County of San Diego

SARAH E. AGHASSI
DEPUTY CHIEF ADMINISTRATIVE OFFICER

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December 17, 2014

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

COUNTY OF SAN DIEGO, PERMIT R9-2013-0001, PIN 255223 – INTERIM DELIVERABLE IN RESPONSE TO PROVISION B.3 WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES FOR THE WATER QUALITY IMPROVEMENT PLAN FOR THE SAN LUIS REY RIVER WATERSHED MANAGEMENT AREA

Dear Mr. Gibson:

On behalf of the Participating Agencies (PAs) in the San Luis Rey River Watershed Management Area, the County of San Diego is pleased to submit the attached document in accordance with requirements set forth in Provision F.1.a. (3)(c) of Order R9-2013-0001, the National Pollution Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region, NPDES No. CAS0109266 (Permit).

In order to facilitate regulatory review, a "crosswalk" table is provided at the end of the Executive Summary to indicate where specific permit provisions are addressed in the document. This Section 3 follows the framework of Permit Provision B.3, Water Quality Improvement Goals, Strategies, and Schedules:

- Section 3.1. Introduction
- Section 3.2. Water Quality Improvement Goals and Schedules
- Section 3.3. Water Quality Improvement Strategies and Schedules
- Section 3.4. Optional Watershed Management Area Analysis

We thank your staff for their willingness to provide feedback. We look forward to continued interaction with your staff on development of the Water Quality Improvement Plan for the San Luis Rey River Watershed Management Area.

If you have any questions or comments, please contact LUEG Program Manager, Todd Snyder at (858) 694-3672 or Todd.Snyder@sdcounty.ca.gov, or Jo Ann Weber at (858) 495-5317 or JoAnn.Weber@sdcounty.ca.gov.

Sincerely,

SARAH E. AGHASSI, Deputy Chief Administrative Officer
Land Use and Environment Group

Attachment: San Luis Rey River Water Quality Improvement Plan Provision B.3
(One electronic copy on CD)

cc: Mo Lahsaiezadeh, City of Oceanside, Water Utilities Department (PIN 245793)
Greg Mayer, City of Vista, Engineering Department (PIN 270704)
Bruce L. April, California Department of Transportation, Environmental (PIN 212814)

County of San Diego

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Sarah Aghassi

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Greg Mayer, City of Vista, Engineering Department (PIN 270704)
Bruce L. April, California Department of Transportation, Environmental (PIN 212814)

CITY OF OCEANSIDE
WATER UTILITIES DEPARTMENT

December 5, 2014

Re: San Luis Rey River Watershed Management Area, Water Quality Improvement Plan, Provision B.3 Chapter: 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 — Dec. 2, 2014

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

Date

300 NORTH COAST HIGHWAY • OCEANSIDE, CA 92054 • TELEPHONE 760-435-5800 • FAX 760-435-5821

CITY OF VISTA
CALIFORNIA

December 11, 2014

SAN LUIS REY RIVER WATERSHED MANAGEMENT AREA, WATER QUALITY IMPROVEMENT PLAN PROVISION B.3 CHAPTER, 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

12-11-14
Date

200 Civic Center Drive • Vista, California 92084 • (760) 726-1340 • www.cityofvista.com

DEPARTMENT OF TRANSPORTATION
DISTRICT 11
4050 TAYLOR STREET, M.S. 242
SAN DIEGO, CA 92110
PHONE (619) 688-0100
FAX (619) 688-4237
TTY 711
www.dot.ca.gov

Serious drought.
Help save water!

December 2, 2014

STATEMENT OF CERTIFICATION

SAN LUIS REY RIVER WATERSHED MANAGEMENT AREA, WATER QUALITY IMPROVEMENT PLAN PROVISION B.3 CHAPTER, 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.

BRUCE L. APRIL
Deputy District Director, Environmental

12/4/14
Date

Enclosure

County of San Diego

SARAH E. AGHASSI
DEPUTY CHIEF ADMINISTRATIVE OFFICER

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Sarah Aghassi

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

Date 12/17/14

SAN LUIS REY RIVER

WATERSHED MANAGEMENT AREA

WATER QUALITY IMPROVEMENT PLAN

DRAFT PROVISION B.3 CHAPTER

Submitted by

City of Oceanside
City of Vista
County of San Diego
Caltrans

Prepared by

Geosyntec consultants

engineers | scientists | innovators

Larry Walker Associates

December 17, 2014

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Executive Summary

Water Quality Improvement Goals, Strategies, and Schedules (Section 3)

The SLR Participating Agencies must develop specific water quality improvement goals and strategies to address the water quality conditions identified for the San Luis Rey Watershed (SLR), as defined in the Provision B.2 Chapter of the Water Quality Improvement Plan.

The goals include interim and final numeric (i.e., quantifiable) goals for the highest priority water quality condition (HPWQC), fecal indicator bacteria (bacteria), for wet weather and dry weather in the lower San Luis Rey Watershed. 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 WQIP 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 priority water quality conditions (PWQCs) in the lower San Luis Rey Watershed. The approach to achieving WQIP goals, and corresponding WQIP section, is shown in **Figure ES-1.**

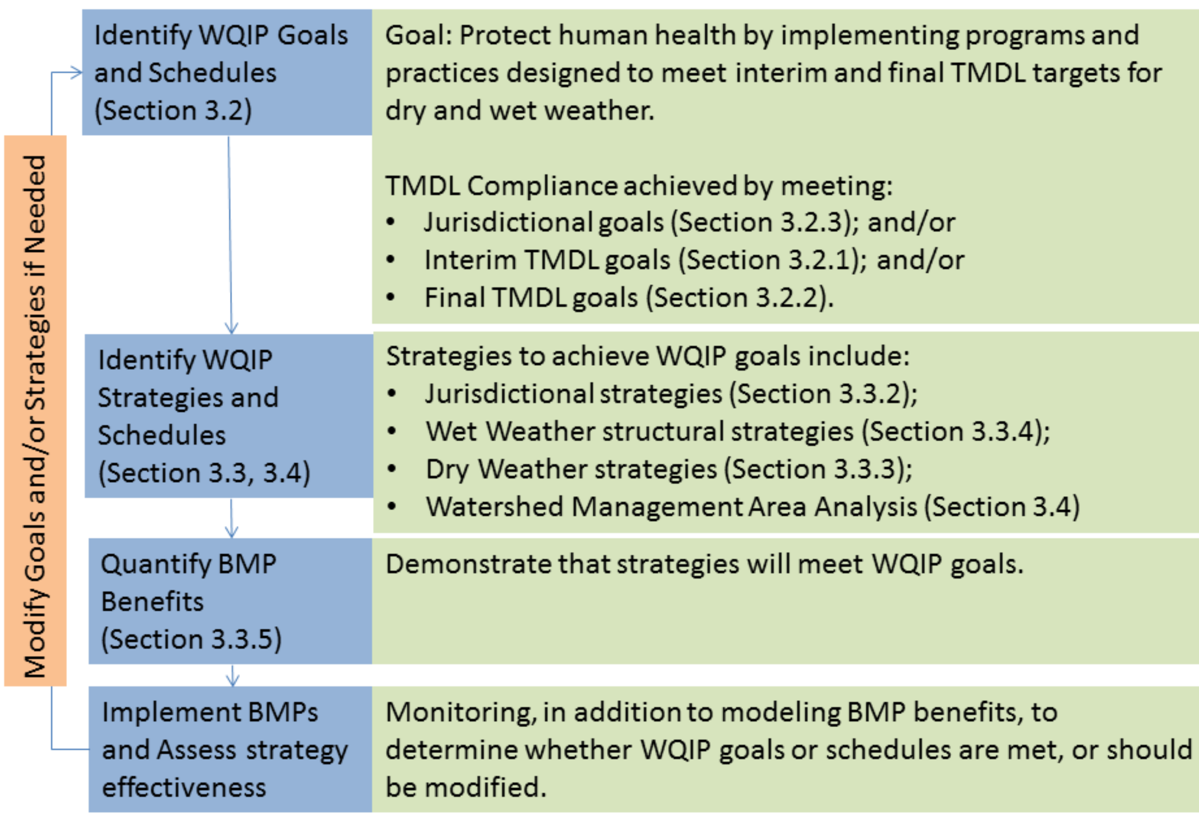

Figure ES-1. Approach for Achieving WQIP Goals

Water Quality Improvement Goals and Schedules (Section 3.2)

The jurisdictional interim and final goals are based on the compliance options for the Bacteria TMDL from Attachment E of the Permit. The goals are presented for dry and wet weather conditions as follows:

- Interim goals include jurisdictional specific goals based on 5-year Permit terms and those based on the Bacteria TMDL schedules to demonstrate progress toward meeting the final goals.
- Final goals are based on final TMDL compliance requirements.

Since the permit allows multiple pathways to be followed to achieve compliance (i.e. demonstration of progress toward all compliance pathways is not required), the numeric goals are independent of each other. The timelines and relationships between the goals are shown in **Figure ES-2.**

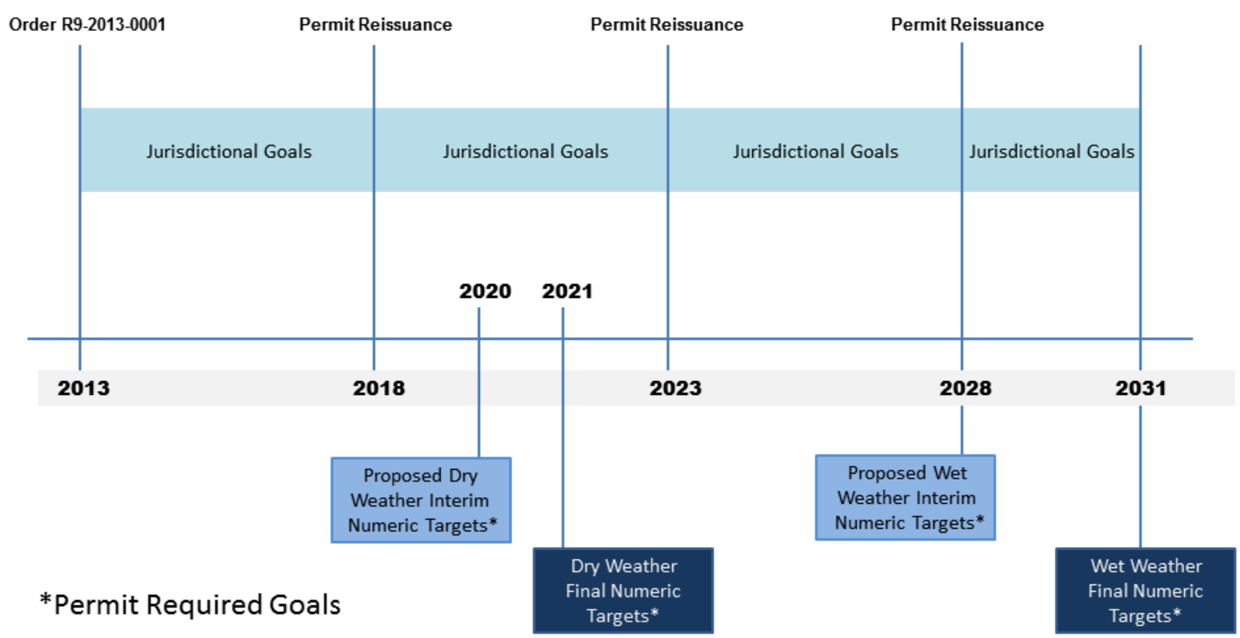

Figure ES-2. Timelines and Relationships between Bacteria TMDL Numeric Targets

Water Quality Improvement Strategies (Section 3.3)

Each jurisdiction has developed its own strategies that will be implemented to work toward its 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.

Strategies were selected for consideration using the following criteria:

- BMP effectiveness, particularly for bacteria reduction, with consideration for the priority water quality conditions;
- Provision of multiple benefits; and
- The degree to which the strategy is sustainable, implementable, and cost-effective.

In order to assess the ability of the proposed strategies to achieve WQIP numeric goals, load reductions expected to result from the implementation of these strategies were estimated for dry and wet weather.

To provide a reasonable assurance, quantitative wet weather load reduction modeling was performed for the structural BMPs to demonstrate that the load reduction target for the SLR watershed management area can be achieved through implementation of this WQIP. The predicted wet weather load reduction is greater than the estimated target load reduction, indicating that WQIP implementation is expected to meet the HPWQC final numeric goal. For dry weather, an analytical spreadsheet approach was used to demonstrate reasonable assurance that compliance wll be reached through implementation of this WQIP. Per the requirements in Attachment E of the Permit, the structural BMPs proposed in the San Luis Rey Comprehensive Load Reduction Reduction Plan (CLRP), or equivalent BMPs, were included in this WQIP.

Optional Watershed Management Area Analysis (Section 3.4)

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. 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 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.

Understanding that development of a WMAA is on a watershed-by-watershed basis 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 WQIPs. Components of the WMAA performed on a regional scale are presented it in Appendix G.

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 section, including the WQIP page number reference. This crosswalk is intended to ease the review process.

Permit Provision		WQIP Section		WQIP Page No.
B.3	Water Quality Improvement Goals, Strategies and Schedules	3.	Water Quality Improvement Goals, Strategies and Schedules	1
B.3.a	Water Quality Improvement Goals and Schedules	3.2	Water Quality Improvement Goals and Schedules	5
B.3.a.(1)	Numeric Goals	3.2.1 3.2.2	Required Interim Goals Required Final Goals	7 8
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B.3.b.(4)	Optional Watershed Management Area Analysis	3.4	Optional Watershed Management Area Analysis	52

3 Water Quality Improvement Goals, Strategies, and Schedules

3.1 Introduction

Provision B.3 of Order R9-2013-0001 (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 (SLR). 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.

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

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

Provision B.3 defines the goals of the WQIP and the strategies and schedules for achieving those goals. The goals include interim and final numeric (i.e., quantifiable) goals for the highest priority water quality condition (HPWQC), fecal indicator bacteria (bacteria), for wet weather and dry weather in the lower San Luis Rey Watershed.

Wet Weather is defined as >0.2" of rain within a 24 hour period and the following 72 hours.

Dry Weather is defined as all other days where rainfall is <0.2" within a given 24 hour period, preceded by 72 hours of no measurable precipitation.

Bacteria are important indicators for recreational beneficial uses. Fecal 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 SLR 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

[1] For example: EPA/600/R-10/168: "Report on the 2009 National Epidemologic 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)

those who recreate in waterbodies receiving runoff from the SLR Watershed by reducing the amount of bacteria discharged to the waterbodies through urban runoff, stormwater, and other sources.

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 Bacteria Reference Study. The 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 fecal indicator 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 fecal indicator 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 within the WQIP 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 priority water quality conditions (PWQCs) in the lower San Luis Rey Watershed. PWQCs and the HPWQC were identified according to the process described in Section 2.3 of the WQIP. 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 Provision B.2 of the WQIP and are presented in **Table 1**.

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

	Dry Weather	Wet Weather
Highest Priority Water Quality Condition	• Bacteria	• Bacteria
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 WQIP Provision B.3 sections noted, is presented in **Figure 1** and will be further discussed in the WQIP Provision B.5 chapter.

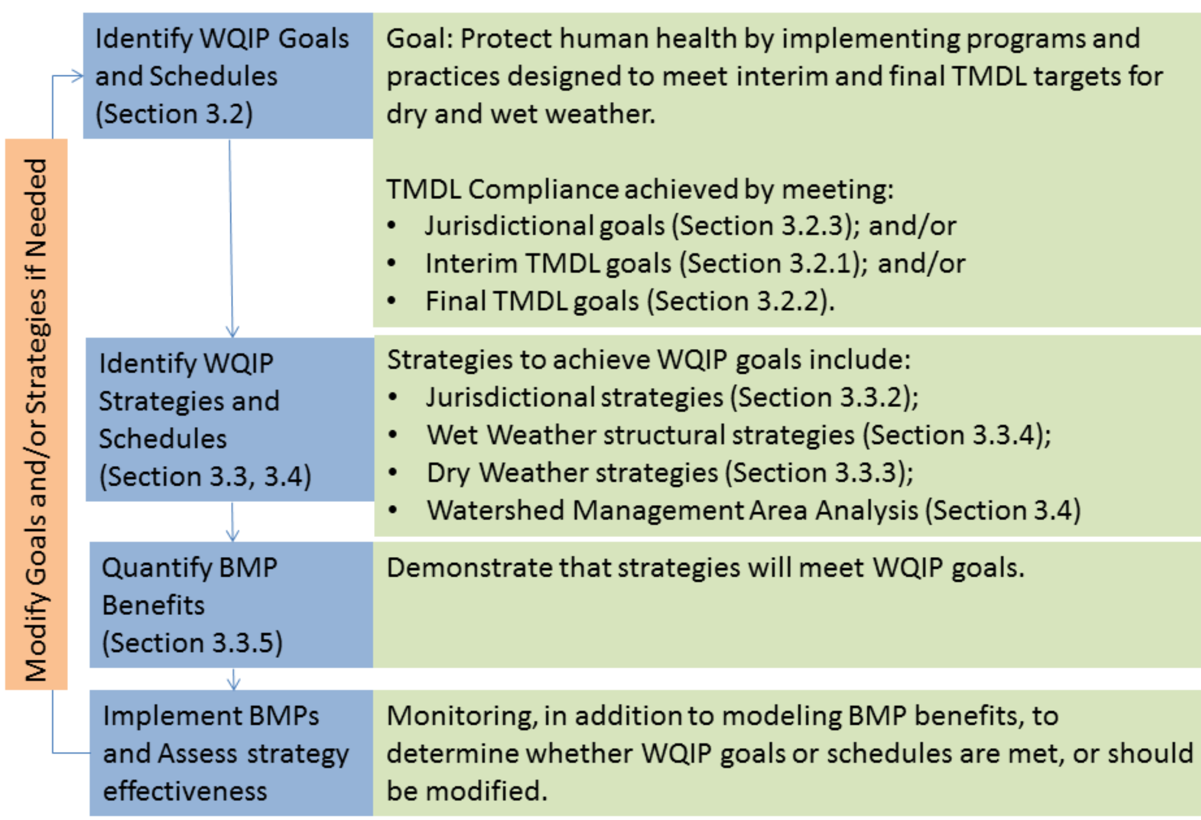

Figure 1. Iterative Approach for Achieving WQIP Goals

3.1.1 *WATER QUALITY IMPROVEMENT PLAN DEVELOPMENT PROCESS*

The WQIP is being developed in three phases. The first phase of WQIP development identified the priority water quality conditions and potential water quality improvement strategies and was summarized in the first WQIP submittal. The process for development of the WQIP is outlined by the diagram below; this chapter addresses the "Develop Goals" and "Develop Strategies" steps of the diagram. This chapter summarizes the second phase of WQIP development and includes:

- Identification of the numeric goals for bacteria in the watershed;
- Strategies that will be implemented to achieve the numeric goals;
- Development of the optional watershed management area analysis; and
- Public participation and involvement.

The third phase of the Water Quality Improvement Plan will include a monitoring and assessment program (Provision B.4) to provide feedback to program managers; and an adaptive management process (Provision B.5) to facilitate modifications to the strategies and schedules to meet the goals as new information becomes available.

3.1.2 *PUBLIC PARTICIPATION*

As required by the Permit, the SLR Participating Agencies are implementing a public participation process to solicit data, information, and recommendations for the development of the WQIP. On September 23, 2013, the SLR 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 and provide comments during the various stages of the WQIP development process. The public workshops were held on October 7, 2013 and on June 24, 2014 at the City of Oceanside Civic Center.

Public comments on the goals and strategies developed as part of the WQIP process were received at the workshops and submitted online. Input received was considered during development of the WQIP. Comments during the public workshop focused on controlling anthropogenic sources of bacteria, education and outreach to address pet waste, and addressing septic system impacts. Responses to public comments will be provided prior to the finalization of the WQIP in June 2015.

The SLR Participating Agencies formed a WQIP Consultation Panel (Panel) to provide recommendations during the development of the WQIP. The Panel consists of representatives from the Regional Water 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 Water Board)
- Julia Escamilla (Environmental Community)
- Tory Walker (Development Community)
- Jeremy Jungreis (Industrial Environmental Association)
- Eric Larson (San Diego County Farm Bureau)

The first Panel meeting was held on January 29, 2014, and the second on August 21, 2014, both at the City of Vista. The SLR Participating Agencies coordinated the schedules for the public participation process among the San Diego County Watershed Management Areas to provide the public time and opportunity to participate during the development of the WQIPs. Feedback received at the workshops, online and at Panel meetings was vital to the development of this WQIP. All comments received were considered during the development of the goals and strategies.

The SLR Participating Agencies transmitted a memorandum to the Panel on October 16, 2014, to solicit their input on the jurisdictional numeric goals (discussed in Section 3.2.3), 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. Additionally, text was added to Section 3.3 to clarify the linkage between the strategies and goals.

3.2 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 highest priority water quality condition [HPWQC] over the course of implementation of the WQIP.

As described in Chapter 2 of this WQIP, bacteria is the HPWQC for dry and wet weather in the lower San Luis Rey watershed. The goals of the WQIP 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 jurisdictional goals based on 5-year Permit terms.
- Interim goals based on the interim Bacteria TMDL compliance pathways.
- Final goals based on final Bacteria TMDL compliance pathways.

The latter two types of goals are already established in Attachment E of the Permit, and are herein referred to as "required goals". These goals are presented in this WQIP to 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 WQIP (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 WQIP is implemented, the Participating Agencies will use adaptive management, as discussed in Section 5 of this WQIP (to be submitted to RWQCB in June 2015), to re-evaluate goals and improve strategies to effectively address priorities.

Figure 2 illustrates the timelines and relationships between the goals; additional details on the proposed schedule are provided in Section 3.2.4.

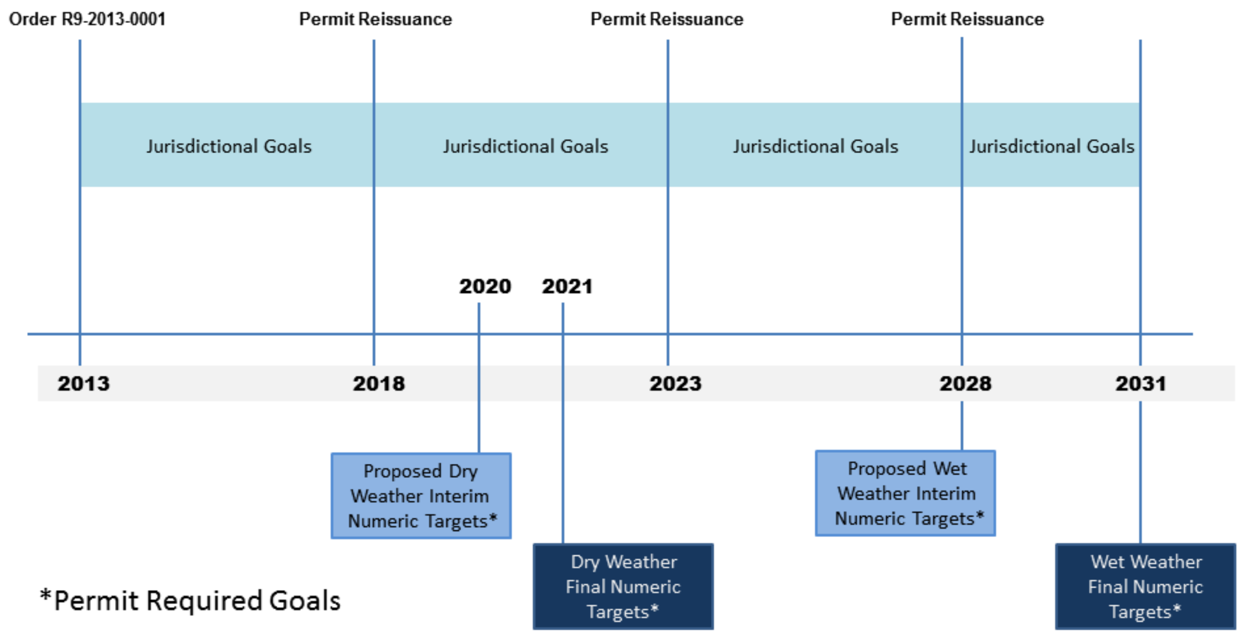

Figure 2. Timelines and Relationships between Bacteria TMDL Numeric Targets

3.2.1 Compliance Pathways for Required Interim Goals

Since each 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 in the WQIP. That is, all pathways do not have to be assessed, but are options for use in the WQIP. The compliance pathways to achieve interim required goals, summarized from Attachment E of the Permit, are presented in **Table 2.**

Table 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 stormwater drain outfalls to receiving waters.		
3 OR	Reduce loads at storm drain outfalls	The pollutant load reductions for discharges from the Participating Agencies' 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 WQIP and use adaptive management	The Participating Agencies develop and implement an accepted WQIP.[b]	Implementation of jurisdictional strategies	Implementation of jurisdictional strategies as developed in accepted WQIP 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 WQIP 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 San Diego Regional Water 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.

3.2.2 *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**.

Table 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 stormwater 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 FIB 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 WQIP, 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 SLR watershed were determined through modeling and are presented in Appendix B.
j The baseline fecal coliform load (1993 water year) equals 6,186 x 1012 MPN resulting in a target load reduction of 723 x 1012 MPN for wet weather.

3.2.3 *Jurisdictional Goals*

The Participating Agencies have each developed "jurisdictional goals" to demonstrate individual progress toward interim and final TMDL goals and to meet the overall purpose of the Permit: to protect the physical, chemical and biological integrity of waterbodies. The permit does not require each jurisdiction to have numeric goals for every permit term, but instead requires only that at least one jurisdiction, or the waterhed as a whole, has a numeric goal for each permit term (i.e., only one numeric goal is required for the watershed for each permit term).

Each jurisdiction (aka, Participating Agency) has developed its own goals that will result in a positive, measureable impact on water quality in the San Luis Rey Watershed. Wet and dry weather jurisdictional goals are proposed for each 5-year permitting cycle, through the implementation period of the Bacteria TMDL (2021 for dry weather and 2031 for wet weather). Jurisdictional goals for each participating agency are summarized below and in **Table 4** through **Table 9**.

3.2.3.1 Jurisdictional Goals for City of Oceanside

Dry Weather Jurisdictional Goals

Reduce dry weather flow volumes from targeted outfalls with persistent flows – The City of Oceanside has a dry weather goal to eliminate controllable dry weather persistent flows (excluding groundwater or other exempt or permitted non-stormwater flows and sanitary sewer overflows) from major outfalls downstream of targeted neighborhoods. During the first permit term, the goal is to initiate a pilot program in one targeted neighborhood to reduce controllable dry weather persistent flows by 25%.

