordance with Bight Workplans.

A water-only reference toxicity test should be conducted concurrently with the whole sediment amphipod test to assess the relative sensitivity of test organisms used in the evaluation of project sediments. Amphipod reference toxicant tests are typically conducted using cadmium. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing. If ammonia is selected as the reference toxicant, pore water ammonia will be measured between sample receipt and test set-up, and again at test initiation. If the un-ionized pore water ammonia concentration in the test initiation sample is 0.8 mg/L or greater, then the ammonia reference toxicant test will be extended from 4 days to 10 days for better comparison to 10-day test sample results.

Table 11. Summary of Conditions for 10-Day Whole Sediment Amphipod Bioassay

Test Conditions 10-Day Whole Sediment Bioassay				
	Test Species	***E. estuarius***	***L. plumulosus***	***R. abronius***
	Test Procedures	USEPA (1994); ASTM E1367-03 (2006)		
	Test Type/Duration	Static - Acute Whole Sediment/10 days		
	Sample Storage Conditions	4 °C, dark, minimal head space		
	Age/Size Class	3-5 mm	2-4 mm; immature	3-5 mm
	Grain Size Tolerance	0.6-100% sand	0-100% sand	10-100% sand
Recommended Water Quality Parameters	Temperature	15 ± 1 °C	25 ± 1 °C	15 ± 1 °C
	Salinity	20 ± 2 ppt	20 ± 2 ppt	28 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation		
	Total Ammonia	< 60 mg/L	< 60 mg/L	< 30 mg/L
	Test Chamber	1 L glass		
	Exposure Volume	2 cm sediment, 800 mL seawater		
	Replicates/Sample	5		
	No. of Organisms/Replicate	20		
	Photoperiod	Continuous light		
	Feeding	None		
	Water Renewal	None		
	Aeration	Constant gentle aeration		
	Acceptability Criteria	Mean control survival $\geq$ 90%; $\geq$80% survival in each replicate		

mg/L milligram per liter

Sublethal Testing

The second type of testing required for SQO analysis is a sublethal test. Either a 48-hour development test exposing embryos of the bivalve *Mytilus galloprovincialis* to the sediment-water interface may be conducted or a 28-day survival and growth test exposing the polychaete worm *Neanthes arenaceodentata* to whole sediment. Test condition summaries for the bivalve and polychaete tests are presented in Table 12 and Table 13, respectively. The *M. galloprovincialis* sediment-water interface test has been the sublethal test method used in previous San Diego County enclosed bay and estuary monitoring programs, including the Bight Program, where the SQO analytical tool was used to assess aquatic health.

Mytilus galloprovincialis Sediment-Water Interface Development Sublethal Test

Sediment-water interface bioassays are performed to estimate the potential toxicity of contaminants fluxing from test sediments into the overlying water. The sediments will be tested in a 48-hour sediment-water interface test using the bivalve *M. galloprovincialis* in accordance with procedures outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (USEPA, 1995) and Assessment of Sediment Toxicity at the Sediment-Water Interface (Anderson et al., 1996). If sediment monitoring is conducted as part of the Bight Program, then procedures and test conditions should be in accordance with Bight Workplans. Sediment-water interface bioassays will be tested on intact cores collected in the field or on homogenized sediment samples as described in Section 2.1.6 of the Sediment Monitoring Plan.

A water-only reference toxicity test should be conducted concurrently with the sediment-water interface bivalve test to assess the relative sensitivity of test organisms used in the evaluation of the project sediments. Bivalve reference toxicant tests are typically conducted using copper. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing. If ammonia is selected as the reference toxicant, pore water ammonia will be measured between sample receipt and test set-up, and again at test initiation. If the un-ionized pore water ammonia concentration in the test initiation sample is 0.8 mg/L or greater, then the ammonia reference toxicant test will be extended from 4 days to 10 days for better comparison to 10-day test sample results.

Table 12. Test Conditions for the 48-Hour *M. galloprovincialis* Sediment-Water Interface Bioassay

Test Conditions 10-Day Whole Sediment Bioassay		
	Test Species	***M. galloprovincialis***
	Test Procedures	USEPA (1995), Anderson et al. (1996)
	Test Type/Duration	Static - Acute sediment-water interface/48 hours
	Sample Storage Conditions	4 °C, dark, minimal head space
	Age/Size Class	< 4 hour old larvae
Recommended Water Quality Parameters	Temperature	15 ± 1 °C
	Salinity	32 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation
	Total Ammonia	< 4 mg/L
	Test Chamber	Polycarbonate core tube 7.3-cm inner diameter, 16 cm high
	Exposure Volume	5 cm sediment, 300 mL water
	Replicates/Sample	4

Test Conditions 10-Day Whole Sediment Bioassay	
No. of Organisms/Replicate	Approximately 250 larvae
Photoperiod	16 hours light: 8 hours dark
Feeding	None
Water Renewal	None
Aeration	Constant gentle aeration
Acceptability Criteria	Mean control normal-alive $\geq$ 80%

Neanthes arenaceodentata Whole Sediment Survival and Growth Sublethal Test

The *N. arenaceodentata* test will be conducted in accordance with ASTM method E1562 (ASTM, 2002) with modifications described in Farrar and Bridges (2011) that have been found to contribute manageability and precision to the ASTM procedure. If sediment monitoring is conducted as part of the Bight Program, then procedures and test conditions should be in accordance with Bight Workplans. A water-only reference toxicity test should be conducted concurrently with the whole sediment polychaete test to assess the relative sensitivity of test organisms used in the evaluation of the project sediments. Polychaete reference toxicant tests are typically conducted using cadmium. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing. If ammonia is selected as the reference toxicant, pore water ammonia will be measured between sample receipt and test set-up, and again at test initiation. If the un-ionized pore water ammonia concentration in the test initiation sample is 0.8 mg/L or greater, then the ammonia reference toxicant test will be extended from 4 days to 10 days for better comparison to 10-day test sample results.

Table 13. Test Conditions for the 28-Day Whole Sediment *N. arenaceodentata* Bioassay

Test Conditions 10-Day Whole Sediment Bioassay		
Test Species		***N. arenaceodentata***
Test Procedures		ASTM E1562 (2002), Farrar and Bridges (2011)
Test Type/Duration		Static - Acute Whole Sediment/28 days
Sample Storage Conditions		4 °C, dark, minimal head space
Age/Size Class		≤ 7 days post-emergence
Grain Size Tolerance		5-100% sand
Recommended Water Quality Parameters	Temperature	20 ± 1 °C
	Salinity	30 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation
	Total Ammonia	< 20 mg/L
Test Chamber		300 mL glass
Exposure Volume		2 cm sediment, 125 mL seawater
Replicates/Sample		10
No. of Organisms/Replicate		1
Photoperiod		12 hours light: 12 hours dark
Feeding		Twice per week
Water Renewal		Weekly
Aeration		Constant gentle aeration
Acceptability Criteria		Mean control survival ≥ 80%; positive growth in controls

Benthic Infauna Samples

The benthic infaunal samples will be transported from the field to the laboratory and stored in a formalin solution for a minimum of 48 hours and no longer than 5 days. The samples will then be transferred from formalin to 70% ethanol for laboratory processing. Alternative specimen preservation methods may be used if equivalent. The organisms will initially be sorted using a dissecting microscope into five major phyletic groups: polychaetes, crustaceans, molluscs, echinoderms, and miscellaneous minor phyla. While sorting, technicians will keep a count for quality control purposes. After initial sorting, samples will be distributed to qualified taxonomists who will identify each organism to species or to the lowest possible taxon. Taxonomists will use the most recent version of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) taxonomic listing for nomenclature and orthography. If sediment monitoring is conducted as part of the Bight Program, then procedures should be in accordance with Bight Workplans.

ELEMENT 14 QUALITY CONTROL

QA/QC Field Procedures

Field measurements for salinity will be made using a water quality probe, such as a YSI data sonde, that has been calibrated according to manufacturer specifications. Operation of field equipment will be conducted as per manufacturer instructions. Calibrations will be performed and recorded to ensure accurate functionality. Proper storage and maintenance procedures will be followed.

QA/QC for sampling processes begins with proper collection of the samples to minimize the possibility of contamination. Sediment samples will be collected in appropriate containers, kept on wet ice or otherwise chilled during the sampling event, and placed into coolers along with completed COC for transfer to the analytical laboratory. Field crews will ensure that sampling containers are being filled properly and the requirement to avoid contamination of samples at all times is met. The field data log sheets will include empirical observations of the site and water quality characteristics. Field duplicates will be collected at a minimum of 5% of total project sample count. A minimum of one equipment blank will be collected during the monitoring event. The equipment blank will be analyzed for the same target SQO analytes specified for the sediment samples (excluding grain size and percent solid analyses).

QA/QC Laboratory Analyses

Chemistry Analyses

The chemistry analysis of the samples will be performed under the guidelines of the analytical laboratories respective standard operating procedures (SOPs) and QAPPs as well as meet the DQOs and quality objectives set forth in this QAPP. This includes analyzing the appropriate QC laboratory controls for each analysis in accordance with SWAMP criteria such as laboratory blanks and duplicates, MS/MSDs, certified or standard reference materials, and surrogates (see Element 7 for frequency of analysis and DQOs for QC laboratory controls).

Toxicity Analyses

A water-only reference toxicity test will be conducted concurrently with each batch of sediment tests to establish the sensitivity of the test organisms used in the evaluation of the sediments and to evaluate the potential influence of ammonia toxicity on the test organisms. Typically, amphipod and polychaete reference toxicant tests are conducted using cadmium and bivalve reference toxicant tests are typically conducted using copper. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing. The LC_{50} and/or EC_{50} values of the reference toxicant test will be compared to historical laboratory data for each respective test species. The results of these reference toxicant tests will be used in combination with the control mortality to assess the health of the test organisms.

Benthic Infauna Analyses

A QA/QC procedure will be performed on each of the sorted samples to ensure a 95% sorting efficiency. This procedure is the same one followed in the Bight programs. A 10% aliquot of a sample will be re-sorted by a senior technician trained in the QA/QC procedure. The number of organisms found in the aliquot will be divided by 10% and added to the total number found in the sample. The original total will be divided by the new total to calculate the percent sorting efficiency. When the sorting efficiency of the sample is below 95%, the remainder of the sample (90%) will be re-sorted.

ELEMENT 15 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Field Sampling

Prior to conducting field sampling, field technicians will be responsible for preparing sampling kits that include field logs, COC forms, sample labels, sampling containers, decontamination equipment and tools. Field measurement equipment should be checked for operation in accordance with the manufacturer’s specifications. Equipment should be inspected prior to use and when returned from use for damage.

Analytical Laboratories

All analytical laboratories including chemistry, toxicity, and benthic infaunal will maintain their equipment in accordance with their SOPs, which include those specified by the manufacturer and those specified by the method. Each laboratory’s QAPP will specify equipment and system evaluations.

ELEMENT 16 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

The equipment and instruments used at each analytical laboratory will be operated and calibrated according to manufacturer recommendations as well as by criteria defined in each analytical laboratory's SOPs. Operation and calibration will be performed by properly trained personnel. Documentation of routine and special calibration information will be recorded in appropriate logbooks and reference files. If a critical measurement is found to be out of compliance during analysis, the results of that analysis will not be reported, corrective action will be taken and documented, and the analysis will be repeated.

Field Equipment

Water quality instruments used for salinity measurements will be calibrated per manufacturer's specifications prior to each monitoring event. Complete records of calibration will be maintained for each field instrument that requires periodic calibration.

Analytical Laboratories

All analytical laboratories including chemistry, toxicity, and benthic infaunal will calibrate their instrumentation at a frequency that ensures the validity of the results. Each laboratory's calibration procedures must follow EPA guidelines and the recommendations of the instrument manufacturer. Each laboratory's QAPP should provide detailed information on calibration procedures.

ELEMENT 17 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

It is the duty of each person who is responsible for equipment ordering to inspect equipment and materials for quality and report any equipment or materials that do not meet acceptance criteria to the Project Manager, Laboratory Manager, and/or QA Officer, as appropriate. Upon receipt of materials or equipment, a designated employee must receive and sign for the materials. The items will then be reviewed to ensure the shipment is complete, prior to delivery to the proper storage location. Chemicals must be dated upon receipt. Supplies will be stored appropriately and discarded on their expiration date. The equipment and supplies purchased for use in field sampling activities will be inspected for damage as they are received. Confirmation that sample bottles are laboratory-certified clean will be made when received.

Critical Supplies and Consumables

Chemistry Sample Bottles – Chemistry sample bottles will be provided by the analytical laboratory. They will be shipped from the laboratory and stored appropriately by the field sampling team prior to use in the field. Confirmation that sample bottles are laboratory-certified clean will be made when received from the analytical laboratories. Preservatives may be required for the analysis of certain analyte groups and the laboratory supplied bottles should already contain any required preservatives.

Toxicity Sample Containers – Clean, food-grade, heavy duty 0.004 gauge polyethylene bags capable of holding up to 20-L, or clean glass jars with Teflon-lined lids should be used as the sample container for sediment toxicity samples. If bags are used, samples should be double bagged, twisted at the top with excess air removed, and cable tied to ensure sample integrity.

Benthic Infauna Jars– Clean, 1-L HDPE or glass sample jars should be used as containers for benthic infauna samples following sediment processing in the field. Additionally, magnesium sulfate and 10% formalin solutions that are used for processing benthic infauna samples will need to be on hand during sampling events and should be provided by San Luis Rey River WMA Responsible Copermittees or their subcontractor(s).

ELEMENT 18 NON-DIRECT MEASUREMENTS

Data will be reviewed against DQOs in Section 7 prior to SQO analysis. Only data meeting the DQOs will be used in the SQO analysis.

ELEMENT 19 DATA MANAGEMENT

Data will be maintained as described in Element 9. The original data sheets and reports produced will be accumulated into project-specific files that are kept by either the San Luis Rey River WMA Responsible Copermittees or Contractor Project Manager.

The San Luis Rey River WMA Responsible Copermittees or Contractor Project Manager will document and track the aspects of the sample collection process, including generating field logs at each site and COC forms for the samples collected. COC forms will accompany samples to the appropriate laboratories for analysis. Each analytical laboratory will document and track the aspects of sample receipt and storage, analyses, and reporting. Each analytical laboratory's results will be stored in a database system at their office and will be provided to the San Luis Rey River WMA Responsible Copermittees or Contractor Project Manager both electronically and by hard copy. Further details of each laboratory's data management protocols can be found in each laboratory's respective QAPP.

Field logs and analytical data will be entered into or transferred to the San Luis Rey River WMA Responsible Copermittees or Contractor's database. After the data is added to the database, the Contractor Project QA Officer will validate the data by checking for errors and ensure the data is complete. The database will be updated with finalized data. The results of the laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology or the DQOs described in Element 7 will be identified, and the corresponding data will be appropriately qualified in the final report. All QA/QC records will be kept on file for review by regulatory agency personnel. Once data are finalized, all monitoring data and analytical results will be formatted and uploaded into CEDEN. All records should be maintained for at least five years.

GROUP C:
ASSESSMENT AND OVERSIGHT

ELEMENT 20 ASSESSMENTS AND RESPONSE ACTIONS

Corrective Actions

The following sections identify the responsibilities of key project members and corrective actions to be taken if issues arise during field sampling or laboratory analyses that may result in noncompliance with protocols established in the Sediment Monitoring Plan.

Field Sampling

The initial responsibility for monitoring the quality of field measurements lies with the field personnel. The Field Task Manager is responsible for verifying that QC procedures are followed. This requires that the Field Task Manager assess the accuracy of the field methods as well as the ability to meet QA objectives and make a value judgment regarding the impact a procedure has on field objectives and subsequent data quality. If a problem occurs that might jeopardize the integrity of the project, hinder a QA objective, or impact data quality, the Field Task Manager will immediately (within 24 hours) notify the San Luis Rey River WMA Responsible Copermittees or Contractor Project Manager. Corrective action measures are then decided upon and implemented. The Field Task Manager documents the situation, the field objective affected, the corrective action taken, and the results of that action. Copies of the documentation are provided to the San Luis Rey River WMA Responsible Copermittees or Contractor Project Manager and the QA Officer.

Laboratory

The need for corrective action comes from several sources, including equipment malfunction, failure of internal QA/QC checks or to follow-up on performance or system audit findings, and noncompliance with QA requirements. All laboratory personnel are responsible for documenting and correcting problems that might affect quality. When measurement equipment or analytical methods fail QA/QC requirements, the problem(s) will be brought immediately to the attention of the Laboratory Manager and QA Officer. Corrective measures will depend entirely on the type of analysis, the extent of the error, and whether or not the error is determinant. The corrective action is determined by either the Laboratory Manager, technicians, the San Luis Rey River WMA Responsible Copermittees or Contractor Project Manager, the QA Officer, or by all of them in conference, if necessary, but final approval is the responsibility of the San Luis Rey River WMA Responsible Copermittees or Contractor QA Officer and/or Project Manager.

If failure is due to equipment malfunction, the equipment will not be used until repaired. Precision and accuracy will be reassessed, and the analysis will be rerun. Attempts will be made to reanalyze the affected parts of the analysis so that in the end, the product is not affected by failure of QC requirements. When a result in a performance audit is unacceptable, the laboratory will identify the problem(s) and implement corrective actions immediately. A step-by-step analysis and investigation to determine the cause of the problem will take place as part of the corrective action program. If the problem cannot be controlled, the laboratory will analyze the impact on data. If the data is affected, the problem will be documented and the San Luis Rey

River WMA Responsible Copermittees or Contractor QA Officer and/or Project Manager will be notified. When a system audit reveals an unacceptable performance, work will be suspended until corrective action has been implemented and performance has been proven acceptable. If the problem is instrumental or specific only to preparation of a sample batch, samples are reprocessed after the instrument is repaired and recalibrated. In the event that a QC measure is out-of-control and the data are to be reported, qualifiers are reported together with sample results.

ELEMENT 21 PROJECT REPORTS

The Project Manager is responsible for preparation and submittal of all project deliverables. Each analytical laboratory's QA Officer is responsible for the preparation of all data packages and laboratory reports originating from their laboratory. Provision D.1.e.(2)(c) of the Permit requires incorporation of a Sediment Monitoring Report into the WQIP Annual Report. The Sediment Monitoring Report will contain an evaluation, interpretation, and tabulation of monitoring data, including an assessment of whether receiving water limits outlined in the Permit were attained; a sample location map; and a statement of certification that monitoring data and results have been uploaded into CEDEN.

Based on the conclusions of the Sediment Monitoring Report, a human health risk assessment may be necessary in order to determine whether human health objectives have been obtained at each sample location. Provision A.2.a.(3)(b)(ii) states that "pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health." The potential risk assessments must consider any relevant information, such as guidelines set forth in the CA EPA's Office of Environmental Health Hazard Assessment (OEHHA) fish consumption policies, CA EPA's Department of Toxic Substances Control (DTSC) risk assessment, and the USEPA human health risk assessment policies.

The San Luis Rey River WMA Responsible Copermittees included the 2012-2014 Sediment Monitoring Report with the Transitional Monitoring and Assessment Report submitted to the San Diego RWQCB on January 31, 2015. The Sediment Monitoring Report includes the results from the 2013 Bight Program and follow-up monitoring conducted in the San Luis Rey River Estuary in 2014 to satisfy Provisions D.1.e.(1)(b) and D.1.e.(2) of the Permit. Any sediment quality monitoring or stressor identification studies conducted after 2014 will be included in the WQIP Annual Reports.

The schedule for completing the sediment quality monitoring requirements of the Permit and for submitting the Sediment Monitoring Report(s) is shown in Table 14.

Table 14. Sediment Monitoring Report Schedule

Activity/Deliverable	Dates(s)*
San Diego RWQCB Order No. R9-2013-0001	Adopted May 8, 2013 and effective June 27, 2013
Southern California Bight Regional Monitoring Program	August-September 2013
Follow-up confirmation monitoring	August-September 2014
Final Sediment Monitoring Plan and Sediment Monitoring QAPP incorporated into WQIPs	December 2014
Draft Sediment Monitoring Report	December 2014
Final Sediment Monitoring Report incorporated into Transitional Monitoring and Assessment Report	January 31, 2015
Potential Stressor ID Studies	TBD

*Table does not include future permit cycles

GROUP D:
DATA VALIDATION AND USABILITY

ELEMENT 22 DATA REVIEW, VERIFICATION, AND VALIDATION

Data reduction, verification, validation, and reporting are ongoing processes, which involve the field technicians, laboratory technicians, Laboratory Managers, and QA personnel. Data generated by the sediment monitoring activities including field sampling and laboratory analyses will be reviewed against the DQOs presented in Element 7 and the QA/QC practices cited in this QAPP. This includes field logbooks, COC forms, and all data related to laboratory analytical procedures (e.g., sample preparation logs, instrument logs, etc.). Data entry of field sampling data will be reviewed to check for accuracy and completeness. Analytical laboratory electronic data deliverables and hard copy reports will be reviewed to ensure that the proper QC elements are included (e.g., blanks, lab duplicates, etc.), all sample analyses are correct, holding times were met, and data failing to meet QC criteria are properly qualified. Data that does not meet the DQOs will be evaluated to determine the impact of the failure on the data quality. If sufficient evidence is found to support the use of the data, the data will be qualified, and entered into the database.

ELEMENT 23 VERIFICATION AND VALIDATION METHODS

After each sampling event, the field data sheets will be removed from the field logbooks, and the sheets will be checked for completeness and accuracy by the QA Officer or Project Manager. The appropriate field sheets must be present. If there are any questions, clarification from the Field Task Manager will be obtained as soon as possible.

In the laboratory, sample preparation activities will be documented in bound laboratory notebooks or on bench sheets. Data validation includes dated and signed entries by technicians on the data sheets and logbooks used for the samples, the use of sample tracking and numbering systems to track the progress of samples through the laboratory, and the use of QC criteria to reject or accept specific data. The laboratory generating the data will have the prime responsibility for the accuracy and completeness of the data. Each laboratory will review the data to ensure that the following information is correct and complete: sample description information, analysis information, results, and documentation of the data. Further data validation is performed by the Laboratory Manager. Validation is accomplished through routine audits of the data collection and flow procedures and by monitoring of QC sample results. In the data review process, the data will be compared to information such as the sample's history, sample preparation, and QC sample data to evaluate the validity of the results. Corrective action will be minimized through the development and implementation of routine internal system controls. Analysts are provided with specific criteria that must be met for each procedure, operation, or measurement system.

ELEMENT 24 RECONCILIATION WITH USER REQUIREMENTS

The QA personnel will review data after each survey to determine if DQOs have been met. If data do not meet project specifications, the QA personnel will review errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors, and they will suggest corrective action. It is expected that the problem would be correctible through personnel re-training, technique revision, or supplies/equipment replacement. If not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA personnel will recommend appropriate modifications. Any revisions would need approval by the San Luis Rey River WMA Responsible Copermittees or Contractor Project Manager.

ELEMENT 25 REFERENCES

Anderson, B.S., Hunt, J.W., Hester, M., Phillips, B.M. 1996. Assessment of sediment toxicity at the sediment-water interface. In: G.K. Ostrander (ed.) *Techniques in Aquatic Toxicology*. Lewis Publishers, Ann Arbor, MI.

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ATTACHMENT 4A-3: SAN LUIS REY RIVER WATERSHED BACTERIA TMDL MONITORING PLAN

SAN LUIS REY RIVER WATERSHED BACTERIA TMDL MONITORING PLAN

Prepared For:
San Luis Rey River Watershed
Participating Agencies

Prepared By:
AMEC Environment and Infrastructure, Inc.
9177 Sky Park Court
San Diego, California 92123
January 2015

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ACRONYMS AND ABBREVIATIONS

Abbreviation/Acronym	Meaning
303(d) List	Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments
AMEC	AMEC Environment & Infrastructure, Inc.
Bacteria TMDL	A *Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) to Incorporate Revised Total Maximum Daily Loads for Indicator Bacteria Project I-Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek)*
Basin Plan	San Diego Region Basin Plan
BPA	Basin Plan Amendment
CEDEN	California Environmental Data Exchange Network
CFU	Colony Forming Units
CLRP	Comprehensive Load Reduction Plan
COC	Chain of Custody
CWA	Clean Water Act
DEH	Department of Environmental Health
EDD	Electronic Data Deliverable
FIB	Fecal Indicator Bacteria
HA	Hydrologic Area
HSA	Hydrologic Sub-Area
LA	Load Allocation
LARWQCB	Los Angeles Regional Water Quality Control Board
mL	Milliliter
mm	Millimeter
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NA	Not Applicable
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
*.pdf	Portable Document Format
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
REC-1	Water Contact Recreation
SDRWQCB	San Diego Regional Water Quality Control Board
State Board	State Water Resources Control Board
SWAMP	Surface Water Ambient Monitoring Program
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WLA	Waste Load Allocation

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

The San Diego Regional Water Quality Control Board (SDRWQCB) issued Resolution No. R9-2010-0001, *A Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) to Incorporate Revised Total Maximum Daily Loads (TMDL) for Indicator Bacteria Project I-Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek)*, herein referred to as the Bacteria TMDL (SDRWQCB, 2011a). Subsequently, the Bacteria TMDL has been incorporated into the National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region Order No. R9-2013-0001 (SDRWQCB, 2013) (MS4 Permit). In the MS4 Permit Bacteria TMDL is included as “Attachment E: Specific Provisions for Total Maximum Daily Loads 6. Revised Total Maximum Daily Loads for Indicator Bacteria, Project I –Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek)” Provision 6 of MS4 Permit Attachment E outlines an Implementation Plan that includes a compliance schedule and a description of minimum monitoring requirements to assess compliance with the TMDLs, WLAs, and Load Allocations (LAs). The Phase I MS4s (hereafter called the Responsible Parties) have developed this Monitoring Plan for the San Luis Rey River Watershed to meet the requirements of the MS4 Permit.

The ultimate goal of the Bacteria TMDL is to achieve the necessary pollutant load reductions to restore and protect the designated beneficial use of water contact recreation (REC-1). Beneficial uses within the San Luis Rey River Watershed, as designated by the State Water Resources Control Board’s (State Board) San Diego Region Basin Plan (Basin Plan) for surface waters, are provided in Table 1-1 (SDRWQCB, 2011c).

Table 1-1.
Beneficial Uses for the 303(d) Listed Waterbodies

Hydrologic Unit	Waterbody Type	Beneficial Use																
		IND	NAV	REC1	REC2	COMM	BIOL	EST	WILD	RARE	MAR	AQUA	MIGR	SPWN	WARM	SHELL	MUN	AGR
Coastal Waters																		
Mouth of San Luis Rey River	Pacific Ocean			•	•				•	•	•		•					

Notes:
Source: SDRWQCB, 2011c

• Existing Beneficial Use

1.2 PURPOSE

This Monitoring Plan is designed to fulfill the compliance monitoring requirements of the MS4 Permit. The San Luis Rey River Bacteria TMDL Monitoring Program will collect data to evaluate the approved TMDL pollutants. A list of the applicable pollutants for the San Luis Rey River Watershed is provided in Table 1-2. The goals of the San Luis Rey River Bacteria TMDL Monitoring Program include the following:

- Characterize the current conditions of receiving waters in terms of approved TMDL pollutants
- Assess progress toward meeting the Bacteria TMDL numeric targets

1.3 WATERSHED BACKGROUND

The San Luis Rey River Watershed is located in northern San Diego County, California. It is the third largest of the nine major watersheds in San Diego County, extending over 55 miles inland and covering approximately 360,000 acres. The watershed is primarily undeveloped (54%), followed by residential and agricultural uses (15% and 14%, respectively) (SanGIS, 2009). Agricultural uses include citrus and avocado groves, as well as nurseries.

The Bacteria TMDL is based on the 2002 303(d) List, which indicated that the greatest cause of waterbody impairments in the San Diego Region was elevated bacteria levels (United States Environmental Protection Agency [USEPA], 2003). Table 1-2 presents the targeted segment identified in the Bacteria TMDL. The targeted segment if the Pacific Ocean Shoreline at Oceanside City Beach.

Table 1-2.
Waterbodies and Pollutants Listed in the Bacteria TMDL for SLR WMA

Waterbody	TMDL Pollutants
Pacific Ocean Shoreline, Oceanside City Beach at San Luis Rey River Mouth (HSA 903.11)	Total coliform, Fecal coliform, *Enterococcus*

Notes:
HSA – Hydrologic Sub-Area

1.4 RESPONSIBLE PARTIES

Attachment E of the MS4 Permit identifies the Responsible Parties for the San Luis Rey River Watershed. The Responsible Parties are working on implementation of the monitoring programs for their watershed. The Responsible Parties, excluding owners and operators of small MS4s, are:

- County of San Diego
- City of Vista
- City of Oceanside

1.5 BACTERIA TMDL RECEIVING WATER LIMITATIONS

The receiving water limitations (RWLs) are a combination of numeric targets for bacteria density and allowable exceedance frequencies. The MS4 Permit clarifies the final RWLs (in most probable number [MPN]) for total coliform, fecal coliform, and *Enterococcus* as numeric targets. For dry weather days, the 30-day geometric mean RWLs must be achieved with a 0 percent exceedance frequency. The single- sample maximum RWLs are required to be achieved during wet weather, with an allowable exceedance frequency of 22 percent.

Table 1-3 provides the final numeric and exceedance targets for the San Luis Rey River Watershed per the Bacteria TMDL. Monitoring data collected under the San Luis Rey River Watershed Bacteria TMDL Monitoring Program will be used to evaluate progress and attainment of TMDL numeric targets.

Table 1-3.
Final Numeric Targets in Bacteria TMDL

Parameter	Dry Weather[(a)]		Wet Weather[(b)]	
	Numeric Target (MPN/100mL)[(c)]	Allowable Exceedance[(c)]	Numeric Target (MPN/100mL)[(d)]	Allowable Exceedance[(e)]
Enterococcus	35	0%	104	22%
Fecal Coliform	200	0%	400	22%
Total Coliform	1,000	0%	10,000	22%

Notes:
mL – milliliter
MPN – Most Probable Number
Source: SDRWQCB, 2011a

(a) Dry weather days defined as days with less than 0.1 inch of rainfall observed in the previous 72 hours.
(b) Wet weather days defined as days with rainfall events of 0.1 inches or greater and the following 72 hours.
(c) Dry weather numeric objectives based on the 30-day geometric mean water quality objectives in the California Ocean Plan (SWQCB, 2009) and the MS4 Permit (SDRWQCB, 2013). Compliance with the dry weather TMDLs in the receiving water is based on the frequency that the dry weather days in any given year exceed the dry weather numeric objective. The TMDL set a zero percent (0%) allowable exceedance frequency of the Final REC-1 Dry Weather Numeric Targets.
(d) Wet weather numeric objectives based on the single sample maximum water quality objectives in the California Ocean Plan (SWQCB, 2009) and MS4 Permit (SDRWQCB, 2013). Compliance with the wet weather TMDLs in the receiving water is based on the frequency that the wet weather days in any given year exceed the wet weather numeric objective, but 30-day geometric mean must also be met.
(e) The wet weather allowable exceedance frequency is set at 22%. In the calculation of the wet weather TMDLs, the San Diego Regional Board chose to apply the 22% allowable exceedance frequency as determined for Leo Carillo Beach in Los Angeles County (LARWQCB, 2010a,b). At the time the wet weather watershed model was developed, the 22% exceedance frequency from Los Angeles County was the only reference beach exceedance frequency available.

1.6 EXISTING, INTERIM, AND FINAL EXCEEDANCE FREQUENCIES

Interim and final RWLs used to determine progress toward achieving compliance milestones are presented in Table 1-4. These numbers were calculated using the “existing” exceedance frequencies that were derived from dry weather FIB data collected at the historical AB411 monitoring site (OC-100) between 2004 and 2010. The interim reduction is a 50 percent reduction of an existing exceedance frequency; a final exceedance frequency is the final numeric goal for a given FIB species.

Table 1-4.
San Luis Rey River Watershed TMDL Compliance Reduction Milestones

Classification	Segment	Analyte	"Existing" Exceedance Frequency	Interim Milestone 50% Reduction	Final 100% Reduction
Dry Weather	San Luis Rey River Watershed[a]	*Enterococcus*[a]	32.0%[a]	16.0%[a]	0%
		Fecal coliform[a]	8.0%[a]	4.0%[a]	0%
		Total coliform[a]	9.4%[a]	4.7%[a]	0%
Wet Weather	Pacific Ocean Shoreline	*Enterococcus*	76%[b]	47%[c]	22%
		Fecal coliform	68%[b]	44%[c]	22%
		Total coliform	66%[b]	45%[c]	22%

Notes:

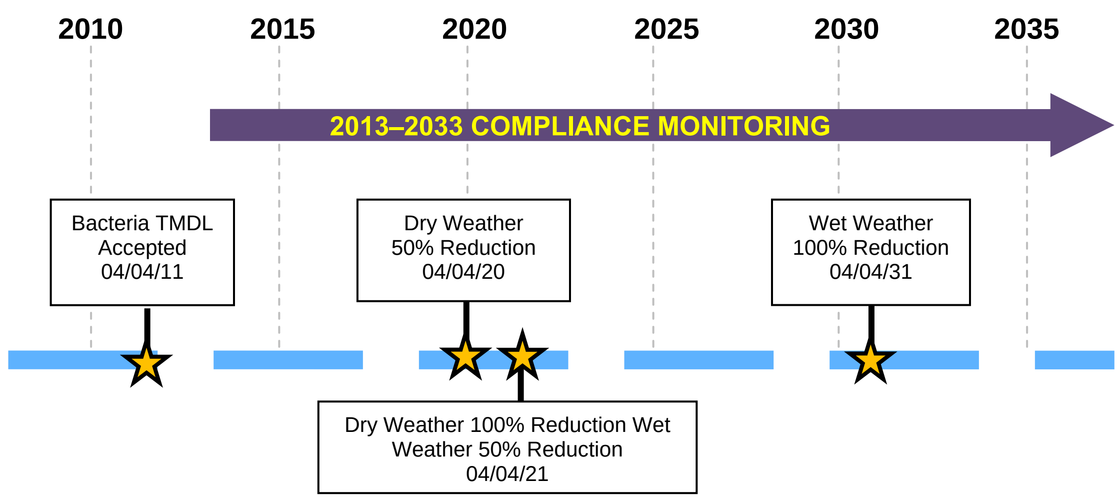
a. Interim exceedance frequencies were provided by the County of San Diego and were calculated on a watershed-wide basis from the DEH AB411 data collected at site OC-100 (San Luis Rey River Outlet) between 2004 and 2010.

b. Per the Bacteria TMDL (page A-56). See Appendix H

c. Per the MS4 Permit (Attachment E Table 6.5). See Appendix H.

1.7 IMPLEMENTATION SCHEDULE

The effective date of the Bacteria TMDL is April 4, 2011 (SDRWQCB, 2011a). The TMDL provides a compliance timeline outlining the interim reduction milestones over the 20-year compliance period. Figure 1-1 provides an overall timeline for the San Luis Rey River Bacteria TMDL Monitoring Program. Compliance Monitoring is scheduled to begin 50 days after the adoption of the MS4 Permit (June 27, 2013).



Legend:
CLRP – Comprehensive Load Reduction Plan

Figure 1-1. San Luis Rey Monitoring Program Timeline

2.0 MONITORING APPROACH

This section describes the purpose, scope, and types of sampling conducted. Additional details of the sampling and analytical methodology and data quality objectives are described in the Quality Assurance Project Plan (QAPP) (County of San Diego, 2015).

2.1 MONITORING

Monitoring is designed to meet the receiving water monitoring requirements of the recently adopted MS4 Permit (SDRWQCB, 2013). The monitoring, including wet and dry weather sampling, will be conducted at the locations listed in Table 2-1. The data generated will be used to address the following questions:

- Are bacteria levels improving at the compliance monitoring locations?
- Are TMDL numeric targets for bacteria indicators being met at the compliance monitoring locations?

Table 2-1. Scope of the Monitoring Program

Months	Number of Monitoring Locations	Event Type	Grab Samples Per Site Per Event	Event Frequency
Apr. 1 to Oct. 31	1	Dry	1	Weekly (5 events per month)
Nov. 1 to Mar. 31	1	Dry	1	At least Monthly
Oct. 1 to Apr. 30	1	Wet	1	At least once within the first 24 hours of the end of the storm event during the rainy season (Oct. 1 through Apr. 30).

Notes:
[a] Not including QA Samples

2.1.1 Monitoring Locations

According to Provision 6.d.(1)(a) of Attachment E of the MS4 Permit, for beaches addressed by the TMDL, monitoring locations should consist of, at a minimum, the same locations used to collect data required pursuant to Order Nos. R9-2007-0001 and R9-2009-0002, and beach monitoring for Health and Safety Code Section 115880.3. Therefore, the location historically sampled under the AB411 beach monitoring program (SDRWQCB, 2011a), OC-100, has been selected for the current monitoring program. Data collected at OC-100 between years 2004 and 2010 have been used in the calculation of the “existing” exceedance frequencies from which the interim and final exceedance frequencies for the Bacteria TMDL have been derived. Even if the AB 411 location is changed by the State Water Resources Control Board, Participating Agencies request that compliance with the Bacteria TMDL be assessed at the current AB411 location (OC-100), as these are the data used to develop the 303(d) listing and to develop the baseline of exceedance frequency.

Table 2-2 provides the location names and coordinates. Figure 2-1 presents a map of the locations within the San Luis Rey River Watershed.

Table 2-2.
Compliance Monitoring Locations

Site ID	Site Name	Site Type	Site Description	Latitude	Longitude
OC-100	Oceanside City Beach at San Luis Rey River Mouth	Pacific Ocean Shoreline	Historical AB411 Location[(a)]	33.20155952	-117.3922027

(a) Historical AB411 location is approximately 25m downcoast of river outlet

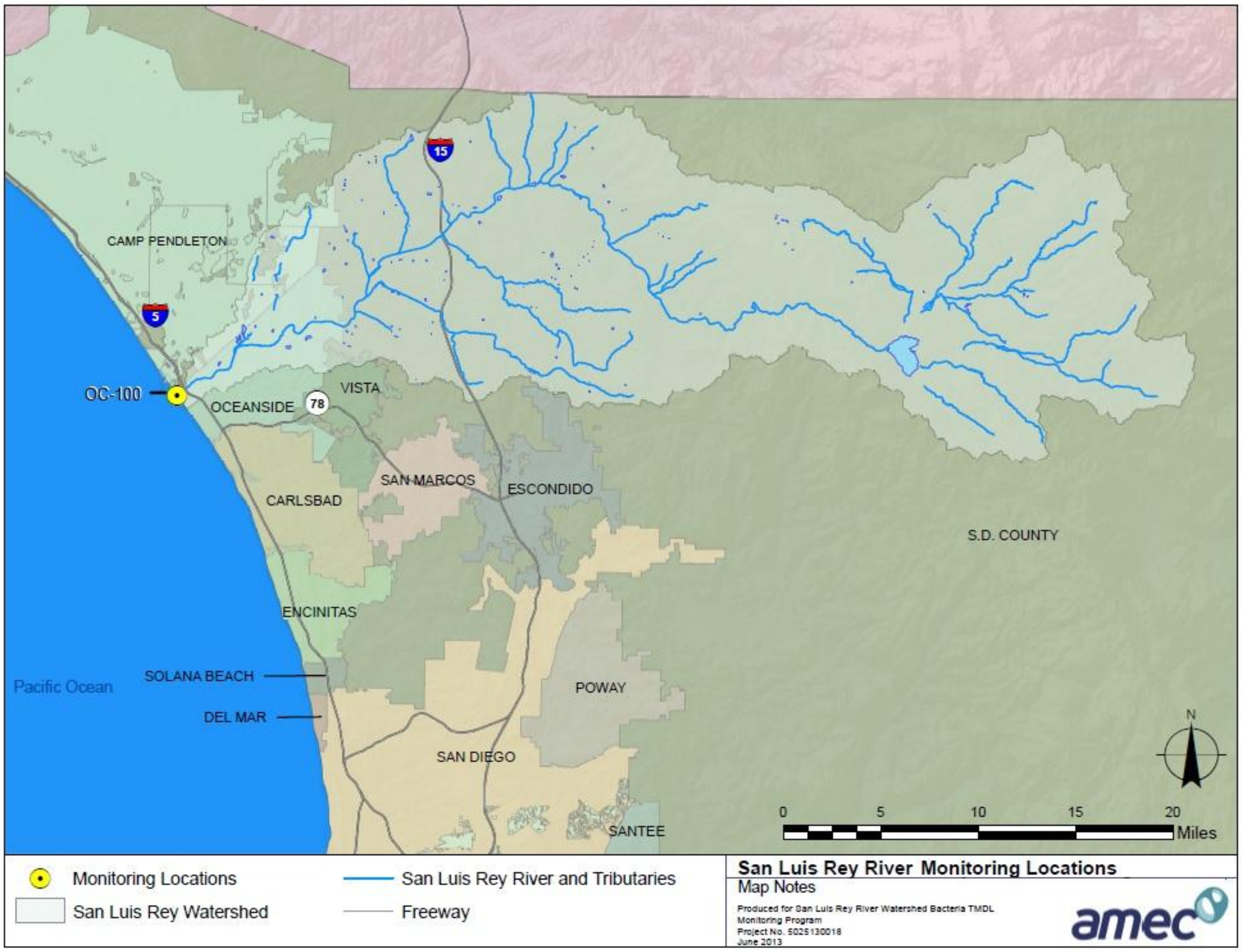


Figure 2-1. Monitoring Location

2.1.2 Constituents

Fecal indicator bacteria (FIB) are the target constituents as indicated by the TMDL. For beach samples, grab samples will be collected in a manner consistent with the AB411 program. Beach water samples will be analyzed for fecal coliform, *Enterococcus*, and total coliform. All samples will be analyzed for FIB in accordance with Surface Water Ambient Monitoring Program (SWAMP) requirements provided in the QAPP (County of San Diego, 2015). Table 2-3 presents the constituents and reporting limits.

Table 2-3. Water Sample Analyses for Bacteria TMDL Monitoring

Parameter	Project Reporting Limit[a]
Enterococcus	1 CFU/100mL
Fecal Coliform	2 CFU/100mL
Total Coliform	2 CFU/100mL

Notes

CFU – Colony Forming Units

(a) The target reporting limits are consistent with methodology of the Assembly Bill 411 program to facilitate overlap with that program. However, reporting limits may increase depending on dilution in countable range.

2.1.3 Dry Weather Monitoring

Dry weather monitoring will be conducted from April through October as described in Table 2-1. Samples will be collected at the monitoring locations listed in Table 2-2 on dry weather days, after an antecedent dry period of 72 hours with less than 0.1 inch of rainfall. During each dry weather monitoring event, field observations will be recorded and a grab water sample will be collected at each location. The methodology for field observations and sample collection/transport is described in the QAPP (County of San Diego, 2015).

2.1.4 Wet Weather Monitoring

Wet weather monitoring will be conducted at the location listed in Table 2-2 during at least one storm event during the wet season, (October 1, to April 30). Storms resulting in greater than 0.1 inch of precipitation will be targeted for sampling. During each wet weather monitoring event, a grab water sample will be collected within 24 hours of the end of precipitation using the same sample collection technique as during a dry weather monitoring event, taking additional safety precautions as needed. Field observations are not required but will be recorded, if feasible. The methodology for field observations and sample collection/transport is described in the QAPP (County of San Diego, 2015).

2.1.5 Storm Selection Criteria

The following criteria will be used to determine if mobilization will occur for an impending storm event:

- Storms must be forecast to produce at least 0.10 inch (2.54 millimeters [mm]) of rainfall.

- Storm events must be preceded by at least 72 hours of dry conditions (<0.10 inch of precipitation).

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3.0 DATA MANAGEMENT AND REPORTING PROCEDURES

This section describes the management of field and analytical data and reporting procedures for the San Luis Rey Bacteria TMDL Monitoring Program.

3.1 DATA MANAGEMENT

Field Data Records and Analytical Data Reports will be sent to and kept by the Project Manager. Data will be submitted in a standardized California Environmental Data Exchange Network (CEDEN)-compatible format to the County of San Diego.

Specific data review, storage and maintenance procedures for field and laboratory data are described in the QAPP (County of San Diego, 2015).

Follow-up monitoring may be conducted on the basis of indicator bacteria results obtained at the compliance monitoring locations. Detailed follow-up investigations are not required until the first interim milestone is reached; however, Copermittees may choose to voluntarily conduct follow-ups to identify and abate sources, where there is a preponderance of evidence to support the action.

3.2 ASSESSMENT AND REPORTING PROCEDURES

Compliance Monitoring Reports will be prepared annually to be included in the Transitional Monitoring and Assessment Program Reports or WQIP Annual Reports as appropriate. The annual reports will summarize the collected data and provide the results of analysis and assessments of dry and wet weather data collected herein as described in Provisions 6.d.(1)(c) and 6.d.(2)(c) of Attachment E to the MS4 Permit. This will include assessments of whether the interim and final WQBELs for the Pacific Ocean Shoreline at San Luis Ley River Mouth as listed in Table 6.0 in Attachment E of the MS4 Permit have been achieved. The following assessments will be conducted and results presented in the reports:

1. Exceedance frequencies for dry weather data:

    Thirty-day geometric means for dry weather samples will be calculated and used to determine dry weather exceedance frequencies by dividing the number of geometric means that exceed receiving water limitations by the total number of geometric means for the dry season.

2. Exceedance frequencies for wet weather data:

    Single sample maximum exceedance frequencies will be calculated for wet weather data by dividing the number of wet weather days that exceed the single sample maximum receiving water limitations by the total number of wet weather days during the rainy season.

    Dry weather data will be used in addition to wet weather data to calculate the wet weather 30-day geometric means. The exceedance frequency of the wet weather 30-day geometric means will be calculated by dividing the number of geometric means that exceed the geometric mean receiving water limitations by the total number of geometric means calculated from samples collected during the wet season.

    In calculating exceedance frequencies for wet weather data, the following assumptions will be made:

a) If only one sample is collected for a storm event, the bacteria density for every wet weather day associated with that storm event will be assumed to equal the results from the one sample collected;

b) If more than one sample is collected for a storm event, but not on a daily basis, the bacteria density for all wet weather days of the storm event not sampled will be assumed to equal the highest bacteria density result reported from the samples collected;

c) For the storm events not sampled, the bacteria density for every wet weather day of those storm events will be assumed to equal the average of the highest bacteria densities reported from each storm event sampled;

   For assessing and determining compliance with the concentration-based effluent limitations under Provision 6.b.(2)(b)(i) of Attachment E of the MS4 Permit, dry and wet weather discharge bacteria densities may be calculated based on a flow-weighted average across all major MS4 outfalls along a water body segment or within a jurisdiction if samples are collected within a similar time period.

The resulting data will also be submitted to the California Environmental Data Exchange Network (CEDEN).

4.0 REFERENCES

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ATTACHMENT 4A-4: SAN LUIS REY RIVER WATERSHED TOXICITY IDENTIFICATION EVALUATION / TOXICITY REDUCTION EVALUATION IMPLEMENTATION DRAFT WORK PLAN

Toxicity Identification Evaluation / Toxicity Reduction Evaluation Implementation Draft Work Plan

Prepared for:

San Diego County Regional Copermittees

Prepared by:

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January 16, 2015

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LIST OF ACRONYMS

2007 Permit	RWQCB Order No. R9-2007-0001
2013 Permit	RWQCB Order No. R9-2013-0001
BMP	best management practice
BSA	bovine serum albumin
CLRP	Comprehensive Load Reduction Plan
Copermittees	San Diego Regional Copermittees
EDTA	ethylenediaminetetraacetic acid
IWC	instream waste concentration
JRMP	Jurisdictional Runoff Management Plan
LC_{50}	median lethal concentration
LID	low impact development
MAP	Monitoring and Assessment Plan
MEP	maximum extent practicable
MS4	multiple separate storm sewer system
NOEC	no observed effect concentration
NPDES	National Pollutant Discharge Elimination System
PBO	piperonyl butoxide
QA/QC	quality assurance/quality control
RWQCB	Regional Water Quality Control Board
SMC	Stormwater Monitoring Coalition
SPE	solid phase extraction
STS	sodium thiosulfate
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TIE	toxicity identification evaluation
TMDL	Total Maximum Daily Load
TRE	toxicity reduction evaluation
TST	Test of Significant Toxicity
USEPA	United States Environmental Protection Agency
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan
WURMP	Watershed Urban Runoff Management Program

UNITS OF MEASURE

ppt	parts per thousand
%	percent
<	less than
>	greater than

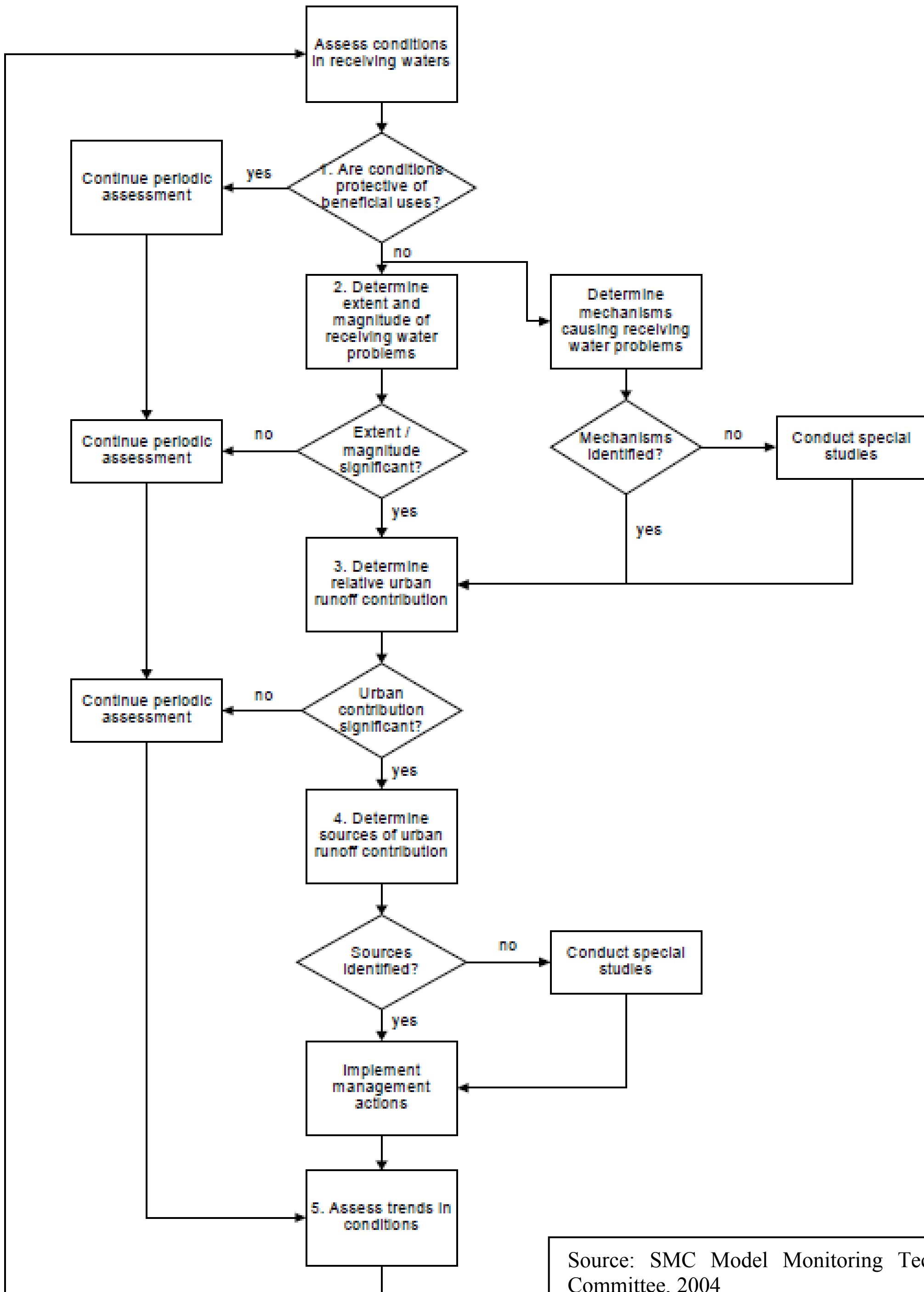
1.0 INTRODUCTION

In May of 2013, San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001 (2013 Permit) was adopted. Provision B of the 2013 Permit requires Copermittees in each Watershed Management Area (WMA) to develop a Water Quality Improvement Plan (WQIP) which, per Provision B.4, incorporates a Monitoring and Assessment Program (MAP). Also, per Provision D.1.c.(4)(f), "*If chronic toxicity is detected in receiving waters, the Copermittees must discuss the need for conducting a TIE/TRE in the assessments required under Provision D.4.a.(2), and develop a plan for implementing the TIE/TRE to be incorporated in the Water Quality Improvement Plan*."

A toxicity identification evaluation (TIE) is defined by the 2013 Permit as "*A set of procedures for identifying the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests*." A toxicity reduction evaluation (TRE) is defined as "*A study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices and best management practices. A TIE may be required as part of the TRE, if appropriate*."

This Work Plan outlines the process used to identify chronic toxicity in receiving waters, as well as guidance to prioritize the need to implement a TIE/TRE based on the magnitude and persistence of chronic toxicity. The Work Plan refers to the appropriate references for detailed sampling and analytical/toxicity test methods specific to the TIE/TRE treatment process. An example of a potential TRE decision process for receiving water samples (Stormwater Monitoring Coalition (SMC) Model Monitoring Technical Committee, 2004) is presented in Figure 1-1. The process should be modified on location-specific and pollutant-specific basis, and a detailed work plan should be developed for the implementation of a pollutant reduction program once the specific pollutant(s) causing toxicity exceedances are identified.

This Work Plan focuses primarily on the implementation of the TIE/TRE process, recognizing the limitations of utilizing TRE guidance developed for point source discharges. Receiving water stations potentially capture pollutants from many sources with runoff flows and contaminant concentrations likely more variable than those from point source discharges. However, with modifications to the TRE guidance developed for point source discharges, a TRE may be conducted to attempt to identify sources of toxicity, propose mitigation measures for these sources, and conduct follow-up studies to confirm toxicity reduction. Any activities that result in consistently reducing toxicity to an acceptable level may be considered TRE activities (USEPA 2001).



Source: SMC Model Monitoring Technical Committee, 2004

Figure 1-1. Example Receiving Water Monitoring and TIE/TRE Decision Framework

2.0 RECEIVING WATER TOXICITY TESTING

Receiving water monitoring is conducted by the San Diego Regional Copermittees (Copermittees) in accordance with Provision D of the 2013 Permit and chronic toxicity is one of the parameters evaluated in both wet and dry weather receiving water samples. Under the long-term monitoring requirements of the 2013 Permit, chronic toxicity tests are conducted in accordance with Provision D.1.c.(4)(e) as summarized in Table 2-1. Toxicity is evaluated using the Test of Significant Toxicity (TST) as outlined in the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (USEPA, 2010). The TST approach assigns a Pass or Fail result based on whether the organism response observed at the chronic instream waste concentration (IWC) of 100 percent (%) receiving water is significantly different from that in the control treatment. When chronic toxicity is observed in receiving water samples (i.e., the sample receives a "Fail" based on the TST), implementation of a TIE/TRE process following the phased approach described in subsequent sections will be considered, as appropriate.

Table 2-1. Transitional and Long-Term Receiving Water Toxicity Tests

Organism	Endpoint	Toxicity Threshold	USEPA Protocol
Monitoring in accordance with Order No. R9-2013-0001, Salinity < 1 ppt			
Ceriodaphnia dubia	Chronic survival and reproduction	Pass/Fail	EPA-821-R-02-013
Selenastrum capricornutum	Chronic growth		
Pimephales promelas	Chronic survival and growth		
Monitoring in accordance with Order No. R9-2013-0001, Salinity $\geq$ 1 ppt			
Strongylocentrotus purpuratus	Chronic development	Pass/Fail	EPA-600-R-95-136

3.0 TIE/TRE PROCESS

3.1 Information and Data Acquisition

Prior to initiating the TIE/TRE process, an evaluation of sampling and toxicity testing procedures should be conducted to assess whether toxicity may have been introduced during these procedures or errors may have been made. This may include a review of the following:

- Sampling equipment decontamination procedures
- Field and laboratory logs
- Laboratory reports

If all test acceptability criteria are met and no errors are identified, Copermittees will consider implementing the TIE/TRE process. Conducting a TIE is often the first step to identifying the toxicant.

3.2 TIE Testing

TIEs may be conducted in accordance with USEPA guidance for characterizing, identifying, and confirming toxicity (USEPA 1991, 1992, 1993a, and 1993bPriority may be given to stations exhibiting significant and persistent toxicity that has not previously been characterized and where analytical results indicate that a specific toxicant may be causing or contributing to toxicity. The sample may be evaluated for TIE suitability using the following assessments:

- Presence of Persistent Toxicity: toxicity is considered persistent if more than 50% of samples (generally during a monitoring year) collected at a station receive a "Fail" based on the test of significant toxicity (TST).
- Magnitude of Toxicity: based on past experience, a 50% response rate (i.e. 50% of test organisms respond in a 100% receiving water sample) can provide a reasonable opportunity for a successful TIE.
- Previous Characterization: TIEs are generally prioritized for receiving water stations where previous TIEs have not characterized the pollutant(s) causing toxicity. However, TIE/TRE procedures should not be ruled out for previously characterized stations since contributor(s) to toxicity may change over time.

The TIE approach is divided into three phases, as described in USEPA (1991) and summarized as follows:

- Phase I – characterizes the physical/chemical nature of the constituent(s) which cause or contribute to toxicity. Such characteristics as solubility, volatility and filterability are determined without specifically identifying the toxicants.
- Phase II – utilizes methods to specifically identify toxicants.
- Phase III – utilizes methods to confirm the suspected toxicants.

Phase I (characterization) manipulations of receiving water samples generally include those presented in Table 3-1.

Table 3-1. Phase I TIE Receiving Water Sample Manipulations

Physical and Chemical Manipulations on Receiving Water Samples	Purpose of Test
Baseline	Confirms toxicity is still present in the sample at time of TIE testing
Filtration	Detects particulates or particulate-bound toxicants
Aeration	Detects volatile, oxidizable, sublatable, or spargeable compounds
Ethylenediaminetetraacetic acid (EDTA) addition	Detects cationic metals (e.g., cadmium)
Sodium thiosulfate (STS) addition	Detects oxidative compounds (e.g., chlorine)
Solid phase extraction (SPE) over C18 column (may be followed by methanol elution)	Detects non-polar organics and some surfactants (methanol elution adds toxicity back to sample)
Piperonyl butoxide (PBO) addition	Detects organophosphate pesticides and pyrethroids

Carboxyl esterase addition*	Hydrolyzes pyrethroids
Bovine serum albumin (BSA) addition	Protein BSA is used as a control for the carboxyl esterase
Temperature reduction	Increases toxicity of pyrethroid pesticides
pH adjustment	Detects pH-dependent toxicants (e.g., ammonia and sulfides)
* Carboxylesterase addition has been used in recent studies to help identify pyrethroid-associated toxicity (Wheelock et al., 2004; Weston and Amweg, 2007). However, this treatment is experimental in nature and should be used along with other pyrethroid-targeted TIE treatments (e.g., PBO addition).	

Adjustments may be made to these TIE protocols if specific contaminants are suspected to be contributing to toxicity. For example, total dissolved solids (TDS) controls and/or mock effluents to mimic TDS concentrations observed in samples are often added to the treatments listed in Table 3-1 if ionic imbalance or elevated TDS are suspected. Toxicity due to ionic imbalance occurs when ion concentrations are not within the tolerance range of the selected test organism; utilizing *S. purpuratus* for toxicity tests conducted for samples with salinity > 1 ppt may help to alleviate this common issue, especially during dry weather.

Phase II and III TIEs may be necessary, depending whether the Phase I determination of toxicant class is sufficient for identifying pollutants for outfall monitoring and/or identifying source control measures. If necessary, Phase II and III procedures may include toxicant removal and add-back, serial additions, and/or toxicant spiking experiments in accordance with USEPA 1993a and 1993b.

It should be noted that, due to intermittent toxicity and/or toxicity resulting from multiple toxicants, TIEs are not always conclusive. In such cases, conducting toxicity tests with additional organisms (SMC Model Monitoring Technical Committee, 2004) and/or serially identifying toxicants (USEPA, 2001) may help characterize observed toxicity. When a receiving water sample exhibits persistent toxicity of a high magnitude, as is generally the case when TIEs are conducted, TIEs are typically successful (USEPA, 2001).

3.3 Toxicity Source Evaluation

Once any toxicants have been identified during the TIE process, Copermittees must discuss the need for conducting a TRE. The following sections provide an outline for developing specific monitoring elements intended to focus the effort in locating the source(s) of the pollutant(s).

If urban runoff is suspected as a significant source of the pollutant(s) characterized by a TIE to be a contributor to toxicity at a receiving water station, source identification procedures may need to be considered. An evaluation of chemistry and bioassessment data for the receiving water station and chemistry data for upstream outfalls may help to confirm whether urban runoff is a significant source of the pollutant(s) causing toxicity and may justify further source identification procedures.

More comprehensive source identification procedures, if warranted, may include compiling descriptions of all potential sources to the receiving water station, determining actual sources and their relative magnitudes, and quantitatively estimating loads from these sources. A model for a source identification investigation study is outlined in the *Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California* (SMC Model Monitoring Technical Committee, 2004) and more detailed source identification study methodology is outlined in USEPA (1993c) and by Pitt (2004). The general approach may include a combination of the components presented in Figure 3-1.

Desktop Assessment

- Delineate tributary drainage area and MS4 infrastructure draining to receiving water, as well as responsible agencies to be involved in TRE and investigations.
- Identify upstream land uses and watershed activities which may represent contributing sources of pollutant(s) causing toxicity.
- Compile and evaluate existing data for upstream MS4 from MS4 inventory.
- Leverage observation and monitoring data from other programs such as for example:
  - *Industrial Permit*
  - *Construction Permit*
  - *IC/ID Program*

Initial Field Assessment

- Implement initial upstream MS4 investigations, sampling for pollutant(s) identifed in TIE to be causing toxicity. Prioritize investigations based on MS4 inventory and other factors.
- Types of Investigations to conisder may include::
  - Visual/Observation
  - Upstream MS4 Transect Surveys
  - Land Use or Activity Based Source Investigations
  - Special Studies

Watershed Planning

- Review existing water quality plans and programs (i.e. WQIPs, CLRPs, TMDL implementation plans, WURMPs, JRMPs) for pollutant sources, watershed priorities, and existing institutional activities and BMPs implemented locally. Cross-reference effectiveness to reducing pollutant(s) causing observed toxicity.
- Identify local water quality criteria and habitat health criteria to establish triggers for source investigations.
- Develop source investigation report and work plan based on existing guidance.

Figure 3-1. The Toxicity Source Evaluation Approach

Source identification efforts may coordinate with monitoring and assessment activities necessary for compliance with the following Provisions:

- Provision A.4.a.(2) – If it is determined that discharges from the MS4 are causing or contributing to a new exceedance of an applicable water quality standard not addressed by the WQIP, update the WQIP with the water quality improvement strategies implemented or to be implemented, the implementation schedule, and the monitoring and assessment program updates intended to track progress toward achieving compliance.

