CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

SANTA MARGARITA RIVER ESTUARY, CALIFORNIA NUTRIENTS TOTAL MAXIMUM DAILY LOAD PROJECT

DRAFT STAFF REPORT

DRAFT JULY 2018

Santa Margarita River Estuary, California Nutrients Total Maximum Daily Load Project

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Riverside County Flood Control and Water Conservation District
County of Riverside
Rancho California Water District
City of Temecula
City of Murrieta
City of Wildomar
City of Menifee
U.S. Marine Corps Base Camp Pendleton
NAVY Space and Naval Warfare Systems – Systems Center Pacific (SPAWAR)
Pechanga Band of Luiseno Indians
Sierra Club
Cal Trout
Tetra Tech, Inc.
Stetson Engineers Inc.
Larry Walker and Associates
Southern California Coastal Water Research Project
United States Environmental Protection Agency (U.S. EPA)

EXECUTIVE SUMMARY

Waterbody	Santa Margarita River Estuary (902.11)
Impaired Uses	Contact Water Recreation Non-Contact Water Recreation Estuarine Habitat Wildlife Habitat Migration of Aquatic Organisms Rare, Threatened, or Endangered Species Marine Habitat Spawning, Reproduction, and or Early Development
Clean Water Act 303(d) Listing	Eutrophic Conditions
Causative Pollutants	Total Nitrogen and Total Phosphorus
Sources	Groundwater polluted with nutrients, agricultural discharges, and upstream non-storm surface water and illicit discharges from upstream Municipal Separate Storm Sewer Systems (MS4s)
Total Maximum Daily Load	13,246 pounds per year of delivered total nitrogen 1,528 pounds per year of delivered total phosphorus
Numeric Targets: Apply during dry weather conditions	*Primary Numeric Targets:* • Daily minima equal to or greater than 5.0 mg/l dissolved oxygen • Macroalgal biomass equal to or less than 57 grams dry weight per square meter. *Secondary Numeric Targets:* • 7-day average minimum equal to or greater than 5.0 mg/L dissolved oxygen with 10 percent allowable exceedance • Macroalgal biomass equal to or less than 70 grams dry weight per square meter. • SQO Benthic Community Condition Score ≤ 2.0
Necessary Load Reduction	76% of total nitrogen and total phosphorus loads
Load and Waste Load Allocations for total nitrogen and total phosphorus	Delivered total nitrogen Waste Load Allocation and Load Allocation: 8226 pounds per year Delivered total phosphorus Waste Load Allocation and Load Allocation: 574 pounds per year Margin of Safety: Implicit
Implementation Mechanisms	Implementation of existing discharge prohibitions, discharge requirements, effluent-based discharge limitations, receiving water limitations, and management practices, specifically those in the permits listed below.

	Primary Permits: • Permit and Waste Discharge Requirements for Discharges from the Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region (Order No. R9-2013-0001, as amended by R9-2015-0001, R9-2015-0100); and • General Waste Discharge Requirements for Discharges from Commercial Agricultural Operations for Discharges that are Members of a Third Party Group in the San Diego Region (0rder No. R9-2016-0004) and General Waste Discharge Requirements for Discharges from Commercial Agricultural Operations for Discharges Not Participating in a Third Party Group in the San Diego Region (0rder No. R9-2016-0005); and • Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) (2013-0001-DWQ, as amended by 20015-0133-EXEC, 2016-069-EXEC). Supporting-Role Permits: • Statewide Storm Water Permit Waste Discharge Requirements (WDRs) for State of California Department of Transportation (2012-0011-DWQ, as amended by 2014-0006-EXEC, 2014-0077-DWQ, 2015-0036-EXEC); and • General Permit for Storm Water Discharges Associated with Industrial Activities(2014-0057-DWQ); and • General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (2009-0009-DWQ, as amended by 2010-0014-DWQ, 2012-0006-DWQ); and • Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. 2006-0003-DWQ, as amended by 2008-0002-EXEC, 2013-0058-EXEC) and Waste Discharge Requirements for Sewage Collection Agencies in the San Diego Region (Order No. R9-2007-0005); and • General Waste Discharge Requirements for Small Domestic Wastewater Treatment Systems (Order No. WQ 2014-0153-DWQ).
Estimated Attainment of Numeric Targets and Beneficial Uses	2038

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ACRONYMS AND ABBREVIATIONS

ASBS	Areas of Special Biological Significance
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
CA	California
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIWQS	California Integrated Water Quality System Project
COLD	Cold Freshwater Habitat
CTR	California Toxics Rule
CWA	Clean Water Act
CWRMA	Comprehensive Water Management Resource Agreement
DDW	Division of Drinking Water
DO	Dissolved Oxygen
DWQ	Division of Water Quality
EFDC	Environmental Fluid Dynamic Code
EPA	Environmental Protection Agency
EST	Estuarine Habitat
FY	Fiscal Year
GIS	Geographic Information Systems
HSPF	Hydrological Simulation Program Fortran
HU	Hydrologic Unit
LA	Load Allocation
LAMP	Local Area Management Plan
LWA	Larry Walker and Associates Inc.
MAR	Marine Habitat Beneficial Use
MEP	Maximum Extent Practicable
MIGR	Migration of Aquatic Organisms
MLLW	Mean lower Low Water
MLOE	Multiple Lines of Evidence
MODFLOW	Modular Three-Dimensional Finite-Difference Groundwater Flow Model
MOS	Margin of Safety
NCTD	North County Transportation District
NNE	Nutrient Numeric Endpoint
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge and Elimination System
OCC	Office of Chief Counsel
OWTS	On-Site Water Treatment Systems
PDF	Portable Document Format
QAPP	Quality Assurance Project Plan
RARE	Rare, Threatened, or Endangered Species
RCWD	Rancho California Water District
REC	Recreational Beneficial Use
SCCWRP	Southern California Coastal Water Research Project
SCUBA	Self Contained Breathing Apparatus
SD	San Diego
SDWB	San Diego Water Board
SIC	Standard Industrial Classification
SMARTS	Storm Water Multiple Application and Report Tracking System
SMR	Santa Margarita River
SPAWAR	Space and Naval Warfare Systems Command
SPWN	Spawning, Reproduction, and/or Early Development
SQO	Sediment Quality Objective

SWAMP	Surface Water Ambient Monitoring Program
SWPPP	Surface Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TBD	To be Determined
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
USA	United States of America
USMCCP	United States Marine Corps Base Camp Pendleton
WARM	Warm Freshwater Habitat
WASP	Water Quality Analysis Simulation Program
WDR	Waste Discharge Requirements
WILD	Wildlife Habitat
WLA	Waste Load Allocation
WQ	Water Quality
WQIP	Water Quality Improvement Plan
WQO	Water Quality Objective
WQRP	Water Quality Restoration Plan
WQS	Water Quality Standards
WY	Water Year

1 CONTEXT FOR THE DEVELOPMENT AND PROPOSED APPROACH OF THE SANTA MARGARITA RIVER ESTUARY NUTRIENTS TMDL PROJECT

In the 1990s, the California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) and others observed that more total nitrogen and total phosphorus (nutrients) were entering the Santa Margarita River Estuary (Estuary) than it could assimilate. Those excess nutrients led to unsightly algal blooms and eutrophication, which harmed aquatic life and impaired ecosystem and aesthetic beneficial uses of the Estuary. To investigate and correct the impairment, the San Diego Water Board began a Total Maximum Daily Load (TMDL) process in 2007 by working collaboratively with the Santa Margarita River Nutrient Initiative Stakeholder Group (Stakeholder Group). Since this process began, however, historic major discharges have ceased and the San Diego Water Board has issued new or revised permits such that eutrophication is not expected to occur if parties comply with their permits.

The Stakeholder Group agreed to assess the Estuary through a nutrient numeric endpoint (NNE) process to provide critical information for the long-term management of the Estuary. Accordingly, the Stakeholder Group calculated TMDLs, load allocations, and waste load allocations to achieve NNE-based targets rather than traditional eutrophication objectives such as water column nutrient concentrations. The NNE-based targets include macroalgal biomass and dissolved oxygen benchmarks.

The results of this TMDL process can be used to adopt a formal TMDL (thus the organization of this Staff Report), or they can be used to justify a decision *not to adopt a traditional rule-making TMDL,* because waste discharge requirements are now sufficient to prevent chronic eutrophication and historic nutrient-heavy discharges have ceased.