In order for the City to effectively determine whether the implemented WQIP strategies in the San Luis Rey River WMA are in fact reducing dry weather non-storm water flows and pollutant loading, baseline data are required to assess trends in outfall discharges over time. These data may include, but are not limited to, measurements of discharge volume, pollutant loading estimates, frequency of observed illicit discharges from outfalls, and/or any other applicable empirical quantitative measurement directly related to discharges from the City's major MS4 outfalls. Provision D of the MS4 Permit describes requirements for major MS4 outfall monitoring. The City is required to conduct dry weather visual outfall inspections both during the transitional period prior to implementation of the WQIP, as well as intensified discharge water quality monitoring after the WQIP has been completed and accepted by the RWQCB. During the development of the WQIP in the 2013-2014 monitoring year, the City completed outfall inspections at all inventoried major MS4 outfalls discharging to the San Luis Rey River within its jurisdiction. In monitoring year 2014-2015 the City will continue dry weather routine visual outfall inspections while prioritizing certain persistently flowing outfalls for intensified analytical monitoring in the following year. As of the submittal of Section B.3 of the WQIP, the City is still in the process of establishing which outfall locations have persistent dry weather non-storm water flows, consistent with definitions described in Provision D of the MS4 Permit.

Following completion of the WQIP, the Participating Agencies are required to collect detailed monitoring data from major MS4 outfalls within the San Luis Rey River WMA that have persistent non-storm water discharges. Analytical monitoring data will provide information on both discharge volume and pollutant loading estimates for the priority water quality conditions (PWQCs) constituents throughout the WQIP implementation period. At the end of the 2015-2016 monitoring year, the combined data will be used to establish baseline discharge and loading estimates required to detect trends in reductions in future implementation years. In addition to permit required monitoring activities, data will be supplemented through additional discharge information collected as part of a neighborhood-specific pilot project.

The pilot project would involve observations, inspections, enforcement, outreach and outfall monitoring. Progress toward the goal to reduce controllable dry weather persistent flows would be measured through both the permit required monitoring activities described above and supplementary 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. 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.

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 Management Area. During Permit Term 2014-2015, the City of Oceanside will identify two residential areas and up to five restaurants in areas where the SSOs have occurred in the SLR WMA. Based on this information, residential 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. Education outreach and enforcement will occur in 2015-2016 to the identified targeted residential areas and restaurants. In 2016-2017 stormwater staff will collaborate with the City sewer division to determine if there is a reduction of SSOs. If needed, CCTVing sewer lines may be used to determine baseline grease buildup in the sewer lines and reduction in buildup after non-structural BMP implementation. The goal is a 20% reduction of SSOs from the sewer lines that serve the targeted areas.

Wet Weather Jurisdictional Goals

The City of Oceanside's wet weather goal is to reduce human sourced bacteria loading to receiving waters. The first permit term goal focuses on coordination with nonprofit agencies on the development of outreach programs to reduce homeless encampments. During the second permit term, the City will work on development of a list of barriers for homeless persons to utilize sanitation facilities and dispose of trash. The third permit term goal focuses on implementation of programs related to proper trash disposal and determining costs to address sanitation facilities for homeless, and the fourth permit term goal focuses on providing sanitation facilities for homeless persons as funding is available to prevent bacteria from reaching receiving waters.

Optional wet weather goals include metrics related to structural best management practices, specifically storm water treatment systems, identified in the San Luis Rey River Comprehensive Load Reduction Plan (CLRP). These projects and their estimated numeric goals for achieving bacteria and nutrient load reductions during wet weather are listed in Appendix D.

3.2.3.2 Jurisdictional Goals for City of Vista

The City of Vista has a dry and wet weather goal to reduce anthropogenic surface runoff at selected stormwater outfalls. During the first permit term, a baseline of the flow will be determined during FY 15-16 using weather flow measurements, and by 2018 the runoff will be reduced by 10% of the measured baseline flow. During the second permit term, the City would meet the interim and then final dry weather TMDL requirements of Attachment E of the Permit (as summarized in Tables 2 and 3). During the second permit term, the City would further reduce anthropogenic surface runoff at selected stormwater outfalls by 20% to show progress toward the interim wet weather TMDL requirements. In addition, the City would meet the interim wet weather TMDL requirements during the third permit term, and then meet the final wet weather TMDL requirements during the fourth permit term.

3.2.3.3 Jurisdictional Goals for County of San Diego

The County of San Diego has established one dry and two wet weather numeric goals for the HPWQC in the San Luis Rey watershed – bacteria that are presented in **Table 8** and **Table 9**, respectively. Throughout implementation of the WQIP, adaptive management will be used to evaluate reasonable progress toward the numeric goals and to consider changes to program design and project implementation as needed to meet goals and as funding becomes available. This process will be further described in the final WQIP.

The County's dry weather goal: Eliminate anthropogenic (excludes gourndwater and other exempt or permitted non-stormwater flows) dry weather flows from storm drain outfalls, was established to reduce nuisance flow in storm drains to zero to reduce pollutant loading to water bodies during dry weather. This goal will be accomplished through implementation of numerous JRMP strategies to mitigate dry weather flows from storm drain outfalls. Five persistent-flow outfalls have been identified within the County's jurisdiction. A baseline will be established in FY 15-16 utilizing flow measurements at a subset of the storm drains identified with persistent dry weather flows. Once the baseline is established, the first permit term goal is to reduce flow from the outfalls by 20 percent of the baseline. This effort will be leveraged at the five persistent flows being simultaneously investigated and potentially mitigated in accordance with the requirements of the dry weather program (Provision D of the Permit, section D.2.b(2)). The County has shifted to a more active field program to better locate and abate dry weather flows. County stormwater staff will spend more time in unincorporated communities to identify nuisance anthropogenic flows and address them through appropriate education and enforcement strategies. All County staff has been trained to identify and report illicit discharges and illicit connections during required annual stormwater training that has been updated to reflect recent Permit changes. Using lessons learned during the first permit term, efforts will be increased to mitigate dry weather flows, and small-scale structural controls will be considered as needed during the second Permit term. For final TMDL compliance, scheduled for April 2021, the goal is to effectively eliminate all anthropogenic discharges from the County of San Diego's storm drain outfalls to the receiving water – this will be demonstrated through the dry weather storm drain outfall monitoring program.

The County's two wet weather goals follow the TMDL compliance option that requires a 5.85% reduction of bacteria loads from storm drain outfalls by the interim compliance date (refer to Table 2, pathway 3, enterococcus) and an 11.7% reduction of bacteria loads from storm drain outfalls by 2031 (refer to Table 3, pathway 4, enterococcus). The first goal is to implement the WQIP with focus on programmatic BMPs and use adaptive management to increase effectiveness to achieve a 10% total load reduction; the second is to implement structural BMPs as needed and as funding is available to achieve a 1.7% total load reduction. Together, achievement of these goals would result in the required 11.7% bacteria load reduction required by the TMDL. Load reductions for the wet weather goals will be measured as % bacteria load reduction from storm drain outfalls with the expected outcome of meeting the TMDL required load reductions for the interim and final compliance dates.

The WQIP implementation goal involves a programmatic approach that would reduce wet weather bacteria loading from storm drain outfalls through implementation of a suite of non-structural or programmatic source control BMPs that would result in a 10% reduction of the bacteria loads from the storm drain system. The load reduction is anticipated to take place incrementally by permit term, with a 2% reduction during the second permit term, 5.85% total reduction during the third permit term, and 10% total reduction during the fourth permit term. If these estimated reductions are not confirmed by the monitoring program, then program adjustments will be made according to the adaptive management process. This may require the incorporation of more effective strategies, changes in program design, or incorporation of additional optional strategies, as funding is available. Strategies are further discussed in Section 3.3, and detailed tables of the County's programmatic BMPs are included in Appendix A.

The structural BMPs goal involves modeled wet weather load reductions that would result from small-scale and other structural BMPs. A credit for 0.3% load reduction has been applied for the first permit term for those distributed BMPs that were constructed between 2003 and 2009 as a part of certain private development projects. As with the WQIP implementation goal, additional incremental load reductions are expected during the second (0.5%), third (0.6%) and fourth (0.3%) permit terms as a result of implementation of small scale BMPs through the public-private partnership program (may include roof downspout disconnections to re-route these flows to landscaped areas, rain barrel capture and rain gardens)and by LID implementation required for redevelopment projects to achieve a total load reduction of 1.7% by 2031. If bacteria concentration monitoring reveals a deficiency in the expected load reductions, additional structural BMPs, including distributed and regional, described in Appendix D, will be considered for implementation.

3.2.3.4 Jurisdictional Goals for Caltrans

Caltrans storm water flows are not included in the Permit; however, Caltrans is subject to similar requirements through its own MS4 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 MS4 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 Quarter and State Water Control 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 Responsible 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 SLR 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 MS4 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.

Table 4. City of Oceanside Dry Weather Jurisdictional Numeric Goals

Title	Metric	Baseline	Outcome	1st Permit Term Numeric Goals 2013 - 2018	2nd Permit Term Numeric Goals 2018 - 2023	
					TMDL Interim Compliance Date April 4, 2020 (b)	TMDL Final Compliance Date April 4, 2021
Pilot Program to Reduce Dry Weather Flow(a) Volumes from Targeted Outfalls with Persistent Flows	Percent reduction of flow volume and/or pollutant loading at outfall downstream of targeted neighborhood	To be established via monitoring data collected during FY13-14, 14-15, and 15-16	Reduce dry weather flow volumes at one targeted outfall.	Reduce dry weather flow volumes at one targeted outfall by 25%.	Expand effective elements of the pilot program to other prioritized targeted neighborhoods and drainage areas.	Effectively eliminate dry weather flow from storm drain outfalls to receiving waters.
Fats, Oils, and Grease Outreach to Targeted Residential Areas and Restaurants	Percent reduction of sanitary sewer overflows (SSO) in sewer lines serving targeted areas.	Identify areas where sanitary sewer overflows have occurred during FY14-15. SSO data at these locations serves as the baseline.	Reduced SSOs (and bacteria loading) in targeted residential and commercial areas	Reduce number of SSOs in targeted areas by 20%.		

Footnotes:

(a) Here and throughout the table the term “dry weather flows” excludes groundwater, other exempt or permitted non-stormwater flows, and sanitary sewer overflows.

(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 dry weather flows through the adaptive management process of the WQIP.

Table 5. City of Oceanside Wet Weather Jurisdictional Numeric Goals

Title	Metric	Baseline	Outcome	1st Permit Term 2013 - 2018	2nd Permit Term 2018 - 2023	3rd Permit Term 2023 - 2028	4th Permit Term 2028 - 2033
						Meet TMDL Interim Compliance Date April 4, 2028 (c) (d)	Meet TMDL Final Compliance Date April 4, 2031
Reduction of Human Sourced Bacteria Loading through Outreach Programs targeting Homeless Encampments	Coordination with non-profit agencies and development of outreach programs targeting homeless encampments	The City's current outreach programs serve as the baseline, where no targeted outreach exists focused on homeless encampments	Implementation of targeted outreach to reduce homeless encampments and reduce the associated bacteria loading.	Discuss outreach programs regarding homeless encampments with local nonprofit agencies that serve the homeless including the Regional Task Force on the Homeless.	Develop list of barriers for homeless to utilize proper sanitation facilities and to properly dispose of trash and clothing.	Determine costs to address barriers of preventing homeless to utilize proper sanitation facilities. Implement programs to properly dispose of trash and soiled clothing.	Provide sanitation facilities (upon funding) to allow homeless to utilize, preventing bacteria from reaching receiving waters. Compliance with final WQBELs will be demonstrated by the inclusion of an analysis in the Water Quality Improvement plan, utilizing a watershed model to demonstrate that the implementation of the BMPs required under Provisions 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).

Footnotes:

(c) 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 monitor progress through the adaptive management process of the WQIP

(d) Progress toward final goals will be monitored and if implemented distributed BMPs are not enough then additional structural BMPs based on quantitative modeling conducted as part of the WQIP will be considered. To prepare for this contingency additional design and planning work will be conducted during Permit 2 and are included in the optional jurisdictional strategies of Provision B.3 Goals, Strategies and Schedule report. The County of San Diego is concerned that a funding source to construct, operate and maintain structural controls is not identified.

Table 6. City of Vista Dry Weather Jurisdictional Numeric Goals

Title	Metric	Baseline	Outcome	1st Permit Term Numeric Goals 2013 - 2018	2nd Permit Term Numeric Goals 2018 - 2023	
					TMDL Interim Compliance Date April 4, 2020 [(b)]	TMDL Final Compliance Date April 4, 2021
Reduce the anthropogenic surface water runoff at selected MS4 outfall(s) in the SL01 and SL02	Percent (%) anthropogenic surface water runoff reduction	To be established FY 2015-16 using dry weather flow measurements	Effectively reduce anthropogenic surface water runoff at selected outfall(s)	Reduce the anthropogenic surface water runoff (dry weather flow[(a)]) at selected MS4 outfall(s) in the SL01 and the SL02 by 10%	Meet TMDL interim compliance requirements [Attachment E.6.c(3)]	Meet TMDL final compliance requirements [Attachment E. 6.b(3)]

Footnotes:

(a) Here and throughout the table the term "dry weather flows" excludes groundwater, other exempt or permitted non-stormwater flows, and sanitary sewer overflows.

(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 dry weather flows through the adaptive management process of the WQIP.

Table 7. City of Vista Wet Weather Jurisdictional Numeric Goals

Title	Metric	Baseline	Outcome	1st Permit Term 2013 - 2018	2nd Permit Term 2018 - 2023	3rd Permit Term 2023 - 2028	4th Permit Term 2028 - 2033
						Meet TMDL Interim Compliance Date April 4, 2028 (d) (e)	Meet TMDL Final Compliance Date April 4, 2031
Reduce the anthropogenic surface water runoff (dry weather flow (c)) at selected MS4 outfall(s) in the SL01 and SL02	Percent (%) anthropogenic surface water runoff reduction	To be established FY 2015-16 using dry weather flow measurements	Effectively reduce anthropogenic surface water runoff at selected outfall(s)	Reduce the anthropogenic surface water runoff (dry weather) at selected MS4 outfall(s) in the SL01 and the SL02 by 10%	Reduce the anthropogenic surface water runoff (dry weather) at selected MS4 outfall(s) in the SL01 and the SL02 by 20%	Meet TMDL interim compliance requirements [Attachment E.6.c(3)]	Meet TMDL final compliance requirements [Attachment E.6.b(3)]

Footnotes:

(c) Here and throughout the table the term "dry weather flows" excludes groundwater, other exempt or permitted non-stormwater flows, and sanitary sewer overflows. Reducing the amount of dry weather flows is anticipated to reduce the accumulation of biofilm that grows/regrows in MS4 systems. By reducing the wetted footprint of the conveyance system, there is less of a footprint for the biofilm to grow, thereby reducing the amount of biofilm accumulation. It is expected that under wet weather conditions, the increased flow rates and velocities will cause the biofilm to slough off in enclosed drains and potentially cause water quality standards exceedances.

(d) 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 monitor progress through the adaptive management process of the WQIP.

(e) Progress toward final goals will be monitored and if implemented distributed BMPs are not enough then additional structural BMPs based on quantitative modeling conducted as part of the WQIP will be considered. To prepare for this contingency additional design and planning work will be conducted during Permit 2 and are included in the optional jurisdictional strategies of Provision B.3 Goals, Strategies and Schedule report. The County of San Diego is concerned that a funding source to construct, operate and maintain structural controls is not identified.

Table 8. County of San Diego Dry Weather Jurisdictional Numeric Goals

Title	Metric	Baseline	Outcome	1st Permit Term Numeric Goals 2013 - 2018	2nd Permit Term Numeric Goals 2018 - 2023	
					TMDL Interim Compliance Date April 4, 2020 [(b)]	TMDL Final Compliance Date April 4, 2021
Eliminate anthropogenic dry weather flows [(a)] from storm drain outfalls	% reduction of flow volume 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 volume or the number of persistently flowing outfalls during dry weather	Reduce by 75% the aggregate flow volume or the number of persistently flowing outfalls during dry weather	Effectively eliminate anthropogenic dry weather discharges from storm drain outfalls to the receiving water

Footnotes:

(a) Here and throughout this table, the term “dry weather flows” excludes groundwater, other exempt or permitted non-stormwater flows, and sanitary sewer overflows.

(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 dry weather flows through the adaptive management process of the WQIP.

Table 9. County of San Diego Wet Weather Jurisdictional Numeric Goals

Title	Metric	Baseline	Outcome	1st Permit Term 2013 - 2018	2nd Permit Term 2018 - 2023	3rd Permit Term 2023 - 2028	4th Permit Term 2028 - 2033
						Meet TMDL Interim Compliance Date April 4, 2028 (c) (d)	Meet TMDL Final Compliance Date April 4, 2031
Implement WQIP with 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 baseline bacteria loads by 10% from storm drain outfalls to meet TMDL required load reductions	Implement programmatic (non-structural) BMPs to achieve 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 3.85% (total 5.85%) from the storm drain outfalls by continued implementation of programmatic BMPs	Reduce bacteria loads by an additional 4.15% (total 10%) from the storm drain outfalls by continued implementation of programmatic BMPs
Structural BMPs (as needed and as funding is available)	% bacterial load reduction for structural BMP implement-ation 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 reduction	Reduce bacteria load by 0.3% from distributed BMPs constructed between 2003 and 2009 during redevelopment	Reduce bacteria loads by an additional 0.5% (total 0.8%) from constructed structural BMPs and/or through participation in the public private partnership program and redevelopment.	Reduce bacteria loads by an additional 0.6% (total 1.4%) from constructed structural BMPs and/or through participation in the public private partnership program and redevelopment.	Reduce bacteria loads by an additional 0.3% (total of 1.7%) from constructed structural BMPs and/or through participation in the public private partnership program and redevelopment.

Footnotes

(c) 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 monitor progress through the adaptive management process of the WQIP

(d) Progress toward final goals will be monitored and if implemented distributed BMPs are not enough then additional structural BMPs based on quantitative modeling conducted as part of the WQIP will be considered. To prepare for this contingency additional design and planning work will be conducted during Permit 2 and are included in the optional jurisdictional strategies. The County of San Diego is concerned that a funding source to construct, operate and maintain structural controls is not identified if these are needed to achieve compliance.

3.2.4 *Schedule for Compliance with Interim and Final Goals*

The proposed schedule below reflects the time necessary to implement the proposed strategies outlined in Section 3.3 of the WQIP and detailed in Appendix A. 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 10**.

Table 10. 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 Water Resources Control 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 3.3 and further detailed in Appendix A. The strategies are designed to attain the required and jurisdictional goals for the lower San Luis Rey Watershed and would be implemented at the jurisdictional scale.

3.3 Water Quality Improvement Strategies

Once the goals have been set, the Participating Agencies must develop strategies to meet the goals. As with the goals, each jurisdiction has developed its own strategies that will be implemented to work toward its 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 A. 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.

3.3.1 Description of Strategies

The Permit establishes that WQIP strategies should be identified based on their likelihood to "effectively prohibit non-stormwater discharges to the stormwater conveyance system, reduce pollutants in stormwater discharges from the stormwater conveyance system to the maximum extent practicable, protect the beneficial uses of receiving water from 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 selected for this WQIP 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.

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 WQIP 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 E. Wet weather load reductions will be achieved through implementation of both non-structural and structural BMPs.

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.

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.

Potential non-structural and structural BMP strategies were identified in Section 2.5 of this WQIP. The following subsections describe the specific strategies within each of these categories which may be selected for implementation.

3.3.2 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 3.2.

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.

3.3.2.1 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].

The Participating Agencies have identified known and suspected sources contributing to bacteria loading and BMPs to address the sources of bacteria in Provision B.2. These known and suspected sources include storm drain outfalls with persistent (non-stormwater or dry weather) flow and certain land use activities. The number of outfalls in each participating agency's jurisdiction with consistent flow are included in **Table 11**, and the numbers of pollutant generating facilities, areas, and activities associated with the construction and existing development inventories for each jurisdiction are presented in **Table 12**.

Table 11. Number of Copermittee Storm Drain Outfalls with Persistent Non-Stormwater Flow.

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

Table 12. 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. Jursidictional defintions 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, included in Appendix A, provide a bridge from the planning level strategies developed in the WQIP 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 that are concurrently being developed with the WQIPs.

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 regional Permit; however, Caltrans is subject to TMDL requirements through its statewide Permit (SWRCB, 2013). Caltrans' strategies vary from those of other Responsible 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 San Luis Rey Watershed is dependent on state funding. Caltrans has voluntarily contributed to the WQIP 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).

3.3.2.1.1 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 13**. 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 A.

Table 13. Jurisdictional Strategies Related to the Illicit Discharge Detection and Elimination Program[a]

San Luis Rey 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 WQIP.

3.3.2.1.2 Development Planning

> **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.

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.

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 3.4). 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 14.** 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 A.

Table 14. Jurisdictional Strategies Related to the Development Planning Program[a]

San Luis Rey Watershed 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.	•	•	•		•	•	•	•		•	•	•	•	•	•
Consider development of an alternative compliance program 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 WQIP.

3.3.2.1.3 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 municipal stormwater Permit.

Table 15 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 A.

Table 15. Jurisdictional Strategies Related to the Construction Management Program[a]

San Luis Rey Watershed 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 enhanced 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 WQIP.

3.3.2.1.4 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**. 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.

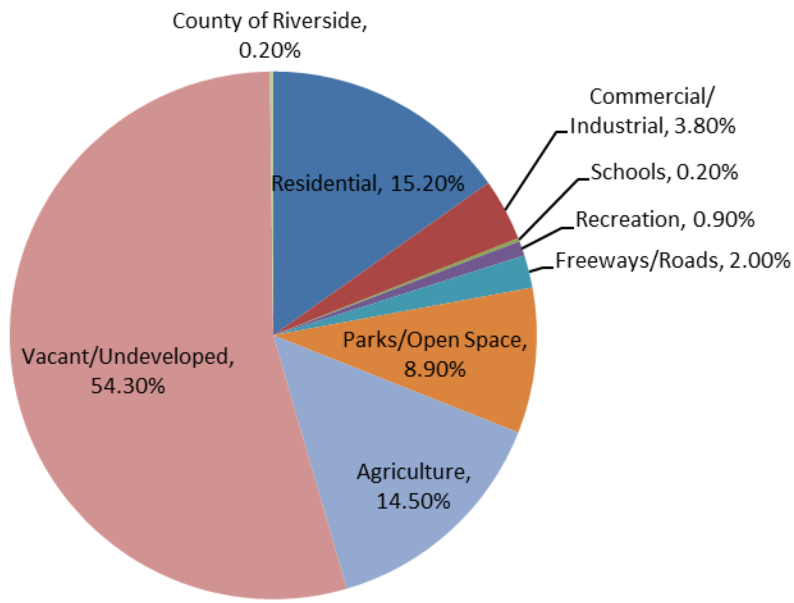

Figure 3. Land Use Distribution within the San Luis Rey Watershed

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 16 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 A.

Table 16. Jurisdictional Strategies Related to the Existing Development Management Program[a]

San Luis Rey Watershed 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.	•	•	•		•					•	•	•			•

San Luis Rey Watershed 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 WQIP.

3.3.2.2 Optional Jurisdictional Strategies

Optional jurisdictional strategies include those that agencies may implement if necessary to achieve interim and final numeric goals as defined by the water quality improvement plan. 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 17**, and detailed in the individual jurisdictional strategies tables in Appendix A.

Table 17. Optional Jurisdictional Strategies

Optional Strategy and Program	Participating Agency				Consideration(s) for Implementation	Funding
	City of Oceanside	City of Vista	County of San Diego	Caltrans		
Focused microbial source tracking study addressing prioritized drainages (IDDE)	•		•		The project will build on the existing microbial source tracking work and be triggered geographically where monitoring indicates the need to account for and mitigate the presence of human sources.	Cost of the project is dependent on the geographic focus of the project; project implementation is contingent upon grant funding.
Social services to homeless populations through local and regional agencies (IDDE)	•				Where all other human sources of bacteria have been addressed, this program may be considered for implementation.	One full time equivalent (FTE) code enforcement officer plus overtime pay for two police officers (~0.5 FTE), contigent on need and adequate funding.
Equestrian and Residential Resource Conservation Plans (Existing Development)			•		Where progress towards interim or final goals is not significant, an equestrian program may be implemented in specifically targeted geographic areas.	Program costs to be provided in JRMP updates, contingent on need and adequate funding.
Equestrian BMP Handbook (Existing Development/Outreach)	•		•		Where progress towards interim or final goals is not significant, an outreach	Program costs to be provided in JRMP updates;

Optional Strategy and Program	Participating Agency				Consideration(s) for Implementation	Funding
	City of Oceanside	City of Vista	County of San Diego	Caltrans		
					program targeting horse owners may be implemented.	implementation contingent on need and adequate funding.
Consider Alternative Compliance Program for Land Development – potential to address retrofits and rehabilitation (Development Planning)	•	•	•		Dependent on the results of the Watershed Management Area Analysis, feasibility of implementation, and availability of funding.	Costs have not been quantified but include costs for program development, administration, and transactions. A source of funding has not been identified.
Consider Green Street Retrofits or other small scale retention or infiltration controls (Existing Development)	•	•	•	•	Where progress towards interim or final goals is not significant and watershed analysis indicates the need for distributed BMPs to attain the final goals, green streets will be considered where funding is available.	Project dependent and contingent on need and adequate funding
Consider Distributed and/or Regional Structural BMPs (e.g., detention basins, treatment systems) Refer to Appendices C and D for details.	•	•	•	•	Where progress towards final goals is not significant and watershed analysis indicates the need for additional structural BMPs to attain the final goals, structural options will be considered where funding is available.	Project dependent and contingent on need and adequate funding.
Consider Dry Weather Flow Diversions or other small-scale LID structural BMPs to mitigate dry weather flows		•	•	•	Where progress towards interim or final dry weather goals is not significant and watershed analysis indicates the need for additional BMPs to attain the final goals, dry weather diversions may be considered where funding is available.	Project dependent and contingent on need and adequate funding.
Retrofit projects in areas of existing development	•	•	•	•	Dependent on the results of the Watershed Management Area Analysis, feasibility of	Project dependent and contingent on need and adequate

Optional Strategy and Program	Participating Agency				Consideration(s) for Implementation	Funding
	City of Oceanside	City of Vista	County of San Diego	Caltrans		
					implementation, and availability of funding.	funding.
Consider stream, channel, and/or habitat rehabilitation projects	•	•	•	•	Dependent on the results of the Watershed Management Area Analysis, feasibility of implementation, and availability of funding.	Project dependent and contingent on need and adequate funding.
Consider public-private partnership incentives program to encourage installation of structural BMPs on existing development			•		Dependent on the availability of opportunities for retrofits	Seek grant support and collaborations with non-government and other agencies

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 (ROWD); the ROWD 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 ROWD 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 WQIP as it is. If the results are affirmative, the Participating Agencies will continue implementing the WQIP 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 WQIP implementation to maximize their ability to achieve the goals.