- Provision B.2.d – identify and prioritize known and suspected sources of stormwater and non-stormwater pollutants from MS4 outfalls that contribute to the highest priority water quality conditions, as identified in the WQIP.
- Provision B.3 – identify water quality improvement goals and strategies to address the highest priority water quality conditions, as identified in the WQIP.
- Provision D.2.b – perform dry weather MS4 outfall monitoring to identify non-storm water flows and illicit discharges within its jurisdiction and to prioritize these discharges for investigation and elimination.
- Provision D.2.c – perform wet weather MS4 outfall monitoring to identify pollutants in storm water discharges from the MS4, guide pollutant source identification efforts, and determine compliance with applicable Total Maximum Daily Loads (TMDLs).
- Provision D.3 – conduct special studies related to the highest priority water quality conditions. Provision D.3.c specifies that special studies related to pollutant and/or stressor source identification should include a compilation of known information on the pollutant and/or stressor, an identification of data gaps intended to be filled by the studies, and a monitoring plan which includes, among other required elements, a prioritization of sources of the pollutant and/or stressor.
- Provision E.2 – implement a program to detect and eliminate illegal discharges and improper disposal into the MS4.

If no source can be identified as a major contributor to receiving water toxicity, more intensive follow-up studies may be required.

3.4 Toxicity Control Evaluation

Using the results from the TRE elements conducted to this point, alternatives for reducing receiving water toxicity may be identified and the most feasible approach(es) may be selected. Pollution Prevention measures are designed to target pollutants and wastes before they are generated, while Source Controls are designed to reduce or eliminate pollutants before entering the MS4. These measures may include outreach, incentive programs, regulatory controls, and enforcement activities, as well as broader "true source controls" that must be implemented at a national or state level (e.g., product regulation). Institutional Programs, such as street sweeping, MS4 cleaning and repair, and other institutional services are typically maintenance activities implemented by agencies at various targeted frequencies to meet pollutant load reduction goals and minimum National Pollutant Discharge Elimination System (NPDES) Permit compliance criteria. Treatment Controls include structural systems designed to remove pollutants from stormwater and non-stormwater flows and may include a variety of low impact development (LID) and best management practices (BMPs) (e.g., infiltration-type, bioremediation, treatment trains, etc.). These BMPs are intended to protect receiving waters by eliminating or reducing the discharge of pollutants to the maximum extent practicable (MEP). Advantages and disadvantages of BMP alternatives should be considered, and appropriate BMPs should be selected based on site-specific conditions and pollutant(s) of concern. An integrated approach using a combination of Pollution Prevention measures, Institutional Programs, and Treatment Controls may be appropriate if more than one pollutant is identified to be causing or contributing to toxicity, or if the source is unknown. These three components of the toxicity control evaluation are shown in Figure 3-2.

Figure 3-2. Components of Toxicity Control Evaluation

3.5 Toxicity Control Implementation

Once the selected toxicity control method(s) are implemented, monitoring may be continued and possibly accelerated to confirm that toxicity reduction objectives are being met. Depending on the location and pollutant(s) being evaluated, some of this monitoring may be satisfied by Permit-required monitoring of receiving water and outfall locations (see Section 3.3).

Compliance with the monitoring and assessment requirements of the 2013 Permit, including Provision D.1.c.(4)(f) which requires the implementation of the TIE/TRE process described in this Work Plan, is intended to meet the discharge and receiving water limitations outlined in the 2013 Permit to the MEP. Updates to the monitoring programs developed to comply with these provisions will be incorporated into the WQIP through the adaptive management process outlined in Provisions B.4 and B.5 in order to continually monitor effectiveness and re-evaluate the programs.

3.6 Quality Assurance/Quality Control

A quality assurance/quality control (QA/QC) program for the TIE/TRE should be developed in order to ensure reliability of data collected throughout the process. The QA/QC program should include the QA/QC objectives, sample collection and preservation techniques, chain of custody procedures, analytical QA/QC, laboratory equipment maintenance, QA/QC training requirements, documentation and reporting procedures, and corrective action protocols (USEPA, 1993c). In addition, toxicology and analytical laboratories should be experienced and qualified to conduct the TIE/TRE.

3.7 TIE/TRE Limitations

There are inherent limitations associated with the TIE/TRE process summarized in this Work Plan, including the difficulty of characterizing intermittent toxicity (USEPA, 1993c) and/or toxicity resulting from multiple toxicants (USEPA, 2001). In addition, existing TRE guidance was developed primarily for point source discharges from wastewater treatment plants whereas receiving waters potentially capture pollutants from many sources and contain contaminants at more variable concentrations than those from a wastewater treatment facility, especially during a storm event.

4.0 REFERENCES

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ATTACHMENT 4A-5: SAN LUIS REY RIVER WATERSHED STORM DRAIN OUTFALL MONITORING PLAN

San Luis Rey River Watershed
Storm Drain Outfall Monitoring Plan

Prepared For:
San Luis Rey River Watershed
Participating Agencies

Prepared By:
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January 2015

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LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
<	less than
303(d) list	Clean Water Act Section 303(d) List of Impaired Waterbodies
Bacteria TMDL	A Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) To Incorporate Revised Total Maximum Daily Loads for Indicator Bacteria Project I—Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek) (Regional Board, February 10, 2010)
CMP	corrugated metal pipe
CP	concrete pipe
CWA	Clean Water Act
ELAP	California Environmental Laboratory Accreditation Program
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
JRMP	Jurisdictional Runoff Management Program
Storm Drain	Municipal Separate Storm Sewer System
Permit	San Diego Regional Water Quality Control Board Order Number R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region
NAL	non-stormwater action level
NPDES	National Pollutant Discharge Elimination System
PID	photoionization detector
QA	quality assurance
RCC	reinforced concrete channel
RCP	reinforced concrete pipe

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

Regional Board	Regional Water Quality Control Board, San Diego Region
SAL	stormwater action level
SWAMP	Surface Water Ambient Monitoring Program
TBD	to be determined
TKN	total Kjeldahl nitrogen
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WATERSHED	Watershed Management Area
WQBEL	Water Quality Based Effluent Limit
WQIP	Water Quality Improvement Plan
WQO	Water Quality Objective
WURMP	Watershed Urban Runoff Management Program

1 INTRODUCTION

In May 2013, the San Diego Regional Water Quality Control Board (Regional Board) Order No. R9-2013-0001, *National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirement for Discharges From The Municipal Separate Storm Sewer Systems (MS4s) Draining The Watersheds Within the San Diego Region* (Permit; Regional Board, 2013) was adopted, replacing Regional Board Order No. R9-2007-0001 (Regional Board, 2007), and became effective June 27, 2013. The Permit prescribes monitoring programs for the storm drain outfalls during wet and dry weather for the duration of the Permit cycle.

1.1 PROGRAM OVERVIEW

In the San Luis Rey River Permit Watershed Management Area (Watershed) three Municipal Copermittees (Copermittees) are named under the Permit:

- City of Oceanside
- City of Vista
- County of San Diego

The Copermittees are required to perform storm drain outfall monitoring in accordance with Provision D of the Permit. Permit-required storm drain outfall monitoring is composed of two major components:

- Dry Weather Storm Drain Outfall Discharge Monitoring (Provision D.2.b; Regional Board, 2013)
- Wet Weather Storm Drain Outfall Discharge Monitoring (Provision D.2.c; Regional Board, 2013)

The purpose of this monitoring plan is to describe the monitoring and assessment requirements and procedures for the San Luis Rey River Watershed Storm Drain Outfall Discharge Monitoring Program required by the Permit.

2 DRY WEATHER STORM DRAIN OUTFALL DISCHARGE MONITORING

This section details the dry weather storm drain outfall monitoring required to comply with the Permit. Each Copermittee is required to perform dry weather Storm Drain outfall prioritization and monitoring to aid in the identification of non-stormwater and illicit discharges within its respective jurisdictions as required by Provision D.2.b of the Permit.

2.1 STORM DRAIN OUTFALL INVENTORY

The Copermittees have identified the known major storm drain outfalls that discharge directly to receiving waters within their respective jurisdictions within the San Luis Rey River Watershed. The identified major storm drain outfalls have been geo-located on respective Geographic Information System (GIS) jurisdictional map of the San Luis Rey River Watershed as required by Provision D.2.a.(1) of the Permit. Each Copermittee will individually maintain, confirm, and update its respective maps during annual field screening (Provision D.2.2). The respective jurisdictional storm drain maps contain the following items that, at a minimum, will be confirmed and updated during annual field screening as applicable:

- Segments of the storm drain owned, operated, and maintained by the Copermittee
- Known locations of inlets that discharge and/or collect runoff into the Copermittee's storm drain
- Known locations of connections with other storm drains not owned or operated by the Copermittee
- Known locations of storm drain outfalls and private outfalls that discharge runoff collected from areas within the Copermittee's jurisdiction
- Segments of receiving waters within the Copermittee's jurisdiction that receive and convey runoff discharged from the Copermittee's storm drain outfalls
- Locations of the storm drain outfalls within each Copermittee's respective jurisdiction
    - Latitude and longitude of storm drain outfall point of discharge
    - Watershed Management Area
    - Hydrologic subarea
    - Outlet size
    - Accessibility (i.e. safety and without disturbance of critical habitat)
    - Approximate drainage area
    - Classification of whether the storm drain outfall is known to have persistent non-stormwater flows, transient non-stormwater flows, no non-stormwater flows, or unknown non-stormwater flows
- Locations of the selected non-stormwater persistent flow storm drain outfall discharge monitoring stations within each Copermittee's respective jurisdiction (Provision D.2.3.2)

Because of their size, geo-located storm drain outfall maps are not included in this monitoring plan. Table 2-1 presents the number of identified major outfalls in the San Luis Rey River Watershed by Copermittee.

Table 2-1. Number of Identified Major Storm Drain Outfalls by Copermittee

Copermittee	Number of Identified Major Outfalls
City of Oceanside	23
City of Vista	4
County of San Diego	18

2.2 *Field Screening*

Each Copermittee is required to conduct field screening to determine which non-stormwater storm drain outfall discharges are transient flows and which are persistent flows, and to prioritize the non-stormwater storm drain discharges that will be investigated and eliminated in accordance with the Illicit Discharge Detection and Elimination (IDDE) program.

2.2.1 *Monitoring Locations And Frequency*

Per the requirements of Provision D.2.a.(2).(a) of the Permit, the number of major outfalls required to be screened is dependent upon the number of known major outfalls present in a Copermittee's inventory. The requirements are as follows:

- For Copermittees with fewer than 125 known major storm drain outfalls that discharge to receiving waters within a Watershed, at least 80 percent of the outfalls are required to be visually inspected two times per year during non-stormwater conditions. All Copermittees in the San Luis Rey River Watershed fall into this category:
    - City of Oceanside
    - City of Vista
    - County of San Diego

Based on these criteria, Table 2-2 details the number of major outfalls Copermittee will inspect within its respective jurisdiction and the frequency at which they will inspect within the San Luis Rey River WMA.

Table 2-2. Storm Drain Outfall Screening Number and Frequency by Copermittee

Copermittee	Number of Identified Major Outfalls	Frequency of Screening
City of Oceanside	19 (23)	80% of major outfalls, twice annually
City of Vista	4 (4)	80% of major outfalls, twice annually
County of San Diego	15 (18)	80% of major outfalls, twice annually

1. For Copermittees with fewer than 125 major storm drain outfalls in the watershed, 80% of major outfalls must be screened twice per year. Total number of major outfalls within each jurisdiction in the watershed is provided in parentheses.

2.2.2 *Visual Observations*

Per the Permit, during a field screening visual observation inspection, each storm drain outfall selected for screening will be inspected following at least 72 hours of dry weather after any storm event producing greater than 0.10 inch of rainfall within a 24-hour period. Table 2-3 details the visual observations that will be recorded during each field screening visual observation inspection, per the requirements of Provision D.2.a.(2) of the Permit. An example field observation form used to record field screening visual observations is included in Attachment A. Example procedures for flow estimation are described in Attachment B.

Table 2-3. Field Screening Visual Observations for Storm Drain Outfall Discharge Monitoring Stations

Field Observations
Station identification and location
Presence of flow, or pooled or ponded water
If flow is present:
Flow estimation (i.e., width of water surface, approximate depth of water, approximate flow velocity, flow rate)
Flow characteristics (i.e., presence of floatables, surface scum, sheens, odor, color)
Flow source(s) suspected or identified from non-stormwater source investigation
Flow source(s) eliminated during non-stormwater source identification
If pooled or ponded water is present:
Characteristics of pooled or ponded water (i.e., presence of floatables, surface scum, sheens, odor, color)
Known or suspected source(s) of pooled or ponded water
Station description (i.e., deposits or stains, vegetation condition, structural condition, observable biology)
Presence and assessment of trash in and around station
Evidence or signs of illicit connections or illegal dumping

2.3 *Non-Stormwater Persistent Flow Storm Drain Outfall Discharge Monitoring*

Each Copermittee is required to perform non-stormwater persistent flow storm drain outfall discharge monitoring to determine whether persistent non-stormwater discharges may be impacting receiving water quality.

2.3.1 *Outfall Prioritization*

Copermittees must each identify a minimum of the 5 highest priority major storm drain outfalls with non-stormwater persistent flows that they will monitor within their respective jurisdictions in the San Luis Rey River Watershed, in accordance with Permit Provision D.2.b.(2)(b) (Regional Board, 2013). If a Copermittee has less than 5 major outfalls within the Watershed, the Copermittee will monitor all its major Storm Drain outfalls with persistent flow. The Copermittees selected dry weather storm drain outfall discharge monitoring stations from the inventories developed pursuant to Provision D.2.b.(2)(a) for the San Luis Rey River Watershed as follows:

> *Based upon the dry weather storm drain outfall discharge field screening monitoring records developed pursuant to Provision D.2.a.(2)(c), each Copermittee must identify and prioritize the storm drain outfalls with persistent flows based on the highest priority water quality conditions identified in the Water Quality Improvement Plan and any additional criteria developed by the Copermittee, which may include historical data and data from sources other than what the Copermittee collects.*

2.3.2 *MONITORING LOCATIONS AND FREQUENCY*

The highest priority major storm drain outfalls with non-stormwater persistent flows selected by each Copermittee are presented in Table 2-4 and Figure 2-1.

Each selected highest priority major outfall will be monitored at least semi-annually. A Copermittee may substitute a next-highest priority major outfall for a selected major outfall in the event that one of the following criteria becomes applicable, until no qualifying major storm drain outfalls remain within the Copermittee's jurisdiction in the San Luis Rey River Watershed:

- The non-stormwater discharges have been effectively eliminated (i.e., no flowing, pooled, or ponded water) for three consecutive non-stormwater monitoring events.
- The source of the persistent flows has been identified as a category of non-stormwater discharges that does not require an NPDES permit and does not have to be addressed as an illicit discharge because it was not identified as a source of pollutants.
- The constituents in the persistent flow non-stormwater discharge do not exceed NALs.
- The source of the persistent flows has been identified as a non-stormwater discharge authorized by a separate NPDES permit.

In the event of a substitution, each Copermittee will document the reprioritization of its highest priority persistent flow storm drain outfalls in the Water Quality Improvement Plan (WQIP) Annual Report.

Table 2-4. Selected Highest Priority Major Storm Drain Outfalls for Non-Stormwater Persistent Flow Monitoring

Jurisdiction	Site ID	Outfall Size	Outfall Type	Latitude	Longitude
City of Oceanside	SLR-005	42 in.	CMP	33.207409	-117.384914
	SLR-008	36 in.	RCP	33.206785	-117.382836
	SLR-015	36 in.	RCP	33.221830	-117.356296
	S116* (no current program name)	60 in.	CC	33.25568	-117.2931
	SXXX* (no name yet)	48 in.	RCP	33.25582	-117.29243
City of Vista	1	96x12 in.	CP	33.23424	-117.25785
	43	54 in.	CP	33.2332	-117.24994
County of San Diego	MS4-SLR-041	54 in. circular	RCP	33.31787	-117.16385
	MS4-SLR-095	36 in. circular	RCP	33.22163	-117.0975
	MS4-SLR-150	36 in circular	RCP	33.2837	-117.21707
	MS4-SLR-152	54 in. circular	RCP	33.33078	-117.15099
	MS4-SLR-155	72 in. circular	RCP	33.32802	-117.15234

Notes:
CP = Concrete Pipe; CMP = Corrugated Metal Pipe; RCP = Reinforced Concrete Pipe; CC = Concrete Channel
1. Manhole type structure; the outfall is not accessible
2. Outfall structure located at point of discharge

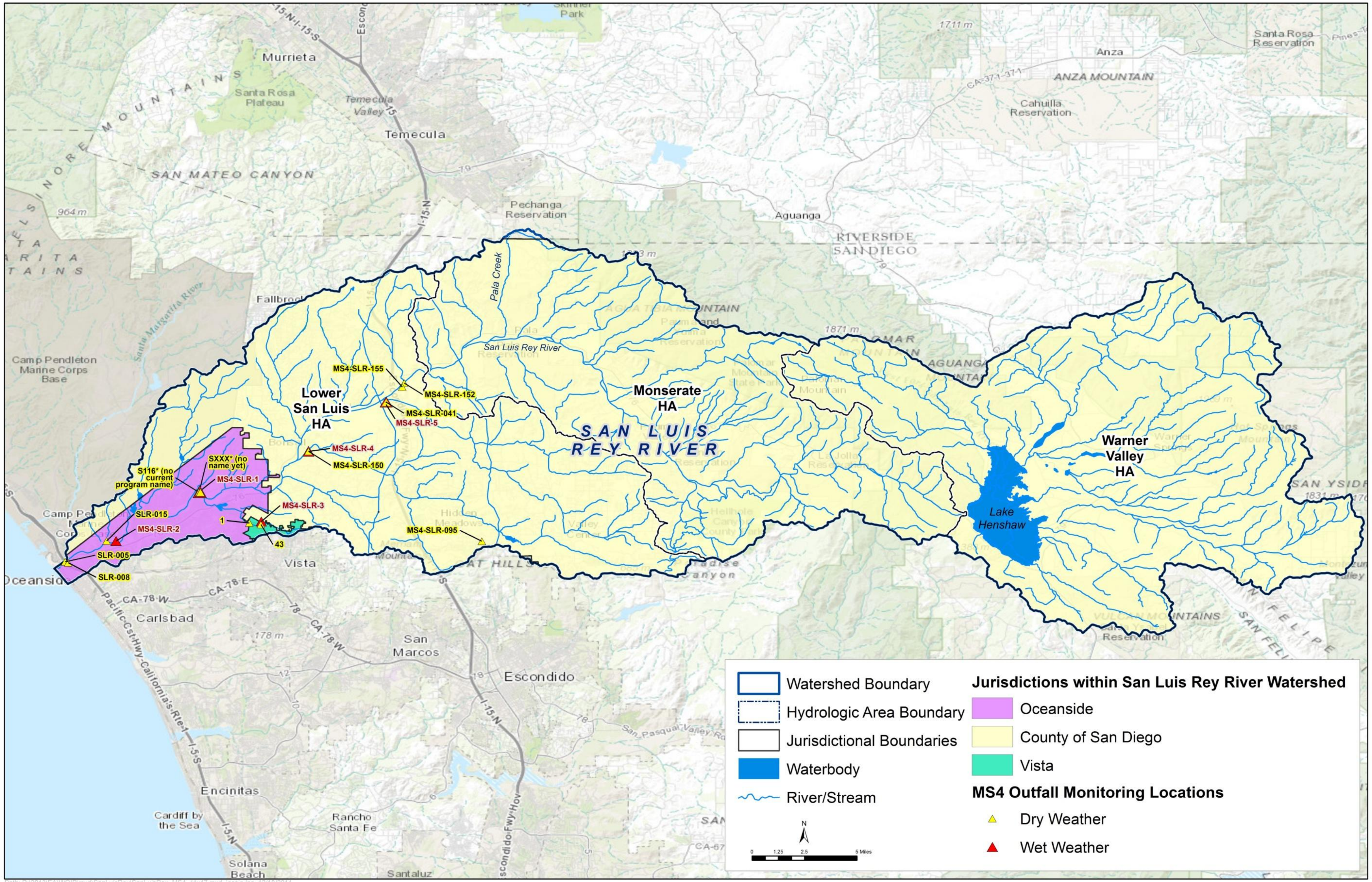

Figure D2-1. Selected Major Outfalls for Dry and Wet Weather Storm Drain Discharge Monitoring

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2.3.3 *Field Observations*

During the monitoring events, field observations will be recorded at each of the selected major outfall persistent flow monitoring sites. The flow rates and volumes will be measured or estimated using data from nearby USGS gauging stations, or by manual measurements performed in accordance with the USEPA Storm Water Sampling Guidance Document (EPA-833-B-92-001), section 3.2.1. Alternative flow measurement or estimation methods that are acceptable to the San Diego Water Board may be employed. An example dry weather field observations form is provided in Attachment A. A list of required field observations is presented in Table 2-3.

2.3.4 *Field Monitoring*

During the monitoring events, *in-situ* measurements will be collected at each of the selected major outfall persistent flow monitoring sites. These will include:

- pH
- Temperature
- Specific conductivity
- Dissolved oxygen
- Turbidity

Field monitoring will be documented on a field observation form. A list of parameters, monitored corresponding target reporting limits, and suggested analytical methods is provided in Attachment A.

2.3.5 *Analytical Monitoring*

2.3.5.1 *Sample Collection*

During the monitoring events, provided sufficient measurable flow is present, samples will be collected for analysis by an analytical laboratory. Grab samples will be collected in accordance with the Surface Water Ambient Monitoring Program (SWAMP) protocols. An example chain-of-custody (COC) form is included in Attachment C. Quality assurance and quality control procedures are outlined in Attachment F.

2.3.5.2 *Laboratory Analysis*

The required analyses are based upon the following five groupings of constituents:

1) Constituents contributing to the highest priority water quality conditions identified in the San Luis Rey River Watershed WQIP
2) Constituents listed as a cause for impairment of receiving waters in the San Luis Rey River Watershed as listed on the 303(d) list
3) Constituents for implementation plans or load reduction plans (e.g., Bacteria Load Reduction Plans, Comprehensive Load Reduction Plans) developed for the San Luis Rey River Watershed where the Copermittees are listed responsible parties to a Total Maximum Daily Load (TMDL)

4) Applicable NAL constituents listed in Provision C.1 of the Permit
5) Constituents listed in Table D-7 of the Permit

Attachment A details the analyses required for selected storm drain outfall persistent flow monitoring, including target reporting limits. Per Provision 2.i.(3)in Attachment B of the Permit, all chemical and bacteriological analysis of samples will be performed by laboratory(ies) certified for such analyses by the California Department of Public Health or laboratory(ies) approved by the San Diego Water Board.. All sampling, analysis and quality assurance/quality control will be conducted in accordance with the Quality Assurance Management Plan (QAMP) for the State of California's Surface Water Ambient Monitoring Program (SWAMP), adopted by the State Water Resources Control Board (State Water Board).

3 WET WEATHER STORM DRAIN OUTFALL DISCHARGE MONITORING

This section details the wet weather storm drain outfall monitoring required to comply with the Permit. Each Copermittee is required to perform wet weather storm drain outfall monitoring to identify pollutants in stormwater discharges from the storm drains, guide pollutant source identification efforts, and determine compliance with the Water Quality Based Effluent Limits (WQBELs) associated with the Bacteria TMDL within its respective jurisdiction as required by Provision D.2.c of the Permit. This section is based on the Wet Weather MS4 Outfall Discharge Monitoring Work Plan (San Diego County Regional Copermittees [SDCRC], 2014).

3.1 Stormwater Storm Drain Outfall Discharge Monitoring

Each Copermittee is required to perform wet weather storm drain outfall prioritization and monitoring to aid in the identification of pollutants in stormwater discharges from the storm drains, to guide pollutant source identification efforts, and to determine compliance with the WQBELs associated with the applicable TMDLs within its respective jurisdiction as required by Provision D.2.c of the Permit.

3.1.1 Outfall Prioritization

The Copermittees selected wet weather storm drain outfall discharge monitoring stations from the inventories developed pursuant to Provision D.2.a.(3).(a).(1) of the Permit for the San Luis Rey River Watershed as follows:

- *At least five wet weather storm drain outfall discharge monitoring stations that are representative of stormwater discharges from areas consisting primarily of residential, commercial, industrial, and typical mixed-use land uses present within the Permit Management Area*
- *At least one wet weather storm drain outfall discharge monitoring station for each Copermittee within the Permit Management Area*

The Copermittees may adjust the wet weather storm drain outfall discharge monitoring locations in the San Luis Rey River Watershed, as needed, to identify pollutants in stormwater discharges from storm drains, to guide pollutant source identification efforts, and to determine compliance with the WQBELs associated with applicable TMDLs in accordance with the highest priority water quality conditions identified in the San Luis Rey River Watershed WQIP.

3.1.2 Monitoring Locations and Frequency

The monitoring locations for wet weather storm drain outfall monitoring are provided in Table 3-1 and Figure 2-1.

Table 3-1. Wet Weather Storm Drain Outfall Monitoring Locations

Storm Drain Site Name	Jurisdictional Identifier	Jurisdiction	Latitude	Longitude
MS4-SLR-1	North River Rd & Melba Bishop Park	City of Oceanside	33.25583	-117.29243
MS4-SLR-2	Toopal Drive at Wanis View Estates	City of Oceanside	33.22186	-117.34984
MS4-SLR-3	G-5	City of Vista	33.23521	-117.24966
MS4-SLR-4	COSD MS4 SLR02	County of San Diego	33.283702	-117.217033
MS4-SLR-5	COSD MS4 SLR03	County of San Diego	33.31787	-117.16383

Per the requirements of the Permit, the Copermittees will monitor wet weather storm drain outfall discharge monitoring station(s) in the San Luis Rey River Watershed once annually.

3.1.2.1 Wet Weather Events

Storm events will be considered viable for mobilization if they are predicted to produce at least 0.1 inch of rainfall in the drainage area. Storm forecasts can be obtained from the National Weather Service website (http://www.wrh.noaa.gov/sgx/) or an equivalent source.

3.1.3 Field Observations

During each wet weather monitoring event, narrative descriptions and field observations will be recorded at each wet weather storm drain outfall discharge monitoring station. Narrative descriptions and observations include:

- Station location
- Date and duration of the storm event(s) sampled
- Rainfall estimates of the storm event
- Duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event

Flow estimation or measurement will be performed as described in Attachment B, using data from nearby United States Geological Survey (USGS) gauging stations, or flow rates may be measured or estimated in accordance with the United States Environmental Protection Agency (USEPA) Storm Water Sampling Guidance Document (EPA-833-B-92-001), Attachment B, or other method proposed by the Copermittees that is acceptable to the Regional Board.

3.1.4 FIELD MONITORING

During each wet weather monitoring event, *in-situ* measurements for field monitoring parameters will be collected at each of the selected outfall sites. Field monitoring parameters include:

- pH
- Temperature
- Specific conductivity
- Dissolved oxygen
- Turbidity

Field monitoring will be documented on the field observation form. A list of field monitoring parameters and corresponding target reporting limits for field monitoring parameters is provided in Attachment A.

3.1.5 ANALYTICAL MONITORING

3.1.5.1 SAMPLE COLLECTION

Samples will be collected as follows:

- Consistent sample collection methods will be employed for regional comparability of data, unless site-specific conditions indicate the need for alternate methods;
- Grab samples will be collected for the analytes not amenable to composite sampling. These include pH, temperature, specific conductivity, dissolved oxygen, turbidity, and indicator bacteria;
- For all other constituents, composite samples will be collected for a duration adequate to be representative of changes in pollutant concentrations and runoff flows using one of the following techniques:
    - Time-weighted composites collected over the length of the storm event or the first 24 hour period whichever is shorter, composed of discrete samples, which may be collected through the use of automated equipment, or
    - Flow-weighted composites collected over the length of the storm event or a typical 24 hour period, whichever is shorter, which may be collected through the use of automated equipment, or
    - If automated compositing is not feasible, a composite sample may be collected using a minimum of 4 grab samples, collected during the first 24 hours of the stormwater discharge, or for the entire stormwater discharge if the storm event is less than 24 hours; and

All samples will be collected, transported, processed and analyzed in accordance with SWAMP protocols.

3.1.5.2 LABORATORY ANALYSIS

The required analyses are based upon the following four groupings of constituents:

1) Constituents contributing to the highest priority water quality conditions identified in the San Luis Rey River Watershed WQIP

2) Constituents listed as a cause for impairment of receiving waters in the San Luis Rey River Watershed as listed on the 303(d) list
3) Constituents for implementation plans or load reduction plans (e.g., Bacteria Load Reduction Plans, Comprehensive Load Reduction Plans) developed for the San Luis Rey River Watershed where the Copermittees are listed as responsible parties under a TMDL
4) Applicable stormwater action level (SAL) constituents listed in Provision C.2 of the Permit.

Attachment A details the analyses required for wet weather storm drain outfall monitoring, including corresponding target reporting limits and suggested analytical methods. Equivalent analytical methods may be substituted for those listed in Attachment A. Analytes that are field measured are not required to be analyzed by a laboratory. Per Provision 2.i.(3)in Attachment B of the Permit, all chemical and bacterial analysis of samples will be performed by laboratory(ies) certified for such analyses by the California Department of Public Health or laboratory(ies) approved by the San Diego Water Board.. All sampling, analysis and quality assurance/quality control will be conducted in accordance with the Quality Assurance Management Plan (QAMP) for the State of California's SWAMP, adopted by the State Water Board.

4 STORM DRAIN OUTFALL ASSESSMENT AND REPORTING

Each Copermittee must evaluate dry and wet weather storm drain data collected pursuant Permit Provisions D.2.b and D.2.c as outlined in Provision D.4.b. Assessments required for the WQIP Annual Reports are presented in Section 4.1. Assessments required for inclusion in the Report of Waste Discharge (ROWD) in Section 4.2.4.

4.1 WQIP Annual Report Assessments

The storm drain outfall discharge assessments include evaluating both the dry weather monitoring data associated with the IDDE program collected as part of the Jurisdictional Runoff Management Program (JRMP) and wet and dry weather storm drain outfall monitoring data collected by the Copermittees as described in Sections 2 and 3 above. Details of the wet and dry weather storm drain outfall assessments are provided below. Each San Luis Rey River Watershed Copermittee will report the results in the San Luis Rey River Watershed WQIP Annual Report.

4.1.1 Dry Weather STORM DRAIN Outfall Assessments and Illicit Discharges

Each Copermittee must assess and report the progress of its IDDE program (required pursuant to Permit Provision E.2) toward effectively prohibiting non-stormwater and illicit discharges into the storm drains within its jurisdiction. Additionally, each Copermittee will assess its dry weather storm drain outfall monitoring data and provide results annually for inclusion in the San Luis Rey River Watershed WQIP Annual Report. The following dry weather storm drain outfall assessments are required per Provision D.4.b.(1) of the Permit (a summary of the assessments is provided in Table 4-1).

- Identify sources of non-stormwater discharges.
    - Identify the known and suspected controllable sources (e.g., facilities, areas, land uses, and pollutant generating activities) of transient and persistent flows within each Copermittee's jurisdiction in the San Luis Rey River Watershed.
    - Identify sources of transient and persistent flows within each Copermittee's jurisdiction in the San Luis Rey River Watershed that have been reduced or eliminated.
    - Identify modifications of the field screening monitoring locations and frequencies for the storm drain outfalls in each Copermittee's inventory necessary to identify and eliminate sources of persistent flow non-stormwater discharges (Provision D.2.b).
    - The JRMP Annual Report will be used to guide this assessment in the WQIP Annual Report. Known and suspected sources will be identified during the implementation of JRMP activities. These activities include the facility inspections that complement the IDDE program and information gathered by the stormwater hotline or other public complaints. The JRMP Annual Report now consists of a one-page form that summarizes the JRMP activities in Attachment D of the Permit, along with supporting information. Section IV of the JRMP Annual Report Form summarizes the findings of the IDDE Program. The back-up that will be provided along with the form may include the following information to help identify sources:
        - Identify the subwatershed of the source or complaint

    - Identify the potential receiving water of the source or complaint
    - Identify the potential pollutant or pollutant category that could be contributed by the source or complaint

- Rank and prioritize non-stormwater discharges.
  - Based on the data collected and applicable numeric action levels described in San Luis Rey River Watershed WQIP, the Copermittees must rank the persistently flowing major outfalls in their jurisdictions according to the potential threat to receiving water quality and produce a prioritized list of major storm drain outfalls. The WQIP will be updated annually on the basis of these findings and with the goal of implementing (in the order of the ranked priority list) targeted programmatic actions and source investigations to eliminate persistent non-stormwater discharges and/or pollutant loads. The list will be reprioritized according to one or more of the following criteria (Provision D.2.b.(2)(b)(ii)):
    - The non-stormwater discharges have been effectively eliminated (i.e., there is no flowing, pooled, or ponded water) for three consecutive dry weather monitoring events.
    - The sources of the persistent flows have been identified as a category of non-stormwater discharges that do not require an NPDES permit and do not have to be addressed as an illicit discharge because they were not identified as sources of pollutants (i.e., the constituents in the non-stormwater discharge do not exceed numeric action level) and the persistent flow can be reprioritized to a lower priority.
    - The constituents in the persistent flow non-stormwater discharge do not exceed NALs (Provision C.1).
    - The source(s) of the persistent flows has (have) been identified as a non-stormwater discharge authorized by a separate NPDES permit.
  - Where these criteria have not been met but the threat to water quality has been reduced by the Copermittee, the highest priority persistent flow storm drain outfall monitoring stations may be reprioritized accordingly for continued dry weather storm drain outfall discharge field screening monitoring as part of the Dry Weather Storm Drain Outfall Discharge Field Screening Program.
  - Each Copermittee must document removal or reprioritization of the highest priority persistent flow storm drain outfall monitoring stations identified under the Non-Stormwater Persistent Flow Storm Drain Outfall Discharge Monitoring Program in the WQIP Annual Report. When a Copermittee removes a persistent flow storm drain outfall monitoring station, it will be replaced with the next highest prioritized major storm drain outfall designated by that jurisdiction in the San Luis Rey River Watershed. If there are no remaining qualifying major storm drain outfalls within its jurisdiction, the number of major storm drain outfalls monitored will be reduced.
- Identify sources contributing to NAL exceedances.
  - For the highest priority major storm drain outfalls with persistent flows that exceed NALs (Provision C1.), each Copermittee must identify the known and suspected sources within its jurisdiction in the San Luis Rey River Watershed that may cause or contribute to the numeric action limit exceedances and report them annually.
- Estimate volumes and loads of non-stormwater discharges.

- Annually, each Copermittee must (1) analyze the data collected as part of the Non-Stormwater Persistent Flow storm drain Outfall Discharge Monitoring Program from the highest priority major storm drain outfalls, and (2) use a model or another method to calculate or estimate and report the non-stormwater volumes and pollutant loads collectively discharged from all the major storm drains outfalls in its jurisdiction that have persistent dry weather flows during the monitoring year. These calculations or estimates must include:
  - The percent contribution from each known source for each storm drain outfall
  - The annual non-stormwater volumes and pollutant loads collectively discharged from the Copermittee's major storm drain outfalls to receiving waters within the Copermittee's jurisdiction
  - The annual volumes and pollutant loads for sources of non-stormwater not subject to the Copermittee's legal authority that are discharged from the Copermittee's major storm drain outfalls to downstream receiving waters

Table 4-1. Annual Dry Weather Storm Drain Outfall Assessments

<table>
<tr><th>Assessment</th><th>Components</th><th>Reporting</th></tr>
<tr><td>Identify known and suspected controllable sources</td><td>Identify known and suspected controllable sources (e.g., facilities, areas, land uses, pollutant generating activities) of transient and persistent flows</td><td rowspan="8">Provide annually in WQIP Annual Report</td></tr>
<tr><td>Identify sources that have been reduced or eliminated</td><td>Identify sources of transient and persistent flows that have been reduced or eliminated</td></tr>
<tr><td>Identify necessary modifications to monitoring locations and frequencies</td><td>Identify necessary modifications to monitoring locations and frequencies necessary to identify and eliminate sources of persistent flows</td></tr>
<tr><td rowspan="2">Rank and prioritize non-stormwater discharges</td><td>Rank persistently flowing outfalls according to potential threat to receiving water quality</td></tr>
<tr><td>Produce/update prioritized list of outfalls</td></tr>
<tr><td>Identify sources contributing to NAL exceedances</td><td>Identify known and suspected sources that may cause or contribute to exceedances</td></tr>
<tr><td rowspan="2">Estimate volumes and loads of non-stormwater discharges</td><td>Analyze data collected as part of the Permit-required dry weather outfall monitoring</td></tr>
<tr><td>Use a model or other method to calculate and estimate collective persistent non-stormwater discharge volumes and pollutant loads. Specific calculations/estimates include:
1) Annual non-stormwater volumes and loads discharged from the Copermittee's major storm drain outfalls to receiving waters within its jurisdiction, with an estimate of the percent contribution from each known source for each storm drain outfall
2) Annual identification and quantification (by volume and pollutant load) of sources of discharged non-stormwater not subject to the Copermittee's legal authority</td></tr>
<tr><td rowspan="3">Evaluate progress in achieving non-stormwater volume and load reductions</td><td>Identify reductions and progress in achieving reductions</td><td rowspan="3">Provide at minimum once during Permit cycle in WQIP Annual Report</td></tr>
<tr><td>Assess the effectiveness of WQIP improvement strategies, with estimates of volume and load reductions attributed to specific strategies when possible</td></tr>
<tr><td>Identify modifications necessary to increase the effectiveness of WQIP strategies</td></tr>
<tr><td>Identify data gaps</td><td>Identify data gaps in the monitoring data necessary to fulfill assessment requirements</td><td>Provide annually in WQIP Annual Report</td></tr>
</table>

4.1.2 *Wet Weather Outfall Assessments*

According to the Permit Provision D.4.b.(2), the Copermittees must assess and report the progress of the water quality improvement strategies implemented as part of the WQIP and the JRMP toward reducing pollutants in stormwater discharges from the storm drains. This is designated as the Wet Weather Storm Drain Outfall Discharge Monitoring Program. The assessment of this program will contain the elements provided below and summarized in Table 4-2.

The elements for assessment of this program include the following:

- Estimate volumes and loads of stormwater discharges.
    - Analyze data collected as part of the Wet Weather storm drain Outfall Discharge Monitoring Program. For each monitoring year, calculate or estimate the following:
        - The average stormwater runoff coefficient for each land use type within the San Luis Rey River Watershed.
        - For storm events with measurable rainfall greater than 0.1 inch, the volume of stormwater and pollutant loads discharged from the monitored storm drain outfalls to receiving waters within the San Luis Rey River Watershed.
        - The total flow volume and pollutant loadings discharged from each Copermittee's jurisdiction within the San Luis Rey River Watershed over the course of the wet season, extrapolated from the data produced from the monitored storm drain outfalls.
        - For storm events with measurable rainfall greater than 0.1 inch, the percent contribution of stormwater volumes and pollutant loads discharged from the land use type within (1) each hydrologic subarea with a major storm drain outfall to receiving waters or (2) each major storm drain outfall to receiving waters.
- Evaluate WQIP analysis.
    - The Copermittees will evaluate the WQIP analysis on the basis of the wet weather storm drain outfall monitoring data collected and the applicable stormwater numeric action levels (Provision C.2). This evaluation will include analyzing and comparing the monitoring data collected as part of the wet weather storm drain outfall monitoring program to the analysis and assumptions used to develop the WQIP. This will include the water quality improvement strategies developed pursuant Provision B.3 of the Permit. Additionally, the Copermittees will evaluate whether those analyses and assumptions should be updated as a component of the adaptive management described in the WQIP.

Table 4-2. Annual Wet Weather Storm Drain Outfall Assessments

Assessment	Component	Reporting
Estimate loads and volumes	Calculate or estimate the average stormwater runoff coefficient for each land use type	Provide annually in WQIP Annual Report
	Calculate or estimate the volume of stormwater and pollutant loads discharged from each monitored storm drain outfall for each qualifying storm event	
	Calculate or estimate the total volume and pollutant load discharged from the Copermittee's jurisdiction over the course of the wet season	
	Calculate or estimate the percent contribution of stormwater volumes and pollutant loads discharged from each land use type within each hydrologic subarea with a major storm drain outfall or each major storm drain outfall for each qualifying storm event	
Evaluate WQIP analysis	Using data and applicable SALs, evaluate and compare data collected to the analyses and assumptions used to develop the WQIP	
	Evaluate whether analyses and assumptions should be updated as a component of the adaptive management efforts	
Evaluate progress in achieving stormwater pollutant reductions	Identify reductions and progress in achieving reductions from different land uses and/or drainage areas	Provide minimum once during Permit cycle in WQIP Annual Report
	Assess the effectiveness of WQIP improvement strategies, with estimates of volume and load reductions attributed to specific strategies when possible.	
	Identify modifications necessary to increase the effectiveness of WQIP strategies	
Identify data gaps	Identify data gaps in the monitoring data necessary to fulfill assessment requirements	Provide annually in WQIP Annual Report

4.2 *Report of Waste Discharge Once Per Permit Cycle Assessments*

4.2.1 *Dry Weather STORM DRAIN Outfall Assessments*

Progress in achieving non-stormwater volume and load reductions will be assessed based on the data collected under the dry weather storm drain outfall monitoring program and annual assessments at least once per Permit cycle as follows:

- Identify reductions and progress in achieving reductions in non-stormwater and illicit discharges to each Copermittee's storm drain system.

- Evaluate the effectiveness of the water quality improvement strategies being implemented toward reducing or eliminating non-stormwater and pollutant loads discharging from each Copermittee's storm drain to receiving waters, with an estimate of the volume and/or pollutant load reductions attributable to specific strategies, if possible.
- Identify modifications necessary to increase the effectiveness of the WQIP strategies being implemented toward reducing or eliminating non-stormwater and pollutant loads discharging from the storm drain to receiving waters.

4.2.2 Wet Weather STORM DRAIN Outfall Assessments

Progress in achieving stormwater pollutant reductions will be assessed based on the data collected under the wet weather storm drain outfall monitoring program and annual assessments at least once per Permit cycle as follows:

- Identify reductions and progress in achieving reductions in stormwater discharges to the Copermittee's storm drain system from different land uses and/or drainage areas
- Evaluate the effectiveness of the water quality improvement strategies being implemented toward reducing pollutants in stormwater discharging from the Copermittee's storm drain to receiving waters, with an estimate of the pollutant load reductions attributable to specific strategies, if possible
- Identify modifications necessary to increase the effectiveness of the WQIP strategies being implemented toward reducing pollutants discharging from the storm drain to receiving waters.

4.3 Data Management and Reporting

Data sharing templates have been developed to support reporting under previous Permit cycles. Copermittees may leverage existing data sharing templates in order to facilitate compilation of Watershed-wide datasets for assessment and reporting purposes. Data compiled should be CEDEN-compatible and contain the following categories of information:

- General site description
- Visual observations
- Field measurements
- Laboratory data

5 REFERENCES

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Regional Water Quality Control Board, San Diego (Regional Board). 2007. Resolution No. R9-2007-0001, Waste Discharge Requirements for Discharges Of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining The Watersheds Of The County Of San Diego, The Incorporated Cities Of San Diego County, The San Diego Unified Port District, And The San Diego County Regional Airport Authority.

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Regional Board. 2013. Resolution No. R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the MS4s Draining the Watershed in the San Diego Region (Permit). May 14.

San Diego County Regional Copermittees, 2014. 2013-2014 and 2014-2014 Transitional Wet Weather MS4 Outfall Discharge Monitoring Work Plan. Prepared by Weston Solutions. October.

State Water Resources Control Board (SWRCB). 2010. 2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report). Available online at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml Accessed on May 30th, 2014.

COUNTY OF SAN DIEGO
WATERSHED PROTECTION PROGRAM

DEPARTMENT OF PUBLIC WORKS
5510 OVERLAND AVE., SUITE 410
SAN DIEGO, CA 92123

SAMPLE

MS4 Outfall Visual Observation Field Datasheet

New Site? ☐ Yes ☐ No ☐ **Source Investigation Follow-up for**____________________

General Site Description

Site ID				**Site Type**		**Sample Event ID**	
Location						**Sample Event Type**	
Date		**Time**		**Latitude**	° N (NAD83)	**HU**	
Staff		**TB Guide**		**Longitude**	° W (NAD83)	**HSA**	

Historical Outfall Dry Weather Flow Info: ☐ Unknown ☐ Persistent ☐ Transient ☐ Dry

Conveyance (Check one only) ☐ Concrete Channel ☐ Natural Creek ☐ Earthen Channel ☐ Manhole ☐ Outfall ☐ Other_____

Flow Status ☐ Flowing ☐ Ponded ☐ Tidal ☐ Dry

Flow Reaches Receiving Water? ☐ Yes ☐ No

Non-Stormwater Flow Source? ☐ Yes ☐ No ☐ Unknown

Evidence of Obvious IC/ID?* ☐ Odor ☐ Color ☐ High Flow

***Requires immediate follow-up**

Outfall Structural Condition
☐ Normal
☐ Damaged
☐ Scour Pond
☐ Blockage

Potential Source ☐ Ground Water ☐ Irrigation Runoff ☐ Permitted Discharge ☐ Vehicle Washing ☐ Power Washing ☐ Pool/Spa Discharge ☐ Water Line Break ☐ Unknown ☐ Tidal ☐ Other____

Was Flow Source Eliminated? ☐ Yes ☐ No

Notes:____

____

Weather ☐ Clear ☐ Partly Cloudy ☐ Overcast ☐ Fog
Last Rain ☐ > 72 hours ☐ < 72 hours but ≤ 0.1"
Tide ☐ N/A ☐ Low ☐ Incoming ☐ High ☐ Outgoing Tide Height______ft.

Observations

Odor	☐ None	☐ Sewage	☐ Sulfides	☐ Petroleum		☐ Manure	☐ Other
Color	☐ None	☐ Yellow	☐ Brown (Silty)	☐ White (Milky)		☐ Gray	☐ Other
Clarity	☐ Clear	☐ Cloudy(>4" vis)	☐ Murky(<4" vis)				☐ Other
Floatables	☐ None	☐ Trash	☐ Bubbles/Foam	☐ Sheen	☐ Algae	☐ Biofilm	☐ Other
Deposit	☐ None	☐ Coarse Particulate	☐ Fine Particulate	☐ Stains/Minerals		☐ Oily Deposit	☐ Other
Vegetation	☐ None	☐ Limited	☐ Normal	☐ Excessive			☐ Other
Biology	☐ None	☐ Insects	☐ Algae ☐ Snails	☐ Fish	☐ Birds	☐ Cray Fish	☐ Other

MS4 Outfall Flow Estimate

Width	ft
Depth	ft
Velocity	ft/sec
Length of Ponded Area	ft

Flowing Pipe Diameter _______ft. Depth________ft. Velocity_______ft/sec
Bottle Fill Volume_______ml Time to Fill________seconds
Leaf Float Distance__________ft. Time___________seconds

Estimated Flow Rate ___________ ☐ cfs ☐ gpm

Trash Present? ☐ Yes ☐ No **Trash Assessment** ☐ High (>400 pieces) ☐ Medium (50 to 400 pieces) ☐ Low (<50 pieces)
Evidence of Illegal Dumping ☐ Yes ☐ No **Evidence of Illegal Connection** ☐ Yes ☐ No
Accessibility ☐ Easy ☐ Moderate ☐ Difficult ☐ Critical Habitat

Comments:____

COUNTY OF SAN DIEGO
WATERSHED PROTECTION PROGRAM

DEPARTMENT OF PUBLIC WORKS
5510 OVERLAND AVE., SUITE 410
SAN DIEGO, CA 92123

Site Type: VOM (Visual Outfall Monitoring) – For sites that are within the visual outfall monitoring program.
A, B, C, D… (Source Investigation) – For locations that are aimed at source follow-up investigations.

Sample Event Type: Visual Observation
Confirmation
Source Investigation
Duplicate
Blank
Lab Standard

Watersheds

Hydro. Unit	Watershed
902	Santa Margarita River
903	San Luis Rey River
904	Carlsbad Management Area
905	San Dieguito River
906	Los Penasquitos
907	San Diego River
908	Pueblo San Diego
909	Sweetwater River
910	Otay River
911	Tijuana River

COUNTY OF SAN DIEGO
WATERSHED PROTECTION PROGRAM

DEPARTMENT OF PUBLIC WORKS
5510 OVERLAND AVE., SUITE 410
SAN DIEGO, CA 92123

SAMPLE

MS4 Outfall Inventory Field Datasheet

GENERAL SITE DESCRIPTION

New Site? ☐ Yes ☐ No

Site ID				**Site Type**		**Sample Event ID**	
Location						**Sample Event Type**	
Date		**Time**		**Latitude**	° N (NAD83)	**HU**	
Staff		**TB Guide**		**Longitude**	° W (NAD83)	**HSA**	
Outfall Drainage Area			**Acres**				

Accessibility ☐ Easy ☐ Moderate ☐ Difficult ☐ Critical Habitat
☐ Barbed wire fence ☐ Other fence ☐ County Gate ☐ Steep hillside ☐ Behind house/building ☐ Under bridge ☐ Other______________

Historical Outfall Dry Weather Flow Info: ☐ Unknown ☐ Persistent ☐ Transient ☐ Dry

OUTFALL DESCRIPTION

OUTFALL	MATERIAL	SHAPE		DIMENSIONS	SUBMERGED
☐ **Closed Pipe**	☐ RCP ☐ CMP ☐ PVC ☐ CPP ☐ Steel ☐ HDPE ☐ Other ______________	☐ Circular ☐ Elliptical ☐ Box ☐ Other ________	☐ Single ☐ Double ☐ Triple ☐ Other ________	Diameter: __________inches Dimensions:________inches by________________inches Diameter: (If different sized outfalls)___________inches	In water: ☐ No ☐ Partially ☐ Fully With sediment: ☐ No ☐ Partially ☐ Fully
☐ **Open Channel**	☐ Concrete ☐ Earthen ☐ Rip-rap ☐ Other: _____________	☐ Trapezoid ☐ Parabolic ☐ Other ______________		Depth: _____________feet Top width: __________feet Bottom width: _______feet	
☐ **Man Hole access (only if outfall is not accessible)**	☐ RCP ☐ Other ______________	☐ Circular ☐ Elliptical ☐ Box ☐ Other ______________		Diameter/Dimensions: _______________feet by_____________feet	In water: ☐ No ☐ Partially ☐ Fully With sediment: ☐ No ☐ Partially ☐ Fully
Upstream Conveyance	☐ Natural Creek ☐ Concrete Channel ☐ Earthen Channel ☐ County MS4 pipe ☐ Private pipe (i.e. French drain, irrigation pipe, unknown pipe) ☐ Street Inlet ☐ Street drainage channel ☐ Gutters ☐ Curb drains ☐ Other _______________				
Flow Status	☐ Flowing ☐ Ponded/Pooled ☐ Dry	**Flow Description** ☐ Trickle ☐ Moderate ☐ Substantial			
Does Flow Reaches Receiving Water?	☐ Yes ☐ No ☐ Unknown				
If no flow, indication of intermittent flows?	☐ None ☐ Minor ☐ Medium ☐ Significant Describe ________________________________				
Flows Adjacent to Outfall (If present)	☐ Seepage ☐ Drain pipes ☐ Irrigation drainage ☐ Overland flow ☐ Other__________________ Describe________________________________				
Outfall Condition	☐ Good ☐ Spalling, cracked, or chipped ☐ Heavily damaged ☐ Corrosion (i.e. rust) ☐ Other___________ ☐ Blockage, if so what %___________ and with what? ☐ Vegetation ☐ Sediment ☐ Rock ☐ Other___________ ☐ Refer for Cleaning				
Deposits/Stains	☐ Oily ☐ Flow line ☐ Minerals ☐ Paint ☐ Sediment ☐ Organics (i.e. algae) ☐ Other________________				
Vegetation around outfall	☐ Normal ☐ Limited ☐ Excessive ☐ Poison Oak ☐ Stinging Nettle ☐ Other______________				

Comments: ____

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ATTACHMENT A
FIELD OBSERVATION FORMS

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ATTACHMENT B
FLOW MONITORING AND EQUIPMENT CALIBRATION PROCEDURES

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B Flow Monitoring and Equipment Calibration Procedures

This attachment describes potential methodologies and equipment that may be used to complete flow monitoring and field measurements for the Storm Drain Outfall Monitoring Program, as well as the installation and maintenance procedures.

Flow estimation and water quality sampling are dynamic processes which may require modification based on current site and channel conditions. Thus, the methodologies presented are subject to modification or substitution in order to meet the requirements of this monitoring program.

B.1 Flow Monitoring

B.1.1 Dry Weather Storm Drain Outfall Flow Monitoring

B.1.1.1 Field-Based Flow Estimation

During non-stormwater screening and storm drain outfall monitoring, flow will be estimated visually and/or manually using one of the methodologies detailed in Section 3.2.2 of the National Pollutant Discharge Elimination System (NPDES) Storm Water Sampling Guidance Document (EPA-833-B-92-001; United States Environmental Protection Agency (USEPA), 1992). These methodologies include, but are not limited to the “float method” and the “bucket and stopwatch method”.

B.1.1.2 Equipment-Based Flow Estimation

Copermittees may choose to perform optional equipment-based flow monitoring of non-stormwater persistent flows. Equipment-based flow estimation procedures are described in Section B.1.2.1.

B.1.2 Wet Weather Storm Drain Outfall Flow Monitoring

Per the San Diego County Copermittees’ (SDCRC) Transitional Wet Weather MS4 Outfall Discharge Monitoring Work Plan, flow monitoring may be conducted as described herein (SDCRC, 2014). During wet weather storm drain outfall monitoring, the flow rates and volumes will be measured or estimated from the storm drain outfalls. Flow rates will be measured or estimated in accordance with the NPDES Storm Water Sampling Guidance Document Section 3.2.1 (USEPA, 1992), or by another method proposed by the Copermittees that is acceptable to the San Diego RWQCB. Flow monitoring may need to be adapted specifically for tidally influenced sites.

B.1.2.1 Equipment-Based Flow Estimation

Flow hydrograph and volume estimations will be captured utilizing estimated flow rates in accordance with the Section 3.2.1 of the USEPA document NPDES Storm Water Sampling Guidance Document (USEPA, 1992).

Measurement devices, sensor types, and equipment program settings will be selected on a site specific basis using best professional judgment. Due to flood control concerns typically associated with storm drain outfalls during storm events especially, a primary measurement device such as a weir or flume is unlikely to be selected. Thus, a lower profile secondary flow measurement device, such as an area-velocity senor or bubbler pressure transducer, is recommended for flow estimation from storm drain outfalls.

Flow will be monitored at each site to determine the volume of runoff. Flow may be estimated with a Sigma 920 Flow Meter (or similar type device) with an area velocity sensor and pressure transducer (Figure B-1). An area velocity sensor measures water level and velocity. Flow will be calculated based on the cross sectional area of the pipe, level of water, slope, and velocity. Flow may also be estimated using a HOBO level logger (or similar type device) (Figure B-2). The HOBO level logger is a pressure transducer only, and the flow will be estimated based on the area of the pipe, level of water, and slope.

Field teams will mount equipment securely using best professional judgment. Sampler tubing and wiring will be routed through conduits that will be placed between the monitoring locations and the sampling equipment or enclosures. Above-ground instruments will be protected within a site equipment enclosure. Depending on site configuration, enclosures may be semi-permanent (installed before monitoring begins and removed only when the monitoring program ends) or temporary. Exposed conduit, intakes, and sensors will be securely fastened using stainless steel brackets, screws, and anchors (Figure B-3).

Figure B-1. Sigma 910 Flowmeter and Area/Velocity Pressure Sensor

Figure B-2. HOBO Level Logger

Figure B-3. Example of Sensor Installation

The flow meter may be connected to an automated sampler through a 4-20 milliampere (mA) range output. In this configuration, the flow meter provides a method to control or pace the sampler, and store sampling data and other auxiliary data. The flow meter may measure and log estimated flow, rainfall, and sample history.

At each site, the pipe diameter and slope will be measured and recorded. Level and flow measurements will be logged at minimum 5-minute intervals for the duration of the monitoring event when using continuous logging devices. Data downloads will occur after the monitoring event is complete. Due to the velocities and potential for debris to be carried by storm flows, it is possible that the flow sensor may be damaged during storm flows. Damage to a flow sensor may result in a data gap of actual recorded flows. In this event, flows from the respective drainage area will be modeled for any data gaps based on the drainage area and impervious cover.

B.1.2.1.1 Data Downloads and Storage

All recorded flow data downloaded to a field computer will be immediately copied to a main office data server. The server will be backed up daily in accordance with standard server practices. Data will also be copied to project folders for QA review and approval prior to moving to the project file.

B.2 Equipment Calibration

B.2.1 Field Meter Calibration

Calibration of all field meters will be conducted immediately prior to deployment or use. Water quality probes will be calibrated with specified calibration solutions, and it will be verified that the solution expiration date has not been exceeded. All calibrations will be conducted in accordance with the manufacturer's specifications.

B.2.2 Flow Equipment Calibration

Calibration of flow equipment will be conducted immediately prior to deployment or use using the procedures described in the corresponding operations and maintenance manual.

All level logging equipment will be calibrated on-site and field verified for accuracy with a level measurement tape.

B.2.3 AUTOSAMPLER CALIBRATION

Calibration of autosampling equipment will be conducted immediately prior to deployment or use using the procedures described in the corresponding operations and maintenance manual.

All autosampling equipment will be calibrated on-site and field verified for aliquot collection accuracy using a graduated flask or beaker.

B.3 REFERENCES

San Diego County Regional Copermittees, 2014. 2013-2014 and 2014-2014 Transitional Wet Weather MS4 Outfall Discharge Monitoring Work Plan. Prepared by Weston Solutions. October.

United States Environmental Protection Agency (USEPA). 1992. NPDES Storm Water Sampling Guidance Document Storm Water Sampling Guidance Document (EPA-833-B-92-001). July, 1992. Available online at: http://www.epa.gov/npdes/pubs/owm0093.pdf.

ATTACHMENT C
CHAIN-OF-CUSTODY FORM

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ATTACHMENT D
LIST OF ANALYTES, SUGGESTED METHODS, AND TARGET REPORTING LIMITS

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Storm Drain Outfall Monitoring Analyte List

Analyte	Suggested Analytical Method*	Target Reporting Limit	Dry Weather MS4 Outfall Monitoring	Wet Weather MS4 Outfall Monitoring
Conventional Parameters				
Chloride	USEPA 300.0	0.5	X[4]	X[4]
Dissolved Oxygen	Meter	0.01	X[1,2,6C]	X[1,2,9]
pH	Meter	0.01	X[1,2,6B,6C]	X[1,2,9]
Specific Conductivity	Meter	1	X[1,2]	X[1,2,9]
Temperature	Meter	0.1	X[1,2]	X[1,2,9]
Total Hardness	SM 2340B	0.662	X[7]	X[9]
Turbidity	Meter	0.1	X[1,2,6B,6C]	X[1,2,8,9]
Indicator Bacteria				
Enterococcus	SM 9230C	20	X[3,4,5,6A,6B,6C,7]	X[3,4,5,9]
Fecal Coliform	SM 9221E	20	X[3,4,5,6A,6B,6C,7]	X[3,4,5,9]
Fecal Coliform	SM 9221B	20	X[3,4,5,6A,7]	X[3,4,5,9]
Inorganic Analytes				
Cadmium (Dissolved)	USEPA 200.8	0.0001	X[6B,6C,7]	-
Cadmium (Total)	USEPA 200.8	0.0001	X[6B,6C,7]	X[8]
Chromium III (Dissolved)	Calculated from Chromium and Chromium VI	NA	X[6B,6C]	-
Chromium III (Total)	Calculated from Chromium and Chromium VI	NA	X[6B,6C]	-
Chromium VI (Dissolved)	USEPA 218.6	0.0003	X[6B,6C]	-

Storm Drain Outfall Monitoring Analyte List (Continued)

Analyte	Suggested Analytical Method*	Target Reporting Limit	Dry Weather MS4 Outfall Monitoring	Wet Weather MS4 Outfall Monitoring
Chromium VI (Total)	USEPA 218.6	0.0003	X[6B,6C]	-
Chromium (Dissolved)	USEPA 200.8	0.0002	X[6B,6C,12]	-
Chromium (Total)	USEPA 200.8	0.0002	X[6B,6C,12]	-
Copper (Dissolved)	USEPA 200.8	0.0005	X[6B,6C,7]	-
Copper (Total)	USEPA 200.8	0.0005	X[6B,6C,7]	X[8]
Iron (Dissolved)	USEPA 200.7	0.01	X[6C]	-
Iron (Total)	USEPA 200.7	0.01	X[6C]	-
Lead (Dissolved)	USEPA 200.8	0.0002	X[6B,6C,7]	-
Lead (Total)	USEPA 200.8	0.0002	X[6B,6C,7]	X[8]
Manganese (Dissolved)	USEPA 200.8	0.0002	X[6C]	-
Manganese (Total)	USEPA 200.8	0.0002	X[6C]	-
Nickel (Dissolved)	USEPA 200.8	0.0008	X[6B,6C]	-
Nickel (Total)	USEPA 200.8	0.0008	X[6B,6C]	-
Selenium (Dissolved)	USEPA 200.8	0.0002	X[4]	X[4]
Selenium (Total)	USEPA 200.8	0.0002	X[4]	X[4]
Silver (Dissolved)	USEPA 200.8	0.0002	X[6B,6C]	-
Silver (Total)	USEPA 200.8	0.0002	X[6B,6C]	-
Zinc (Dissolved)	USEPA 200.8	0.005	X[6B,6C,7]	-
Zinc (Total)	USEPA 200.8	0.005	X[6B,6C,7]	X[8]
Nutrients				
Ammonia	USEPA 350.1	0.1	X[4,7]	X[4]

Storm Drain Outfall Monitoring Analyte List (Continued)

Analyte	Suggested Analytical Method*	Target Reporting Limit	Dry Weather MS4 Outfall Monitoring	Wet Weather MS4 Outfall Monitoring
Dissolved Phosphorus	USEPA 365.1	0.002	X[4]	X[4]
Nitrate	USEPA 353.2	0.1	X[4,7,10]	X[4,8,11]
Nitrite	USEPA 353.2	0.1	X[4,7,10]	X[4,8,11]
Orthophosphate	USEPA 365.1	0.002	X[4,7]	X[4]
TKN	USEPA 351.2	0.1	X[4,7]	X[4]
Total Nitrogen	Calculated from TKN, Nitrate, and Nitrite	NA	X[4,5,6C]	X[4,5]
Total Phosphorus	USEPA 365.1	0.01	X[4,5,6C,7]	X[4,5,8]
Solid Parameters				
TDS	SM 2540C	10	X[4,7]	X[4]
TSS	SM 2540D	5	X[7]	-
Synthetic Organic Compounds				
MBAS	SM 5540C	0.05	X[6C]	-

NA = Not applicable; mL = milliliter; L = liter; D = day; H = hour; M = month

* The methods presented in the table are optional. Other equivalent EPA-approved methods may be substituted as long as the target reporting limits are met for the corresponding constituents

1. Parameter listed in Table D-2 of the Permit.
2. Analytes that are field measured are not required to be analyzed by a laboratory.
3. Parameter contributes to a highest priority water quality condition identified in the San Luis Rey River Watershed Water Quality Improvement Plan.
4. Parameter listed as a cause for impairment of receiving waters in the San Luis Rey River Watershed on the 303(d) list.
5. Parameter for CLRP developed for a TMDL in the San Luis Rey River Watershed.