The staff recommendation, as outlined in Tentative Resolution No. R9-2018-TBD, is to postpone adoption of a rule-making TMDL. The TMDL adoption process could resume in a few years if the expected water quality outcome is not achieved. That recommendation is contingent upon:

1. Commitments from Phase I municipal storm water NPDES permittees to take specific actions that prioritize the elimination of illicit discharges and dry-weather discharges to receiving waters in the Santa Margarita River Estuary watershed during the next five years;

2. Commitments from U.S. Marine Corps Base Camp Pendleton to take specific actions that prioritize the elimination of illicit discharges and dry-weather discharges to receiving waters in the Santa Margarita River Estuary watershed during the next five years;

3. Commitment by agricultural dischargers to eliminate illicit discharges and reduce or eliminate excess nutrient loading to receiving waters and groundwater in the Santa Margarita River Estuary watershed during the next five years; and

4. The ability for monitoring and assessment programs to effectively and reliably document improvements in the Estuary's condition and achievement of the NNE-based targets; in other words, to confirm the effectiveness of the new and revised permits to prevent excessive loading of nutrients to the Estuary.

Ideally, the local municipalities will amend their Water Quality Improvement Plans[1] to include an Estuary Monitoring and Assessment Program plan. If not, then the San Diego Water Board could consider other options, such as a water quality Investigative Order pursuant to Water Code section 13267 to establish an appropriately informative monitoring and assessment plan.

2 INTRODUCTION

The Santa Margarita River Estuary (Estuary), located in northern San Diego County, has one of the least developed watersheds and coastal zones in southern California (Section 4). However, data indicate eutrophic conditions exist in this Estuary. Eutrophication — excessive nutrient loading resulting in explosive algal growth and low dissolved oxygen which leads to physiological stress or mortality in aquatic life — produces adverse ecological effects and creates a condition of public nuisance (Section 5). Eutrophic conditions within the Estuary restrict the ability of its water to support the beneficial uses designated in the *Water Quality Control Plan for the San Diego Basin* (Basin Plan) (Section 4.3.1). As a result, the San Diego Water Board placed the Estuary on the 1996 Clean Water Act (CWA) section 303(d) list of impaired waterbodies. The impairment is limited to dry-weather conditions (Section 10). Significant sources of nutrients entering the Estuary include: groundwater polluted with nutrients, agricultural discharges, as well as upstream non-storm water and illicit discharges from upstream Municipal Separate Storm Sewer Systems (MS4s) (Section 7). These factors combined with dry weather conditions contribute to excessive algal growth and low dissolved oxygen, leading to adverse eutrophic conditions.

In accordance with CWA section 303(d) and California State Water Resources Control Board (State Water Board) Resolution 2005-0050, *Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options*, the San Diego Water Board, the United States Environmental Protection Agency (U.S. EPA), and local stakeholders investigated the conditions, sources of pollutants, loading capacity, and existing control requirements affecting the eutrophic conditions with the purpose of developing the Total Maximum Daily Load (TMDL) project for the pollutants causing the eutrophic conditions in the Estuary and an implementation plan to achieve the TMDLs (Section 3).

[1] The Water Quality Improvement Plans are developed through a collaborative effort by the municipal storm water Copermittees in each Watershed Management Area, and other key stakeholders, including representatives from the San Diego Water Board. The Water Quality Improvement Plans include descriptions of the highest priority pollutants or conditions in a specific watershed, goals and strategies to address those pollutants or conditions, and time schedules associated with those goals and strategies.

The Estuary's TMDL project used the *Technical Approach to Develop Nutrient Numeric Endpoints (NNE) for California Estuaries* (Sutula *et al.* 2007) to establish final numeric targets for the Estuary rather than relying on chemical water quality objectives (WQOs) alone (Section 6.1). The NNE approach uses multiple lines of evidence based on ecological response indicators (e.g., macroalgal biomass and dissolved oxygen) rather than water column nutrient concentrations to evaluate the risk to beneficial uses from eutrophication (Section 6.1.1). The NNE framework employed was developed by the Southern California Coastal Water Research Project (SCCWRP) for the State Water Board in response to a requirement from U.S. EPA for all states to set nutrient criteria (Sutula *et al.* 2007).

The ultimate goal of the Estuary TMDL project is to restore water quality in the Estuary so that it supports its beneficial uses as designated in the Basin Plan. After the most sensitive beneficial uses — Estuarine Habitat (EST), Spawning, Reproduction, and or Early Development (SPWN), Migration of Aquatic Organisms (MIGR), and Rare, Threatened, or Endangered Species (RARE) — are restored, the Estuary can be removed from the CWA 303(d) list for eutrophication (Section 4.3.1). The pollutants causing eutrophication in the Estuary are total nitrogen and total phosphorus.

This report presents the TMDLs for total nitrogen and total phosphorus (Section 11). These TMDLs are the maximum amount of total nitrogen and total phosphorus that the Estuary can assimilate while maintaining water quality conditions that support its beneficial uses.

The Implementation Plan to achieve the total nitrogen and total phosphorus TMDLs is for regulated dischargers to comply with the updated San Diego Regional Municipal Separate Storm Sewer System (MS4) Permit (Regional MS4 Permit, Order No. R9-2013-0001, as amended by R9-2015-0001, and R9-2015-0100), newly issued San Diego Regionwide Agricultural Waste Discharge Requirements (WDRs) (Order Nos. R9-2016-0004 and -0005), and the updated statewide Phase II Small MS4 General Permit (Order No. 2013-0001-DWQ) (Section 12).

Loading of nutrients into the Estuary from upstream MS4 sources and agricultural discharges represent the largest controllable sources (Sutula *et al*. 2016a).

The Regional MS4 Permit prohibits non-storm water and illicit discharges into the MS4 and receiving waters that contribute to existing impairments (Section 12.2.1). Similarly, the Regionwide Agricultural WDRs require the reduction and or elimination of excess nutrient loading by prohibiting discharges that cause nuisance or pollution conditions (Section 12.2.3). The requirements mandated by these permits are sufficiently robust to attain the necessary nutrient source load reductions from controllable sources without the need for additional NPDES permits, WDRs, or revision of existing WDRs, and NPDES permits.

3 THE TMDL PROCESS

The purpose for developing and implementing a TMDL process is to attain water quality objectives (WQOs) that support beneficial uses in a waterbody suffering an impairment, in accordance with federal Clean Water Act section 303(d) requirements. In addition to federal requirements, California State law also imposes additional requisites:

> In California, the SWRCB [State Water Board] has interpreted state law (Porter-Cologne Water Quality Control Act, California Water Code section 13000 et. seq.) to require that implementation be addressed when TMDLs are incorporated into Basin Plans (water quality control plans). The Porter-Cologne Act requires each Regional Board to formulate and adopt water quality control plans for all areas within its region. It also requires that a program of implementation be developed that describes how water quality standards will be attained. TMDLs can be developed as a component of the program of implementation, thus triggering the need to describe the implementation features, or alternatively as a Water Quality Standard. When the TMDL is established as a standard, the program of implementation must be designed to implement the TMDL. Typically a revision to the program of implementation is needed whenever a new standard is adopted (SWRCB 2017).

By definition, a TMDL is the maximum amount or load of a pollutant that a waterbody can assimilate while maintaining the necessary water quality to support its beneficial uses. TMDL load(s) are allocated to point sources as waste load allocations (WLA), to nonpoint sources and background sources as load allocations (LA), and to a margin of safety (MOS) to account for uncertainties and unknowns.

Mathematically, the TMDL can be expressed as:

$$TMDL = WLA + LA + MOS$$

A TMDL also includes an allocation of quantitative limits for point and nonpoint pollution sources. Once the total maximum pollutant load has been calculated, it is allocated among contributing sources in the watershed. The TMDL process begins with the development of a technical analysis which includes the following seven components:

1) *Problem Statement* – generally describes impairment (Section 5)

2) *Numeric Targets*– identifies the numeric target(s) which, when achieved, will result in attainment of the WQOs and protection of beneficial uses (Section 6)

3) *Source Analysis* – identifies all of the known point sources and nonpoint sources of the impairing pollutant in the watershed (Section 7)

4) *Linkage Analysis* – The technical analysis of the relationship between pollutant loading from identified sources and the response of the waterbody to this loading is referred to as the linkage analysis. Linkage analysis results are used to calculate the Estuary's assimilative capacity — the maximum load of the pollutant that may be discharged to the waterbody without causing exceedances of WQOs and impairment of beneficial uses (Section 8)

5) *Margin of Safety (MOS)* – accounts for uncertainties in the analysis (Section 9)

6) *Seasonal Variation and Critical Conditions* – describes how these factors are accounted for in the TN and TP TMDLs determination (Section 10)

7) *Allocation of the TMDLs* – division of the TN and TP TMDLs among each of the contributing sources in the watershed; waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint and background sources (Section 11)

The U.S. EPA provides additional guidance regarding the statutory and regulatory requirements for establishing TMDLs (Tables 1 and 2).[2] Table 1 lists these requirements and locations where the information is provided.