3.3.2.3 Optional Watershed Management Area Strategies

The Participating Agencies have identified multiple coordinated efforts to be implemented within the San Luis Rey 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 18**.

Table 18. Optional Watershed Management Area Strategies

Strategy and Program	Lead Agency	Cooperating Agencies	Other Organizations	Optional Strategy	Implementation Timeframe
Collaboration with social service agencies and organizations that assist homeless populations (wet weather; IDDE)	City of Oceanside		Regional and local social service agencies and organizations	Yes	Dependent on need and funding.
Volunteer surveillance program (dry weather; IDDE)	City of Oceanside		San Diego Coastkeeper	Yes	Dependent on potential project scope and funding.
Promotion of rain barrel incentive programs (Existing Development)	County of San Diego	City of Oceanside	San Luis Rey Watershed Council	No	FY 15-16
Coordinated Response to Water Main Breaks (IDDE)	City of Vista		Vista Irrigation District	No	Current Program
Coordinated investigations at targeted outfalls (IDDE)	City of Vista	County of San Diego, City of Oceanside		No	Current Program
Investigate incentive program for retrofits (e.g., weather based irrigation controllers (Existing Development)	City of Vista		Vista Irrigation District	No	FY 15-16
Coordination with sewer agencies (IDDE)	City of Vista	City of Vista Sewer Program	Buena Sanitation District	No	Current
Equestrian and Residential Resource Conservation Plans (Existing Development)	County of San Diego	City of Oceanside	Mission Resource Conservation District	Yes	Dependent on need and funding.
Equestrian BMP Handbook (Existing Development/Outreach)	County of San Diego	City of Oceanside		Yes	Dependent on need and funding.

3.3.3 *QUANTIFICATION OF DRY WEATHER STRATEGIES*

Dry weather load reductions were calculated using a tiered approach to demonstrate reasonable assurance that the WQIP 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 included in this WQIP. 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 turfgrass 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 19 provides a summary of the dry weather quantification results and corresponding assumptions and references, while Appendix E contains a more detailed description of the dry weather load reduction quantification values, results, assumptions, and methods.

Table 19. 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 x 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 MS4 Permit Attachment E, Table 6.6
Expected load reduction from quantifiable dry weather nonstructural BMPs (Smart controller and turfgrass replacement rebates, and Residential and commercial site inspections/audit)	8.1 to 37.4% of the baseline storm drain load	See Appendix E 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 19** demonstrates, the average MS4 total load reduction for dry weather is greater than or equal to the TMDL required load reduction and therefore Reasonable Assurance is demonstrated.

3.3.4 Proposed Wet Weather Structural Strategies

Potential water quality improvement strategies that may be implemented within the SLR 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 the WQIP. As required in Attachment E of the Permit, the structural BMPs proposed in the WQIP are equivlaent to the suite of BMPs proposed in the SLR CLRP.

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 ROWD assessment process. The WQIP 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 B for a description of SBPAT, and Appendix D for details on how the wet weather load reductions were calculated.

To determine high priority potential locations for distributed structural BMPs, the lower SLR 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 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 D.

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 FIB-FC load reduction would be 1,025 x 10^{12} most probable number[2] (MPN) per year. This reduction equates to 16% of the FIB-FC load from the muncipal land uses in San Luis Rey River Watershed. The water quality benefits that are predicted to result from the proposed distributed and regional structural BMPs are summarized in **Table 20** and **Table 21** 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 20. Water Quality Benefits from Proposed Distributed Structural BMPs

Structural BMP Type	FIB-FC load reduction (10^{12} MPN/year)	Nitrate load reduction (lbs/year)	Total Phosphate load reduction (lbs/year)
	Average [Low-High][1]	Average [Low-High][1]	Average [Low-High][1]
Implemented Distributed BMPs	41 [22-47]		
Proposed Distributed BMPs	151 [86-174]	800 [380-830]	170 [150-180]

MPN = Most Probable Number

[a] Range of water quality benefits represent 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 21. Water Quality Benefits from Proposed Regional Structural BMPs

Structural BMP Type	FIB-FC load reduction (10^{12} MPN/year)	Nitrate load reduction (lbs/year)	Total Phosphate load reduction (lbs/year)
	Average [Low-High][1]	Average [Low-High][1]	Average [Low-High][1]
Proposed Regional BMPs	834 [641-942]	69,011 [51,440-77,507]	7,871 [7,254-8,540]

MPN = Most Probable Number

[1] Range of water quality benefits represent 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.

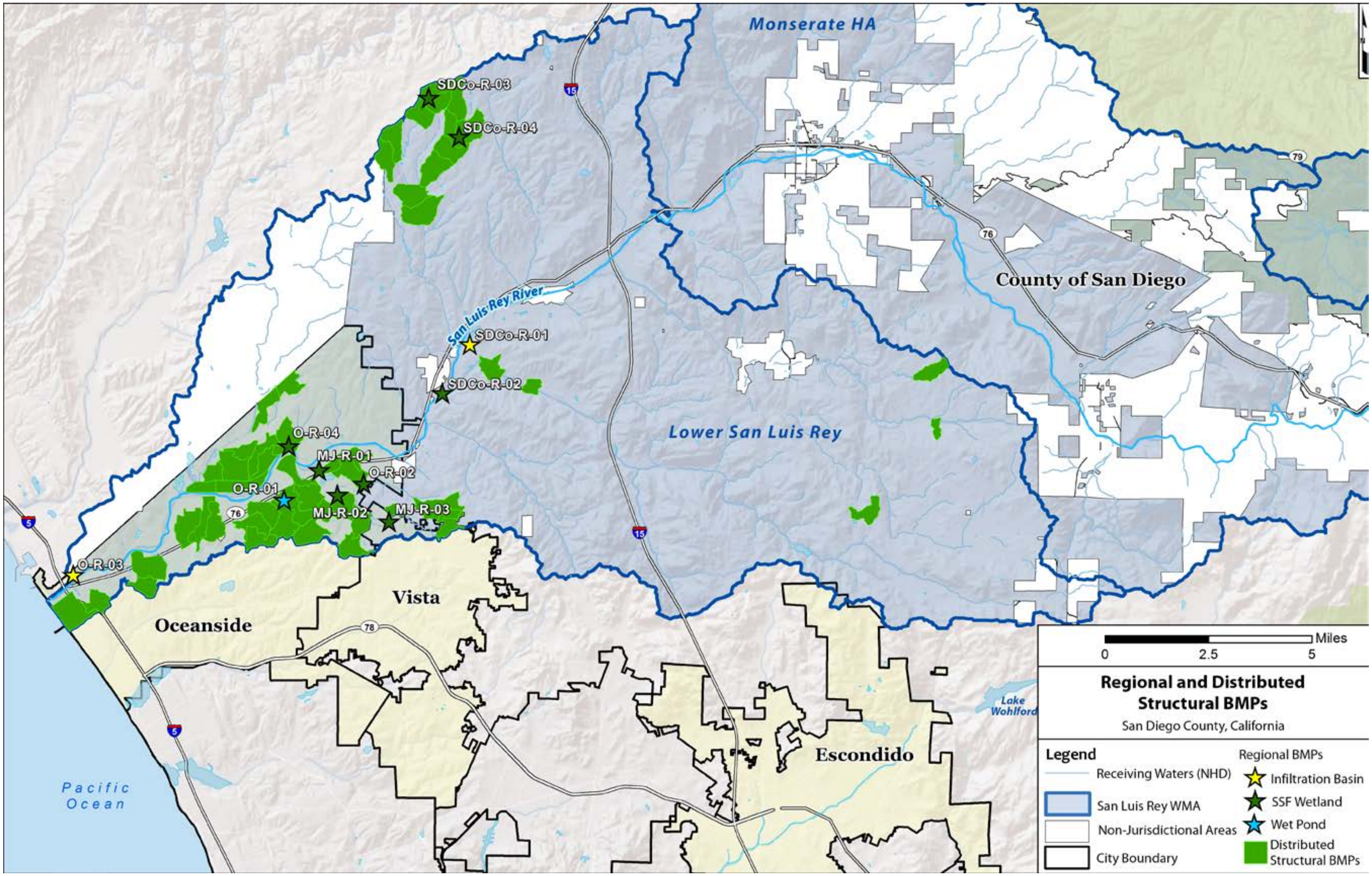

Figure 4. Proposed Catchments for Implementation of Distributed Structural BMPs

3.3.5 *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 the WQIP would 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 WQIP goals. 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 WQIP strategies that the Participating Agencies have proposed (increasing likelihood of WQIP approval); is a flexible tool that can accommodate the WQIP'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 WQIP 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 C, D and E, 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 WQIP 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.

3.3.5.1 BMP Water Quality Benefit Estimation

The wet weather bacteria TMDL requires a bacteria load reduction of 11.7 percent (enterococcus, see Table 3, 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 C – G, was performed to demonstrate that the load reduction target for the SLR watershed management area can be achieved through implementation of this WQIP. The estimated load reductions and target load reduction are provided in **Table 22**.

Table 22. Summary of Wet Weather Load Reductions by BMP type

BMP Category	FIB-FC Load Reduction	
	10^{12} MPN/Year Average [Low-High]	Percentage of Average Municipal Load Average [Low-High]
Programmatic Strategies	619 [569-676]	10% [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 represent 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.

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 partenerships are not adequate, implementation of the modeled distributed and regional structural BMPs will be considered.

3.3.6 *Linkage Between Goals and Strategies*

The goals presented in Section 3.2 were developed consistent with the bacteria TMDL to demonstrate progress towards addressing bacteria, in the Lower San Luis Rey Watershed. In order 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 BMPs will be considered where necessary. As shown in **Table 19** (dry), and **Table 20** and **Table 21** (wet), anticipated load reductions for suites of non-structural and structural BMPs were quantified. The quantification demonstrates the anticipated effectivenss 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, these load reductions are anticipated to achieve the goals for dry and wet weather.

The non-structural strategies as presented in **Table 13** through **Table 16** are broad and were developed as a guide to the actions that the Participating Agencies will implement. Examples of methods that jurisdictions have chosen to implement the various strategies are discussed below. Further details are contained in Appendix A.

3.3.6.1 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 San Luis Rey 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 each strategy is provided in Appendix A. 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, vererinary offices, an dothe rsites frequesnted 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. 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 develop a strategy to 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 methos to reduct 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 chamicals 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.

3.3.6.2 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 San Luis Rey 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 A. 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.

Development Planning

The City of Oceanside is currently updating BMP design manual procedures to specify stormwater requirements. Additionally, Oceanside is implementing source control, low-impact development, and on-site structural controls for priority development projects and updating codes, ordinances, and stormwater design standards to be consistent with Permit requirements.

Existing Development

The City of Oceanside continues to maintain and update their watershed-based inventory of existing development. Oceanside plans to address the impacts of improper water use and irrigation runoff by promoting rain barrel incentive programs and water agency-sponsored turf replacement programs. Oceanside plans to continue maintaining bike trail pet waste dispensers as part of the pet waste program. The City of Oceanside will promote and encourage implementation of designated BMPs in residential areas. Oceanside will develop a strategy to identify opportunities and facilitate the implementation of retrofit projects in areas of existing development.

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.

3.3.6.3 City of Vista Example Strategies

The City of Vista identified administrative policies, stormwater management programs, and is investing in research for site locations for green infrastructure and outreach opportunities throughout its jurisdiction in the San Luis Rey watershed. Most of the City of Vista's geographic representation is in the Carlsbad Watershed. However, a small percentage of the City (six percent) is located in the San Luis Rey Watershed. Vista's geographic representation in the San Luis Rey Watershed totals 743 acres, which is less than one percent (0.2%) of the watershed's total land area of almost 360,000 acres. The majority of Vista's land use in this watershed is rural residential and open space/parks and recreation, with commercial/industrial land uses representing a nominal footprint. 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 municipality.

The following strategies are examples of those selected by the City of Vista and planned for implementation. A complete list of strategies planned for implementation and a description of each strategy is provided in Appendix A. 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.

Development Planning

The City of Vista is currently establishing criteria to designate priority development projects for new and redevelopment and updating BMP design manual procedures to specify stormwater requirements. Additionally, Vista is implementing source control, low-impact development, and on-site structural controls for priority development projects and updating codes, ordinances, and stormwater design standards to be consistent with the stormwater permit.

Existing Development

The City of Vista continues to maintain and update their watershed-based inventory of existing development. Vista plans to develop and distribute outreach materials that target over-irrigations, investigate opportunities to participate in and promote multi-agency water conservation programs, and consider partnerships with water agencies to promote incentives for BMP retrofits. Vista will coordinate with the Parks Department to enhance their pet waste program. To address the impacts of septic systems within the watershed, Vista will develop and distribute outreach materials targeting septic system maintenance and investigate the presence of septic systems within their jurisdiction. To reduce the impacts of public and private sanitary sewer systems, the city will develop outreach materials, investigate the feasibility of a program for private sewer repairs, and continue CCTV programs.

Structural Strategies

The City of Vista is interested in developing a strategy to identify opportunities and facilitate the implementation of stream, channel, and habitat rehabilitation projects in areas of existing development. Vista also requires implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties.

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 Vista. There are plans to develop, improve, and distribute outreach materials. Outreach presentations are planned for elementary, middle, and high schools.

3.3.6.4 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.

3.3.7 Schedules for Implementing Strategies

The following sections detail the proposed schedules for phasing in the strategies discussed above. As noted earlier, the overall WQIP 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 wet and dry weather load reduction goals. The benefits calculations summarized in Section 3.3.6 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 WQIP is based. **Figure 5** illustrates this concept for the wet weather condition of pursuing programmactic BMP implementation to the extent that they achieve the target load reduction, and then implementing structural BMPs if necessary.

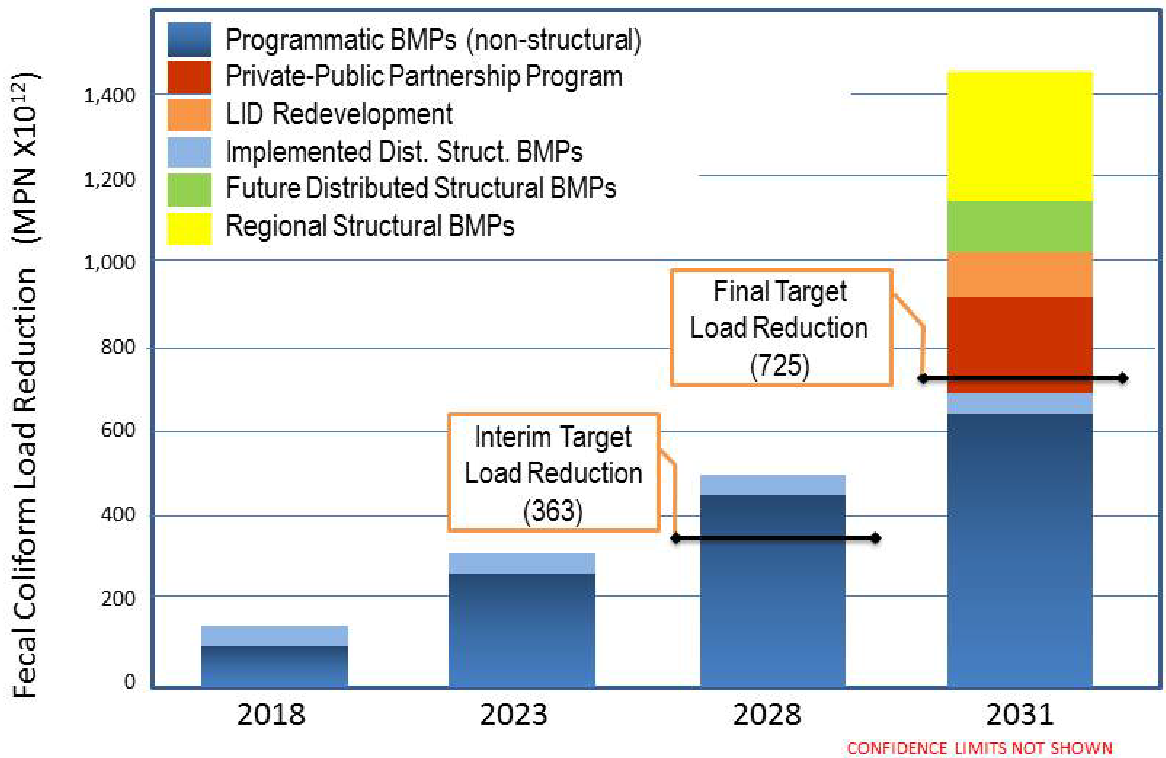

Figure 5. BMP Implementation Schedule and Load Reduction Benefits

3.4 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 WQIPs. The geospatial data and technical documentation from this project has been packaged individually for each watershed, with the SLR WMAA package in Appendix G.

3.4.1 *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 SLR Candidate Project list that appears in Appendix G. The effort to identify these projects is described in the associated SLR-specific WMAA data assessment that also appears in Appendix G. It should be noted that only the Candidate Project list is being supplied in the WQIP 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 the WQIP.

3.4.2 *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 SLR 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

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 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 outfall of the conveyance system, and any other criteria determined by the local jurisdiction.

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APPENDIX A
Jurisdictional Strategies

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A.1 City of Oceanside

Table A.1-1. City of Oceanside, 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 to identify and report illicit discharges and connections.*	Current	Daily
• *Utilize water department meter readers to document irrigation runoff, with a focus on residential areas.*	Current	Daily
• *Facilitate public reporting of illicit discharges and connections via telephone and email.*	Current	N/A
• *Educate the public regarding illegal discharges/dumping.*	Current	Continuous
• *Implement a volunteer surveillance program.*	FY 15-16	As Needed
• *Coordinate with upstream entities to prevent illicit discharges from upstream sources from entering the MS4.*	Current	As Needed
• *Coordinate with neighboring jurisdictions to investigate results of outfall inspections.*	Current	As Needed
Develop and implement approaches to address the impacts of septic systems within the watershed.		
• *Report un-recorded septic systems (installed prior to 1970) to the County Department of Environmental Health for inspection.*	Current	As Needed
• *Locate and identify septic systems in the watershed with County of San Diego Permit Information and their proximity to surface waters and City sewer lines.*	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 prevent and address spills with the potential to enter the MS4.*	Current	Continuous
• *Implement practices and procedures to prevent/limit infiltration of seepage from sanitary sewers to the MS4.*	Current	Continuous
Implement monitoring programs to provide new information to refine the prioritization of drainage areas.		
• *Conduct transitional dry weather MS4 outfall monitoring to identify persistent/transient non-storm water flows.*	FY 15-16	Twice per Year
• *Conduct dry weather MS4 outfall monitoring within specific drainages to quantify flow reductions in response to targeted outreach programs and/or enforcement action.*	FY 15-16	As Needed

Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency
Actively enforce prohibitions related to illicit discharges and connections.		
• *Investigate and eliminate illicit discharges and connections.*	Current	As Needed
• *Enforce legal authority to ensure all illicit discharges and connections identified are eliminated within timeframes established in the MS4 Permit.*	Current	As Needed
Other Related Programs and Activities.		
• *Maintain MS4 map to facilitate implementation of the IDDE program.*	Current	Annual

Table A.1-2. City of Oceanside, Development Planning Program Strategies

Development Planning Program Strategies	Implementation Timeframe	Frequency
Provide updated materials and enhanced outreach to convey land development requirements.		
• *Establish criteria designating priority development projects for new and redevelopment.*	FY 15-16	One Time
• *Update BMP design manual procedures to specify storm water requirements applicable to development and redevelopment projects, identify and design appropriate BMPs, and establish maintenance criteria,.*	Current	One Time
• *Internal staff training on updated BMP design manual.*	FY 15-16	As Needed
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.		
• *Develop and implement a Watershed Management Area Analysis to develop watershed specific requirements for structural BMP implementation.*	FY 15-16	One Time
Consider the development of an alternative compliance program for Priority Development Projects.		
• *Consider implementation of an alternative compliance program to provide off-site alternatives for pollutant control and hydromodification management.*	FY 18-19	Continuous
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 on PDPs.*	Current	Continuous
• *Inspect all high priority structural BMPs annually (prior to the rainy season for Copermittees).*	Current	Annual
Enforce post construction requirements related to new and redevelopment.		
• *Require implementation of source control and low impact development (LID) BMPs for all development projects.*	Current	Continuous
• *Require implementation of source control, LID, and on-site structural controls for all priority development projects.*	Current	Continuous
• *Enforce legal authority to ensure all development projects are in compliance with all post construction requirements.*	Current	As Needed
• *Update codes, ordinances, and stormwater design standards consistent with permit and BMP Manual.*	Current	One Time

Table A.1-3. City of Oceanside, Construction Management Program Strategies

Construction Management Program Strategies	Implementation Timeframe	Frequency
Improve data tracking methods for construction inventories and inspections where necessary.		
• *Maintain, update quarterly, and prioritize a watershed based inventory of all projects issued local permits that allow soil disturbing activities.*	Current	Quarterly
Ensure that minimum BMPs are designated and required for construction projects.		
• *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
• *Review and confirm that the submitted plan is in compliance.*	Current	Continuous
• *Implement or require implementation of BMPs that are site specific, seasonally appropriate, and appropriate to the construction phase year round.*	Current	Continuous
• *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	High Priority, Wet Season = Biweekly Medium Priority, Wet Season = Monthly Low Priority, Wet Season = As Needed Dry Season = As Needed
• *Enforce legal authority to ensure inventoried construction projects are in compliance with all requirements.*	Current	As Needed

Table A.1-4. City of Oceanside, Existing Development Management Program Strategies

Existing Development Management Program Strategies	Implementation Timeframe	Frequency
Improve data tracking methods for existing development inventories where necessary.		
• *Maintain and update a watershed based inventory of existing development (i.e., commercial, industrial, and municipal facilities and residential areas).*	Current	Annual
Develop and implement approaches to address the impacts of improper water use and irrigation runoff.		
• *Promote rain barrel incentive programs.*	Current	Continuous
• *Continued enforcement of drought-related restrictions on landscape irrigation frequency*	Current	Ongoing
• *Relay information to residents regarding water agency-sponsored turf replacement programs*	Current	Ongoing when programs are available
Improve and/or continue existing pet waste programs.		
• *Install and maintain SLR Bike Trail Pet Waste Dispensers.*	Current	Continuous
Improve trash management strategies within the watershed.		
• *Coordinate Trash Collection Events (public outreach/participation).*	Current	Multiple per Year
Improve and implement existing outreach programs to target key sources and pollutants.		
• *Distribute watershed based outreach posters.*	Current	Continuous
• *Provide outreach presentations at elementary schools.*	Current	Continuous
• *Educational Workshops (e.g., landscape irrigation and maintenance, agricultural).*	Current	Biennial
Implement existing MS4 maintenance programs.		
• *Implement a schedule of operation and maintenance activities for the MS4 and related structures.*	Current	Per JRMP
Develop and implement targeted programs to address issues in residential areas.		
• *Promote and encourage implementation of designated BMPs in residential areas.*	Current	Continuous
• *Implement residential irrigation runoff study.*	FY 15-16	One Time
• *Conduct residential management area focused inspections.*	FY 15-16	Per JRMP
Implement existing road maintenance activities.		
• *Implement a schedule of operation and maintenance for public streets, unpaved roads, paved roads, and paved highways.*	Current	Per JRMP

Existing Development Management Program Strategies	Implementation Timeframe	Frequency
Improve existing inspections programs to more efficiently target key sources.		
• *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
Actively enforce stormwater and urban runoff requirements for existing development.		
• *Designate and require minimum BMPs for all inventoried existing development.*	Current	Continuous
• *Enforce legal authority to ensure inventoried existing development facilities and/or areas are in compliance with all requirements.*	Current	As Needed
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
Other BMPs/Activities		
• *Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties.*	Current	Continuous

Table A.1-5. City of Oceanside, Optional Strategies

Optional Strategies (If needed and if funding is available)	Implementation Timeframe	Frequency
Optional septic system related strategies		
• *Implement septic system rebate program.*	TBD	N/A
Other optional strategies		
• *Implement Homeless Outreach Program in conjunction with local resource agencies.*	TBD	N/A

A.2 City of Vista

Table A.2-1. City of Vista, 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	Daily
• *Coordinate with Vista Irrigation District to identify and report ICIDs.*	FY 15-16	TBD
• *Facilitate public reporting of illicit discharges and connections via telephone and email.*	Current	N/A
• *Educate the public regarding illegal discharges/dumping.*	Current	Continuous
• *Coordinate with Vista Irrigation District for response to potable water main breaks.*	FY 15-16	As Needed
• *Enhance coordination with Vista Fire Department regarding incident response*	FY 15-16	As Needed
• *Coordinate with upstream entities to prevent illicit discharges from upstream sources from entering the MS4.*	Current	As Needed
• *Coordinate with neighboring jurisdictions to investigate results of outfall inspections.*	Current	As Needed
Develop and implement approaches to address the impacts of septic systems within the watershed.		
• *Investigate and eliminate illicit discharges and connections.*	Current	As Needed
• *Investigate presence of septic systems within the jurisdiction in the watershed.*	FY 16-17	TBD
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
• *Update Sanitary Sewer Overflow Response Plan (SSORP) and reporting procedures.*	FY 15-16	One Time
• *Increase coordination between storm water and sanitary sewer programs.*	FY 15-16	Continuous
• *Investigate feasibility of program for private sewer lateral repairs (e.g., incentives, outreach, ordinance updates).*	FY 15-16	One Time
• *Implement practices and procedures to prevent/limit infiltration of seepage from sanitary sewers to the MS4.*	Current	Continuous
• *Develop a strategy to implement phases of sewer exfiltration study.*	FY 15-16	One Time

Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency
• *Continue citywide CIP and CCTV programs*	Current	Continuous
Implement monitoring programs to provide new information to refine the prioritization of drainage areas.		
• *Conduct transitional MS4 outfall discharge program to identify persistent/transient flows.*	Current	Twice per Year
• *Conduct watershed-specific MS4 outfall discharge program to identify persistent and transient flows.*	FY 15-16	Twice per Year
Actively enforce prohibitions related to illicit discharges and connections.		
• *Investigate and eliminate illicit discharges and connections.*	Current	As Needed
• *Enforce legal authority to ensure all illicit discharges and connections that are identified are eliminated.*	Current	As Needed
Other Related Programs and Activities.		
• *Maintain MS4 map to facilitate implementation of the IDDE program.*	Current	Annual