6A. Parameter listed in NALs for discharges from storm drains to Ocean Surf Zone (Permit Provision C.1.a(1))

6B. Parameter listed in NALs for discharges from storm drains to Bays, Harbors, and Lagoons/Estuaries (Permit Provision C.1.a(2))

6C. Parameter listed in NALs for discharges from storm drains to Inland Surface Waters (Permit Provision C.1.a(3))

7. Parameter listed in Table D-7 of the Permit.
8. Parameter listed in SALs for discharges from storm drains to receiving waters (Table C-5 of the Permit).
9. Grab samples may be collected for pH, temperature, specific conductivity, dissolved oxygen, turbidity, hardness, and indicator bacteria.

Storm Drain Outfall Monitoring Analyte List (Continued)

10. Nitrite and nitrate may be combined and reported as nitrite+nitrate.
11. Nitrite and nitrite will be reported as nitrite+nitrate.
12. Analysis of Chromium in storm drain discharges is not explicitly required in the permit. Chromium is analyzed to calculate Chromium III.

ATTACHMENT E
SAMPLE COLLECTION PROCEDURES

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E. SAMPLE COLLECTION PROCEDURES

This attachment describes the sampling procedures for the Storm Drain Outfall Monitoring Program.

E.1 DRY WEATHER STORM DRAIN OUTFALL SAMPLE COLLECTION

For dry weather monitoring events, the Copermittees will collect and analyze grab samples from each dry weather storm drain outfall discharge monitoring station to satisfy the requirements of the Permit. Analytes that are field measured are not required to be analyzed by a laboratory.

E.2 WET WEATHER STORM DRAIN OUTFALL SAMPLE COLLECTION

Per the San Diego County Copermittees' (SDCRC) Transitional Wet Weather MS4 Outfall Discharge Monitoring Work Plan, prepared by Weston Solutions, wet weather samples may be collected as described herein (SDCRC, 2014). For wet weather monitoring events, the Copermittees will collect and analyze samples from each wet weather storm drain outfall discharge monitoring station to satisfy the following requirements in accordance with the Permit:

- Analytes that are field measured are not required to be analyzed by a laboratory;
- The Copermittees must implement consistent sample collection methods for regional comparability of data, unless site-specific conditions indicate the need for alternate methods;
- Grab samples may be collected for pH, temperature, specific conductivity, dissolved oxygen, turbidity, and indicator bacteria;
- For all other constituents, composite samples must be collected for a duration adequate to be representative of changes in pollutant concentrations and runoff flows using one of the following techniques:
    - Time-weighted composites collected over the length of the storm event or the first 24 hour period whichever is shorter, composed of discrete samples, which may be collected through the use of automated equipment, or
    - Flow-weighted composites collected over the length of the storm event or a typical 24 hour period, whichever is shorter, which may be collected through the use of automated equipment, or
    - If automated compositing is not feasible, a composite sample may be collected using a minimum of 4 grab samples, collected during the first 24 hours of the stormwater discharge, or for the entire stormwater discharge if the storm event is less than 24 hours; and
- Only one analysis of the composite of aliquots is required

To ensure the most consistent sample collection method for all sites, the Copermittees will collect a single time-weighted composite at each site. When unattended automated sampling is feasible, time-weighted composites will be collected over the length of the storm event or in the first 24 hour period, whichever is shorter, composed of discrete samples, which may be collected through the use of automated equipment set at the time intervals listed in Table E-1 based on the anticipated size of the storm.

Table E-1. Automated Sample Pacing for Time-Weighted Composites Per Storm Duration

Storm Duration (Hours)	Sample Aliquot Interval (Minutes)	Sample Volume (mL)	Total Sample Aliquots	Total Volume (mL)
2	10	800	12	9,600
4	10	800	24	19,200
6	10	400	36	14,400
8	10	400	48	19,200
12	10	400	72	28,800
16	20	400	48	19,200
20	20	400	60	24,000
24	20	400	72	28,800

mL = milliliter

When unattended automated sampling is not feasible (i.e., security or safety issues), a composite sample will be collected using a minimum of four grab samples, collected during the first 24 hours of the stormwater discharge, or for the entire stormwater discharge if the storm event is less than 24 hours at the time intervals listed in Table E-2 based on the anticipated size of the storm. Some variation may occur depending on the actual storm intensity and duration. After the storm event, the discrete samples will be composited into one time-weighted composite for chemistry analysis.

Table E-2. Grab Sample Pacing for Time-Weighted Composites Per Storm Duration

Storm Duration (Hours)	Sample Aliquot Interval (Minutes)	Sample Volume (mL)	Total Sample Aliquots	Total Volume (mL)
2	20	2,000	6	12,000
4	20	2,000	12	24,000
6	40	2,000	9	18,000
8	40	2,000	12	24,000
12	60	2,000	12	24,000
16	60	2,000	16	32,000
20	120	2,000	10	20,000
24	120	2,000	12	24,000

Automated samples for chemistry will be collected with a Sigma 900MAX autosampler (or similar type device). Teflon-lined tubing will be installed and secured at each monitoring location prior to the wet weather event. The autosampler will be deployed by the field team upon arrival at each site. Samples will be pumped with the autosampler into a clean glass bottle. The sample bottle will be appropriately labeled with the sample identifier (ID), date, and time, and will be preserved on ice for transport to the laboratory. After compositing, samples will be subsampled into the appropriate bottles for analysis. Grab samples will be collected using either the Sigma 900MAX autosampler or a sample bottle connected to a sample pole that will be used to collect the sample directly from the outfall location. Nitrile or latex gloves will be worn during sample handling.

Bacteria samples and field measurements will not be taken from the composite sample; therefore, a grab sample will be collected for bacteria and field measurements during elevated flows. The grab sample will be collected after the second hour of stormwater runoff and before the sixth hour of stormwater runoff. If the stormwater runoff is less than 2 hours, the grab sample will be collected as close to the peak of flow as possible.

Bacteria samples will be collected using sterile techniques. Nitrile or latex type gloves will be worn during sample handling. During the sampling event, a 100-milliliter (mL) sterile bacteria bottle will be secured to a sample pole that will be used to collect the sample directly from the outfall location. Care will be employed to not allow contact with area structures or the bottom sediments. The container will be opened only for the needed time to collect the sample and will then be closed immediately following sample collection. If it is suspected that the container was compromised at any times, the sample container will be discarded, and a new sample will be collected with a new sample bottle. The sample bottle must be filled only to the 100-mL mark on the bottle (not over topped or under filled).

Field parameters will include hydrogen ion concentration (pH), conductivity, temperature, dissolved oxygen (DO), and turbidity. Samples will be collected and the measurements will be made using a YSI Inc. 6600 series water quality probe or similar type device. Calibration of the instruments will be conducted in accordance with Attachment D.

A field observation data sheet will be completed (Attachment A) for each sample collected to be representative of site conditions during each sample collection. Chain-of-custody (COC) documentation (Section E.3) will be completed, and samples will be delivered to the respective laboratory to allow for all applicable analyte holding times.

E.3 Chain-of-Custody Procedures

Chain-of-custody (COC) procedures will be used for all samples throughout the collection, transport, and analytical process. A copy of a COC form is included in Attachment C. Samples will be considered to be in custody if they are: 1) in the custodian's possession or view, 2) retained in a secured place (under lock) with restricted access, or 3) placed in a container and secured with an official seal so that the sample cannot be reached without breaking the seal. The principal documents used to identify samples and to document possession will be COC records, field logbooks, and field tracking forms.

The COC procedures will be initiated during sample collection. A COC record will be provided with each sample or group of samples. Each person who had custody of the samples will sign the form and ensure that the samples were not left unattended unless properly secured. Documentation of sample handling and custody will include the following:

- Sample identifier.
- Sample collection date and time.

- Any special notations on sample characteristics or analysis.
- Initials of the person collecting the sample.
- Date the sample was sent to the analytical laboratory.
- Shipping company and waybill information.

Completed COC forms will be placed into a plastic envelope and kept inside the cooler containing the samples. Upon delivery to the analytical laboratory, the COC form will be signed by the person receiving the samples. COC records will be included in the final reports prepared by the analytical laboratories and will be considered an integral part of the laboratory report.

E.4 Health and Safety

Field sampling events have the potential for dangerous situations to arise. Field personnel need to be aware of safety hazards and take appropriate precautions. A health and safety tailgate meeting will be held prior to any on-site activity. During this meeting, site-specific hazards will be discussed and addressed appropriately. There are several health and safety issues that pertain to the proposed sampling and equipment installation within any areas.

E.4.1 Traffic Hazards and Traffic Control

Because this study is being conducted in residential areas, traffic control procedures must be employed. All traffic rules and regulations and all traffic control signs and devices should be obeyed. Field personnel should allow for extra time when planning travel routes. Vehicle traffic is a major concern during field monitoring activities. Traffic presents hazards when site workers are working close to roadways and the potential exists to be hit by oncoming traffic, and when driving to, from, and on the site. Driving during rain events also presents hazards as slick roadway conditions exist. It is recommended that safe speeds and distances be maintained to avoid rain-related accidents.

Whenever possible, field personnel should park as far off the road as possible to avoid interfering with any traffic flow and should comply with the following guidelines when working:

- Turn on the vehicle’s flashing yellow warning light and hazard lights.
- Put out safety cones to mark off the work area.
- Place yellow barricade around open manhole to clearly mark the area.
- Avoid steep slopes and stream banks.
- Always use a flashlight in the dark.
- Always wear bright orange and reflective safety vests to be more visible.

E.4.2 Confined Space

Several monitoring locations for this project are located in the underground storm drain conveyance system. To install, maintain, and uninstall monitoring equipment within the storm drain conveyance system, confined space entry will need to be performed. Confined spaces are defined as any space with only one entry and exit point; therefore, an outfall is considered a confined space. To perform confined space entry, project personnel must have confined space entry, attendant, and supervisor training, and must have their certificate card. Entering confined spaces presents many health and safety hazards if not performed properly. These hazards include asphyxiation, falls, burns, drowning, engulfment, toxic exposure, and electrocution. A confined space represents the potential for unusually high concentrations of contaminants, explosive atmospheres, limited visibility, physical injury, and restricted movement.

A five-gas meter will be used to monitor the atmosphere within the storm drain outfall prior to any personnel entering the system. If the outfall is unsafe for entry, field personnel may attempt to ventilate the space. If the outfall is still determined to be unsafe for entry, then no personnel will enter the outfall. Once the outfall has been determined to be safe for entry, the personnel may enter. A harness and retrieval system are used for personnel entering the system. When field personnel are in the outfall, continued air monitoring will occur to ensure that the atmosphere remains non-hazardous. Should air monitoring determine at any time that the air is becoming hazardous, field staff will immediately evacuate the confined space.

E.4.3 Weather Hazards

Installation and maintenance activities will be conducted during dry weather periods only. Though the San Diego region is generally mild during the fall season, the most likely safety issue related to weather is excessive heat. Extreme heat can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials. Standard precautions should be taken to mitigate heat exhaustion during field monitoring events.

Storm event monitoring will occur during wet weather. Wet weather conditions increase slipping and tripping hazards, braking distances of vehicles, and the potential for slippage or handling difficulties of field equipment. Rain fills holes and obscures trip-and-fall hazards. Tools and personnel can slip on wet surfaces. Rain and wet weather conditions may decrease visibility and increase the potential for driving accidents. Rain and high humidity may also limit the effectiveness of certain direct-reading instruments (e.g., photoionization detectors (PIDs)).

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ATTACHMENT F
QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

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F. QUALITY ASSURANCE / QUALITY CONTROL

F.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance (QA) and quality control (QC) for sampling processes will include proper collection of the samples to minimize the possibility of contamination. All samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample bottles. Field staff will wear powder-free nitrile gloves or a similar type of gloves at all times during sample collection.

Target measurement objectives for field quality control samples are provided in Table F-1

Table F-1. Field Quality Control Samples

Sample Type	Measurement Objective			Frequency of Analysis
	Field Duplicate	Field Blank	Equipment Blank	
Conventionals	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Indicator Bacteria	RPD<25%[(c)]	Negative Response	Negative Response	Per batch of samples submitted to the laboratory[b]
Metals	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Nutrients	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Solid Parameters	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Organics	Per method	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Toxicity	NA	NA	NA	NA

Notes:
RL = reporting limit.
RPD = relative percent difference.
a. NA if native concentration of either sample<RL.
b. For equipment blanks, the frequency is 10% of the cleaned material. Equipment blanks are only analyzed for TOC and total metals per Section F.1.5
c. Field duplicates are not a current SWAMP requirement for indicator bacteria. However, the collection and analysis of a field duplicate is recommended.

F.1.1 TRAINING

All sampling personnel will be trained according to field sampling standard operating procedures (SOPs). Additionally, the field staff will be made aware of the significance of the project's detection limits and the requirement to avoid contamination of samples at all times.

F.1.2 *Field Blank*

A field blank will be collected and analyzed to assess contamination from field-related conditions to ensure that positive bias of the sample has not been introduced, and to remain in compliance with the Surface Water Ambient Monitoring Program (SWAMP) protocols. One field blank will accompany each batch of samples submitted to the analytical laboratory.

F.1.3 *Field Duplicate*

A duplicate sample may be collected and analyzed to assess the variability in sampling and to remain in compliance with the SWAMP protocols. One field duplicate will accompany each batch of samples submitted to the analytical laboratory.

F.1.4 *Temperature Blank*

A temperature blank will be used to ensure that sample holding temperatures were maintained from sample collection through delivery to the laboratory.

F.1.5 *Equipment Blank*

The selected analytical laboratory Teflon-lined tubing, silicone pump tubing, silicone bottle stoppers, and stainless steel sample intake strainers. The following blank samples will be created for analysis:

- One blank sample representative of the cleaned silicone and Teflon-lined tubing. Blank water will be passed through at least 10% of cleaned tubing and be representative of both silicone and Teflon-lined tubing.
- One blank representing the bottles and stoppers. Blank water will be passed into/over at least 10% of cleaned bottles and stoppers.

The analytical laboratory will analyze the equipment blanks for total organic carbon and total metals at a minimum. The analytical laboratories will analyze blank water from the cleaned sampling equipment at the same detection level proposed for sample analysis; this will verify that the sampling equipment in contact with sample water is clean and is not a likely source of contamination.

If a blank sample produces an analyte detection above the RL, the equipment will be cleaned and blanked again. Cleaned and blanked sampling equipment will not be deployed for sampling until an acceptable blank analysis has occurred unless directed by the Copermittees.

F.1.6 *Inspection/Acceptance of Supplies and Consumables*

Sample bottles (provided by the laboratory) and collection equipment will be inspected prior to their use. Procured supplies will be examined for damage prior to use per Table F-2.

Field supplies will be stored at the sampling team's offices; laboratory supplies will be stored at the laboratory. Inspection and testing requirements for laboratory supplies are covered in the laboratory's QA/QC procedures.

Table F-2. Inspection/Acceptance Testing Requirements for Consumables and Supplies

Project-Related Supplies/ Consumables	Inspection/ Testing Specifications/ Source	Acceptance Criteria	Frequency	Responsible Party
Pre-cleaned sample bottles	Closed bottle	Lids screwed on bottles	100%	Sampling Team
Silicone tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Laboratory/Sampling Team
Teflon tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Laboratory/Sampling Team
Gloves	New box	New box	As needed	Sampling Team

F.2 Laboratory Quality Assurance/Quality Control

This section addresses QA/QC activities associated with laboratory analyses. Laboratory QA/QC samples provide information to assess potential laboratory contamination, analytical precision, and accuracy. Analytical quality assurance for this program includes the following:

- Employing analytical chemists trained in the procedures to be followed.
- Adherence to documented procedures, United States Environmental Protection Agency (USEPA) approved methods, and written Standard Operating Procedures (SOPs).
- Calibration of analytical instruments.
- Use of quality control samples, internal standards, surrogates, and Standard Reference Materials (SRMs).
- Complete documentation of sample tracking and analysis.

Internal laboratory quality control checks will include the use of laboratory replicates, method blanks, matrix spikes/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCSs). The quality control checks performed by constituent class is presented in Table F-3. The frequency of the laboratory QA/QC samples will a minimum of once per batch per analyte unless otherwise adjusted by Copermittees.

Table F-3. Laboratory Quality Control Samples by Constituent Class

Laboratory Quality Control	Constituent Class							
	Conventionals	Indicator Bacteria	Inorganic Analytes	Nutrients	Solid Parameters	Acute Toxicity	Chronic Toxicity	Synthetic Organic Compounds
Calibration Standard	✓	–	✓	✓	–	–	–	–
Calibration Verification	✓	–	✓	✓	–	–	–	✓
Laboratory Blank	✓	✓	✓	✓	✓	–	–	✓
Reference Material	✓	–	✓	✓	–	–	–	✓
Matrix Spike	✓	–	✓	✓	–	–	–	✓
Matrix Spike Duplicate	✓	–	✓	✓	–	–	–	✓
Laboratory Duplicate	✓	✓	✓	✓	✓	–	–	–
Internal Standard	✓	–	✓	–	–	–	–	✓
Sterility Checks	–	✓	–	–	–	–	–	–
Laboratory Positive Control	–	✓	–	–	–	–	–	–
Laboratory Negative Control	–	✓	–	–	–	–	–	–
Laboratory Water Control	–		–	–	–	✓	✓	–
Conductivity/Salinity Control Water	–	–	–	–	–	✓	✓	–
Additional Control Water	–	–	–	–	–	✓	✓	–
Sediment Control	–	–	–	–	–	✓	✓	–
Reference Toxicant Tests	–	–	–	–	–	✓	✓	–
Tuning	–	–	–	–	–	–	–	✓
Surrogate	–	–	–	–	–	–	–	✓
Calibration	–	–	–	–	–	–	–	✓

F.2.1 Data Quality Objectives

Data quality objectives (DQOs) are quantitative and qualitative statements that define project objectives and specify the acceptable ranges of field sampling and laboratory performance. DQOs include accuracy, precision, and completeness.

Accuracy describes how close the measurement is to its true value. Accuracy is the measurement of a sample of known concentration and comparing the known value against the measured value. The accuracy of chemical measurements will be checked by performing tests on a standard prior to and/or during sample analysis. A standard is a known concentration of a certain solution. Standards can be purchased from chemical or scientific supply companies. Standards might also be prepared by a professional partner (e.g., a commercial or research laboratory). The concentrations of the standards should be within the mid-range of the equipment. Recovery measurements are determined by spiking a replicate sample in the laboratory with a known concentration of the analyte. Accuracy of the project data will be determined by comparing results from MS/MSDs, LCSs, field blanks, and equipment blanks to the accuracy objectives to be developed by Copermittees.

Precision describes how well repeated measurements agree. The evaluation of precision described here applies to repeated measurements and samples collected in the field (field duplicates) or the laboratory (laboratory replicates and MS/MSDs). Precision measurements will be determined by comparing results from field duplicates, laboratory replicates and MSD to the precision objectives. Relative Percent Differences (RPDs) will be calculated to determine the precision between duplicate samples. This calculation is presented in Equation 1. Precision objectives will be developed by the Copermittees.

$$RPD = \frac{abs[x_1 - x_2]}{0.5 * (x_1 + x_2)} \qquad \text{Equation 1}$$

Where:
abs is the absolute value.
x1 is measurement 1.
x2 is measurement 2.

Completeness is the fraction of planned data that must be collected to fulfill the statistical criteria of the project. There are no statistical criteria that require a certain percentage of data. However, the anticipated target is 90%. This accounts for adverse weather conditions, safety concerns, and equipment problems. The project team determined completeness by comparing the number of measurements planned to be collected with the number of measurements actually collected that are deemed valid. An invalid measurement would be one that does not meet the sampling method requirements. Completeness will be measured as a percentage of the number of samples collected that meet the respective DQOs compared to the anticipated number of samples. This calculation is presented in Equation 2.

$$Completeness = \frac{Actual\ number\ of\ samples\ collected}{Project\ required\ total\ samples\ to\ be\ collected} * 100 \qquad \text{Equation 2}$$

F.2.2 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Laboratory equipment will be calibrated based on manufacturer recommendations and in accordance with the method and laboratory SOP. The laboratory SOP is maintained by the respective Laboratory Directors and QA officers, and is available upon request.

F.2.3 Corrective Action

Corrective action will be taken when an analysis is deemed suspect. Reasons a sample may be considered suspect consist of exceedances of the RPD ranges, spike recoveries, and blanks. The corrective action may vary from analysis to analysis, but typically will involve the following:

Check of procedures.

- Review of documents and calculations to identify possible errors.
- Error correction.
- Re-analysis of the sample extract, if available, to see if results can be improved.
- Reprocessing and re-analysis of additional sample material, if it is available.

Malfunctions that occur during data collection and laboratory analyses will be the responsibility of the field crew or laboratory conducting the work, respectively. In the case of field instruments, problems will be addressed through instrument cleaning, repair, or replacement of parts or the instrument, as warranted. Field crews should carry basic spare parts and consumables with them, and have access to spare parts. The laboratories have procedures in place to follow when failures occur, and have identified individuals responsible for corrective action and developed appropriate documentation as needed.

ATTACHMENT G
VOLUME AND LOAD ESTIMATE CALCULATIONS

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G. CALCULATION OF RUNOFF VOLUMES AND LOAD ESTIMATIONS FOR ASSESSMENT AND REPORTING

The methods to complete the wet weather storm drain outfall discharge monitoring assessment, as described in the Transitional Wet Weather Storm Drain Outfall Monitoring Work Plan prepared by Weston Solutions, are detailed in this section (San Diego County Regional Copermittees, 2014).

The assessment methods were formulated with the purpose of providing a means to calculate various parameters required by Section II.D.4.b.(2)(b) of the Permit based on the storm drain outfall wet weather monitoring data collected during the 2013-2014 and 2014-2015 wet seasons. Section II.D.4.b.(2)(b) of the Permit states:

> (b) Based on the transitional wet weather storm drain outfall discharge monitoring required pursuant to Provision D.2.a.(3) the Copermittees must assess and report the following:
>
> (i) The Copermittees must analyze the monitoring data collected pursuant to Provision D.2.a.(3), and utilize a watershed model or other method, to calculate or estimate the following for each monitoring year:
>
> [a] The average stormwater runoff coefficient for each land use type within the Watershed;
>
> [b] The volume of stormwater and pollutant loads discharged from each of the Copermittee's monitored storm drain outfalls in its jurisdiction to receiving waters within the Watershed Management Area for each storm event with measurable rainfall greater than 0.1 inch;
>
> [c] The total flow volume and pollutant loadings discharged from the Copermittee's jurisdiction within the Watershed Management Area over the course of the wet season, extrapolated from the data produced from the monitored storm drain outfalls; and
>
> [d] The percent contribution of stormwater volumes and pollutant loads discharged from each land use type within each hydrologic subarea with a major storm drain outfall to receiving waters or within each major storm drain outfall to receiving waters in the Copermittee's jurisdiction within the Watershed for each storm event with measurable rainfall greater than 0.1 inch.
>
> (ii) Identify modifications to the wet weather storm drain outfall discharge monitoring locations and frequencies necessary to identify pollutants in stormwater discharges from the storm drain conveyance system in the Watershed Management Area pursuant to Provision D.2.c.(1) (RWQCB, 2013).

G.1 LAND USE CATEGORIZATION

Geographic information system (GIS) mapping software, in combination with data from the San Diego Geographic Information Source (SanGIS), will be used to determine the quantities of the various land use types within each monitored outfall drainage area. The SanGIS land use dataset has numerous land use classifications, and the assessment included categorizing the SanGIS land use classifications into several assessment land use categories. The correlations between SanGIS land use data and the assessment land use classes are shown in Table G-1. Table G-2 shows the assessment land use classes along with the San Diego Hydrology Manual (Hydrology Manual) land use types runoff coefficient (Runoff "C") values.

SanGIS land uses will be grouped into a minimum of four assessment categories listed by the Permit (e.g., Commercial, Industrial, Residential, and Mixed Land Use). The Commercial land use category will incorporate all "commercial" and most of the "public facility," "parking lot," and "commercial recreation" SanGIS classifications. The Industrial land use category will incorporate "industrial," "airport," "communications and utilities," and "terminal" SanGIS classifications. The Residential land use category will incorporate Rural Residential (1 to 4 dwelling units per acre (DU/A)), Single-Family Residential (4.3 to 20 DU/A), and Multi-Family Residential (>20 DU/A). The Multi-Family Residential land use categorization will incorporate high density housing types, such as barracks, dormitories, monasteries, and other group quarters. The Mixed Land Use classification will incorporate the SanGIS classes 9700 (mixed use). These additional land uses will include a combination of roads, parking areas, various types of impervious surfaces (tennis courts, buildings, sidewalks/paved areas), and less than 90% open space (maintained fields and undeveloped lands).

SanGIS land uses classes that are not easily grouped into one of the four main land use categories will be identified as "other" and will undergo further assessment. Two additional land use categories, Open Space and Agriculture, will be used to address less developed regions in San Diego County. In accordance with the Hydrology Manual (County of San Diego, 2003), these land uses will undergo a separate analysis based on the soil type and associated pervious Runoff "C" value.

The Open Space land use category will include open space, vacant and undeveloped land, parks and recreation, and most of the remaining military SanGIS land uses. Given that areas classified as water, bay, lagoon, lake, reservoir, and large pond would likely turn into a sink for runoff storage, water-related land use classifications (9200, 9201, and 9202) will be excluded from this analysis.

Traditionally, Transportation land uses were considered a unique land use classification. The Hydrology Manual does not include unique Runoff "Cs" for roads, freeways, right of ways, and other Transportation land uses. These SanGIS classes will be grouped into a Transportation land use category and assigned a Runoff "C" based on the approximate percentage of impervious cover and associated Runoff "C" listed in the Hydrology Manual.

Table G-1. Assessment Land Use Categories Developed from SanGIS Land Use Classes

Assessment Land Use Category	SanGIS Land Use Classification	
Agriculture	7204	Golf Course
	8001	Orchard or Vineyard
	8002	Intensive Agriculture
	8003	Field Crops
Commercial	1401	Jail/Prison
	1501	Hotel/Motel (Low-Rise)
	1502	Hotel/Motel (High-Rise)
	1503	Resort
	4111	Rail Station/Transit Center
	4114	Parking Lot - Surface
	4115	Parking Lot - Structure
	4116	Park and Ride Lot
	5001	Wholesale Trade
	5002	Regional Shopping Center
	5003	Community Shopping Center
	5004	Neighborhood Shopping Center
	5005	Specialty Commercial
	5006	Automobile Dealership
	5007	Arterial Commercial
	5008	Service Station
	5009	Other Retail Trade and Strip Commercial
	6001	Office (High-Rise)
	6002	Office (Low-Rise)
	6003	Government Office/Civic Center
	6101	Cemetery
	6102	Religious Facility
	6103	Library
	6104	Post Office
	6105	Fire/Police Station
	6108	Mission
	6109	Other Public Services
	6501	UCSD/VA Hospital/Balboa Hospital

Table G-1. Assessment Land Use Categories Developed from SanGIS Land Use Classes (Continued)

Assessment Land Use Category	SanGIS Land Use Classification	
Commercial (continued)	6502	Hospital - General
	6509	Other Health Care
	6807	School District Office
	7201	Tourist Attraction
	7202	Stadium/Arena
	7203	Racetrack
	7205	Golf Course Clubhouse
	7206	Convention Center
	7207	Marina
	7209	Casino
	9501	Residential Under Construction
	9502	Commercial Under Construction
	9504	Office Under Construction
	7208	Olympic Training Center
	7210	Other Recreation - High
	7607	Residential Recreation
Educational	6801	SDSU/CSU San Marcos/UCSD
	6802	Other University or College
	6803	Junior College
	6804	Senior High School
	6805	Junior High School or Middle School
	6806	Elementary School
	6809	Other School
	9505	School Under Construction

Table G-1. Assessment Land Use Categories Developed from SanGIS Land Use Classes (Continued)

Assessment Land Use Category	SanGIS Land Use Classification	
Industrial	2001	Heavy Industry
	2101	Industrial Park
	2103	Light Industry - General
	2104	Warehousing
	2105	Public Storage
	2201	Extractive Industry
	2301	Junkyard/Dump/Landfill
	4101	Commercial Airport
	4102	Military Airport
	4103	General Aviation Airport
	4104	Airstrip
	4113	Communications and Utilities
	4120	Marine Terminal
	9503	Industrial Under Construction
Transportation	4112	Freeway
	9507	Freeway Under Construction
	4117	Railroad Right of Way
	4118	Road Right of Way
	4119	Other Transportation
	9506	Road Under Construction
Mixed Use	9700	Mixed Use
Residential: Multi-Family	1200	Multi-Family Residential
	1280	Single Room Occupancy Units (SRO's)
	1290	Multi-Family Residential Without Units
	1300	Mobile Home Park
	1402	Dormitory
	1403	Military Barracks
	1404	Monastery
	1409	Other Group Quarters Facility

Table G-1. Assessment Land Use Categories Developed from SanGIS Land Use Classes (Continued)

Assessment Land Use Category	SanGIS Land Use Classification	
Residential: Rural	1000	Spaced Rural Residential
Residential: Single-Family	1100	Single Family Residential
	1110	Single Family Detached
	1110	Single Family Detached
	1120	Single Family Multiple-Units
	1190	Single Family Residential Without Units
Open Space	6701	Military Use
	6702	Military Training
	6703	Weapons Facility
	7211	Other Recreation - Low
	7601	Park - Active
	7603	Open Space Park or Preserve
	7604	Beach - Active
	7605	Beach - Passive
	7606	Landscape Open Space
	7609	Undevelopable Natural Area
	9101	Vacant and Undeveloped Land
Water	9200	Water
	9201	Bay or Lagoon
	9202	Lake/Reservoir/Large Pond
Source: SanGIS, 2014		

Table G-2. Assessment Land Use Hydrology Manual Runoff "C" Values

Land Use Type	Hydrology Manual Runoff "C"
Agriculture-A	0.2
Agriculture-B	0.25
Agriculture-C	0.3
Agriculture-D	0.35
Commercial	0.82
Educational	0.58
Industrial	0.87
Mixed Use	0.66
Multi-Family Residential	0.6
Open Space-A	0.2
Open Space-B	0.25
Open Space-C	0.3
Open Space-D	0.35
Rural-Residential	0.41
Single-Family Residential	0.49
Transportation	0.71

Source: County of San Diego, 2003

G.2 Stormwater Runoff Coefficient Calculations

Measured flow values will be used in combination with the hydrological features associated with the drainage areas of the monitored outfalls to calculate the average stormwater Runoff "C" for each land use type within the WMA. First, for each monitored outfall, the actual event Runoff "C" will be calculated based on outfall drainage area, rainfall, and measured flow. Next, the Hydrology Manual land use Runoff "C" values and overall outfall drainage area Hydrology Manual Runoff "C" value will be calculated based on the individual land use areas within each monitored outfall drainage area. For each monitored outfall, a correction factor will be calculated based on the comparison between the actual Runoff "C" value and the overall Hydrology Manual Runoff "C" value. The associated correction factor will be applied to the individual land use Runoff "C" values for each outfall. Finally, the WMA individual land use Runoff "C" values will be determined based on the area-weighted average of the monitored outfalls' individual land use Runoff "C" values. The steps in this process are discussed in more detail in the following paragraphs

The actual Runoff “C” for each outfall will be calculated based on the measured stormwater runoff, rainfall, and overall size of the drainage area. Flow equipment will be installed in each monitored outfall, except in rare cases where it is not feasible, in order to estimate the volume of stormwater runoff for the monitored event. Rainfall data for each event will be obtained from the County of San Diego Automatic Local Evaluation in Real Time (ALERT) System rain gauge database for the gauge nearest to the monitored outfall. The delineation of each monitored outfall drainage area will be performed by the responsible Copermittee. The actual Runoff “C” for each outfall will be calculated using the following formula:

$$Runoff\ "C"_{Outfall\,Actual} = \left(\frac{Monitored\ StormWater\ Runoff\ Volume}{Area \times Rainfall} \right)_{Outfall} (UC)$$

Volume in cubic feet (ft3)
Area in acres
Rainfall in inches (in)

$$UC = Unit\ Conversion = \left(\frac{1\ ft}{12\,in} \right) \left(\frac{43{,}560\ ft^2}{1\ acre} \right)$$

The Hydrology Manual Runoff “C” for each monitored outfall will be selected based on the guidance found in Section 3 (Rational Method) of the Hydrology Manual. The area-weighted Hydrology Manual Runoff “C” for each monitored outfall will be calculated using the following formula:

$$Runoff\ "C"_{Outfall\,HM\ Calculated} = \frac{\sum \left(Area_{Outfall\,LU} \times HM\ Runoff\ "C"_{LU} \right)}{\sum Area_{Outfall\,LU}}$$

Where: LU = land use type
HM = Hydrology Manual

A Runoff “C” correction factor will be calculated for each monitored outfall using the following formula:

$$CF_{Outfall\,Runoff"C"} = \frac{Runoff\ "C"_{Outfall\,Actual}}{Runoff\ "C"_{Outfall\,HM\ Calculated}}$$

Where: CF = correction factor

For each monitored outfall, the calculated correction factor will be applied to the Hydrology Manual land use Runoff “C” values within the applicable drainage area as follows:

$$Runoff\ "C"_{Outfall\,LU} = CF_{Outfall\,Runoff"C"} \times Runoff\ "C"_{HM\ LU}$$

The land use type Runoff "C" calculation results for the monitored outfalls within the WMA will be compiled as follows to determine the WMA Runoff "C" value for each land use type:

$$Runoff\ "C"_{WMALU} = \frac{\sum(Runoff\ "C" \times Area)_{OutfallLU}}{\sum Area_{OutfallLU}}$$

Monitored Outfalls Annual Runoff Volumes and Pollutant Loads Calculations

The annual stormwater runoff volumes and pollutant loads discharged from monitored storm drain outfalls for storm events greater than 0.1 inch of measurable rainfall will be calculated using the actual Runoff "C" values, drainage area sizes, ALERT rain gauge data, and chemistry results obtained from the collection of stormwater samples during the 2013-2014 and 2014-2015 wet seasons. The actual Runoff "C" value and drainage area size for each monitored outfall will be determined as described in Section 5.2. Annual rainfall will be obtained from the ALERT rain gauge database for the gauge nearest to each monitored outfall. The rain gauge data will be analyzed, and rainfall values will be identified and excluded from the annual stormwater volume calculations when precipitation totals do not exceed 0.1 inch over a 24-hour period. The annual volume discharge from each monitored outfall will be calculated as follows:

$$Storm\,Water\,Volume_{Outfall} = \left(Runoff\ "C"_{OutfallActual} \times Area_{Outfall}\right)\left(\sum Rainfall_{Event}\right)(UC)$$

Where:

$$UC = Unit\ Conversion = \left(\frac{1\ ft}{12\ in}\right)\left(\frac{43{,}560\ ft^2}{1\ acre}\right)$$

The pollutant loads discharged from each monitored storm drain outfall will be calculated based on the calculated annual volume and the chemistry results specific to each outfall as follows:

$$Pollutant\ Load_{Outfall} = \left(Storm\ Water\,Volume \times Pollutant\,Concentration\right)_{Outfall}(UC))$$

Where:

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{1000\ mg}\right)\left(\frac{1\ lbs}{453.592\ _g}\right), for\ \frac{mg}{L}\ concentration\ units;$$

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{10^6\ \mu g}\right)\left(\frac{1\ lbs}{453.592\ _g}\right), for\ \frac{\mu g}{L}\ concentration\ units; or$$

Watershed Jurisdictional Annual Runoff Volumes and Pollutant Loads Calculations

The total flow volume and pollutant loads discharged from each Copermittee's jurisdiction within the watershed over the course of the wet season will be calculated based on the data produced from monitoring storm drain outfalls during the 2013-2014 and 2014-2015 wet seasons. The Watershed Runoff "C" values, calculated as described in Section 5.2, will be used in combination with land use data and ALERT rain gauge data to calculate the total flow volume for each jurisdiction. The annual volumes will be applied to pollutant event mean concentrations (EMCs) in order to estimate the annual pollutant loads conveyed by the storm drain conveyance system in each Copermittee's jurisdiction. The EMC for each applicable pollutant will be determined by compiling the results from the outfalls monitored in the WMA. More details on the flow volume and pollutant load calculations are provided in the paragraphs that follow.

The total flow volume conveyed by each Copermittee's storm drain conveyance system will be calculated using the land use data, watershed land use type Runoff "C" values (see Section 5.2), and ALERT rain gauge data. GIS mapping software will be used to determine the quantities of the various land use types for each Copermittee by comparing the watershed boundary with the Copermittees' boundaries. The areas associated with hydrologic subareas (HSAs) without a major outfall will be included in the total area to calculate the assessment required by Section II.D.4.b.(2)(b)(i)[c]; however, an HSA without a major outfall will not be included in the assessment required by Section II.D.4.b.(2)(b)(i)[d].

Properties owned by state or federal agencies and indian reservations will also be excluded from the total jurisdictional watershed area. An ALERT rain gauge located within the watershed will be selected for the volume calculations. In the event that data from more than one ALERT gauge are available for the watershed, the ALERT gauge that has the most representative data related to the monitored outfalls will be selected (i.e., the station closest to the majority of monitored outfalls was selected to perform outfall-specific calculations for more of the outfalls and was also selected for watershed calculations). The ALERT data will be analyzed, and rainfall values will be identified and excluded from the calculations when precipitation totals do not exceed 0.1 inch of rainfall over a 24-hour period. The following formulas will be used to calculate the annual flow volume from each land use type and total flow volume within each Copermittee's jurisdiction in the watershed during the wet season:

$$Storm\ Water\ Volume_{WMA\,Jurisd\,LU} = \left(Runoff\ "C"_{WMA\,LU}\right)\left(Area_{WMA\,LU}\right)\left(\sum Rainfall_{Event}\right)(UC)$$

Where:

$$UC = \left(\frac{1\ ft}{12\ in}\right)\left(\frac{43{,}560\ ft^2}{1\ acre}\right)$$

$$Storm\,Water\,Volume_{WMA\,Jurisd,} = \sum Storm\,Water\,Volume_{WMA\,Jurisd\,LU}$$

The chemistry results obtained from analyzing samples collected at the monitored outfalls during the 2013-2014 and 2014-2015 wet seasons will be evaluated in order to estimate the watershed EMC values for the measured constituents for each general land use type assessed. This evaluation includes estimating each monitored outfall drainage area's EMC values for the measured constituents for each general land use type assessed. The monitored outfalls will be selected, where practical, to have a single primary land use type in order to facilitate the correlation between land use type and pollutant loading; however, due to the general mixed composition of urban development, the drainage areas of the monitored outfalls may typically consist of a combination of land use types (e.g., primarily single-family residential with some commercial, open space, transportation.).

The correlation of measured pollutant concentrations to EMC values for various land use types, therefore, will incorporate the use of published, typical EMC values so that the measured chemistry results will be proportioned to the different land use types within each drainage area. The methods to proportion the measured chemistry results will be similar to the methods to determine the land use type Runoff "C" values (Section 5.2). The measured chemistry results will be the actual EMC values for each monitored outfall drainage area. Typical EMC values will be selected from the literature for each land use type for the measured constituents. Typical overall or comingled EMC values will be calculated for each monitored outfall based on the weighted average of the outfall land use type Runoff "C" values and drainage area land use type areas. The actual EMC values (comingled chemistry results) of the monitored outfall will then be compared to the calculated, typical outfall EMC values in order to determine correction factors for each constituent. For each constituent, the correction factor will then be applied to the typical land use type EMC values for the associated monitored outfall drainage area. The WMA EMC values for the various land use types will be calculated based on corrected land use type EMCs of the monitored outfalls within the WMA, which are weighted by the product of the land use type Runoff "C" values and land use type areas. The following formulas will be used to complete these calculations:

$$EMC_{Outfall\,Actual} = Sampling\ \ Chemisty\ Result_{Outfall}$$

The overall or comingled outfall typical EMC for each measured constituent will be calculated using the following formula:

$$EMC_{OutfallCalculated} = \frac{\sum\left(Area_{OutfallLU} \times Runoff\ "\ C"_{OutfallLU} \times Typical\ EMC_{LU}\right)}{\sum\left(Area_{OutfallLU} \times Runoff\ "\ C"_{OutfallLU}\right)}$$

An EMC correction factor will be calculated for each constituent for each monitored outfall using the following formula:

$$CF_{OutfallEMC} = \frac{EMC_{Outfall\,Actual}}{EMC_{OutfallCalculated}}$$

For each monitored outfall for each constituent, the calculated EMC correction will be applied to the land use type typical EMC value as follows:

$$EMC_{OutfallLU} = CF_{OutfallEMC} \times Typical\ EMC_{LU}$$

The calculation results for the monitored outfalls within the watershed will be compiled to determine the EMC value for each constituent of each land use type assessed within the watershed.

$$EMC_{WMALU} = \frac{\sum(Runoff\ "C" \times Area \times EMC)_{OutfallLU}}{\sum(Area \times Runoff\ "C")_{OutfallLU}}$$

The total watershed pollutant load for each constituent within each jurisdiction will be calculated utilizing the follow the formula:

$$Pollutant\ Load_{WMA Jurisd,} = \sum \left(Storm\ Water\ Volume_{WMA Jurisd LU} \times EMC_{WMALU} \times UC\right)$$

Where:

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{1000\ mg}\right)\left(\frac{1\ lbs}{453.592\ _g}\right),\ for\ \frac{mg}{L}\ concentration\ units;$$

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{10^6\ \mu g}\right)\left(\frac{1\ lbs}{453.592\ _g}\right),\ for\ \frac{\mu g}{L}\ concentration\ units;\ or$$

$$UC = \left(10\frac{100\ mL}{L}\right)\left(\frac{28.317\ L}{1\ ft^3}\right),\ for\ \frac{MPN}{100\ mL}\ EMC\ units;$$

G.3 References

Weston, 2014. 2013-2014 and 2014-2014 Transitional Wet Weather Storm Drain Outfall Discharge Monitoring Work Plan. Prepared for San Diego County Regional Copermittees. October.

EXAMPLE - CHAIN-OF-CUSTODY FORM

Date: _________ ***Page*** ____ ***of*** ____

Analyzing Laboratory: ____________________________

Project Name / Project Number					**Container Type / Volume**	**Total Number of Containers**	**Analysis / Test Requested**									**Laboratory Use Only**	
Project Manager / Contact																	
Client																	
Address																	
Phone / Fax / Email																	
Site ID (Location)	**Sample ID**	**Date**	**Time**	**Matrix**											**Preservation**	**Temp (C) Upon Receipt**	**Laboratory ID**

Sample Matrix Code: FW = Freshwater; SW = Storm Water; SLT = Saltwater; SED = Sediment; BIO = Biologic; O = Other (Specify) __________________

Container Code: G = Glass; P = Plastic; B = Bags; O = Other (Specify) ______________

Shipped By: ☐ Courier ☐ FedEx ☐ UPS ☐ USPS ☐ Client Drop-Off ☐ Other ________________

Turnaround Time: ☐ 2-day ☐ 5-day ☐ 7-day ☐ 10-day ☐ 14-day ☐ Standard ☐ Other _______________________

Reporting Requirements: ☐ PDF ☐ EDD ☐ Hard Copy ☐ Email ☐ Other _______________________

Sampled By:

Name (Print): _____________________________

Signature: _____________________________

Comments/Special Instructions:

Relinquished By				**Received By**			
Print Name	Signature	Firm	Date/Time	Print Name	Signature	Firm	Date/Time
1				1			
2				2			
3				3			
4				4			
5				5			

ATTACHMENT 4A-6: SAN LUIS REY RIVER WATERSHED DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

Prepared for

County of San Diego, Department of Public Works
5510 Overland Ave, Suite 410
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TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

Prepared by

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Project Number LA022824

December 23, 2014

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1 INTRODUCTION

1.1 Objective

This dry weather Microbial Source Tracking (MST) Work Plan has been prepared to facilitate the following objectives:

1) Identify sources of dry weather flow into the County of San Diego's (County) Municipal Separate Storm Sewer System (MS4) (consistent with the non-structural best management practices [BMPs] identified in the San Luis Rey [SLR] watershed Comprehensive Load Reduction Plan [CLRP][1]);
2) Identify dry weather sources of human waste in the County's MS4 by sampling MS4 outfalls[2] for fecal indicator bacteria (FIB), sewage indicators, and human source markers;
3) Identify dry weather sources of non-human waste in the County's MS4 by sampling MS4 outfalls for FIB and non-human fecal source markers (e.g., cattle, equestrian, canine, etc.); and
4) Prioritize locations for implementation of remedies to eliminate dry weather flows and fecal waste sources.

These data will be used to support bacteria TMDL implementation planning (e.g., sewer repair), and to address portions of the MS4 Permit (Permit) (SDRWQCB, 2013a), including requirements for an Illicit Discharge Detection and Elimination (IDDE) program, prohibition of conveyance or discharge of human waste, source assessment, and dry weather flow observations. This Work Plan will also potentially provide screening-level data to support planning for either a Natural Source Exclusion (NSE) or a Quantitative Microbial Risk Assessment (QMRA) study, since both options require first investigating and eliminating sources of human waste within the County's MS4 discharges.

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[1] The CLRPs were prepared to comply with Resolution No. R9-2010-0001, "Total Maximum Daily Load for Indicator Bacteria, Project 1 – Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek)" (Bacteria TMDL) which became effective on April 4, 2011 (SDRWQCB 2010). The Bacteria TMDL requires that owners and operators of municipal separate storm sewer systems (MS4) in the SLR Watershed, forthwith known as Responsible Parties, to develop either a bacteria-specific or comprehensive, multi-pollutant approach to reducing loads of Fecal Indicator Bacteria (FIB) – enterococcus, fecal coliform, and total coliform – from storm drain discharges.

[2] For the purposes of this plan, 'outfalls' are defined as points of discharge from the MS4 to receiving waters of the State, and do not include culverts or MS4 pipes that discharge into systems other than receiving waters of the State. In some instances, where outfalls were not accessible (such as MS4 pipe outfalls to a box culvert), the downstream culvert outlet will be sampled to represent the discharge from one or more outfalls. In addition, where networks cross jurisdictional boundaries and the actual network outfall is not within County jurisdiction, samples will be collected at the jurisdictional boundary.

1.2 Study Area

The study area lies within the unincorporated County jurisdictional boundaries in the SLR watershed. A map of the MST study area is included in Figure 1.

The SLR watershed is located in northern San Diego County and is bordered to the north by the Santa Margarita River watershed and to the south by the Carlsbad and San Dieguito River watersheds. The SLR watershed is comprised of three Hydrologic Areas (Has): Lower San Luis (HA 903.1), Monserate (HA 903.2), and Warner Valley (903.3). Of the nine major watersheds in the San Diego region, the SLR watershed is the third largest, measuring 559 square miles. Lake Henshaw drains the eastern third of the SLR watershed, capturing water from the Warner Valley hydrologic area (HA 903.3), approximately 209 square miles. This MST Work Plan addresses MS4s on County jurisdictional land from the remainder of the watershed downstream of Lake Henshaw, which excludes tribal, military, state, and federal lands, is comprised primarily of rural residential (28%), agricultural (29%), and vacant and undeveloped (38%) lands. See Figure 2 for land use coverage[3] and a complete breakdown of land use percentages.

1.3 Scope of Work

Geosyntec has been contracted to perform the following tasks to support the development of the MST Work Plan:

- Conduct a Desktop Evaluation of existing infrastructure and historical data (including GIS analysis, existing data review, observational data collection, and initial water sample collection and analysis), for the purpose of guiding field inspections;
- Develop a draft and final Work Plan, which will include a Sampling and Analysis Plan (SAP) and a Quality Assurance Project Plan (QAPP); and
- Conduct initial receiving water reconnaissance of MS4 outfalls, including a validation of MST labs, and Preliminary Outfall Investigation to identify flowing outfalls, as well as outfalls with possible human bacterial sources, based on consultation with the County and Work Plan guidance and approach (results described in a separate Preliminary Findings Report).

1.4 Report Organization

This Work Plan is organized as follows:

- Section 2 describes the overall approach of the study, and how it compares to the MST methodology outlined in the recently released Draft California Microbial Source Identification Manual (SIPP Manual), which summarizes the findings of the Source Identification Protocol Project (SIPP).

[3] Land use data retrieved from SanGIS/SANDAG GIS Data Warehouse

- Section 3 summarizes objectives and methodology for the Desktop Evaluation of the MS4 system within the SLR watershed.
- Section 4 presents the objectives and methodology for the Validation Study in the San Diego River (SDR) watershed and the Preliminary Outfall Investigations in the SLR watershed.
- Section 5 presents the objectives and tentative methodology for the Storm Drain Network Investigations, to be revised based on the results of the Preliminary Outfall Investigations.
- Section 6 discusses human source marker confirmation sampling, which would be conducted after all previously identified sources of human waste have been addressed.
- Section 7 describes the Natural Source Exclusion (NSE) and Quantitative Microbial Risk Assessment (QMRA) approaches to TMDL compliance, in the case that either approach is deemed appropriate based on the results of the prior investigations.
- Section 8 provides a list of references cited in this Work Plan.

1.5 Terms of Reference

This work is conducted by Geosyntec for the County Department of Public Works (DPW) Watershed Protection Program. This report serves as the draft deliverable for the Professional Services Agreement between the County and Geosyntec dated December 11, 2012. This work is directed by Brandon Steets, PE and conducted by Rita Kampalath, PhD, PE, Megan Otto, PE, Avery Blackwell, Scott Mansell, PhD, and Adam Questad, PE, of Geosyntec. Senior review was provided by Brandon Steets in accordance with Geosyntec's quality assurance policies.

2 STUDY APPROACH AND CONFORMANCE WITH SIPP MANUAL

In conformance with the SIPP Manual (Griffith et al., 2013), this MST study plan is hypothesis driven, and begins with an initial Desktop Evaluation as well as discussions with County staff familiar with the watershed and MS4 system under investigation, in order to gather information about local potential sources. In the SDR watershed, which will also be investigated using the methods described in this Work Plan and will be investigated before SLR, this step will be followed by a Validation Study, to evaluate MST markers as well as labs, since different markers have been shown to differ with regards to inter-laboratory reproducibility (Ebentier et al. 2013). This step will be followed by a Preliminary Outfall Investigation, during which outfalls with dry weather flow are identified, and a single round of fecal indicator bacteria and human and animal marker testing is performed. The results of the Desktop Evaluation and Preliminary Outfall Investigation will then be used to develop hypotheses about potential sources in the study area, as well as identify sites at which to focus more detailed investigations. These hypotheses (discussed in the Preliminary Findings Report) will then be tested during the Storm Drain Network Investigation. SIPP-recommended MST markers will be used exclusively for this project. These steps are illustrated in the Figure 3 flowchart.

This study design is also generally consistent with recent California MST projects that were approved by State Water Resources Control Board (SWRCB) staff and the SWRCB Clean Beaches Task Force for Clean Beach Initiative funding.

A Technical Advisory Committee (TAC) may be assembled to assist with review of this Plan, as well as Plan implementation. The TAC may also advise on interpretation of Study results.

3 DESKTOP EVALUATION

3.1 Objectives

The Desktop Evaluation was intended to provide an overview of the two watersheds, with respect to existing infrastructure and land uses that may impact the County's MS4 system and receiving waters. This included the identification of the existing sewer systems, septic-served areas, and County outfalls.

The Desktop Evaluation included input from County staff who had previously conducted initial outfall surveys, and a review of available geographic information and water quality data. As part of the evaluation, a template field observation sheet (included in Appendix A) was developed based on past source identification studies and known potential sources of bacteria. This field observation sheet was also used to develop a field observation smartphone app which may be used to collect data electronically.

3.2 Geographic Information

Working with the County GIS department, all available relevant data were gathered, reviewed, and processed. This analysis included consolidation and review of the following data, in ArcGIS shapefile format:

- Watershed boundaries
- Subwatershed boundaries
- Waters of the State
- Jurisdictional boundaries
- County MS4 system
- Roads
- Existing land uses (including specific agricultural uses [e.g., dairies, pastures, nurseries, orchards, etc.], as available)
- Wastewater treatment plants
- MS4 points of interest, including MS4 outfalls previously monitored by the County
- Sewer systems
- Sewer pump stations

- Septic-served areas

Additionally, the following desktop analyses were completed using the GIS data above:

- Critical areas for potential human fecal inputs into the MS4. These include areas where sewer mains cross[4] or fall within three meters of storm drains.
- MS4 outfalls were categorized based on proximity to receiving waters[5], proximity of corresponding networks to sewer mains, and other factors (see Section 2.5).

GIS data were reviewed to identify areas that had high potential to contribute animal fecal inputs (such as pastures), however available data was limited.

During field investigations, electronic maps including the shapefiles described above will be used by field investigators with tablets to identify potential bacteria source locations with respect to their proximity to the MS4 system. The electronic field observation app, and lab analytical data may be linked directly to GIS maps so that all outfall-associated data are mapped.

3.3 Water Quality Data

Existing MS4 outfall water quality data for the SLR watershed from 2011 and 2012 were provided by the County for preliminary review and analysis. The data included documentation of outfall conditions with flow status (flow/no-flow/ponded water) and analytical results where samples were collected. Table 1 provides a summary of the data provided.

While the outfalls visited in 2011 and 2012 were those with diameters equal to 36-inches or larger, MS4 outfalls of all sizes will be included in this current study resulting in a much greater number of County MS4 outfalls. Of the outfalls visited in 2011 and 2012, approximately 34% were flowing, 44% were ponded, and 19% were dry (Table 1). Of the outfall flows tested for FIB, the TMDL Enterococcus single sample limit was exceeded more frequently than the fecal coliform single sample limit (94% [16 of17 samples analyzed] as compared to 59% [10 of 17 samples analyzed], respectively). There were also more Enterococcus samples that exceeded single sample limits by 10 times or greater as compared to fecal coliform samples (65% [11 of 17 samples analyzed] as compared to 29% [5 out of 17 samples analyzed] respectively). These results are consistent with the ongoing SCCWRP reference stream study which is finding Enterococcus to most frequently exceed recreational water quality objectives.

Table 1. Summary of County MS4 Dry Weather Outfall (≥ 36” diameter) Observations

Year	*Outfalls*	*Outfalls*	*Outfalls*	*Outfalls*	*Samples Analyzed*	*Fecal coliform > 400 MPN/100mL*	*Enterococcus > 61*

[4] Intersection points where sewer mains cross *above* storm drains would be a more likely source of contamination than intersection points where sewer mains cross *below* storm drains (Holden et al. 2011). However, invert information is not currently available for all infrastructure, so intersection points, regardless of inverts, will be prioritized for the initial analysis. Invert information will be researched in more detail for drainage areas of concern, based on the analytical results. Infrastructure details such as this (also age, materials, etc.) may be obtained from the owning authorities based on original as-built drawings if they are not included in the shapefiles.

[5] In some cases discharge points end in detention basins or non-receiving waters of the State. In these instances, they are not ‘outfalls’ and will be referred to as MS4 ‘points of interest.’

	Observed	Dry	Flowing	Ponded	for FIB	(>4000 MPN/100mL	MPN/100mL (>610 MPN/100mL)
2011	16	4	3	9	9	6(3)	8(5)
2012	16	2	8	6	8	4(2)	8(6)
Total	32	6	11	15	17	10(5)	16(11)

From 2008 to 2010, the City of Oceanside led a bacteria source identification study within SLR and several of its tributaries (MACTEC, 2011). Four dry weather sampling events were conducted using three types of human markers which all target *Bacteroides* (a general fecal *Bacteroides* assay, the BacHum human marker, and HF183) at the Bonsall Bridge site, located in the unincorporated County. Two of the three human marker assays (general *Bacteroides* and BacHum) were detected during all four sampling events. Although all three human markers were detected more frequently during wet weather than during dry weather across the whole study area, this trend was not observed specifically at the unincorporated County site.

3.4 Other Data

Additionally, data relating to sanitary sewer or pump station overflows – including flow/volume, date, and location – were compiled and reviewed.

Based on available data, sanitary sewer overflows (SSOs) within the County study area between 2001 and 2008 were relatively infrequent (SDRWQCB, 2013b). Between 2001 and 2008, a maximum of seven SSOs were reported in the SLR watershed. Across the County unincorporated study area, there were 24 total SSOs reported in that same period, with an average volume per SSO of approximately 57,000 gallons, therefore a single SSO has potential to release significant volume.

The SLR CLRP (County of San Diego 2012) identified homeless encampments as a potentially significant source of human-related fecal contamination. This conclusion was based on findings from a San Diego River-Ocean Beach study (Weston 2007), the Lower SLR MST study (MACTEC 2011), and observations from the CLRP Responsible Parties. The Regional Task Force on the Homeless (RTFH) conducts annual surveys of the homeless population in San Diego County. Based on its 2011 Point-In-Time Count (RTFH 2011), there are 103 homeless people in the city of Oceanside and the unincorporated areas of Northern San Diego County potentially within the SLR watershed.

3.5 Outfall Categorization

County MS4 sampling locations in the SLR study area were distinguished based on the following criteria[6]:

- *MS4 Outfalls:* County MS4 outfalls (including pipes and open channels) terminating near or in the receiving water, including outfalls previously investigated by the County. These outfalls will be visited with physical observations logged (and samples will be collected if flow is present). Other points of interest will also be included, such as downstream culvert outlets, in cases where outfalls are not accessible, or points where the MS4 network crosses jurisdictional boundaries.
- *County Culverts and Other Storm Drain Outlets:* Other MS4 outlets include culverts which only convey the receiving water, culverts which convey flow from an existing (non-receiving water of the State) natural drainage to an existing natural drainage and do not cross sewer mains or have septic influences, as well as outlets that are not near receiving waters. These sites will not be visited or sampled.

GIS data were used to categorize MS4 outfalls based on potential upstream interaction of the MS4s with sewer mains or septic systems (Holden et al. 2011). Maps identifying County MS4 outfall locations and locations of other County MS4 points of interest, including culverts, for the SLR watershed are included as Figures 4-7. Two maps for each of the watersheds are included, one illustrating the outfalls in sewered areas, and the other illustrating the outfalls in unsewered areas. Some outfalls were identified as serving both types of areas; therefore these outfalls have been illustrated on both maps and will be included in both the sewer and septic investigation.

3.6 Outfall Investigation Field Sheet and Smartphone App

The Outfall Investigation Field Sheet was developed to characterize the physical conditions of each outfall and the surrounding areas as visible from the outfall. The Field Sheet was developed based on information from similar source tracking studies as well as data available from the County. The Field Sheet was then developed into a smartphone app. The Field App has several advantages over the paper Field Sheet including reducing paper usage, convenience for the field team, and increased efficiency since data do not need to be manually entered into a database, which also reduces the chance for error. The Field Sheet, included as Appendix A, and the App (screenshot included in Appendix A) contain the following sections:

1) *Background Data:* Critical information relating to outfall identification and location, antecedent rainfall, weather conditions, GPS and photo IDs, drainage area land uses observed from the outfall, and notes on the receiving water flow condition (flowing, not flowing, and rate of flow, if applicable).

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[6] Based on preliminary analysis for the SLR Watershed there are approximately 663 outfalls and other discharges, including culverts, within the County area (442 outfalls and 221 other discharges and culverts).

2) *Outfall Description:* Outfall details including location (closed or open pipe), material, shape, dimensions, and state of submergence. The presence and amount of water in and adjacent to the outfall is also recorded and the collection of an analytical sample can be noted. Additionally, indications of intermittent flow can be recorded.
3) *Quantitative Characterization:* Flow depth, width, and/or ponded length, as well as field probe measurements such as temperature, pH, turbidity, conductivity, and dissolved oxygen.
4) *Physical Indicators for Observed Flow and/or Ponded Water:* Qualitative observations of the outfall flow or ponded water that may indicate the presence of bacteria, including the presence, description, and relative severity of water odor, color, cloudiness, and floatables.
5) *Other Physical Indicators:* Additional qualitative observations that may indicate the presence of intermittent dry-weather flow and other general observations including the presence and description of outfall damage, deposits/stains, abnormal vegetation, benthic growth, and biology.
6) *Potential Bacteria Sources:* Outfall's or receiving water's proximity to and severity of potential bacteria sources. These may include human sources (homeless encampments, RVs, porta potties, park bathroom facilities, dumpsters, swimming pools, trash, yard/landscaping waste, etc.), non-human animal sources (dog, bird, horse, cattle, goat, sheep, etc.), agricultural sources (barns, pastures, manure disposal sites, manure being used as fertilizer, etc.), and natural sources (sediment, decaying vegetation, algae, biofilm, etc.).

Appendix A also includes excerpts from the Center for Watershed Protection (CWP) Illicit Discharge Detection and Elimination (IDDE) Manual (CWP and Pitt, 2004), which provide photographic guidance for completing the qualitative observation sections.

4 PRELIMINARY OUTFALL INVESTIGATION AND VALIDATION STUDY

4.1 Objective

A Preliminary Outfall Investigation will be conducted over one round in the SLR watershed using the methodology described in detail in Section 4.3. The Preliminary Outfall Investigation (as well as input from the TAC, if available) will be used to test and refine this methodology prior to commencement of the Storm Drain Network Investigation. Results from this investigation will be used to develop hypotheses regarding sources of high FIB counts and human marker detections, which will then be evaluated during the Storm Drain Network Investigation (Section 5). This investigation will also be used to refine the Field Sheet and App, identify flowing outfalls in sewered areas of the MS4, validate lab methods, and evaluate the use of chemical indicators (see Section 4.3.4) to serve either for pre-screening samples to trigger human or animal marker testing, or as additional lines of evidence of the presence of sewage. Correlations between FIB and genetic markers will also be investigated to determine if any clear trends may be observed and to evaluate the frequency of false positives/negatives[7]. The Preliminary Outfall Investigation will be conducted in both septic and sewered areas of the SLR watershed, though these areas will be investigated during different seasons, as described in Section 4.3.1.

Prior to conducting the Preliminary Outfall Investigation, a Validation Study will be performed in the SDR watershed to test both the marker methods and the proficiency of several labs. Results of this study will be used to determine which markers and labs should be used for the next phases of sampling and investigations.

4.2 Preliminary Testing of Human and Non-human Markers (Lab Validation Study)

The SIPP study evaluated the reliability of human and non-human markers using artificial fresh water samples that were spiked with fecal samples, and applied these markers in the field in four coastal watersheds. Water types vary geographically, so the performance of MST methods may differ, particularly when water samples contain constituents that can interfere with marker detection. In addition, certain non-human fecal waste, in particular dog, is known to cause false positive results for human markers (Layton et al. 2013). Thus, the SIPP investigators recommended that MST investigators analyze method performance in their respective study areas prior to initiating sampling.

The reliability of the MST methods also depends on the proficiency of the laboratories conducting the analyses and laboratory steps such as water filtration and DNA extraction, which can lead to approximately half a log unit of variability in estimated marker levels (Ebentier et al. 2013, Shanks et al. 2012). As a quality assurance and control measure, this project will include preliminary testing of various marker methods and laboratories prior to initiating field sampling. At least a dozen "blind" samples prepared using stormwater collected from different study sites in the SDR watershed will be inoculated with raw sewage and sent to each of the three laboratories being considered for the MST analysis. The samples will be analyzed using the SIPP-recommended human markers, HF183 and HumM2, as well as for animal markers. Due to the relative proximity of the SLR and SDR watersheds, the outcome of the preliminary testing in the SDR watershed will be used to determine the best combination of methods and laboratories for use in the investigations for both watersheds.