Table 1
U.S. EPA TMDL Elements

U.S. EPA TMDL ELEMENT	SECTION/COMMENTS
The name and geographic location of the impaired waterbody for which the TMDL is being established and the names and geographic locations of the waterbodies upstream of the impaired waterbody that contribute significant amounts of the pollutant for which the TMDL is being established.	Section 4
Identification of the pollutant for which the TMDL is being established and quantification of the pollutant load that may be present in the waterbody and still ensure attainment and maintenance of water quality standards.	Sections 5.3 and 11
Identification of the amount, or degree, by which the current pollutant load in the waterbody deviates from the pollutant load needed to attain or maintain water quality standards.	Section 11 a
Identification of the source categories, source subcategories, or individual sources of the pollutant for which the waste load allocations and load allocations are being established.	Section 7

[2] https://www.epa.gov/tmdl/impaired-waters-and-tmdls-tmdl-information-and-support-documents

U.S. EPA TMDL ELEMENT	SECTION/COMMENTS
Waste load allocations to each industrial and municipal point source permitted under §402 of the Clean Water Act discharging the pollutant for which the TMDL is being established; waste load allocations for storm water, combined sewer overflows, abandoned mines, combined animal feeding operations, or any other discharges subject to a general permit may be allocated to categories of sources, subcategories of sources or individual sources; pollutant loads that do not need to be allocated to attain or maintain water quality standards may be included within a category of sources, subcategory of sources or considered as part of background loads; and supporting technical analyses demonstrating that waste load allocations when implemented, will attain and maintain water quality standards.	Sections 7 and 11
Load allocations, ranging from reasonable accurate estimates to gross allotments, to nonpoint sources of a pollutant, including atmospheric deposition or natural background sources; if possible, a separate load allocation must be allocated to each source of natural background or atmospheric deposition; load allocations may be allocated to categories of sources, subcategories of sources or individual sources; pollutant loads that do not need to be allocated may be included within a category of sources, subcategory of sources or considered as part of background loads; and supporting technical analyses demonstrating that load allocations, when implemented, will attain and maintain water quality standards.	Section 11
A margin of safety expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL; e.g., derivation of numeric targets, modeling assumptions, or effectiveness of proposed management actions which ensures attainment and maintenance of water quality standards for the allocated pollutant.	Section 9
Consideration of seasonal variation such that water quality standards for the allocated pollutant will be met during all seasons of the year.	Section 10
An allowance for future growth which accounts for reasonably foreseeable increases in pollutant loads.	Section 9.1
An implementation plan.	Section 12

The U.S. EPA has also provided guidance on the requirements for a TMDL implementation plan. Table 2 presents the Implementation Plan Elements and where they can be found.

Table 2
U.S. EPA Implementation Plan Elements

U.S. EPA IMPLEMENTATION PLAN ELEMENT	SECTION/COMMENTS
A description of the control actions and/or management measures which will be implemented to achieve the waste load allocations and load allocations, and a demonstration that the control actions and/or management measures are expected to achieve the required pollutant loads	Section 12
A time line, including interim milestones, for implementing the control actions and/or management measures, including when source-specific activities will be undertaken for categories and subcategories of individual sources and a schedule for revising NPDES permits.	Section 13
A discussion of reasonable assurances that waste load allocations and load allocations will be implemented.	Section 12
A description of the legal authorities under which the control actions will be carried out.	Section 12
An estimate of the time required to attain and maintain water quality standards and discussion of the basis for that estimate.	Section 13
A monitoring and/or modeling plan designed to determine the effectiveness of the control actions and/or management measures and whether allocations are being met.	Section 12.3
A description of measurable, incremental milestones for the pollutant for which the TMDL is being established for determining whether the control actions and/or management measures are being implemented and whether water quality standards are being attained.	Section 13
A description of the process for revising TMDLs if the milestones are not being met and projected progress toward attaining water quality standards is not demonstrated.	Section 12

4 BACKGROUND INFORMATION

4.1 Description of the Santa Margarita River Estuary

The Estuary is located along the southern California coast in northern San Diego County, on the southwestern edge of the U.S. Marine Corps Base Camp Pendleton (Camp Pendleton) (Figures 1-5). The Estuary's watershed (Watershed) drains into the Pacific Ocean and covers an area of approximately 750 square miles, encompassing portions of both Riverside County and San Diego County.

The Estuary is one of the few remaining and largely unmodified coastal estuaries in southern California, providing 192 acres of valuable estuarine habitat including mudflats, salt pannes, salt marsh, and subtidal habitats. This unique estuarine habitat provides important refuge, foraging areas, and breeding grounds for several threatened and or endangered species, as well as coastal marine species. These include populations of State and federally endangered or threatened species such as the California Least Tern (*Sterna antilarum browni*), Western Snowy Plover (*Charadrius alexandrines nivosus*), Tidewater Goby (*Eucyclogobius newberryi*), Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*), Light-footed Ridgway's Rail (*Rallus obsoletus levipes*), and Southern California Steelhead (*Oncorhynchus mykiss*).

Besides providing estuarine habitat, the Estuary supports numerous other important beneficial uses. The Basin Plan lists the followings beneficial uses for the Estuary: contact water recreation (REC1), non-contact water recreation (REC2), estuarine habitat (EST), wildlife habitat (WILD), rare, threatened or endangered species (RARE), marine habitat (MAR), migration of aquatic organisms (MIGR) and spawning, reproduction and or early development (SPWN) (Section 4.3.1) (SDWB 2016a).

Figure 1
2006 Aerial View of Santa Margarita River Estuary
Showing agricultural fields west of U.S. Marine Corps Base Camp Pendleton in 2006 growing crops and open mouth Estuary condition (note contrast with the closed mouth Estuary condition shown on cover of report)

Over the course of the 20th century, anthropogenic activities on the land bordering the Estuary and upstream in the Watershed have resulted in excess nutrient loading, eutrophication, and degradation of the estuarine habitat. Eutrophic conditions in the Estuary can harm its designated beneficial uses. Major contributors of nutrient loading in the Watershed include: releases of nutrients from polluted groundwater, agricultural discharges (including those associated with orchards, vineyards, nursery and irrigated lands operations), sanitary sewer system spills, septic tank and private sewer lateral spills, point source discharges, sediment discharges, and urban runoff.

The effects of excess nutrient loading on the Estuary are more pronounced during summer-dry (May through September) and winter-dry (October through April) weather conditions. Eutrophication in the Estuary typically peaks during the summer-dry season when its outlet to the Pacific Ocean is partially closed by the seasonal formation of a sand berm. The duration of Estuary mouth closure varies from year-to-year and can be extended during years of drought, as observed in 2015. However, as the rainy season begins (October through April), the combination of a rising water level in the river and the erosion of the berm by wave action re-establish the connection between the Estuary and the Pacific Ocean resulting in most nutrients being exported out to sea (Figure 1). During the rainy season, upstream nutrient loads entering the estuary are mostly (upwards of 95 percent) exported out to the Pacific Ocean. Although most nutrients are exported out to sea, some nutrients do remain in the Estuary's sediments and are re-released into the water column, contributing to algal blooms (Sutula *et al.* 2016a).

Figures 2 through 4 show different segments of the Estuary and the lower portion of the Santa Margarita River.

Figure 2
View of the Western Terminus of the Estuary (Downstream)
Photograph of the Estuary looking west from I-5 towards the Pacific Ocean outlet.