Table A.2-2. City of Vista, Development Planning Program Strategies

Development Planning Program Strategies	Implementation Timeframe	Frequency
Provide updated materials and enhanced outreach to convey land development requirements.		
• *Establish criteria designating priority development projects for new and redevelopment.*	FY 15-16	One Time
• *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
• *Internal staff training on updated BMP design manual.*	FY 15-16	As Needed
• *External land development workshops targeting the development community.*	FY 15-16	TBD
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.		
• *Develop and implement a Watershed Management Area Analysis to develop watershed specific requirements for structural BMP implementation.*	FY 15-16	One Time
Consider the development of an alternative compliance program for Priority Development Projects.		
• *Consider implementation of an alternative compliance program to provide off-site alternatives for pollutant control and hydromodification management.*	FY 18-19	Continuous
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 on PDPs.*	Current	Continuous
• *Inspect all high-priority structural BMPs annually prior to the rainy season for.*	Current	Annual
Enforce post construction requirements related to new and redevelopment.		
• *Require implementation of source control, LID, and on-site structural controls for all priority development projects.*	Current	Continuous
• *Enforce legal authority to ensure all development projects are in compliance with all post construction requirements.*	Current	As Needed
• *Update codes, ordinances, and stormwater design standards consistent with permit and BMP Manual.*	Current	One Time

Table A.2-3. City of Vista, Construction Management Program Strategies

Construction Management Program Strategies	Implementation Timeframe	Frequency
Improve data tracking methods for construction inventories and inspections where necessary.		
• *Maintain, update quarterly, and prioritize a watershed based inventory of all projects issued local permits that allow soil disturbing activities.*	Current	Quarterly
• *Integration of inventory management with Cityworks.*	TBD	One Time
• *Integration of inspections documentation with Cityworks.*	TBD	One Time
Ensure that minimum BMPs are designated and required for construction projects.		
• *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
• *Review and confirm that the submitted plan is in compliance.*	Current	Continuous
• *Implement or require implementation of BMPs that are site-specific, seasonally appropriate, and appropriate to the construction phase year round.*	Current	Continuous
• *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	High Priority, Wet Season = Biweekly Medium Priority, Wet Season = Monthly Low Priority, Wet Season = Monthly Dry Season = Bimonthly
• *Enforce legal authority to ensure inventoried construction projects are in compliance with all requirements.*	Current	As Needed

Table A.2-4. City of Vista, Existing Development Management Program Strategies

Existing Development Management Program Strategies	Implementation Timeframe	Frequency
Improve data tracking methods for existing development inventories where necessary.		
• *Maintain and update a watershed-based inventory of existing development (i.e., commercial, industrial, and municipal facilities and residential areas).*	Current	Annual
Develop and implement approaches to address the impacts of improper water use and irrigation runoff.		
• *Develop and distribute outreach materials targeting over-irrigation.*	FY 15-16	Continuous
• *Investigate opportunities to participate in and promote multi-agency water conservation programs.*	FY 15-16	Continuous
• *Investigate incentives for BMP retrofits, such as weather-based irrigation controllers, in partnership with water agency(ies).*	FY 15-16	Continuous
Improve and/or continue existing pet waste programs.		
• *Coordinate with Parks Department to enhance pet waste program.*	FY 15-16	Continuous
Improve trash management strategies within the watershed.		
• *Sponsor Trash Collection Events (public outreach/part).*	Current	Annual
Develop and implement approaches to address the impacts of septic systems within the watershed.		
• *Develop and distribute outreach materials targeting septic system maintenance.*	FY 15-16	One Time, On Going
• *Investigate presence of septic systems within the jurisdiction in the watershed.*	FY 15-16	One Time
Develop and implement approaches to reduce the impacts of public and private sanitary sewer systems within the watershed.		
• *Develop and distribute outreach materials targeting sewer lateral maintenance.*	FY 15-16	One Time, On Going
• *Implement controls to prevent infiltration of sewage into the MS4 from leaking sanitary sewers.*	Current	Continuous
• *Develop a strategy to implement phases of sewer exfiltration study.*	FY 15-16	One Time
• *Investigate feasibility of program for private sewer lateral repairs (e.g., incentives, outreach, ordinance updates).*	FY 15-16	One Time
• *Continue citywide CIPP and CCTV programs.*	FY 15-16	Continuous
• *Enhanced coordination with sewer program related to FOG inspections.*	FY 15-16	Continuous

Existing Development Management Program Strategies	Implementation Timeframe	Frequency
Improve and implement existing outreach programs to target key sources and pollutants.		
• *Develop, improve, and distribute outreach materials.*	FY 15-16	Continuous
• *Outreach presentations to elementary, middle, and high schools.*	Current	Multiple per Year
• *Educational Workshops (e.g., IPM, manure management).*	Current	TBD
Enhance existing MS4 maintenance programs.		
• *Implement a schedule of operation and maintenance activities for the MS4 and related structures.*	Current	Per JRMP
• *Evaluate MS4 maintenance program for target areas; focus may include increased cleaning and/or retrofit opportunities.*	FY 15-16	One Time
• *Investigate feasibility of targeted MS4 CCTV program.*	FY 15-16	One Time
Develop and implement targeted programs to address issues in residential areas.		
• *Investigate feasibility of program for private sewer lateral repairs (e.g., incentives, outreach, ordinance updates).*	FY 15-16	One Time
• *Promote and encourage implementation of designated BMPs in residential areas.*	Current	Continuous
• *Develop targeted outreach materials.*	FY 16-17	Continuous
• *Outreach to and coordination with homeowners associations.*	FY 16-17	Continuous
• *Conduct residential management area focused inspections.*	FY 15-16	
Improve existing inspections programs to more efficiently target key sources.		
• *Implement a schedule of operation and maintenance for public streets, unpaved roads, paved roads, and paved highways.*	Current	Per JRMP
• *Evaluate existing street maintenance program for potential target areas.*	FY 15-16	One Time
• *Conduct inspections of inventoried existing development to ensure compliance. Each area/activity inspected once every five years minimum, with equivalent of 20% of inventory inspected annually.*	Current	Per JRMP
• *Enhanced coordination with sewer program related to FOG inspections.*	FY 15-16	Continuous
Actively enforce stormwater and urban runoff requirements for existing development.		
• *Designate and require minimum BMPs for all inventoried existing development.*	Current	Continuous
• *Enforce legal authority to ensure inventoried existing development facilities and/or areas are in compliance with all requirements.*	Current	As Needed

Existing Development Management Program Strategies	Implementation Timeframe	Frequency
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
• *Evaluate MS4 maintenance program for target areas and potential retrofit opportunities.*	FY 15-16	One Time
• *Investigate incentives for BMP retrofits, such as weather-based irrigation controllers, in partnership with water agency(ies).*	FY 15-16	Continuous
Improve coordination between agencies.		
• *Investigate opportunities to participate in and promote multi-agency water conservation programs.*	FY 15-16	Continuous
Other BMPs/Activities		
• *Develop and distribute outreach materials targeting sediment control.*	FY 15-16	Continuous
• *Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties.*	Current	Continuous
• *Develop a strategy to identify opportunities and facilitate the implementation of stream, channel, and/or habitat rehabilitation projects in areas of existing development.*	FY 15-16	One Time

A.3 County of San Diego

Table A.3-1. County of San Diego, Illicit Discharge Detection and Elimination Program Strategies

Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency	Program Type*
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	Daily	Base
• *Utilize municipal personnel and contractors to monitor stormwater outfalls for discharges of potential illicit discharges and connections.*	Current	Annual	Base
• *Updated, focused training for field staff.*	FY 15-16	Annual	Enhanced
• *Facilitate public reporting of illicit discharges and connections via telephone and email.*	Current	Continuous	Base
• *Bilingual hotline answered by live operator (I Love a Clean San Diego) providing better customer service.*	FY 15-16	Continuous	Enhanced
• *Coordinate with upstream entities to prevent upstream-sourced illicit discharges from entering the storm drain system.*	Current	As Needed	Base
Develop and implement approaches to address the impacts of septic systems, and public and private sanitary sewer systems within the watershed.			
• *Address septic system failures where observed.*	Current	As Needed	Base
• *Implement practices and procedures to address spills with the potential to enter the storm drain system.*	Current	As Needed	Base
• *Coordinate spill response with responsible sewer agencies.*	FY 15-16	As Needed	Base
• *Implement practices and procedures to prevent/ limit infiltration of seepage from sanitary sewers to the storm drain system.*	Current	Continuous	Base
Enforce prohibitions related to illicit discharges and connections.			
• *Investigate illicit discharges and connections.*	Current	Continuous	Base
• *Impose legal authority to ensure all illicit discharges and connections that are identified are eliminated.*	Current	As Needed	Base
• *Update ordinances to reflect current illicit discharge and detection and elimination requirements and strategies.*	Current	One Time	Base
Other Related Programs and Activities.			
• *Maintain stormwater conveyance system map to facilitate implementation of the IDDE program.*	Current	Annual	Base

***Program Types:** *Base* – strategy that is a requirement of the Permit; *Enhanced* – base program that has been enhanced beyond the Permit requirements; the enhanced portions of these strategies would be implemented if needed and if funding is available

Table A.3-2. County of San Diego, Development Planning Program Strategies

Development Planning Program Strategies	Implementation Timeframe	Frequency	Program Type*
Provide updated materials and enhanced outreach to convey land development requirements.			
• *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).*	Current	One Time	Base
• *Conduct internal staff training on updated BMP design manual.*	FY 15-16	As Needed	Base
• *Hold external land development workshops targeting the development community.*	FY 15-16	TBD	Enhanced
• *Update codes, ordinances, and stormwater design standards consistent with permit and BMP Manual.*	Current	One Time	Base
Implement a BMP compliance program to ensure proper design and maintenance planning.			
• *Implement a program that ensures that all structural and Low Impact Development (LID) BMPs are designed, constructed, and maintained on Priority Development Projects.*	Current	Continuous	Base
Enforce post construction requirements related to new and redevelopment.			
• *Require implementation of source control and low impact development (LID) BMPs for all development projects.*	Current	Continuous	Base
• *Require implementation of source control, LID, and on-site structural controls for all priority development projects.*	Current	Continuous	Base
• *Impose legal authority to ensure all development projects are in compliance with all post construction requirements.*	Current	As Needed	Base

Program Types: *Base* – strategy that is a requirement of the Permit; *Enhanced* – base program that has been enhanced beyond the Permit requirements; the enhanced portions of these strategies would be implemented if needed and if funding is available

Table A.3-3. County of San Diego, Construction Management Program Strategies

Construction Management Program Strategies	Implementation Timeframe	Frequency	Program Type*
Improve data tracking methods for construction inventories and inspections where necessary.			
• *Maintain, update, and prioritize a watershed based inventory of all projects issued local permits that allow soil disturbing activities.*	Current	Quarterly	Base
Ensure that minimum BMPs are designated and required for construction projects.			
• *Require implementation of BMPs that are site specific, seasonally appropriate, and appropriate to the construction phase year round.*	Current	Continuous	Base
• *Make updates to ordinance related to construction; reference to existing grading ordinance.*	Current	One Time	Base
Enforce Construction Management Requirements			
• *Impose legal authority to ensure inventoried construction projects are in compliance with all requirements.*	Current	As Needed	Base
Provide enhanced outreach and coordination to convey construction requirements.			
• *Provide internal staff training related to construction stormwater management.*	FY 15-16	As Needed	Base

***Program Types:** *Base* – strategy that is a requirement of the Permit; *Enhanced* – base program that has been enhanced beyond the Permit requirements; the enhanced portions of these strategies would be implemented if needed and if funding is available

Table A.3-4. County of San Diego, Existing Development Management Program Strategies

Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Program Type*
Improve data tracking methods for existing development inventories where necessary.			
• *Maintain and update a watershed based inventory of existing development (i.e., commercial, industrial, and municipal facilities and residential areas).*	Current	Annual	Base
Develop and implement approaches to address the impacts of improper water use and irrigation runoff.			
• *Promote rain barrel incentive programs.*	Current	Continuous	Enhanced
• *Promote incentive programs for BMP retrofits (e.g., water smart irrigation controllers, turf replacement program, residential landscape evaluation program).*	Current	Continuous	Enhanced
Improve and/or continue existing pet waste programs.			
• *Pet waste management and outreach in County Parks.*	Current	Continuous	Enhanced
Improve trash management strategies within the watershed.			
• *Sponsor Trash Collection Events (public outreach and participation).*	Current	Multiple per Year	Enhanced
Improve and implement existing outreach programs to target key sources and pollutants.			
• *Develop, improve, and distribute outreach materials.*	FY 15-16	Continuous	Enhanced
• *Give outreach presentations to elementary, middle, and high schools.*	Current	Multiple per Year	Enhanced
• *Outreach to mobile landscaping businesses.*	FY 15-16	Continuous	Enhanced
• *Educational Workshops (e.g., integrated pest management, manure management).*	Current	TBD	Enhanced
• *Education & Outreach Effectiveness Survey.*	Current	Annual	Enhanced
Enhance existing stormwater conveyance system maintenance programs.			
• *Implement a schedule of operation and maintenance activities for the stormwater conveyance system and related structures.*	Current	Per JRMP	Base
Develop and implement targeted programs to address issues in residential areas.			
• *Promote and encourage implementation of designated BMPs in residential areas.*	Current	Continuous	Base
• *Conduct focused residential inspections based on strategic assessments.*	FY 15-16	Per JRMP	Enhanced
Improve existing inspections programs to more efficiently target key sources.			
• *Implement a schedule of operation and maintenance for public streets, unpaved roads, paved roads, and*	Current	Per JRMP	Base

Existing Development Management Program Strategies	Implementation Timeframe	Frequency	Program Type*
paved highways.			
• *Conduct inspections of inventoried existing development to ensure compliance.*	Current	Per JRMP	Base
Actively enforce stormwater and urban runoff requirements for existing development.			
• *Impose legal authority to ensure inventoried existing development facilities and/or areas are in compliance with all requirements.*	Current	As Needed	Base
• *Updates to ordinances, reference existing guidance documents.*	Current	One Time	Enhanced
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	Base
Other BMPs/Activities			
• *Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties.*	Current	Continuous	Base
• *Develop a strategy to identify opportunities and facilitate the implementation of stream, channel, and/or habitat rehabilitation projects in areas of existing development.*	FY 15-16	One Time	Base

***Program Types:** *Base* – strategy that is a requirement of the Permit; *Enhanced* – base program that has been enhanced beyond the Permit requirements; the enhanced portions of these strategies would be implemented if needed and if funding is available

Table A.3-5. County of San Diego, Optional Strategies (if needed and if funding is available)

Optional Strategies (if needed & if funding is available)	Implementation Timeframe	Frequency	Program Type*
Optional outreach and information gathering and/or sharing strategies			
• *Consider developing a volunteer surveillance program illicit discharges and connections identification.*	FY 15-16	TBD	Optional
• *Consider conducting an over irrigation outreach pilot study*	Current	One Time	Optional committed
• *Consider developing and implementing a large residential property pet waste management outreach program*	FY 15-16	Continuous	Optional committed
• *Consider implementing an improved, consolidated database to track watershed based inventories.*	FY 15-16	One Time	Optional committed
• *Consider developing and implementing a mobile phone application for staff to track residential inspections data.*	FY 15-16	One Time	Optional committed
• *Consider partnerships with Master Gardeners to provide education opportunities on water use and practices for gardening*	TBD	TBD	Optional
• *Consider collaboration with community groups to provide "boots on the ground" local information to focus implementation efforts on reducing bacteria and other pollutants, close to the source*	TBD	TBD	Optional
• *Consider collaboration with watershed partners to encourage consistent messaging to specific targeted audiences (commercial, residents, and others) to conserve water and mitigate dry weather flows*	TBD	TBD	Optional
• *Conduct homeowners associations outreach and coordination pilot study*	FY 15-16	One Time	Optional
• *Consider expanding homeowners associations outreach and coordination as needed and as funding is identified.*	TBD	TBD	Optional
Optional septic and sewer system related strategies			
• *Consider collaboration with watershed partners to apply for grants to provide septic system rebates or incentives*	TBD	TBD	Optional
• *Consider developing and implementing septic system rebates program.*	FY 15-16	TBD	Optional
• *Consider developing pilot online septic system maintenance outreach program in coordination with the Department of Environmental Health.*	FY 15-16	Continuous	Optional committed
• *Consider developing incentive programs for pumping septic systems in high risk areas adjacent to*	TBD	TBD	Optional

Optional Strategies (if needed & if funding is available)	Implementation Timeframe	Frequency	Program Type*
waterways (within 600 ft) or stormwater system			
• *Consider collaboration with wastewater agencies to identify where sewer and stormwater infrastructure are in close proximity and confirm the absence of flow at nearby stormwater MS4 outfall during dry weather*	TBD	TBD	Optional
• *In collaboration with DEH, consider developing program for on-site wastewater treatment (septic) systems. May include mapping and risk assessment, inspection, or maintenance practices.*	TBD	TBD	Optional
Optional planning and study strategies			
• *Consider conducting dry weather microbial source tracking study at storm drain outfalls with flow to further prioritize drainage areas.*	FY 15-16	One Time Special Study	Optional committed
• *Consider developing and implementing Stormwater Quality Master Plans for Special Drainage Fee Areas.*	Current	Continuous	Optional committed
Optional physical strategies			
• *Implement Valley Center Green Street Pilot Project (redevelop 2.6 miles of Cole Grade Road between Fruitvale Road and Oak Glen Road)*	FY 15-16	One Time	Optional committed
• *Investigate feasibility of developing a Green Streets Program*	TBD	TBD	Optional
• *Consider developing and implementing the Sustainable Landscapes Program subject to available grant funding*	FY 15-16	Continuous	Optional
• *Investigate feasibility of developing and implementing 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.)*	FY 15-16	Continuous	Optional committed
• *Consider the need to plan, design, and conduct environmental review for the following or equivalent structural BMPs to reduce bacteria and other priority pollutants, as needed:* o *SLR WQIP - SDCo-R-01[a], infiltration basin* o *SLR WQIP - SDCo-R-02, subsurface flow wetland* o *SLR WQIP - SDCo-R-03, subsurface flow wetland* o *SLR WQIP - SDCo-R-04, subsurface flow*	TBD	TBD	Optional

[a] The Guajome Lake BMP may not be compatible with future planned uses at the site, and if needed, an equivalent or alternate suite of BMPs will be considered.

wetland o *SLR WQIP - MJ-R-01, subsurface flow wetland* o *SLR WQIP - MJ-R-02, subsurface flow wetland* *Refer to Appendix E for details on these structural BMPs.*			
• *Consider investigating diverting persistent dry weather flows from storm drains to sanitary sewer, where feasible*	TBD	TBD	Optional
• *Consider the design of structural controls for persistent unpermitted dry weather flows where outreach has been unsuccessful and groundwater has been ruled out*	TBD	TBD	Optional
• *Consider developing a strategy to evaluate opportunities to naturalize concrete stormwater conveyances, and identify potential funding sources (such as grants) for design and implementation*	TBD	TBD	Optional
Watershed Management Area Analysis and candidate projects list for alternative compliance options for Priority Development Projects.			
• *Consider developing and implementing a Watershed Management Area Analysis to develop watershed specific requirements for structural BMP implementation.*	FY 15-16	One Time	Optional committed
• *Consider implementation of an alternative compliance program to provide off-site alternatives for pollutant control and hydromodification management.*	FY 18-19	Continuous	Optional
Optional equestrian related strategies			
• *Consider developing and distributing an Equestrian BMP Handbook.*	FY 15-16	Continuous	Optional committed
• *Equestrian/Residential Resource Conservation Plans in collaboration with Mission Resource Conservation District (MCRD).*	FY 15-16	Continuous	Optional committed
Other optional strategies			
• *Consider development of incentive programs for water conservation (turf replacement, smart irrigation controllers, irrigation modifications, sustainable landscapes, rain barrels), in collaboration with water agencies and others, to reduce priority pollutants.*	TBD	TBD	Optional
• *Consider collaboration with watershed partners on Round 4 of Proposition 84 IRWM grant opportunities to fund targeted educational programs, building of structural controls (brick and mortar projects), or incentive programs to reduce runoff*	TBD	TBD	Optional
• *Consider collaboration with watershed partners and Regional Water Quality Control Board on effective measures to reduce potential impact of pollutant loads to waterways from unauthorized encampments*	TBD	TBD	Optional
• *Consider developing and implementing full scale residential pet waste projects (commitments, large*	TBD	TBD	Optional

property, urban)			
• *Consider promoting and encouraging implementation of designated BMPs at residential and commercial areas through collaborations with San Diego County Water Authority and other water agencies.*	TBD	TBD	Optional

***Program Types:** *Optional* – strategies that are not required by the Permit that would be implemented if needed and if funding is available; *Optional committed* – optional strategies that are currently funded this fiscal year (FY14-15) and/or are being undertaken or planned for undertaking.

A.4 Caltrans

Table A.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*	Current	Continuous

Illicit Discharge Detection and Elimination Program Strategies	Implementation Timeframe	Frequency
illegal dumping.		

Table A.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 A.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 A.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.		
• *Maintain and update a watershed based inventory of existing development (i.e., commercial, industrial, and municipal facilities and residential areas).*	Current	Annual
Improve trash management strategies within the watershed.		
• *Implement "Don't Trash California" campaign.*	Current	Continuous
• *Promote "On the Job with Caltrans Litter Removal" video.*	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
• *Promote "On the Job with Caltrans Litter Removal" video.*	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 for the MS4 and related structures.*	FY 15-16	Per JRMP
Improve existing inspections programs to more efficiently target key sources.		
• *Implement a schedule of operation and maintenance for public streets, unpaved roads, paved roads, and paved highways.*	Current	Per JRMP
• *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 via templates and guidance documents.*	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.		

Existing Development Management Program Strategies	Implementation Timeframe	Frequency
• *Develop and implement a Municipal Coordination Plan.*	FY 15-16	One Time, On Going
Other BMPs/Activities		
• *Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties.*	Current	Continuous
• *Implement and evaluate the Vegetation Controls Program.*	Current	Continuous

APPENDIX B
Wet Weather Baseline Loads

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APPENDIX B: WET WEATHER BASELINE LOADS

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 nitrate and total phosphorus were established using Structural BMP Prioritization and Analysis Tool (SBPAT); a U.S. Environmental Protection Agency approved, 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

[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

FC EMCs. **Table B-1** below provides the CLRP and the updated WQIP arithmetic estimates of log mean and log standard deviation for the two land uses. **Table B-2** provides the EMCs for all land uses and pollutants used in the WQIP analysis.

Table B-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 B-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 B-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.

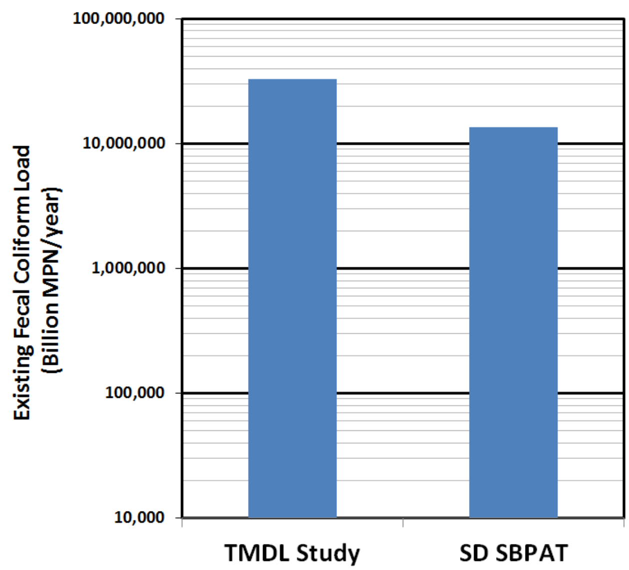

Figure B-1. Comparison of baseline loads for SLR watershed for WY 1993 calculated by TMDL model versus SBPAT method

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 B-2 shows the estimated modeled percentage breakdown of SLR wet weather watershed FC baseline loads by jurisdiction. Modeled baseline FC loads by jursidiction are also summarized in **Table B-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.

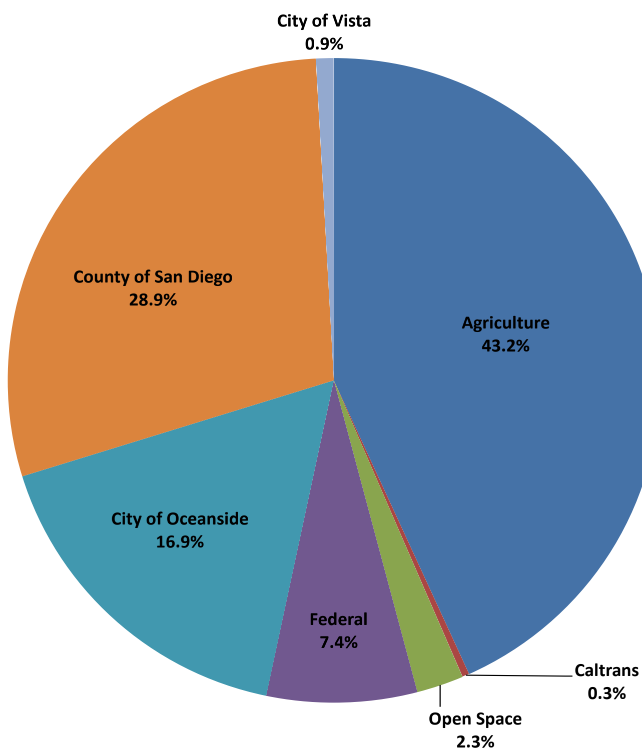

Figure B-2 Wet weather Baseline FC modeled loads in the SLR Watershed, by land use/ownership category, water year 1993

Table B-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

APPENDIX C
Wet Weather Small-Scale BMPs

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APPENDIX C: WET WEATHER SMALL-SCALE BMPS

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 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 C-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 C). 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 C-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 C-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 provision B.2 chapter, section 2.5.1 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, studies frequently document, and best professional judgment reinforces (i.e., remove illicit connections and bacteria loading decreases), the qualitative effectiveness of these programmatic BMPs as described in the provision B.2 chapter, section 2.5.1. 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 C-2 City of San Diego Pet Waste Dispenser

Table C-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%	600 0.53%	7,500 6.7%	130 0.16%	1,700 2.0%
				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.							
				0.952	lbs of nitrate 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							
				7.833	lbs of nitrate 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 3.2%	310 5.0%	1600 1.4%	2400 2.1%	960 1.1%	1400 1.7%
				0.643	10^12 MPN of fecal coliform reduced per Commercial Acre Converted								
				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								
				2.180	lbs of nitrate reduced per Residential Acre Converted								
				0.480	lbs of nitrate reduced per Commercial Acre Converted								
				1.000	lbs of nitrate reduced per Industrial Acre Converted								
				0.150	lbs of nitrate reduced per Education Acre Converted								
				0.700	lbs of nitrate reduced per Transportation Acre Converted								
				0.340	lbs of total phosphorus reduced per Residential Acre Converted								
				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 parentheses) to watershed area by land use							
				5.1	Acres Commercial Converted per year (Land Use Redev. Rate = 0.15%)								
				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**	**2200**	**9900**	**1090**	**3100**
							% of average MS4 total load	**4.6%**	**23%**	**2.0%**	**8.8%**	**1.3%**	**3.7%**

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.