4.3 Preliminary Outfall Investigation Methodology

The following activities will be conducted at every observed MS4 outfall (as defined in Section 2.5) in the study area of the watersheds:

1) The Outfall Investigation Field Form will be completed; and

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[7] Here, a false negative is when a chemical analyte is less than the detection limit or trigger threshold and a human marker is detected. A false positive is when a chemical analyte is detected or is measured at a concentration greater than the trigger threshold and a human marker is not detected. Use of chemical analytes that are prone to false negatives should be discontinued, since use of these may result in samples that do contain detectable human marker concentrations not being analyzed.

2) Photographs of outfall and surrounding area will be taken, as appropriate.

Additionally, the following will be done at every observed MS4 outfall with flowing water[8]:

1) Measure and record flow rate (when possible);
2) Record field probe measurements (temperature, pH, turbidity, conductivity, and dissolved oxygen [DO]);
3) Collect water samples of sufficient volume to analyze for all parameters (see Section 3.3.4 for parameter list); and
4) Transfer water quality samples to appropriate laboratories for analysis, filtration, and archiving.

Results will be reviewed in an effort to identify any correlations between the presence of human markers and other less expensive pre-screening parameters. Results of this preliminary analysis will guide future testing across all three watersheds.

4.3.1 Investigation Timing

The timing of all sampling will be based on the conditions summarized in Table 2, which require different sampling conditions for sewered and septic areas.

Table 2. Sampling Conditions in Sewered and Septic Areas

Watershed Area	Antecedent Precipitation	Groundwater Table	Baseflow
Sewered	Extended dry weather – wait 4 weeks after a rainfall event of 0.2-inch or greater in 24-hours	Low groundwater table – when groundwater is below average depth of MS4 or during dry season (May 1 to September 30)	Hydrograph has receded
Septic	Dry weather – wait 72 hours after a rainfall event of 0.1-inch or greater in 24-hours[a]	High groundwater table – during spring, late in wet season (October 1 to April 30)	High baseflow – as close to a storm as possible without compromising dry weather conditions

[a] San Diego County Dry Weather and MS4 Analytical and Field Screening Monitoring Procedures Manual (County of San Diego, 2010)

Prior to beginning any field work, past precipitation data and weather forecasts for each watershed will be examined at the rain gage listed in Table 3 to ensure the timing criteria in Table 2 are being fulfilled. The current National Weather Service precipitation data can be

[8] When a flowing MS4 outfall meets the receiving waters in an inaccessible culvert, a representative sample was collected from the first accessible downstream location.

retrieved for the identified rain gages from MesoWest, a cooperative weather data center (http://mesowest.utah.edu/).

Table 3. Rain Gage Information

Watershed	Gage Location	Gage ID	Gage Coordinates	Gage Elevation
San Luis Rey	Oceanside Municipal Airport	KOKB	33°13’5” N, 117°21’5” W	30 ft

The baseflow measurements will also be evaluated to ensure that timing criteria are being fulfilled for each watershed at the United States Geological Survey (USGS) stream gage stations listed in Table 4. The time-series daily data for each gage can be retrieved from the USGS National Water Information System (http://waterdata.usgs.gov/nwis). The time-series data will graphically show whether baseflow has returned to pre-storm conditions, or if additional time for baseflow recession is required prior to performing sewered area investigation and sampling.

Table 4. USGS Stream Gage Information

Watershed	Gage Location	Gage ID	Gage Coordinates
San Luis Rey	SLR at Oceanside	11042000	33°13’05” N, 117°21’34” W

For information regarding current and seasonal groundwater conditions, the State Water Resources Control Broad maintains a website, Groundwater Ambient Monitoring and Assessment (GAMA) Geotracker (http://geotracker.waterboards.ca.gov/gama/), that contains georeferenced depth-to-groundwater data. The data can be viewed online or downloaded and imported in GIS. It will be important to confirm that average groundwater depths are below the estimated depth of MS4 in the sewered areas so that groundwater, an uncontrollable source, can be ruled out as a contributor to any samples collected. In addition, depth-to-groundwater data will be used to identify periods of high groundwater tables for sampling in areas without sewers (as described in Table 2).

4.3.2 Field Observations and Documentation

The Outfall Investigation Field Sheet (hardcopy, Appendix A) and App (electronic form) were developed to provide a comprehensive overview of potential sources of bacteria and will be filled out for every observed outfall in the sewered areas of the unincorporated County, regardless of the presence of flow.

During the field visits, photographs will also be taken to document the current conditions of the outfall and surrounding areas. These photographs will also be helpful in assisting future staff in locating the outfall in subsequent visits. For each outfall visited, one photograph will be taken of the outfall, as well as one facing upstream and one downstream. Additional photographs will be taken at the discretion of the field team as necessary to document other important observations. In order to geocode the location of the photographs, a mobile phone, tablet, or other GPS linked device will be used.

4.3.3 Sample Frequency

The Preliminary Outfall Investigation will consist of one round of sampling from all observed outfalls with flowing water in an effort to develop hypotheses on potential sources in the watershed that could be tested in the subsequent investigations, as well as to assess potential correlations between human markers and FIB, ammonia, phosphate, MBAS, caffeine, cotinine, and sucralose.

4.3.4 Selected Parameters

Samples collected for the Preliminary Outfall Investigation will be analyzed for the following parameters:

- Ammonia
- Phosphate
- MBAS
- Caffeine
- Cotinine
- Sucralose
- Fecal coliforms[9]
- Enterococcus
- SIPP-recommended animal markers (cow [CowM2], ruminant [Rum2Bac], dog [BacCan], horse [HoF97] and pig [Pig2Bac])[10]
- SIPP recommended human markers (Human HF183 taqman and HumM2)

This list was developed to include chemical indicators as well as multiple human MST markers in order to provide multiple lines of evidence for waste detection. The parameters and information on the labs that will perform the analyses are listed in Table 5. Further detail on these methods can be found in the Quality Assurance Project Plan (QAPP) in Appendix E.

Table 5. Preliminary Outfall Investigation Sample Parameters and Analytical Labs

[9] *E. coli* was the preferred FIB, however, the lab performing the FIB analysis and filtration does not do membrane filtration analysis for *E. coli*, therefore fecal coliforms will be analyzed instead.
[10] Since much of the unincorporated County portions of the watersheds are in rural and agricultural areas, the presence of domesticated and wild animals is significantly higher than in more urban areas. These sources may increase FIB concentrations in the MS4 and receiving waters.

Parameter	*Analytical Labs*
Ammonia and phosphate	Enviromatrix
MBAS	Calscience
Caffeine and cotinine	Weck Labs
FIB (Fecal Coliforms and Enterococcus)	City of San Diego Lab
Sucralose	Southern Nevada Water Authority (SNWA)
Human and animal markers	TBD
Human marker validation sampling	TBD

TBD = To be determined based on results of the validation study.

Ammonia, phosphate, MBAS, caffeine, and cotinine are potential human indicator parameters selected based on findings in the Santa Barbara Source Tracking Protocol Development Project (Holden et al. 2011), the CWP IDDE Guidance Manual (CWP and Pitt, 2004), and the book "Microbial Source Tracking: Methods Applications, and Case Studies" (Hagedorn et al. 2011). They have all shown high concentrations in typical sewage and low concentrations in typical groundwater, reclaimed water, and natural creek water samples. Ammonia, phosphate, and MBAS in particular, are relatively fast and inexpensive to analyze. Potential non-human sources that could locally increase human indicator concentrations are fertilizers (ammonia and phosphate), influent from cleaning operations and car washing (MBAS), and other unspecified inputs from agricultural, commercial, or industrial sources.

Caffeine and cotinine, though more human specific, are also more expensive analytes than ammonia, phosphate, and MBAS, in part due to the low concentrations at which they typically occur in sewage. Sucralose has also been identified as a potential indicator of human waste in surface waters (Oppenheimer, 2011), since it is anthropogenic in origin. Similar to caffeine and cotinine, it is also relatively more expensive to analyze for as compared to the other indicators. In addition, due to its novelty, the number of labs with the capability to analyze for sucralose with an appropriate level of sensitivity is limited. Furthermore, since caffeine, cotinine, and sucralose are not typically removed using conventional water treatment processes, these compounds may be detectable in water that has inputs from reclaimed water or treated municipal wastewater discharges although there is no raw sewage present in these flows. Other indicators, such as optical brighteners, were found to be not sensitive enough to detect sewage (Holden et al. 2011).

FIB typically originate from the gut of warm-blooded animals, and can, therefore, be indicative of human or non-human waste. However, FIB are not reliable indicators of human waste as illustrated by the observed lack of correlation between FIB and human markers (Holden et al. 2011, McQuaig et al. 2012, MACTEC, 2011), enteric pathogens (Noble et al. 2006, Rajal et al. 2007, Boehm et al. 2003, Choi and Jiang 2005, Jiang et al. 2004), and illness rates in swimmers (Arnold et al. 2012, Colford et al. 2007, Colford et al. 2012, USEPA 2010, Boehm et al. 2009). Potential reasons for this lack of correlation include the prevalence of other sources of FIB to the environment such as animals, plants, algae, soil, and insects (Griffith 2012, Imamura et al. 2011, Izbicki et al. 2012). FIB have also been shown to survive and even regrow in water, storm drains, sediments, sand, and insects (Imamura et al. 2011, Izbicki et al. 2012, Lee et al. 2006, Ferguson et al. 2005, Griffith 2012, Grant 2001, Litton et al. 2010, Phillips et al. 2011, Jiang et al. 2004, Sabino et al. 2011, Weston Solutions 2010, Weisberg and Ferguson 2009).

However, compliance with the San Diego County Draft MS4 NPDES permit[11] (specifically the bacteria TMDL provisions) is based on water quality standards expressed as FIB concentrations. Therefore, the analysis of FIB will help prioritize locations for TMDL implementation planning and for follow-up non-human source marker analysis.

Certain human marker assays have higher specificity[12] to human waste, others have higher sensitivity.[13] Therefore, two human genetic marker assays with different targets, Human HF183 taqman (more sensitive) and HumM2 (more specific), will be paired in order to leverage both advantages. The disadvantages of human-specific markers are the significantly higher labor and analytical cost per sample and the delay in obtaining results (approximately 5 to 10 days[14]). Human markers are not 100% accurate and are prone to inhibition, interference (e.g., by turbidity), and detection of non-viable DNA fragments (so reclaimed water may test positive even though bacteria and presumably pathogens may be dead or inactive). There is a potential for false negatives as well, in the case of an aged waste input, since genetic markers may decay, similar to FIB.

For all qPCR samples, duplicates are run as well as a third replicate that serves to monitor for qPCR inhibition. Both replicates must be detected above the assay-specific limit of detection for that sample to be called positive, and if it is above the limit of detection but below the limit of quantification, the marker will be considered to be present but in trace amounts (below the limit of quantification). If only one replicate is positive, the test is repeated. If only one replicate is positive the second time or if none are detected, the sample is called negative (below the limit of detection).

Correlations between genetic markers and chemical/bacterial indicators will be evaluated using data collected during the Preliminary Outfall Investigation based on hypothesized thresholds listed in Table 6 (Holden 2011, Jacangelo 2013). Based on the results of this evaluation, these thresholds and triggers may be used during follow-up sampling rounds if the parameters are found to be predictive of human markers. One round of results would not provide sufficient data to calculate FIB geometric means, which are to be based on a minimum of five samples collected within a 30-day period. Therefore, only the single sample FIB thresholds will be evaluated in the preliminary round of investigation.

Table 6. Hypothesized Threshold Values Used for Evaluation of Indicators

[11] SD County TMDL (PDF page E-25, Table 6.2): http://www.waterboards.ca.gov/rwqcb9/water_issues/programs/stormwater/docs/updates103012/2012-1031_Tentative_Order_(Complete).pdf
[12] Specificity refers to lower likelihood of interference due to non-targeted sources.
[13] Sensitivity refers to a higher detection capability (low detection limit).
[14] Excludes time for filtering and shipping

Parameter	*Threshold Value*	*Threshold Reference*	*Analysis Triggered*
Ammonia	6.5 mg/L	10% sewage	Human and non-human markers
Phosphate	1.2 mg/L	10% sewage	Human and non-human markers
MBAS	0.38 mg/L	10% sewage	Human and non-human markers
Caffeine	9.2 ug/L	10% sewage	Human and non-human markers
Cotinine	0.6 ug/L	10% sewage	Human and non-human markers
Sucralose	100 ng/L	None	Human and non-human markers
SIPP recommended human markers	None	None	None, study endpoint
Fecal coliform	400 MPN/100mL (single sample) 200 MPN/100mL (geometric mean)	MS4 Permit	Human (potential) and non-human markers
Enterococcus	61 MPN/100mL (single sample) 33 MPN/100mL (geometric mean)	MS4 Permit	Human (potential) and non-human markers
SIPP recommended non-human markers	None	None	None, study endpoint

4.3.5 Sample Collection

Water samples will be collected from all flowing outfalls. A Sampling and Analysis Plan (SAP) is included as Appendix B describing the detailed procedures for the sample collection. Outfalls that do not have observed flow during the Preliminary Outfall Investigation may be revisited periodically (frequency and number of revisits will be determined through discussions with the TAC) to confirm the absence of flow or identify the need for further investigation.

4.3.6 Field Equipment

During field observations and sample collection, the correct use of properly maintained field equipment is essential. Key pieces of field equipment include a GPS unit, tablet computer with interactive GIS maps and camera, water quality probe, and analytical sample collection bottles. A full list of field equipment is included as Appendix C.

4.3.7 Health and Safety

The health and safety of field staff is of the upmost importance, therefore sample sites will always be assessed for hazardous conditions prior continuing with investigation activities. A site-specific Task Hazard Analysis (THA) was prepared for the investigation and sampling areas to identify potential safety concerns and is included as Appendix D.

4.4 Data Management

All data collected on the Outfall Investigation Field Sheets and App will be transferred to the project database. Photographs will be saved and, where hardcopy field forms were used instead of the app, data will be entered by staff who are involved with the field investigation to lessen the chance of error. Analytical data will be compiled and entered into the project database.

4.5 Quality Control

Sampling will be conducted in accordance with the Quality Assurance Project Plan (QAPP) (Appendix E), which was developed to conform to Surface Water Ambient Monitoring Program (SWAMP) protocol. The QAPP describes the personnel, responsibilities, sampling and laboratory protocols and methods, quality objectives, and data management operations for the project. The purpose of the QAPP is to document the project's technical planning process, providing in one place a clear, concise, and complete plan for the sampling and laboratory activities, the quality objectives, and key project personnel. The QAPP communicates this information to all parties and serves to ensure that the operating procedures are followed and the data quality objectives are achieved. For example, the QAQC plan to send approximately 10% of source marker samples to a second laboratory for verification testing is included in the QAPP.

Additionally, Geosyntec subcontracted an expert microbiologist, Donna Ferguson, who is experienced with microbial source tracking methods and studies to provide technical review and quality control with respect to analytical laboratory selection, methods, and results analysis.

5 STORM DRAIN NETWORK INVESTIGATION

5.1 Objective

All outfalls in the SLR watershed that are identified to have flow during the Preliminary Investigations will be investigated to determine the source of dry weather flows and, if positive for human MST markers during the Preliminary Investigations, will be investigated for sources of human waste (outfalls that were not flowing may be revisited periodically as described in Section 4.3.5).[15] The investigations will be undertaken using some combination of GIS analysis, closed-circuit television (CCTV), additional source marker sampling, dye-testing, and smoke testing. All outfalls identified as potentially impacted by human waste will be investigated using CCTV regardless of whether flow sources are identified aboveground. Based on results of these investigations, targeted source control and/or flow elimination strategies will be recommended to support MS4 Permit compliance. The Permit specifies a limited list of non-stormwater discharges that do not have to be addressed as illicit discharges in Provision E.2.

[15] Storm Drain Network Investigations will also be conducted after the Verification Monitoring (Section 6.0) using the same methodology described here, to investigate any additional outfalls that are identified to be flowing.

5.2 <u>Methodology</u>

The following sections describe the methodology that will be used for the Storm Drain Network Investigation.

5.2.1 Visual Delineation of Flowing Storm Drain Segments

The first step at every flowing outfall will be to visually trace the source of dry weather flow up the storm drain network by removing manholes and visually observing presence/absence of flow while the outfall is discharging. This method will be used to isolate individual branches of the network for further investigation, utilizing one of the approaches below. GIS data will be used to identify locations where sewers and storm drains cross or are located within three meters of one another (Holden 2011) which, if within the isolated flowing branch, would necessitate follow-up sampling within the network and a CCTV investigation in that targeted area. Land uses and septic coverage will also be evaluated to better inform the selection of appropriate investigation tools.

5.2.2 Network Sampling and Analysis

Additionally, all outfalls that are potentially impacted by human waste will be subject to follow-up sampling for FIB, MST markers, as well as selected chemical indicators, at key junctions in the network and wherever accessibility permits. Sampling locations will be chosen with consideration for factors such as: accessibility; placement above major confluence points; jurisdictional boundaries; above and below sewer crossings and septic areas; upstream and downstream of potential bacteria sources (e.g. homeless encampments); and major nodes.

As mentioned above, these outfalls will also all be investigated using CCTV.

5.2.3 CCTV

CCTV will be used to 1) identify inflows from the joints and cracks in the storm drain pipe, which would indicate potential inflow from a high groundwater table or nearby leaky sewers, 2) identify any unknown pipe connecting and discharging to the storm drain, which could indicate illicit sewer or other connections, and 3) investigate storm drain pipes with human positive outfalls. After inflows have been identified, the upstream storm drain will be observed to verify that there are not upstream contributing flows. Any illicit connections will be traced upstream using CCTV if possible, or further investigated using dye or smoke testing.

5.2.4 Dye Testing

Where a sewer to storm drain hydraulic connection is suspected based on CCTV, Rhodamine Wastewater Tracer (RWT) dye will be added to a sewer manhole upstream of the observed storm drain inflow location. Continuous dye monitoring, based on methods employed for the Santa Barbara Source Tracking Protocol Development Project (Santa Barbara, 2011), will be implemented at a downstream access point within the storm drain network. Two doses of RWT will be applied at the upstream manhole within a 30 minute interval. Monitoring will be conducted in the downstream manhole with an automated sonde (detection limit of 1 ppb with linear range of 1-200 ppb) equipped with an optical RTW sensor and a temperature and conductivity sensor. Local public will be notified prior to dye testing.

5.2.5 Smoke Testing

If an unknown pipe connecting and discharging to the storm drain has been observed via CCTV within the isolated storm drain branch, then smoke testing will be employed to identify the source of the illicit connection. Prior to smoke testing it is critical to inform the local public of the plan testing activities. Smoke testing, described in the CWP IDDE Guidance Manual (CWP and Pitt, 2004), employs three basic steps: (1) seal off the storm drain section for testing, (2) force smoke into the storm drain section, and (3) observe above ground smoke and identify connection. To seal the storm drain, either the downstream or upstream manhole is removed and the storm drains that will not be included in the testing are sealed with one of several options, including sandbags, a beach ball inflated just larger than the pipe diameter, or expandable plugs. Then the other end of the storm drain is sealed; it is necessary that there is only one open entrance to the storm drain section and no open exits. To create the smoke either a smoke bomb is lowered into the manhole or liquid smoke is injected through a blower. High powered blowers are placed in front of the manhole to force the smoke into the storm drain and out illicit connections, sewer valves or cracks in the storm drain. While searching for above ground smoke it is important to be aware of the reports from residents.

5.2.6 Canine Scent Tracking

As necessary, canine scent tracking may be used to trace the high priority storm drains from their outfalls to catch basins and manholes throughout the flowing portions of each storm drain network of interest. Canine scent tracking, with canine sensitivity trained to human waste scents, allows an investigator to conduct a rapid but medium sensitivity and low specificity screening (Boehm 2013) of a sewershed in a way that only intensive manual sampling could compare with (i.e., dogs can sniff every inlet and manhole in a sewershed in a few days with immediate results, whereas hundreds of manual samples plus lab analysis would be required to produce data with comparable spatial coverage). The need for or benefit of canine scent tracking will be assessed on a site-by site basis, and may be beneficial when storm drain networks are very large, or CCTV and dye/smoke testing results are inconclusive.

5.2.7 Intermittent Flows

At outfalls that are not flowing but appear to have transient dry-weather flow[16] (e.g., dripping or wet outfall invert, foul sewer-like odors, significant algae growth, etc.), an intermittent flow trap, such as sand bags or a caulk dam, may also be used to capture dry weather flow. Depending on site-specific conditions, in the case that intermittent flow traps are unsuccessful but dry-weather

[16] Persistent flow is defined in the Permit as “the presence of flowing, pooled, or ponded water more than 72 hours after a measurable rainfall event of 0.1 inch or greater during three consecutive monitoring and/or inspection events.” Any flow not meeting this definition is considered transient.

flows are still suspected, fiber optic cables in combination with automated continuous flow monitoring and sampling may be conducted as follows:

- *Fiber optic cables:* Key sections of streams, engineered channel, or major storm drains may have multiple outfalls identified with the potential of intermittent flow. If follow-up visits are unsuccessful at identifying flow, yet it is still believed that dry-weather intermittent flows are persisting, a fiber optic cable could be deployed along the channel bottom. The fiber optic cable would continuously measure temperature variations in the flow which may be helpful in identifying locations and timing of intermittently flowing outfalls for further investigation.
- *Automated continuous flow monitoring:* An additional technique for determining the timing, frequency, and magnitude of intermittent flows where follow-up visits have been unsuccessful would be the use of an automated continuous flow gauge. As necessary, the flow gauge could be employed at key locations within the MS4 to determine flow magnitude, variability, and patterns (e.g., early morning peaks associated with irrigation). Automated flow monitoring may also help identify the source of water, such as irrigation (with daily timers) and sump pumps (with a regular on/off timing).
- *Automated sampler:* When unpredictable variability or night discharges are identified, an autosampler could be installed to capture a sample. If employed, the sampler would need to be able to collect shallow flows typically found during dry weather.

The need for either fiber optic cables or automated flow samplers will be determined on a case by case basis.

5.3 Remediation Approaches

Remediation approaches will be specific to the sources identified, but may include:

- Re-plumbing illicit connections (performed by building owners who would be immediately notified of such connections);
- Replacing or repairing leaking sewer lines (potentially performed by sanitation districts who would be immediately notified of such leaks);
- Repairing or replacing damaged storm drains (in the case where septic inflows may exist);
- Increasing outreach/enforcement to address residential or commercial sources of non-stormwater flow;
- Programs to address local homeless encampments;
- Strategies to prevent access to storm drains by wildlife;
- Targeted pet waste management programs; and/or
- Other site-specific solutions.

6 VERIFICATION MONITORING

6.1 Objective

After the Preliminary Outfall Investigation and Storm Drain Network Investigation have been completed and remedies have been implemented, Verification Monitoring for flow, FIB, and human source markers will be performed at all outfalls that were identified as flowing during previous investigation phases. At outfalls where analysis for human source markers confirm that no human sources of bacteria are present, but dry weather flows and FIB exceedances remain, this dataset may be used as a line of evidence supporting a request to reopen the TMDL, request a NSE, or perform a Quantitative Microbial Risk Assessment (QMRA) (see Section 8). An additional study investigating the origin of FIB may be conducted to assess whether FIB may be linked to natural sources or regrowth within storm drains.

For outfalls where human source markers are again detected after remedies have been implemented, additional Storm Drain Network Investigations will occur and appropriate remedies will be reassessed. This process will continue in an iterative fashion until human sources of bacteria or all dry weather flows have been eliminated.

6.2 Methodology

All outfalls that were previously found to be flowing during the Preliminary Outfall Investigation and Storm Drain Network Investigation will be revisited after implementation of remedies to identify whether flow is still present, and, if so, to conduct Verification Monitoring for human markers and FIB. As recommended in the SIPP Manual, the number of samples used to confirm the absence of human waste will be determined by precedent from previous successful or CBI MS4 MST studies, the final SIPP Manual, TAC recommendations, and/or the algorithm described in Cao, et al. (2013), though it should be noted that Cao, et al. acknowledges the need for additional work to "further develop, validate and demonstrate the algorithm." It should be noted that confirming the absence of human waste will likely require a different (and larger) number of samples than would confirming the presence, therefore flexibility with schedule will be required. Furthermore, if human detects are found within a specific network, sampling at the location will be suspended in order to perform another Storm Drain Network Investigation and reevaluate appropriate remedies.

FIB samples will also be collected during Verification Monitoring. If possible, FIB data will be collected five times within 30-days for comparison with the FIB geometric mean criteria.

For outfalls that are dry during a Verification Monitoring visit, field observation sheets will be completed, and the outfall will be revisited periodically at a frequency to be determined through discussions with the TAC.

Additional samples will be taken in the receiving waters at locations prioritized based on the results of the Verification Monitoring. For consistency, sample frequency, collection, laboratory methods, QAQC procedures, etc. will be similar to those employed in outfall sampling, and are described in detail in the SAP (Appendix B) and the associated QAPP (Appendix E).

7 POTENTIAL POST-MST TMDL REOPENER ACTIVITIES

The results of the outfall sampling described in the prior sections will serve as preliminary screening data to evaluate the potential benefit of either a Natural Source Exclusion (NSE) or Quantitative Microbial Risk Assessment (QMRA). If necessary, additional analyses, including possibly additional sample collection, will be considered. This section describes these two potential pathways for modifying existing TMDL WLAs. Technical issues associated with these pathways were discussed at the November 2012 State of the Science meeting and can be found here: ftp://ftp.sccwrp.org/pub/download/SOURCE_ID_WORKSHOP/

7.1 NSE

As described in Resolution No. R9-2008-0028*, A Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) to Incorporate Implementation Provisions for Indicator Bacteria Water Quality Objectives to Account for Loading from Natural Uncontrollable Sources within the Context of a TMDL* (SDRWQCB, 2008), required applicability criteria include:

1) All appropriate BMPs have been implemented to control all anthropogenic sources of FIB to the target water body such that they do not cause or contribute to exceedances of the FIB water quality objectives;

2) The residual indicator bacteria densities are not indicative of a human health risk; and

3) Natural sources have been identified and quantified.

If these criteria are demonstrated, exceedances of the indicator bacteria water quality objectives may be allowed based on the residual exceedances in the target water body. The applicability of this approach will be assessed based on results of the Verification Monitoring, as well as on outcomes of the ongoing NSE requests in the Los Angeles region. These NSE requests, such as by Malibu and by the Port of Los Angeles for Inner Cabrillo Beach, follow extensive MST investigation to confirm the absence of human fecal waste.

7.2 QMRA

The EPA has approved the use of QMRA for developing site-specific objectives in its 2012 Recreational Criteria. QMRA allows for estimating the risk of illness from exposure to pathogens while swimming or recreating in receiving waters. As FIB from natural and non-human sources have a much lower association with human pathogens than FIB from human fecal sources, if it can be shown that most FIB in a waterbody have originated from non-human sources, QMRA may be used to show that the risk of illness from recreating in these waterbodies is low, even at higher FIB concentrations. In a QMRA, receiving water pathogen concentrations are measured. These concentration distributions are then combined with ingestion volume distributions to estimate a range of likely doses using Monte Carlo simulations. Pathogen doses are translated into infection and illness frequencies based on pathogen-specific dose-response curves from published epidemiological studies. If it can be shown that the risk of illness from recreating in a waterbody is low, there is an opportunity for more lenient FIB regulations for that waterbody.

Recent published QMRAs have demonstrated the low recreational illness risk associated with exposure to receiving waters containing fecal waste from non-human sources (Soller 2010, Schoen 2010). The benefits of this approach will be further evaluated based on the outcomes of ongoing QMRAs funded by the SWRCBs CBI and the City of San Diego.

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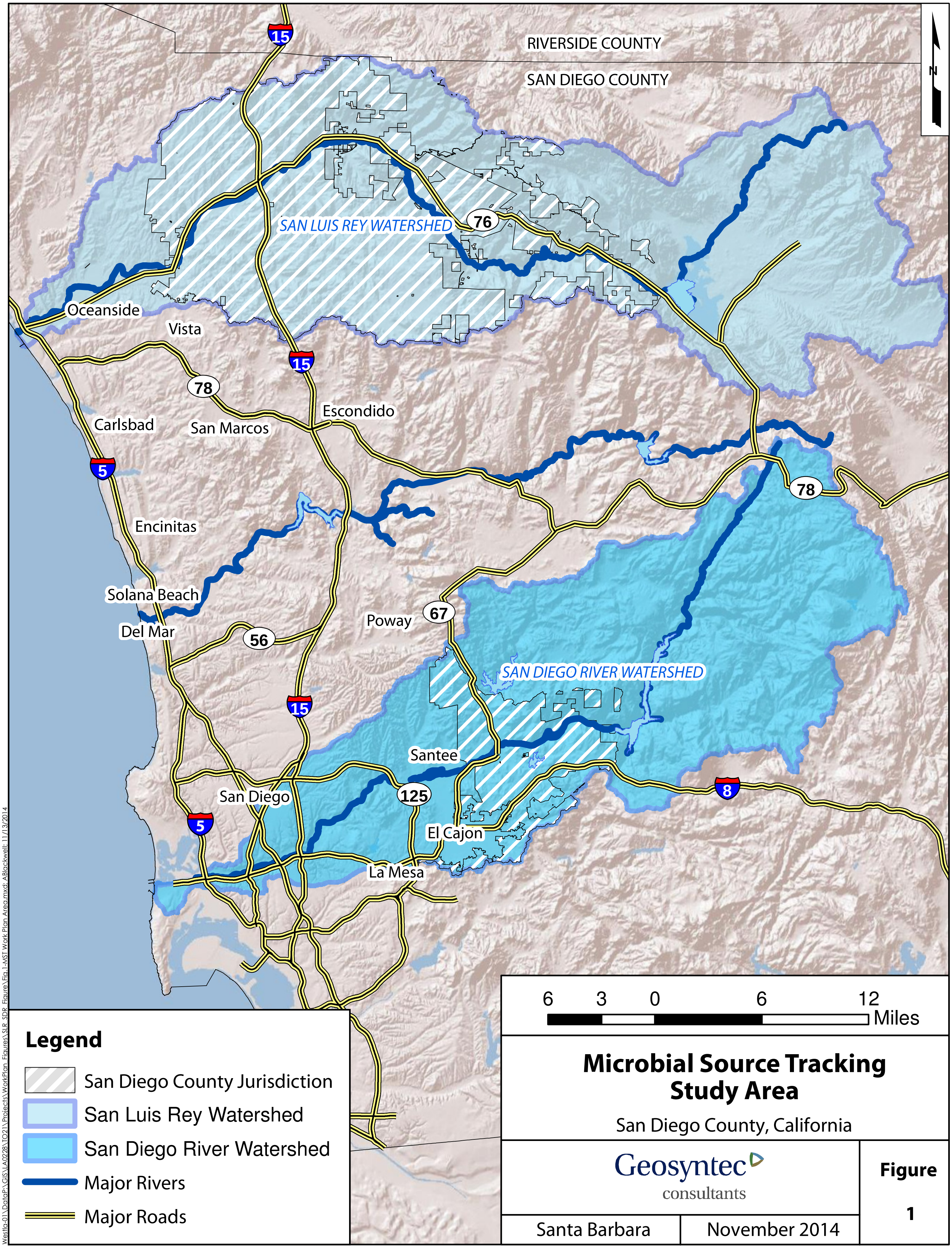
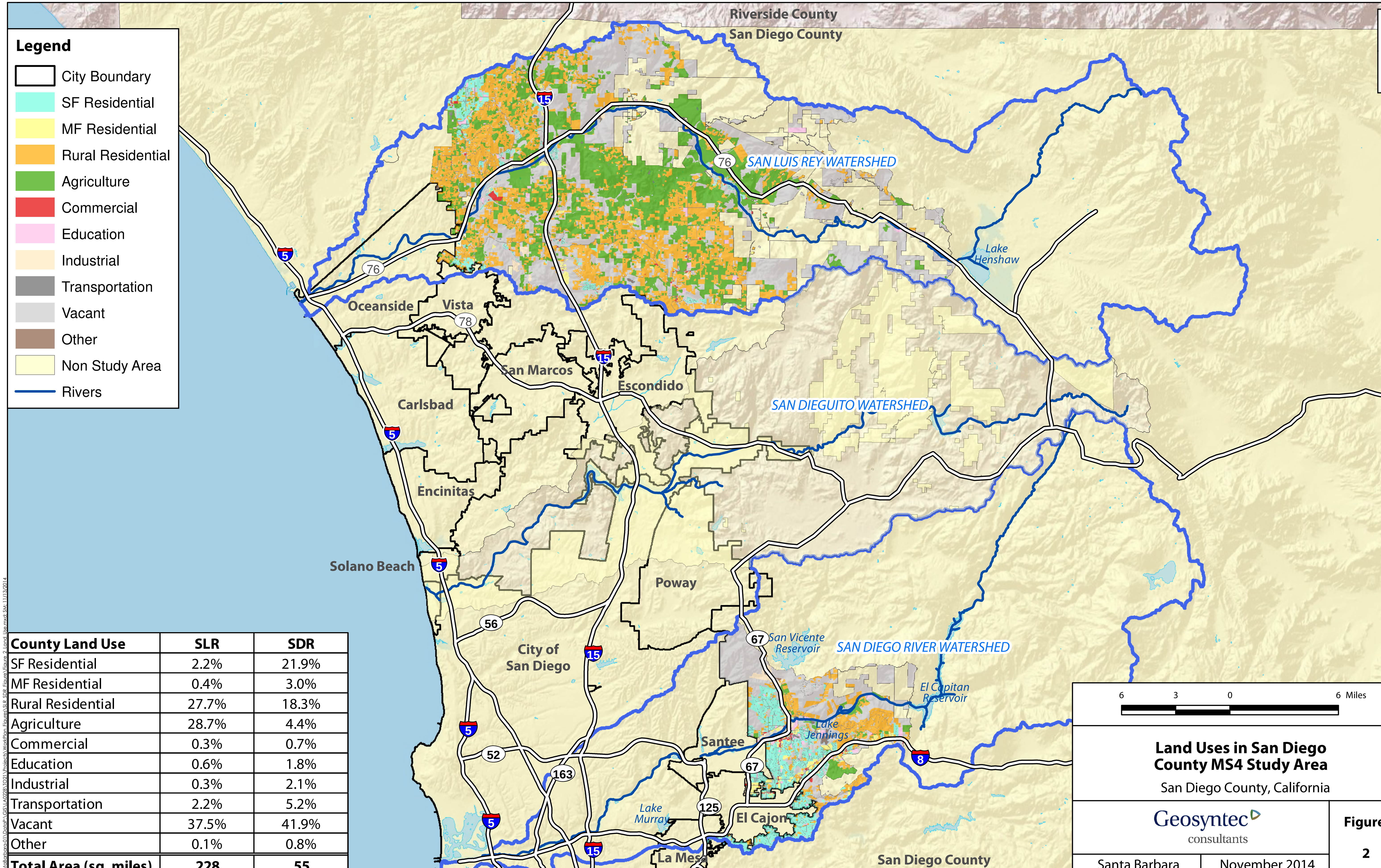


RIVERSIDE COUNTY
SAN DIEGO COUNTY
N
15
76
SAN LUIS REY WATERSHED
Oceanside
Vista
15
78
Escondido
Carlsbad
San Marcos
5
78
Encinitas
Solana Beach
Del Mar
56
Poway
67
SAN DIEGO RIVER WATERSHED
15
Santee
San Diego
125
8
5
El Cajon
La Mesa
6 3 0 6 12
Miles
Legend
San Diego County Jurisdiction
San Luis Rey Watershed
San Diego River Watershed
Major Rivers
Major Roads
Microbial Source Tracking Study Area
San Diego County, California
Geosyntec
consultants
Figure
1
Santa Barbara
November 2014



County Land Use	SLR	SDR
SF Residential	2.2%	21.9%
MF Residential	0.4%	3.0%
Rural Residential	27.7%	18.3%
Agriculture	28.7%	4.4%
Commercial	0.3%	0.7%
Education	0.6%	1.8%
Industrial	0.3%	2.1%
Transportation	2.2%	5.2%
Vacant	37.5%	41.9%
Other	0.1%	0.8%
Total Area (sq. miles)	**228**	**55**

Land Uses in San Diego County MS4 Study Area

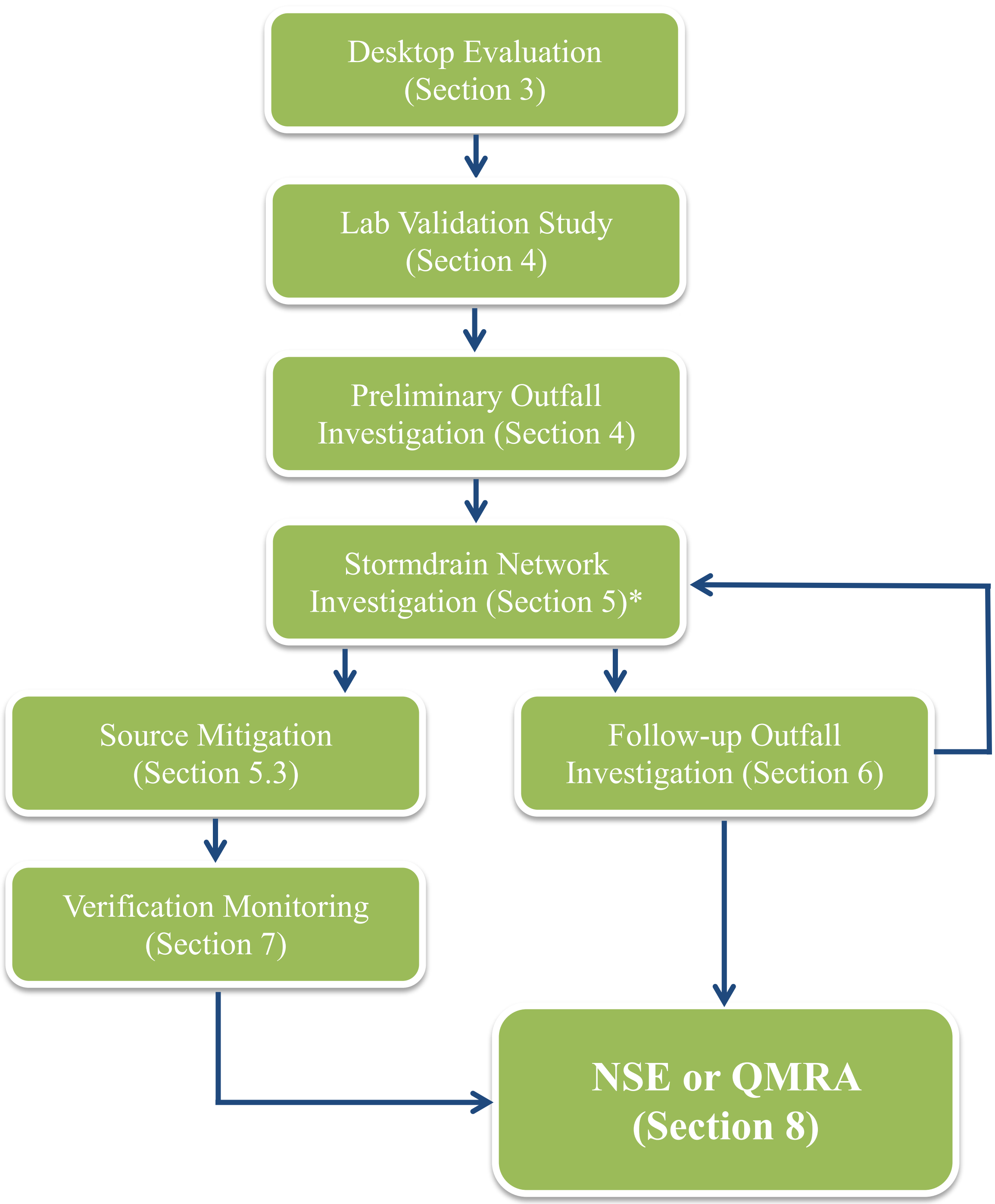
San Diego County, California

Geosyntec consultants

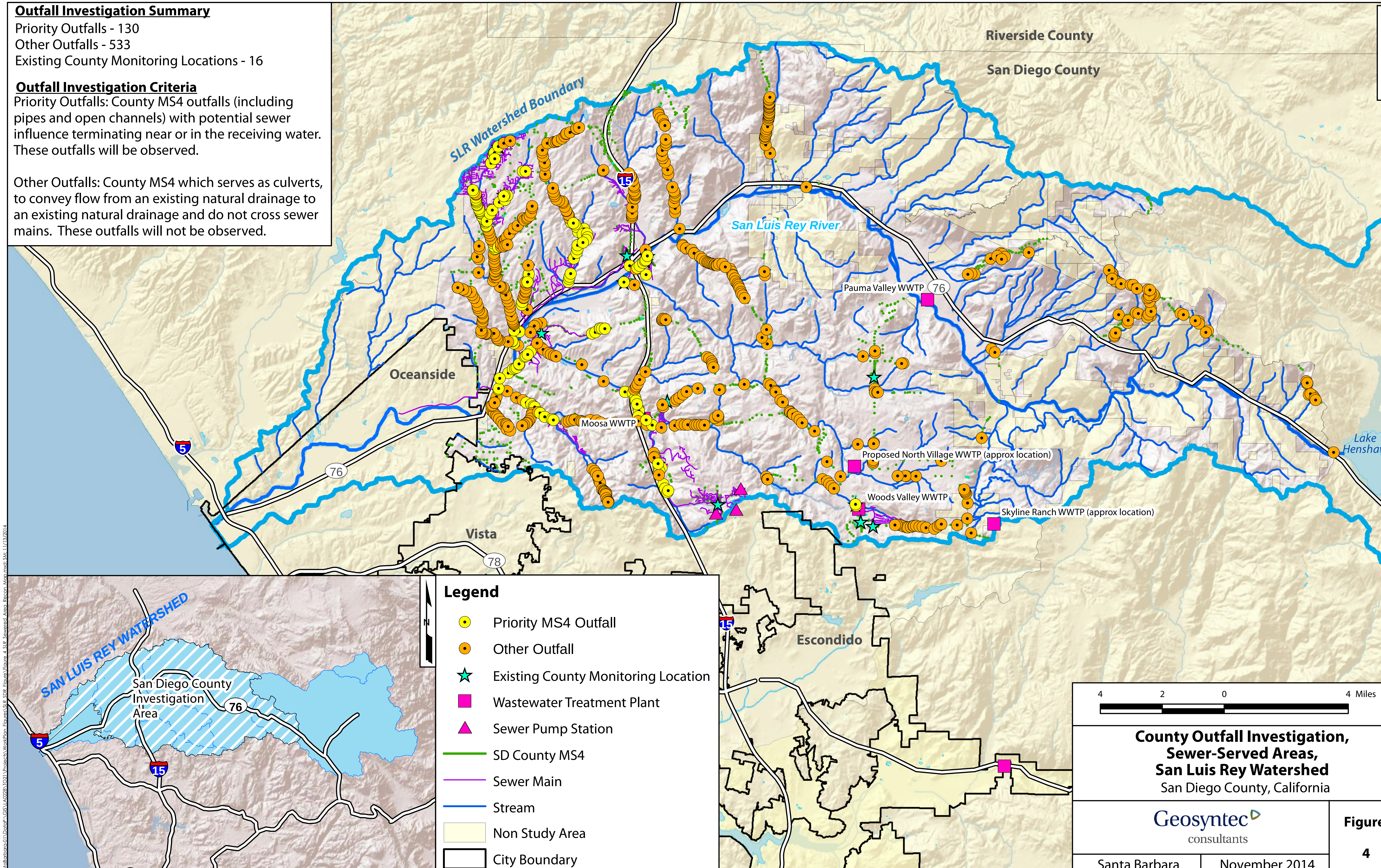
Santa Barbara | November 2014

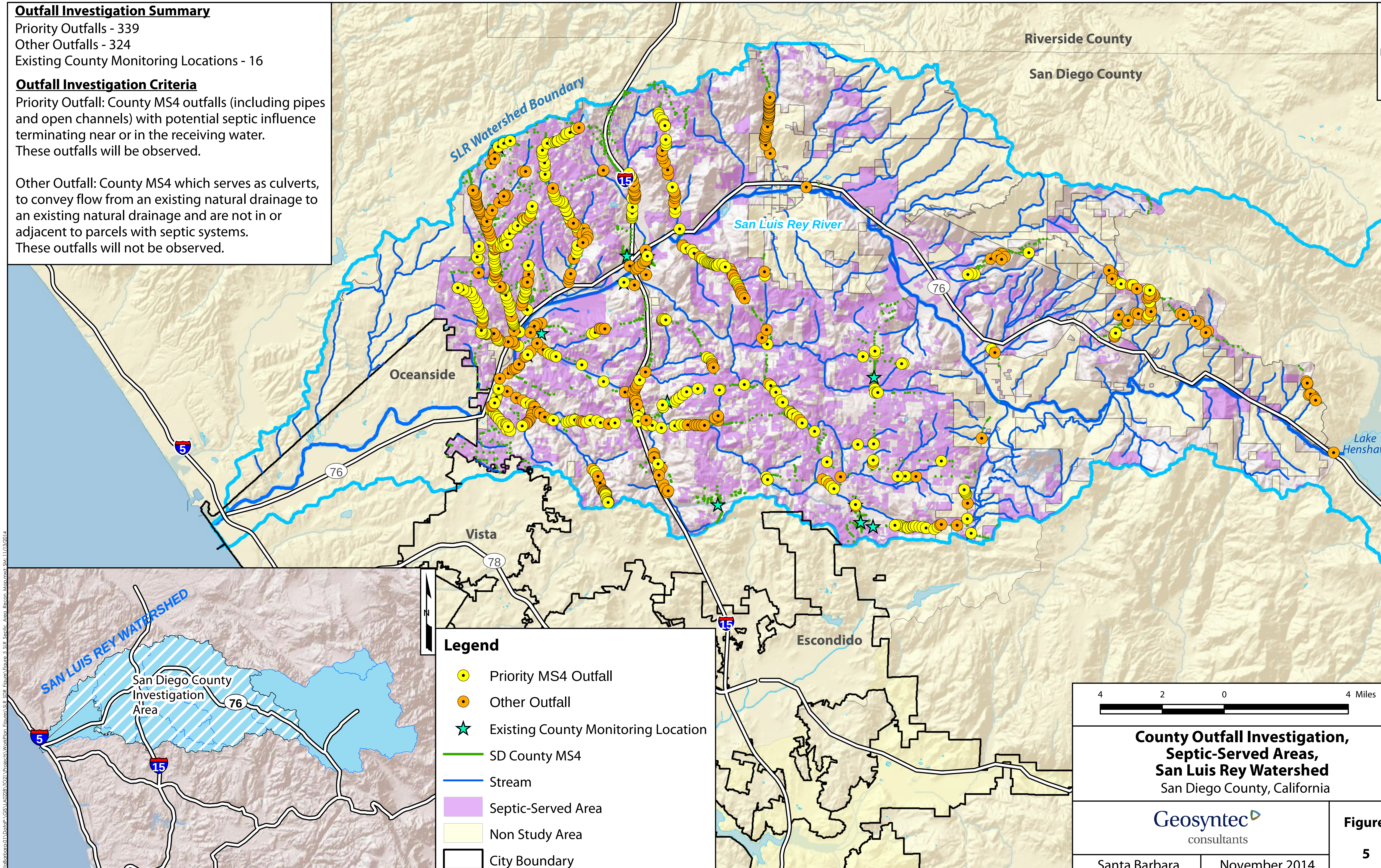
Figure 2

Figure 3. Unincorporated County MS4 Outfall MST Study Approach Flowchart



* During the Stormdrain Network Investigation, human positive outfalls will be subject to a human waste source investigation, including network sampling for MST markers and potentially other chemical indicators, as well as a flow source investigation (visual inspection of network, CCTV, etc.). Human negative outfalls will only be investigated for flow sources.


Outfall Investigation Summary
Priority Outfalls - 130
Other Outfalls - 533
Existing County Monitoring Locations - 16
Outfall Investigation Criteria
Priority Outfalls: County MS4 outfalls (including pipes and open channels) with potential sewer influence terminating near or in the receiving water. These outfalls will be observed.
Other Outfalls: County MS4 which serves as culverts, to convey flow from an existing natural drainage to an existing natural drainage and do not cross sewer mains. These outfalls will not be observed.
SLR Watershed Boundary
Riverside County
San Diego County
San Luis Rey River
Pauma Valley WWTP
76
15
5
78
Oceanside
Vista
Escondido
Moosa WWTP
Proposed North Village WWTP (approx location)
Woods Valley WWTP
Skyline Ranch WWTP (approx location)
Lake Henshaw
SAN LUIS REY WATERSHED
San Diego County Investigation Area
Legend
Priority MS4 Outfall
Other Outfall
Existing County Monitoring Location
Wastewater Treatment Plant
Sewer Pump Station
SD County MS4
Sewer Main
Stream
Non Study Area
City Boundary
4
2
0
4 Miles
N
County Outfall Investigation,
Sewer-Served Areas,
San Luis Rey Watershed
San Diego County, California
Geosyntec
consultants
Figure
4
Santa Barbara
November 2014



Outfall Investigation Summary
Priority Outfalls - 339
Other Outfalls - 324
Existing County Monitoring Locations - 16
Outfall Investigation Criteria
Priority Outfall: County MS4 outfalls (including pipes and open channels) with potential septic influence terminating near or in the receiving water.
These outfalls will be observed.
Other Outfall: County MS4 which serves as culverts, to convey flow from an existing natural drainage to an existing natural drainage and are not in or adjacent to parcels with septic systems.
These outfalls will not be observed.
SLR Watershed Boundary
Riverside County
San Diego County
San Luis Rey River
Oceanside
Vista
Escondido
Lake Henshaw
15
76
5
78
SAN LUIS REY WATERSHED
San Diego County Investigation Area
Legend
Priority MS4 Outfall
Other Outfall
Existing County Monitoring Location
SD County MS4
Stream
Septic-Served Area
Non Study Area
City Boundary
4 2 0 4 Miles
County Outfall Investigation, Septic-Served Areas, San Luis Rey Watershed
San Diego County, California
Geosyntec consultants
Figure
5
Santa Barbara
November 2014

Prepared for

County of San Diego, Department of Public Works
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San Diego, California, 92123-1237

APPENDIX A

OUTFALL INVESTIGATION FIELD SHEET AND VISUAL OBSERVATION GUIDANCE

FOR TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

Prepared by

Geosyntec consultants

engineers | scientists | innovators

3990 Old Town Ave., Suite A-101
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Project Number LA022824

November 24, 2014

Outfall Investigation / Sample Collection (Field Sheet 1 of 2)

Section 1: Background Data

Watershed: ☐ San Diego River ☐ San Luis Rey River ☐ San Dieguito River		GIS Outfall ID: ☐ Not in GIS database	
Today's date:	Time (Military):	Stream Reach and Location:	
Investigators:	Rainfall (in.): Last 72 hours:	Number of days since rainfall ≥ 0.1 inches in 24 hours:	
Temperature (°C):	Weather: ☐ Sunny ☐ Partly Cloudy ☐ Overcast ☐ Fog		
Latitude:	Longitude:	GPS Unit ID:	GPS Point ID #:
Camera ID:		Photo #(s):	

Land Use in Drainage Area
(Check all that apply):

☐ Rural Residential
☐ Single Family Residential
☐ Multi-Family Residential
☐ Agriculture
☐ Open Space
☐ Commercial
☐ Industrial
☐ Parks
☐ Other: ___________________
Describe known agriculture or industries: ______________________________
☐ *Septic Systems*

Receiving waters flowing? ☐ Yes ☐ No (Dry)	Flow Depth _____ ft	Flow Width _____ ft	Flow Velocity _____ ft/sec

Notes or additional actions need (e.g.., origin of outfall, if known):

Section 2: Outfall Description

LOCATION	MATERIAL	SHAPE	DIMENSIONS (IN.)	SUBMERGED
☐ **Closed Pipe**	☐ RCP ☐ CMP ☐ PVC ☐ HDPE ☐ Steel ☐ Other: __________	☐ Circular ☐ Elliptical ☐ Box ☐ Other: _____ ; ☐ Single ☐ Double ☐ Triple ☐ Other: _____	Diameter/Dimensions: __________________ in	In water: ☐ No ☐ Partially ☐ Fully; With sediment: ☐ No ☐ Partially ☐ Fully
☐ **Open Drainage**	☐ Concrete ☐ Earthen ☐ Rip-rap ☐ Other: _____	☐ Trapezoid ☐ Parabolic ☐ Other: _____	Depth: _____ in; Top width: _____ in; Bottom width: _____ in	

Water Present?	☐ Yes ☐ No (Dry) ***If no, skip to Section 5***	Intermittent flow trap set? ☐ Yes ☐ No If Yes, type: ☐ Sandbags ☐ Caulk dam
Flow Description (If present)	☐ Trickle ☐ Moderate ☐ Substantial ☐ Ponded water	☐ Analytical Lab Sample Collected
Flows Adjacent to Outfall (If present)	☐ Seepage ☐ Drain pipes ☐ Wetland drainage ☐ Overland flow, describe:	☐ Other: _____

Section 3: Quantitative Characterization

FIELD DATA FOR OUTFALLS WITH WATER PRESENT				
PARAMETER		**RESULT**	**UNIT**	**EQUIPMENT**
Flow depth			feet	Tape measure
Flow width			feet	Tape measure
Ponded length (if ponded)			feet	Tape measure
☐ Flow Method #1	Volume		liter	Bottle
	Time to fill		second	Stop watch
☐ Flow Method #2	Velocity		ft/sec	Flow meter
☐ Flow Method #3	Measured length		feet	Tape measure
	Time of travel		second	Stop watch
Temperature			°C	Thermometer
pH			pH Units	Probe
Turbidity			mS/cm	Probe
Conductivity			NTU	Probe
Dissolved Oxygen			mg/L	Probe

OUTFALL INVESTIGATION / SAMPLE COLLECTION (FIELD SHEET 2 OF 2)

Section 4: Physical Indicators for Observed Flow and/or Ponded Water Is flow and/or ponded water present, and are physical indicators present? Yes No (*If no, skip to Section 5)*

INDICATOR	CHECK IF PRESENT	FLOW DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)		
Odor		Sewage Rancid/sour Petroleum/gas Sulfide Other:	1 – Faint	2 – Easily detected	3 – Noticeable from a distance (>20 ft)
Color		White Brown Gray Yellow Green Orange Red Other:	1 – Faint color in sample bottle	2 – Clearly visible in sample bottle	3 – Clearly visible in flow
Cloudiness		See severity	1 – Slight cloudiness	2 – Cloudy	3 – Opaque
Floatables (does not include trash)		Sewage (toilet paper, etc.) Suds/Foam Microalgae Petroleum (oil sheen) Macroalgae Other:	1 – Few/slight; origin not obvious	2 – Some; indications of origin (e.g., possible suds or oil sheen)	3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

Section 5: Other Physical Indicators Are physical indicators that are not related to flow and/or ponded water present? Yes No (*If no, skip to Section 6)*

INDICATOR	CHECK IF PRESENT	OUTFALL DESCRIPTION	COMMENTS
Outfall Damage		Spalling, cracking, or chipping Peeling paint Corrosion	
Deposits/Stains		Oily Flow line Paint Sediment Other:	
Abnormal Vegetation		Excessive Inhibited	
Benthic Growth		Brown Orange Green Other:	
Biology		Insects Algae Snails Fish Birds Crayfish Other:	

Section 6: Potential Bacteria Sources Are potential bacteria sources present in or near the outfall/MS4 or stream? Yes No

HUMAN SOURCE			ANIMAL SOURCE			AGRICULTURE SOURCE		
DESCRIPTION	PROXIMITY (check all that apply)	SEVERITY	DESCRIPTION	PROXIMITY (check all that apply)	SEVERITY	DESCRIPTION	PROXIMITY (check all that apply)	SEVERITY
Homeless encampment(s)	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Dog	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Barn	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High
RV(s) Quantity:	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Bird Type:	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Pasture	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High
Porter potties	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Horse	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Manure disposal site	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High
Park bathroom facilities	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Cattle	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Manure used as fertilizer	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High
Dumpsters Leaking?:	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Goat	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Other:	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High
Swimming pool(s)	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Sheep	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High			
Other*:	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High	Other:	Outfall/MS4 Stream In Adjacent _____ ft	Low Medium High			

*E.g., Trash (describe)

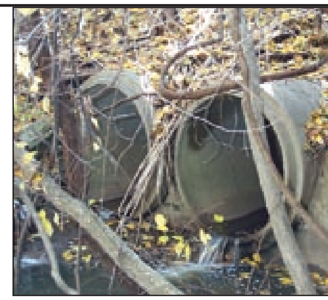
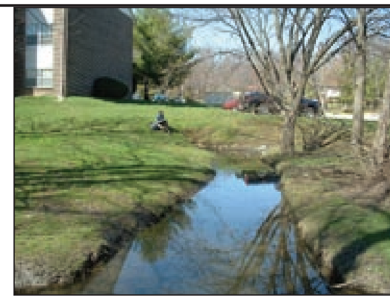
 Ductile iron round pipe	 4-6" HDPE; Check if roof leader connection (legal)	 Field connection to inside of culvert; Always mark and record.
 Small diameter (<2") HDPE; Often a sump pump (legal), or may be used to discharge laundry water (illicit).	 Elliptical RCP; Measure both horizontal and vertical diameters.	 Double RCP round pipes; Mark as separate outfalls unless known to connect immediately up-pipe
 Culvert (can see to other side); Don't mark as an outfall	 Open channel "chute" from commercial parking lot; Very unlikely illicit discharge. Mark, but do not return to sample (unless there is an obvious problem).	 Small diameter PVC pipe; Mark, and look up-pipe to find the origin.
 CMP outfall; Crews should also note upstream sewer crossing.	 Box shaped outfall	 CMP round pipe with two weep holes at bridge crossing. (Don't mark weep holes)

Figure 22: Typical Outfall Types Found in the Field

Submerged: More than ½ below water

Partially submerged: Bottom is below water



Fully submerged: Can't see outfall

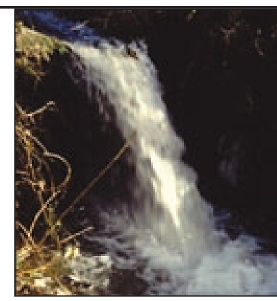
Outfall fully submerged by debris

Fully submerged from downstream trees trapping debris

Partially submerged by leaf debris "back water"

Trickle Flow: Very narrow stream of water

Moderate Flow: Steady stream, but very shallow depth

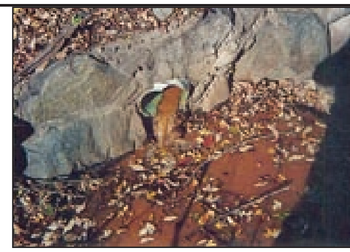


Significant flow (Source is a fire hydrant discharge)

Figure 28: Characterizing Submersion and Flow

Color: Brown; Severity: 2
Turbidity Severity: 2

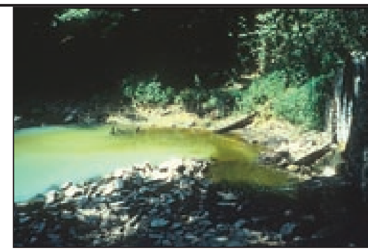
Color: Blue-green; Severity: 3
Turbidity Severity: 2



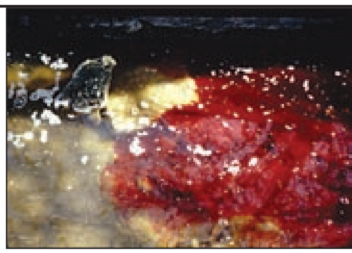
Highly Turbid Discharge
Color: Brown; Severity: 3
Turbidity Severity: 3

Sewage Discharge
Color: 3
Turbidity: 3

Paint
Color: White; Severity: 3
Turbidity: 3



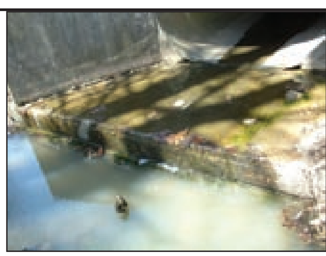
Industrial Discharge
Color: Green; Severity: 3
Turbidity Severity: 3



Blood
Color: Red; Severity: 3
Turbidity Severity: None

Failing Septic System:
Turbidity Severity: 3

Turbidity in Downstream Plume
Turbidity Severity: 2
(also confirm with sample bottle)

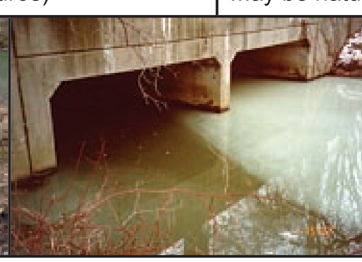


High Turbidity in Pool
Turbidity Severity: 2
(Confirm with sample bottle)

Iron Floc
Color: Reddish Orange; Severity: 3
(Often associated with a natural source)

Slight Turbidity
Turbidity: 1
(Difficult to interpret this observation; May be natural or an illicit discharge)

Construction Site Discharge
Turbidity Severity: 3



Discharge of Rinse from Floor Sanding (Found during wet weather)
Turbidity Severity: 3

Figure 34: Interpreting Color and Turbidity

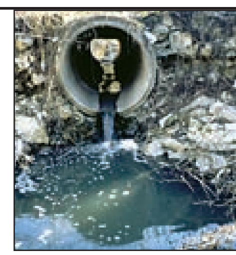
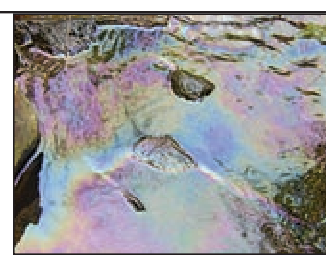
SUDS		
		
Natural Foam Note: Suds only associated with high flows at the “drop off” Do not record.	Low Severity Suds Rating: 1 Note: Suds do not appear to travel; very thin foam layer	High severity suds Rating: 3 Sewage
OIL SHEENS		
		
Low Severity Oil Sheen Rating: 1	Moderate Severity Oil Sheen Rating: 2	High Severity Oil Film Rating: 3

Figure 35: Determining the Severity of Floatables

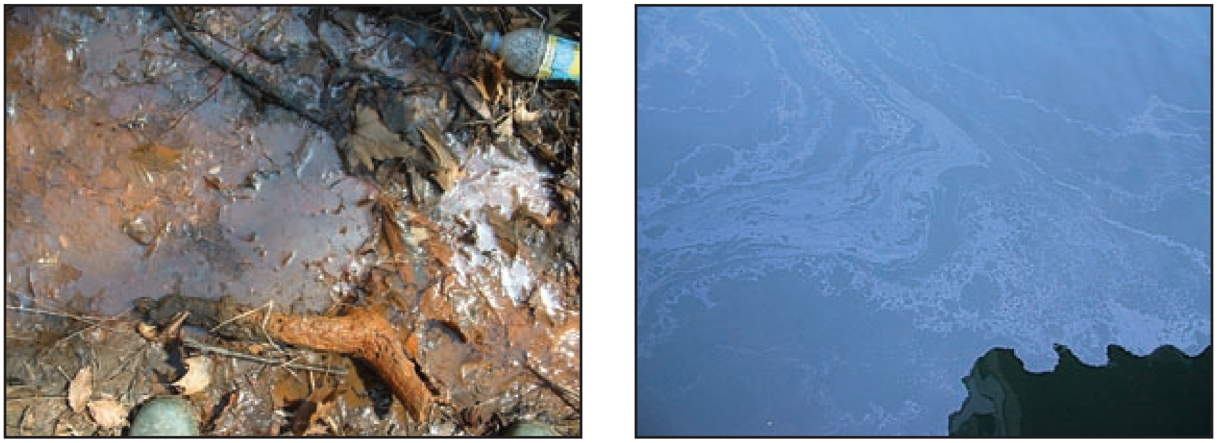


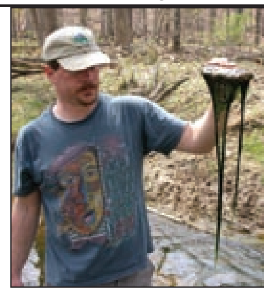
Figure 36: Synthetic versus Natural Sheen (a) Sheen from bacteria such as iron floc forms a sheet-like film that cracks if disturbed (b) Synthetic oil forms a swirling pattern

Bacterial growth at this outfall indicates nutrient enrichment and a likely sewage source.