Figure 3
View of Eastern Segment of the Estuary (Upstream)
Photograph of Estuary looking east from Stuart Mesa Bridge towards lower Santa Margarita River

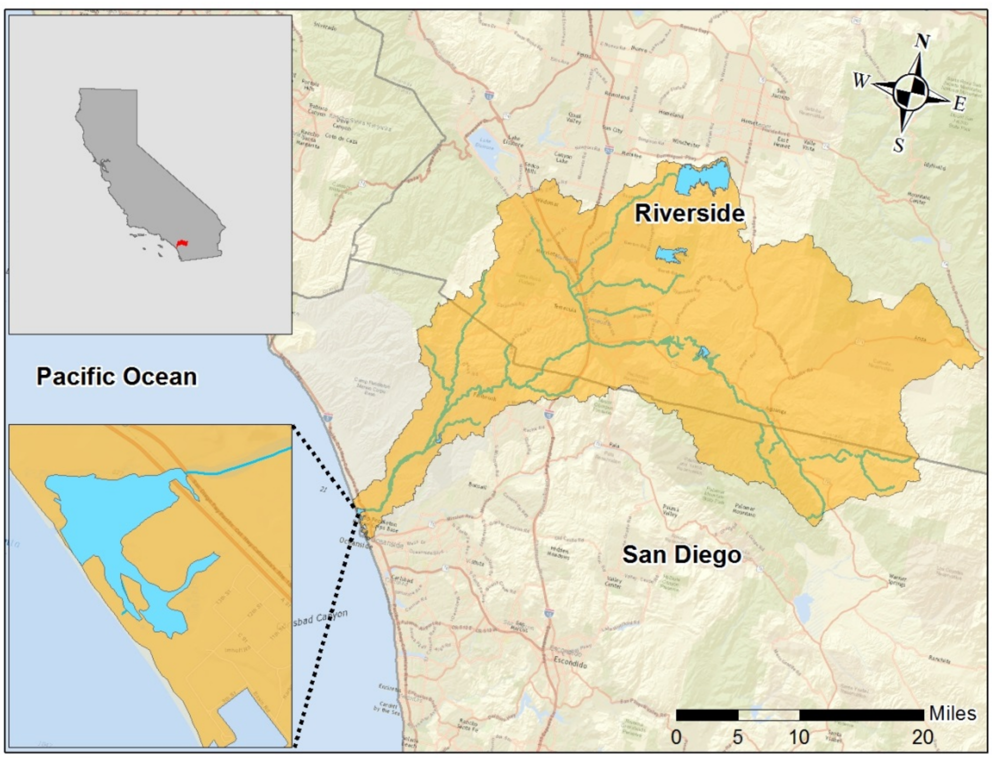
Figure 4
View of Riparian Zone Along Santa Margarita River (Upstream of Estuary)
Photograph taken along the banks of the lower Santa Margarita River

4.2 Description of the Santa Margarita River Estuary Watershed

The impaired Santa Margarita River Estuary and its 750 square mile Watershed comprise the Santa Margarita Hydrologic Unit (HU 902) (Figure 1). This Hydrologic Unit includes nine hydrologic areas: Ysidora (902.1), DeLuz (902.2), Murrieta (902.3), Auld (902.4), Pechanga (902.5), Wilson (902.6), Cave Rocks (902.7), Aguanga (902.8), and Oak Grove (902.9). The main surface waterbodies in the hydrologic unit are: the Santa Margarita River, Rainbow Creek, De Luz Creek, Sandia Creek, Temecula Creek, Murrieta Creek, Vail Lake, Skinner Reservoir, Diamond Valley Lake, and the Estuary.

Approximately 73.5 percent of the Watershed's land surface falls within Riverside County, which includes all or portions of the cities of Murrieta, Temecula, Menifee, and Wildomar. The remaining 26.5 percent of the Watershed is in San Diego County, where U.S. Marine Corps Base Camp Pendleton and the unincorporated communities of Fallbrook and Rainbow are located. Major highways traverse the Watershed including California Interstate 5 (I-5) at the Estuary and Interstates 15 and 215 (I-15 and I-215) to the east in the Cities of Temecula and Murrieta.

Figure 5
Regional Map Showing Location of the Santa Margarita River Watershed and Estuary



The principal land uses in the Watershed are open space, developed land, and agricultural land, comprising 81, 13, and 6 percent of the surface area, respectively (Mazor and Schiff 2007). Figure 6 shows land-use by category in the Estuary's Watershed. This Watershed is one of the least developed in southern California and includes parts of the Cleveland National Forest as well as the 8,000 acre Santa Rosa Plateau Ecological Preserve. However, in recent years, the upper part of the Watershed near the Cities of Murrieta and Temecula has become one of the fastest growing urban areas in California. Land use by area and percent impervious area is shown in Table 3.

Figure 6
Santa Margarita River Estuary Watershed Loading Model Land Use

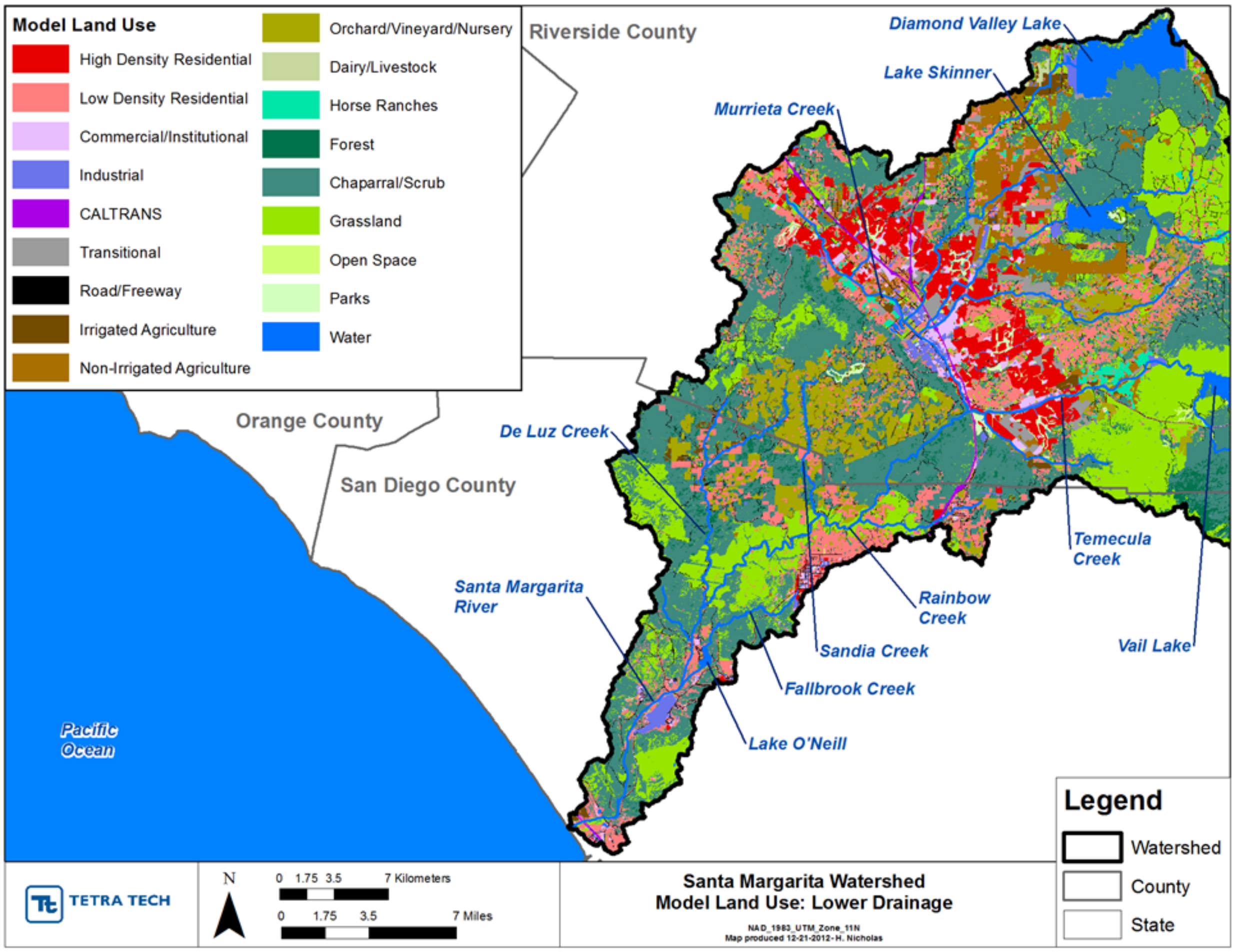


Table 3
Santa Margarita River Watershed Land Use Area and Percent Impervious Cover by Area (Data provided by Tetra Tech Inc.)