APPENDIX D
Wet Weather Structural BMPs

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Appendix D: Wet Weather Structural BMPs

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.

D.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

[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.

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 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

[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.

- 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 D-1** and associated descriptions are provided in **Table D-1**. A summary of the estimated load reductions for these implemented distributed structural BMPs appear in **Table D-2**. These BMPs were quantified using unit area quantification results based on an assumption that these BMPs were designed to meet the SUSMP critiera.

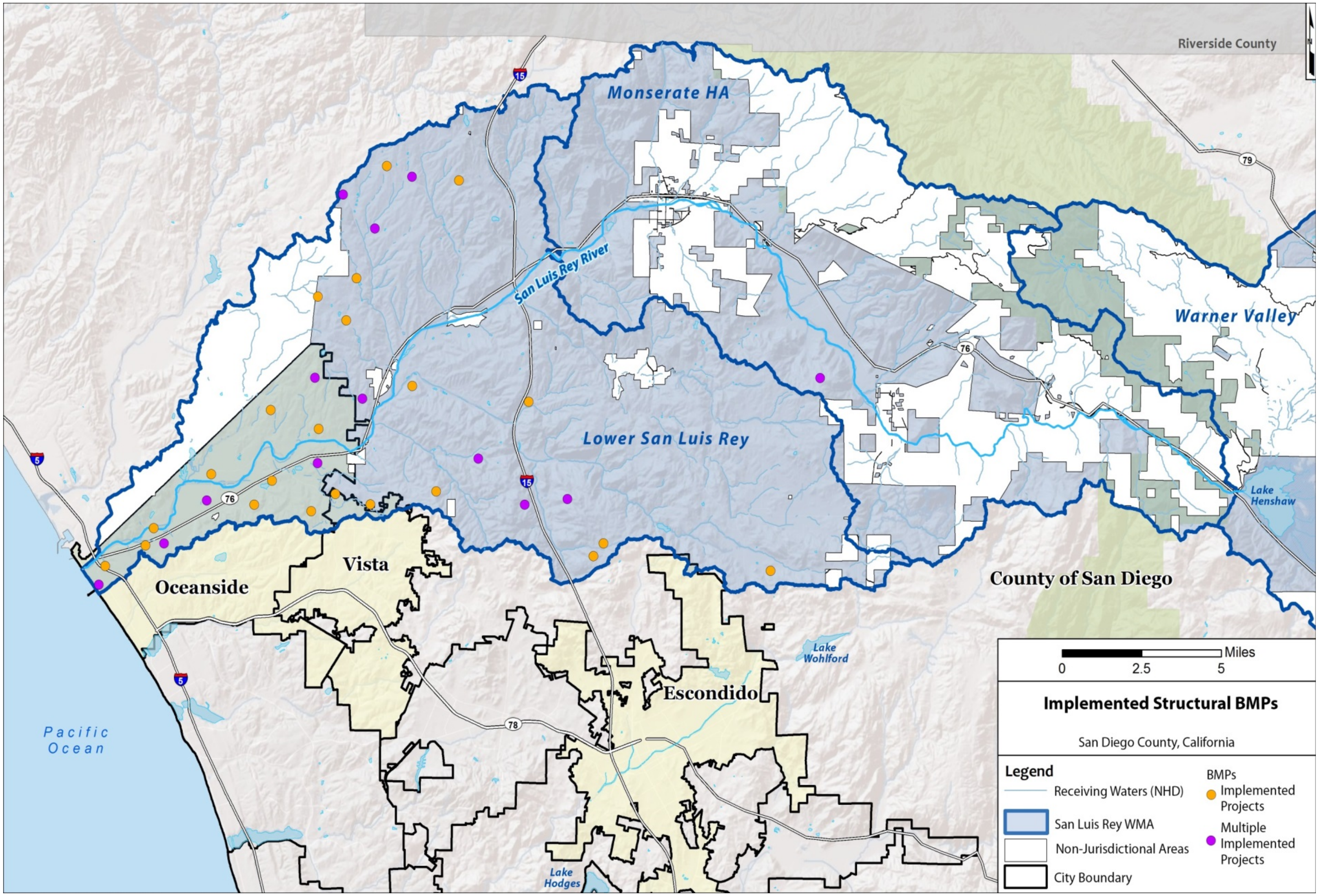


Figure D-1 Locations of Implemented Distributed BMPs

Table D-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
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

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
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
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

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
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
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

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
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
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 D-2**.

Table D-2 Estimated Load Reductions from Implemented Distributed BMPs

Location/Name	Water Quality (FC Load) Benefits (10^{12} MPN reduction/year)	Water Quality (Nitrate 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]	NA	NA
Totals[a]	**41 [22 - 47]**		

[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.

D.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:

[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.

    - 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.

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 scoreusing the weights listed in **Table D-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 D-2** and **Table D-3.**

Table D-3 Pollutant Group Weights for Normalized Pollutant CPI Calculation

Pollutant	Weight
Nitrogen (Nitrate)	10
Bacteria (Fecal Coliform)	20
Total Suspended Solids (representing Phosphorus)	10

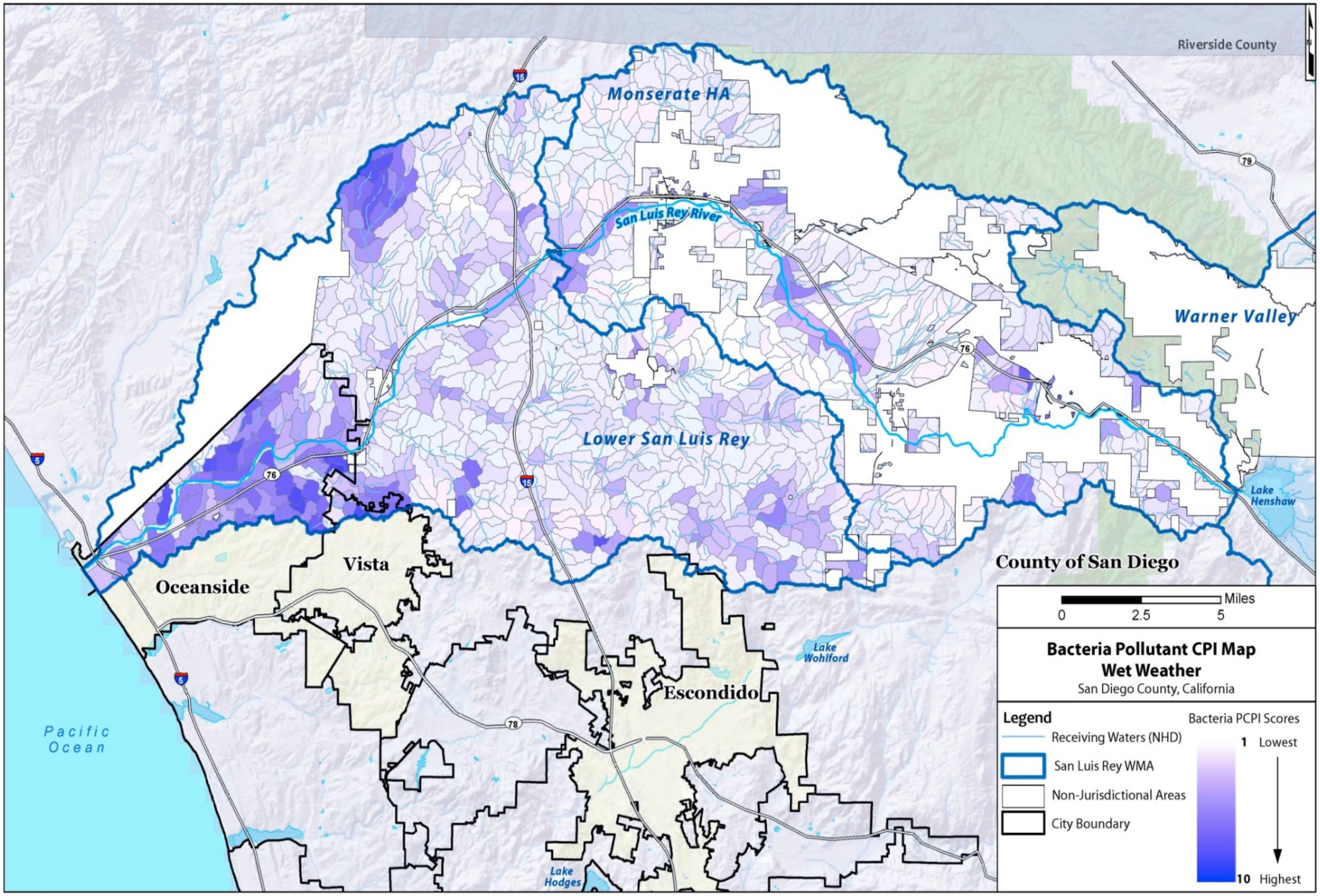


Figure D-2 CPI Map for Bacteria (HPWQC)

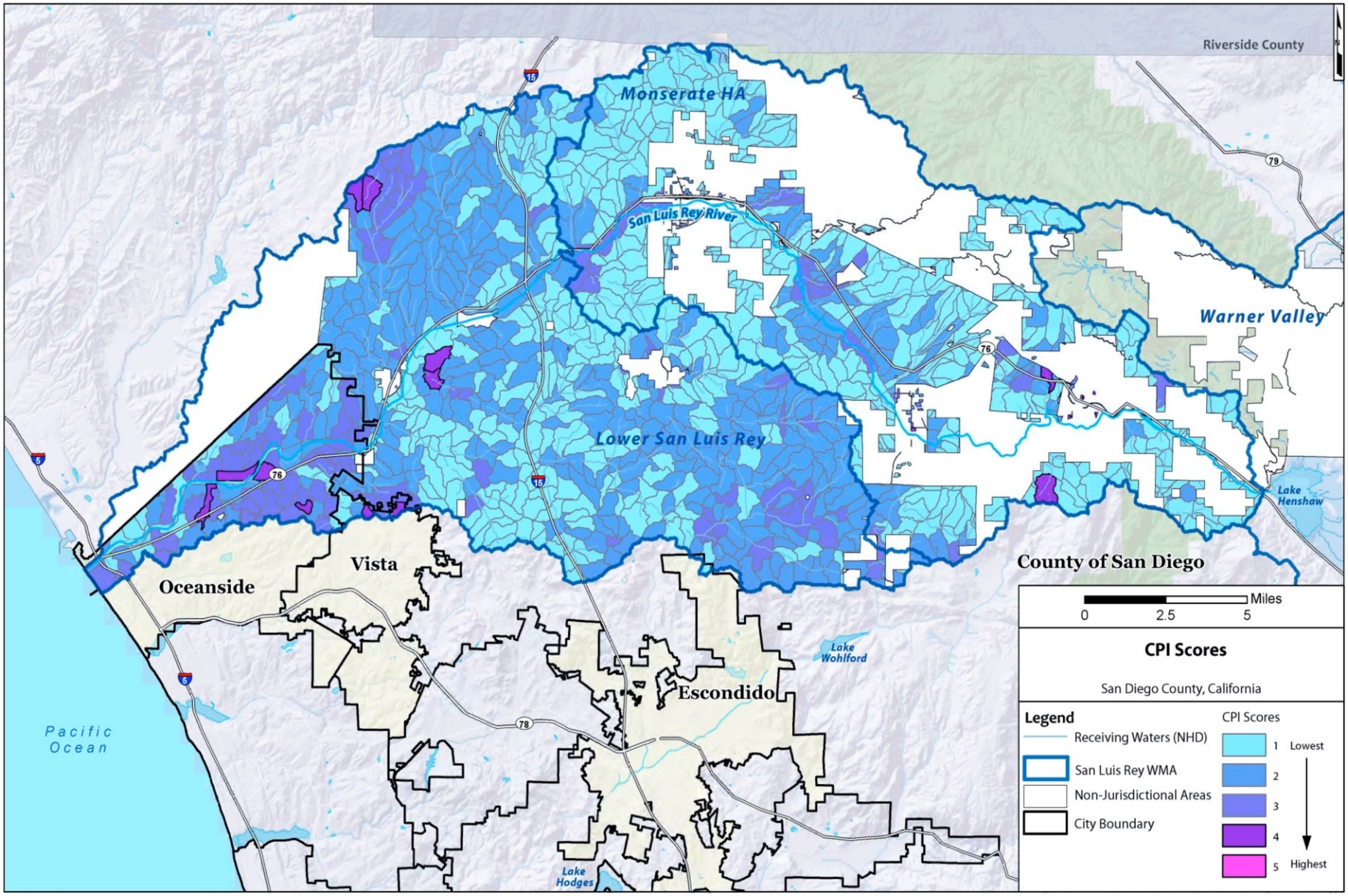


Figure D-3 Integrated CPI Map for Bacteria (HPWQC) and Nutrients (PWQCs)

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 D-4**.

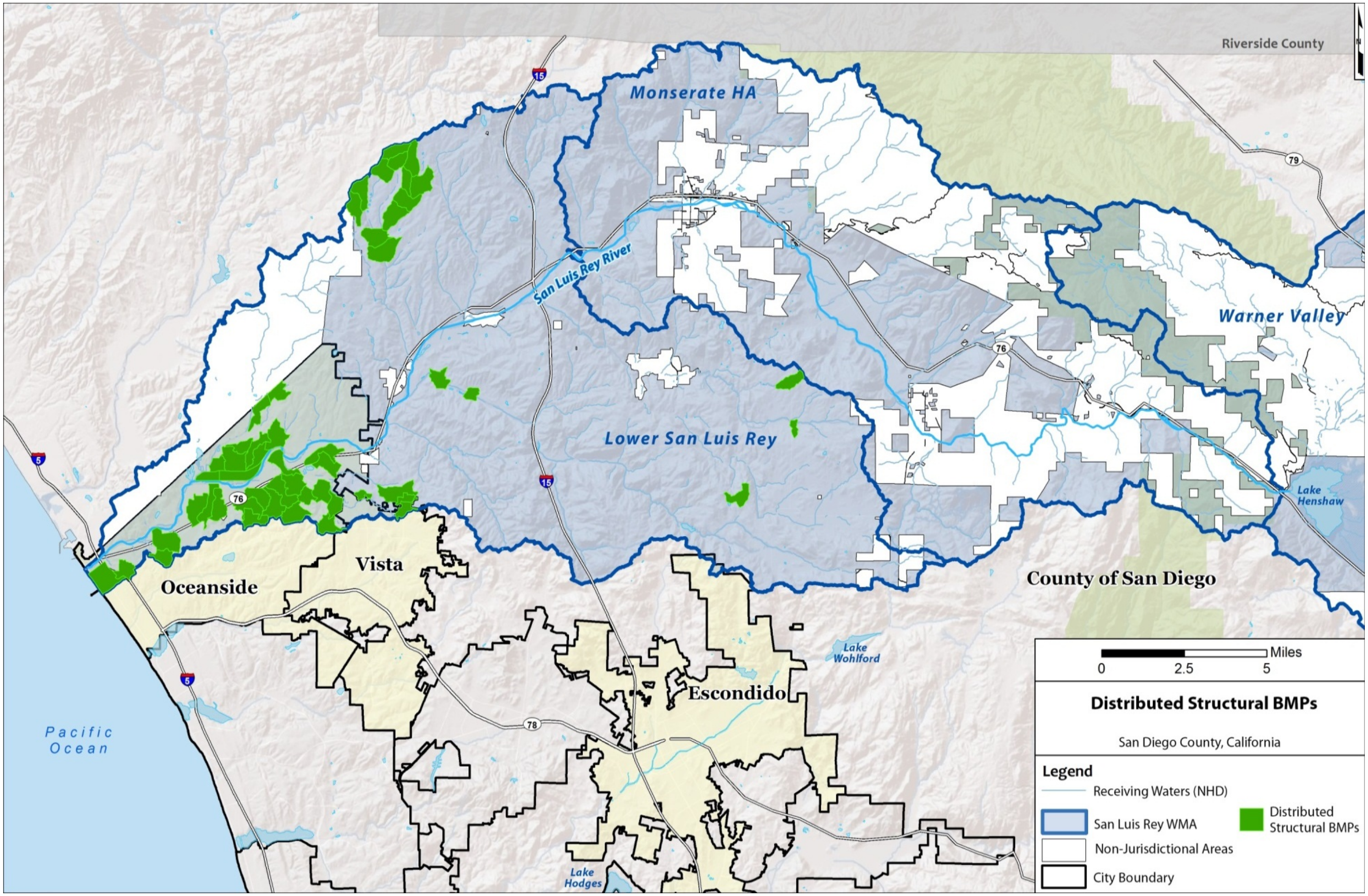


Figure D-4 Proposed Catchments for Implementation of Distributed Structural BMPs

Load Reduction Quantifications

The estimated load reductions for the proposed distributed structural BMPs are presented in **Table** D-4.

Table D-4 Estimated Load Reductions from Proposed Distributed BMPs

Location/Name	Water Quality (FC Load) Benefits (10^12 MPN reduction/year)	Water Quality (Nitrate 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]	800 [380 - 830]	170 [150 - 180]
Totals[1]	**151 [86 - 174]**	**800 [380 - 830]**	**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.

D.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 D-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 D-6** shows a map of locations for the candidate regional structural BMPs.

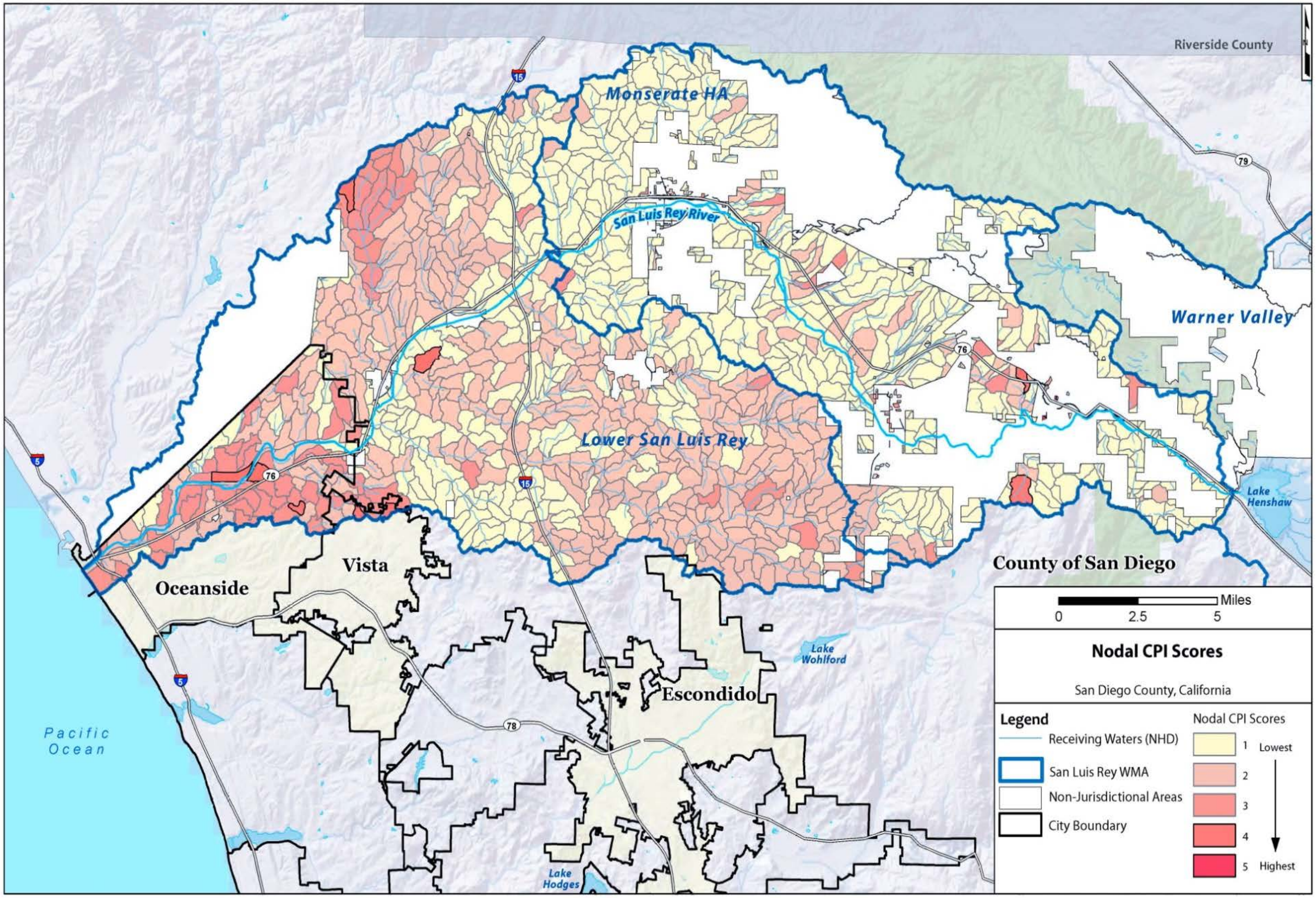


Figure D-5 Integrated NCPI Map for Bacteria and Nutrients

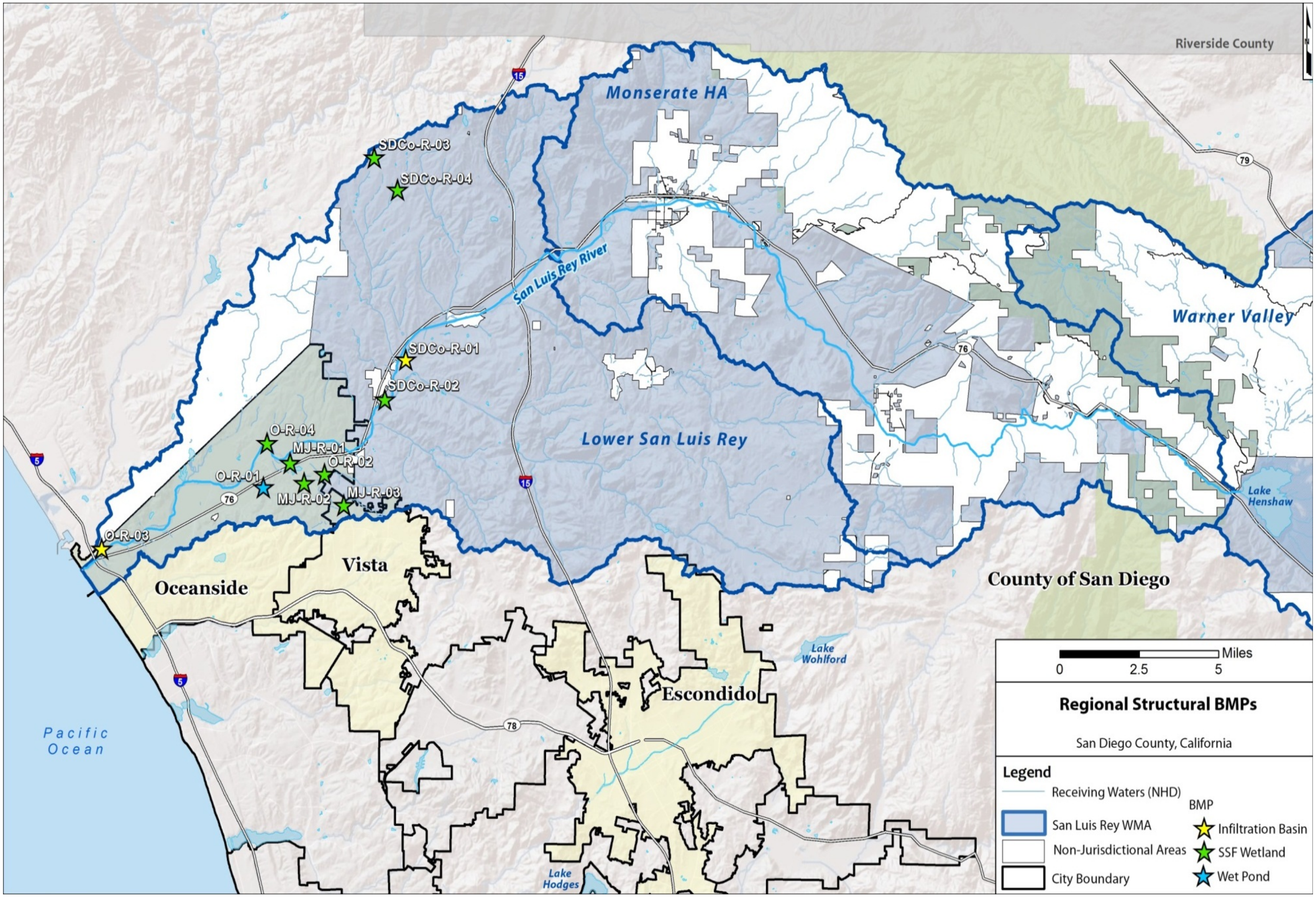


Figure D-6 Locations of Proposed Regional Structural BMPs

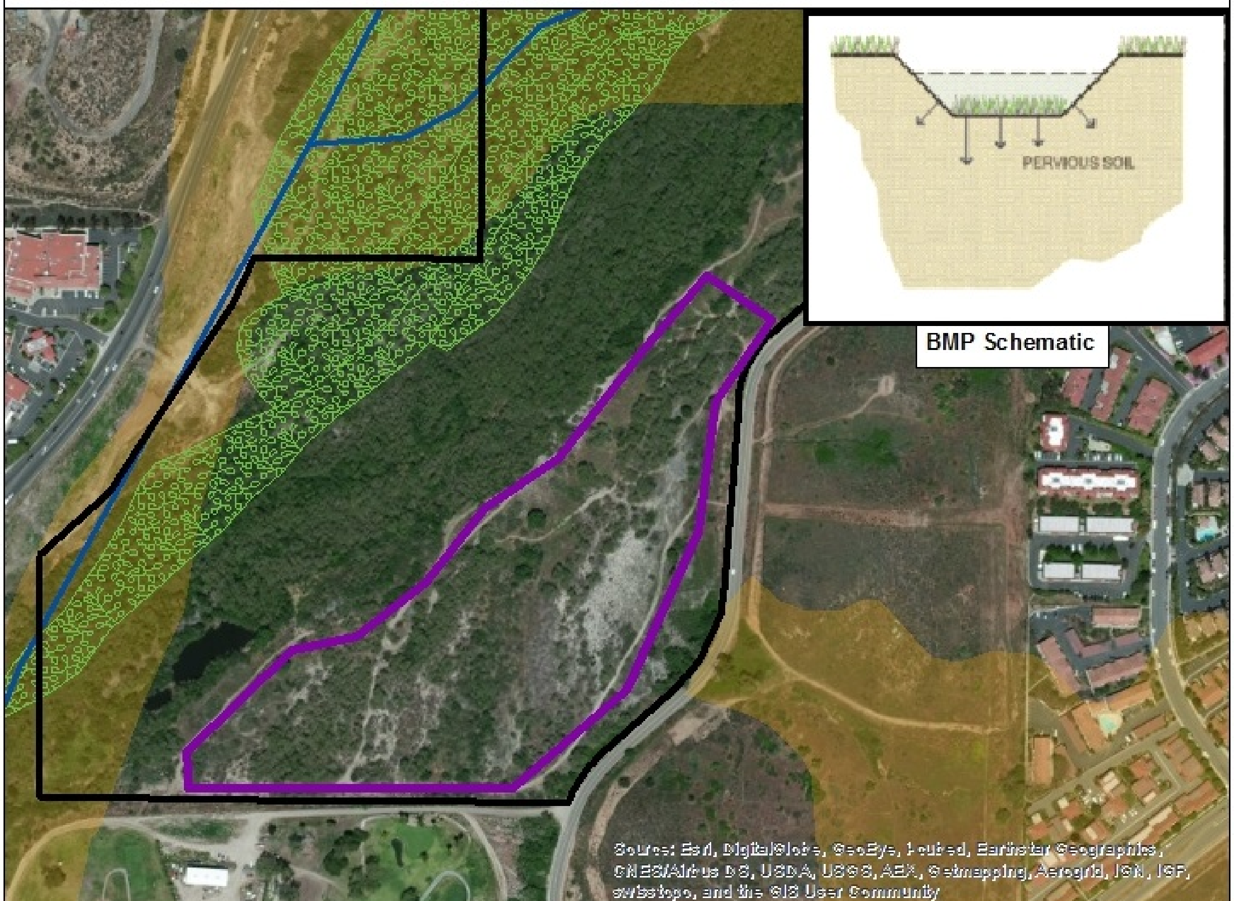
The proposed regional structural BMPs are listed in **Table D-5**, and design criteria specific to each project is presented in their respective BMP sheets, included as **Figure D-7** through **Figure D-17**.