This bright red bacterial growth often indicates high manganese and iron concentrations. Surprisingly, it is not typically associated with illicit discharges.

Sporalitis filamentous bacteria, also known as “sewage fungus” can be used to track down sanitary sewer leaks.

Algal mats on lakes indicate eutrophication. Several sources can cause this problem. Investigate potential illicit sources.

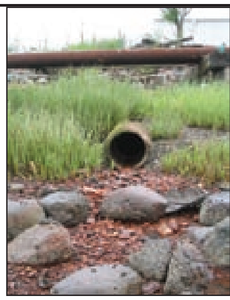


Illicit discharges or excessive nutrient application can lead to extreme algal growth on stream beds.

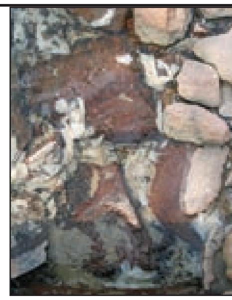
The drainage to this outfall most likely has a high nutrient concentration. The cause may be an illicit discharge, but may be excessive use of lawn chemicals.

This brownish algae indicates an elevated nutrient level.

Figure 38: Interpreting Benthic and Other Biotic Indicators

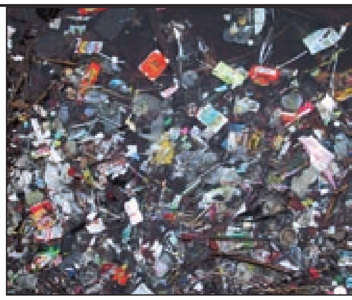


Reddish staining on the rocks below this outfall indicate high iron concentrations.



Toilet paper directly below the storm drain outlet.

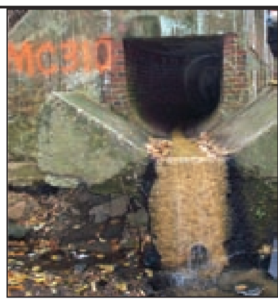
Watershed Protection??



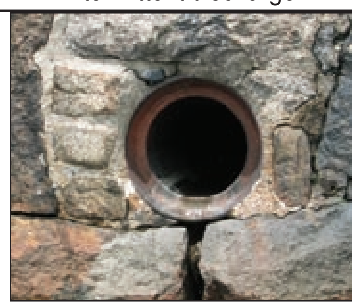
Trash is not an indicator of illicit discharges, but should be noted.

Staining at the base of the outfall may indicate a persistent, intermittent discharge.

Excessive vegetation may indicate enriched flows associated with sewage.



Brownish stain of unclear origin. May be from degradation of the brick infrastructure.

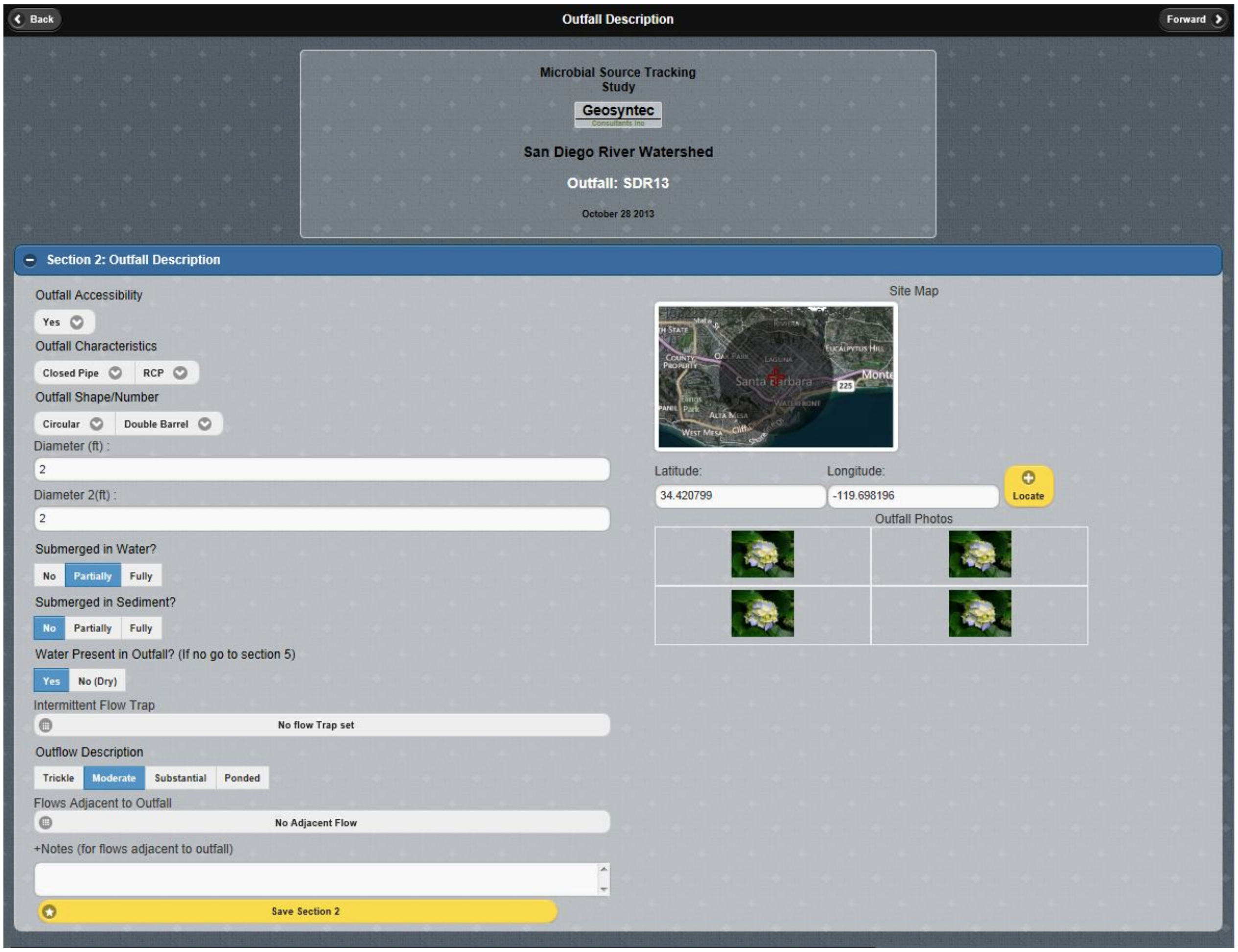


Cracked rock below the outfall may indicate an intermittent discharge.

Poor pool quality. Consider sampling from the pool to determine origin.

Figure 39: Typical Findings at Both Flowing and Non-Flowing Outfalls

SCREENSHOT OF FIELD APP (OUTFALL DESCRIPTION PAGE)



Prepared for

County of San Diego, Department of Public Works
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San Diego, California, 92123-1237

APPENDIX B

SAMPLING AND ANALYSIS PLAN (SAP)

FOR TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

Prepared by

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engineers | scientists | innovators
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San Diego, California 92110

Project Number LA022824

November 24, 2014

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1. INTRODUCTION

This Sampling and Analysis Plan (SAP), describes the sampling and analysis procedures, including field measurement methods and equipment, methods for sample collection, and laboratory analytical methods. This SAP, along with the Quality Assurance Project Plan (QAPP) (Appendix E), is intended to ensure that the objectives of the Work Plan are met to scientifically defensible standards.

2. SAMPLING PROGRAMS

The following sampling programs will be implemented during the course of the Work Plan. When required, the program will be carried out during dry weather as defined in the Work Plan.

2.1 Preliminary Outfall Investigation Sampling

During the Preliminary Outfall Investigation, samples will be collected at all outfalls with flowing water. FIB, ammonia, phosphate, MBAS, sucralose, caffeine, cotinine, human markers, and non-human markers will be analyzed in the samples. The main objectives of this Preliminary Investigation are to (1) identify the flowing outfalls, (2) categorize flowing outfalls as positive or negative for human markers, and (3) determine which of the more common analytical parameters, if any, will serve as reliable pre-screening analytes to trigger the more costly human marker testing in subsequent follow-up sampling.

2.2 Storm Drain Network Investigation Sampling

A Storm Drain Network Investigation will be undertaken to locate the potential sources of flow and bacteria that were observed during the Preliminary Outfall Investigation. During the investigation, it may be necessary to sample specific locations within the storm drain network where flows converge, in order to prioritize which flow to investigate. The decision to sample will be made on a case by case basis.

Outfalls from the Preliminary Investigation that had no flow, but did have indications of intermittent flow, will be revisited as described in the Work Plan.

During the investigation, select storm drains will be observed using Closed-Circuit Televsion (CCTV) to locate inflows. For those storm drain networks that were positive for human markers during the Preliminary Investigation, after an inflow to the stormdrain has been identified, the closest downstream manhole will be sampled to confirm the presence of human impacts. As described in the Work Plan, once a source has been confirmed follow-up procedures will be taken to eliminate the source.

All Storm Drain Network Investigation sampling will include the parameters determined to be reliable during the Preliminary Investigation and follow the tiered analysis methodology developed based on the Preliminary Outfall Investigation sampling results.

2.3 Verification Sampling

Verification sampling will occur at all outfalls where remedial activities took place based on the results of the Storm Drain Network Investigation. Only field measurements, FIB and human markers will be analyzed. The frequency of FIB and human marker sampling will be determined as discussed in the Work Plan. In the situation in which no flow is present during a sampling visit, the field observation sheet would still be completed and no flow would be noted. Also to ensure representative sampling, when practical, visits should be spaced at least two days apart and collected at different times of day.

3. FIELD MEASUREMENT METHODS AND OBSERVATIONS

Field measurements collected at MS4 outfalls shall include flow rate, water temperature, pH, turbidity, conductivity, and dissolved oxygen. A field probe, such as the Horiba U-10 5-parameter probe shall be used to collect the field measurements. Appendix F includes the SOP for use and calibration of the Horiba U-10.

Aesthetic observations of the flowing water including odor, color, cloudiness, or floating particulates will also be observed and recorded. Additional observations will be undertaken of the outfall or receiving waters including damage, deposits/stains, abnormal vegetation, benthic growth, or biologic species, and proximity of potential human, animal, or agriculture bacteria sources to the outfall or stream. Appendix A contains the Outfall Investigation Field Sheet and photographic guidance.

4. SAMPLE COLLECTION METHODS FOR LABORATORY ANALYSIS

Samples will be analyzed for the parameters discussed in the Work Plan and shown in Section 6.2 of the Work Plan QAPP (Appendix E). Samples shall be collected in outfalls as grab samples using laboratory-approved containers, depending on analyte and analytical method requirements of the laboratory. Appropriate sample bottles, with preservatives as necessary, will be provided by the contracted laboratory. Table E11-1 in the Work Plan QAPP (Appendix E) includes laboratory sampling guidelines, including container type, sample volume, preservative requirements, and holding time until analysis.

Quality assurance methods, such as collection of field duplicates and trip blanks, are discussed in the Work Plan QAPP (Appendix E). Standard Operating Procedures describing sample collection methods are included in Appendix F. Section 11.2 of the Work Plan QAPP (Appendix E) describes a more conservative method for collecting human and non-human marker samples, because of the high potential for contamination.

Grab samples are to be collected wearing clean, disposable gloves standing downstream and submerging the sample container facing in the upstream direction, disturbing as little of the bottom material as possible. If practical, the sample will be collected at about 60% of the stream depth (from the surface) in an area of maximum turbulence. Sampling of the slowly flowing water near the edge of stormdrain will be avoided if possible. If the flowing water level is too low for collection without contacting the bottle lip to the submerged ground, a clean syringe will be used to fill sample bottle and this will be noted on the field sheet. If it is infeasible to collect sufficient volume by syringe, then insufficient flowing water will be reported for the sampling event and no samples will be analyzed.

Samples will be transported to the laboratory in an ice-filled cooler. Chain of custody forms will be filled out onsite and transferred to the laboratory upon sample exchange. These procedures are discussed in Section 12 of the Work Plan QAPP (Appendix E).

5. LABORATORY ANALYTICAL METHODS

To ensure availability for the tiered analysis when needed, all samples will be handled by the receiving laboratory in accordance with section 12 of the Work Plan QAPP (Appendix E). Analytical methods were selected from USEPA-approved methods (excluding human and non-human markers) to meet Work Plan requirements, including ensuring reporting accuracy and method detection limits. Analytical methods to be used for each measured water quality parameter are shown in section 6.2 of the Work Plan QAPP (Appendix E).

To provide consistency and comparability between events, only analytical laboratories (excluding Source Molecular based in Florida) certified by the State of California will be contracted for sampling events. Analytical data quality objectives, including accuracy, precision, percent recovery, target reporting limits, and completeness are included in Section 7 of the QAPP (Appendix E).

Prepared for

County of San Diego, Department of Public Works
5510 Overland Ave, Suite 410
San Diego, California, 92123-1237

APPENDIX C

FIELD EQUIPMENT

FOR TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

Prepared by

Geosyntec consultants

engineers | scientists | innovators
3990 Old Town Ave., Suite A-101
San Diego, California 92110

Project Number LA022824

November 24, 2014

Safety – Equipment and Supplies

First aid kit	
Proper safety boots	
Snake guards	
Safety vests	
Orange traffic cones	
Sun screen	
Insect repellent containing DEET	
Cell phone	
Drinking water	

Investigation and Sampling - Equipment and Supplies

Backpack or bag	
Clipboard, pens, pencils, Sharpie, or other waterproof pens	
Field Sheets	
Thomas Guide, MS4 maps, and land use maps	
County Road Station map and addresses	
IPAD	
Multi-parameter probe (Horiba – U10)	
Wristwatch	
Flashlight	
Extra batteries for all electronic equipment	
Latex Free gloves	
Cooler and either blue ice, or regular ice and bubble wrap	
Field-temp cooler thermometers (need 4 - Cat. No. ER-0040 from I-Chem)	
Paper towels	
Black permenanat waterproof marker	
Ziploc® bags (1 gallon for 1 L bottles)	
Sample bottles with preservatives	
Plastic syringes (1 case 60 cc syringes VWR MJ8881-560265 from I-Chem)	
Plastic sample cups	
De-ionized or ultra-pure water in squeeze bottles for rinsing, dilutions, etc.	
Wide-mouth bottle to measure flow	
Waste disposal bottles (keep in truck)	
Trash bags/bin	
Measuring tape for measuring stream width	
Folding scale for measuring stream depth	
Pole dipper stick for sampling	
Rubber boots	
Spray paint	
Manhole cover opening tool	
Machete	

Prepared for

County of San Diego, Department of Public Works
5510 Overland Ave, Suite 410
San Diego, California, 92123-1237

APPENDIX D

TASK HAZARD ANALYSIS (THA)

FOR TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

Prepared by

Geosyntec consultants

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3990 Old Town Ave., Suite A-101
San Diego, California 92110

Project Number LA022824

November 24, 2014

Geosyntec consultants

PRE-WORK THA

THA Title:	Field observation, measurements, and sample collection	**Date:**	3/28/2013
Project Name:	San Diego County Microbial Source Tracking Study	**Client Name:**	County of San Diego
Project Number:	LA022821	**Client Project Manager:**	Jo Ann Weber
Project Location:	San Diego, San Luis Rey, and San Dieguito rivers and tributaries	**Geosyntec Project Manager:**	Brandon Steets
Scope of Work Summary:	Walking the river and tributaries to take measurements and field observations and to collect samples at many outfalls throughout the San Diego River, San Luis Rey River, and San Dieguito River watersheds within the MS4 areas.		

Work Steps	**Process or Activity**	**Hazards**	**Hazard Control**
1)	Field Reconaissance, water quality measurements, sample collection, and observation of MS4 outfalls.	Slip/trip/fall; potential for hot or cold weather; environmental hazards from animals/plants; drowning hazard near river	Pay close attention to foot placement; slow deliberate movement-don't hurry. Wear appropriate clothing for hot or cold weather; see weather forecast before leaving, stay dry if possible. Wear appropriate clothing and use repellant for biting insects. Wear approved personal floatation device when taking measurements near fast-flowing water that poses a drowning hazard; their use shall be up to the discretion of field personnel based on site conditions.
Min. Personal Protective Equipment (PPE):	Appropriate shoes, long pants/sleeves to protect against poisonous plants/insects/snakes. Personal Floatation Devices whenever deemed necessary by field personnel.		

Individuals Must Sign the last page of this THA after review.

HAZARD		**HAZARD CONTROLS (check all that apply and comment as required)**
WALKING/WORKING SURFACES (EHS 210, 501)		
☒	☒ Uneven terrain ☒ Slippery surfaces	☒ Appropriate shoes worn. ☒ Field operations are not conducted before sunrise or after sunset unless adequate lighting is provided.
ENVIRONMENTAL HAZARDS (NON CHEMICAL) (EHS 124, 125, 127)		
☒	☒ Heat Stress ☒ Cold Stress ☒ Insects, spiders, ticks ☒ Wild animals ☒ Mold, fungi ☒ Poisonous plants ☒ Drowning risk	☒ Heat/Cold stress are monitored in accordance with Geosyntec procedures EHS 124 & EHS 125 ☒ Fluids are provided to prevent worker dehydration ☒ Types and injury potential of snakes, insects, spiders are reviewed with workers ☒ Insect repellant is used, PPE is used to protect against sting/bite injuries. ☒ All potentially poisonous plants such as poison ivy, poison oak, poison sumac are identified, long sleeve shirt or Tyvek is worn or a barrier cream is used when near these plants ☒ Coast Guard-approved Personal Floatation Device (PFD) may be required in cases of fast-flowing water. Their use shall be up to the discretion of field personnel based on site conditions. **Environmental Hazards Comments:** Some measurements may be conducted near flowing rivers and streams.

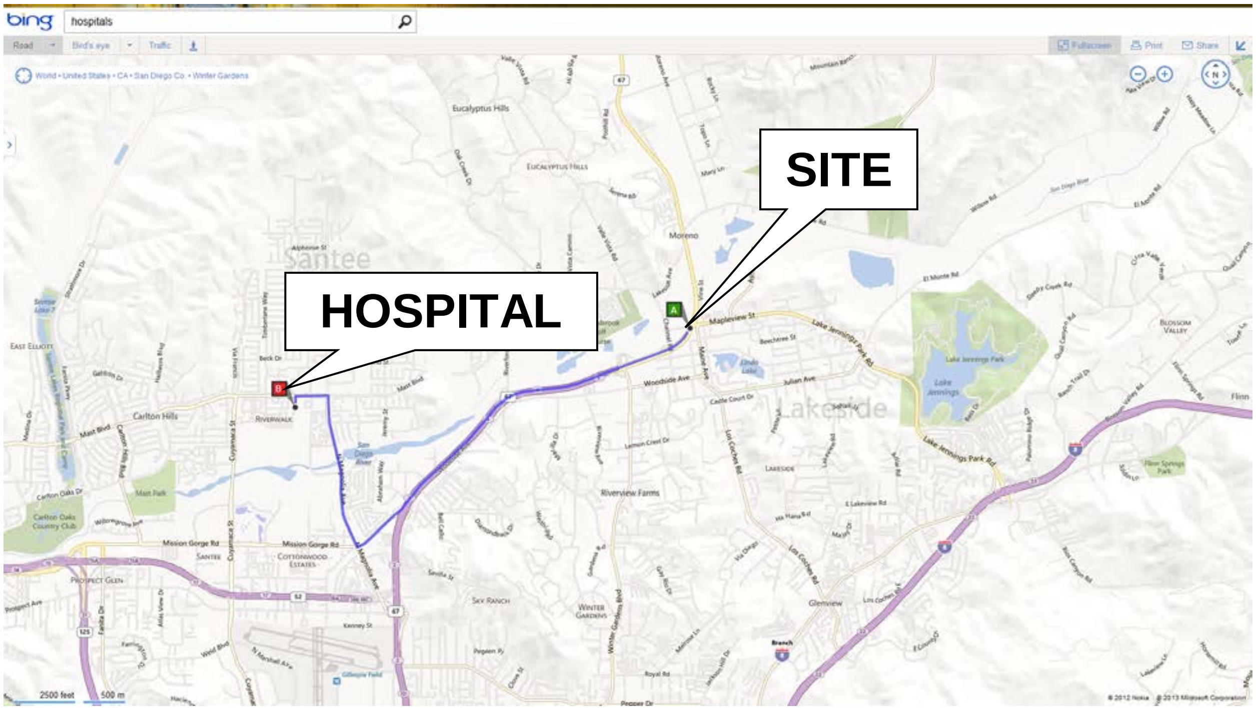
EMERGENCY RESPONSE (911 Service is Available ☒ Yes ☐ No)			
Emergency Medical Treatment - Hospital Name: Hospital Address:	Several depending on sampling location. See hospital information below	**Number:**	
Non-Emergency Med. Treatment - Clinic Name: Occupational Clinic Address:	Several depending on sampling location. See hospital information below	**Number:**	
Client Representative Name::	Jo Ann Weber, County of San Diego	**Office Number:**	(858) 495-5317
		Cell Number:	
Geosyntec **Project Manager** Name:	Brandon Steets	**Office Number:**	(805) 979-9122
		Cell Number:	(805) 455-9591
Geosyntec **Corporate H&S** Name:	Dale Prokopchak	**Office Number:**	(804) 332-6376
		Cell Number:	(804) 349-8067

HAZARD	HAZARD CONTROLS (check all that apply and comment as required)
Emergency Response Comments:	

Date:	
Project Name: San Diego County Microbial Source Tracking Study	
THA Title: Field observation and measurements	
Subcontractor Name: N/A	
Geosyntec Representative (reviewed by): Christopher Wessel	
Subcontractor Foreman/Supervisor Signature (authorize):	
Crew Signatures (acknowledge):	
Print Name	**Signature**
PLEASE RETURN A COPY OF THIS SIGNED PAGE TO GEOSYNTEC PROJECT MGR., SUPERINTENDENT UPON REVIEW AND ACKOWLEDGMENT BY THE CREW MEMBERS. ALL NEW CREW MEMBERS SHALL BE ORIENTATED THE SAME AND A SUBMITTAL OF A NEW SIGN IN SHEET SHALL BE COMPLETED.	

ROUTES TO HOSPITALS

From San Diego River Watershed Sampling Locations:



Edgemoor Hospital
(619) 596-5500
655 Park Center Drive
Santee, CA 92071

Written Directions to Edgemoor Hospital from Site (Site location will vary as field work commences):

Route: **4.7 mi, 6 min**

A near CA-67 S, CA 92040

1. Depart CA-67 S toward N Magnolia Ave 2.6 mi

2. At exit 3, take ramp right for Woodside Ave toward Santee 0.2 mi

3. Keep straight onto Woodside Ave 0.4 mi

4. Turn right onto N Magnolia Ave

7-Eleven on the corner

1.2 mi

5. Turn left onto Mast Blvd

Exxon on the corner

0.3 mi

6. Turn left onto Park Center Dr

76 on the corner

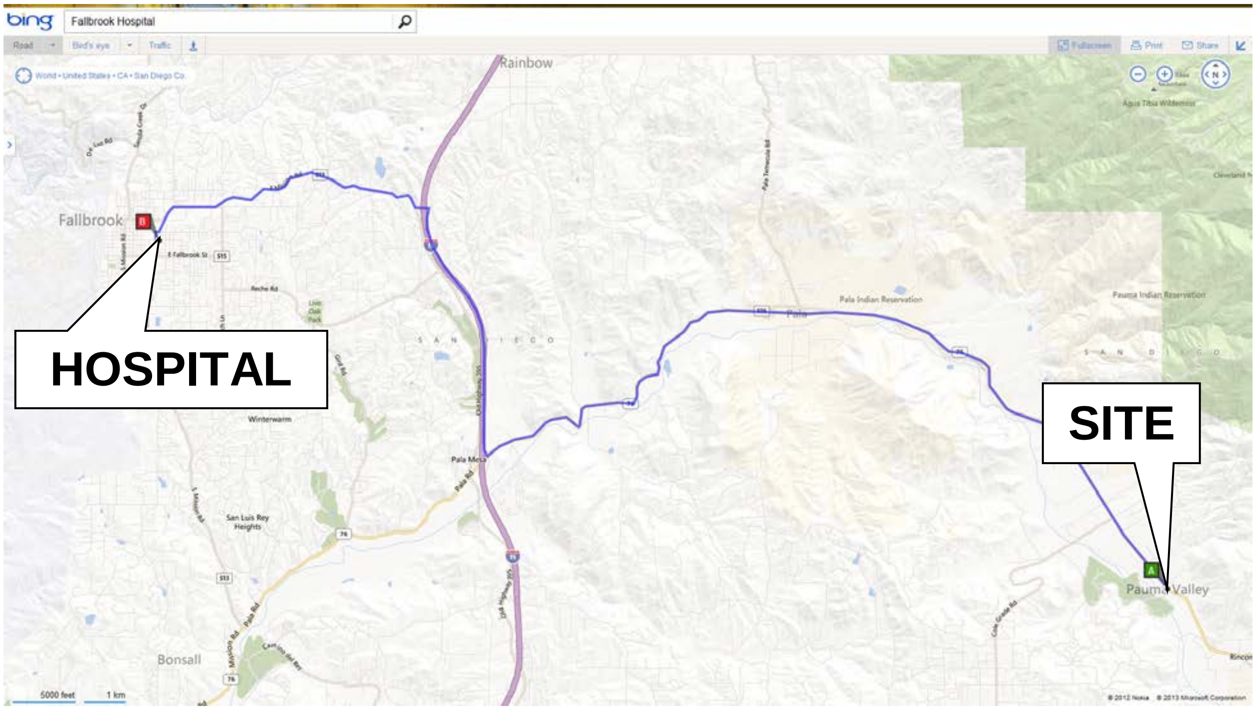
446 ft

B 7. Arrive at 655 Park Center Dr, Santee, CA

The last intersection is Mast Blvd

If you reach Cuyamaca St, you've gone too far

From San Luis Rey Watershed Sampling Locations:



Fallbrook Hospital
(760) 728-1191
624 E. Elder St.
Fallbrook, CA 92028

Written Directions to Fallbrook Hospital from Site (Site location will vary as field work commences):

Route: **22.9 mi, 30 min**

A Pauma Valley, CA

1. Depart CA-76 toward Community Church Dr

13.8 mi 17 min

2. Take ramp right and follow signs for I-15 North 3.7 mi

3. At exit 51, take ramp right for Mission Rd toward Fallbrook 0.3 mi

4. Turn left onto Old Highway 395 / CR-S13 0.2 mi

5. Turn right to stay on E Mission Rd / CR-S13 4.4 mi

6. Turn left onto N Brandon Rd 0.2 mi

7. Turn right onto E Alvarado St, and then immediately turn left onto S Brandon Rd 0.2 mi

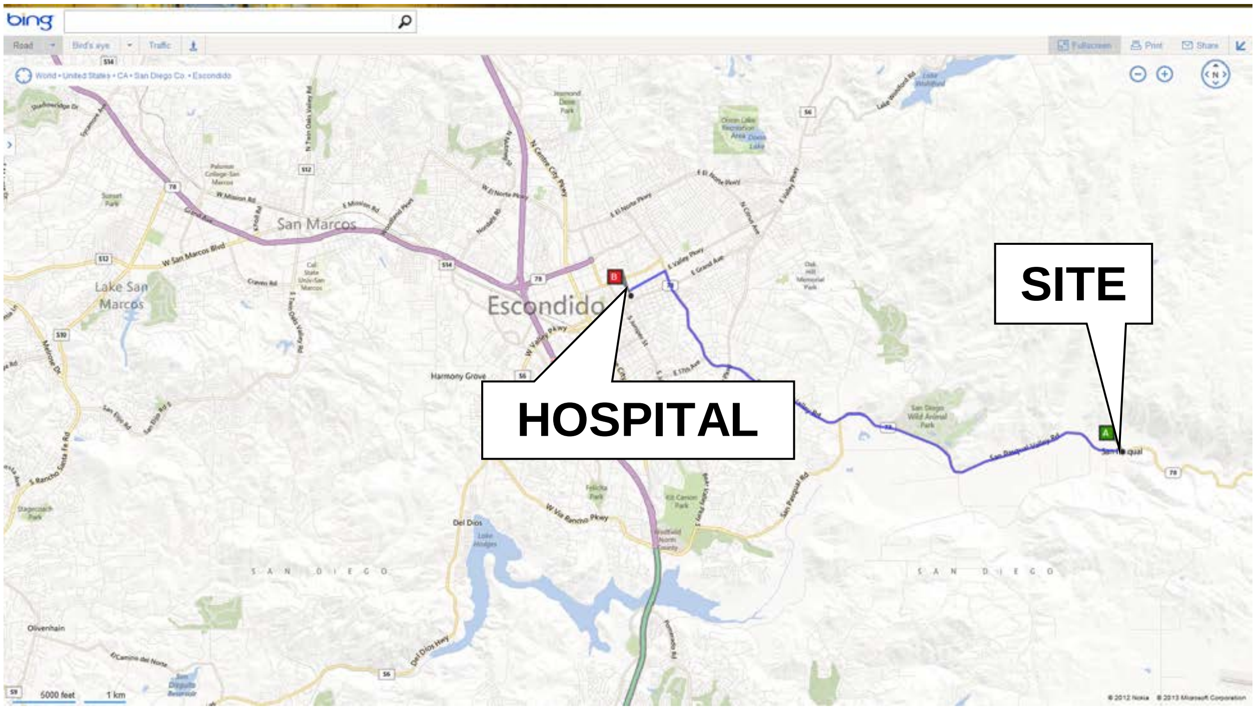
8. Turn left onto E Elder St 331 ft

B 9. Arrive at 624 E Elder St, Fallbrook, CA

The last intersection is S Brandon Rd

If you reach Potter St, you've gone too far

From San Dieguito River Watershed Sampling Locations:



Palomar Medical Center
(442) 281-5000
2185 Citracado Parkway
Escondido, CA 92029

Written Directions to Palomar Medical Center from Site (Site location will vary as field work commences):

Route: **9.5 mi, 14 min**

A San Pasqual, CA

1. Depart CA-78 / San Pasqual Valley Rd toward Bandy Canyon Rd 8.8 mi

2. Turn left onto E Valley Pkwy / CR-S6

   Circle K/Circle K on the corner

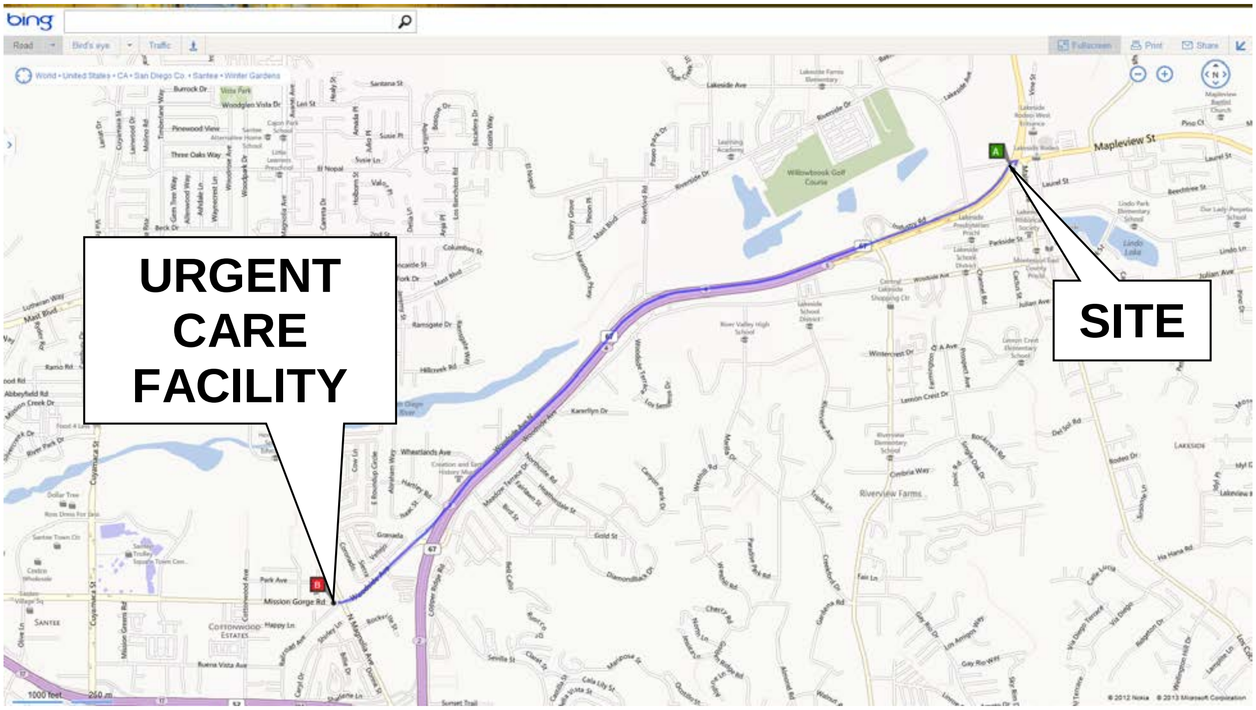
   0.6 mi

3. Turn left onto road 0.1 mi

B 4. Arrive at Palomar Medical Center, CA

ROUTE TO URGENT CARE FACILITY

From San Diego River Watershed Sampling Locations:



Doctors Express Urgent Care of Santee
(619) 456-0033
10538 Mission Gorge Road #100
Santee, CA 92071

Written Directions to Doctors Express Urgent Care of Santee from Site (Site location will vary as field work commences):

Route: **3.3 mi, 5 min**

A near CA-67 N, CA 92040

A–B: 3.3 mi

5 min

1. Depart CA-67 N toward Mapleview St 197 ft

2. Turn back on CA-67 S 2.6 mi

3. At exit 3, take ramp right for Woodside Ave toward Santee 0.2 mi

4. Keep straight onto Woodside Ave 0.4 mi

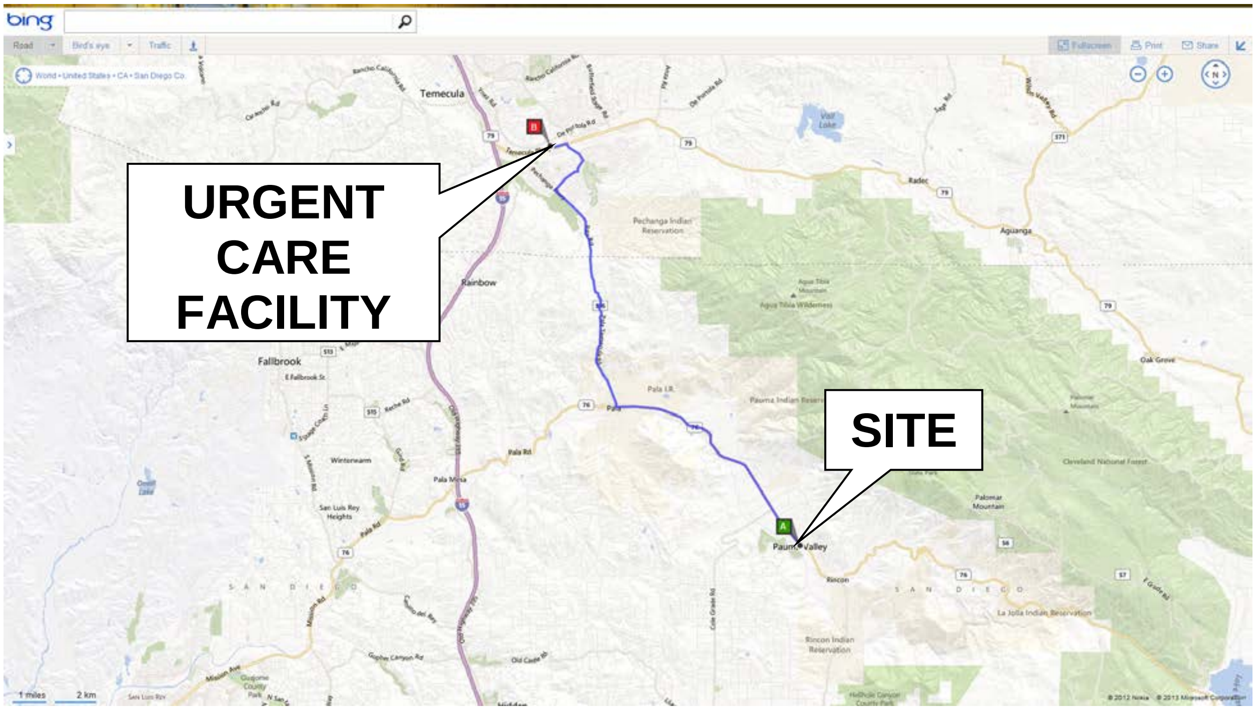
5. Road name changes to Mission Gorge Rd 174 ft

B 6. Arrive at 10538 Mission Gorge Rd Ste 100, Santee, CA

The last intersection is Railroad Ave

If you reach 1st St, you've gone too far

From San Luis Rey River Watershed Sampling Locations:



Inland Urgent Care - Temecula
(951) 303-6440
31565 Rancho Pueblo Rd Ste 102
Temecula, CA 92592

Written Directions to Inland Urgent Care - Temecula from Site (Site location will vary as field work commences):

Route: **17.8 mi, 24 min**

A Pauma Valley, CA

a. A–B: 17.8 mi
b. 24 min

1. Depart CA-76 toward Community Church Dr 7.6 mi

2. Turn right onto Apapas Rd / Pala Temecula Rd

c. Unpaved Road
d. 459 ft

3. Bear left onto Pala Temecula Rd / CR-S16 7.4 mi

4. Turn right onto Wolf Valley Rd 0.9 mi

5. Turn left onto Redhawk Pkwy 0.4 mi

6. Turn left to stay on Redhawk Pkwy 0.7 mi

7. Turn left onto CA-79 N / Temecula Pkwy

    e. Jack in the Box on the corner
    f. 0.4 mi

8. Turn right onto Dona Lynora 423 ft

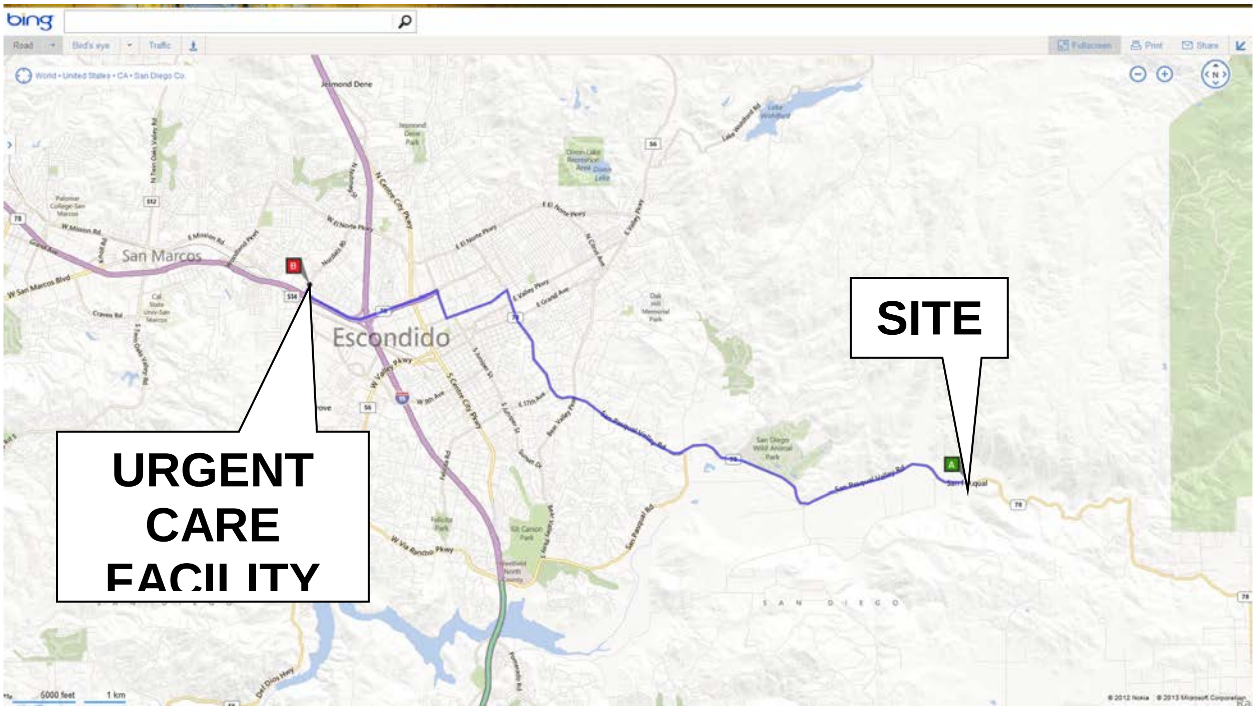
9. Turn left onto Rancho Puebla Rd 325 ft

B 10. Arrive at 31565 Rancho Puebla Rd, Temecula, CA 92592

The last intersection is Dona Lynora

If you reach Rancho Community Way, you've gone too far

From San Dieguito River Watershed Sampling Locations:



Concentra Medical Center
(760) 432-9000
740 Nordahl Rd Ste 117
San Marcos, CA 92069

Written Directions to Concentra Medical Center from Site (Site location will vary as field work commences):

Route: **12.8 mi, 18 min**

A San Pasqual, CA

A–B: 12.8 mi

18 min

1. Depart CA-78 / San Pasqual Valley Rd toward Bandy Canyon Rd 9.0 mi

2. Turn left to stay on CA-78 / E Washington Ave 1.0 mi

3. Turn right to stay on CA-78 / N Broadway 0.5 mi

4. Turn left onto CA-78 W

SUZUKI on the corner

1.9 mi

5. At exit 15, take ramp right and follow signs for Nordahl Rd 0.2 mi

6. Turn right onto Nordahl Rd 0.1 mi

B 7. Arrive at 740 Nordahl Rd Ste 117, San Marcos, CA

If you reach Center Dr, you've gone too far

Following are hazard mitigators (prevention, signs and symptoms, and treatment) for each of the potential hazards.

COLD STRESS

- Work in pairs to keep an eye on each other and watch for signs of cold stress.
- Wear layers of loose fitting clothing, including insulated coveralls, head covering, gloves and boots.
- Minimize wind chill effects by wearing a wind resistant outer shell.
- Minimize lengthy periods of outdoor activity. This may require additional shifts and taking frequent breaks to warm up.
- Provide warm shelter.
- Remain hydrated. There is a tendency not to drink as many fluids when temperature is cold.
- Be aware of the symptoms of cold stress and appropriate first aid measures. Because of the considerable danger to personnel, outdoor work should be suspended if the ambient temperature drops below 0°F or if the wind chill factor drops below -29°F.

Signs and symptoms:

Mild hypothermia

Shivering, lack of coordination, stumbling, fumbling hands, slurred speech, memory loss, pale and cold skin.

Moderate hypothermia

Shivering stops, unable to walk or stand, confused and irrational.

Severe hypothermia

Severe muscle stiffness, very sleepy or unconscious, ice cold skin.

Treatment:

Mild hypothermia

Move to warm area, stay active, remove wet clothes and replace with dry clothes or blankets, cover the head, drink warm (not hot) sugary drink.

Moderate hypothermia

Call for an ambulance, cover all extremities completely, Place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin and follow treatments for mild hypothermia.

Severe hypothermia

Call for an ambulance, treat the victim very gently, cover all extremities completely.

FLASH FLOOD

Before a Flood

- Be familiar of regional or local flash flood history in your work area.
- Be aware if your work area is in a floodplain, and if it is above or below flood stage water level.
- If available, review Flood Insurance Rate Maps (FIRMs).
- Always be aware of the latest weather forecast in your area, especially if your work site is prone to flash flooding.

- In the event of the heavy rain or steady rainfall during work, stop work immediately and head for higher grounds.

Once the Flood Arrives

- Don't drive through a flooded area. If you come upon a flooded road, turn around and go another way. More people drown in their cars than anywhere else.
- If your car stalls, abandon it immediately and climb to higher ground. Many deaths have resulted from attempts to move stalled vehicles.
- Don't walk through flooded areas. As little as six inches of moving water can knock you off your feet.
- Stay away from downed power lines and electrical wires. Electrocution is another major source of deaths in floods. Electric current passes easily through water.
- Look out for animals - especially snakes. Animals lose their homes in floods, too. They may seek shelter in yours.
- If the waters start to rise within your work area before you have evacuated, retreat to high ground such as cars, trucks, and field equipment.
- Take dry clothing, a flashlight and a portable radio with you. Then wait for help.
- Don't try to swim to safety; wait for rescuers to come to you.
- If outdoors, climb to high ground and stay there.

HEAT STRESS

Prevention:

- Drink plenty of hydrating fluids, such as Gatorade® or water. In high heat, a minimum of one gallon per day should be consumed. Fluid should be consumed frequently. Don't wait until thirsty.
- Provide cooling devices, when necessary, to aid natural body heat exchange during prolonged work or severe heat exposure. Devices include field showers, hose-down areas, shade umbrellas/tents, wide-brim hats, and cooling jackets, vests, or suits.
- If amenable to work conditions, wear light-colored, loose fitting, "breathable" clothing.
- Avoid prolonged periods of exposure. Take breaks as necessary. Higher heat exposure requires more frequent breaks.
- Be able to recognize the signs, symptoms and how to treat for heat stress. Signs, symptoms and treatment are listed below.

Signs and Symptoms:

- Mild heat stress - Decreased energy, slight loss of appetite, nausea, lightheadedness.
- Moderate heat stress - heavy sweating, thirst, faintness, headache, confusion.
- Severe heat stress (heat stroke) - Throbbing headache, confusion, irritability, rapid heartbeat, difficulty breathing, dry skin (no sweating), vomiting, diarrhea.

Treatment:

- Mild and Moderate heat stress - Take to cool place, drink cool (not cold) fluids, remove excess clothing, rest.
- Severe heat stress - Call 911 for an ambulance and get to a cool place, remove excess clothing and rest.
- Adjust work and rest schedules as needed. Establish a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.

- Provide shelter or shaded areas (77ºF is best) to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels to ensure that the cardiovascular system functions adequately. Daily fluid intake must equal the approximate amount of water lost in sweat. Workers are encouraged to drink more than the amount required to satisfy thirst (recommend water and sport drinks, not coffee or soda), because thirst is not an adequate indicator of adequate salt and fluid replacement.
- Remove impermeable protective garments during rest periods.
- Do not assign other tasks to personnel during rest periods.

SLIPS, TRIPS, AND FALLS

- Wear the proper foot wear and clothing for the task at hand.
- Pay attention to the work environment and become aware of all equipment and vehicles active onsite and use caution when moving about.
- Use caution when walking on sloped areas (especially geosynthetics), particularly when moisture is present. Use caution when walking on soft or uneven surfaces; e.g., marsh areas. Watch for icy conditions in cold weather.
- Follow the established designated safe paths for travel and keep these areas free from debris. Avoid steep or slippery slopes and paths near operation vehicles and equipment.
- Follow good housekeeping procedures. Never assume that someone else will clean up a spill or put away an object.
- Remove or clearly mark objects that pose tripping hazards.
- Prevent water accumulation where practicable.
- Cables and/or wiring should be taped down, when possible. Locate cables and/or wiring out of the commonly used areas.
- Mark or repair any opening or hole in the floor.
- Carry objects in a manner that allows you to see in the area you are moving in. Do not carry objects that are too large or bulky. Do not carry more weight than you can balance and keep stable. Understand that PPE can reduce or limit your field of vision and mobility.
- Use the proper ladder for the task at hand and do not exceed the recommended height. Do not use the top two rungs of a ladder. Ensure a flat and stable footing for the placement of a ladder. Utilize the buddy system to help secure the ladder. When working over 6 ft., utilize fall prevention measures. Obey height and weight guidelines and/or rules.
- Use the handrail when using stairs. Be aware of stairway blockages.
- If conditions even slightly resemble an unsafe environment, do not make any assumptions that the integrity of a workplace is intact.
- Never jump over or into a trench or excavation.
- Walk, do not run.
- Maintain proper lighting so obstacles are clearly visible

ALLERGIC REACTION TO POISONOUS PLANTS

- Be able to recognize and identify poisonous plants indigenous to the site location (e.g., poison ivy, poison oak, poison sumac). For example, poison Ivy plants have three leaves arranged at the end of each stem. Two secondary leaves are attached opposite one another and directly to the stem at their base. The primary leaf is attached to the end of the stem. The leaves often, but NOT ALWAYS, have a shiny appearance. See photos below.



- Poison Ivy often appears as ground cover at the edge of wooded areas and along trails within fields and woods. It may also appear growing from a vine wrapped around trees.
- Avoid or remove poisonous plants where practicable. Wear appropriate protective clothing (e.g., gloves, long-sleeved shirts) as required.
- One can become sensitized (like a latex allergy) though immune for several years at the beginning.
- If you come in contact with the plant, the plant's oil will be transferred onto your skin and clothing. The best way to manage the oil is to wash skin with cool water and soap (preferably 5% tincture of green soap available at CVS). If soap and water is unavailable, thorough (2-3 minutes) rinsing with cold water may help (not warm...want to keep those pores closed!)
- The lag time between exposure and symptoms can be quite long like several days.
- If you are in the field, blot the area with an alcohol patch and follow by washing as soon as possible. Calamine lotion, Tecnu, yellow laundry soap, or Colloidal oatmeal (Aveeno®) baths provide relief from itching and rashes. More information about Tecnu can be found at http://www.teclabsinc.com/.
- If you have to pass through heavy ivy growth, be sure to carefully handle your field cloths when you return. Your shoe laces will always get you if you are not careful. The oil can last on clothing for a few weeks, so wash frequently.
- For additional information, please see http://poisonivy.aesir.com/

DOGS

- Never approach a stray dog.
- If a stray dog is at your site, stay in your vehicle.
- If a stray dog approaches, back away slowly and proceed to your vehicle or the closest secure building.
- If a vehicle or secure building is not close by when a stray dog approaches, stay calm. Do not run and do not yell. If you must say anything at all, use a calm, firm voice and avoid eye contact. Back away slowly from the dog or stand still until it turns away. Keep your hands firmly by your side.
- If a dog jumps, raise your knee to protect yourself.
- If a dog attacks, curl into a ball with your hands over your head and neck, and protect your face.
- Be aware of unusual dog behavior. Stray dogs may have rabies, which is exemplified by the following signs:

  - Constant growling and barking
  - Dilated pupils, disorientation
  - Erratic behavior

- Facial expression showing anxiety and hyper-alertness

- Inability to swallow, leading to drooling and foaming of saliva (i.e., "foaming at the mouth")

- If bitten or scratched by a dog, seek medical attention immediately.

MOUNTAIN LIONS

- Do not hike alone. At least two field personnel should be in constant visual and verbal contact when in areas with mountain lions.
- If a mountain lion is encountered:
  - Do not approach the lion. Most mountain lions will try to avoid a confrontation.
  - Do not run from a mountain lion, stand and face it, make eye contact.
  - Do not crouch down, squat, or bend over, remain standing.
  - Try to appear larger by raising and waving arms, opening a jacket, speak firmly in a loud voice.
  - If necessary throw stones, branches, or whatever may be reachable without crouching or bending over.
- If attacked, face animal and fight back with sticks, jackets, tools or whatever may be available without turning away from the animal.
- Report any encounters or attacks to the SHSO and seek first aid immediately if necessary.

STINGING INSECTS / VERMIN / SNAKES

- Approach dark pipes, culverts, very cautiously in case of rattlesnakes or wasp/hornets nests
- Be able to recognize stinging insects/vermin/snakes indigenous to the site location and habitats. Learn the indigenous dangerous species (e.g., spiders, snakes, ticks) prior to entering the field and know the first aid treatments.
- Venomous snakes swim on top of the water, non-venomous snakes swim with only their heads above water. Rattlesnakes can be recognized by their rattle, and their triangle-shaped head.
- Advise the SHSO if you have allergies to any insects prior to engaging in any field activities.
- Include the following preventative measures as necessary: wear light-colored clothing, keep clothing buttoned, tuck pant legs into socks, keep shirt tails tucked in, boots, hoods, netting, gloves, masks, insect repellants or other personal protection.
- Snake bite kits are commercially available and should be carried by field personnel when working where venomous snakes exist. In the case of a snake bite, keep the patient calm, restrict activity and immobilize the bite area (do not elevate), and immediately obtain medical attention.

- Report any bites or stings to the SHSO and seek medical attention immediately.
- Be aware of potential hive/nest locations, which may include culverts, drainage pipes, junk piles, or dense shrubbery.
- Advise the SHSO if you are allergic to stinging insects prior to engaging in any field activities.
- Include the following controls:
  - Do not agitate stinging insects or disrupt their hive/nest.
  - Wear light-colored clothes.
  - Avoid wearing perfumes, hair spray, or scented lotions in the wilderness.
- If attacked:
  - <u>Do not</u> scream or wave arms.
  - Cover your face with your hands.
  - Run for shelter in a building or vehicle. Do not seek shelter in water.
  - Remove stingers as quickly as possible to lessen the amount of venom entering the body. Remove the stinger by raking your fingernail across it. Don't pinch or pull the stinger out. Put ice on the sting to reduce the swelling.

Prepared for

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APPENDIX E

QUALITY ASSURANCE PROJECT PLAN

FOR TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

Prepared by

Geosyntec consultants

engineers | scientists | innovators
3900 Old Town Ave., Suite A-101
San Diego, California 92110

Project Number LA022824

November 24, 2014

1 APPROVAL SIGNATURES

County of San Diego, Department of Public Works (Responsible Organization):

Title:	Name:	Signature:	Date:
Project Director	Jo Ann Weber		

Geosyntec Consultants (Contracted by County of San Diego Department of Public Works)

Title:	Name:	Signature:	Date:
Geosyntec Project Director	Ken Susilo, P.E.		
Geosyntec Project Manager	Brandon Steets, PE		
Geosyntec QA Officer	Rita Kampalath, Ph.D., P.E.		

Laboratory (Calscience)

Title:	Name:	Signature:	Date:
Laboratory Project Manger	Stephen Nowak		

Laboratory (Enviromatrix)

Title:	Name:	Signature:	Date:
Laboratory Project Manger	Dan Verdon		

Laboratory (Weck)

Title:	Name:	Signature:	Date:
Laboratory Project Manger	Brandon Gee		

Laboratory (City of San Diego)

Title:	Name:	Signature:	Date:
Laboratory Project Manger	Laila Othman		

Laboratory (Source Molecular)

Title:	Name:	Signature:	Date:
Laboratory Project Manger	Mauricio Larenas		

Laboratory (Southern Nevada Water Authority)

Title:	Name:	Signature:	Date:
Laboratory Project Manger	Eric Dickenson		

Independent Reviewer (Orange County Sanitation District)

Title:	Name:	Signature:	Date:
Microbiology Independent Reviewer	Donna Ferguson		

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3 DISTRIBUTION LIST

Table E3-1: QAPP Distribution List

Title	***Name (Affiliation)***	***Tel. No.***	***No Copies***
Project Director	Jo Ann Weber (County of San Diego Department of Public Works)	(858) 495-5317	1
Geosyntec Project Director	Ken Susilo, PE (Geosyntec)	(310) 957-6100	1
Geosyntec Project Manager	Brandon Steets, PE (Geosyntec)	(805) 979-9122	1
Geosyntec Project QA Officer	Rita Kampalath, Ph.D., PE (Geosyntec)	(310) 957-6116	1
Laboratory Project Manager	Stephen Nowak (Calscience)	(714) 895-5494	1
Laboratory Project Manager	Dan Verdon (Enviromatrix)	(858) 560-7717	1
Laboratory Project Manager	Brandon Gee (Weck)	(626) 336-2139	1
Laboratory Project Manager	Laila Othman (City of San Diego)	(619) 668-3232	1
Laboratory Project Manager	Mauricio Larenas (Source Molecular)	(786) 220-0379	1
Laboratory Project Manager	Eric Dickenson (Southern Nevada Water Authority)	(702) 856-3659	1
Microbiology Independent Reviewer	Donna Ferguson (Orange County Sanitation District)	(714) 755-3239	1

4 PROJECT/TASK ORGANIZATION

Implementation of the Microbial Source Tracking Study (MST) requires the involvement and cooperation of staff from the County of San Diego Department of Public Works (SDCDPW), Geosyntec Consultants, Calscience Laboratory, Enviromatrix Laboratory, Weck Laboratory, City of San Diego Water Quality Laboratory, Source Molecular Laboratory, Southern Nevada Water Authority Water Quality Laboratory, and an independent technical reviewer at the Orange County Sanitation District Laboratory. This section describes the roles and responsibilities of key project personnel. A summary of the personnel responsibilities is included in Table E4-1. An organizational chart is included in Figure A4-1.

4.1 SDCDPW Project Director

The Project Director for SDCDPW will be responsible for review and approval of reports completed by Geosyntec. The Project Director will also be responsible for maintaining contracts that are required for completion of Project tasks and reports, including those with the consultant and the analytical laboratory.

4.2 Geosyntec Project Manager

The Project Manager (PM) is responsible for the overall direction of the technical and administrative functions within the program, as well as the day-to-day activities associated with site characterization and data analysis. He will work under the general oversight of the Project Director. The PM will be responsible for implementing and modifying all program plans and coordinating and communicating with those involved in the Project. The PM is also responsible for the management of data collection activities and project deliverables, as well as all communication with the SDCDPW Project Director. Although various functions will be performed by other individuals, it is the PM who will ultimately provide signature approval to all Project activities.

4.3 Quality Assurance Officer

The Quality Assurance Officer (QAO) will implement this QAPP, make updates as necessary, and conduct project reviews with respect to quality assurance. The QAO will be responsible for assuring the integrity of the QAPP and coordinating all quality assurance (QA) specific activities. The QAO will (1) check that the appropriate analytical methods and sampling supplies are ordered from the laboratory, (2) be responsible for data validation and advise the PM with respect to data management and statistical evaluation of the data, and (3) be responsible for performance and/or systems audits of the laboratory, should they be required.

4.4 Data Manager

The Data Manager is responsible for all data collection and laboratory coordination activities associated with the project. The Data Manager or their designee will be located at the site during field activities and will coordinate the technical field activities in accordance with approved plans, including the Monitoring Plan, QAPP, and Task Hazard Analysis (THA). They are responsible for verifying that the field work, including sampling operations and sampling quality control (QC), is performed within the approved guidelines. The Data Manager is responsible for implementing and maintaining overall operating standards and field QA responsibilities. Such responsibilities will include (a) calibrating and maintaining field instruments appropriately, (b) ensuring that appropriate equipment decontamination is performed, and (c) monitoring compliance with QA/QC sampling requirements (e.g. field replicate collection). They coordinate all safety and technical activities occurring at the site and conducts daily briefing sessions prior to field work. The Data Manager is responsible for communicating bottle orders, data quality, and reporting turnaround time expectations to the lab, and is responsible for leading the reporting and data analysis process.

4.5 Laboratory Project Managers

The laboratories will provide analytical services for the scope of work detailed in the MST Work Plan. The Laboratory Project Managers will be responsible for managing laboratory work (i.e., data processing and data processing QA), verifying that laboratory QA/QC procedures are maintained, and conducting a technical review of reports. Although various laboratory functions will be performed by different individuals, it is the Laboratory Project Managers who will provide signature approvals to laboratory-generated information and bear laboratory responsibilities.

4.6 Microbiology Independent Reviewer

The Microbiology Independent Reviewer will oversee all laboratory analyses and review results to ensure that analytical methods have appropriately addressed the needs of the project, that the data collected are of sufficient quality to meet project objectives, and to provide input as to the significance of the data.

Table E4-1: Personnel Responsibilities

Name	*Organization*	*Role*	*Contact Information*
Jo Ann Weber	San Diego County Department of Public Works	Project Director	(858) 495-5317
Ken Susilo	Geosyntec	Project Director	(310) 957-6100
Brandon Steets	Geosyntec	Project Manager	(805) 979-9122
Rita Kampalath	Geosyntec	QA Officer	(310) 957-6112
Avery Blackwell	Geosyntec	Data Manager	(805) 979-9125
Stephen Nowak	Calscience	Laboratory Project Manager	(714) 895-5494
Dan Verdon	Enviromatrix	Laboratory Project Manager	(858) 560-7717
Brandon Gee	Weck	Laboratory Project Manager	(626) 336-2139
Laila Othman	City of San Diego	Laboratory Project Manager	(619) 668-3232
Mauricio Larenas	Source Molecular	Laboratory Project Manager	(786) 220-0379
Eric Dickenson	Southern Nevada Water Authority	Laboratory Project Manager	(702) 856-3659
Donna Ferguson	Independent Consultant (Orange County Sanitation District)	Microbiology Independent Reviewer	(714) 755-3239

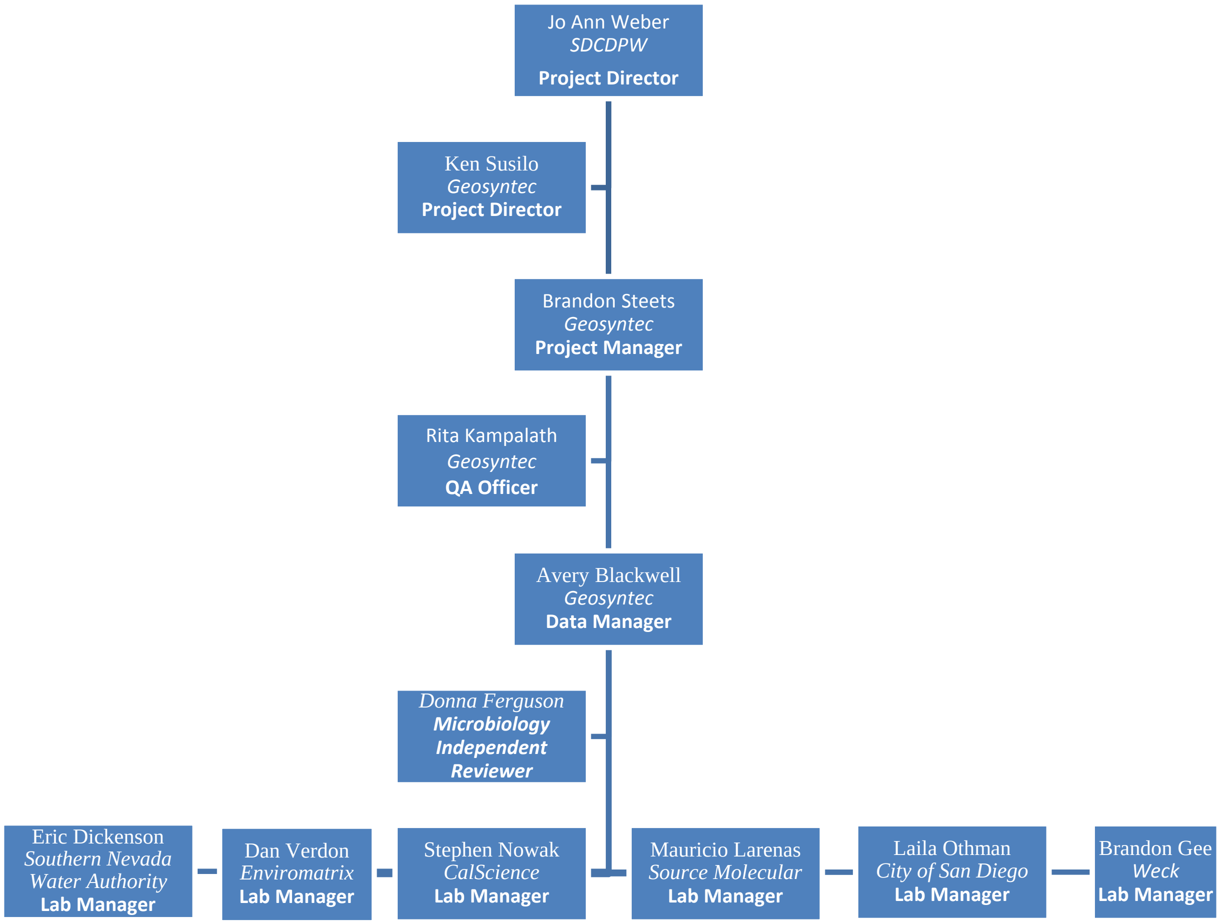

Figure E4-1: Organizational chart

5 PROBLEM DEFINITION/BACKGROUND

5.1 Problem Statement

The San Luis Rey (SLR) watershed is located in San Diego County, CA. This watershed receives discharges from developed areas through Municipal Separate Storm Sewer Systems (MS4s) from various municipalities, unincorporated County of San Diego, and other federal, state, and tribal agencies. In order to comply with the Total Maximum Daily Load (TMDL) criteria for fecal indicator bacteria (FIB) which apply to the receiving waters of this watershed, human sources of FIB to the compliance monitoring locations of the watershed must be detected and eliminated to the extent possible. FIB originate from both human and natural sources. FIB from human sources can enter MS4s from illicit sanitary sewer connections, leaky sewer pipes, homeless encampments, or other illicit discharges of human waste. Because natural sources of FIB are difficult or impossible to control, eliminating human sources of FIB offers the best chance for FIB reductions. In addition, human sources of FIB have higher correlations to illness-causing pathogens than natural sources of FIB, so eliminating their sources will have the greatest effect on reducing illness in receiving waters.