Model Land Use Description	Area (acres)	Effective Impervious Area (acres)	Percent Effective Impervious Area	Percent Total Impervious Area
Low Density Residential	41,750	1,594	3.8%	7.1%
High Density Residential	11,877	4,268	35.9%	45.0%
Commercial, Institutional	2,805	1,210	37.1%	46.0%
Industrial	3,617	876	24.2%	33.1%
Road, Freeway (non-Caltrans)	13,230	358	2.7%	5.8%
Parks and Recreation	1,929	105	5.4%	10.1%
Open and Recreation	531	22	4.1%	7.4%
Irrigated Agriculture	8,396	19	0.2%	0.6%
Non-irrigated Agriculture	14,807	186	1.3%	2.5%
Orchard, Vineyard, Nursery	19,493	135	0.5%	1.1%
Dairy, Livestock	254	1	0.2%	0.6%
Horse Ranches	3,099	46	1.5%	3.1%
Forest	23,055	4	0.0%	0.0%
Chaparral, Scrub	227,364	201	0.1%	0.2%
Grassland, Herbaceous	78,518	81	0.1%	0.2%
Water	7,044	0	0.0%	0.9%
Transitional	6,380	515	8.1%	13.3%
Caltrans	1,277	252	19.7%	29.0%
Total	**465,424**	**9,871**	-	-

The soils in the Watershed are an important factor influencing river hydrology and pollutant loading, as the combination of soil type and topography (slope) can affect rates of infiltration and runoff. Near the Estuary, in the lower Watershed, soils types covering the largest percent of land are the Cieneba very rocky coarse sandy loam (CmrG) and Fallbrook sandy loam (FaD2/FaE2). In the central part of the Watershed, the Lodo rocky loam (LpF2), Las Posas stony fine sandy loam (LrG), and the Cieneba very rocky coarse sandy loam are most abundant. Native soils in the Watershed have limited water holding capacity and moderate to high erosion potential, suggesting that fertilizers and other chemicals applied to land could be easily discharged to groundwater and surface water. In addition, east into the upper Watershed soils become rocky, increasing the potential for runoff into surface waters.

Like much of the San Diego Region, the Watershed has a Mediterranean climate, with hot dry summers and cool wet winters. Historically, the majority of rainfall in the region occurs between October and April, with the highest monthly precipitation (approximately 2 inches) taking place in January (SWAMP 2007). On average, the total annual rainfall for the region is just over 10 inches. Within the Watershed, precipitation decreases noticeably from Palomar Mountain towards the coast, with differences of several inches in rainfall between those two locations commonly observed.

4.3 Water Quality Standards

CWA section 303 and section 13240 of the California Water Code (Water Code) require the San Diego Water Board to establish water quality standards for each waterbody within its region. Water quality standards include three elements: beneficial uses, water quality objectives (WQOs), and the anti-degradation policy. Water quality standards applicable for the Estuary are presented in the Basin Plan, *California Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (Enclosed Bays and Estuaries Plan), and the *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) (SWRCB 2008; SWRCB 2015b). The Basin Plan contains implementation programs to achieve water quality standards.

Similarly, the State Water Board, as required by Water Code Section 13393, develops Sediment Quality Objectives (SQOs) for toxic pollutants in California's enclosed bays and estuaries. The Enclosed Bays and Estuaries Plan and Ocean Plan outline the implementation program to achieve the SQOs, including specific monitoring procedures to determine compliance and actions to be taken when an SQO is not met (SWRCB 2008; 2015b). Time schedules to achieve the objectives are to be developed on a case-by-case basis by each Regional Water Board.

4.3.1 Beneficial Uses

The Estuary (also referred to as the Santa Margarita Lagoon in the Basin Plan) is part of Santa Margarita Hydrologic Unit (902) within the Ysidora Hydrologic Area (902.1) and the Lower Ysidora Hydrologic Subarea. The Basin Plan (Chapter 2, Table 2-3) designates the following existing beneficial uses for the Estuary:

i. *Contact Water Recreation (REC 1):* Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.

ii. *Non-Contact Water Recreation (REC 2):* Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

iii. *Estuarine Habitat (EST):* Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

iv. *Wildlife Habitat (WILD):* Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

v. *Rare, Threatened, or Endangered Species (RARE):* Waters that support habitats. Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

vi. *Marine Habitat (MAR):* Includes uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

vii. *Migration of Aquatic Organisms (MIGR):* Includes uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.

viii. *Spawning, Reproduction, and/or Early Development (SPWN):* Waters that support high quality habitats. Includes uses of water that support high quality habitats suitable for reproduction, early development, and sustenance of marine fish and or cold freshwater fish.

The beneficial uses most affected by eutrophication in the Estuary include: EST, RARE, MIGR, and SPWN. Impacts associated with eutrophic conditions include: excess growth of nuisance algae, shading of beneficial benthic algae and plants, increased turbidity, increased oxygen demand by decaying algae, increased sediment organic matter deposition, smothering of benthic organisms, and reduction of habitable space due to lowered dissolved oxygen concentrations in both the water column and sediments.

4.3.2 Water Quality Objectives

The Basin Plan contains WQOs developed to protect the most sensitive beneficial uses designated for a waterbody. The WQO for biostimulatory substances — substances including total nitrate and total phosphate that promote algal growth and can cause eutrophication — includes both a narrative WQO and a numeric interpretation.

i. Narrative WQO: The narrative WQO for biostimulatory substances for inland surface waters, enclosed bays and estuaries, and coastal lagoons is:

> *Inland surface waters, bays and estuaries and coastal lagoon waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growths cause nuisance or adversely affect beneficial uses (SDWB 2016).*

ii. Numeric Interpretation of the WQO: The numeric interpretation of the WQO for biostimulatory substances for inland surface waters, enclosed bays and estuaries, and coastal lagoons is:

> *Concentrations of nitrogen and phosphorus, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth. Threshold phosphorus (P) concentrations shall not exceed 0.05 milligrams per liter (mg/L) in any stream at the point where it enters any standing body of water, nor 0.025 mg/L in any standing body of water. A desired goal in order to prevent plant nuisance in streams and other flowing waters appears to be 0.1 mg/L P. These values are not to be exceeded more than 10 percent of the time unless studies of the specific waterbody in question clearly show that water quality objective changes are permissible and changes are approved by the Regional Board. Analogous threshold values have not been set for nitrogen compounds; however, natural ratios of nitrogen to phosphorus are to be determined by surveillance and monitoring and upheld. If data are lacking, a ratio of N:P = 10:1, on a weight to weight basis shall be used (SDWB 2016a).*

4.3.3 Sediment Quality Objectives

The *California Water Quality Control Plan for Enclosed Bays and Estuaries Plan – Part 1 Sediment Quality* contains narrative Sediment Quality Objectives (SQOs) and an implementation program aimed at protecting benthic communities and human health beneficial uses (SWRCB 2008). Part 1 of the Enclosed Bays and Estuaries Plan is not intended to address low dissolved oxygen, pathogens, or nutrients (including ammonia). Part 1 of the Plan represents the first stage of the State's SQO development effort and is focused primarily on the protection of benthic communities in enclosed bays and estuaries. The Estuary beneficial uses protected by Part 1 are Estuarine and Marine Habitat (EST and MAR).

The SQOs applicable to the Estuary TMDL project are as follows:

IV. Sediment Quality Objectives

A. Aquatic Life – Benthic Community Protection

Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California. This narrative objective shall be implemented using the integration of multiple lines of evidence (MLOE) as described in Section V of Part 1.

4.3.4 Anti-degradation

State Water Board Resolution No. 68-16, *"Statement of Policy with Respect to Maintaining High Quality Water" in California*, known as the "Anti-degradation Policy," protects surface and groundwater from degradation (SWRCB 1968). Any actions that can adversely affect water quality in all surface and groundwater must be consistent with the maximum benefit to the people of the State, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are subject to the federal Anti-degradation Policy (40 CFR 131.12).

5 PROBLEM STATEMENT

In the Estuary, eutrophic conditions occur during dry-weather in the summer and winter months. Eutrophication produces adverse ecological effects and creates a condition of public nuisance. This condition results in an impairment of water quality and limits the ability of the Estuary to support its designated EST, WILD, MAR, MIGR, RARE, SPWN, REC-1, and REC-2 beneficial uses (Section 4.3.1). As a result, the San Diego Water Board placed the Estuary on the 1996 CWA section 303(d) list of impaired waterbodies.