Table D-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

LEGEND

BMP Footprint
Priority Acquisition
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

400 200 0 400 Feet

DATA SOURCES: ESRI, SANDAG, SANGIS, USGS

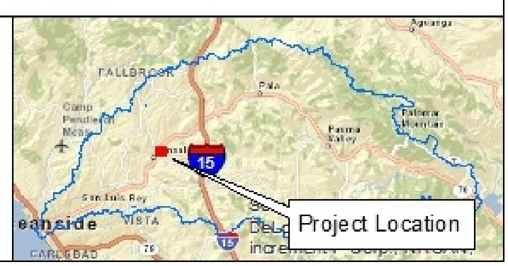
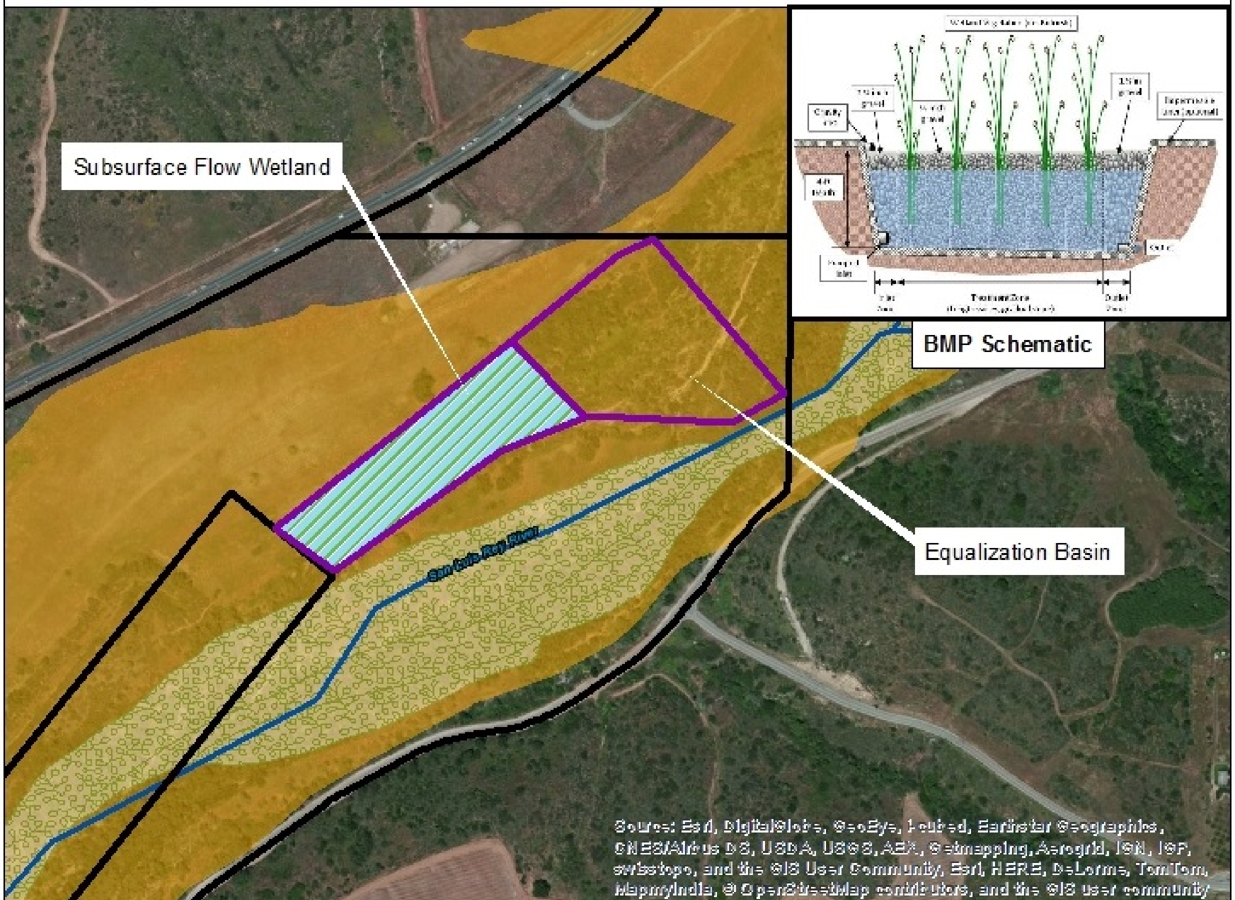


Figure D-7. SDCo-R-01

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

LEGEND

BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

500 250 0 500 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

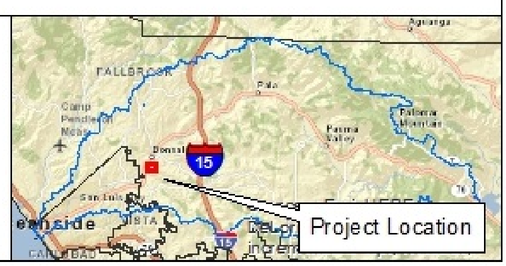
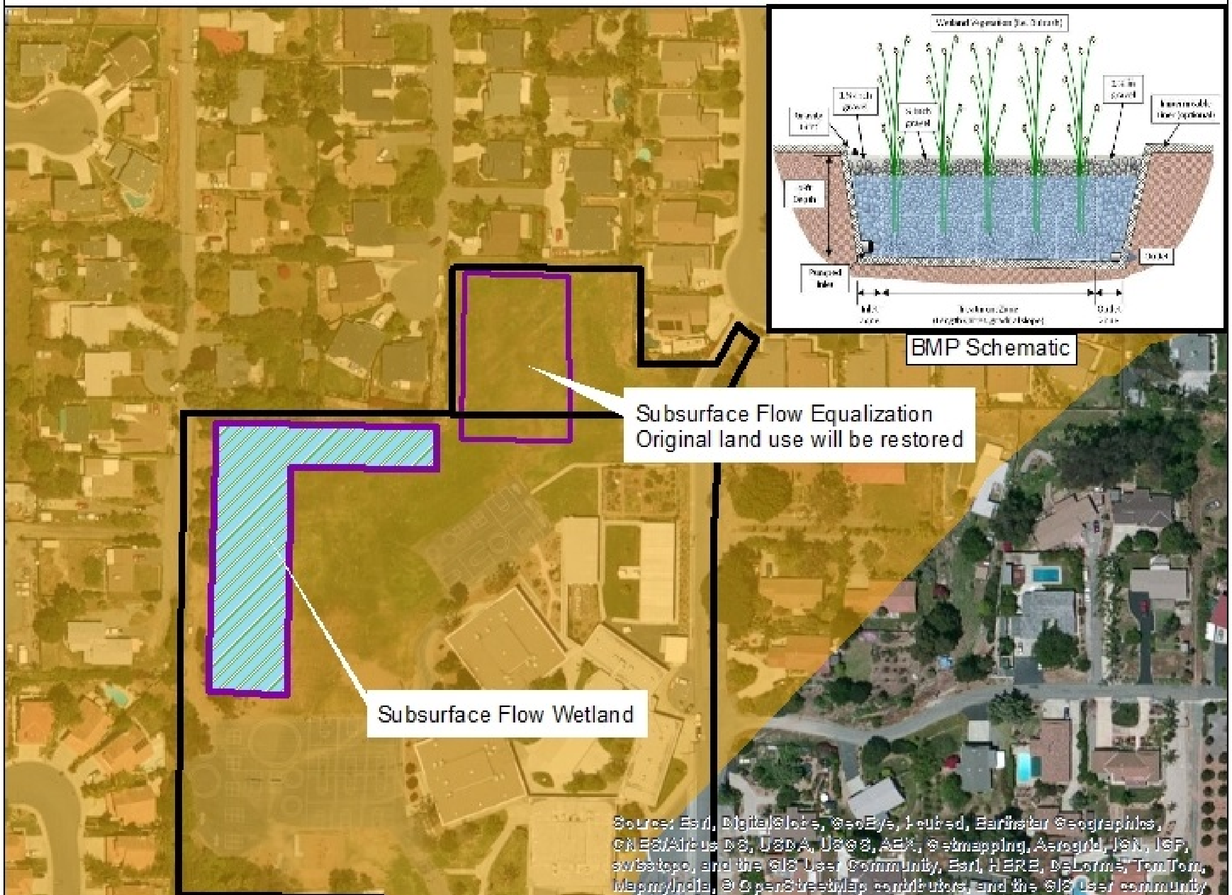


Figure D-8. SDCo-R-02

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

SDCo-R-03

October 2014



Parcel Information

Owner: Fallbrook Union Elementary School District
Jurisdiction: County of San Diego
Constraints in Parcel: Low Permeability Soils
Current Land Use: Elementary School

Project Name: TBD

BMP Information

BMP Proposed: Subsurface Flow Wetland
Constraints in Footprint: Low Permeability Soils
Tributary Area: ~ 142 acres; SUSMP Volume Treated: ~63%
BMP Footprint: ~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

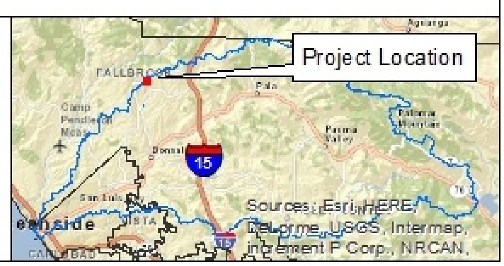
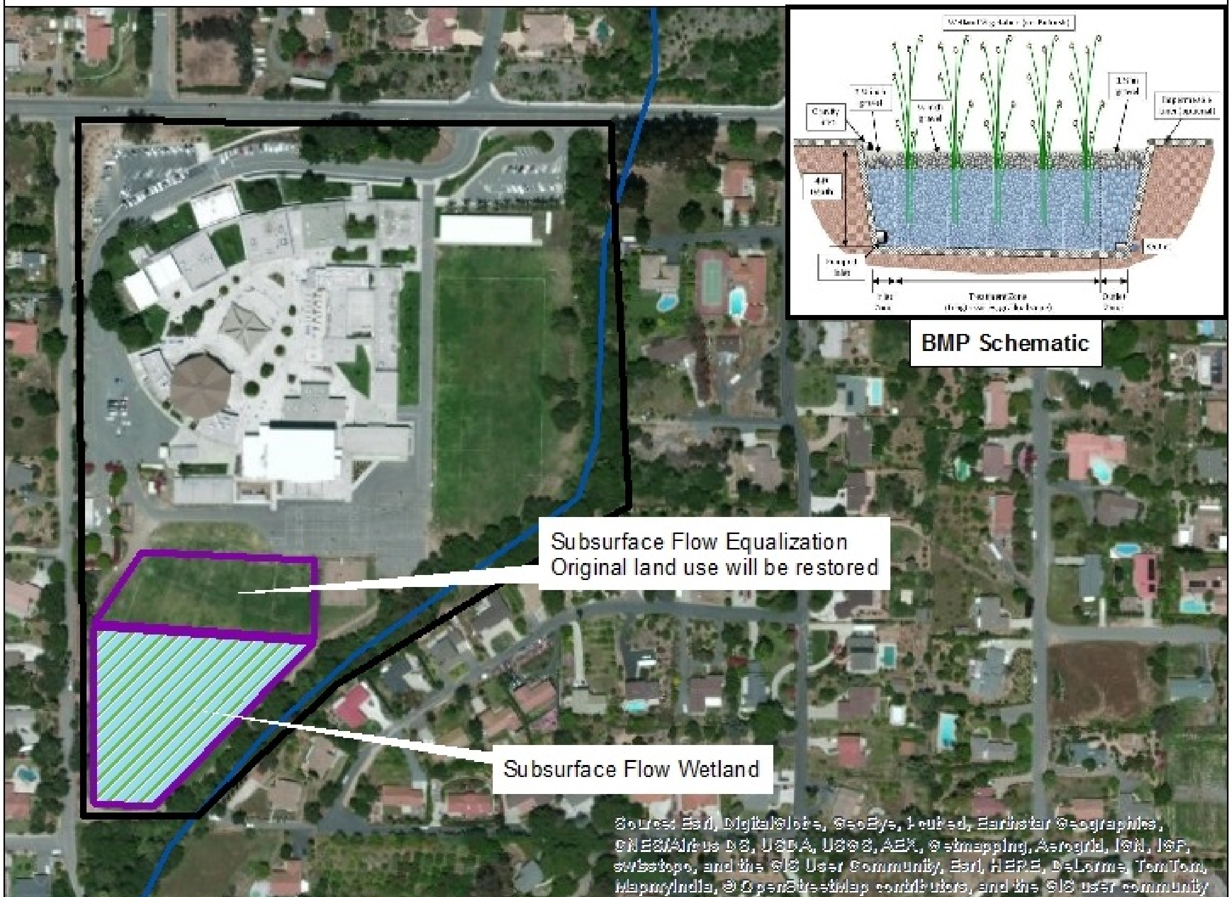


Figure D-9. SDCo-R-03

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

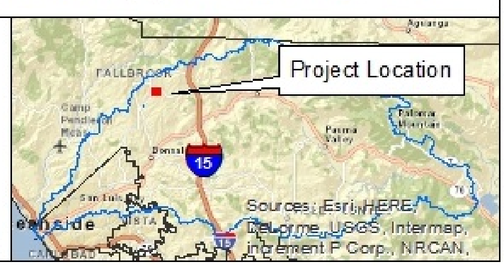
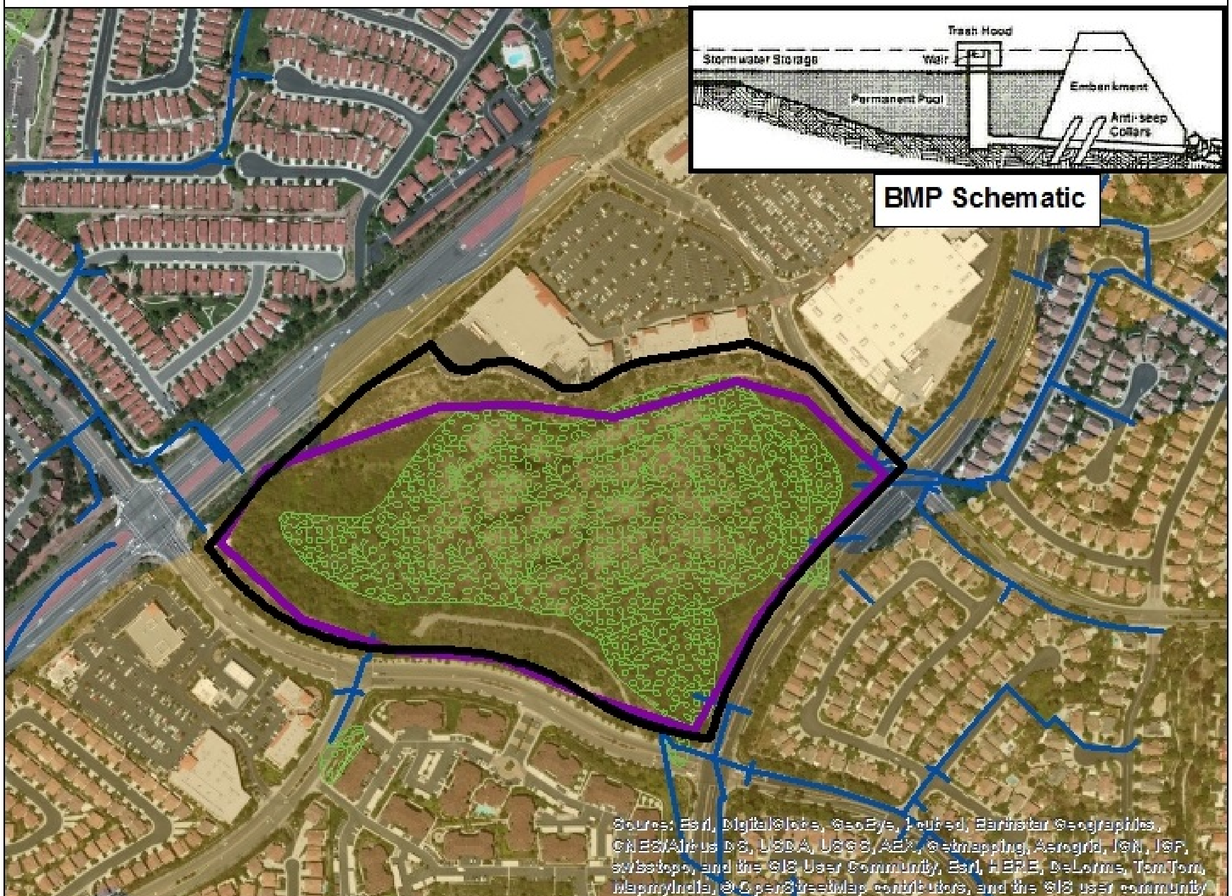


Figure D-10. SDCo-R-04

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

O-R-01 **October 2014**



Parcel Information

Owner : Talone Conservancy Corp
Jurisdiction: City of Oceanside
Constraints in Parcel: Wetlands, Low Permeability Soils

Note: Benefits shown in the quantification table assume the wetland was not functional in 2002.

Project Name: Talone Lake

BMP Information

Existing BMP: Wetlands/Wet Pond
Constraints in Footprint: Wetlands, Low Permeability Soils
Diversion: No
Tributary Area: ~ 1096 acres; SUSMP Volume Treated: ~100%
Volume: 1,400,000 cubic feet
Permanent Pool Depth: 4 feet
Hydraulic Residence Time: 24 hours

LEGEND

- BMP Footprint
- Parcel Boundary
- Storm Drains/Streams
- Wetlands (National Wetlands Inventory)
- Low Permeability Soils (NRCS Type D)

N

500 250 0 500 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

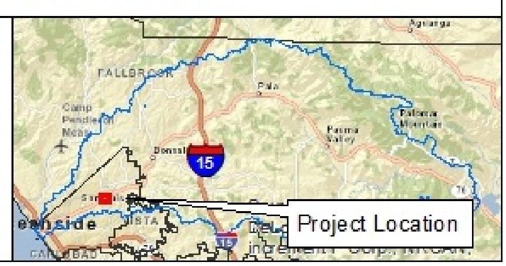
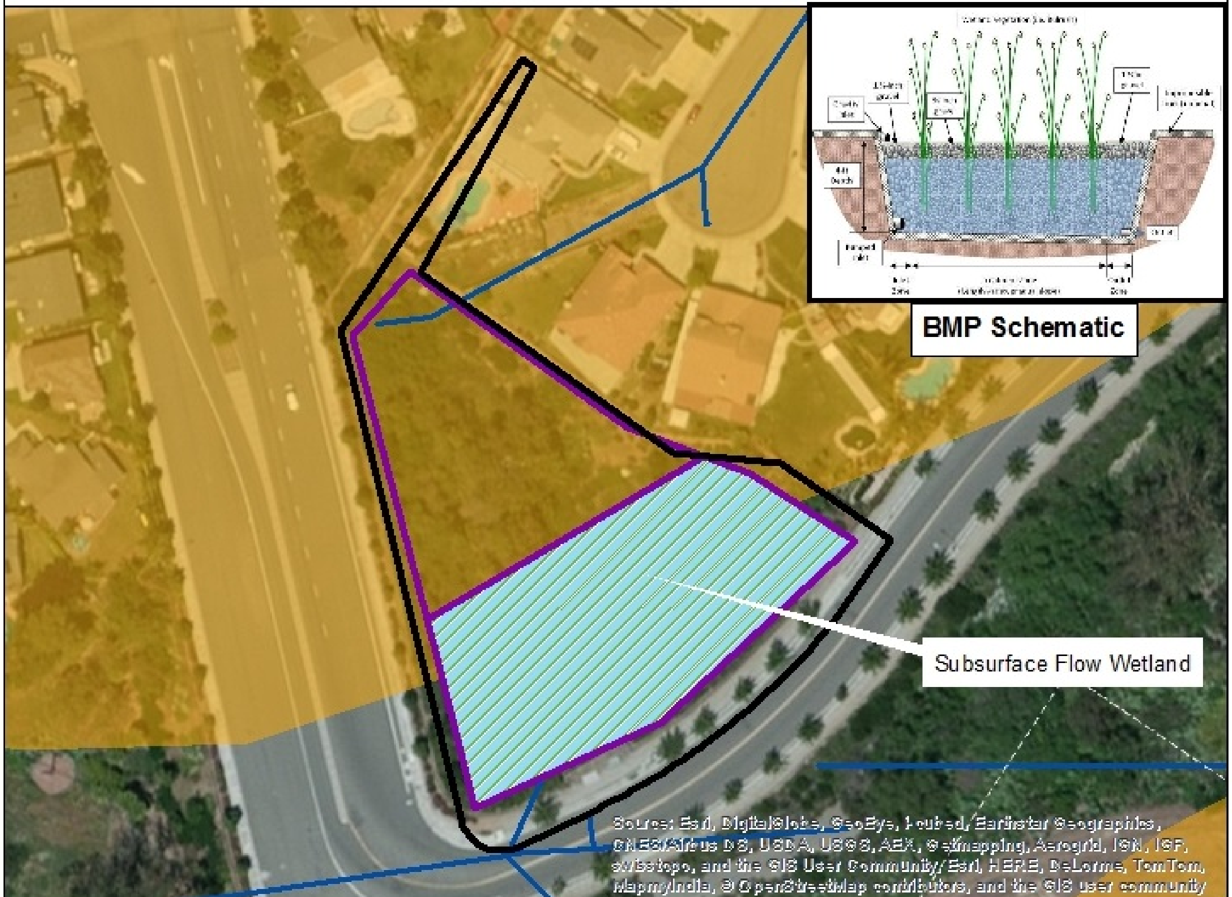


Figure D-11. O-R-01

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

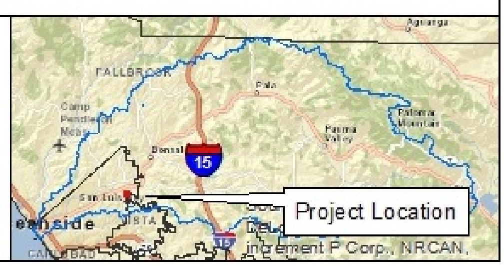
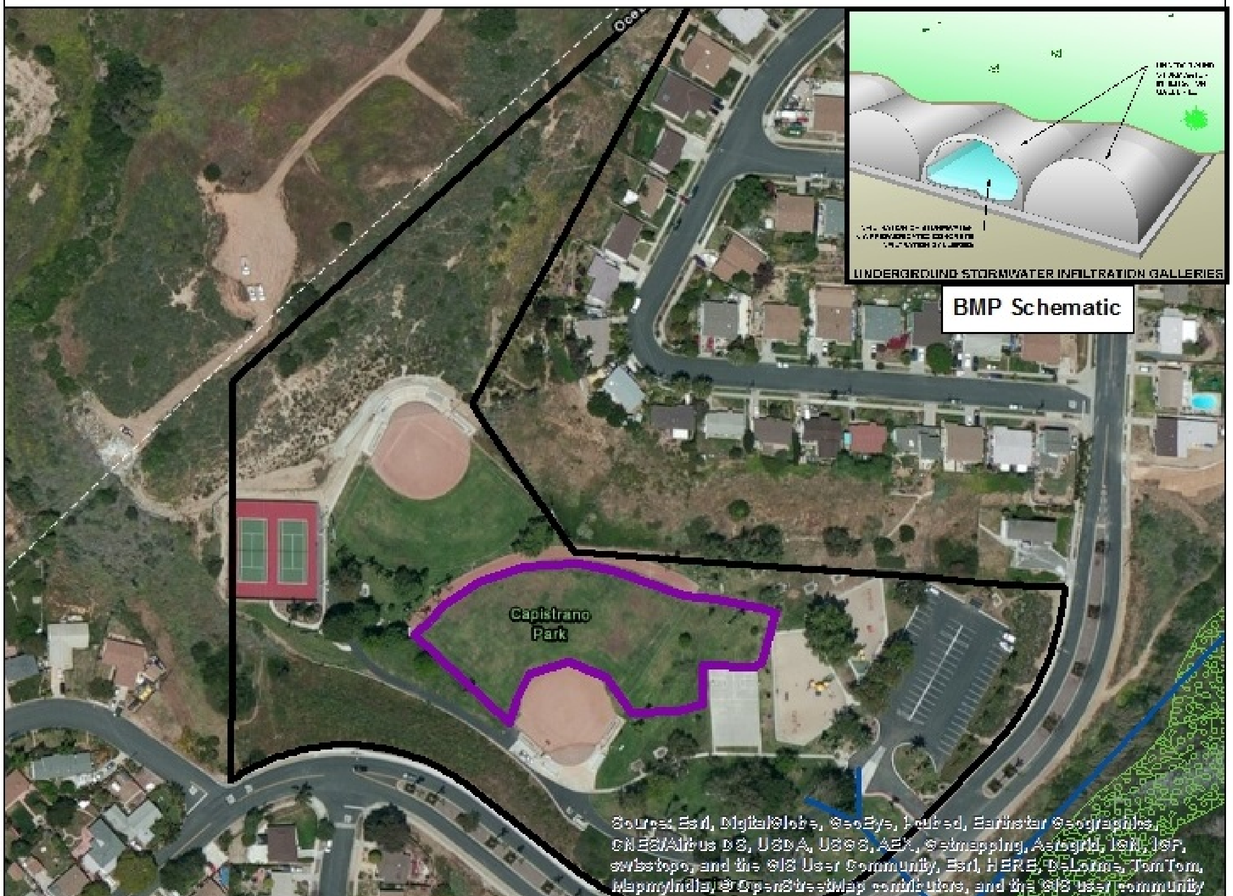