5.2 Project Objectives

The primary objectives of this project are to identify sources of human and non-human waste to the County's MS4 in the SLR watershed, and to eliminate identified bacteria sources through site specific methods. A second objective is to accumulate microbial source data to support a Natural Source Exclusion (NSE) and/or Quantitative Microbial Risk Assessment (QMRA)-based offramp (via TMDL Wasteload Allocation modifications or Site-Specific Criteria) for the County for the bacteria TMDL reopener in 2016.

Project design, sampling procedures, and laboratory analysis need to provide data of adequate quantity and quality to (1) confidently identify sources of dry weather flow to the County's MS4 and isolate priority stormdrain networks, (2) confidently determine the presence/absence of human sources of FIB in dry weather flows in the MS4 through the use of various human markers, (3) confidently determine the presence/absence of non-human sources of FIB in dry weather flows in the MS4 through the use of various non-human markers, and (4) determine the source(s) of human waste impacts to the County's MS4.

5.3 Water Quality Criteria

The watershed is required to comply with the Revised Total Maximum Daily Loads for Indicator Bacteria, Project I-Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek) (San Diego Regional Water Quality Control Board, 2010) and the County MS4 Permit. However, sampling for this study is not necessarily to be conducted at specific compliance outfalls, and is therefore to be used to indirectly comply with the MS4 Permit by eliminating/controlling sources of FIB from the County's MS4 and/or providing data for a NSE or QMRA-based offramp. FIB will be measured on outfall samples, but results will only be used for bacteria-based outfall comparison (i.e. to assist with dry weather bacteria TMDL compliance planning), not to inform the human waste investigation (unless the Preliminary Outfall Investigation results suggest that FIB are a reliable pre-screening indicator for human markers).

6 PROJECT/TASK DESCRIPTION

6.1 Work Statement

The MST Work Plan provides details of the objectives and methodology for each phase of the project. The tasks associated with each phase are summarized in the sections below.

6.1.1 Desktop Evaluation

Working with the County GIS department, all necessary GIS and water quality data will be gathered, reviewed, and processed. GIS data will include physical features, monitoring locations, and civil infrastructure. Maps will be created from this data for use in the field, as needed for discussion purposes, and for post-investigation analysis and further source identification and prioritization. Water quality data will include results from MS4 outfall monitoring from 2011 and 2012 which includes flow monitoring and analytical results where samples were collected. The GIS and water quality data will be used to prioritize MS4 outfalls to target those terminating in receiving waters, those previously investigated by the County, and those that cross or are near sanitary sewer lines or parcels with septic systems.

6.1.2 Preliminary Outfall Investigation

The Preliminary Outfall Investigation will serve to provide guidance for future rounds of sampling and determine which water quality parameters, if any, will serve as reliable pre-screening analytes to trigger the more costly human marker testing. The Preliminary Outfall Investigation will be limited to one round of sampling in the watershed. At each County-owned MS4 outfall where the Desktop Evaluation suggests the likelihood of human impacts, observations and pictures will be taken relating to dry-weather flow and the potential for human waste impacts. At every outfall with flowing water, flow measurements, water quality measurements (pH, conductivity, turbidity, dissolved oxygen (DO), and temperature), and water quality samples (ammonia, phosphate, methyl blue active substances (MBAS), caffeine, cotinine, sucralose, FIB, and SIPP-recommended human and non-human fecal genetic markers) will be collected (see Work Plan Appendix B for Sampling and Analysis Plan).

Areas with sewer systems will be observed during dry-weather periods when baseflow has receded (May 1 through September 30). Areas with septic systems will be observed during dry weather while baseflow is still high (October 1 to April 30). Rain gages and stream gages will be observed to verify these conditions before sampling. For the Preliminary Outfall Investigation, outfalls will only be sampled once. If an outfall is not flowing, but shows signs of intermittent dry-weather flow, it will be revisited a maximum of 3 times during the Preliminary Outfall Investigation.

For the Preliminary Outfall Investigation, all samples will be analyzed for the parameters discussed in section 3 of the MST Work Plan.

6.1.3 Storm Drain Network Investigation

The data from the Preliminary Outfall Investigation sampling will be used to identify those MS4 outfalls most likely to be impacted by human waste. Prioritized outfalls and their contributing storm drain network will be investigated to determine the source of the human waste. The investigation will be undertaken using some combination of GIS analysis, canine scent-tracking, closed-circuit television (CCTV), dye-testing, and smoke bombs. Based on the results of these investigations, the County will take the necessary actions to eliminate the sources of human waste to the MS4.

6.1.4 Follow-Up Outfall Sampling

The Follow-up Outfall Investigation is intended to collect a sufficient number of samples to verify outfalls with human or non-human fecal inputs (or the absence thereof), and to evaluate the hypotheses regarding sources of fecal inputs that were formed from the Preliminary Outfall Investigation. Sampling protocols for this investigation will be revised following the Preliminary Outfall Investigation as described in Section 3 of the MST Work Plan.

If evidence of human waste is found or additional flowing outfalls are identified, the Follow-up Outfall Investigation will be followed by Storm Drain Network Investigation procedures (Section 5 of the MST Work Plan), including implementation activities to address sources that are identified (if any), and then by Verification Monitoring (Section 7 of the MST Work Plan) at human-positive sites to establish that abatement of the targeted waste signals was successful.

6.1.5 Human Source Marker Verification Sampling

After the Storm Drain Network Investigation has been completed and fecal sources have been thought to have been eliminated from the system, verification sampling of human source markers will be performed for the outfalls addressed using similar methods as the previous sampling efforts. If human source markers confirm that the human sources of bacteria have indeed been eliminated from the receiving waters and MS4, then this dataset may be used as a line of evidence supporting a request to reopen the TMDL, request a NSE, or site-specific objective based on QMRA.

6.2 <u>Constituents to be Monitored and Measurement Techniques</u>

Analytical methods for all water quality parameters to be measured are listed below. Details of each analytical method can be provided by the laboratory upon request. The final list of methods and assays may change based on discussions with labs, validation study, expected reliability, costs, and availability.

Flow rates will be estimated using one of the methods described in Appendix F. Conductivity, pH, turbidity, DO, and temperature will all be measured in the field using a Horiba U-10 probe, or similar. Ammonia, phosphate, and MBAS will be analyzed using colorimetric methods according to methods SM4500NH3 (B,C), SM4500P (B,E), and SM 5540C, respectively. Caffeine, cotinine, and sucralose will be analyzed using liquid chromatography tandem mass spectrometry (LC/MS/MS) with electrospray ionization (ESI+) according to EPA method 1694M-ESI+. Fecal Coliforms and *Enterococcus* will be analyzed using membrane filtration methods (SM 9222D, EPA 1600 respectively). The fecal gene biomarkers for human, cow, ruminant, dog, pig, and horse will be analyzed with qPCR using the following SIPP-recommended assays:

- Human: HF183 taqman, HumM2
- Cow: CowM2
- Ruminant: Rum2Bac
- Dog: BacCan
- Pig: Pig2Bac
- Horse: HoF597

6.3 Project Schedule

The anticipated project schedule is shown below in Table E6-1.

Table A6-1: Project Schedule

Activity	*Anticipated Date of Initiation*	*Anticipated Date of Completion*	*Deliverable*	*Approximate Deliverable Due Date*
MST Work Plan Development	December 2012	TBD	Monitoring Plan	TBD
QAPP Development	February 2013	TBD	QAPP	TBD
Desktop Evaluation	Upon approval of the MST Work Plan	TBD	NA	NA
Preliminary Outfall Investigation	Upon completion of Desktop Evaluation	TBD	NA	NA
Follow-up Outfall Investigation	Upon analysis of data from Preliminary Outfall Investigation	TBD	NA	NA
Stormdrain Network Investigation and Source	Upon completion of all laboratory analyses and	TBD	NA	NA

elimination	analysis of potential sites			
Human Source Marker Confirmation Smplaing	Upon completion of Source Elimination	TBD	NA	NA
Final Report and Project Completion	Upon analysis of all collected data and results of Phase 2 sampling	TBD	Final Report	TBD
Pathogen sampling, QMRA (optional, if needed)	Upon client analysis of final report and preparation of new MST Work Plan/QAPP	TBD	NA	NA

6.4 Geographical Setting

The SLR Watershed is located in northern San Diego County and is bordered to the north by the Santa Margarita River Watershed and to the south by the Carlsbad and San Dieguito River Watersheds. The San Luis Rey River originates in the Palomar and Hot Springs Mountains, both over 6,000 feet above mean sea level, as well as several other mountain ranges along the western border of the Anza Borrego Desert Park. The river extends over 55 miles across northern San Diego County forming a watershed with an area of approximately 360,000 acres or 562 square miles. The river ultimately discharges to the Pacific Ocean near the City of Oceanside. Of the nine major watersheds in the San Diego region, the SLR Watershed is the third largest.

6.5 Constraints

There are a very large number of MS4 outfalls to the watershed. In addition, dry weather MS4 flows and water quality parameters in those flows are typically highly variable. Both the variability in data collected at a single monitoring site and the difference in results between compared sites will impact statistical significance. As measured concentrations for water quality parameters often vary by orders of magnitude between sites and/or monitoring events, it is difficult to predict the number of data points needed to make statistically significant comparisons of results. Within these limitations, every effort will be made to detect sources of human waste to the County’s MS4 to the highest degree of confidence possible given the time and resource constraints.

Field sampling can be subject to unforeseen circumstances, including unpredictable weather, equipment malfunctions, potential safety concerns, and seasonal rainfall variations. Implementation of the MST Work Plan will minimize the effects of these problems by providing procedures for storm tracking so that sampling can be conducted exclusively during dry weather.

7 DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

7.1 Data Quality Definitions

This QAPP addresses both field and laboratory activities. QA objectives, formally known as Data Quality Indicators (DQIs), for measurement data are expressed in terms of precision, accuracy, completeness, comparability, and sensitivity (PARCCS). Evaluation of DQIs provides the mechanism for ongoing review and evaluation of data quality throughout the project and ultimately will be used to define the data quality achieved for the various measurement parameters. All DQIs were selected to meet SWAMP requirements for monitoring data collection where applicable. The field QA/QC program will be accomplished through the collection of field replicates and trip blanks. The analytical QA/QC program will be assessed through the internal laboratory QC performed, including but not limited to method blanks, laboratory control sample (LCS) recoveries, laboratory duplicates, surrogate recoveries, and matrix spike/matrix spike duplicate (MS/MSD) recoveries and positive and negative controls. Data quality acceptance criteria are presented below.

7.1.1 Precision

Precision describes the extent to which a measurement is reproducible and is expressed by calculating variability in a group of measurements. During the collection of data using field methods and/or instrumentation, precision is checked by reporting several measurements taken at one location and comparing the results. Precision will be reported as the relative percent difference (RPD) for two results and relative standard deviation (RSD) for three or more results.

In the field, precision is determined by replication of field measurements and collection of field duplicates (for a minimum of 5 percent of total project sample count). In the laboratory, analytical precision is measured through laboratory duplicates (for a minimum 5 percent of samples), matrix spike/matrix spike duplicate pairs, and LCS/LCS duplicate pairs and is evaluated by comparison to the maximum allowable relative percent difference (RPD) used by the analytical laboratory and the Project Measurement Quality Objectives (MQOs) shown in Tables E7-1 to E7-3. Precision RPD is calculated using the equation:

$$RPD(Precision) = \left|\frac{C_1 - C_2}{(C_1 + C_2)/2}\right| \times 100$$

where C_1 = Sample 1 concentration, and C_2 = Sample 2 concentration

Precision RSD is calculated using the equation:

$$RSD(Precision) = \left|\frac{s}{\mu}\right| \times 100$$

where s is the standard deviation and μ is the mean of repeated samples.

Field measurement precision MQOs are shown in Table E7-1.

7.1.2 Accuracy

Accuracy describes the degree of closeness of a measurement to its true (or actual) value. The accuracy of field protocols is difficult to assess quantitatively, but sampling accuracy can be maximized by the adoption of and adherence to a strict field QA program. Specifically, procedures will be performed following the SOPs discussed in the Sampling and Analysis Plan (Appendix B) and shown in Table E11-1. Equipment and instrumentation will be properly calibrated and well-maintained as explained in the SOP. Through regular review of field procedures, any deficiencies will be documented and corrected in a timely manner.

In the laboratory, accuracy will be determined by measurement of a standard solution with a known concentration of analyte. Laboratory accuracy will be ascertained through the analysis of matrix spike/matrix spike duplicate (MS/MSD), laboratory control samples (LCSs), and surrogate recoveries (for organic constituents). Accuracy is reported as percent recovery (%R) and compared against laboratory performance criteria and Project MQOs. Maximum acceptable %R for accuracy is shown in Tables E7-1 to E7-3.

%R is calculated using the equation:

$$\% R = \frac{Spiked\,Sample Concentration - Sample Concentration}{Spike Concentration} \times 100$$

7.1.3 Completeness

Completeness is the measurement quality criterion that assesses the proportion of data obtained that is determined to be valid based on analytical QA/QC methods. By design, the sampling sites, frequency, and water quality measurements will provide sufficient depth and quantity of information to meet Project objectives. No data gaps have been identified that might impede success of the Project. For the purposes of meeting Work Plan objectives, the Project MQO will be 90 percent completeness for all measurements.

The percent completeness for each set of samples will be calculated as follows:

$$\% \; Completeness = \frac{Valid \;\; Data}{Total \;\; Data \;\; Planned} \times 100$$

7.1.4 Comparability

USEPA-established methods and approved protocols have been selected or specified as appropriate for this investigation. By using standard sampling and analytical procedures, data sets will be comparable. These procedures are discussed in detail in the Sampling and Analysis Plan (Appendix B).

7.1.5 Sensitivity

Sensitivity refers to the minimum magnitude at which analytical methods can resolve quantitative differences among sample concentrations. If the minimum magnitude for a particular analytical method is below an action level or risk screening criterion, then the method sensitivity is acceptable to fully evaluate the dataset with respect to the desired reference values. To allow for matrix interferences and variability in instrument control, a reporting limit of 2.5-5 times the method detection limit (MDL) is typically selected. Sensitivity is measured by the method reporting limit, which expresses the lowest concentration of analyte that can be accurately detected by the method. Laboratory reporting limits shall be less than or equal to the method reporting limit MQOs are shown in Tables E7-1 through E7-3.

7.1.6 Method Quality Objectives

Water pH, conductivity, turbidity, DO, and temperature are measured in situ using the Horiba U-10 probe, or similar. The precision (expressed as % RSD) is determined as follows: After calibration using two standard solutions, the probe is used to measure a third standard solution to obtain multiple readings. The accuracy for each parameter (expressed as % R) is calculated by measuring the standard against its respective known value. The “true” value of temperature for the standard can be obtained by using a calibrated standard thermometer.

The MQOs for field measurements are shown in Table E7-1.

Table E7-1: Field Measurement MQOs

Parameter	*Resolution*	*Accuracy*	*Target Reporting Range*	*Completeness*
Temperature (°Celsius)	0.5	± 0.1	5-50	90
pH (standard units)	0.1	± 0.2	3.5-10.5	90
Turbidity (NTU)	1	± 1	5 - 100	90
Specific Conductivity (µS/cm)	1	± 2	2 - 3999	90
Dissolved Oxygen (mg/L)	0.1	± 0.2	0.2-19.9	90

MQOs for all laboratory analyses are provided by the laboratories and presented in Table E7-2.

Table E7-2: Analytical Chemistry and Indicator Bacteria MQOs

Parameter	*Precision*	*Accuracy*	*Recovery*	*Target Reporting Limit (mg/L)*	*Completeness (%)*
Ammonia-N	MS/MSD RPD up to 20%.	Laboratory Control Sample (LCS)	Matrix spike recovery	0.1	90

		within 80% to 120% of true value.	between 80% - 120%.		
Phosphate-P	MS/MSD RPD up to 20%.	Laboratory Control Sample (LCS) within 80% to 120% of true value.	Matrix spike recovery between 80% - 120%.	0.05	90
Methylene Blue Active Substances (MBAS)	MS/MSD RPD up to 25%.	Laboratory Control Sample (LCS) within 80% to 120% of true value.	Matrix spike recovery between 70% - 130%.	0.1	90
Caffeine	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Standard Reference Materials (SRM, CRM, PT) within 90% CI stated by supplier. If not available, within 50% to 150% of true value	Matrix spike 50% -150% or control limits at + 3 standard deviations based on actual lab data.	0.00005	90
Cotinine	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Standard Reference Materials (SRM, CRM, PT) within 90% CI stated by supplier. If not available, within 50% to 150% of true value	Matrix spike 50% -150% or control limits at + 3 standard deviations based on actual lab data.	0.00005	90
Sucralose	Sample duplicate RPD up to 30%.	Laboratory Control Sample (LCS) within 70% to 130% of true value.	Matrix spike recovery between 70% - 130%.	0.000025	90
Bacterial indicators (TC, FC, E. Coli, Enterococcus)	Laboratory positive and negative cultures – proper positive or negative response. Bacterial PT sample –within the stated acceptance criteria.	Rlog within 3.27*mean R_{log} (reference is section 9020B of 18th, 19th, or 20th editions of *Standard Methods*	NA	2 MPN (or #)/100mL	

For MST markers, a filter “method blank” consisting of sterile buffer water is sent with every test sample batch to the contracting lab performing molecular marker testing and analyzed together with test samples to verify that no contamination has been introduced during the membrane filtration process.

Standard curves using DNA standards are generated for determination of performance characteristics of the qPCR assays and instrument.

Positive controls are analyzed to ensure that the method is performing properly by ruling out false negatives and are performed with every sample run. The positive control must be detected.

At least one No-Template Control (NTC), consisting of DNA grade water will be included with every run. The negative control ensures that qPCR reagents and materials are not contaminated with the DNA target and rules out analytical false positives. All negative controls (NTCs) must either not be detected at all or detected at a minimum of 3 CT units greater than the unknown sample CT value.

Each sample will be monitored for inhibition by running an additional and separate qPCR reaction containing sample template DNA that has been diluted 10-fold. This will be done for every bio-marker to be analyzed. If the 10-fold diluted template amplifies at a CT lower than the corresponding undiluted template, the sample is inhibited and appropriate measures must be taken, such as re-analyzing the sample in duplicate using the diluted form.

For Quantification tests, the standard deviation between replicate reactions must not exceed 1.5 units. For low concentration samples with detection levels ≥ 35 CTs, a standard deviation of ≥ 1.4 units is permitted.

Sample replicates amplifying past the lowest standard are considered detectable but not within quantification range of the assay (DNQ). Only samples with 2 or more replicates within quantification range of the assay are assigned concentration values.

Table E7-3: Human/non-Human Genetic Fecal Markers Assays for Primary MST Lab

Parameter	***Precision (RPD)***	***Accuracy (%R)***	***Limit of Detection (# of target copies/qPCR reaction)***	***Completeness***
HF183 taqman	TBD	TBD	10	90
HumM2	TBD	TBD	10	90
CowM3	TBD	TBD	10	90
Rum2Bac	TBD	TBD	50	90
BacCan	TBD	TBD	5	90
Pig2Bac	TBD	TBD	100	90
HoF597	TBD	TBD	100	90

8 SPECIAL TRAINING NEEDS/CERTIFICATION

8.1 Specialized Training or Certifications

All field sampling personnel will be experienced and trained in environmental sampling techniques. Sampling personnel will be required to review the Task Hazard Analysis. The analytical laboratory selected to perform chemical analysis will be certified by the USEPA and the California Department of Public Health’s Environmental Laboratory Accreditation Program.

8.2 Training and Certification Documentation

Copies of required training documentation for Project personnel will be kept on file. Contracted laboratories will maintain documentation of certification and will provide to Project representatives on request.

9 DOCUMENTS AND RECORDS

The Data Manager will collect and maintain all documents and records associated with field documentation and laboratory analysis. The QAPP will be maintained by the Data Manager, and the most recent version will be redistributed to those persons listed in Table E3-1 after any revision.

9.1 Field Documentation

Data will be collected on standardized field data sheets or electronically using tablet or smartphone devices to streamline processing. Field data sheets will include date, time, sampling site, names of field personnel, and collected field data. On return to the office, field data sheets will be transcribed electronically or transferred to Data Manager's computer. All field data sheets and photographic documentation will be kept in a project folder on a computer server for reference by all Project personnel. Electronic data kept on the server will be backed up at least weekly and will be stored as described in Table E9-1.

9.2 Analytical Data Records

The analytical laboratory will provide reports (electronic and hard-copy) that include a letter of transmittal, a case narrative, chain of custody information, and analytical results for all field and quality control samples. Additionally, electronic spreadsheets of laboratory results will be provided for ease of analysis. Reports will be reviewed for completeness and errors by the Data Manager and QA/QC will be conducted by the QAO. Any concerns resulting from these reviews will be remedied with the laboratory, and the final reports will be stored as described in Table E8-1: Record Retention and Archival Information.

Table E9-1: Record Retention and Archival Information

Document	*Retention*	*Responsible for Archival*
Field Records	15 years	Data Manager
Analytical Records	15 years	Data Manager
QAPP	15 years	Data Manager
Reports	15 years	Data Manager

10 SAMPLING PROCESS DESIGN

Sampling collection points and sampling process design is described in detail in Sampling and Analysis Plan (Appendix C).

11 SAMPLING METHODS

At each site with flowing water, *in-situ* measurements of flow, pH, conductivity, turbidity, DO, and temperature are made, and samples for all of the water quality parameters listed in section 7 are collected.

11.1 Sample Containers, Preservation, and Holding Times

Samples for laboratory analysis are stored at ≤4°C in an ice cooler. All samples collected for laboratory analysis are collected using the appropriate sample containers (supplied by each laboratory) with appropriate preservatives and not to exceed specified holding times (Table A11-1). The laboratories must acid wash, thoroughly rinse, and autoclave all sample containers prior to be being used for DNA analysis. The human-non-human marker samples will be filtered at the local laboratory to collect the genetic material, and the frozen filters will be sent to Source Molecular Laboratories for analysis.

Table E11-1: Water Quality Analytical Parameters

Parameter	*Analytical Method*	*Container type*	*Sample Volume (mL)*	*Preservative*	*Max Holding Time*
pH	N/A	N/A	N/A	N/A	N/A
Temperature	N/A	N/A	N/A	N/A	N/A
Conductivity	N/A	N/A	N/A	N/A	N/A
Turbidity	N/A	N/A	N/A	N/A	N/A
Dissolved Oxygen	N/A	N/A	N/A	N/A	N/A
Ammonia-N	SM4500NH3 (B,C)	Plastic	250	N/A	28 days
Phosphate-P	SM4500P (B,E)	Plastic or Pyrex	250	H_2SO_4	24 hours if not preserved
MBAS	SM 5540C	Plastic	500	None	48 hours
Caffeine/Cotinine	1694-ESI+	Amber Glass	2000	Sodium Azide, Ascorbic Acid	28 days
Sucralose	1694-ESI+	Amber Glass	1000	Sodium Azide, Ascorbic Acid	14 days
Bacterial Indicators (FC, E. Coli, Enterococcus)	SM 9222D, EPA 1600	Plastic (sterile)	1000	N/A	6 hours (processed ASAP)

Human/Non-human Markers	HF183 taqman, HumM2, CowM2, Rum2Bac, BacCan, Pig2Bac, HoF597	Subsampled from Bacterial Indicator sample

11.2 Standard Operating Procedures

Standard methods described here are intended to be in compliance with SWAMP requirements. All standard operating procedures (SOPs) regarding the proper use, maintenance, and calibration of sampling equipment, sampling procedures, and safety procedures for chemical and indicator bacteria samples are described in the "Dry Weather Analytical and Field Screening Monitoring Procedures Manual" and the "Standard Operating Procedures for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program". Relevant excerpts are included in Appendix F.

Human and non-human marker sample collection requires extreme care because of the high potential for contamination due to the sensitivity of the qPCR method and the likely presence of genetic material on hands, equipment, etc. of sampling personnel. The method was taken from the "San Diego River Bacterial Source Tracking Investigation, Phase I Monitoring and Quality Assurance Project Plan." The sample collection bottle will be labeled with sample identification, sample location, sample date, sample time, and name of collector using black, waterproof ink. The samplers will put on gloves prior to collecting samples. The sample container will be carefully opened and the cap held carefully face down to prevent aerial contamination. The sampling container will be inverted and allowed to fill and then capped and held in one hand.

These steps will be performed for each sample collected, and gloves will be used only once. During sampling, if gloved hands touch anything other than the sampling bottle, the gloves will be discarded, and the procedure will be repeated. The samples will be placed in the ice cooler as soon as possible.

12 SAMPLE HANDLING AND CUSTODY

Sample handling and custody, including sample collection and identification, documentation, field datasheets, sample containers, sample packing, and sample shipping are described below.

12.1 Sample Handling and Custody Protocols

The following sample handling and custody protocols will be used to prevent sample contamination in accordance with SWAMP guidelines:

1. One member of the sampling team will take custody of all collected samples for laboratory analysis.

2. Collected samples will be labeled when collected with site location, date, sample time, analysis to be performed, preservation (if any), and field sampler's name. All samples will be stored in an ice-filled, dark cooler at approximately 4° C for storage and transport. Bottles will be provided by the labs with preservatives or other needed chemicals pre-added.
3. As the indicator bacteria samples must be analyzed within 24 hours (6 hours for regulatory data) to prevent degradation, samples will be transferred as efficiently as possible to the laboratory using standard chain of custody documentation.
4. Samples are analyzed and/or stabilized within the holding times shown in Table A11-1. Human/non-human marker samples must be filtered using the appropriate method to retain genetic material, and the filters frozen for transport to Source Molecular Laboratories.

12.2 Sample Custody Roles and Responsibilities

The persons responsible for sample custody, and a brief description of their duties, are as follows:

1. Laboratory Sample Custodian or Commercial Supplier: Verifies that the sample containers are certified clean; arranges for container shipment to field sampling personnel or the contractor's equipment shop;
2. Equipment Manager: Receives and stores sample containers that are shipped from a laboratory or a commercial supplier; relinquishes sample containers to field sampling personnel; initiates chain of custody (COC) from sample containers in storage;
3. Field Staff: Receive sample containers from laboratory, inspect sample containers for physical integrity; retain shipping invoice or packing list from shipping courier as documentation of transfer of sample containers; collect and preserve samples; complete the COC, retain sample containers and samples under custody until sample shipment; relinquish samples to shipping courier or to lab representative.
4. Project Manager: Verifies reported laboratory analyses to the sample COC form; assures that COC documentation is incorporated into the project file.

12.3 Chain of Custody Record (COC)

The field COC record is used to record the custody of all samples collected and sent to the laboratory for analysis. The COC also serves as a sample logging reference for the analytical laboratories' sample custodian.

The following information must be supplied in the indicated spaces on the field COC record:

1. Project name and number

2. Signatures of all samplers and/or the sampling team leader in the designated signature block
3. Sampling station number, date, and time of sample collection, grab or composite sample designation, sample preservation type, and a brief description of the type of sample and the sampling location must be included on each line (each line shall contain only those samples collected at a specific location).
4. Sampling team leader's name shall be recorded in the right or left margin of the COC when samples collected by more than one sampling team are included on the same form.
5. Total number of sample containers must be listed in the indicated space for each sample. The total number of individual sample containers must also be listed for each type of analysis under the indicated media or miscellaneous columns. Note that it is impossible to have more than one media type per sample. The type of container and required analyses should be circled as indicated on the COC.
6. The field investigator and subsequent transferee(s) must document the transfer of the samples listed on the COC in the spaces provided at the bottom of the Record. Both the person relinquishing the samples and the person receiving them must sign the form; the date and time that this occurred must be documented in the proper space on the Record. Usually, the last person receiving the samples or evidence should be a laboratory sample custodian.
7. Any person relinquishing the samples to a commercial carrier (i.e. Federal Express) shall note the name of the carrier on the COC in the “relinquished to” space with the date and time. The remarks column at the bottom of the Record is used to record air bill numbers or registered or certified mail serial numbers.

The COC record is a serialized document. Once the COC is completed, it becomes an accountable document and must be maintained in the project file. The suitability of any other form for COC should be evaluated upon its inclusion of all of the above information in a legible format. An example of a COC used in this study is provided in Appendix G.

13 ANALYTICAL METHODS

Field and laboratory analytical methods will be standard USEPA-approved if possible and are discussed in Section 6, Section 7, and Section 11 of this QAPP. More details about each method can be obtained from the laboratory upon request.

14 QUALITY CONTROL

Quality Control (QC) checks for both the field and laboratory are used to validate the collected data. In addition, for the human/non-human markers, several duplicate samples will be sent to a separate laboratory for independent analysis. Laboratories will be required to retain consistent procedures, including utilization of consistent staff, and will be provided with a copy of this QAPP. The Microbiology Independent Reviewer will oversee laboratory procedures and QA/QC results. QC checks on samples include field blanks, lab blanks, field duplicates, lab duplicates, matrix spikes, and laboratory control standards (LCS) at the frequencies presented in Table E14-1. QC on field measurements includes calibration of instruments and taking multiple measurements which are required to be within acceptable precision limits.

Table E13-1: Quality Control Measures

Category	*Blank*	*Duplicates*	*Matrix Spike*	*LCS*
Field	1 per 20 samples or less	10%	N/A	N/A
Laboratory	Per method	1 per 20 samples or 10%	1 per 20 samples or less	1 per 20 samples or less

14.1 <u>Field Measurement Quality Control</u>

Field equipment will be calibrated as described in Section 16 of this QAPP to ensure accuracy of field data collection. Additionally, field measurements will be duplicated in the field and must agree by the precision MQOs shown below in Table E14-2. If the two measurements do not meet the precision criteria, three additional replicates will be taken and the median of the five measurements reported on the field data sheet.

Table E14-2: Field Measurement Quality Control Measures

Field Measurement	*Replicates*	*Precision Acceptance Limits*
Temperature (°Celsius)	2	±0.1
pH (standard units)	2	± 0.2
Turbidity (NTU)	2	± 1
Specific Conductivity (µS/cm)	2	± 2
Dissolved Oxygen (mg/L)	2	± 0.2

14.2 <u>Field Sampling Quality Control</u>

Sources of contamination in the field include dirty sampling equipment, airborne contaminants, and contaminants introduced by field personnel (e.g., dirty hands/gloves, sunscreen, and insect repellant). Quality control in the field consists of prevention and testing of field duplicates and trip blanks. Adherence to SOPs discussed in Section 11 will minimize contamination. Additionally, sample quality will be checked by analyzing field duplicates trip blanks.

14.2.1 Field Blanks

Field blanks will represent at a minimum 5 percent of the total project sample count for each sample type. Field blanks are prepared by pouring water known to be free of the substance of interest into a sample collection container, and having the blank present with other collected samples during sampling. Deionized water or other water that has been shown to be free of all analytes and nuclease will be used for all sample types. The same methods should be used for filling the field blank as other samples (i.e. sterile techniques, as appropriate). The expected result of all field blanks is that all parameters should be below method reporting limits.

If contamination of the trip blanks and associated samples is known or suspected, the laboratory should qualify the affected data, and notify the project coordinator, who in turn will follow the process detailed in the method.

14.2.2 Field Duplicates

Blind field duplicate samples will be collected to test sampling precision, and will represent at a minimum 10 percent of the total project sample count for each sample type. The QAO and/or Data Manager will choose analyte(s) and sampling locations for the field duplicate prior to the sampling event. Analytes may be chosen randomly or as a quality check for specific constituents of interest. Field duplicates will be taken from the same sampling container to minimize differences between the samples. Control limits for field duplicates will be equal to the Precision MQOs shown in Tables E7-1 to E7-3.

For duplicates with a heterogeneous matrix or ambient levels below the reporting limit, failed results may be qualified. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.

14.3 Laboratory Quality Control

14.3.1 Laboratory Blanks

A laboratory (or preparation) blank is prepared at the frequency specified by the referenced method (typically one per analytical batch). The purpose of the method blank is to check that contaminants are not introduced by the glassware, reagents, standards, personnel, during sample preparation and/or analysis. An instrument blank is also analyzed during each calibration shift to verify that contaminants are not being introduced by components of the instrumentation or analytical laboratory.

Various, other routine blank checks are in place to verify that new lots of glassware, reagents and standards, decontaminated glassware, sample storage areas (including refrigerators), and water purification systems are contaminant-free. Monitoring parameters should not be detected above the RL in the method blanks. If this occurs, the sample analysis must be halted, the source of the contamination investigated, the samples along with a new method blank prepared and/or re-extracted, and the sample batch and fresh method blank reanalyzed. If reanalysis is not possible due to sample volume, flag associated samples as estimated.

14.3.2 Laboratory Surrogates

Surrogate standards are added to each sample intended for organics (e.g. caffeine, cotinine) analysis in accordance with the particular method being used. Surrogate recoveries must meet method acceptance criteria before the analytical data will be released. In some instances, the sample matrix may produce interferences that adversely affect recoveries. Surrogate recovery interferences must be confirmed by preparation and reanalysis of the sample.

14.3.3 Laboratory Control Samples

A laboratory control sample (LCS) consists of a clean matrix fortified with known concentrations of standard solutions containing target analytes of interest. The recovery of these standards is quantitatively measured during analysis, and historical records maintained on the percent recovery for each sample. One LCS is analyzed for each sample extraction/analytical batch (a batch is a group of 20 samples or less) as applicable to the method. The control limits for LCSs are the MQOs for accuracy shown in Tables E7-1 to E7-3.

14.3.4 Laboratory (Matrix) Duplicates

Laboratory precision will be measured by duplicating an analysis by splitting the same field sample and using the same sample extraction/preparation procedure and analysis for both aliquots. The control limits for laboratory replicates are the MQOs for Precision shown in Tables E7-1 to E7-3. For duplicates with a heterogeneous matrix or ambient levels below the reporting limit, failed results may be qualified. Other failures should be reanalyzed as sample volume allows. A matrix spike duplicate may not be analyzed in place of a laboratory duplicate.

14.3.5 Matrix Spikes and Matrix Spike Duplicates

A matrix spike (MS) is an environmental sample to which known concentrations of analytes have been added. The MS is taken through the entire analytical procedure and the recoveries of the analytes are calculated. Results are expressed as percent recovery. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis.

A matrix spike duplicate (MSD) is one of the aliquots of an environmental sample that is then either collected in separate containers (as the MS/MSD samples) or divided into two separate aliquots once received by the laboratory, each of which is spiked with a known concentrations of analytes. The two spiked aliquots are processed separately and the results compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as RPD and percent recovery.

One MS/MSD set will be analyzed for every 20 investigative samples. The MS/MSD will be site-specific and, therefore, field personnel will be responsible for collecting additional sample volumes to account for the MS/MSD samples. The sample to be used for the MS/MSD analysis shall be identified on the COC, to ensure that a project sample is used (instead of a non-project sample that is part of the analytical batch). Results will be compared to the Recovery MQOs shown in Tables E7-1 to E7-3.

If matrix interference is suspected and reference material recoveries are acceptable, the matrix spike duplicate result must be qualified.

14.4 Independent Laboratory Analysis Duplicate Check

Duplicates from three sites during the first round of sampling will be collected and sent to four laboratories including Source Molecular Laboratories. No SWAMP requirement exists for this analysis, but it is being done to increase confidence in the human-non-human marker analyses due to their fairly recent development. If results are significantly different, as determined by the Microbiology Independent Reviewer, the Microbiology Independent Reviewer and the QA Officer will decide how to proceed with the remaining sample analysis and what actions, if any, to take. Depending on the duration of the sampling, additional samples may be sent to the alternate laboratory.

15 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

All field testing equipment is cleaned and inspected upon return from each sample day/event. The field sampling probe will be auto-calibrated prior to field use and upon return and the results recorded in the calibration data sheet (Appendix F). The probes are replaced at the first sign of deviation from standard solution concentrations and any deviations/replacements are noted in the instrument logbook.

Contracted laboratories are responsible for testing and maintaining laboratory equipment according to manufacturer and method specifications. Laboratories will provide equipment maintenance records to Project staff on request.

Table E15-1: Testing, Inspection, Maintenance of Sampling Equipment and Analytical Instruments

Equipment	***Maintenance Activity***	***Frequency***
Water Quality Probe	Clean, inspect, check with pH7 and pH10 solutions before and after field visit, replace probes as necessary	Upon each field visit, replace probes as necessary
Flow Meter	Clean, inspect, check/replace batteries	Upon each field visit
Digital Camera	Inspect, check/replace batteries, memory	Upon each field visit

16 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

The instrument will be auto-calibrated prior to use in the field each day, and standard solutions checked after each day of sampling as recommended by the manufacturer and if accuracy or precision issues are found. A complete calibration will be done quarterly. Electronic sensors on the probes will be cleaned before and after each sample.

Laboratory instruments will be calibrated at the manufacturer-recommended frequency by the contracted laboratory. Calibration information will be provided to Project staff on request.

17 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Supplies, including sample collection bottles received from the laboratory, will be inspected on receipt for completeness and quality. If any supplies are missing or damaged, the supplier will be contacted and the supplies will be replaced. Supply inventory will be taken before each sampling event to ensure that all necessary materials are available. The contracted laboratory is responsible for inspection and maintenance of laboratory and analysis supplies.

18 NON-DIRECT MEASUREMENTS

The non-direct measurements taken during sampling will be non-quantitative observations of flow or evidence of flow from storm drains, visual and olfactory observations of evidence of human waste or human impacts (odor, coloration, or other visible evidence). After sampling is concluded, storm drains shown to be impacted by human waste will be examined using CCTV, dye testing, or smoke testing.

19 DATA MANAGEMENT

All Project data, if not initially in electronic form (e.g. field data sheets), will be digitized within 7 days of the sampling event. All electronic data, including field data, laboratory data, and quality information will be stored on a computer server that is shared with Project personnel at the Los Angeles office of Geosyntec Consultants. This server is backed up on an off-site server at least every 7 days.

Prior to analysis, field and analytical data will be transcribed or otherwise entered into spreadsheets and saved uniquely by sample date for analysis and inclusion in annual reports. The Data Manager is responsible for ensuring that all data management requirements are met. The QA Officer is responsible for reviewing data sheets for completeness, accuracy, and for data entry or transcription errors.

20 ASSESSMENT AND RESPONSE ACTIONS

The Project QA Officer will annually review sampling, data acquisition, laboratory analysis, and data analysis procedures for the purpose of meeting the quality objectives as described in this QAPP. Reviews will consist of (1) confirming SOPs are being followed during field sampling based on inquiries to field staff and/or the Data Manager, (2) verification of COC documentation, and (3) review of analytical data as they relate to MQOs.

If the annual review finds that any part of the QAPP is not being applied, the QA Officer will discuss the appropriate actions to take with responsible Project staff and/or the Project Manager. Actions may include determining the cause of the discrepancy, quantifying or qualifying the extent of the quality issues, discussing data quality impacts of the discrepancy to the Project, correcting the problem, if possible, and developing a plan to avoid similar issues in the future. If a deviation from the QAPP is discovered, the SDCDPW Project Director will be notified and informed of the potential impact of the deviations on the quality of the data.

21 REPORTS TO MANAGEMENT

Data will be analyzed and reported to SDCDPW. The report will describe sampling efforts and data analysis, along with the actions taken to detect human waste impacts in the County's MS4. Data reports will be reviewed and approved by the Data Manager and the Project Manager before submission to the SDCDPW.

22 DATA REVIEW, VERIFICATION, AND VALIDATION

All Project data will be reviewed by the Data Manager and QA Officer for validation, and all reports will be reviewed by the Data Manager and Project Manager. Data quality will be verified in writing to the appropriate Project staff. Any issues with data quality or reporting will be noted and corrected, if possible. All changes to original data require agreement of the Project QA Officer, Data Manager, and Laboratory Project Managers, as well as written documentation of the change. Data that does not meet the quality objectives will be qualified with an identifying code in all reports. A list of validation qualifiers for analytical data, in accordance with US EPA guidelines, is included in Table A21-1.

Table A21-1: Analytical Validation Data Qualifiers

Qualifier	***Explanation***
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J+	The analyte was positively identified; however, the associated numerical value is likely to be higher that the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.
J-	The analyte was positively identified; however, the associated numerical value is likely to be lower that the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

23 VERIFICATION AND VALIDATION METHODS

All data records will be checked visually and recorded as checked by initials and dates. Geosyntec's QA Officer will review all data. The Microbiology Independent Reviewer will review all laboratory data and methods.

Issues will be noted. Reconciliation and correction will be done a by committee composed of all personnel described in Section 3. Any corrections will require a unanimous agreement that the correction is appropriate.

24 RECONCILIATION WITH USER REQUIREMENTS

Data that satisfies the quality objectives outlined in this QAPP will be analyzed and reported as described in Sections 4.5 of the MST Work Plan.

25 REFERENCES

See Work Plan References section

Prepared for

County of San Diego, Department of Public Works
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APPENDIX F

STANDARD OPERATING PROCEDURES (SOP) – RELEVANT EXCERPTS

FOR TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

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Project Number LA022824

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Surface Water Ambient Monitoring Program

SOP for
Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples

Marine Pollution Studies Laboratory – Department of Fish and Game (MPSL-DFG) Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)

The SOPs below are for reference and information purposes only, the documents are not required by the Surface Water Ambient Monitoring Program (SWAMP). Please see the SWAMP Quality Assurance Management Plan (http://www.swrcb.ca.gov/swamp/qamp.html) for more information regarding SWAMP QA/QC requirements.

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Field Data Measurements

While collecting water samples (see Field Collection Procedures for Water Samples section), record appropriate field measurements. When field measurements are made with a multiparameter instrument, it is preferable to place the sonde in the body of water to be sampled and allow it to equilibrate in the dissolved oxygen (D.O.) mode while water samples are collected. Field measurements are made at the centroid of flow, if the stream visually appears to be completely mixed from shore to shore. *Centroid* is defined as the midpoint of that portion of the stream width which contains 50% of the total flow. For routine field measurements, the date, time and depth are reported as a grab. Measure Quality Objectives (MQO's) for field measurements are listed in appendix C of the SWAMP QAMP.

Recommended Depths for Conducting Field Data Measurements

Water Depth Less than 5 ft (<1.5 m) If the water depth is less than 5 ft (1.5 m), grab samples for water are taken at approximately 0.1 m (4 in.), and multi-probe measurements are taken at approximately 0.2 m (8 in.). This is because all sensors have to be submerged, so 0.1 m would not be deep enough. But taking a grab sample at 0.2 m is not always feasible, as it is difficult to submerge bottles to that depth, and in many cases the bottle will hit the stream bottom.

Water Depth Greater than 5 ft (>1.5 m) If the water depth at the sampling point exceeds 5 ft (1.5 m) in depth, a vertical profile of dissolved oxygen, temperature, pH and specific conductance are made using the multiparameter probe equipment. The depth of the sonde at the time of measurement is most accurately determined from the depth sensor on the multiparameter sonde rather than depth labels on the cable.

Vertical Depth Profiles and Depth-Integrated Sample Collection If depth integration sampling is being conducted, or if vertical profile measurements are requested, multi-probe measurements are made starting at a depth of 0.2 m, and are then conducted at 1.0, 2.0, 3.0, 4.0, and 5.0 m depths after that until 5.0 m depth is reached. Beginning at 5.0 m, measurements are made every 5.0 m through depth profile.

Field data for multiparameter vertical depth profiles are recorded in final form on the SWAMP Field Data Sheets and submitted to the SWAMP data management staff.
Go to http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Water Temperature (^{O}C)

Water temperature data are recorded for each SWAMP visit in final form in a Field Data Logbook and submitted to the SWAMP data management staff.
See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Temperature Sampling Procedures

Temperature is measured in-stream at the depth(s) specified above. Measuring temperature directly from the stream by immersing a multiprobe instrument or thermometer is preferred.

Hand Held Centigrade Thermometer

If an electronic meter is not available, the temperature is measured with a hand-held, centigrade thermometer (Rawson, 1982).

< In wadeable streams, stand so that a shadow is cast upon the site for temperature measurement.

< Hold the thermometer by its top and immerse it in the water. Position the thermometer so that the scale can be read.

< Allow the thermometer to stabilize for at least one minute, then without removing the thermometer from the water, read the temperature to the nearest 0.1^{o} C and record.

< Do not read temperature with the thermometer out of the water. Temperature readings made with modern digital instruments are accurate to within $\pm$ 0.1^{o} C.

Temperature Measurement from a Bucket
When temperature cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic. Care must be taken to insure a measurement representative of in-stream conditions.

The following conditions must be met when measuring temperature from a bucket:

< The bucket must be large enough to allow full immersion of the probe or thermometer.

< The bucket must be brought to the same temperature as the water before it is filled.

< The probe must be placed in the bucket immediately, before the temperature changes.

< The bucket must be shaded from direct sunlight and strong breezes prior to and during temperature measurement.

< The probe is allowed to equilibrate for at least one minute before temperature is recorded.

< After these measurements are made, this water is discarded and another sample is drawn for water samples which are sent to the laboratory.

pH (standard units)

pH data is recorded for each SWAMP visit in final form on the Field Data Sheets and submitted to the SWAMP data management staff. See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

pH Sampling Equipment
The pH meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual. The pH function is pre and post calibrated every 24 h of use for multiparameter instruments.

pH Sampling Procedures
In-stream Method
Preferably, pH is measured directly in-stream at the depth(s) specified earlier in this document. Allow the pH probe to equilibrate for at least one minute before pH is recorded to the nearest 0.1 pH unit.

pH Measurement from a Bucket
When pH cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic. The following precautions are outlined above; “Temperature Measurement from a Bucket”.

Potential Problems

- If the pH meter value does not stabilize in several minutes, out gassing of carbon dioxide or hydrogen sulfide, or the settling of charged clay particles may be occurring (Rawson, 1982).
- If out gassing is suspected as the cause of meter drift, collect a fresh sample, immerse the pH probe and read pH at one minute.
- If suspended clay particles are the suspected cause of meter drift, allow the sample to settle for 10 min, then read the pH in the upper layer of sample without agitating the sample.
- With care, pH measurements can be accurately measured to the nearest 0.1 pH unit.

Dissolved Oxygen (mg/L)

Dissolved oxygen (D.O.) data is recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Dissolved Oxygen Sampling Equipment

The dissolved oxygen meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

Multiprobe Instrument

Pre and post calibrate the D.O. sensor every 24 h and for elevations greater than 500 ft on the multiprobe instrument. Preferably, D.O. is measured directly in-stream at the depth(s) specified in the Field Measurements section above. The D.O. probe must equilibrate for at least 90 s before D.O. is recorded to the nearest 0.1 % saturation or mg/L. Care must be taken at profile stations to insure that the reading is stable for each depth. Since dissolved oxygen takes the longest to stabilize, record this parameter after temperature, conductivity and pH. If the D.O. probe has an operable, automatic stirrer attached, the D.O. probe does not have to be manually stirred. However, if the probe is not equipped with an automatic stirrer, manual stirring must be provided by raising and lowering the probe at a rate of 1 ft/s (0.3m/s) without agitating the water surface. If the stream velocity at the sampling point exceeds 1 ft/s, the probe membrane can be pointed upstream into the flow and manual stirring can be avoided (Rawson, 1982).

D.O. Measurement from a Bucket

When D.O. cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic, following precautions outlined in the Temperature Measurement from a Bucket listed above. During equilibration and reading, water should be moved past the membrane surface at a velocity of 1 ft/s (0.3 m/sec), either by automatic stirrer or manual stirring. If stirred manually in a bucket, the water surface is not agitated (Rawson, 1982).

Specific Conductance (µS/cm)

Specific conductance should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Specific Conductance Sampling Equipment

The conductivity meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

Specific Conductance Sampling Procedure

Preferably, conductivity is measured directly in-stream at the depth(s) specified earlier in this document. Allow the conductivity probe to equilibrate for at least one minute before specific conductance is recorded to three significant figures (if the value exceeds 100). The primary physical problem in using a specific conductance meter is entrapment of air in the conductivity probe chambers. The presence of air in the probe is indicated by unstable specific conductance values fluctuating up to ±100 µS/cm. The entrainment of air can be minimized by slowly, carefully placing the probe into the water; and when the probe is completely submerged, quickly move it through the water to release any air bubbles.

If specific conductance cannot be measured in-stream, it should be measured in the container it can be measured in a bucket-Nalgene or plastic. The following precautions are outlined above; “Temperature Measurement from a Bucket”.

Salinity (parts per thousand--ppt, or ‰)

The value for salinity is computed from chloride concentration or specific conductance. The calculation assumes a nearly constant ratio for major ions in an estuary when seawater is diluted by river water. This assumption does not hold for cases where salinity is less than about three parts per thousand. Salinity determinations at such low values are only approximate. In estuarine waters, salinity is a relevant and meaningful parameter. Often the salinity may be low, approaching that of freshwater. Nevertheless, this is useful information. Determine if a station is estuarine from historical records (i.e., experiences cases where salinity is >2.0 ppt) and always report salinity at this station, regardless of the salinity during periods of high flow.

Salinity is measured directly in-stream at the depth(s) specified earlier in this document. Salinity data should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Values between 2.0 ppt and 1.0 ppt should be reported as <2.0 ppt rather than the actual value and values <1.0 ppt should be reported as <1.0 ppt. The field instruments compute salinity from specific conductance and temperature, and display the value in parts per thousand. Report salinity values above 2.0 ppt to the nearest 0.1 ppt.

Turbidity Measurement with Turbidity Meter

Nephelometric Turbidity can be determined by measuring the amount of scatter when light is passed through a sample using a turbidity meter. The LaMotte 2020 Turbidity meter is a suitable instrument for example.

Meters should be calibrated using a standard close to the expected sample value.

For instructions on how to operate the instruments refer to the manufacturer's manual. Turbidity measurements can be executed together with water sampling. The turbidity sample has to be representative for the sampled water mass. Make sure that no gas bubbles are trapped in the vial for the reading and that the outside of the vial is wiped completely clean (i.e., meaning free of moisture, lint and fingerprints). Take several measurements to assure an accurate reading. Do not record values that vary greatly. If variations are small, record an average. If settling particles are present, record a reading before and one after settling. The meter might have to be recalibrated with a different standard, if the sample water readings are outside of the calibration standard limits.

Days Since Last Significant Precipitation

Significant precipitation is defined as any amount that visibly influences water quality. Water quality in small to medium streams and in the headwaters of many reservoirs is influenced by runoff during and immediately after rainfall events. This influence is site specific and poorly studied. As part of a new initiative to understand and regulate the adverse effects of runoff, SWAMP would like to associate recent rains or melted snow with ambient water quality, using a parameter defined as "days since last significant precipitation". Record the number of days, rounded to the nearest whole number, since a rain has occurred that, in the best professional judgment of monitoring personnel, may have influenced water quality. If it is raining when the sample is collected, or has rained within the last 24-h, report a value of <1. If it has been a long time since a significant rain, record this as greater than that particular value, for example >7 days. If confidence about the recent history of precipitation is low, draw a line through the space on the data form.

Flow Severity -- recommended new parameter

Flow severity should be noted for each SWAMP visit to <u>non-tidally influenced flowing streams</u> and submitted in the comments on the SWAMP Field Data Sheet. It should be recorded even if flow is visible but not measurable on that sampling visit. There are no numerical flow guidelines associated with flow severity. This is an observational measurement that is highly dependent on the knowledge of monitoring personnel. It is a simple but useful piece of information when assessing water quality data. For example, a bacteria value of 10,000 with a flow severity of 1 would represent something entirely different than the same value with a flow severity of 5. The six flow severity values are; 1=No Flow, 2= Low Flow, 3 = Normal Flow, 4 = Flood, 5 = High Flow, and 6 = Dry. The following are detailed descriptions of severity values:

1 **No Flow** When a flow severity of one (1 = no flow) is recorded for a sampling visit, then a flow value of zero ft^3/s should also be recorded for that sampling visit. **A flow severity of one (1) (no flow) describes situations where the stream has water visible in isolated pools.** There should be no obvious shallow subsurface flow in sand or gravel beds between isolated pools. Low flow does not only apply to streams with pools. It also applies to long reaches of bayous and streams that have no detectable flow but may have water from bank to bank.

2 **Low Flow** When stream flow is considered low a flow severity value of two (2) is recorded for the visit and the corresponding flow measurement is also recorded for that visit. In streams too shallow for a flow measurement but with detected water movement, record a value of < 0.10 cfs. Note: Use a stick or other light object to verified the direction of water movement (i.e., movement is downstream and not the affect of wind.) What is low for one stream could be high for another.

3 **Normal Flow** When stream flow is considered normal, a flow severity value of three (3) is recorded for the visit and the corresponding flow measurement is also be recorded for that visit. Normal is highly dependent on the stream. Like low flow, what is normal for one could be high or low for another stream.

4 and 5 **Flood and High Flow** Flow severity values for high and flood flows have long been established by EPA and are not sequential. Flood flow is reported as a flow severity of four (4) and high flows are reported as a flow severity of five (5). High flows would be characterized by flows that leave the normal stream channel but stay within the stream banks. Flood flows are those which leave the confines of the normal stream channel and move out on to the flood plain.

6 **Dry** When the stream is dry a flow severity value of six (6 = dry) is recorded for the sampling visit. In this case the flow is not reported. This will indicate that the stream is completely dry with no visible pools.

Flow information for over 200 USGS sites is available on the Internet. The address is **http://water.usgs.gov/index.html**. This is useful information in determining flow conditions prior to sampling. This information may be included in general observations.

Flow Measurement Method (Reporting)

The method (or instrument) used to measure flow is noted by reporting a method number. The method numbers are:

1- Flow Gage Station (USGS/IBWC)	3- Electric (ex. Marsh-McBirney)
2- Mechanical (ex. Pigmy meter)	4- Weir/Flume
5- Other (orange peel, etc.)	

Flow (ft^3/s)
If requested, flow data should be recorded for each monitoring visit to non-tidal, flowing streams. Flow data should be recorded in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting. The following are two exceptions to the flow reporting requirement:

No Flow/ Pools If there is no flow at a stream site and accessible, isolated pools remain in the stream bed, collect and report the required field data and laboratory samples from the pools and report instantaneous flow. Under these conditions, flow (ft^3/s) should be reported as zero. The reported flow severity value should be one. Pools may represent natural low-flow conditions in some streams and the chemistry of these pools will reveal natural background conditions.

Dry If the stream bed holds no water, the sampling visit is finished. Report that the stream was "dry" in the observations and record a value of six (meaning "dry") for flow severity. No value is reported for flow since there is no water.

Flow Measurement

If a flow measurement is required at a site, measure and record flow after recording visual observations. The intent of measuring flow first is to delay collection of chemical and biological water samples with limited holding times. Care must be taken not to collect water samples in the area disturbed during flow measurement. There are several acceptable flow measurement methods that can be used.

U.S. Geological Survey (USGS) Gaging Station
Some SWAMP Stations are sampled at sites where the USGS maintains flow gaging equipment. On any type of sampling visit to a site that has a USGS flow gage, observe and record the gage height to the nearest hundredth of a foot in the field logbook. Upon return to the office, contact the USGS office responsible for maintaining the gage. USGS personnel can provide the flow value in cubic feet per second (ft^3/s) that corresponds to the gage height. Although SWAMP personnel may have a rating curve available to them, shifts associated with changes in the stream bed may occur over time. Always call the USGS to determine the shift. At some sites the shift changes frequently. At others, the relation between stream flow and gage height is almost unchanging. If a gage is no longer maintained by USGS, cross out the recorded gage height and be prepared to measure flow by another method on the return visit to that site.

Several factors may influence the accuracy of the USGS rating curves that are used to convert gage height to flow. If there is any doubt about the accuracy of a USGS gage height reading or flow rating curve, sampling personnel should measure the flow if possible.

Gage height may be indicated at a USGS gage by one of three methods:

Staff Gage Staff gages are enameled steel plates (with the appearance of large measuring tapes) bolted to some stable structure. For example, staff gages may be bolted to concrete bridge abutments, pillars, or docks. The staff gage face is white with black lettering and gradations. The gradations shown are feet, tenths of a foot, and 0.02 of a foot. The point at which the water level crosses the staff gage should be recorded to the nearest hundredth of a foot.

Wire Weight Gage Wire weight gages are locked, metal boxes with approximate dimensions of 15 in. long x 12 in. tall x 12 in. deep. Wire weight gages are usually affixed to bridge rails near mid-stream. They must be unlocked with a USGS key. The wire weight gages house a weight attached by wire cable to a graduated reel (gradations are tenths and hundredths of feet) with a counter at one end.

When the reel is released the weight can be gradually lowered until the bottom of the weight contacts the water surface. At the point of contact, the weight causes the water surface to ripple slightly. Maintaining the weight in that position, record the counter value to the nearest whole number and the point indicated by the stylus on the graduated reel to the nearest hundredth of a foot. Determine if the gage is the movable type that can be moved to multiple locations on the bridge. This type is common on braided streams. A correction value is stamped on the bridge near each point that the gage can be attached. Record the corrected value as the gage height in feet.

Bubble Gage Bubble gages are locked in metal sheds that are approximately 4 ft wide x 4 ft deep x 6.5 ft tall. The gage houses are most frequently located on the shore near a bridge but sometimes are attached to bridge pillars near mid-stream or established on the stream bank far from any bridge. The gage house must be unlocked with a USGS key. Bubble gages in gage houses usually indicate the gage height in two or three locations. A counter attached to the manometer system indicates gage height in feet. Some gage houses have stilling wells that can be entered. Often there is a staff gage on the inside wall.

Most bubble gages are also equipped with digital recorders. Digital recorders consist of two white, coded discs, approximately 4 in. in diameter with a punch tape overlapping a portion of each disc. The discs are marked with 100 gradations. As the front of the digital recorder is viewed, the stylus at the disc on the left indicates height in feet. The stylus at the disc on the right indicates gage height in hundredths of feet. The gage height from both discs should be added and the number recorded in the field logbook as gage height to the nearest hundredth of a foot.

Many USGS metal sheds also contain a surface level recorder. This devise can be opened to determine how stable stream flow has been prior to the sampling event. Record observations concerning the flow hydrograph.

Instantaneous Flow Measurement

Water quality monitoring visits to sites where there are no nearby USGS flow gauges will require water quality monitoring personnel to measure flow, when requested by Regional Water Quality Control Boards (Regional Boards).

Flow Measurement Equipment

Flow meter

One of the following or an equivalent:

- Marsh-McBirney Electronic meter
- Montedoro-Whitney Electronic meter
- Price Pigmy meter (with timer and beeper)
- Price meter, Type AA (with Columbus weight)

Additional Equipment

- Top-setting wading rod (preferably measured in tenths of feet)(see Figure 1).
- Tape measure (with gradations every tenth of a foot).

Flow Measurement Procedure (USGS, 1969)

Select a stream reach with the following characteristics:

- Straight reach with laminar flow (threads of velocity parallel to each other) and bank to bank. These conditions are typically found immediately upstream of riffle areas or places where the stream channel is constricted.
- The site should have an even streambed free of large rocks, weeds, and protruding obstructions that create turbulence. The site should not have dead water areas near the banks, and a minimum amount of turbulence or back eddies.

Flat Streambed Profile (cross section)

Stretch the measuring tape across the stream at right angles to the direction of flow. When using an electronic flow meter, the tape does not have to be exactly perpendicular to the bank (direction of flow). When using a propeller or pigmy type meter, however, corrections for deviation from perpendicular must be made.

If necessary and possible, modify the measuring cross section to provide acceptable conditions by building dikes to cut off dead water and shallow flows, remove rocks, weeds, and debris in the reach of stream one or two meters upstream from the measurement cross section. After modifying a streambed, allow the flow to stabilize before starting the flow measurement.

Record the following information on the flow measurement form (see example Flow Measurement Forms at end of this document):

- Station Location and Station ID
- Date
- Time measurement is initiated and ended
- Name of person(s) measuring flow
- Note if measurements are in feet or meters
- Total stream width and width of each measurement section
- For each cross section, record the mid-point, section depth and flow velocity

Measuring the Stream Width
Measure and record the stream width between the points where the tape is stretched (waters edge to waters edge).