The impairment of the Estuary was confirmed by the Southern California Coastal Water Research Project (SCCWRP) during an impairment assessment conducted between 2008 and 2009, in response to Investigative Order (No. R9-2006-0076) issued by the San Diego Water Board (McLaughlin *et al*. 2013a). During that assessment, McLaughlin *et al.* (2013a) found high average macroalgal biomass (1465 to 1714 g wet wt m^{-2}) and macroalgal cover of up to 100 percent. McLaughlin *et al.* (2013a) state that adverse effects to benthic wildlife have been documented with values of 700 g wet wt m^{-2} for biomass and macroalgal cover greater than 30 percent, values that are less than half of what was observed in the Estuary in 2008 and 2009. Also, while more recent data for the Estuary have not yet been published, monitoring of upstream sources conducted in 2013 by AMEC Environment and Infrastructure Inc. shows that excessive nutrient loading to the Estuary persists. In 2013, *in-situ* field measurements in the Rainbow Creek watershed — a tributary to the Santa Margarita River located upstream of the Estuary — showed total nitrogen concentrations of 41 mg/L or 41 times the WQO of 1.0 mg/L (AMEC 2013). In addition, recent data collected in the Estuary between 2014 and 2016 show evidence of eutrophic conditions manifested as excessive macroalgal blooms with average station values as high as 416 g dw/m^2 , almost six times the proposed numeric target (Katz *et al.* 2018). The available evidence shows that eutrophic conditions are present in the Estuary and that excessive loading from upstream sources persists. As a result, to identify nutrient loading capacity necessary to limit algal growth, the development of a nutrients TMDL project for the Estuary is necessary.

5.1 Impairment of EST, WILD, MAR, MIGR, RARE and SPWN Beneficial Uses

A healthy aquatic habitat is needed to support the EST, WILD, MAR, MIGR, RARE, and SPWN beneficial uses of the Estuary. This unique estuarine habitat provides important refuge, foraging areas, and breeding grounds for several threatened and or endangered species, as well as coastal marine species. These include populations of State and federally endangered or threatened species such as the California Least Tern (*Sterna antilarum browni*), Western Snowy Plover (*Charadrius alexandrines nivosus*), Tidewater Goby (*Eucyclogobius newberryi*), Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*), and Southern California Steelhead (*Oncorhynchus mykiss*) (NOAA 2012, USMCCP 2012, McLaughlin *et al*. 2013a).

The beneficial uses listed above cannot be supported when dissolved oxygen is reduced to below 2 milligrams per liter (mg/L) — a condition called hypoxia. Hypoxia is a symptom of eutrophication that impairs beneficial uses by causing physiological distress and mortality in aquatic life (See Section 5.3) (Diaz 2001, Baird *et al*. 2004). Furthermore, the Basin Plan requires much higher concentrations of dissolved oxygen (5 mg/L) be present to protect beneficial uses.

5.2 Impairment of REC-1 and REC-2 Beneficial Uses

The Estuary and lower Santa Margarita River remain largely undeveloped. The Estuary covers an area of 192 acres, including mudflats, salt pannes, salt marsh, and subtidal habitats. Eutrophic conditions create nuisance conditions in the Estuary that impair the public's ability to enjoy this unique and scenic habitat as designated in the REC-2 beneficial use. Excess macroalgal growth in the Estuary can create nuisance odors and detracts from its pleasant visual aspect, impacting the public's aesthetic enjoyment of the waterbody. To illustrate this, Figure 7 shows evidence of excess loading of nutrients demonstrated by abundant macroalgal growth along the shoreline of the Estuary.

In addition, the Estuary also has a REC-1 (contact water recreation) beneficial use designation. Eutrophic conditions impair the REC-1 beneficial use by creating an undesirable aspect in the estuary's water, in addition to increasing the likelihood of harmful algal blooms that can produce toxic effects upon skin contact or ingestion (Anderson *et al.* 2008; Sutula *et al.* 2016a).

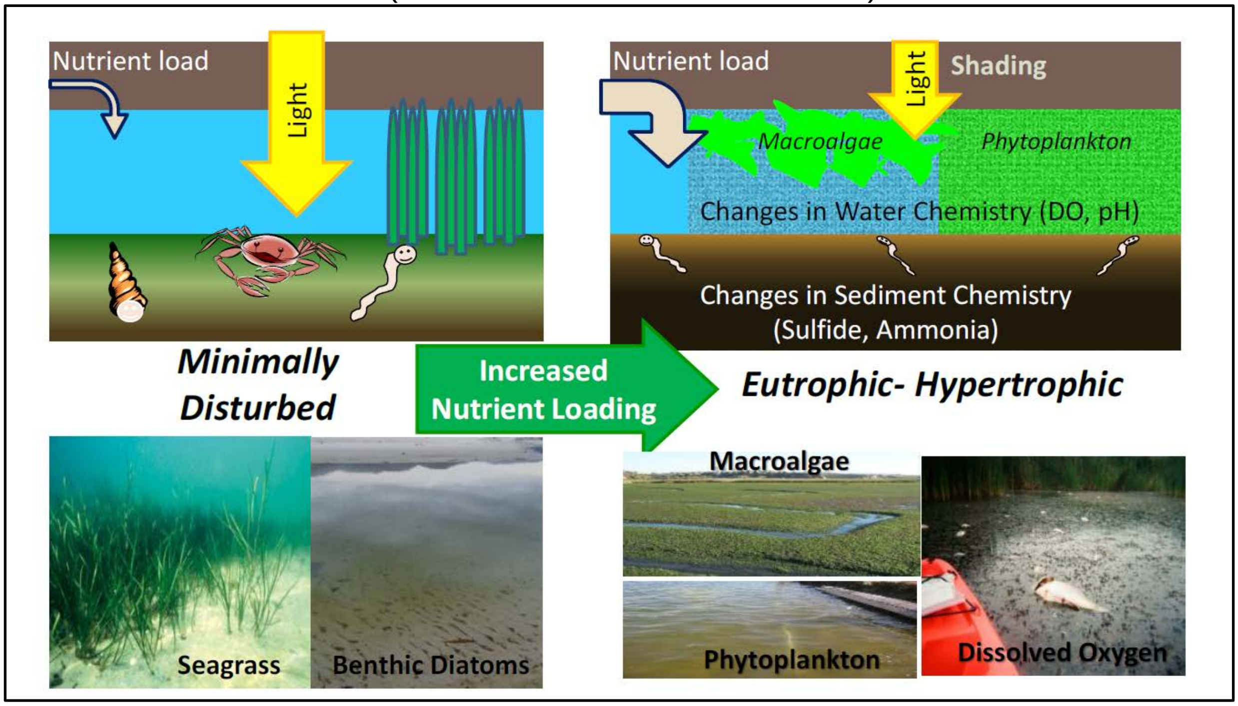
Figure 7
View of Santa Margarita River Estuary Showing an Algal Bloom During Dry Weather Conditions (April 2016)

5.3 Causes of the Impairment

Eutrophic conditions in the Estuary are caused, in part, by excess nutrient loading from polluted groundwater, agricultural discharges, and upstream non-storm water and illicit discharges from upstream Municipal Separate Storm Sewer Systems (MS4s). Loading of nutrients to the Estuary, combined with reduction of tidal flushing due to the buildup of a sand berm at the mouth of the Estuary (see Staff Report cover photo), higher surface water temperatures, lower salinity, and longer duration of daylight (especially during the summer months) promotes excessive macroalgal growth.

These macroalgal blooms eventually collapse due to self-shading — blocking of sunlight required for photosynthesis caused by overcrowding — leading to rapid algal die off and decomposition. Also, because the decay of macroalgae is an aerobic bacterial decomposition process, the breakdown of dead algae reduces the dissolved oxygen content of the Estuary to concentrations that impair beneficial uses (as described in Section 4.3.1) (Mcaughlin *et al.* 2013a; Sutula *et al.* 2016a). Figure 8, illustrates the eutrophication process described above.

Figure 8
Conceptual Model for Eutrophication in Mediterranean Estuaries
(Modified from Sutula *et al.* 2016a)



Eutrophic conditions in the Estuary usually peak during the summer season. However, eutrophication symptoms, such as macroalgal blooms or low dissolved oxygen, can be present throughout the year during dry-weather conditions. For this reason, the waste load reductions required under the Estuary TMDL project apply both to summer-dry and winter-dry conditions (McLaughlin *et al.* 2013a; Sutula *et al.* 2016a).