Figure D-12. O-R-02

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

O-R-03

October 2014



Parcel Information

Owner : City of Oceanside
Jurisdiction: City of Oceanside
Constraints in Parcel: Floodplain
Current Land Use: Park with baseball field
Future Land Use: Park with baseball field

Project Name: TBD

BMP Information

BMP Proposed: Subsurface Infiltration Basin
Tributary Area: ~ 143 acres; SUSMP Volume Treated: ~54%
Diversion from San Luis Rey River: No
BMP Footprint Area: ~1.2
Water Quality Depth: 2 Feet; Surface Area: 43,000 square feet
Infiltration Rate: ~0.5 in/hr

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

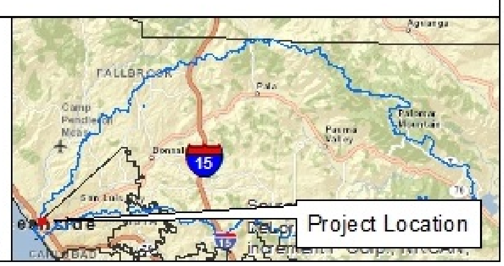
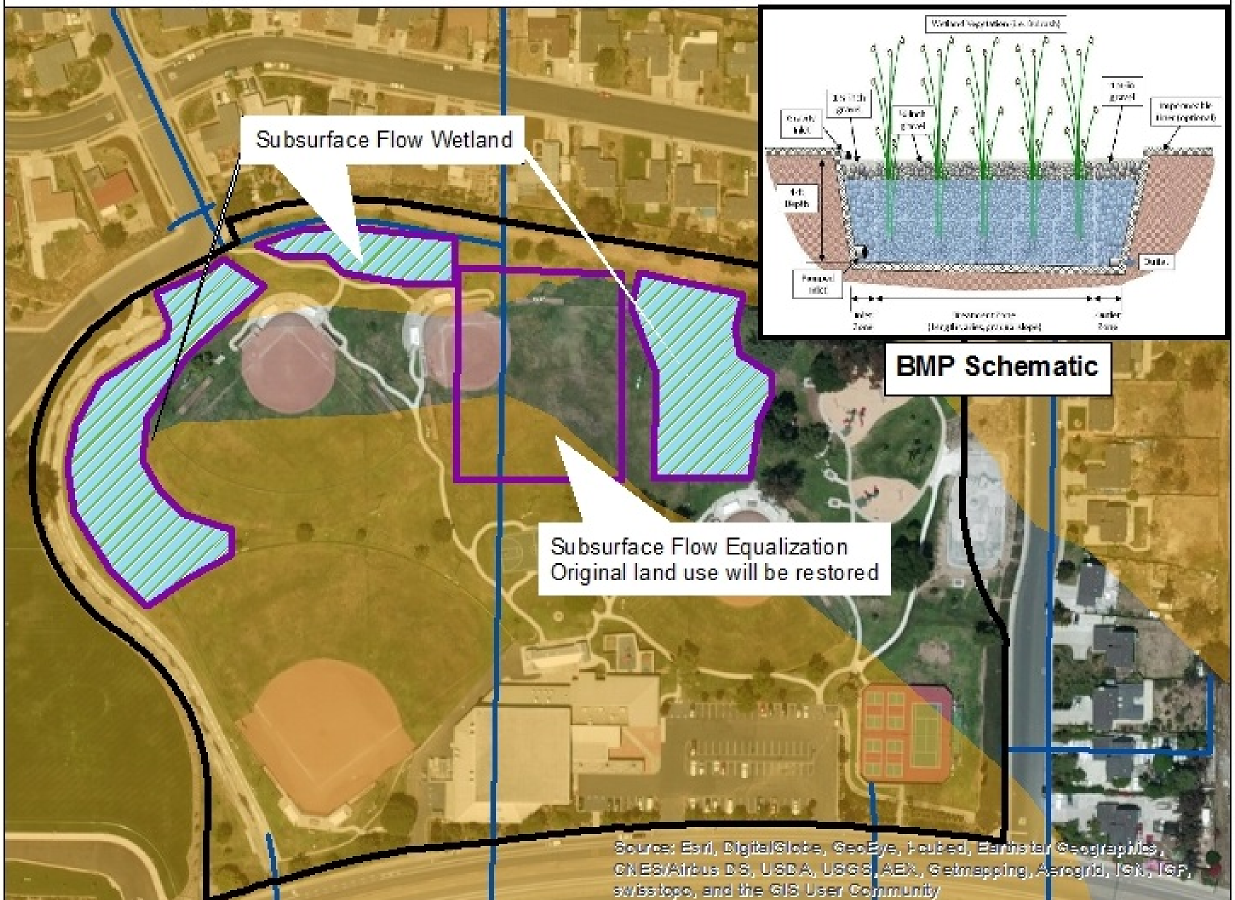


Figure D-13. O-R-03

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

O-R-04

October 2014



Parcel Information

Owner: City of Oceanside
Jurisdiction: City of Oceanside
Constraints in Parcel: Low Permeability Soils
Current Land Use: Park

Project Name: TBD

BMP Information

BMP Proposed: Subsurface Flow Wetland
Constraints in Footprint: Low Permeability Soils
Tributary Area: ~ 636 acres; SUSMP Volume Treated: ~39%
BMP Footprint Area: ~ 3 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

200 100 0 200 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

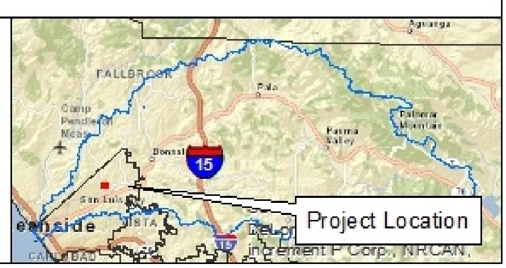
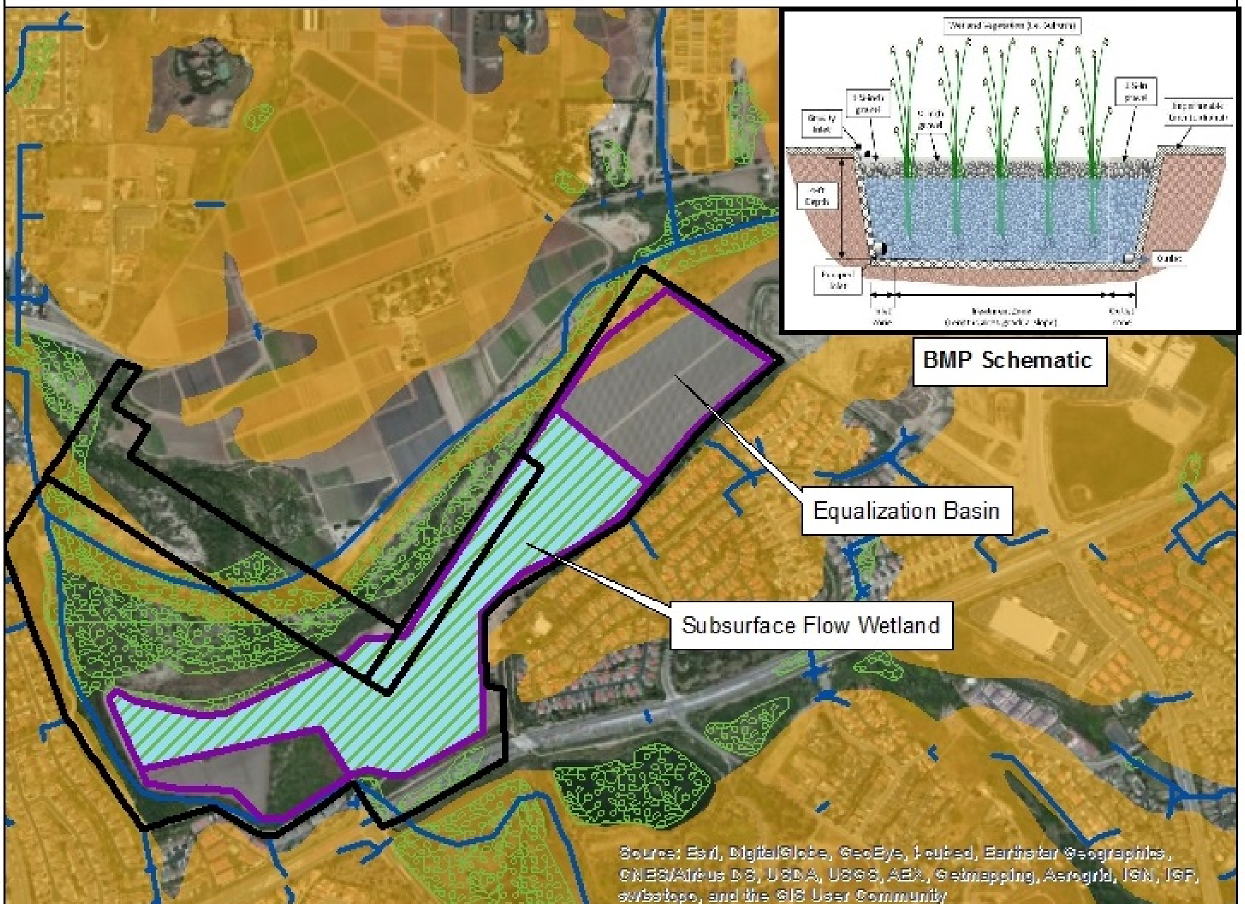


Figure D-14. O-R-04

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

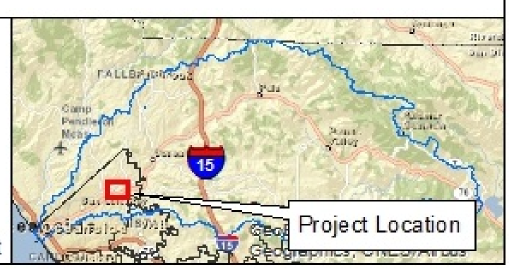
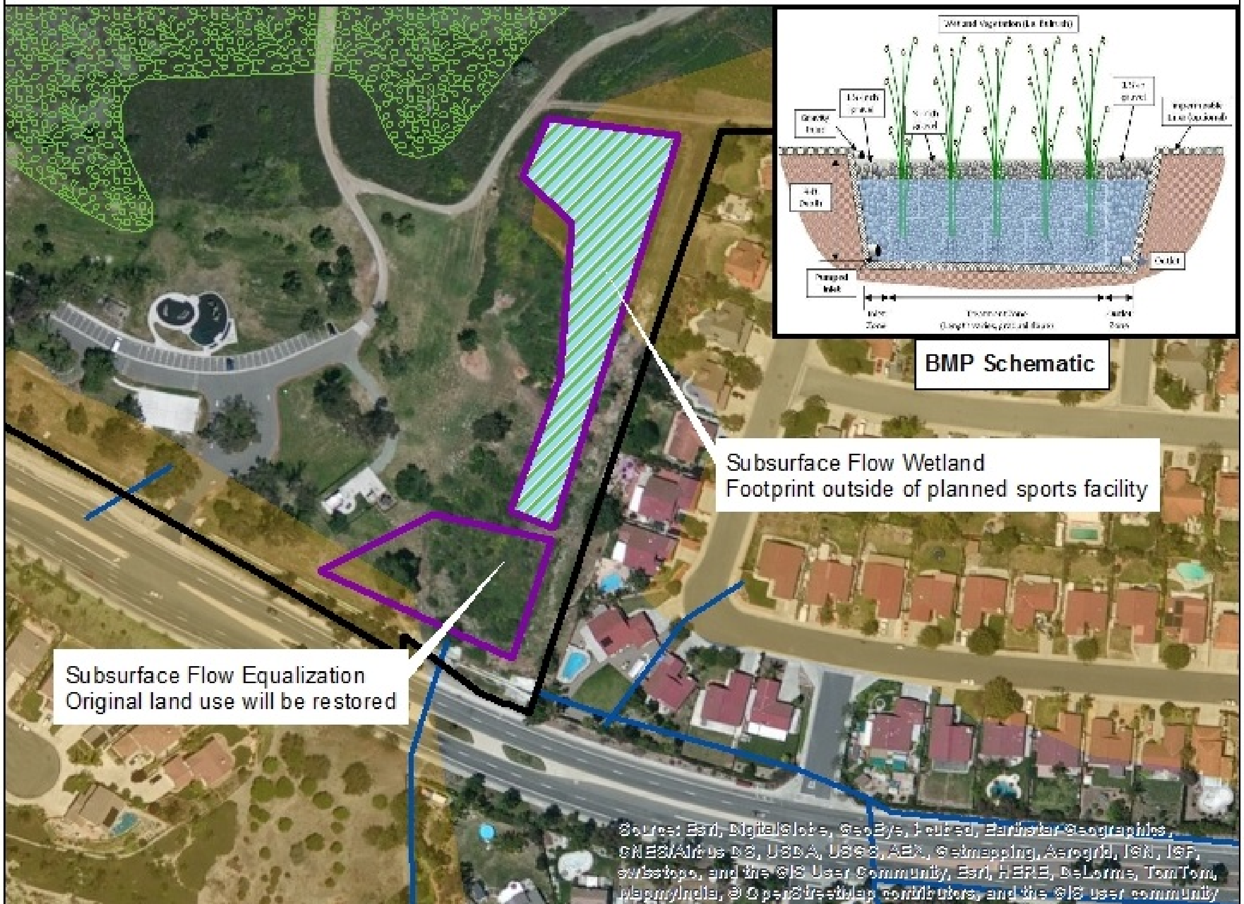


Figure D-15. MJ-R-01

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

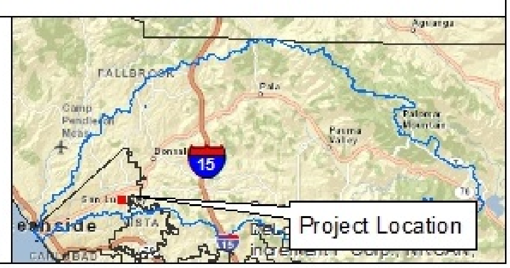
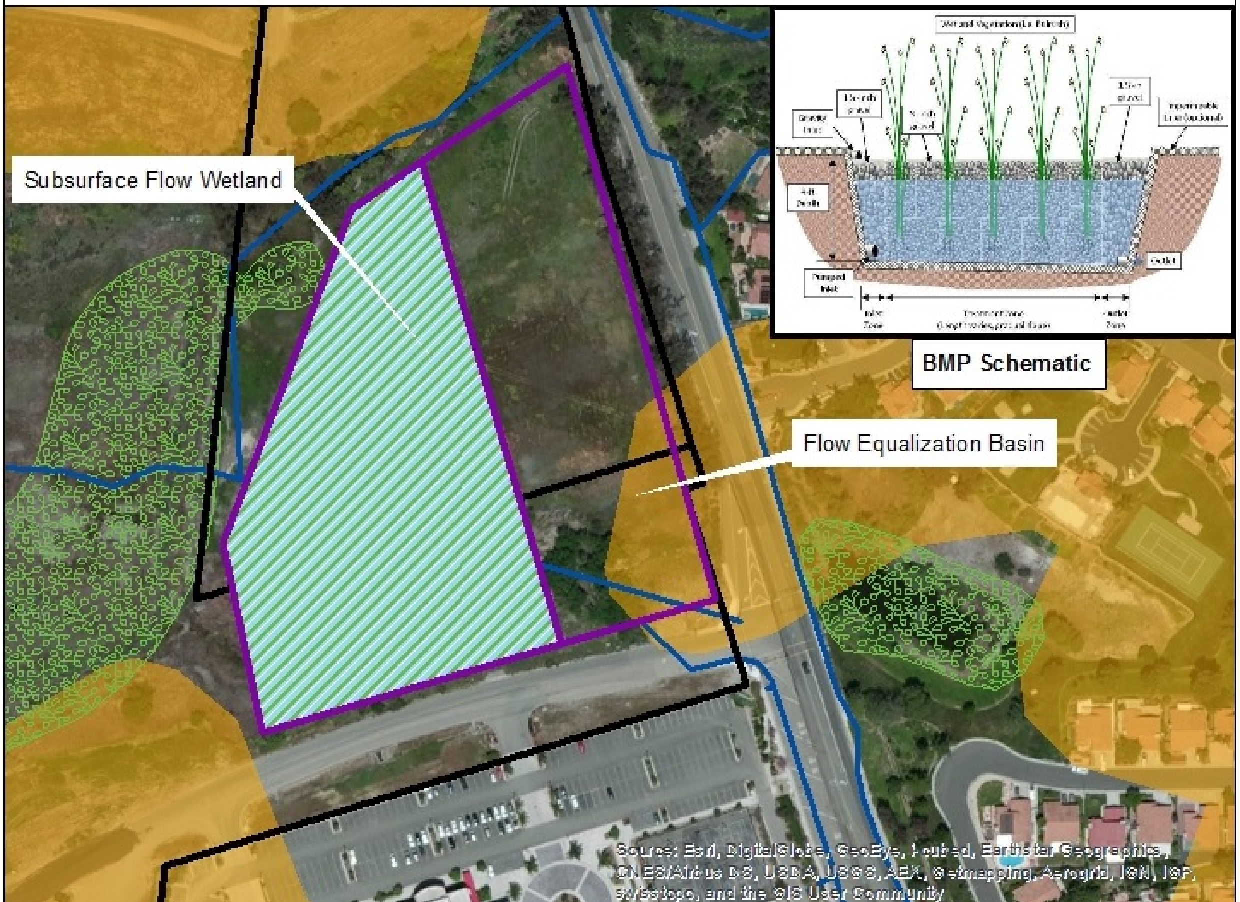


Figure D-16. MJ-R-02

San Luis Rey Watershed Management Area
Water Quality Improvement Plan
Regional BMP Identification and Constraints

MJ-R-03 | **October 2014**



Parcel Information

Owner: County of San Diego
Jurisdiction: City of Vista
Constraints in Parcel: Wetland, 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: ~ 620 acres; SUSMP Volume Treated: ~58%
Diversion from Guajome Creek: Yes
BMP Footprint Area: ~6.9 acres
Equalization Basin: Volume: ~8 acre-feet;
Treatment Flow Rate: 2 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

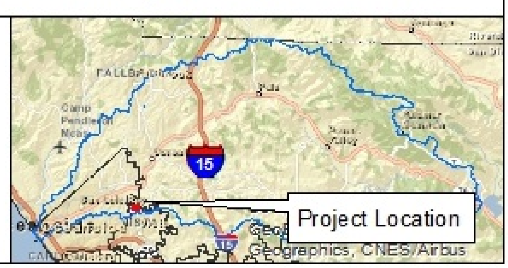


Figure D-17. MJ-R-03

Load Reduction Quantifications

The estimated load reductions for the proposed regional structural BMPs are presented in **Table** D-6.

Table D-6 Estimated Load Reductions from Proposed Regional Structural BMPs

Location/Name	Water Quality (FIB-FC Load) Benefits (10^12 MPN reduction/year)	Water Quality (Nitrate 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]	8,000 [5,857 - 8,609]	910 [837 - 968]
SDCo-R-02	26 [20 - 29]	3,000 [1,923 – 3,010]	300 [282 - 341]
SDCo-R-03	16 [10 - 18]	203 [150 - 235]	50 [44 - 55]
SDCo-R-04	29 [20 - 34]	561 [420 - 640]	140 [126 - 151]
City of Oceanside			
O-R-01	75 [47 - 87]	638 [412 - 756]	166 [133 - 194]
O-R-02	11 [7 - 13]	112 [79 - 132]	30 [26 - 33]
O-R-03	19 [12 - 22]	190 [136 - 220]	62 [56 - 67]
O-R-04	33 [24 - 37]	1,382 [936 - 1,572]	175 [163 - 186]
Multi-Jurisdictional Projects			
MJ-R-01	493 [404 - 551]	54,000 [40,840 - 61,263]	5,800 [5,374 - 6,282]
MJ-R-02	18 [12 - 21]	168 [118 - 199]	46 [40 - 51]
MJ-R-03	61 [43 - 70]	757 [570 - 872]	193 [173 - 211]
Totals[a]	**834 [641 - 942]**	**69,011 [51,440 - 77,507]**	**7,871 [7,254 - 8,540]**

[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.

APPENDIX E
Dry Weather Load Reductions

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APPENDIX E: 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 E-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 E-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: Load Assumption	Quantification Assumptions: Units	Quantification Assumptions: Citation/Assumptions	Quantification Method	Expected Annual Reduction of MS4 Baseline Load by 2021 – Fecal Coliform (10 ^12 MPN and percent): Low Range	Expected Annual Reduction of MS4 Baseline Load by 2021 – Fecal Coliform (10 ^12 MPN and percent): 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								**8.0**	**8.0**
							% of average MS4 total load (58.5 10^12 MPN)	**39.1%**	**39.1%**

APPENDIX F
BMP Adjusted Load Reductions and Water Quality Benefits

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Appendix F: BMP Adjusted Load Reductions and Water Quality Benefits

F.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 18^{th} 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.

F.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 F-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 F-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 F-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 F-2. Summary of Wet Weather Load Reductions for Nutrients

BMP Category	Nitrate Load Reduction (lbs/year) 1993 WY Load [Low-High Range]	Total Phosphorous Load Reduction (lbs/year) 1993 WY Load [Low-High Range]
Programmatic BMPs	NA	NA
Potential Public-Private Partnership BMPs	5,700 [3,100 – 8,300]	2,050 [1,300 – 2,800]
Redevelopment through Permit-Required LID Implementation	2,000 [1,600 – 2,400]	1,180 [960 – 1,400]
Distributed Structural BMPs	800 [380 - 830]	170 [150 - 180]
Regional Structural BMPs	69,011 [51,440 - 77,507]	7,871 [7,254 - 8,540]
Load Reduction Sum	**75,511 [54,920 – 86,637]**	**10,091 [8,704 – 11,520]**

Other Water Resources Benefits

In addition to the reductions in loading of the HPWQC and other PWQCs shown in **Table F-1** and **Table F-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.

APPENDIX G
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	$1/3^{rd}$ 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

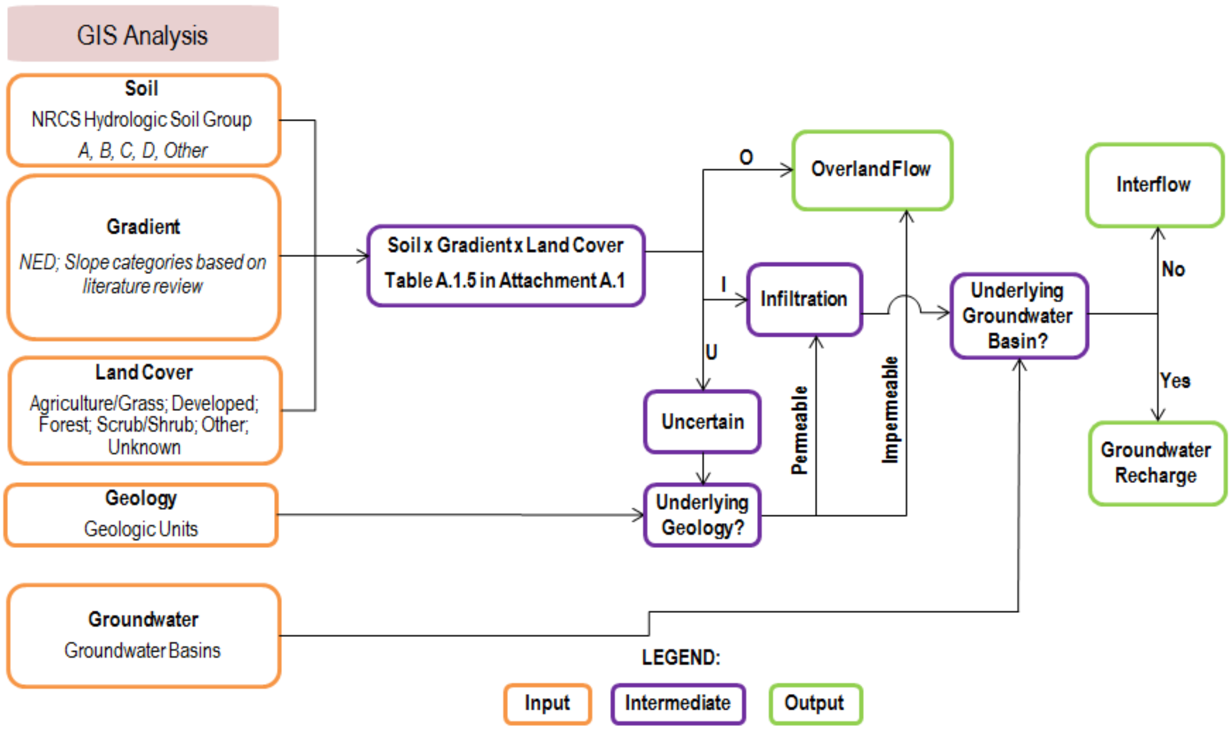
Dataset	Source	Year	Description
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30'x60' Quadrangle, California, 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:

<u>Engineered</u>

- 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.

<u>Natural</u>

- 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:

<u>Constrained</u>

- 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.