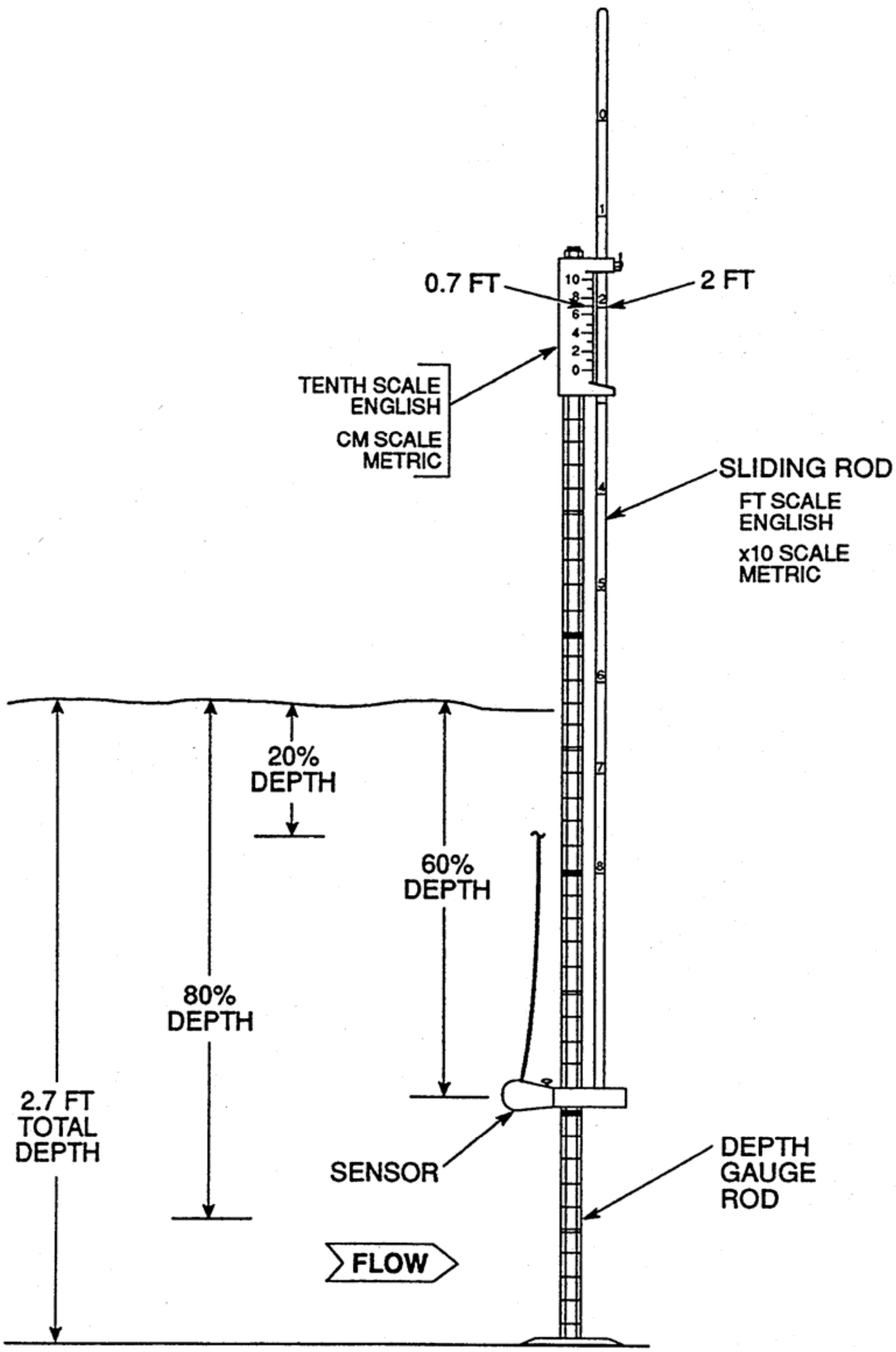
Determining the Number of Flow Cross Sections
Determine the spacing and location of flow measurement sections. Some judgment is required depending on the shape of the stream bed. Measurements must be representative of the velocity within the cross-section. If the stream banks are straight and the depth is nearly constant and the bottom is free of large obstructions, fewer measurements are needed, because the flow is homogeneous over a large section. Flow measurement sections do not have to be equal width. However, they should be unless an obstacle or other obstruction prevents an accurate velocity measurement at that point. ***No flow measurement section should have greater than 10% of the total flow.***

If the *stream width is less than 5 ft*, use flow sections with a width of 0.5 ft (See example 1 on page 23 of this document). If the *stream width is greater than 5 ft*, the minimum number of flow measurements is 10. The preferred number of flow measurement cross sections is 20-30 (See Example 2 on page 24 on this document). The total stream width is 26 ft with 20 measurements, section widths will be 1.3 ft (26/20 = 1.3).

Determining the Mid-Point of the Cross Section
To find the mid-point of a cross section, divide the cross section width in half. Using Example 2 (see forms at end of document);

- The total stream width is 26 ft with 20 cross sections and each cross section width is equal to 1.3 ft.
- Divide 1.3 ft in half and the mid-point of the first section is 0.65 ft. In this example the tape at waters edge is set at zero (0) ft.
- By adding 0.65 to zero the mid-point of the first section is 0.65 ft.
- Each subsequent mid-point is found by adding the section width (1.3 ft) to the previous mid-point. For example; MIDPOINT #1 is 0.65 + 0.0 = 0.65; MIDPOINT #2 is 0.65 + 1.3= 1.95 ft; MIDPOINT #3 is 1.95 + 1.3 = 3.25 ft and ....MIDPOINT # 20 is 24.05 +1.3.
- Place the top setting wading rod at 0.65 ft for the first measurement.
- Using a top setting wading rod, measure the depth at the mid-point of the first flow measurement section and record to the nearest 0.01 ft.

Figure 1. Top-Setting Wading Rod (Marsh-McBirney)



Adjusting the Sensor Depth at a Cross Section

Adjust the position of the sensor to the correct depth at each mid-point. The purpose of the top setting wading rod is to allow the user to easily set the sensor at 20%, 60%, and 80% of the total depth. The total depth can be measured with the *depth gage rod*. Each single mark represents 0.10 foot, each double mark represents 0.50 foot, and each triple mark represents 1.00 foot (see Figure 2).

For Depths < 2.5 Ft	If the depth is less than 2.5 ft, only one measurement is required at each measurement section. To set the sensor at 60% of the depth, line up the foot scale on the *sliding rod* with the *tenth scale*, located on top of the depth gage rod. If, for example, the total depth is 2.7 ft (as shown on Figure 2), then line up the 2 on the foot scale with the 7 on the tenth scale (Marsh-McBirney 1990).
For Depths > 2.5 Ft	If the depth is greater than 2.5 ft, two measurements should be taken at 20% and 80% of the total depth. To set the sensor at 20% of the depth, multiply the total depth by two. For example, if the total depth is 2.7 ft, the rod would be set at 5.4 ft (2.7 x 2). Line up the 5 on the sliding rod with the 4 on the tenth scale.
For Depths > 2.5 Ft (cont)	To set the sensor at 80% of the depth, divide the total depth by two. For example, the total depth is 2.7 ft the rod would be set at 1.35 ft (2.7/2). Line up the 1 on the sliding rod with the 0.35 on the tenth scale. The average of the two velocity measurements is used in the flow calculation. See page 2-36 for an example of a flow form recording measurements for depths greater than 2.5 ft. NOTE: The point where the rod is set for 20 and 80% of the depth will not equal values derived by calculating 20 and 80% of the total depth.

Measuring Velocity (this has typically been measured at 6/10 of the total depth, for velocity-only measurements)

- Position the meter at the correct depth and place at the mid-point of the flow measurement section. Measure and record the velocity and depth. The wading rod is kept vertical and the flow sensor kept perpendicular to the tape rather than perpendicular to the flow while measuring velocity with an electronic flow meter. When using a propeller or pigmy-type meter, however, the instrument should be perpendicular to the flow.
- Permit the meter to adjust to the current for a few seconds. Measure the velocity for a minimum of 20 s with the Marsh-McBirney and Montedoro-Whitney meters. Measure velocity for a minimum of 40 s (preferably 2 min with the Price and pigmy meters).
- When measuring the flow by wading, stand in the position that least affects the velocity of the water passing the current meter. The person wading stands a minimum of 1.5 ft downstream and off to the side of the flow sensor.

< A flow sensor, equipped with cable and weight may be used to measure flows where the water is too deep to wade. Follow the procedure involving meters attached to wading rods.

< Report flow values less than 10 ft^2 /s to two significant figures. Report flow values greater than 10 ft^3/s to the nearest whole number, but no more than three significant figures.

< In cases where the flow is low and falling over an obstruction, it may be possible to measure the flow by timing how long it takes to fill a bucket of known volume.

Avoid measuring flow in areas with back eddies. The first choice would be to select a site with no back eddy development. However, this can not be avoided in certain situations. Measure the negative flows in the areas with back eddies. These negative values will be included in the final flow calculation.

Calculating Flow

To calculate flow, multiply the width x depth (ft^2) to derive the area of the flow measurement section. The area of the section is then multiplied by the velocity (ft/s) to calculate the flow in cubic feet per second (cfs or ft^3/sec) for that flow measurement section. When flow is calculated for all of the measurement sections, they are added together for the total stream flow (see Figure 2).

Q=Total Flow (or discharge), W=Width, D=Depth, V=Velocity.

$$Q = (W_1 * D_1 * V_1) + (W_2 * D_2 * V_2) + ... (W_n * D_n * V_n)$$

What to Do with Negative Values

<u>Do not</u> treat cross sections with negative flow values as zero. Negative values obtained from areas with back eddies should be subtracted during the summation of the flow for a site.

Flow Estimate (ft^3/s)

Flow estimate data may be recorded for a non-tidally influenced stream when it is not possible to measure flows by one of the methods described above. Flow estimates are subjective measures based on field personnel's experience and ability to estimate distances, depths, and velocities. If flow can not be measured at a routine non-tidal station, a new site should be selected where flow can be measured.

Flow Estimate Procedure

< Observe the stream and choose a reach of the stream where it is possible to estimate the stream cross section and velocity.

< Estimate stream width (ft) at that reach and record.

< Estimate average stream depth (ft) at that reach and record. Estimate stream velocity (ft/s) at that reach and record. A good way to do this is to time the travel of a piece of floating debris. If doing this method from a bridge, measure the width of the bridge. Have one person drop a floating object (something that can be distinguished from other

floating material) at the upstream side of the bridge and say start. The person on the downstream side of the bridge will stop the clock when the floating object reaches the downstream side of the bridge. Divide the bridge width by the number of seconds to calculate the velocity. The velocity can be measured at multiple locations along the bridge. These velocities are averaged. If this is done alone, watch for road traffic.

- Multiply stream width (ft) times average stream depth (ft) to determine the cross sectional area (in ft^2) which when multiplied by the stream velocity (in ft/s) and a correction constant, gives an estimated flow (ft^3/s).

Example: A stream sampler conducted a sampling visit to a stream while the flow meter was being repaired. The sampler looked at the creek downstream from the bridge and saw a good place to estimate flow. The stream width was around 15 ft. It appeared the average depth on this reach was about 0.75 ft. The sampler timed a piece of floating debris as it moved a distance of 10 ft in 25 s downstream over the reach. An estimated flow with a smooth bottom was calculated using the following formula.

Width x Depth x Velocity x A (correction factor)= estimated flow
15 ft (width) x 0.75 ft (depth) x 2.5 ft/s (velocity) x A =25 ft^3/s (cfs)

A is a correction constant: 0.8 for rough bottom and 0.9 for smooth bottom

Estimated flow should be reported to one or two significant figures.

Experienced field personnel are able to estimate flow to within 20% of actual flow for total flows less than 50 ft^3/s. The best way to develop this skill is to practice estimating flow before making measurements at all monitoring visits to non-tidally influenced flowing streams and then compare estimated flows with those obtained from USGS gages or from instantaneous flow measurements

Figure 2. Stream Flow (Discharge) Measurement

Example 1.
Stream Flow (Discharge) Measurement
Small Stream < 5 Ft Wide and #2.5 Ft Deep

Stream:____**OAK CREEK**_______________________Date:__**5/29/91**___

Station Description:_____**at US Hwy 90A**________

Time Begin:__**1545**______Time End:__**1630**_______Meter Type:__**Marsh-McBirney**_____________

Observers:_____**BK/MK**_______Stream Width*:____**5 ft**_____ Section Width:____**0.5 ft**__________

Observations:____

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** Ft	Velocity At Point (ft/s)	Velocity Average (ft/s)	Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
0.25	**0.55**			**0.05**		**0.01375**
0.75	**0.80**			**0.11**		**0.044**
1.25	**0.85**			**0.27**		**0.42635**
1.75	**0.90**			**0.49**		**0.2205**
2.25	**1.10**			**0.58**		**0.275**
2.75	**1.50**			**0.72**		**0.540**
3.25	**1.20**			**0.76**		**0.456**
3.75	**0.90**			**0.76**		**0.342**
4.25	**0.75**			**0.44**		**0.165**
4.75	**0.30**			**0.00**		**0.00**
					Total Discharge (3Q) (ft^3/s)	**2.4826**

$m^3/s \times 35.3 = ft^3/s$

Example 2.

Stream Discharge Measurement Example (Larger Stream > 5 Ft and #2.5 Ft Deep)

Stream:____**RED RIVER**____Date:__**5/28/91**___________
Station Description:_____**Post Oak Creek 40 m Below Sherman WWTP Outfall**__________________
Time Begin:__**1542**_____________Time End:__**1601**_____Meter Type:_**Marsh-McBirney**_________
Observers:_____**CM, EW, DO**_______Stream Width*:____**26 ft**___ Section Width:___**1.3 ft**_______
Observations:____

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** ft	Velocity		Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
			At Point (ft/s)	Average (ft/s)		
0.65	**0.55**			**2.03**	**0.715**	**1.451**
1.95	**0.40**			**2.04**	**0.520**	**1.061**
3.25	**0.42**			**2.02**	**0.546**	**1.103**
4.55	**0.38**			**1.77**	**0.494**	**0.874**
5.25	**0.40**			**1.75**	**0.520**	**0.910**
7.15	**0.42**			**1.93**	**0.546**	**1.054**
8.45	**0.40**			**1.99**	**0.52**	**1.035**
9.75	**0.37**			**1.92**	**0.481**	**0.924**
11.05	**0.37**			**1.56**	**0.481**	**0.750**
12.35	**0.43**			**1.32**	**0.559**	**0.738**
13.65	**0.40**			**1.36**	**0.520**	**0.707**
14.95	**0.42**			**1.33**	**0.546**	**0.726**
16.25	**0.40**			**1.35**	**0.520**	**0.702**
17.55	**0.45**			**1.64**	**0.585**	**0.959**
18.85	**0.48**			**1.70**	**0.624**	**1.061**
20.15	**0.48**			**2.00**	**0.624**	**1.248**
21.45	**0.50**			**1.95**	**0.650**	**1.268**
22.75	**0.40**			**2.18**	**0.520**	**1.134**
24.05	**0.48**			**1.71**	**0.624**	**1.067**
25.35	**0.50**			**0.60**	**0.650**	**0.390**
				Total Discharge (3Q) (ft^3/s)		**19.162**

$m^3/s \times 35.3 = ft^3/s$

Example 3.
Stream Flow (Discharge) Measurement (Larger Stream > 5 Ft and >2.5 Ft Deep)

Stream:____ARROYO COLORADO______________________________Date:__**6/16/98**__________

Station Description:_____Downstream of Harlingen WWTP__________________________________

Time Begin:__**1400**______Time End:__**1445**_____Meter Type:___**Marsh-McBirney**______________

Observers:_____**JD, CK**________Stream Width*:___**47.5 ft**___ Section Width:___**2.375 ft**________

Observations: *Note that the starting point is at 4.7 ft on the measuring tape and not zero.

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** ft	Velocity At Point (ft/sec)	Velocity Average (ft/sec)	Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
4.70	0.73			0.65	1.73	1.127
7.08	1.10			1.08	2.61	2.822
9.45	1.85			0.90	4.39	3.954
11.83	2.20			1.05	5.23	5.486
14.20	2.20			1.44	5.23	7.531
16.58	2.45			1.09	5.82	6.342
18.95	2.55	0.20 0.80	1.75 1.76	1.76	6.06	10.659
21.33	2.60	0.20 0.80	1.79 1.32	1.56	6.18	9.633
23.70	2.70	0.20 0.80	1.63 1.26	1.45	6.41	9.298
26.10	3.05	0.20 0.80	1.68 1.15	1.42	7.24	10.286
28.48	3.10	0.20 0.80	1.23 0.69	0.96	7.36	7.068
30.85	2.90	0.20 0.80	1.22 0.89	1.06	6.89	7.301
33.23	2.84	0.20 0.80	0.60 0.37	0.49	6.75	3.305
35.60	2.65	0.20 0.80	0.80 0.21	0.51	6.29	3.210
37.98	2.65	0.20 0.80	0.85 0.96	0.91	6.29	5.727
40.35	2.20			0.28	5.23	1.464
42.73	2.30			0.16	5.46	0.874
45.10	2.05			0.51	4.87	2.483
47.48	1.10			0.49	2.61	1.280
49.86	0.65			0.62	1.54	0.957

$m^3/s \times 35.3 = ft^3/s$ **Total Discharge (3Q) (ft^3/s)**

Stream Flow (Discharge) Measurement Form

Stream:____Date:_______________
Station Description:____
Time Begin:___________ Time End:_____________ Meter Type:__________________________
Observers:____________________Stream Width*:______________ Section Width:___________
Observations:____

Section Midpoint (ft) (m)	**Section Depth (ft) (m) (cm)**	**Observational Depth** ft-m-cm**	**Velocity**		**Area W x D (ft^2) (m^2)**	**Flow (Q) V x A (m^3/s) (ft^3/s)**
			At Point (ft/s) (m/s)	**Average (ft/s)(m/s)**		

$m^3/s \times 35.3 = ft^3/s$

Total Flow (Discharge) (3Q) (ft^3/s)	

* Make a minimum of 10 measurements when the total width is > 5.0 ft, 20 measurements preferred.

** When water is < 2.5 ft deep take one measurement at each cross section. When water is > 2.5 ft deep, take two measurements at each cross section; one at 2 the total depth and the other at 2 x the total depth. Average the two velocity measurements. See SWAMP Procedures Manual for a detailed flow measurement method.

Summary of Significant Figures for Reporting Field Parameters

Parameter	Field Data Reporting Requirements
Water Temperature (^{o}C)	Report temperature to the nearest tenth of a degree. Round insignificant figures 0 through 4 down and 5 thru 9 up.
pH (s.u.)	Report pH to the nearest tenth of a pH standard unit.
D.O. mg/L **D.O.** (% saturation)	Report dissolved oxygen to the nearest tenth of a mg/L. Report % saturation to the nearest tenth of a percent
Specific Conductance (micro siemens/cm)	Report specific conductance to only three significant figures if the value exceeds 100. Do not report ORP which is displayed by some multiprobes.
Salinity (ppt)	Report salinity values above 2.0 ppt to the nearest tenth of a part per thousand. In estuarine waters report the actual values displayed by the multiprobe above 2.0 ppt and values less than 2.0 as <2.0 or <1.0 only. Determine if a station is estuarine (i.e., experiences cases where salinity is >2.0 ppt) and always report salinity at this station, regardless of the salinity during periods of high flow.
Secchi Disk (meters)	Report Secchi depth transparency in meters to two significant figures.
Days Since Last Significant Precipitation(days)	Report whole numbers. If it is raining when the sample is collected or has rained within the last 24 h, report a value of <1. If it has been over a week since a rainfall event, report a value of > 7.
Flow (ft^3/s)	Report instantaneous flow values less than 10 ft^3/s to two significant figures. Report flow values greater than 10 ft^3/s to the nearest whole number, but no more than three significant figures. When there is no flow (pools), report as 0.0. When there is no water, don't report a value, but report as "dry" in the observations.
Flow Severity (1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry)	When there is no flow (pools), report the severity as 1, and the instantaneous flow as 0.0 ft^3/s. If the stream is dry, record only flow severity, as a value of 6.

Field Collection Procedures for Water Samples

Scope and Application

This protocol describes the techniques used to collect water samples in the field in a way that neither contaminates, loses, or changes the chemical form of the analytes of interest. The samples are collected in the field into previously cleaned and tested (if necessary) sample bottles of a material appropriate to the analysis to be conducted. Pre-cleaned sampling equipment is used for each site, whenever possible and/or when necessary. Appropriate sampling technique and measuring equipment may vary depending on the location, sample type, sampling objective, and weather. Trade names used in connection with equipment or supplies do not constitute an endorsement of the product.

Summary of Method

Appropriate sample containers and field measurement gear as well as sampling gear are transported to the site where samples are collected according to each sample's protocol. Water velocity, turbidity, temperature, pH, conductivity, dissolved oxygen as well as other field data are measured and recorded using the appropriate equipment. These field data measurement protocols are provided in the SWAMP Field Measurement SOP. Samples are put on ice and appropriately shipped to the processing laboratories. This procedure has been modified from the Texas Natural Resources Conservation Commission's Procedure Manual for Surface Water Quality Monitoring, with major input from the United State's Geological Survey's (USGS's) National Water Quality Assessment (NAWQA) Protocol for Collection of Stream Water Samples, for which due credit is herewith given.

WATER SAMPLE COLLECTION

Water chemistry and bacteriological samples, as requested, are collected at the same location. *Water samples are best collected before any other work is done at the site*. If other work (e.g., sediment sample collection, flow measurement or biological/habitat sample collection or assessment) is done after or downstream of the collection of water samples, it might be difficult to collect representative samples for water chemistry and bacteriology from the disturbed stream. Care must be taken, though, to not disturb sediment collection sites when taking water samples.

The following general information applies to all types of water samples, unless noted otherwise:

Sample Collection Depth

Sub-Surface Grab Sample Samples are collected at 0.1 m below the water surface. Containers should be opened and re-capped under water in most cases.

Depth-integrated Sample If a depth-integrated sample is taken, the sample is pumped from discrete intervals within the entire water column.

Surface Grab Sample Samples are collected at the surface when water depth is <0.1 m. Since there is a difference in water chemistry on the surface, compared to subsurface, surface water should be noted on the field data sheet as 0 m.

Where to Collect Samples

Water samples are collected from a location in the stream where the stream visually appears to be completely mixed. Ideally this would be at the centroid of the flow (*Centroid* is defined as the midpoint of that portion of the stream width, which contains 50% of the total flow), but depth and flow do not always allow centroid collection. For stream samples, the sampling spot must be accessible for sampling physicochemical parameters, either by bridge, boat or wading. Sampling from the shoreline of any water body (meaning standing on shore and sampling from there) is the least acceptable method, but in some cases is necessary.

In reservoirs, lakes, rivers, and coastal bays, samples are collected from boats at designated locations provided by Regional Water Quality Control Boards (Regional Boards).

Sampling Order if Multiple Media are Requested to be Collected

The order of events at every site has to be carefully planned. For example, if sediment is to be collected, the substrate can not be disturbed by stepping over or on it; water samples can not be taken where disturbed sediment would lead to a higher content of suspended matter in the sample. *For the most part, water samples are best collected before any other work is done at the site*. This information pertains to walk-in sampling.

Sample Container Labels

Label each container with the station ID, sample code, matrix type, analysis type, project ID, and date and time of collection (in most cases, containers will be pre-labeled). After sampling, secure the label by taping around the bottle with clear packaging tape.

Procedural Notes

For inorganic and organic water samples, bottles do not have to be rinsed if they are I-Chem 200 series or higher or ESS PC grade or higher. This means that the sample bottles are analyzed for contamination, and a certification of analysis is included with the bottles. Other sample containers are usually rinsed at least three times if the bottles do not meet these requirements. See filling instruction for each type of analyses if there is uncertainty. If applicable to the sample and analysis type, the sample container should be opened and re-capped under water.

Sample Short-term Storage and Preservation

Properly store and preserve samples as soon as possible. Usually this is done immediately after returning from the collection by placing the containers on bagged, crushed or cube ice in an ice chest. Sufficient ice will be needed to lower the sample temperature to at least 4 °C within 45 min after time of collection. Sample temperature will be maintained at 4 °C until delivered to the laboratory. Care is taken at all times during sample collection, handling and transport to prevent exposure of the sample to direct sunlight. Samples are preserved in the laboratory, if necessary, according to protocol for specific analysis (acidification in most cases).

Field Safety Issues

Proper gloves must be worn to prevent contamination of the sample and to protect the sampler from environmental hazards (disposable polyethylene, nitrile, or non-talc latex gloves are recommended, **however, metals and mercury sample containers can only be sampled and handled using polyethylene gloves as the outer layer**). Wear at least one layer of gloves, but two layers help protect against leaks. One layer of shoulder high gloves worn as a first (inside) layer is recommended to have the best protection for the sampler. Safety precautions are needed when collecting samples, especially samples that are suspected to contain hazardous substances, bacteria, or viruses.

Sample Handling and Shipping

Due to increased shipping restrictions, samples being sent via a freight carrier require additional packing. Although care is taken in sealing the ice chest, leaks can and do occur. Samples and ice should be bagged placed inside a large trash bag inside the ice chest for shipping. Ice should be double bagged to prevent melted ice water from leaking into the sample. The large trash bag can be sealed by simply twisting the bag closed (while removing excess air) and taping the tail down. Prior to shipping the drain plug of the ice chests have to be taped shut. Leaking ice chests can cause samples to be returned or arrive at the lab beyond the holding time.

Although glass containers are acceptable for sample collection, bubble wrap must be used when shipping glass.

Chain of Custody (COC) Forms

Every shipment must contain a complete Chain of Custody (COC) Form that lists all samples collected and the analyses to be performed on these samples.

Make sure a COC is included for every laboratory, every time you send a shipment of samples. Electronic COCs can also be emailed to the various laboratories but must be sent before the samples arrive at their destinations.
Include region and trip information as well as any special instructions to the laboratory on the COC.

The original COC sheet (not the copies) is included with the shipment (insert into ziplock bag) One copy goes to the sampling coordinator, and the sampling crew keeps one copy.

Samples collected should have the salinity (in ppt), depth of collection, and date/time collected for each station on every COC.

Write a comment on this form, if you want to warn the laboratory personnel about possibly hazardous samples that contain high bacteria, chlorine or organic levels.

Field QC Samples for Water Analyses

Field duplicates are currently submitted at an annual rate of 5%. Field travel blanks are required for volatile organic compounds at a rate of one per cooler shipped. Field blanks are required for trace metals (including mercury and methyl mercury), DOC, and volatile organic compounds in water at a rate of 5%. See Appendix C of the SWAMP QAMP for detailed Field QC requirements.

Field Site Data Sheets

Each visited field site requires a field observation completed SWAMP Field Data Sheet, even if no samples are collected (i.e. at a site which is found to be dry). If water and/or sediment samples are collected, all elements of the SWAMP Field Data Sheet must be completely filled out.

General Pre-Sampling Procedures

Instruments. All instruments must be in proper working condition. Make sure all calibrations are current. Multi-probe sondes should be pre-calibrated every morning prior to sampling and post-calibrated within 24 h of the original calibration. Conductivity should also be calibrated between stations if there is a significant change in salinity. Dissolved oxygen sensors should be re-calibrated if there is a 500 ft change in elevation.

Calibration Standards. Pack all needed calibration standards.

Sample Storage Preparations. A sufficient amount of cube ice, blue ice and dry ice as well as enough coolers of the appropriate type/size must be brought into the field, or sources for purchasing these supplies identified in advance.

Sample Container Preparation. After arriving at the sample station, pack all needed sample containers for carriage to the actual collection site, and label them with a pre-printed label containing Station ID, Sample Code, Matrix info, Analysis Type info, Project ID and blank fields for date and time (if not already pre-labeled).
Safety Gear. Pack all necessary safety gear like waders, protective gloves and safety vests.

Walk to the site. For longer hikes to reach a sample collection site, large hiking backpacks are recommended for transport of gear, instruments and containers. Tote bins can be used, if the sampling site can be accessed reasonably close to the vehicle.

GPS. At the sampling site, compare/record reconnaissance GPS reading with current site reading and note differences. GPS coordinates should be in Decimal Degrees (e.g. 38.12345 -117.12345).

COLLECTION OF WATER SAMPLES FOR ANALYSIS OF CONVENTIONAL CONSTITUENTS

In most streams, sub-surface (0.1 m below surface) water is representative of the water mass. A water sample for analysis of conventional constituents is collected by the grab method in most cases, immersing the container beneath the water surface to a depth of 0.1 m. Sites accessed by bridge can be sampled with a sample container-suspending device. Extreme care must be taken to avoid contaminating the sample with debris from the rope and bridge. Care must also be taken to rinse the device between stations. If the centroid of the stream cannot be sampled by wading, sampling devices can be attached to an extendable sampling pole.

Collection of Water Samples for Analysis of Synthetic Organic Compounds

Collect organic samples at a depth of 0.1 m by submerging the sample container by hand. If depth-integrated sampling is required, use the in-line peristaltic pump methodology described previously. Since organic compounds tend to concentrate on the surface of the sampling device or container, the sampling device and sample container are ***not*** to be rinsed with ambient water before being filled.

Sample Containers and Collection
Also refer to Appendix C of the SWAMP QAMP for a list of sample volumes and containers.

Pesticides/ Herbicides	The sample container for pesticides and herbicides is a new, clean, unused amber glass jar with a Teflon-liner inside the cap. Collect one liter of water for each of the three sample types (Organophosphorus Pesticides, Organochlorine Pesticides and Chlorinated Herbicides). **EACH ANALYSIS TYPE REQUIRES A SEPARATE JAR**. Minimize the air space in the top of the jar. Preserve immediately after collection by placing on ice out of the sunlight.
Semi-volatile Organics	The sample container for semi-volatile organics must also be new, clean, unused amber glass bottles with a Teflon-liner inside the cap, and pre-rinsed with pesticide-grade hexane, acetone, or methylene chloride. Fill jars to the top and place on ice in the dark. In addition to other sample information, label the jar Semi-volatiles.
Volatile Organics: **Volatile Organic Carbon (VOC), Methyl-Tert Butyl Ether (MTBE) and (BTEX)**	The sample containers for volatiles are VOA vials. Fill the 40-mL VOA vials to the top and cap without trapping any air bubbles. If possible, collect directly from the water, keeping the vial under water during the entire collection process. To keep the vial full while reducing the chance for air bubbles, cap the vials under the water surface. Fill one vial at a time and preserve on ice. The vials are submitted as a set. If the vial has been pre-acidified for preservation, fill the vial quickly, without shaking using a separate clean glass jar. Fill the vial till the surface tension builds a meniscus, which extends over the top end of the vial, then cap tightly and check for bubbles by turning the vial on its head. Ensure that the pH is less than 2. If the water may be alkaline or have a significant buffering capacity, or if there is concern that pre-acidified samples may have the acid wash out, take a

few practice vials to test with pH paper. It may take more than two drops, and it will then be known how to preserve the other samples that are being submitted to the lab. If an alternative method has proven successful, continue with that method.

Note: If vigorous foaming is observed following acidification, discard that sample and collect another set. Do not acidify the second set. Mark the sample clearly "not acidified" and the lab will run them immediately. Holding time is 14 days with acid, 24 h without acid.

Collect three VOA vials, if VOC, MTBE and BTEX are required, two vials, if only VOC is required and two vials, if only MTBE and BTEX are require. The vials may be taped together to keep them together.

Perchlorate

Surface water samples for perchlorate should be collected in a new unused polyethylene or glass container. Perchlorate samples should be placed immediately on ice to maintain temperature at 4 ^{o}C. The sample holding time is 28 days, under refrigeration.

Sample Treatment in Presence of Chlorine

(NOTE: This treatment has not been performed in SWAMP, but may be in the future, or if a known or suspected chlorine residual is suspected and this information is made known by a Regional Board SWAMP contact beforehand.)

If in stream chlorine residual is suspected, measure the chlorine residual using a separate water subsample. Free chlorine will oxidize organic compounds in the water sample even after it is collected. If chlorine residual is above a detectable level, (i.e., the pink color is observed upon adding the reagents) immediately add 100 mg of sodium thiosulfate to the pesticides, herbicides, semivolatiles and VOA samples; invert until sodium thiosulfate is dissolved. Record the chlorine residual concentration in field logbook. If chlorine residual is below detectable levels, no further sample treatment necessary.

VOA Trip Blank

Submit one Trip Blank for VOA samples (2- 40 mL VOA vials) for each sampling event. Trip Blanks are prepared in advance just before the sampling trip and transported to the field. Ask the laboratory for DI water and specify that it is for a VOA trip blank. VOA blanks require special purged water. Trip blanks demonstrate that the containers and sample handling did not introduce contamination. The trip blank vials

	are never opened during the trip.
Field QC Samples	If required, field Duplicates and field blanks are submitted at a rate subject to the discretion of the project manager. Refer to Appendix C of the SWAMP QAMP for details on required blanks and duplicates.

BACTERIA AND PATHOGENS IN WATER SAMPLES

Summary of Collection Procedure (Based on EPA water quality monitoring procedures)

Make sure the containers are sterilized; either factory-sealed or labeled.

Whirl-pak® bags

- Label the bottle as previously described for SWAMP.
- Tear off the top of the bag along the perforation above the wire tab just prior to sampling. Avoid touching the inside of the bag. If you accidentally touch the inside of the bag, use another one.
- If wading into the stream, try to disturb as little bottom sediment as possible. Be careful not to collect water that has sediment from bottom disturbance. Stand facing upstream. Collect the water sample on your upstream side, in front of you. You may also attach your bottle to an extension pole to sample from deeper water.
- If taking sample from a boat, carefully reach over the side and collect the water sample on the upstream side of the boat.
- Hold the two white pull-tabs in each hand and lower the bag into the water on your upstream side with the opening facing upstream. Open the bag midway between the surface and the bottom by pulling the white pull-tabs. The bag should begin to fill with water. You may need to "scoop" water into the bag by drawing it through the water upstream and away from you. Fill the bag no more than 3/4 full.
- Lift the bag out of the water. Pour out excess water. Pull on the wire tabs to close the bag. Continue holding the wire tabs and flip the bag over at least 4-5 times quickly to seal the bag. Don't try to squeeze the air out of the top of the bag. Fold the ends of the wire tabs together at the top of the bag, being careful not to puncture the bag. Twist them together, forming a loop.
- If the samples are to be analyzed in the lab, place them in a cooler with ice or cold packs for transport to the lab.

Screw cap containers

- Label the bottle as previously described for SWAMP.
- Remove the cap from the bottle just before sampling. Avoid touching the inside of the bottle or cap. If you accidentally touch the inside, use another bottle.
- If wading into the stream, try to disturb as little bottom sediment as possible. Be careful not to collect water that has sediment from bottom disturbance. Stand facing upstream. Collect the water sample on your upstream side, in front of you. You may also attach your bottle to an extension pole to sample from deeper

water.
- If taking sample from a boat, carefully reach over the side and collect the water sample on the upstream side of the boat.
- Hold the bottle near its base and plunge it (opening downward) below the water surface. If you are using an extension pole, remove the cap, turn the bottle upside down, and plunge it into the water, facing upstream. Collect a water sample 2” beneath the surface. You can only use this method if the sample bottles do not contain sodium thiosulfate.
- Turn the bottle underwater into the current and away from you. In slow moving stream reaches, push the bottle underneath the surface and away from you in an upstream direction.
- Alternative sampling method: In case the sample bottle contains preservatives/chlorine removers (i.e. Sodium-Thiosulfate), it cannot be plunged opening down. In this case hold the bottle upright under the surface while it is still capped. Open the lid carefully just a little to let water run in. Fill the bottle to the fill mark and screw the lid tight while the bottle is still underneath the surface.
- Leave a 1-in. air space so that the sample can be shaken just before analysis. Recap the bottle carefully, remembering not to touch the inside.
- If the samples are to be analyzed in the lab, place them in a cooler with ice or cold packs for transport to the lab.

Pouring from another clean bottle

- Due to different sampling conditions (high turbidity, rough water etc.) it is sometimes easy to pour water from another clean bottle into the bacteria bottle. This helps to make sure that the sample water is only being filled to the desired line and no overfilling occurs.

San Diego County

SOP for
Dry Weather and MS4 Analytical and Field Screening Monitoring Procedures
Manual

Dry Weather and MS4 Analytical and Field Screening Monitoring Procedures Manual

County of San Diego, Department of Public Works
Watershed Protection Program

Updated May 2010

V. BACKGROUND AND SAFETY PRECAUTIONS

Dry weather monitoring will not occur when the sampling environment and/or discharges create hazardous conditions (e.g. diesel spill to a creek) or when there is any rain event > 0.1 inch. Seventy-two (72) hours must pass from the end of the storm event before dry weather monitoring can be resumed. Use the following safety precautions at all times when conducting dry weather monitoring and be sure to heed all warnings and precautionary statements. This program is intended to assess dry weather conditions.

- Do not sample during dangerous conditions such as high winds, lightning storms, or flooding conditions.
- Do not remain in open areas or stand under trees if lightning is occurring in the vicinity.
- Do not enter a conveyance if it is raining. Staff should not be sampling during any rain event. If adverse conditions develop while in the field, return to the vehicle and if necessary return to DPW Headquarters.
- Do not enter confined spaces.
- Do not open any manhole with out consulting DPW, Roads Division (Stormwater Strike Team Supervisor for Div. 1 is Tony Stanley (619-660-5831) and for Div. 2 Tony Ariosta (760-510-2389)).
- Wear appropriate attire (i.e. hat, safety boots, gloves, and long pants).
- Be aware of your environment! Watch for: snakes, ticks, bees, poison oak, and stinging nettle (see Appendix 1 for photos).
- Be familiar with Material Safety Data Sheets (MSDS) for all chemicals used in the field and when calibrating instruments. Know the health hazards and emergency medical treatments, and follow proper disposal instructions.
- Keep a first aid kit and fire extinguisher in the vehicle.
- Make sure accident reporting packet with film camera is in the vehicle.

- Park vehicle off road if possible, turn hazard light on, and place orange safety cones out if you are parking near traffic lanes.
- Watch out for traffic along the access road when sampling or making observations.
- Watch your step; the ground may be wet and slippery, steep, or unstable. Rocks may be loose. Do not attempt to climb down unsafe slopes. Return another day.
- Always wear clean disposable gloves when sampling.
- Protect eyes and skin against contact with acids and other preservatives.
- Use a backpack when transporting sample bottles from the sample location back to the ice chest in the vehicle.

Safety Equipment

The following safety equipment is required during dry weather monitoring:

- First aid kit
- Safety glasses
- Disposable gloves
- Proper safety boots
- Snake guards
- Safety vests
- Orange traffic cones
- Sun screen
- Insect repellent containing DEET
- Cell phone
- Drinking Water

APPENDIX 1

Field Sampling Safety
Things to watch out for

Poison Oak

Stinging Nettle

Deer Tick

Rattle Snake

VII. EQUIPMENT

The Dry Weather Monitoring Program Manual is required to perform monitoring while in the field. All applicable equipment and supplies needed to implement this program are listed in Appendix 2. The field screening analyses are performed using the following equipment:

- Horiba U-10, 5-parameter probe
- Chemetrics V-2000 Photometer (handheld spectrometer) and CHEMetrix® reagent kits.
- Global Flow Probe, Model FP101 or FP201 (arrow points downstream with the current).

EQUIPMENT MAINTENANCE

- Field staff will maintain clean and properly functioning equipment at all times.

- The viability of field screening test kit reagents will be assessed periodically by noting the reagent expiration dates on the reagent's package.

- The Horiba U-10 Meter is to be calibrated before each day of use using the AutoCal solution provided by the manufacturer following the procedure in Appendix 3. All calibration results will be documented in the calibration log sheet. Care should be taken to keep calibration solution uncontaminated. Solutions should be changed weekly, and should not be used after the expiration date. Keep waste solutions contained!

- Field meters and cameras must be in proper working order. Make sure that batteries have sufficient voltage to power the equipment for the entire field trip.

- Recharge or replace batteries as necessary. Keep extra batteries in the instrument case. Probes should be inspected, cleaned and reconditioned regularly.

- Clean and rinse all other sampling equipment after returning from the field.

- Sample containers used in the field (e.g. graduated cylinders for sample dilutions, test kit flasks and / or beakers) should be cleaned immediately after use. Rinse three to four times with deionized water. Rinsewater from test kit cleaning must be poured into the waste container.

- Supply of containers used for analytical laboratory analysis should be checked and restocked as needed.

5. FLOW MEASUREMENT PROCEDURES

A flow measurement should be made during each site visit where flowing water is observed. Flow measurements can be used to estimate pollutant mass loading, prioritize storm drains for future investigations, or to identify significant changes in flow that may be indicative of an illegal release upstream. Since a majority of sample locations lack a permanent flow measurement installation, several field methods may be employed to estimate flow rate. If water is ponded, take width, length, and depth and record velocity as zero (0).

Velocity-area method - The most practical method for measuring the discharge of a stream is the velocity-area method. This method requires the physical measurement of the cross-sectional area and the velocity of the flowing water. Discharge is determined as the product of the area times the velocity.

Discharge (ft^3/sec) = Velocity (ft/sec) x Depth (ft) x Width (ft)

Using the Global Flow Probe, measure the velocity of the water flow (see flow probe instruction in Appendix 6). Use the measurement marks on the probe to measure the stream width and depth. Note: The probe markings are in tenths of a foot, therefore, you read directly from the markings and do not need to make any conversions. Record results on the datasheet; the Dry Weather database will calculate the discharge flow.

Fill a bottle method - If conducting an IC/ID investigation on an outfall, staff should record information on the diameter of an outfall for the determination of the discharge flow. The rate can be determined by measuring the length of time it takes to fill a 1-Liter bottle. This method is very helpful for low-flow situations.

Partially filled pipe method - Another method for measuring flow is the partially filled pipe method. This method is helpful when you have a substantial flow coming from an outfall. For this method all measurements must be converted to a common unit before calculation (ft, in, or cm). Measure the water depth and inside pipe diameter and apply the following formula using the partially filled pipe formula chart in Table 1.

- Let D = water depth.
- Let d = *inside* pipe diameter
- Calculate D/d.
- Find the tabulated (Ta) value on the partially filled pipe formula chart below using the D/d value. (i.e. if D/d = 0.263 then Ta =0.1623).
- Find the area using the formula

  $a = Ta*d^2$.
- Multiply area (a) by the water velocity.
- Convert to desired value.

Table 1: Partially Filled Pipe Formula Chart *(clarify values in first row and column)*

Calculating the Area (a) of the Cross Section of a Circular Pipe Flowing Partially Full										
D = Depth of water d = diameter of the pipe		a = area of water in partially filled pipe Ta = Tabulated Value					Then a = Ta*d2			
D/d	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.0	0.0000	0.0013	0.0037	0.0069	0.0105	0.0147	0.0192	0.0242	0.0294	0.0350
0.1	0.0409	0.0470	0.0534	0.0600	0.0668	0.0739	0.0817	0.0885	0.0951	0.1039
0.2	0.1118	0.1199	0.1281	0.1365	0.1440	0.1535	0.1623	0.1711	0.1800	0.1890
0.3	0.1982	0.2074	0.2187	0.2280	0.2355	0.2450	0.2540	0.2642	0.2780	0.2836
0.4	0.2934	0.3032	0.3130	0.3220	0.3328	0.3428	0.3527	0.3627	0.3727	0.3827
0.5	0.3980	0.4030	0.4130	0.4230	0.4330	0.4430	0.4520	0.4620	0.4720	0.4820
0.6	0.4920	0.5020	0.5120	0.5210	0.5310	0.5400	0.5500	0.5590	0.5690	0.5780
0.7	0.5870	0.5960	0.6050	0.6140	0.6230	0.6320	0.6400	0.6490	0.6570	0.6660
0.8	0.6740	0.6810	0.6890	0.6970	0.7040	0.7120	0.7190	0.7250	0.7320	0.7360
0.9	0.7450	0.7500	0.7560	0.7610	0.7660	0.7710	0.7750	0.7790	0.7820	0.7840

APPENDIX 6

Flow Probe User Instructions

1. The FP101 probe handle is a two-piece rod expandable from 3’ to 6’. The FP201 probe handle is a three-piece rod expandable from 5’ to 15’. To expand the rod for correct placement in flow, loosen the locking nut on the handle, pull out the top piece, and retighten the nut.

2. Make sure the Flow Probe’s propeller turns freely by blowing strongly on the prop. Remove any accumulated debris (e.g.- magnetic sediment). If the propeller still does not turn freely, remove the screw holding the propeller and clear any debris present. Re-attach the propeller with the screw, taking care not to over-tighten the screw.

3. Scroll with the bottom button until the “AVGSPEED” for velocity appears on the bottom of the screen. Push the top button for three (3) seconds to reset the display. The display will read in feet/second units.

4. Point the propeller directly into the flow you wish to measure. Face the arrow inside the prop housing **downstream** (arrow points in the direction of flow). If there’s no arrow the raised bump on the outside of the housing should be pointed **into** the flow.

5. For small streams, the probe can be moved **slowly** and smoothly throughout the flow during average velocity measurement. Move the probe smoothly and evenly back and forth from top to bottom of the flow so that the probe stays at each point in the flow for approximately the same amount of time. Keep moving the probe for 20-40 seconds to obtain an accurate average value that accounts for surging. (Move the probe as if you were spray painting and attempting to get an even coat of paint over the entire surface).

   The Flow Probe uses true velocity averaging. Reset “AVGSPEED” before starting a new measurement. One reading is taken per second, and a continuous average is displayed. For example, after 10 seconds, 10 readings are totaled and then divided by 10 and this average is displayed. Once the average reading becomes steady, the true average velocity of the stream is obtained. When you pull the probe from the water, this average value is frozen on the display until it is reset. Record this value in the proper cell on the field sheet.

6. Measure/calculate the cross-sectional area of your flow stream in square feet (Note: optional, the database will do this calculation). The average velocity (calculated with the Flow Probe in feet/second) times the cross-sectional area (square feet) equals flow in cubic feet per second (cfs), or Q = V x A.

7. If the propeller gets fouled while measuring flow, clean it until the prop turns freely and start over.

APPENDIX 3

Horiba U-10 Calibration Procedure and Log Sheet

Instrument Calibration and Frequency

The Horiba U-10 Meter is to be calibrated using the Auto-Calibration procedure described below prior to use in the field each day. Upon return to the lab from the field (post-deployment), the Horiba pH 7 and pH 10 solutions will be checked and results recorded. All measurements will be checked against the data quality objectives (DQOs) listed in Table 1. If results are out of the DQO range then probe must be calibrated using the manual two-point calibration methods. Manual two-point calibrations for dissolved oxygen, pH, conductivity and turbidity will be conducted quarterly. Following manual calibration the probe will be checked using the Horiba pH 4 (Autocal) solution and probe condition will be noted. All data will be recorded in the calibration data sheet.

Auto-calibration Procedure (performed daily prior to departure):

1. Fill each Horiba calibration cup with the proper pH solution, according to its label. The pH 4 cup should be filled slightly **over** the fill line.
2. Rinse probe with tap water and blot dry with a clean cloth or Kimwipe.
3. Place probe in Horiba calibration cup containing Horiba pH 4 solution. Allow a **few** minutes for equilibration.
4. Using the MODE key put in MAINT mode then toggle to “S.SET”. Using the ↑↓ keys select “A” for Auto-salinity. Press ENT to complete salinity setting.
5. Horiba pH 4 (Autocal) solution. Using the MODE key put in MAINT mode then toggle to AUTO sub-mode. Press ENT to initiate auto-calibration. Readout will automatically return to MEAS mode when completed.
6. Record readouts for all parameters (pH, conductivity, turbidity, dissolved oxygen, temperature, and salinity) in the Daily Calibration Logsheet.
7. Remove the probe from the Horiba pH 4 solution, rinse in tap water, dry and place in the pH 7 solution. Record the pH and temperature values on Daily Calibration Logsheet. Repeat this step with pH 10 solution.
8. Follow the directions below for Zero and Span calibration should the pH values fall outside accepted ranges.
9. Upon return from the field, check the probe using the Horiba pH 7 and pH 10 solutions, record pH and temperature values in the Daily Calibration Logsheet, then rinse probe in tap water and place in a beaker of tap water for short-term storage.

Manual Two-point Calibrations (performed quarterly):

pH Calibration:

pH calibration is done using two standard solutions of different pH values, one for the ZERO calibration, the other for the SPAN calibration. Water Quality objectives for pH in surface waters for the San Diego region are 6.5 to 9.0, therefore it is recommended to use pH 7 and pH10 solutions.

Zero Calibration:

— Use the pH 7 solution (Must use pH7 solution), check temperature of standard.

- Press MODE, select MAINT mode.
- Press MODE again to move the lower cursor to ZERO.
- Press SELECT to move the upper cursor to pH
- Select the appropriate pH value after the readout has stabilized (e.g. enter pH = 6.86 if temp. is 25°C; note that different brands of standard pH solutions may have different pH values at a given temperature; Table 3) using the ↑↓ keys.

To complete pH zero calibration, press ENT. Record this value in the calibration data sheet.

Span Calibration:

- Rinse and dry probe and place in second standard solution (e.g. pH 10).
- Use the MODE key to move the lower cursor to SPAN.
- Check the temperature of the standard solution and select the appropriate pH value after the readout has stabilized using the ↑↓ keys.
- To complete pH span calibration, press ENT. Record this value in calibration data sheet.

Record all data into the logsheet.

Conductivity Calibration:

The Horiba U-10 automatically selects the proper range to measure conductivity. Therefore, manual calibration must be done for all three ranges used by the probe.

Zero calibration:

- Triple rinse probe in DI or distilled water. Shake off excess water and allow to air dry.
- Press MODE and move lower cursor to ZERO.
- Press SELECT and move upper cursor to COND
- Press the ↑↓ keys to set the readout to zero.
- To complete the zero COND calibration, press ENT. Record this value in the calibration data sheet.

Span calibration:

- Triple-rinse and immerse probe in 0.718 mS/cm solution.
- Press MODE and move lower cursor to SPAN
- Use the ↑↓ keys to select 0.718 once readout has stabilized.
- Press ENT to complete the 0.718 mS/cm conductivity calibration. Record this value in the calibration data sheet.
- Repeat the above procedure using the 6.67 mS/cm and 58.7 mS/cm standard solutions.

Note: Shelf life of conductivity solutions is six months. Keep solutions tightly capped. Conductivity standards are "one-shot" solutions – do not reuse the standard (from SWAMP guidelines).

Turbidity calibration:

When doing zero calibration it is crucial that you clean the probe thoroughly.

Zero calibration:

- Triple-rinse probe and shake off excess water droplets immerse probe in DI or distilled water.
- Press MODE and move the lower cursor to ZERO.
- Press SELECT and move upper cursor to TURB.

- Use the ↑↓ keys to select 0.0 once readout has stabilized.
- Press ENT to complete the zero turbidity calibration. Record this value in the calibration data sheet.

Span calibration:

- Triple-rinse and immerse probe in 100 NTU standard solution.
- Press MODE and move lower cursor to SPAN.
- Use the ↑↓ keys to select 100 NTU once the readout has stabilized.
- Press ENT to complete the 100 NTU turbidity calibration. Record this value in the calibration data sheet.

Note: Shelf life of turbidity solutions is six months.

DO calibration:

DO calibration solution for the span calibration must be prepared fresh just before it is used. Add 1L of DI water to the reagent bottle and shake vigorously until the white powder is completely dissolved.

Zero calibration:

- Triple-rinse probe in tap water and immerse it in zero DO standard solution. This solution must be prepared immediately before use.
- Press MODE and move the lower cursor to ZERO.
- Press SELECT and move the upper cursor to DO.
- Use the ↑↓ keys to select 0.0 once the readout has stabilized.
- Press ENT to complete the zero DO calibration.

Span calibration:

Fill a container with tap water, close lid and bubble air through it with an aquarium pump to saturate it with dissolved oxygen.
Triple-rinse the probe and immerse it in the container of O2-saturated water.
Make sure the probe is set for freshwater by setting the S.SET Sub-Mode to 0.0%.
Press MODE to move the lower cursor to SPAN.
After the readout has stabilized, slowly move the probe up and down in the water and set the readout value to the appropriate DO value based on the temperature of the water (refer to Table 4: DO saturation at various temperatures).
Press ENT to complete the SPAN calibration for DO. Record in the calibration data sheet.

Table 1:Calibration solutions and values at 25^{o} C.

Parameter	pH 4 (Horiba)	pH7 (Horiba)	pH 7 (YSI)	pH 10 (YSI)
pH	4.01	6.86	7.00	10.00
Conductivity (mS/cm)	4.49		5.87	16.7
Turbidity (NTU)	0		0	0
DDO (mg/L)	8.52		0.0 (Zero oxygen)	

Table 2: Data Quality Objectives for Accuracy and Precision

Parameter	Value	+/- ½ unit	+/- ½ unit
	4.01*	3.51	4.51
	6.86*	6.36	7.36
pH (± 0.5 units)	10.0	9.50	10.50
	4.49	4.27	4.71
Conductivity	5.87	5.58	6.16
Turbidity	100	95	105
DO	8.52	8.09	8.95

*Check manufacturers standard reference value.

Table 3: Standard pH values at different temperatures

Temperature (°C)	pH 4 (Horiba)	pH 4 (YSI)	pH 7 (Horiba)	pH 7 (YSI)	pH10 (Horiba)	pH 10 (YSI)
15	4.00	4.00	6.90	7.05		10.12
20	4.00		6.88		10.06	
22	4.00		7.00		10.03	
25	4.01		6.86		10.01	

Table 4: Dissolved Oxygen at Various Temperatures

Temperature (°C)	Dissolved Oxygen (mg/L)	+ 5%	- 5%
15	9.76	10.25	9.27
16	9.56	10.04	9.08
17	9.37	9.84	8.90
18	9.18	9.64	8.72
19	9.01	9.46	8.56
20	8.84	9.28	8.40
21	8.68	9.11	8.25
22	8.53	8.96	8.10
23	8.39	8.81	7.97
24	8.25	8.66	7.84
25	8.11	8.52	7.70
26	7.99	8.39	7.59
27	7.87	8.26	7.48
28	7.75	8.14	7.36
29	7.64	8.02	7.26
30	7.53	7.91	7.15

Horiba U-10 Daily Calibration Log Sheet

PRE-FIELD:

CALIBRATED: BY________ DATE________ TIME_________ METER_____

Calibration		pH*	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (^oC)	Salinity (%)
Auto-Cal Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
pH 7 Solution	Std. Value	6.86**					
	Reading						
pH 10 Solution	Std. Value	10.00					
	Reading						

POST-FIELD:

CHECKED: BY________ DATE________ TIME_________ METER_____

Calibration		pH*	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (^oC)	Salinity (%)
Auto-Cal Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
pH 7 Solution	Std. Value	6.86**					
	Reading						
pH 10 Solution	Std. Value	10.00					
	Reading						

***pH readings should fall within +/- 0.5 units; all other parameters should fall within +/- 5% of standard values.**

****Horiba pH 7 standard solution**

Horiba U-10 Quarterly Calibration Logsheet

CALIBRATED BY________ DATE________ TIME_________ METER_____

Calibration		**pH**	**Cond. (mS/cm)**	**Turbidity (NTU)**	**DO (mg/L)**	**Temp. (°C)**	**Salinity (%)**
1st Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
2nd Solution	Std. Value	7.00	5.87	0			0.31
	Reading						
3rd Solution	Std. Value	10.00	16.7	0			0.99
	Reading						
DO*	0.0 mg/L	N/A	N/A	N/A		N/A	N/A

*Zero DO calibration only.

CHECKED BY________ DATE________ TIME_________ METER_____

Calibration		**pH**	**Cond. (mS/cm)**	**Turbidity (NTU)**	**DO (mg/L)**	**Temp. (°C)**	**Salinity (%)**
1st Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
2nd Solution	Std. Value	7.00	5.87	0			0.31
	Reading						
3rd Solution	Std. Value	10.00	16.7	0			0.99
	Reading						
DO*	0.0 mg/L	N/A	N/A	N/A		N/A	N/A

*Zero DO calibration only.

Parameter	Value	-5%	+5%
pH	4.00*	3.90	4.10
	7.00*	6.90	7.10
	10.00*	9.90	10.10
Conductivity	4.49	4.27	4.71
	5.87	5.58	6.16
Turbidity	100	95	105
DO	8.52	8.09	8.95

*N/A

6. SAMPLING PROCEDURES

The permit requires that we perform field screening at each identified station a minimum of one time between May 1st and September 30th of each year if flow or ponded runoff is observed at a dry weather station and there has been at least 72 hours of dry weather. Field screening involves making observations, collecting at least one grab sample (for: nitrate, phosphate, ammonia and MBAS), measuring water quality properties (for: pH, conductivity, turbidity, dissolved oxygen, temperature, and salinity (see Appendix 15)), recording general information, site descriptions, instantaneous flow estimation, and visual observations on a dry weather field monitoring sheet as stated in the Permit. **Do not** collect ponded water samples for indicator bacteria after the initial permitted required sample has been completed.

All samples are to be analyzed in the field for the physical and chemical constituents as stated in the Permit and are included in Table 2 below. A grab sample may be brought back to the DPW lab for analysis of nitrate, phosphate, ammonia, and MBAS if time is limited. Sample should be transported on ice. Make a note on the field sheet if this is done (all attempts should be made to do the field measurements at the actual sample site). The analytical laboratory analysis will be conducted at a minimum of 25% of the sites where ponded or flowing water is observed. Table 3 provides a summary of all field screening and analytical laboratory analysis parameters available for the Dry Weather Monitoring Program and for use in site investigations.

Physical Water Quality Properties Collection – Use the Horiba U-10, 5-parameter probe to collect pH, conductivity, turbidity, dissolved oxygen, temperature, and salinity. The Horiba U-10 sensor body must be fully submerged in the water so that all sensors are covered. The sensors should be pointed upstream so that the water flows through and around them. Place sensor in a representative portion of the creek and turn the Horiba on. Wait approximately one (1) minute for the sensors to equilibrate. If you are at the first site of the day, you may need to wait up to five minutes with the "Turbidity" mode selected for the turbidity reading to stabilize, especially if the water is cold. This warm-up period is necessary to avoid erroneously high turbidity readings at the first site of the day. Start with the conductive measurement and work on through the parameters, taking care to let the values stabilize at each parameter. If the flow velocity of the creek is slow (i.e. less that 0.50 feet/second), it will be required that the sensor be agitated in the water for approximately 30 seconds, taking care not to lift the sensor out of the water while agitating, in order to obtain a proper D.O. reading (only D.O. is affected by a slow flow velocity). It is recommended that the D.O. be done last if you are at a site with slow flow velocity. If the level of the water is to low and will not cover the sensor, the Horiba measurements can be made in a clean, triple-rinsed beaker. The water can be collected with a syringe or clean sample cup (triple-rinsed). Note on the field sheet how the water was collected if the measurements were done in a beaker.

Field Sample Collection - Grab samples (see below for Oil and Grease grab sample procedure) are to be collected by standing downstream and submerging the sample container immediately below the water surface in the upstream direction, disturbing as little of the bottom material as possible. If practical, collect the sample at about 60% of the stream depth (from the surface) in an area of maximum turbulence (except when sampling for volatile organics). If the water level is very low, collect the water sample using a clean syringe and fill sample container. Note on the field sheet if a syringe was used for sample collection. Avoid sampling the slowly flowing water near the edge of stream, unless intended. For Oil and Grease grab sample collection, fill bottle with water at the water-air interface, and avoid collecting sediments.

Analytical Laboratory Sample Collection - Samples for analytical laboratory analysis need to be collected in the appropriate containers (see Tables 3 and 4 for container type, holding time and necessary preservative for each analyte). The contracting laboratory will provide the appropriate pre-cleaned sample containers with preservative added (see Appendix 7). Samples are to be collected by standing downstream and at the horizontal and vertical center of the stream/creek flow for a more representative sample of the whole stream. When sampling, make sure the container opening faces upstream. For shallow water (i.e. less than 6-inches deep), it will suffice to fill the bottle from the surface of the stream rather than sample mid-depth. For deeper water, sample mid-depth by leaving the lid on the sample bottle and lowering the bottle to the mid-depth position, then removing the lid and allowing the container to fill. Be sure to firmly screw cap on the container to prevent leakage. If water level is very low, collect the water sample using a clean syringe and fill appropriate sample container. Note on the field sheet if a syringe was used for sample collection. Avoid sampling the slowly flowing water near the edge of stream, unless intended. Store all samples in an ice chest with ice at approximately 4^o C until custody is transferred to the analytical laboratory directly or via contracted courier.

C. IC/ID INVESTIGATION

1. INTRODUCTION

At Dry Weather sites, if a parameter is measured and it is equal to or above the action level, an IC/ID investigation must be conducted (Figure 1). Exceptions are made on a case by case basis using best professional judgment for certain parameters (see IX. Interpretation of Data). If the exceedance involves a field measured parameter, the IC/ID investigation must be conducted /

started within two business days. If the exceedance involves an analytical laboratory measured parameter, the IC/ID investigation must be conducted / started within two business days after receiving the laboratory results. Staff shall endeavor to identify the source of the discharge or provide the rationale for why the discharge does not pose a threat to water quality and does not need further investigation. Obvious illicit discharges (i.e. color, odor, or significant exceedances of action levels) shall be investigated immediately.

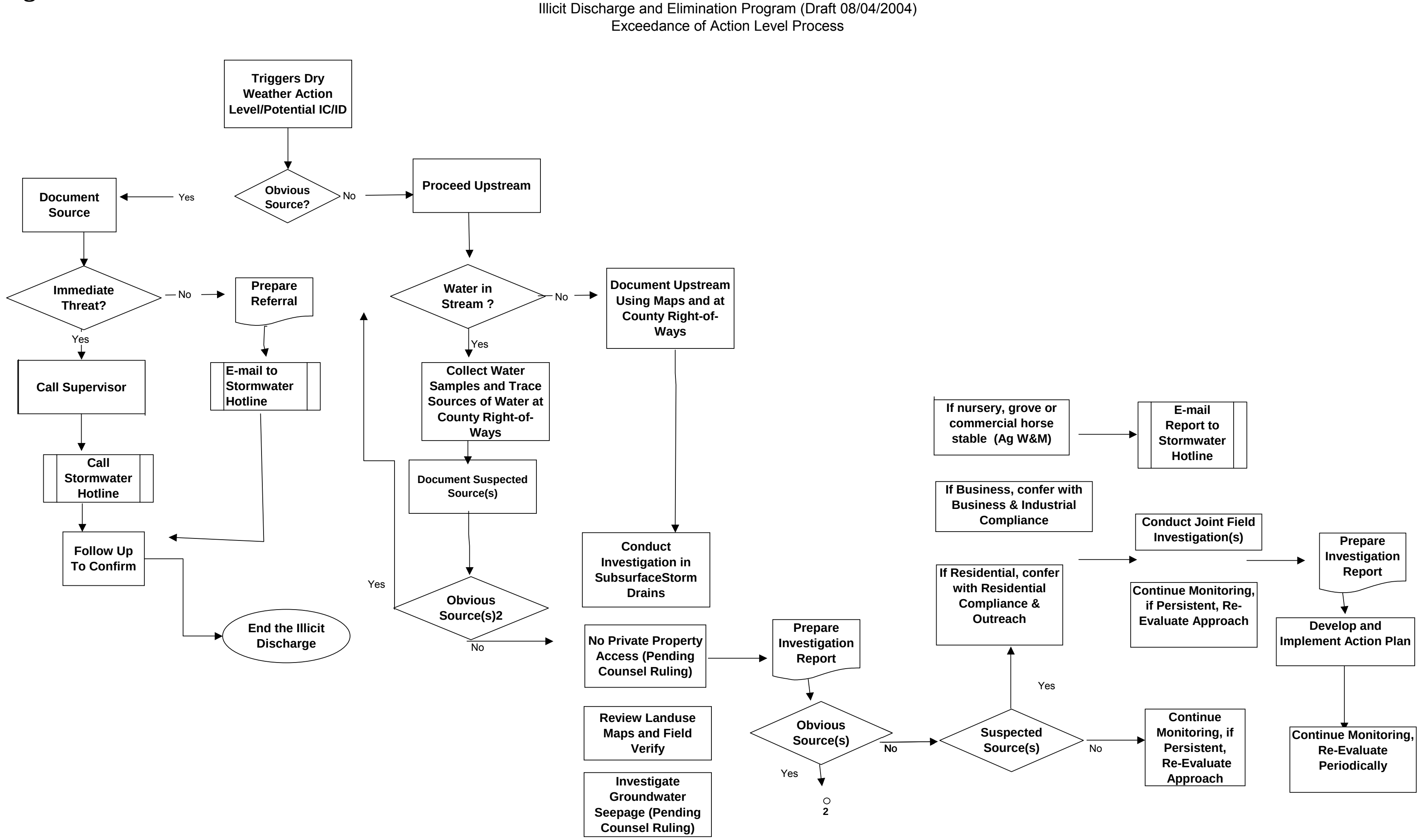
Dry weather flows will generally be followed from the location where they are first observed in an upstream direction along the conveyance system. The Exceedance of Action Level Process flow chart (see Figure 2) is the process followed during an IC/ID investigation. Prior to returning to an IC/ID investigation, field staff should compile and review available resources including past dry weather monitoring reports, GIS land use maps, MS4 maps, available aerial photographs, and property ownership.