6 NUMERIC TARGETS

Numeric targets are interpretations of existing water quality standards; they are not water quality standards, and therefore, the process required when adopting standards, including application of California Water Code section 13241, does not apply (OCC 2002). The Basin Plan's biostimulatory WQO is a narrative objective with a numeric interpretation based on nitrogen and phosphorus. The Estuary TMDL project uses dissolved oxygen (DO), macroalgal biomass, and benthic community condition score as numeric targets to translate the Basin Plan's narrative objective into a quantitative metric.

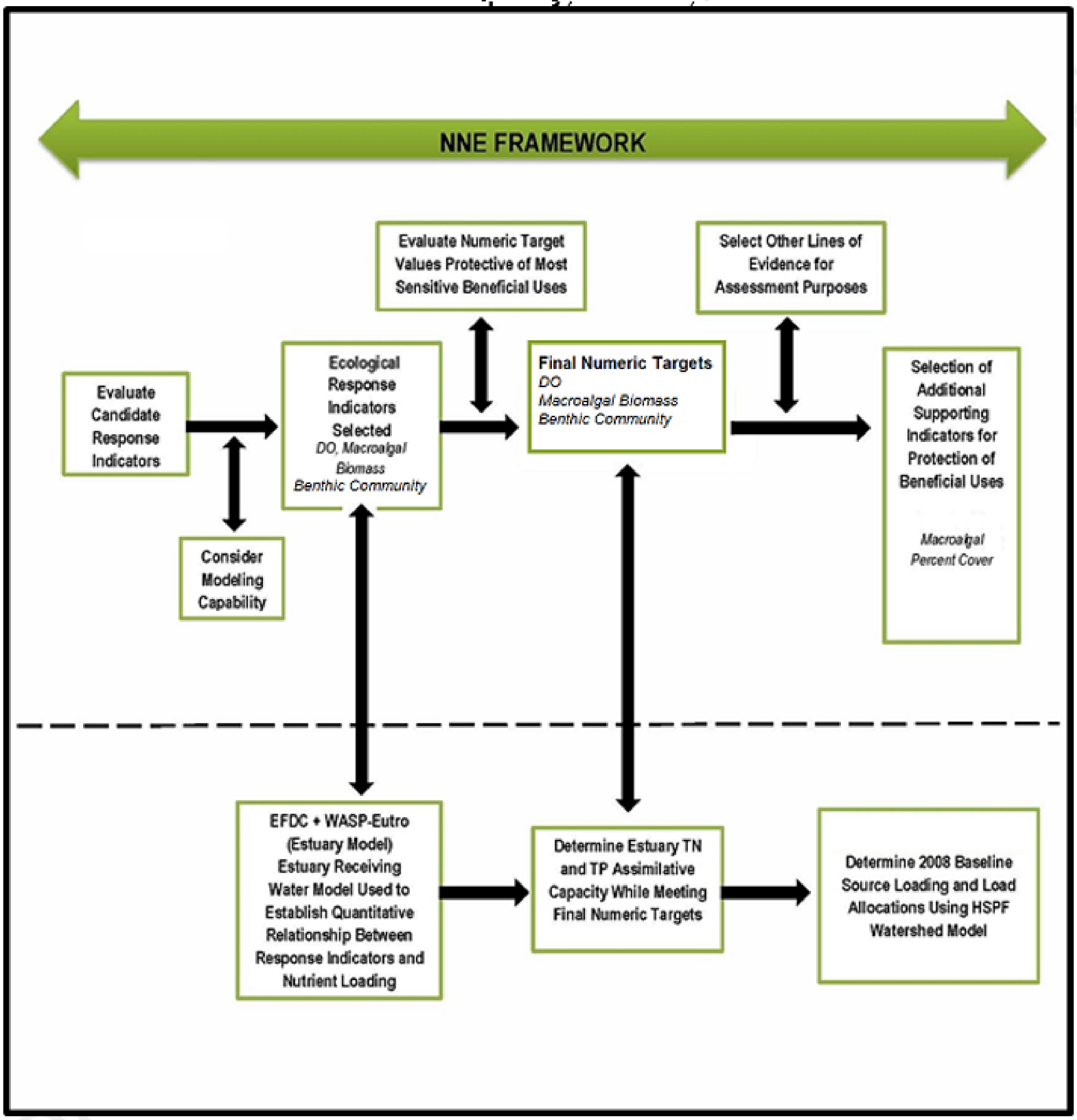
The TMDLs for the Estuary are the mass of total nitrogen and total phosphorus per year that the Estuary is able to assimilate and still meet the final numeric targets. Both total nitrogen and total phosphorus are seasonally limiting nutrients for algal production within the Estuary. Once the numeric targets are achieved, the water quality of the Estuary will be sufficient to support all designated beneficial uses. At that point, the impairment due to eutrophic conditions will no longer exist and the Estuary may be removed from the CWA section 303(d) list of impaired waters.

6.1 Numeric Targets

The San Diego Water Board developed the final numeric targets for the Estuary through a stakeholder process (see Section 6.1.3). To develop these numeric targets, the San Diego Water Board in collaboration with the Stakeholder Group used the nutrient numeric endpoint (NNE) framework approach for California estuaries developed by the Southern California Coastal Water Research Project (SCCWRP) for the State Water Board. The NNE framework provides a scientifically defensible methodology for adopting regulatory numeric criteria. This approach helps to control excess nutrient loads to levels such that the risk of impairing the designated uses is minimized. Hence,"[i]f the nutrients present–regardless of actual magnitude–have a low probability of impairing uses, then water quality standards can be considered to be met" (Sutula *et al.* 2007).

The NNE framework is founded on the premise that site-specific ecological response variables, such as dissolved oxygen concentrations, macroalgal biomass, and benthic community condition score combined with a weight of evidence approach provide a more direct and robust means of assessing beneficial use impairment than relying on nutrient concentrations alone. Because fixed nutrient concentrations may or may not result in protection from eutrophication for a particular waterbody, using the NNE approach is more protective of beneficial uses. Hence, numeric targets represent the values for ecological response indicators at which beneficial uses are protected. The process for development of numeric targets is summarized in Figure 9. Numeric targets for the Estuary were developed by the San Diego Water Board in collaboration with stakeholders with an emphasis on using the best available science and a weight of evidence approach to adopt targets that meet applicable water quality standards and protect the Estuary's most sensitive beneficial uses (EST, MIGR, RARE, and SPWN). These targets were used to determine load reduction requirements, based on the Estuary's receiving water model and watershed loading model output, as shown in Figure 9.

Figure 9
NNE Approach Process for Development of Numeric Targets and Use of Computer Models to Determine Assimilative Capacity, Sources, and Waste Load Allocations



6.1.1 Selection of Ecological Response Indicators for Development of Numeric Targets

To develop the final numeric targets, the San Diego Water Board evaluated several ecological response indicators using the criteria found in the *Review of Indicators for Development of Nutrient Numeric Endpoints (NNE) in California Estuaries* guidance prepared by SCCWRP (Sutula 2011).

The NNE Approach provides conceptual models of effects of nutrient over-enrichment, compares candidate ecological response indicators vis-à-vis review criteria, and summarizes current knowledge to establish a methodology for developing numeric targets.

The NNE Framework establishes four criteria to determine if an environmental variable is suitable as an ecological response indicator. To meet those criteria ecological response indicators must have:

1) strong linkage to beneficial uses,
2) well-vetted means of measurement,
3) working numeric models that link the response indicator to nutrients loads and other management controls, and
4) acceptable signal-to-noise ratio for eutrophication assessment.

Ecological indicators that meet all four criteria are recommended as primary response indicators while those indicators that fall short can still be used as supporting lines of evidence (Sutula 2011).

Following the NNE approach, macroalgal biomass and dissolved oxygen were determined by the San Diego Water Board and the Stakeholder Group to be the most appropriate ecological response indicators for the Estuary. In addition, benthic community condition was also selected to provide confirmatory evidence that Estuary beneficial uses are being supported.

The ecological response indicators evaluated by the San Diego Water Board for the development of numeric targets are described in Table 5 below.