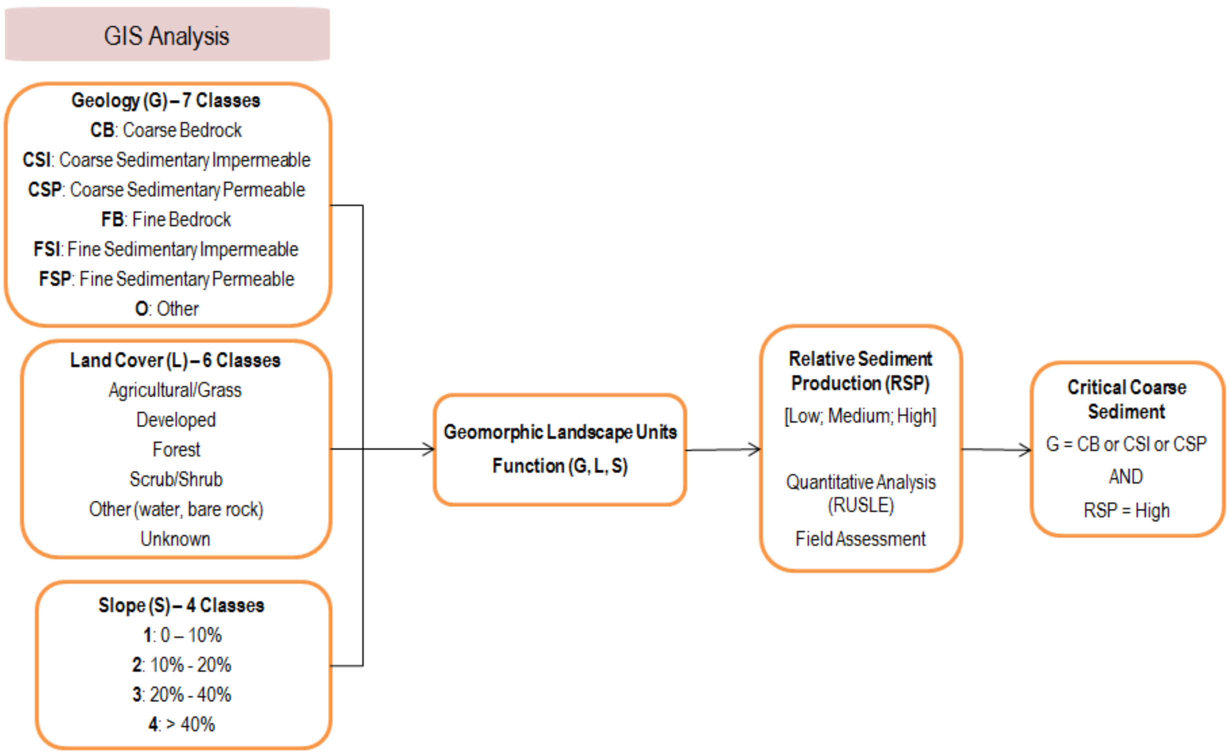
2.4.1. Datasets Used for identifying potential critical coarse sediment yield areas

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

Lake Henshaw

October 3, 2014

Prepared for:
San Diego County Copermittees

Prepared by:

Geosyntec consultants
engineers | scientists | innovators

RICK ENGINEERING COMPANY

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 size 1/8 acre	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
	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 size 1/4 acre	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
	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 size 1/3 acre	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
	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 size 1/2 acre	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
	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 size 1 acre	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
	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

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ATTACHMENT A.2

STREAM CHARACTERIZATION

Watershed Management Area Streams

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

Watershed Management Area Streams by Hydrographic Category

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

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Watershed Management Area Streams by Bed Material

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

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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

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Watershed Management Area Streams by Reach Type

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

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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

Planned Land Use

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

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Developable Land

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Redevelopment and Infill Areas

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

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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%

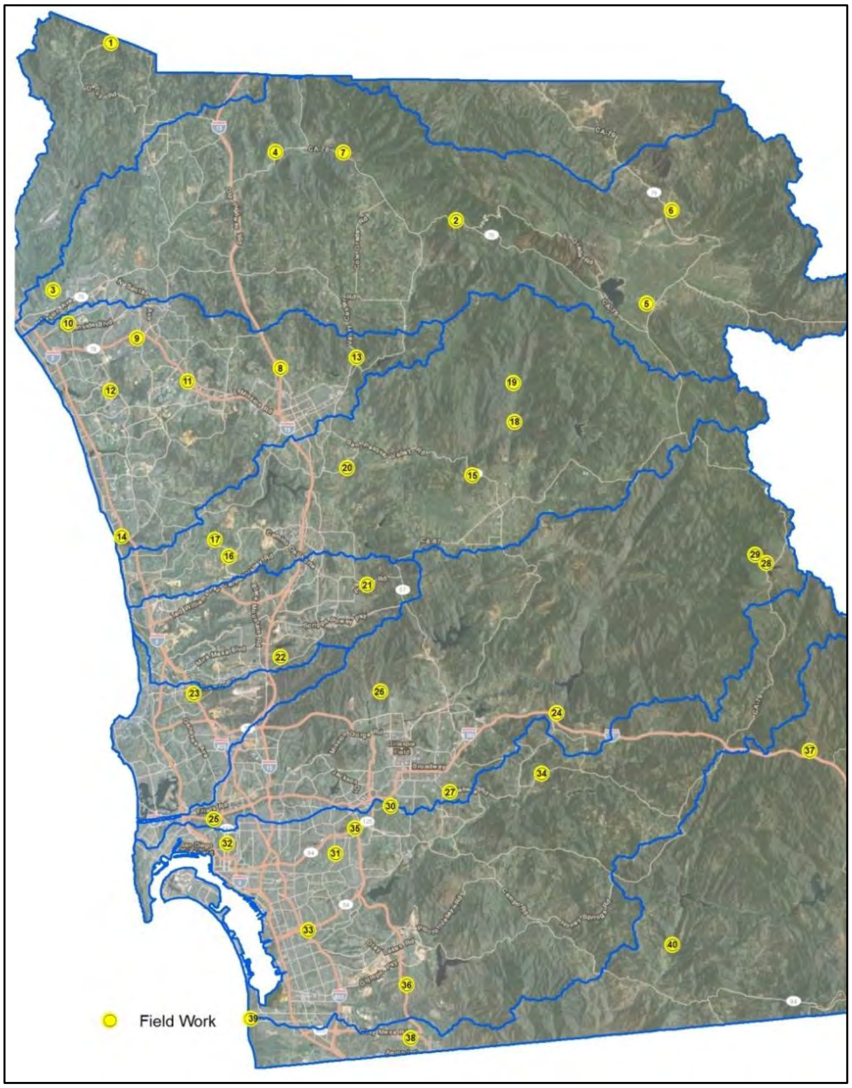
A4.3 Field Assessment

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

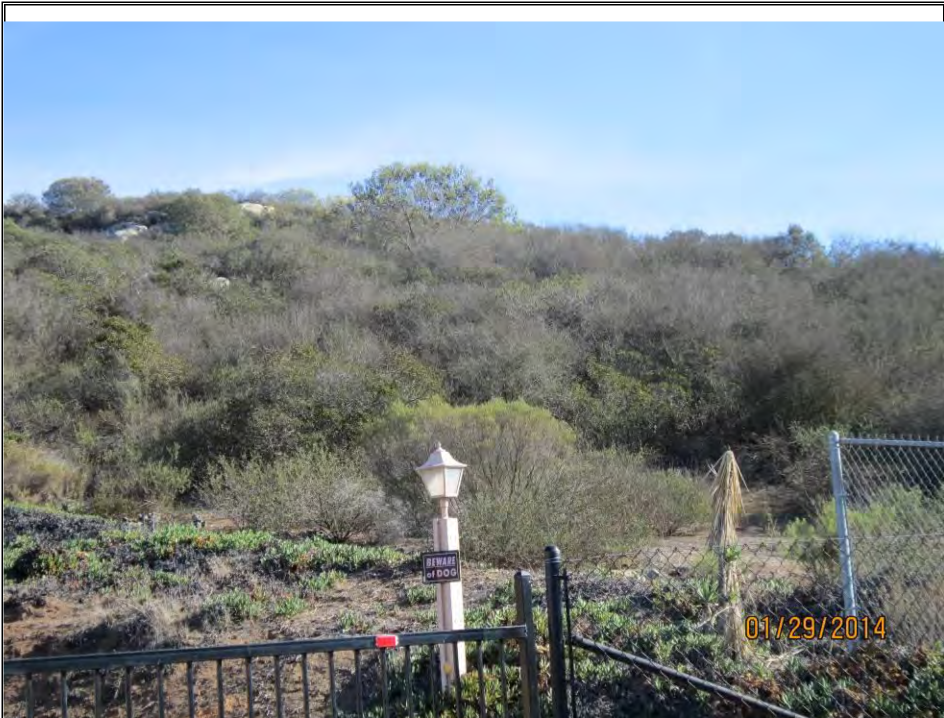
GLU: CSP-Forest-3

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

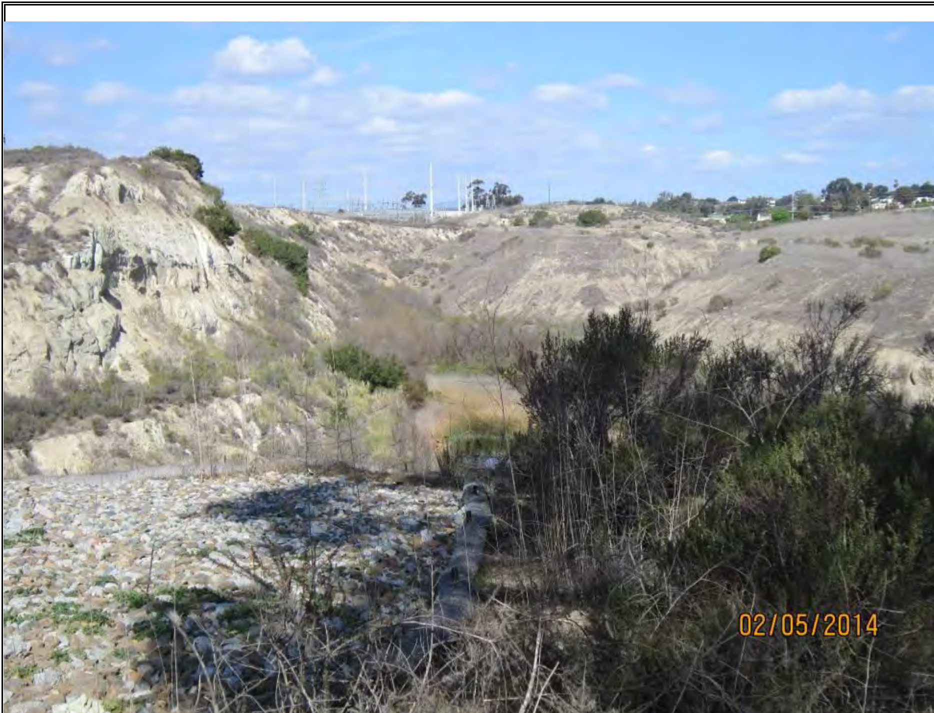
Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover: 90-95%

	**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%

	**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%

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

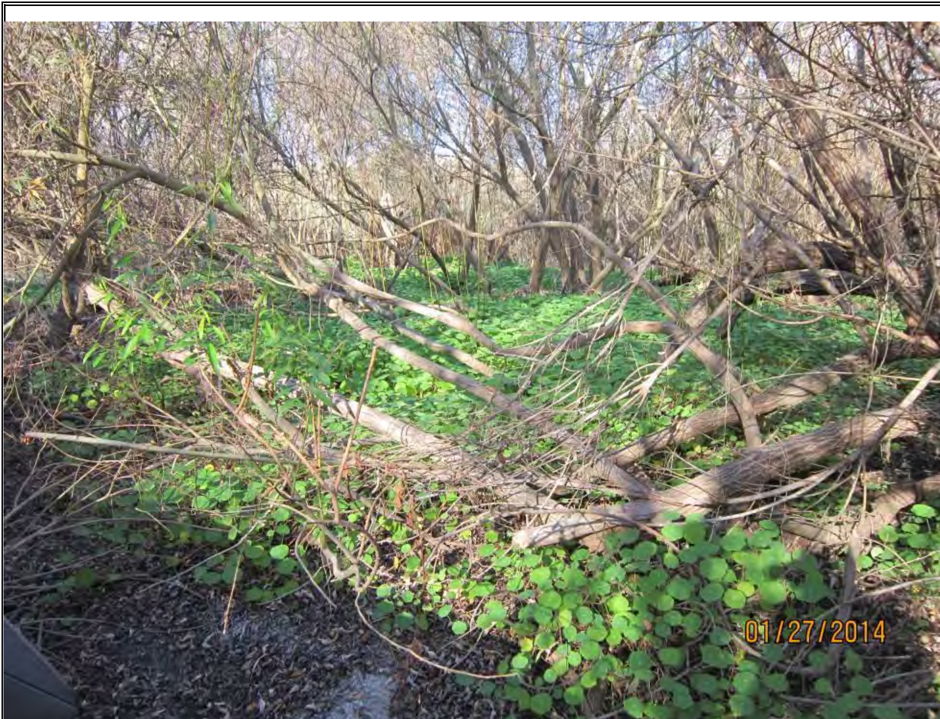
View: Looking southeast

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

Potential Critical Coarse Sediment Yield Areas

San Luis Rey Watershed - HU 903.00, 559 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

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

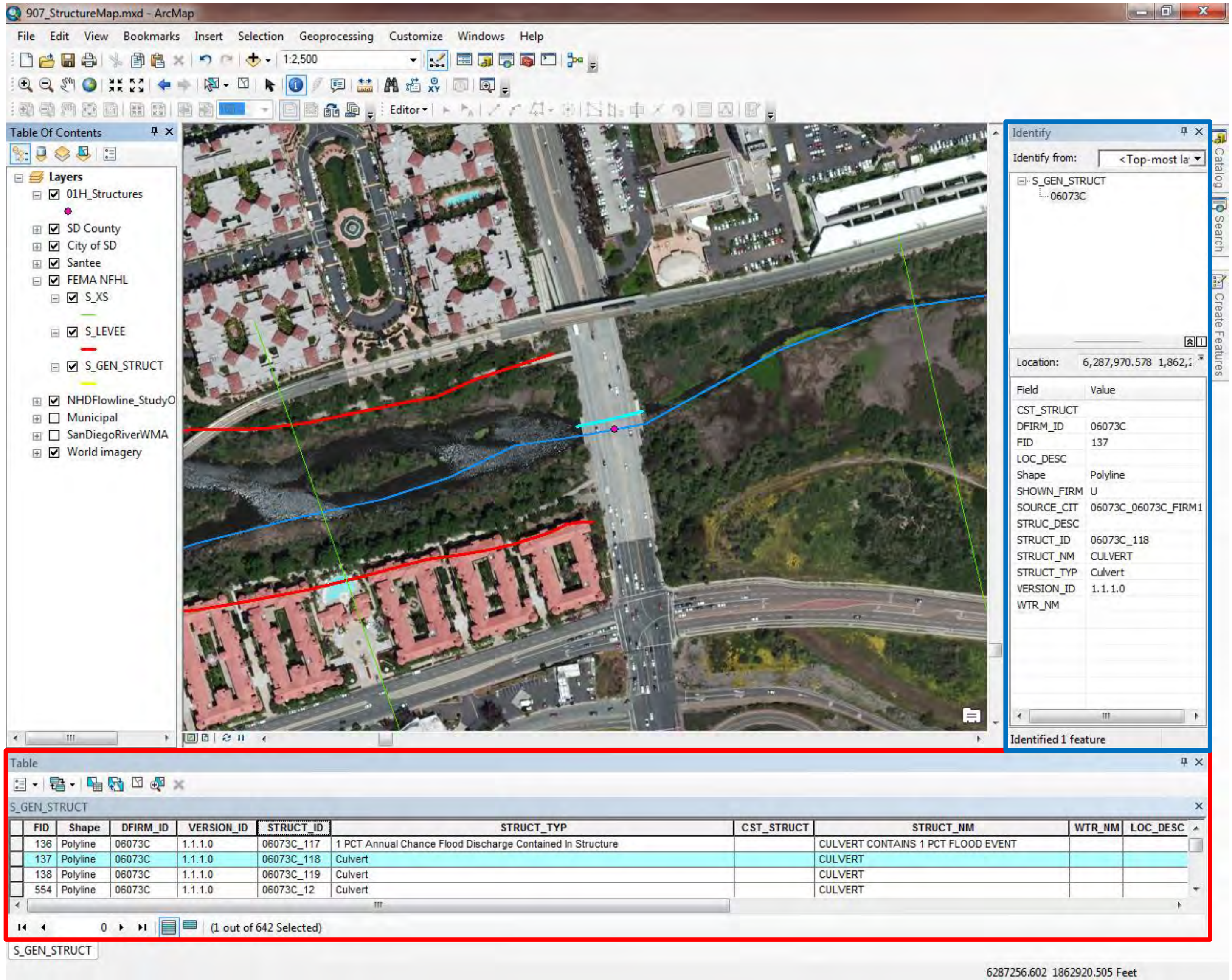
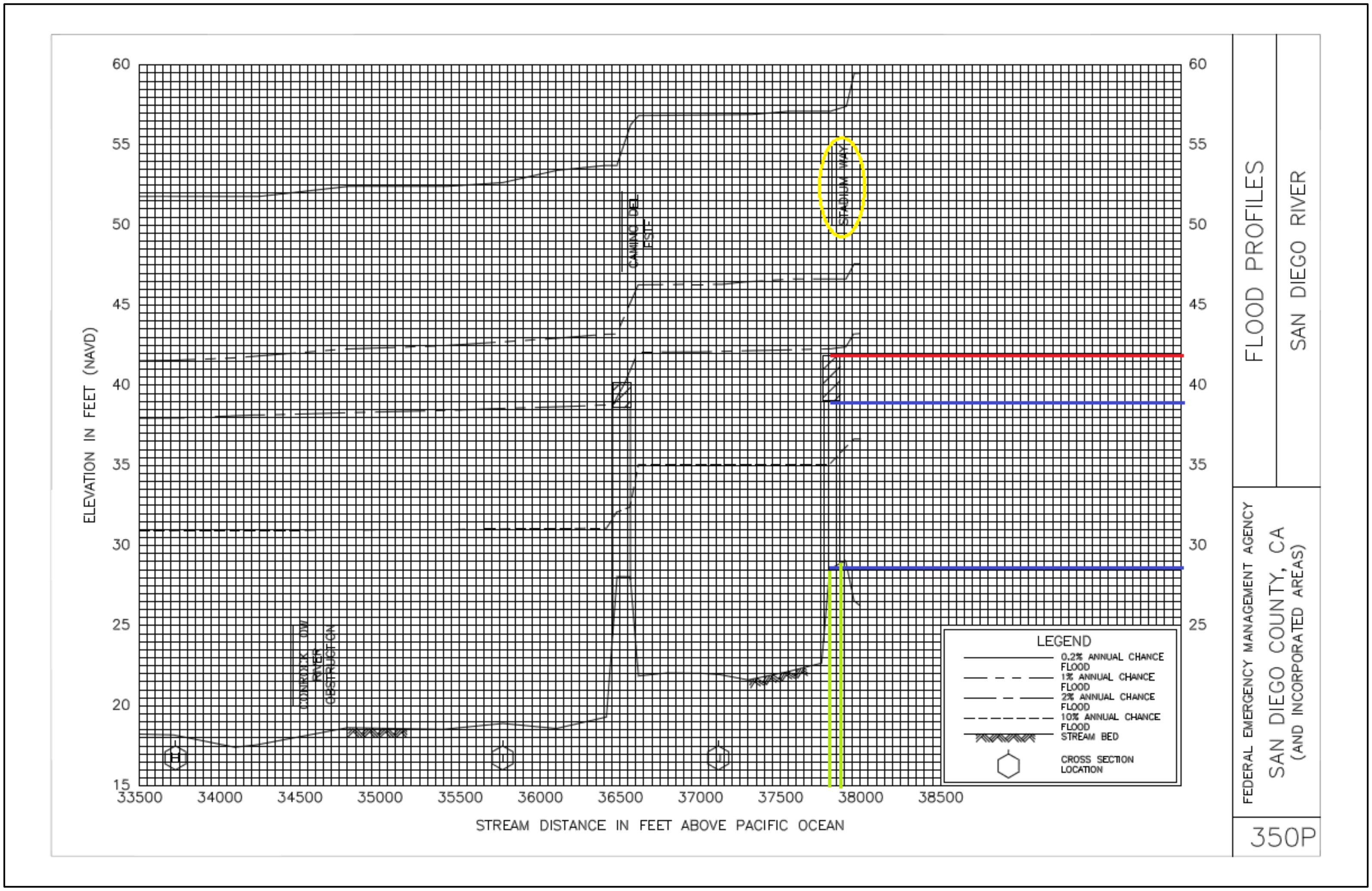


Figure A.5.2: Typical FEMA FIS Flood Profile



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

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:

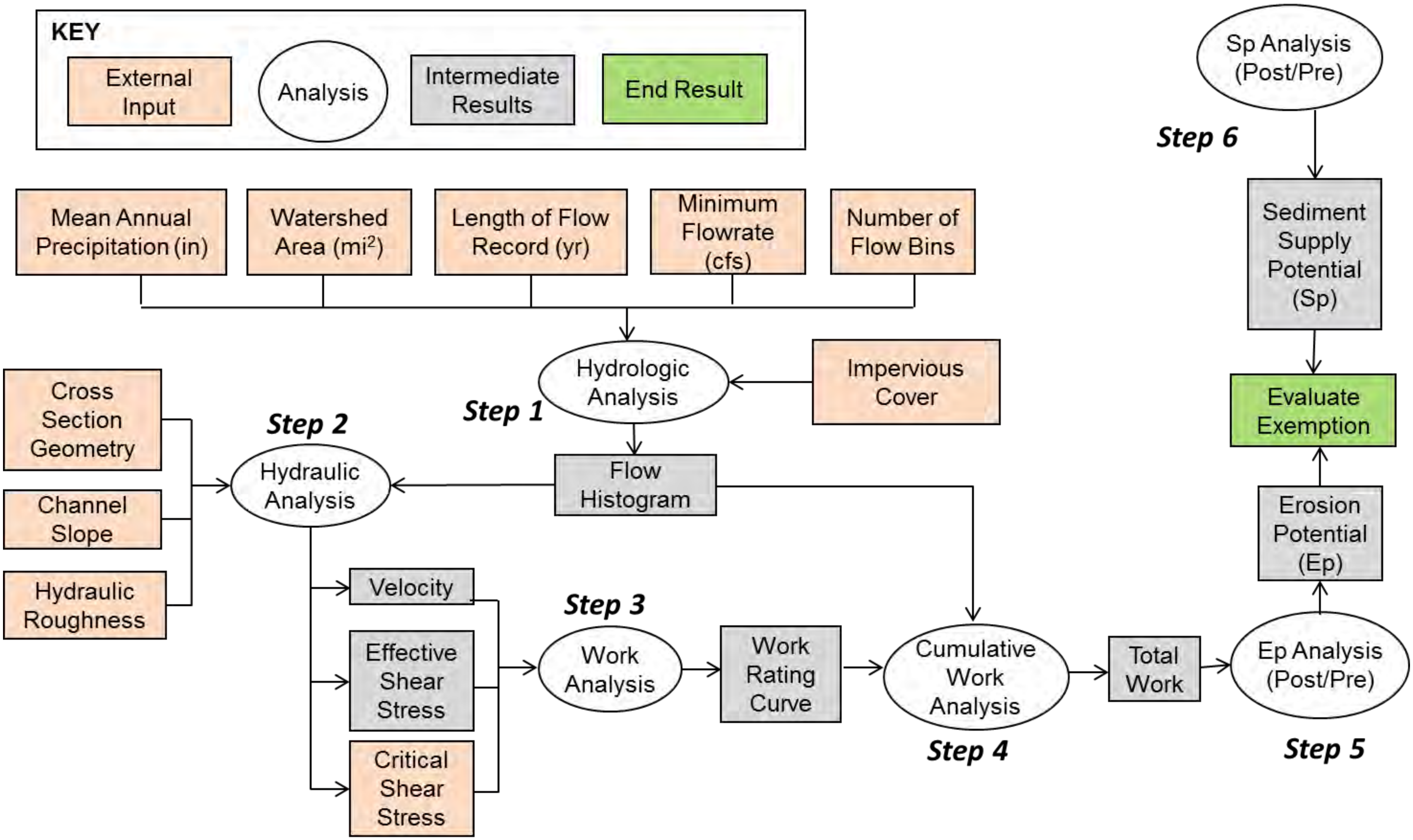
- Ep < 1.05 when d50 < 16 mm or Ep < 1.20 when d50 > 16 mm, and;
- Sp > 0.90

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.

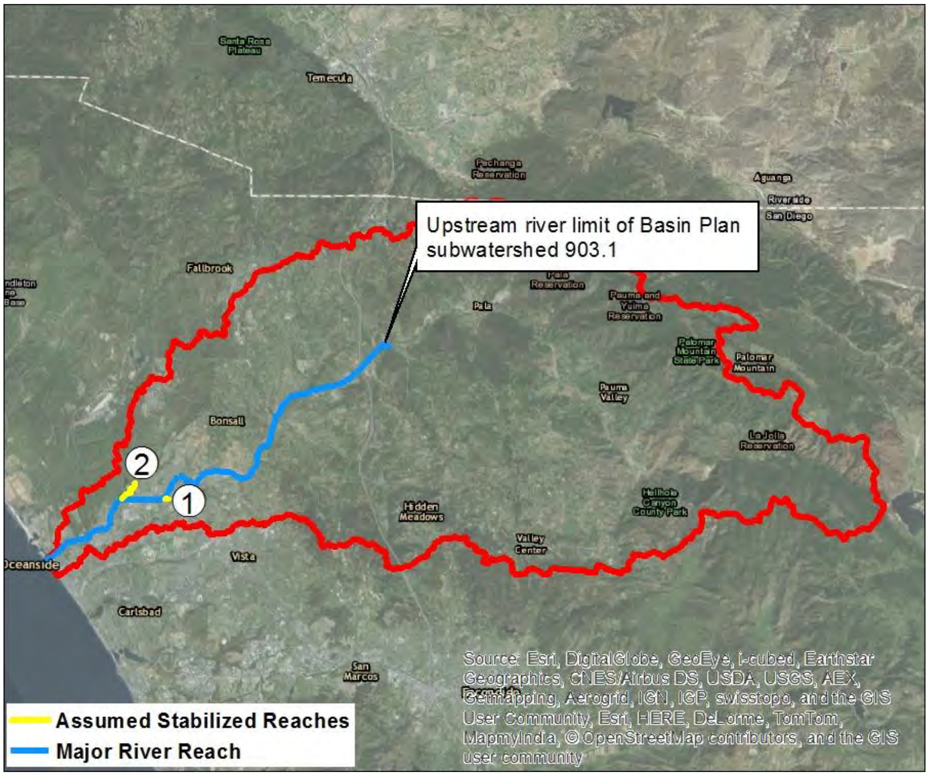
- Step 6 – Sp Analysis: Coarse Sediment Supply Potential for each watershed was estimated using the quantitative results from Section 2.4. First, the watershed coarse sediment soil loss was estimated for all GLUs producing coarse sediment. Then, the future-condition coarse sediment soil loss was estimated 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

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