Note: Do not enter or sample on privately owned land or jurisdictions other than unincorporated San Diego County.

The following steps to be taken during an IC/ID investigation:

1. Proceed upstream in conveyance to trace possible source, collect samples at upstream confluences for chemical analyses. (If tracking a nitrate exceedance, nitrate test strips can be used as a screening tool in determining which flows to follow. If tracking a pH exceedance, use pH test strips instead of Horiba if pH is <5.0 or >10.5.)
2. If possible, trace dry weather flow from conveyance to street / storm drains; if possible collect sample for chemical analysis.
3. If dry weather flow is traced to a facility, collect sample at curb or public right of way and submit for chemical analysis. Document with photos. Notify your supervisor for further instructions.
   Note: Always take GPS coordinates at each new site and fill in a datasheet.
4. If the flow is coming from another jurisdiction make a note and notify your supervisor, so a formal notification in writing can be made to a representative of the relevant jurisdiction, informing them of the situation. County staff will not track flows into other jurisdictions.

Figure 2: Exceedance of Action Level Process



2. FOLLOWING FLOWS

If field staff are initially unable to locate the source of the flow (e.g. the flow is traced to a seep, flow discharges from a pipe, the channel terminates, etc.) consider the following possibilities: first, the flow may originate from a road gutter. Check catch basins and gutters between sites for evidence of flows such as runoff from steam-cleaning operations, car washing, irrigation runoff, etc. There may also be a new or illegal connection to the system, possibly between manholes. Look for areas in the road that have been dug up and re-paved. Also consider checking with the Wastewater Management / Operations and Maintenance Section in DPW for any recent work that may have been done in the area. Finally, look for evidence of recent or past dumping such as wet and / or stained pavement or gutters.

Below Ground Systems - Contact the Department of Public Works, Road Division for assistance on tracking below ground storm drain systems and before opening any manholes (Stormwater Strike Team Supervisor for Division 1 is Tony Stanley (619-660-5831) and for Division 2 Tony Ariosta (760-510-2389)). When tracking flows in below ground systems it may be necessary to follow flows from the outfall or manhole to the next manhole with a junction. Manholes will not always need to be checked if there are no junctions between them. Field staff will record information on the surrounding areas and look for water flowing in gutters and streets. Areas where illegal dumping may typically occur include parking lots and garages behind buildings and warehouses. **DO NOT ENTER MANHOLES.**

Multiple Outlet Systems - If flow is observed coming from only one outlet, continue tracking from that outlet. If flow is observed coming from more than one outlet, track them one at a time, using visual observations, odors, and/or field screening sampling to determine the order of investigation. It is generally easiest to track the largest flows first, but if they are about the same size, start with the one that is easiest, shortest, or with the least number of junctions, or track those originating from areas with the greatest potential for illegal discharges. (Use nitrate test strips for quick preliminary results for multiple flows.)

3. POST-INVESTIGATION REFERRALS

When an exceedance of a field or analytical parameter has been measured or determined, field staff will conduct the initial IC/ID investigation. Field Staff will follow the procedures outlined in the above sections and illustrated in Figure 2.

Referrals will be based upon the following criteria and best professional judgment:

- If this site was previously investigated for the same parameter and similar levels were observed during previous dry weather sampling years and no source was identified, then discuss site investigation with supervisor to determine future strategies.

- If field staff identifies the source of a discharge, a “Science and Monitoring Referral” document needs to be filled out (see Appendix 12) and send to the supervisor for review. The supervisor will then send the referral to the appropriate responsible party.

- If field staff identify a blocked storm drain culvert, trash/debris/vegetation issue, or other storm drain infrastructure issue, a DPW Road Service Request (see Appendix 13) must be filled out and sent to DPW Roads division (Does not need to go to the supervisor).

- If field staff identifies a trash/debris/vegetation/etc. issue on CalTrans right-of-way, then e-mail the CalTrans point of contact for stormwater, Jay C. Knapp @ 619-688-4255 (jay_c_knapp@dot.ca.gov). In the e-mail include photo of site, location (mile marker if possible), and description of issue and send to the supervisor for review.

Note: If field or laboratory sampling is conducted, appropriate documentation will be completed and submitted to the Dry Weather Coordinator (i.e. COC and data field sheets).

Prepared for

County of San Diego, Department of Public Works
5510 Overland Ave, Suite 410
San Diego, California, 92123-1237

APPENDIX G

CHAIN OF CUSTODY EXAMPLE FORM (COC)

FOR TASK ORDER NO. 24: DRY WEATHER MICROBIAL SOURCE TRACKING STUDY WORK PLAN

SAN LUIS REY WATERSHED

Prepared by

Geosyntec consultants

engineers | scientists | innovators

3990 Old Town Ave., Suite A-101
San Diego, California 92110

Project Number LA022824

November 24, 2014

Chain Of Custody Record

Source Molecular Corporation
Leader in Genetic Microbial Source Tracking

SHIPPING ADDRESS:
4985 SW 74th Court, Miami, FL 33155 USA
Tel: (1) 786-220-0379 Fax: (1) 786-513-2733
Email: info@sourcemolecular.com

Company Name:	
Contact Name(s):	
E-mail Address(es):	
Phone:	
Address:	
City/State/Zip:	
Country:	

Analysis Requested

Mark boxes with "X"

Sample ID	Media	Sample Date	Sample Time	# of Containers							Quantification (Yes, No, If Positive)	Comments

Completed by Client:

SAMPLES DELIVERED BY ______________________________

SAMPLER NAME ______________________________

SAMPLE SITE ______________________________

WITNESS ______________________________

TRACKING CODE ______________________________

Completed by Source Molecular:

SAMPLES RECEIVED BY ______________________________

RECEIVED DATE/TIME ______________________________

TEMPERATURE ______________________________

CONDITION ______________________________

SIGNATURE ______________________________

Explanation of Terms Used in Chain-of-Custody Record

Sample ID:	The specific sample identification number, unique to each sample set.
Media:	The sample media (e.g. water, soil).
Sample Date:	The date that the sample was taken, including month, day, and year.
Sample Time:	The time the sample was taken.
# of Containers:	The number of containers for that particular sample set.
Analysis:	The type(s) of analysis required for that particular sample or sample set. NOTE: Confer with a laboratory representative to ensure that the analysis you are requesting is clearly understood and that the lab is capable of performing those analyses.
Quantification:	The type of testing to be performed. Select "Yes" for quantification analysis. Select "No" for only presence or absence analysis. Select "If Positive" for presence or absence with quantification of the host biomarkers that are positive.
Samples Delivered By:	The signature of the individual who is delivering the samples to the laboratory. Under most circumstances, this will be one of the individuals who performed the sampling.
Sampler Name:	The name of the individual(s) performing the sampling.
Sample Site:	The name of the site being sampled.
Witness:	The name of any witnesses to the sampling event, if so desired or required.
Tracking Code:	The resource tracking code for the project.
Samples Received By:	The name of the individual who receives the samples for the laboratory.
Received Date/Time:	The date and time the samples are delivered to the lab, including hour, month, day, and year.
Temperature:	The temperature of the samples upon arrival, in degrees Celsius.
Condition:	The condition of the samples upon arrival.
Signature:	The signature of the individual who receives the samples for the laboratory.

Recommended Quantities
Water Samples:
500mL of water in leak proof bottles per sample.

Contact us for Filters, Sediment, Shellfish or other sample types.

Recommended packing instructions
-Wrap leak proof bottles with abundant paper towels and put them individually in ziplock bags.
-Ice packs should be packed with sample(s). The ice should also go into a ziplock bag.
-Wrap the ziplock bag with abundant paper towels and insert everything in another ziplock bag.
-Please make sure that the ice packs do not touch directly the samples (adding additional packing material will prevent this).
-As an added precaution, please put all your ziplock bags and packing material in two overlapping garbage bags.
-Wrap tightly the garbage bags and put everything in a sturdy cooler.

Calscience Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

☐ SoCal Laboratory
7440 Lincoln Way
Garden Grove, CA 92841-1427
(714) 895-5494

☐ NorCal Service Center
5063 Commercial Circle, Suite H
Concord, CA 94520-8577
(925) 689-9022

WO # / LAB USE ONLY ☐☐ - ☐☐☐☐

Date ______________________

Page __________ of __________

LABORATORY CLIENT:	CLIENT PROJECT NAME / NUMBER:
ADDRESS:	P.O. NO.:
CITY STATE ZIP	PROJECT CONTACT:
TEL: E-MAIL:	SAMPLER(S): (PRINT)

TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ STANDARD

☐ COELT EDF | GLOBAL ID | LOG CODE

SPECIAL INSTRUCTIONS:

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	Unpreserved	Preserved	Field Filtered	TPH (g) or GRO	TPH (d) or DRO or (C6-C36) or (C6-C44)	TPH ( )	BTEX / MTBE (8260) or ( )	VOCs (8260)	Oxygenates (8260)	En Core / Terra Core Prep (5035)	SVOCs (8270)	Pesticides (8081)	PCBs (8082)	PNAs (8310) or (8270)	T22 Metals (6010/747X)	Cr(VI) [7196 or 7199 or 218.6]	Air - VOCs (TO-14A) or (TO-15)	Air - TPH (g) [TO-3]			

Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:

DISTRIBUTION: White with final report, Green and Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

06/01/10 Revision

Sample Information Sheet for ARDC of SNWA

Ancillary Studies

Login Number:

Login Description:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Sample ID	Location	Sub Location	Tap Location	Date	Time	Initials

Additional Water Quality Information (ie: Cl- residual, TOC, alkalinity or other):

Customer Comments:

Date, Time and Initials to be filled in by customer

Weck Laboratories, Inc.
Analytical Laboratory Services - Since 1964

14859 East Clark Avenue : Industry : CA 91745
Tel 626-336-2139 ♦ Fax 626-336-2634 ♦ www.wecklabs.com

CHAIN OF CUSTODY RECORD

STANDARD

Page 1 Of 1

CLIENT NAME:	PROJECT:
Geosyntec Consultants	
ADDRESS:	PHONE: 805-897-3800 FAX: 805-899-8689 EMAIL:
PROJECT MANAGER Brandon Steets	SAMPLER

ANALYSES REQUESTED

ID# (For lab Use Only)	DATE SAMPLED	TIME SAMPLED	SMPL TYPE	SAMPLE IDENTIFICATION/SITE LOCATION	# OF CONT.	COMMENTS

SPECIAL HANDLING

- ☐ Same Day Rush 150%
- ☐ 24 Hour Rush 100%
- ☐ 48-72 Hour Rush 75%
- ☐ 4 - 5 Day Rush 30%
- ☐ Rush Extractions 50%
- ☐ 10 - 15 Business Days
- ☐ QA/QC Data Package

Charges will apply for weekends/holidays

Method of Shipment:

RELINQUISHED BY	DATE / TIME	RECEIVED BY
RELINQUISHED BY	DATE / TIME	RECEIVED BY
RELINQUISHED BY	DATE / TIME	RECEIVED BY

SAMPLE CONDITION:

Actual Temperature:

Received On Ice Y / N
Preserved Y / N
Evidence Seals Present Y / N
Container Attacked Y / N
Preserved at Lab Y / N

SAMPLE TYPE CODE:
AQ=Aqueous
NA= Non Aqueous
SL = Sludge
DW = Drinking Water
WW = Waste Water
RW = Rain Water
GW = Ground Water
SO = Soil
SW = Solid Waste
OL = Oil
OT = Other Matrix

PRESCHEDULED RUSH ANALYSES WILL TAKE PRIORITY OVER UNSCHEDULED RUSH REQUESTS
Client agrees to Terms & Conditions at: www.wecklabs.com

SPECIAL REQUIREMENTS / BILLING INFORMATION

COC version 042707

– *EnviroMatrix* *Analytical, Inc.* ——

4340 Viewridge Ave., Ste. A - San Diego, CA 92123 - Phone (858) 560-7717 - Fax (858) 560-7763

CHAIN-OF-CUSTODY RECORD

EMA LOG #:

Client: County of San Diego

Attn:

Samplers(s):

Address:

Phone: Fax:

Email:

Billing Address:

Project ID:

Project #: PO #:

ID #	Client Sample ID	Sample Date	Sample Time	Sample Matrix	Container # / Type
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Requested Analysis

ID #	Oil & Grease □ 413.1 □ 413.2 □ 1664	8015 (TPH) □ Gas □ Diesel □ Ext	624/8260 (VOC) Full BTXE MTBE Oxy Nap	625 / 8270 (SVOC) □ PAH only	608 / 8081 (Organochlorine Pesticides)	608 / 8082 (Polychlorinated Biphenyls)	8141 (Organophosphorus Pesticides)	TBT (Organotin Compounds)	□ pH □ EC □ TSS □TDS	□ Nitrate □ Nitrite □ TKN □NH3	CAC Title 22/CAM17 Metals □ TTLC □ STLC	TCLP (RCRA) □ Metals □ Organics	Cd Cr Cu Pb Ni Ag Zn □ Dissolved	Coliform, □ Total (MTF) □ Fecal (MTF)	Colilert, T+E.Coli □ P/A □ Enumeration	Enterococcus, □ MTF □ Enterolert	Heterotrophic Plate Count (HPC)	□ BOD □ COD □ Cyanide					
1																							
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							

Matrix Codes: A = Air, DW = Drinking Water, GW = Groundwater, SW = Storm Water
WW = Wastewater, S = Soil, SED = Sediment, SD = Solid, T = Tissue, O = Oil, L = Liquid

Shipped By: □ Courier □ UPS □ FedEx □ USPS □ Client Drop Off □ Other

[1]**Turn-Around-Time:** □ Same Day □ 1 day □ 2 day □ 3 day □ 4 day □ 5 day □ STD (7 day)

[1]**Reporting Requirements:** □ Fax □ PDF □ Excel □ Geotracker/EDF □ Hard Copy □ EDT

[1]**Sample Disposal:** □ By Laboratory □ [2]Return to Client: P/U or Delivery □ Archive

Sample Integrity

Correct Containers: Yes No N/A	Containers Properly Preseved: Yes No N/A
Custody Seals Intact: Yes No N/A	Temp @ Receipt:_______________
COC/Labels Agree: Yes No N/A	Sampled By: Client EMA Autosampler

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Signature		Signature
Print		Print
Company:		Company:
Signature		Signature
Print		Print
Company:		Company:
Signature		Signature
Print		Print
Company:		Company:

Project/Sample Comments:

[1]Additional costs may apply. Please note there is a $35 minimum charge for all clients.

[2]EMA reserves the right to return any samples that do not match our waste profile.

NOTE: By relinquishing samples to EMA, Inc., client agrees to pay for the services requested on this COC form and any additional analyses performed on this project. Payment for services is due within 30 days from date of invoice. Samples will be disposed of 7 days after report has been finalized unless otherwise noted. All work is subject to EMA's terms and conditions.

City of San Diego Public Utilities Department

Environmental Monitoring & Technical Services Division
Marine Microbiology Laboratory

2392 Kincaid Rd
San Diego, CA 92101-0811
(619)758-2361

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

DATE:__________________

CHAIN OF CUSTODY RECORD

Project/Client:	Sampler(s):	Type of sampling equipment / How sample obtained / Other sampling notes:
Contact Name:	Contact Name:	
Phone:	Phone:	

SAMPLE				ANALYSES						COMMENTS
Time	Initials	Source / I.D.	Matrix (water, bio-solid, etc.)	Total Coliform	Fecal Coliform	*E. coli*	Enterococcus	Coliphage	Other	(grab, comp., etc.)

CHAIN-OF-CUSTODY **COMMENTS**

Relinquished by(print): Sign:	Relinquished by(print): Sign:	
Received by(print): Sign:	Received by(print): Sign:	
Date/Time: Location:	Date/Time: Location:	

P:\Project Folders\County of San Diego\LA022821 - Microbial Source Tracking Study Work Plan\400 Technical\Lab Information\COC\Originals\City of SD_COC.xlsx

MMVM-F-168.4-1001

San Luis Rey River Watershed Management Area
Water Quality Improvement Plan Review

PROVISION B.2: PRIORITY WATER QUALITY CONDITIONS

Provision B.2.a: Assessment of Receiving Water Conditions

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
B.2.a	Did the Copermittees consider the following to identify priorities:				
B.2.a.(1)	Receiving waters on 303(d) List?	Y	Section 2.1.1 Appendix 2A		
B.2.a.(2)	TMDL adopted and in development?	Y	Section 2.1.2 Table 2-1		
B.2.a.(3)	Sensitive or highly values receiving waters (e.g. CWA 320 estuaries, MPAs, wetlands, BIOL BU RWs, ASBS)?	Y	Section 2.1.3 Figure 2-2		
B.2.a.(4)	Receiving water limitations of Provision A.2?	Y	Section 2.1.4		
B.2.a.(5)	Known historical vs. current physical, chemical, and biological water quality conditions?	Y	Sections 2.1.5 & 2.1.6 Tables 2-3 to 2-7		
B.2.a.(6)	Available, relevant, and appropriately collected and analyzed RW monitoring data?	Y	Sections 2.1.5 & 2.1.6 Tables 2-3 to 2-7		
B.2.a.(7)	Available evidence of erosional (i.e. hydromodification) impacts?	Y	Section 2.1.7		
B.2.a.(8)	Available evidence of adverse chemical, physical, and biological integrity impacts?	Y	Section 2.1.8		
B.2.a.(9)	Potential improvements to overall condition of WMA that can be achieved?	Y	Section 2.1.9		

PROVISION B.2: PRIORITY WATER QUALITY CONDITIONS

Provision B.2.b: Assessment of Impacts from MS4 Discharges

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
B.2.b	Did the Copermittees consider the following to identify potential impacts to RWs from MS4 discharges:				
B.2.b.(1)	Prohibitions of Provision A.1 and Effluent Limitations of Provision A.3?	Y	Section 2.2.1		
B.2.b.(2)	Available, relevant, and appropriately collected and analyzed MS4 outfall storm water and non-storm water monitoring data?	Y	Section 2.2.2 Tables 2-8 to 2-11		
B.2.b.(3)	Locations of each Copermittee's MS4 outfalls?	Y	Section 2.2.3 Figure 2-5		
B.2.b.(4)	Locations of MS4 outfalls with persistent non-storm water discharges that cause and contribute?	Y	Section 2.2.4 Table 2-12 Figure 2-6		
B.2.b.(5)	Locations of MS4 outfalls known to discharge pollutants in storm water that cause and contribute?	Y	Section 2.2.5		
B.2.b.(6)	Potential improvements to quality of MS4 discharges that can be achieved?	Y	Section 2.2.6		

PROVISION B.2: PRIORITY WATER QUALITY CONDITIONS

Provision B.2.c: Identification of Priority Water Quality Conditions

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
B.2.c.(1)	Did the Copermittees use information from Provisions B.2.a and B.2.b to develop a list of priority water quality conditions?	Y	Section 2.3 Appendix 2D	- Section 2.3.2 indicates Priority water Quality Conditions include Eutrophic Conditions, Chloride, Bacteria, N and P, TDS, toxicity, and Benthic Alternations. - Section 2.3.3 indicates Bacteria as Highest Priority - Appendix 2d indicates bacteria at SLR River mouth (in Attachment E) for wet and dry weather, and in Lower SLR River west of 15 (not in Attachment E) for wet and dry weather are Highest Priority Water Quality Conditions	
B.2.c.(1)	Did the Copermittees each priority water quality condition in the list include:				
B.2.c.(1)(a)	Beneficial use associated with condition?	Y	Section 2.3 Appendix 2D		
B.2.c.(1)(b)	Geographic extent of condition in WMA, or indicate not known?	Y	Section 2.3 Appendix 2D		

B.2.c.(1)(c)	Temporal extent of condition (e.g. dry and/or wet weather)?	Y	Section 2.3 Appendix 2D		
B.2.c.(1)(d)	The Copermittees with MS4 discharges that may cause or contribute to condition?	Y	Section 2.3 Appendix 2D		
B.2.c.(1)(e)	An assessment of the adequacy of and data gaps in monitoring data?	Y	Section 2.3 Appendix 2D		
B.2.c.(2)	Did the Copermittees identify the highest priority water quality conditions to be addressed?	Y	Section 2.3 Appendix 2D	- Section 2.3.3 indicates Bacteria for wet and dry weather as Highest Priority - Appendix 2D indicates bacteria at SLR River mouth (in Attachment E) for wet and dry weather, and in Lower SLR River west of 15 (not in Attachment E) for wet and dry weather are Highest Priority Water Quality Conditions	
B.2.c.(2)	Did the Copermittees provide a rationale for selecting a subset of the conditions identified in B.2.c.(1)?	Y	Section 2.3 Appendix 2D		

PROVISION B.2: PRIORITY WATER QUALITY CONDITIONS

Provision B.2.d: Identification of MS4 Pollutant Sources and/or Stressors

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
B.2.d	Did the Copermittees identify and prioritize known and suspected sources of storm water and non-storm water pollutants and/or other stressors that cause or contribute to the high priority conditions?	Y	Section 2.4	- Table 2-20 ranks bacteria sources for dry and wet weather - Section 2.4.4.3 states SSOs, leaking sewer pipes, homeless, and leaking septic systems has highest rated potential sources - Table 2-20 also has RVs, illegal discharges and illicit connections, dumpsters, trash cans in top 10 or 11 for wet and dry	
B.2.d	Did the Copermittees consider:				
B.2.d.(1)(a)	Each Copermittee's inventory of construction sites, industrial facilities, and areas of existing development?	Y	Section 2.4.1 & 2.4.1.1 Tables 2-14 to 2-16		
B.2.d.(1)(b)	Publicly owned parks and/or recreational areas?	Y	Section 2.4.1.2 Table 2-14		
B.2.d.(1)(c)	Open space areas?	Y	Section 2.4.1.2 Table 2-14		
B.2.d.(1)(d)	All currently operating or closed municipal landfills or other facilities for municipal waste?	Y	Section 2.4.1.3 Table 2-17		
B.2.d.(1)(e)	Areas not within the Copermittees' jurisdiction (Phase II, tribal, state, federal)?	Y	Section 2.4.1.4 Figure 2-11		
B.2.d.(2)(a)	Locations of Copermittees' MS4 outfall that discharge to receiving waters?	Y	Section 2.4.2 Figure 2-5		
B.2.d.(2)(b)	Locations of major structural controls (e.g. retention basins, detention basins, infiltration devices, etc.)?	Y	Section 2.4.2 Figure 2-5		
B.2.d.(3)(a)	Other MS4 outfalls (e.g. Phase II and Caltrans)?	Y	Section 2.4.3 Table 2-18		
B.2.d.(3)(b)	Other NPDES permitted discharges?	Y	Section 2.4.3 Table 2-18		
B.2.d.(3)(c)	Other point sources (e.g. private outfalls)?	Y	Section 2.4.3 Table 2-18		
B.2.d.(3)(d)	Other non-point sources (e.g. ag, wildlife/natural)?	Y	Section 2.4.3 Table 2-18		
B.2.d.(4)(a)	Findings from Copermittees' ICID programs?	Y	Section 2.4.4.1 Table 2-19		
B.2.d.(4)(b)	Findings from Copermittees' Outfall monitoring?	Y	Section 2.4.4.2	LTEA states single family residential may contribute to bacteria exceedances	
B.2.d.(4)(c)	Findings from Copermittees' RW monitoring?	Y	Section 2.4.4.2	LTEA states single family residential may contribute to bacteria exceedances	
B.2.d.(4)(d)	Findings from MS4 outfall and RW assessments?	Y	Section 2.4.4.2	LTEA states single family residential may contribute to bacteria exceedances	
B.2.d.(4)(e)	Other available, relevant, and appropriately collected data, information, or studies?	Y	Section 2.4.4.3 Table 2-20	Table 2-20 ranks bacteria sources for dry and wet weather	
B.2.d.(5)	Adequacy of available data to identify and prioritize sources and/or stressors?	Y	Section 2.4.5		

PROVISION B.2: PRIORITY WATER QUALITY CONDITIONS

Provision B.2.e: Identification of Potential Water Quality Improvement Strategies

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution

B.2.e	Did the Copermittees identify potential strategies based on findings from Provisions B.2.a-d to address highest priority conditions from Provision B.2.c, or MS4 pollutant sources or stressors from Provision B.2.d?	Y	Appendix 3A		
B.2.e	Do potential strategies to address highest priority conditions from Provision B.2.c, or MS4 pollutant sources or stressors from Provision B.2.d include:				
B.2.e.(1)	Structural BMPs, non-structural BMPs, incentives, or programs that can potentially be implemented?	Y	Appendix 3A		
B.2.b.(2)	Retrofitting projects in areas of existing development?	Y	Appendix 3A		
B.2.b.(3)	Stream, channel, and/or habitat rehabilitation projects?	Y	Appendix 3A		

PROVISION B.3: WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES

Provision B.3.a: Water Quality Improvement Goals and Schedules

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
Numeric Goals					
B.3.a.(1)	Did the Copermittees establish numeric goals that meet the following:				
B.3.a.(1)(a)	**Final numeric goals** capable of demonstrating: (i) MS4 discharges will not cause or contribute to exceedances in RWs; AND/OR (ii) Conditions in RWs and associated habitat are protected from MS4 discharges; AND/OR (iii) Beneficial uses of RWs are protected from MS4 discharges and will be supported.	N	Table 3-3	- Table 3-3 Final Compliance Pathways 1, 3, and 4 based on Beaches and Creek TMDL interim WQBELs and compliance determination. - Looks like final numeric goals apply to just SLR River mouth, or also to Lower SLR River. If only SLR River Mouth, need final numeric goals for Lower SLR River. Based on monitoring and assessment data collection, does not look like there is monitoring in Lower SLR River.	Watershed Goals have been developed for the TMDL Compliance Point at the Pacific Ocean Shoreline (i.e., River Mouth) and for the Lower San Luis Rey River. See Tables 3-4, 3-5, 3-6, and 3-7.
B.3.b.(1)(b)	**Interim numeric goals** capable of demonstrating incremental progress that meet the following:				
B.3.b.(1)(b)(i)	One or more interim numeric goals to demonstrate progress toward achieving each final numeric goal	N	Table 3-3	- Table 3-2 Interim Compliance Pathways 1, 3, and 4 based on Beaches and Creek TMDL interim WQBELs and compliance determination. - Looks like interim numeric goals apply to just SLR River mouth. Do they also apply to Lower SLR River? If only SLR River Mouth, need final numeric goals for Lower SLR River. Based on monitoring and assessment data collection, does not look like there is monitoring in Lower SLR River.	Watershed Goals have been developed for the TMDL Compliance Point at the Pacific Ocean Shoreline (i.e., River Mouth) and for the Lower San Luis Rey River. See Tables 3-4, 3-5, 3-6, and 3-7. The goals within the Lower SLR are based on improvements at MS4 outfalls and will be measured through MS4 outfall monitoring programs implemented by the Participating Agencies.
B.3.b.(1)(b)(ii)	At least one interim numeric goal expressed as a reasonable increment of final numeric goal	N	Table 3-3	- Table 3-2 Interim Compliance Pathways 1, 3, and 4 based on Beaches and Creek TMDL interim WQBELs and compliance determination. - Looks like interim numeric goals apply to just SLR River mouth. Do they also apply to Lower SLR River? If only SLR River Mouth, need final numeric goals for Lower SLR River. Based on monitoring and assessment data collection, does not look like there is monitoring in Lower SLR River.	
B.3.b.(1)(b)(iii)	At least one interim numeric goal for each 5 year period between acceptance of Plan and achievement of each final numeric goal	N	Table 3-3	- Table 3-2 Interim Compliance Pathways 1, 3, and 4 based on Beaches and Creek TMDL interim WQBELs and compliance determination. - Looks like interim numeric goals apply to just SLR River mouth. Do they also apply to Lower SLR River? If only SLR River Mouth, need final numeric goals for Lower SLR River. Based on monitoring and assessment data collection, does not look like there is monitoring in Lower SLR River.	
Schedules for Final and Interim Numeric Goals					
B.3.a.(2)	Did the Copermittees incorporate schedules for achieving numeric goals that meet the following:				
B.3.a.(2)(a)	Dates for achieving all final numeric goals based on:				

B.3.a.(2)(a)(i)		N	Table 3-10	- Table 3-10 Proposed Compliance Dates for dry weather based on Beaches and Creeks TMDLs. - Table 3-10 Proposed Compliance Dates for wet weather based on Beaches and Creeks TMDLs for CLRP. Plan does not include quantified load reductions for pollutants other than bacteria, so Plan is only a BLRP. Final compliance date must be April 4, 2021 for wet weather unless Plan includes quantified load reductions for other pollutants. - Not clear if proposed compliance dates also applicable to Lower SLR River. Lower SLR River may have 10 or 20 years from date of Plan acceptance since Lower SLR River not listed in Table 6.0 in Attachment E.	Chapter 3, Appendices 3C, 3D, 3E, and 3G have been updated to include estimated load reductions for total nitrogen and total phosphorous for various control measures. This constitutes a "comprehensive" plan and justifies the 20 year wet weather compliance timeframe.
B.3.a.(2)(a)(ii)		N/A		No applicable ASBS in this WMA	
B.3.a.(2)(a)(iii)	Achievement of final numeric goals must be as soon as possible	Y ?	Table 3-10	- Assume requirement met because schedule based on TMDL compliance schedule requirements - Not clear if proposed compliance dates also applicable to Lower SLR River. Lower SLR River may have 10 or 20 years from date of Plan acceptance since Lower SLR River not listed in Table 6.0 in Attachment E.	Watershed Goals and schedules have been developed for the TMDL Compliance Point at the Pacific Ocean Shoreline (i.e., River Mouth) and for the Lower San Luis Rey River. See Tables 3-4, 3-5, 3-6, and 3-7.
B.3.a.(2)(a)(iv)	Achievement of final numeric goals must reflect a realistic assessment of shortest practicable time based on temporal and spatial extent and time reasonably required to implement strategies	Y ?	Table 3-10	- Assume requirement met because schedule based on TMDL compliance schedule requirements - Not clear if proposed compliance dates also applicable to Lower SLR River. Lower SLR River may have 10 or 20 years from date of Plan acceptance since Lower SLR River not listed in Table 6.0 in Attachment E.	
B.3.a.(2)(b)	**Dates for achieving all interim numeric goals** based on:				
B.3.a.(2)(b)(i)	Interim compliance dates of applicable TMDLs	Y		Attachment E allows alternative interim compliance date to be proposed.	
B.3.a.(2)(b)(ii)	ASBS compliance schedules	N/A		No applicable ASBS in this WMA	
B.3.a.(2)(b)(iii)	Achievement of interim numeric goals must reflect a realistic assessment of shortest practicable time based on time reasonably required to implement new programs and secure funding	Y		- Attachment E allows alternative interim compliance date to be proposed. - Assume requirement met because schedule based on TMDL compliance schedule requirements	
B.3.a.(2)(b)(iv)	For each final numeric goal, at least one interim numeric goal within term of Order	Y	Tables 3-4 to 3-9	Interim numeric Jurisdictional Goals are provided for term of Order	

PROVISION B.3: WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES

Provision B.3.b: Water Quality Improvement Strategies and Schedules

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
Watershed Management Area Strategies					
B.3.b.(2)	Did the Copermittees identify **Optional Regional or Multi-Jurisdictional Strategies** to be implemented, as necessary?	N	Table 3-18	- Several strategies in Table 3-18 appear to be regional or multi- jurisdictional, but not worded as strategies to be implemented, but are preparation for implementation. "Coordinate", "Promote", "Investigate", Develop "Plan" or "Handbook" are not implementation strategies - Several strategies in Table 3-18 appear to be only within one jurisdiction, so not Watershed Management Area strategy	New Optional Watershed Strategies table developed and inserted as Table 3-16. Language and strategies improved to meet permit requirements.
B.3.b.(2)	Do descriptions of **Optional Regional or Multi-Jurisdictional Strategies** include the following:				
B.3.b.(2)(a)	BMPs, incentives, or programs that may be implemented by Copermittees in the WMA	N	Table 3-18	- Several strategies in Table 3-18 appear to be regional or multi- jurisdictional, but not worded as strategies to be implemented, but are preparation for implementation. "Coordinate", "Promote", "Investigate", Develop "Plan" or "Handbook" are not implementation strategies - Several strategies in Table 3-18 appear to be only within one jurisdiction, so not Watershed Management Area strategy	New Optional Watershed Strategies table developed and inserted as Table 3-16. Language and strategies improved to meet permit requirements.
B.3.b.(2)(b)	Incentives or programs that may be implemented by Copermittees in the WMA to encourage or implement regional or multi-jurisdictional projects to retrofit areas of existing development	N	Table 3-18	- Rain barrel incentive program could qualify if it was more than just "promote". Replace "promote" with "implement". - What about Alternative Compliance Program?	
B.3.b.(2)(c)	Incentives or programs that may be implemented by Copermittees in the WMA to encourage or implement regional or multi-jurisdictional projects to rehabilitate channels, streams or habitats in WMA	N	Table 3-18	- No incentives or programs listed in Table 3-18 that could qualify - What about Alternative Compliance Program?	

B.3.b.(2)(d)	Funds and/or resources that must be secured to implement optional strategies from (a)-©	N	Table 3-18	- No qualified Watershed Management Area strategies listed in Table 3-18. If qualified strategies listed for future, need to provide info about funds and/or resources that must be secured to implement. - Assumed Implementation Timeframe of FY15-16 or Current funding and resources already secured. If strategy being implemented or ready to be implemented upon Plan acceptance, Plan should state funds and/or resources already secured.	
B.3.b.(2)(e)	Circumstances necessary to trigger implementation of optional regional or multi-jurisdictional strategies to achieve numeric goals within schedules	N	Table 3-18	- No qualified Watershed Management Area strategies listed in Table 3-18. If qualified strategies listed for future, need to provide info about circumstances necessary to trigger implementation. - Assumed Implementation Timeframe of FY15-16 or Current funding and resources already triggered. If strategy being implemented or ready to be implemented upon Plan acceptance, Plan should state funds and/or resources already secured.	
Schedules for Watershed Management Area Strategies					
B.3.b.(3)(b)	Did the Copermittee incorporate schedules that specify the following:				
B.3.b.(3)(b)(i)	For each **<u>Optional Regional or Multi-Jurisdictional Strategy</u>**, a realistic assessment of shortest practicable time to: [a] Secure resources to fund strategy [b] Procure resources, materials, labor, permits necessary to initiate strategy	N	Unable to locate		New Optional Watershed Strategies table developed and inserted as Table 3-16. Language and strategies improved to meet permit requirements. Specific information added to address implementation timeframe, triggers for implementation, and resources needed.
B.3.b.(3)(a)(ii)	If **<u>Optional Regional or Multi-Jurisdictional Strategy</u>** is expected to be continuously implemented, or completed within a schedule	N	Unable to locate		
B.3.b.(3)(a)(v)	If **<u>Optional Regional or Multi-Jurisdictional Strategy</u>** is expected to be completed within a schedule, the anticipated time to complete based on realistic assessment	N	Unable to locate		

PROVISION B.3: WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES

Provision B.3.b: Water Quality Improvement Strategies and Schedules

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
Optional Watershed Management Area Analysis					
B.3.b.(4)(a)	Did the Copermittees perform a Watershed Management Area (WMAA) analysis?	Y	Section 3.3 Appendix 3H		
B.3.b.(4)(a)	Does the WMAA include the following:				
B.3.b.(4)(a)(i)	A description of dominant hydrological processes	Y	Appx 3H, Section 2.1		
B.3.b.(4)(a)(ii)	A description of existing streams in the watershed, including bed material and composition, and if perennial or ephemeral	Y	Appx 3H, Section 2.2		
B.3.b.(4)(a)(iii)	Current and anticipated land uses	Y	Appx 3H, Section 2.3		
B.3.b.(4)(a)(iv)	Potential coarse sediment yield areas	Y	Appx 3H, Section 2.4		
B.3.b.(4)(a)(v)	Locations of existing flood control and channel structures	Y	Appx 3H, Section 2.5		
B.3.b.(4)(b)	If the Copermittees performed a WMAA, did the Copermittees identify and compile a list of candidate projects?	N	Section 3.3.1 Appx 3H Unable to locate list	List of candidate projects required for San Diego Water Board to accept WMAA	Project list added as new Appendix 3I.
B.3.b.(4)(c)	If the Copermittees performed a WMAA, did the Copermittees identify areas within the WMA where it is appropriate to allow PDPs to be exempt from hydromod BMP requirements with supporting rationale?	Y	Section 3.3.2 Appendix I, Section 4	Proposed exemptions for “Existing underground storm drains or concrete-lined channels discharging directly to the recommended exempt reach of the San Luis Rey River” is not acceptable until the following text is removed “These systems may not represent all discharges to exempt bodies or river. Additional system may be considered exempt if there is no evidence of erosion at the storm drain outfall of the conveyance system and any other criteria determined by the local jurisdiction.”	Language modified in Section 3.3.2 for clarity.

PROVISION B.4: WATER QUALITY IMPROVEMENT MONITORING AND ASSESSMENT PROGRAM

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution

B.4.a	Did the Copermittees develop and incorporate an integrated monitoring and assessment program into the Water Quality Improvement Plan? 1) Progress toward achieving numeric goals and schedules 2) Progress toward addressing highest priority condition of WMA 3) Each Copermittee's efforts to implement Plan	N	Section 4 Appendix 4A	- Table 4A-2 Compliance Pathway 1 refers to Section 4.1.1.3 from Bacteria TMDL Monitoring Program, but no Section 4.1.1.3. TMDL Monitoring discussed in Section 4.1.2.4. - TMDL Monitoring only measures bacteria at AB411 location for compliance point. - Receiving water monitoring only at SLR-MLS station. Need at least one SLR-TWAS station to demonstrate Lower SLR River interim and final numeric goals being met. - Table 4-3 and Appx 4A Table 4A-3 list jurisdictional data collection	Reference in Table 4-2 has been updated. Lower SLR goals are based on improvements at MS4 outfalls and do not require monitoring in the receiving water to demonstrate progress.
B.4.a	Does the monitoring and assessment program incorporate the monitoring and assessment requirements of Provision D?	Y	Section 4 Appendix 4A	Minimum monitoring and assessment requirements from Provision D appear to be described.	
B.4.a	If applicable, does the monitoring and assessment program incorporate the specific monitoring and assessment requirements of applicable TMDLs in Attachment E	Y	Section 4 Appendix 4A Attachment 4A-3	San Luis Rey Watershed Bacteria TMDL Monitoring Plan	
B.4.a	If applicable, does the monitoring and assessment program incorporate the ASBS monitoring requirements in Attachment B to State Water Board Resolution No. 2012-0012?	N/A		No applicable ASBS in this WMA	

PROVISION B.3: WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES

Provision B.3.a: Water Quality Improvement Goals and Schedules

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
CITY OF OCEANSIDE					
Jurisdictional Strategies					
B.3.b.(1)(a)	Did each Copermittee identify Jurisdictional Strategies to be implemented under Provisions E.2 through E.7, including descriptions of the following:				
B.3.b.(1)(a)(i)	For inventories required to be developed for the jurisdiction, identify known or suspected areas or sources causing or contributing to highest priority	Y	Table 2-20 Section 2.4.4.3	- Table 2-20 ranks bacteria sources for dry and wet weather - Section 2.4.4.3 states SSOs, leaking sewer pipes, homeless, and leaking septic systems has highest rated potential sources - Table 2-20 also has RVs, illegal discharges and illicit connections, dumpsters, trash cans in top 10 or 11 for wet and dry	
B.3.b.(1)(a)(ii)	BMPs Copermittee will implement, or require to be implemented, as applicable, for those areas or sources	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	- Sections 3.1.3.1 and 3.2.6.2 discusses strategies, but does not specify what BMPs will be implemented or required to be implemented by the City as part of the requirements under Provisions E.2 to E.7 to address SSOs, leaking sewer pipes, homeless, and leaking septic systems. These sources seem to be primarily ICID and existing development issues. - Table 3B.1 lacks specific BMPs Copermittee will implement or require to be implemented to address bacteria from SSOs, leaking sewer pipes, homeless, and leaking septic systems in the ICID section (Table 3B.1-1) or Existing Development section (Table 3B.1-4. - Table 3B.1-1 includes locating, identifying and reporting septic systems, but does not specify the BMPs that will be implemented to address septic systems. - Table 3B.1-1 includes implementing practices and procedures to prevent and address spills and sewer seepage to MS4, but does not specify what the practices (BMPs) are. - Table 3B.1-4 does not include any strategies to address high priority areas and sources. Septic systems are in existing development.	New text inserted into Chapter 3, Section 3.2.2.4 to link BMPs to priority sources. Minimum BMP tables added as new Appendix 3J. Sources and pollutants added to all strategy tables in Chapter 3 and Appendix 3B to demonstrate linkage between strategies, sources, and pollutants. Language improved in all strategies to be more committal. With respect to septic systems, Oceanside is not authorized to inspect septic systems, these are referred to SD County, DEH.
B.3.b.(1)(a)(iii)	Education programs that will be implemented, as applicable for those areas or sources	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	- No public education and participation strategies specific to bacteria for highest priority areas or source	Added sources/pollutants columns into Appendix 3B tables; modified specific strategies/BMPs as appropriate. Appendix 3B and Section 3.2.6.2.
B.3.b.(1)(a)(iv)	Frequencies inspections will be conducted on those areas or sources	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	- No inspection frequencies specific to bacteria for SSOs, leaking sewer pipes, homeless, and leaking septic systems - Table 3B.1-1 does not include any strategies that include inspecting sewer lines - Table 3B.1-4 includes strategy to inspect existing development, but based on permit requirements, and no information specific to inspecting existing development for properly functioning septic systems	Updated text in Section 3.2.6.2 and Appendix 3B. Sewer line inspection written in narrative and optional strategies table with a scheduled timeline (CCTV of VCP lines). Oceanside is not authorized to inspect septic systems, these are referred to SD County, DEH.
B.3.b.(1)(a)(v)	Incentive and enforcement programs that will be implemented, as applicable, for those areas and sources	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	- No incentive or enforcement programs specific to bacteria for SSOs, leaking sewer pipes, homeless, and leaking septic systems related to requirements under Provisions E.2 to E.7	There is no permit requirement to provide incentive programs for all sources. Oceanside has provided incentive program text for irrigation systems and landscaping. Enforcement will be conducted per the City's Enforcement Response Plan shown in the JRMP.
B.3.b.(1)(a)(vi)	Any other BMPs, incentives, or programs that will be implemented for those areas or sources	Y	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	- Table 3B.1-5 lists optional strategies for septic system rebate program and homeless outreach program only "if needed and funding available." Seems like if homeless and septic systems are highest priority sources, these are needed and should not be TBD.	
Optional Jurisdictional Strategies					
B.3.b.(1)(b)	Did each Copermittee identify Optional Jurisdictional Strategies to be implemented as necessary when Jurisdictional Strategies not making adequate progress, with descriptions that include the following:				
B.3.b.(1)(b)(i)	BMPs, incentives, or programs the Copermittee may implement in addition to Provision B.3.b.(1)(a) strategies	Y	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Table 3B.1-5 lists optional strategies for septic system rebate program and homeless outreach program only "if needed and funding available." Seems like if homeless and septic systems are highest priority sources, these are needed and should not be TBD.	

B.3.b.(1)(b)(ii)	Incentives or programs the Copermittee may implement to encourage or implement projects to retrofit areas of existing development	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	- Table 3B.1-2 includes "Consider implementation of alternative compliance program" but "consider" not a strategy that can result in K112retrofits or improve water quality. - Table 3B.1-.4 includes "Develop a strategy to identify opportunities and facilitate the implementation of retrofit project." "Develop a strategy to identify" is not a strategy that can result in retrofits or improve water quality.	New Table 3-15, Optional Jurisdictional Strategies. Language updated in new table and in Appendix 3B to be more committal. Specific columns added for optional strategies to address timing, triggers, and resources.
B.3.b.(1)(b)(iii)	Incentives or programs the Copermittee may implement to encourage or implement projects to rehabilitate channels or habitats	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Table 3B.1-2 includes "Consider implementation of alternative compliance program" but "consider" not a strategy that can result in rehabilitation projects or improve water quality.	
B.3.b.(1)(b)(iv)	The funds and/or resources that must be secured to implement optional strategies from (i)-(iii)	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Table 3B.1-5 lists optional strategies for septic system rebate program and homeless outreach program only "if needed and funding available." No information about funding or resources that must be secured to implement.	
B.3.b.(1)(b)(v)	Circumstances necessary to trigger implementation of optional strategies in addition to Provision B.3.b.(1)(a) strategies	Y	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Table 3B.1-5 lists optional strategies for septic system rebate program and homeless outreach program only "if needed and funding available." Seems like if homeless and septic systems are highest priority sources, these are needed and should not be TBD.	
Jurisdictional Cooperation/Coordination Strategies					
B.3.b.(1)(c)	Did **each** Copermittee identify strategies that will be implemented in coordination with or with the cooperation of other agencies and/or entities?	Y	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Table 3B.1-5 lists optional strategies for homeless outreach program "in conjunction with local resource agencies."	
Schedules for Jurisdictional Strategies					
B.3.b.(3)(a)	Did **each** Copermittee incorporate schedules that specify the following:				
B.3.b.(3)(a)(i)	If each **Jurisdictional Strategy** will or will not be initiated upon acceptance of Plan	Y	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	All strategies have Implementation Timeframe of Current or FY15-16	
B.3.b.(3)(a)(ii)	If not initiated upon acceptance, shortest practicable time **Jurisdictional Strategy** will be initiated	Y	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Assuming all strategies with Implementation Timeframe of Current or FY15-16 are initiated upon acceptance	
B.3.b.(3)(a)(iii)	For each **Optional Jurisdictional Strategy**, a realistic assessment of shortest practicable time to: [a] Secure resources to fund strategy [b] Procure resources, materials, labor, permits necessary to initiate strategy	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Table 3B.1-5 lists optional strategies with Implementation Timeframe of TBD. No assessment of time to secure and procure funding and resources.	New Table 3-15, Optional Jurisdictional Strategies. Optional strategies updated to meet permit requirements. Specific information added to address timeframes and implementation schedules. Language in 3.1.5 and 3.2.6.2 updated.
B.3.b.(3)(a)(iv)	If **Jurisdictional Strategy** or **Optional Jurisdictional Strategy** is expected to be continuously implemented, or completed within a schedule	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	- All strategies in Table 3B.1-1 to 3B.1-4 with Frequency that appear to be continuous. - Table 3B.1-5 lists optional strategies with Frequency of N/A. If optional strategies are implemented, need to have information about if it will be continuously implemented or completed within a schedule.	
B.3.b.(3)(a)(v)	If **Jurisdictional Strategy** or **Optional Jurisdictional Strategy** is expected to be completed within a schedule, the anticipated time to complete based on realistic assessment	N	Section 3.1.3.1 Section 3.2.6.2 Appendix 3B Table 3B.1	Table 3B.1-5 lists optional strategies with Frequency of N/A. If optional strategies can be completed within a schedule, need information about anticipated time to complete.	

PROVISION B.3: WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES

Provision B.3.b: Water Quality Improvement Strategies and Schedules

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
CITY OF VISTA					
Jurisdictional Strategies					
B.3.b.(1)(a)	Did **each** Copermittee identify **Jurisdictional Strategies** to be implemented under Provisions E.2 through E.7, including descriptions of the following:				
B.3.b.(1)(a)(i)	For inventories required to be developed for the jurisdiction, identify known or suspected areas or sources causing or contributing to highest priority	Y	Table 2-20 Section 2.4.4.3	- Table 2-20 ranks bacteria sources for dry and wet weather - Section 2.4.4.3 states SSOs, leaking sewer pipes, homeless, and leaking septic systems has highest rated potential sources - Table 2-20 also has RVs, illegal discharges and illicit connections, dumpsters, trash cans in top 10 or 11 for wet and dry	
B.3.b.(1)(a)(ii)	BMPs Copermittee will implement, or require to be implemented, as applicable, for those areas or sources	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	- Sections 3.1.3.2 and 3.2.6.3 do not discuss what BMPs will be implemented or required to be implemented by the City as part of the requirements under Provisions E.2 to E.7 to address SSOs, leaking sewer pipes, homeless, and leaking septic systems. - Table 3B.2-1 includes investigating locations of septic systems and eliminating ICID program to address septic systems. - Table 3B.2-1 includes implementing practices and procedures to prevent and address spills and sewer seepage to MS4, but does not specify what the practices (BMPs) are. - Table 3B.2-4 includes "investigating feasibility" strategies for private laterals, but "investigating feasibility" is not a strategy that can address private laterals or result in improved water quality.	New text inserted into Chapter 3, Section 3.2.2.4 to link BMPs to priority sources. Minimum BMP tables added as new Appendix 3J. Sources and pollutants added to all strategy tables in Chapter 3 and Appendix 3B to demonstrate linkage between strategies, sources, and pollutants. Language improved in all strategies to be more committal.
B.3.b.(1)(a)(iii)		N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	- No public education and participation strategies specific to bacteria for highest priority areas or sources	Added sources/pollutants columns into Appendix 3B tables; modified specific strategies/BMPs as appropriate. Appendix 3B and Section 3.2.6.3.
B.3.b.(1)(a)(iv)		N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	- No inspection frequencies specific to bacteria for SSOs, leaking sewer pipes, homeless, and leaking septic systems - Table 3B.2-1 does not include any strategies that include inspecting sewer lines - Table 3B.2-4 includes strategy to inspect existing development, but based on permit requirements, and no information specific to inspecting existing development for properly functioning septic systems or private laterals	Updated text in Section 3.2.6.3 and Appendix 3B.
B.3.b.(1)(a)(v)		N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	- No incentive or enforcement programs specific to bacteria for SSOs, leaking sewer pipes, homeless, and leaking septic systems related to requirements under Provisions E.2 to E.7	Included pertinent language in the following strategies IDDE 7—Septic; IDDE 10—Sanitary Sewer; IDDE 16—Illicit Discharges and Connections; and IDDE 17—Enforcement Response Plan. The permit does not specify that agencies have both incentive and enforcement programs. Rather, the permit language offers copermittees some discretion in developing programs that will most effectively meet its requirements by including an applicability allowance, e.g., "incentive and enforcement programs that each Copermittee will implement, **as applicable**, for those areas or sources in its jurisdiction...." Also, the septic, sewer, and homeless elements do not fall under the immediate purview of the stormwater program but are addressed through its illicit discharge and detection program, which protects the MS4 through detecting, eliminating, and enforcing illegal discharges and illicit connections.

B.3.b.(1)(a)(vi)		Y	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2		
Optional Jurisdictional Strategies					
B.3.b.(1)(b)	Did **each** Copermittee identify **Optional Jurisdictional Strategies** to be implemented as necessary when Jurisdictional Strategies not making adequate progress, with descriptions that include the following:				
B.3.b.(1)(b)(i)	BMPs, incentives, or programs the Copermittee may implement in addition to Provision B.3.b.(1)(a) strategies	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	All strategies in Table 3B.2 appear to be related to Provision E.2 to E.7 requirements. Nothing appears to qualify as optional jurisdictional strategies. Several "investigating" strategies, but "investigating" is not a strategy that results in improved water quality.	New Table 3-15, Optional Jurisdictional Strategies. Language updated in new table and in Appendix 3B to be more committal. Specific columns added for optional strategies to address timing, triggers, and resources.
B.3.b.(1)(b)(ii)	Incentives or programs the Copermittee may implement to encourage or implement projects to retrofit areas of existing development	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	Table 3B.2-2 includes "Consider implementation of alternative compliance program" but "consider" not a strategy that can result in retrofit projects or improve water quality.	
B.3.b.(1)(b)(iii)	Incentives or programs the Copermittee may implement to encourage or implement projects to rehabilitate channels or habitats	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	Table 3B.2-2 includes "Consider implementation of alternative compliance program" but "consider" not a strategy that can result in rehabilitation projects or improve water quality.	
B.3.b.(1)(b)(iv)	The funds and/or resources that must be secured to implement optional strategies from (i)-(iii)	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	All strategies in Table 3B.2 appear to be related to Provision E.2 to E.7 requirements. Nothing appears to qualify as optional jurisdictional strategies. Several "investigating" strategies, but "investigating" is not a strategy that results in improved water quality.	
B.3.b.(1)(b)(v)	Circumstances necessary to trigger implementation of optional strategies in addition to Provision B.3.b.(1)(a) strategies	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	All strategies in Table 3B.2 appear to be related to Provision E.2 to E.7 requirements. Nothing appears to qualify as optional jurisdictional strategies. Several "investigating" strategies, but "investigating" is not a strategy that results in improved water quality.	
Jurisdictional Cooperation/Coordination Strategies					
B.3.b.(1)(c)	Did **each** Copermittee identify strategies that will be implemented in coordination with or with the cooperation of other agencies and/or entities?	Y	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	Table 3B.2-1 includes coordinating with Vista Irrigation District to identify ICIDs and potable water main breaks.	
Schedules for Jurisdictional Strategies					
B.3.b.(3)(a)	Did **each** Copermittee incorporate schedules that specify the following:				
B.3.b.(3)(a)(i)	If each **Jurisdictional Strategy** will or will not be initiated upon acceptance of Plan	Y	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	All jurisdictional strategies have Implementation Timeframe of Current, FY15-16, or FY16-17	
B.3.b.(3)(a)(ii)	If not initiated upon acceptance, shortest practicable time **Jurisdictional Strategy** will be initiated	Y	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	Assuming all strategies with Implementation Timeframe of Current, FY15-16 or FY16-17 are initiated upon acceptance	
B.3.b.(3)(a)(iii)	For each **Optional Jurisdictional Strategy**, a realistic assessment of shortest practicable time to: [a] Secure resources to fund strategy [b] Procure resources, materials, labor, permits necessary to initiate strategy	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	All strategies in Table 3B.2 appear to be related to Provision E.2 to E.7 requirements. Nothing appears to qualify as optional jurisdictional strategies. Several "investigating" or "consider" strategies, but "investigating" or "consider" is not a strategy that results in improved water quality.	New Table 3-15, Optional Jurisdictional Strategies. Optional strategies updated to meet permit requirements. Language improved to be more committal. Language in 3.1.5 and 3.2.6.3 updated.

B.3.b.(3)(a)(iv)	If **<u>Jurisdictional Strategy</u>** or **<u>Optional Jurisdictional Strategy</u>** is expected to be continuously implemented, or completed within a schedule	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	- Most strategies in Table 3B.2-1 to 3B.2-4 with Frequency that appear to be continuous. - All strategies in Table 3B.2 appear to be related to Provision E.2 to E.7 requirements. Nothing appears to qualify as optional jurisdictional strategies. Several “investigating” or “consider” strategies, but “investigating” or “consider” is not a strategy that results in improved water quality.	
B.3.b.(3)(a)(v)	If **<u>Jurisdictional Strategy</u>** or **<u>Optional Jurisdictional Strategy</u>** is expected to be completed within a schedule, the anticipated time to complete based on realistic assessment	N	Section 3.1.3.2 Section 3.2.6.3 Appendix 3B Table 3B.2	- Strategies in Table 3B.2-1 to 3B.2-4 with Frequency of One Time have no schedule or expected timeframe to complete. - All strategies in Table 3B.2 appear to be related to Provision E.2 to E.7 requirements. Nothing appears to qualify as optional jurisdictional strategies. Several “investigating” or “consider” strategies, but “investigating” or “consider” is not a strategy that results in improved water quality.	

PROVISION B.3: WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES

Provision B.3.b: Water Quality Improvement Strategies and Schedules

Provision	Requirement	Y/N	Location in Plan	Notes	Resolution
COUNTY OF SAN DIEGO					
Jurisdictional Strategies					
B.3.b.(1)(a)	Did **each** Copermittee identify **Jurisdictional Strategies** to be implemented under Provisions E.2 through E.7, including descriptions of the following:				
B.3.b.(1)(a)(i)	For inventories required to be developed for the jurisdiction, identify known or suspected areas or sources causing or contributing to highest priority	Y	Table 2-20 Section 2.4.4.3	- Table 2-20 ranks bacteria sources for dry and wet weather - Section 2.4.4.3 states SSOs, leaking sewer pipes, homeless, and leaking septic systems has highest rated potential sources - Table 2-20 also has RVs, illegal discharges and illicit connections, dumpsters, trash cans in top 10 or 11 for wet and dry	
B.3.b.(1)(a)(ii)	BMPs Copermittee will implement, or require to be implemented, as applicable, for those areas or sources	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	- Sections 3.1.3.2 and 3.2.6.3 do not discuss what BMPs will be implemented or required to be implemented by the City as part of the requirements under Provisions E.2 to E.7 to address SSOs, leaking sewer pipes, homeless, and leaking septic systems. - Table 3B.3-1 includes addressing septic systems failures where observed. - Table 3B.3-1 includes implementing practices and procedures to prevent and address spills and sewer seepage to MS4, but does not specify what the practices (BMPs) are. - Table 3B.1-4 does not include any strategies to address high priority areas and sources. Septic systems are in existing development.	New text inserted into Chapter 3, Section 3.2.2.4 to link BMPs to priority sources. Minimum BMP tables added as new Appendix 3J. Sources and pollutants added to all strategy tables in Chapter 3 and Appendix 3B to demonstrate linkage between strategies, sources, and pollutants. Language improved in all strategies to be more committal.
B.3.b.(1)(a)(iii)	Education programs that will be implemented, as applicable for those areas or sources	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	- No public education and participation strategies specific to bacteria for highest priority areas or sources	Added sources/pollutants columns into Appendix 3B tables; modified specific strategies/BMPs as appropriate. Appendix 3B and Section 3.2.6.1.
B.3.b.(1)(a)(iv)	Frequencies inspections will be conducted on those areas or sources	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	- No inspection frequencies specific to bacteria for SSOs, leaking sewer pipes, homeless, and leaking septic systems - Table 3B.2-1 does not include any strategies that include inspecting sewer lines - Table 3B.2-4 includes strategy to inspect existing development, but no information specific to inspecting existing development for properly functioning septic systems or private laterals or sewer	Updated text in Appendix 3B.
B.3.b.(1)(a)(v)	Incentive and enforcement programs that will be implemented, as applicable, for those areas and sources	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	- No incentive or enforcement programs specific to bacteria for SSOs, leaking sewer pipes, homeless, and leaking septic systems related to requirements under Provisions E.2 to E.7	Updated text in Appendix 3B.
B.3.b.(1)(a)(vi)	Any other BMPs, incentives, or programs that will be implemented for those areas or sources	Y	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3		

Optional Jurisdictional Strategies					
B.3.b.(1)(b)	Did **each** Copermittee identify **Optional Jurisdictional Strategies** to be implemented as necessary when Jurisdictional Strategies not making adequate progress, with descriptions that include the following:				
B.3.b.(1)(b)(i)	BMPs, incentives, or programs the Copermittee may implement in addition to Provision B.3.b.(1)(a) strategies	Y	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Table 3B.3-5 includes implementing the Valley Center Green Street Pilot Project. Several optional "consider" and "investigating" strategies, but "consider" and "investigating" is not a strategy that results in improved water quality.	
B.3.b.(1)(b)(ii)	Incentives or programs the Copermittee may implement to encourage or implement projects to retrofit areas of existing development	Y	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Table 3B.3-5 includes implementing the Valley Center Green Street Pilot Project which is a qualified retrofit project. Several optional "consider" and "investigating" retrofit strategies, but "consider" and "investigating" will not encourage or implement retrofit projects.	
B.3.b.(1)(b)(iii)	Incentives or programs the Copermittee may implement to encourage or implement projects to rehabilitate channels or habitats	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	No qualified optional jurisdictional strategies that are incentives or programs to encourage or implement rehabilitation projects.	New Table 3-15, Optional Jurisdictional Strategies with examples for County; all optional strategies for County included in Appendix 3B. Specific columns added for optional strategies to address timing, triggers, and resources.
B.3.b.(1)(b)(iv)	The funds and/or resources that must be secured to implement optional strategies from (i)-(iii)	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Optional jurisdictional strategies lack information about funds and/or resources that must be secured to implement	
B.3.b.(1)(b)(v)	Circumstances necessary to trigger implementation of optional strategies in addition to Provision B.3.b.(1)(a) strategies	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Optional jurisdictional strategies lack information about circumstances necessary trigger implementation	
Jurisdictional Cooperation/Coordination Strategies					
B.3.b.(1)(c)	Did **each** Copermittee identify strategies that will be implemented in coordination with or with the cooperation of other agencies and/or entities?	Y	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Table 3B.3-1 includes cooperating with I Love a Clean San Diego for hotline.	
Schedules for Jurisdictional Strategies					
B.3.b.(3)(a)	Did **each** Copermittee incorporate schedules that specify the following:				
B.3.b.(3)(a)(i)	If each **Jurisdictional Strategy** will or will not be initiated upon acceptance of Plan	Y	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	All jurisdictional strategies have Implementation Timeframe of Current or FY15-16	
B.3.b.(3)(a)(ii)	If not initiated upon acceptance, shortest practicable time **Jurisdictional Strategy** will be initiated	Y	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Assuming all strategies with Implementation Timeframe of Current, FY15-16 or FY16- Current or FY15-16are initiated upon acceptance	

B.3.b.(3)(a)(iii)	For each **Optional Jurisdictional Strategy**, a realistic assessment of shortest practicable time to: [a] Secure resources to fund strategy [b] Procure resources, materials, labor, permits necessary to initiate strategy	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Table 3B.1-5 lists optional strategies with Implementation Timeframe of TBD. No assessment of time to secure and procure funding and resources.	New Table 3-15, Optional Jurisdictional Strategies. Optional strategies updated to meet permit requirements. Specific information added to address timeframes, frequencies, and implementation schedules. Language in 3.1.5 and 3.2.6.1 updated.
B.3.b.(3)(a)(iv)	If **Jurisdictional Strategy** or **Optional Jurisdictional Strategy** is expected to be continuously implemented, or completed within a schedule	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	- All strategies in Table 3B.3-1 to 3B.3-4 with Frequency that appear to be continuous. - Table 3B.3-5 lists optional strategies with Frequency of TBD. If optional strategies are implemented, need to have information about if it will be continuously implemented or completed within a schedule.	
B.3.b.(3)(a)(v)	If **Jurisdictional Strategy** or **Optional Jurisdictional Strategy** is expected to be completed within a schedule, the anticipated time to complete based on realistic assessment	N	Section 3.1.3.3 Section 3.2.6.1 Appendix 3B Table 3B.3	Table 3B.3-5 lists optional strategies with Frequency of TBD. If optional strategies can be completed within a schedule, need information about anticipated time to complete.	