Table 4
Ecological Response Indicators Evaluated Using NNE Criteria and Final Selection of Primary NNE Indicators for Estuary
(Modified from Sutula *et al.* 2011)

Ecological Response Indicator	Direct Link to Beneficial Uses	Standardized Means of Measurement	Working Numeric Model	Used to Assess Eutrophication	Meets Primary NNE indicator Criteria
Dissolved Oxygen	Y	Y	Y	Y	Y
Macroalgal Biomass	Y	Y	Y	Y	Y
Macroalgal Cover	N	Y	N	Y	N
Total Nitrogen and Total Phosphorus Concentration	N	Y	Y	N	N

- Dissolved oxygen was considered as an ecological response indicator because a low concentration of dissolved oxygen is a frequent symptom of eutrophication. Also, all the necessary NNE criteria for numeric target adoption were met by this ecological response indicator. Dissolved oxygen is a key measurement of attainment of beneficial uses because insufficient dissolved oxygen in the water column can cause physiological stress which can lead to reproductive failure or even mortality in fish and benthic organisms. In addition, the Estuary model was able to accurately simulate dissolved oxygen and continuous measurement of dissolved oxygen is routinely carried out in the Estuary (SPAWAR 2016). Moreover, according to the *Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List*, can be used to assess eutrophication. A depression of dissolved oxygen in the morning followed by an increase of dissolved oxygen in the afternoon can be used to diagnose eutrophic conditions in a waterbody (SWRCB 2015a).

- Macroalgal biomass was included in the final numeric target because it is widely recognized in published literature as a reliable ecological indicator for eutrophication in estuaries (Valiela *et al.* 1997; Sutula *et al.* 2016a). Excess macroalgal biomass is linked to beneficial uses because it can indirectly result in dissolved oxygen depletion in the Estuary and adverse impacts to aquatic life (See Section 5.3). In addition, the Estuary model accurately simulated macroalgal biomass, and practical methodologies to measure this parameter in the field are available (McLaughlin *et al.* 2013a; SPAWAR 2016). Furthermore, the measurement of macroalgal biomass is commonly used to assess eutrophic conditions, and it was used in the Estuary's impairment assessment study conducted by SCCWRP (McLaughlin *et al*. 2013a). While both plankton and macroalgal biomass were considered, only macroalgal biomass was adopted because macroalgae outcompetes plankton for nutrients in the Estuary, making it a more reliable indicator for eutrophication (Sutula *et al*. 2016a).

- Macroalgal cover was rejected as an ecological response indicator because the Estuary model was not able to simulate this parameter accurately. The Estuary model assumes 100 percent cover a scale of hundreds of meters, while field measurements are made at a scale of tens of meters and even at that scale substantial variability is observed.

- Water column total nitrogen and total phosphorus concentrations were rejected as ecological response indicators because measuring nutrient concentrations is not a reliable means of diagnosing eutrophication. While excess nutrient loading can be the primary cause of macroalgal blooms and eutrophication, low nutrient concentrations are not a reliable indicator of ecosystem health. For example, in the nearby Loma Alta Slough during the summer of 2008, some of the highest macroalgal biomass levels found in the Southern California Bight were recorded while surface water nutrient concentrations generally met the Basin Plan's WQO (SDWB 2014). Total nitrogen and total phosphorus data will still be collected in the Watershed as part of monitoring required by the Regional MS4 Permit and the Regionwide Agricultural WDRs to monitor nutrient discharges and compliance with WQOs. In addition, the San Diego Water Board will require that an Estuary TMDL project Monitoring and Assessment Program include collection of total nitrogen and total phosphorus data in the Estuary and at mass loading stations in the Watershed to assess nutrient load reductions.

- The purpose for inclusion of benthic community condition score as a numeric target is to confirm attainment of beneficial uses. While no reliable means of modeling benthic community condition are currently available, a good benthic community condition score is a reliable indicator of beneficial use attainment and standardized methods for assessing the condition of benthic communities exist (Bay *et al*. 2014).

6.1.2 Final Numeric Targets

The San Diego Water Board in collaboration with the Stakeholder Group selected dissolved oxygen, macroalgal biomass, and benthic community conditions as the most suitable ecological indicators for the development of numeric targets to protect beneficial uses in the Estuary (Table 5).

Table 5
Proposed Numeric Targets for Santa Margarita River Estuary Nutrients TMDL Project

	Metric	Primary Numeric Targets	Secondary Numeric Targets	Season
Adopted Ecological Response Indicators based on NNE criteria	Surface Water Macroalgal Biomass	≤ 57 g dw/m^2	≤70 g dw/m^2	Winter Dry and Summer Dry
	Water Column Dissolved Oxygen	Daily minima ≥5.0 mg/L	7-day average daily minimum measurements ≥5.0 mg/L 10 percent allowable exceedance	Winter Dry and Summer Dry
	SQO Benthic Community Condition Score	---	≤2.0 (Low Disturbance)	Winter Dry and Summer Dry

The selected numeric targets for macroalgal biomass and dissolved oxygen represent benchmarks to the Basin Plan’s narrative biostimulatory objectives. The inclusion of numeric targets is supported by the U.S. EPA (Creager *et al*. 2006).

The primary and secondary macroalgal biomass numeric targets for the Estuary are based, in part, on a synthesis of literature by Sutula *et al.* (2016a) that documents biomass values found in Estuaries in the Mediterranean region and in California with a wide range of Estuary ecological conditions (Figure 10).

Figure 10
Synthesis of Literature Showing Stressor Response Relationship between Macroalgal Biomass and Benthic Habitat Condition
(Modified from Sutula *et al.* 2016a)

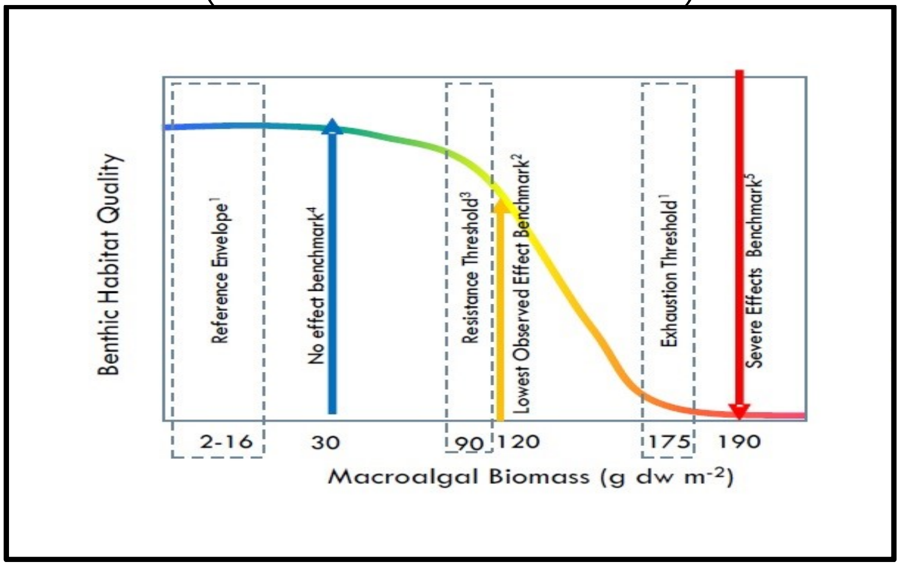


Figure 10 shows macroalgal biomass benchmarks over a qualitative spectrum from very high (blue) to very low (red). Table 6, defines each of the ecological conditions shown in Figure 10.

A "Good" condition for the Estuary (shown in green in Table 6) was used as benchmark for the final target.

Table 6
Classification of Ecological Conditions for Mediterranean Estuaries
(Modified from SDWB 2014)

Very High	**Good**	Moderate	Low	Very Low
Non-Eutrophic Nearly Undisturbed	**Non-Eutrophic Slight Change in Composition and Biomass**	Non- to Eutrophic Moderate Change in Composition and Biomass	Eutrophic Major Change in Biological Communities	Eutrophic Severe Change in Biological Communities

The selection of a “Good” condition for the Estuary is appropriate as it strikes a balance between the recovery potential of this water body, while recognizing the burden of historic pollutants and the degree of urbanization in the Santa Margarita River watershed. The Estuary is one of the few remaining largely unmodified estuaries in southern California, but the presence of historical nutrient pollution in groundwater and the degree of urbanization in the watershed precludes the achievement of pristine conditions (“Very High” ecological condition”) simply by managing nutrient discharges.

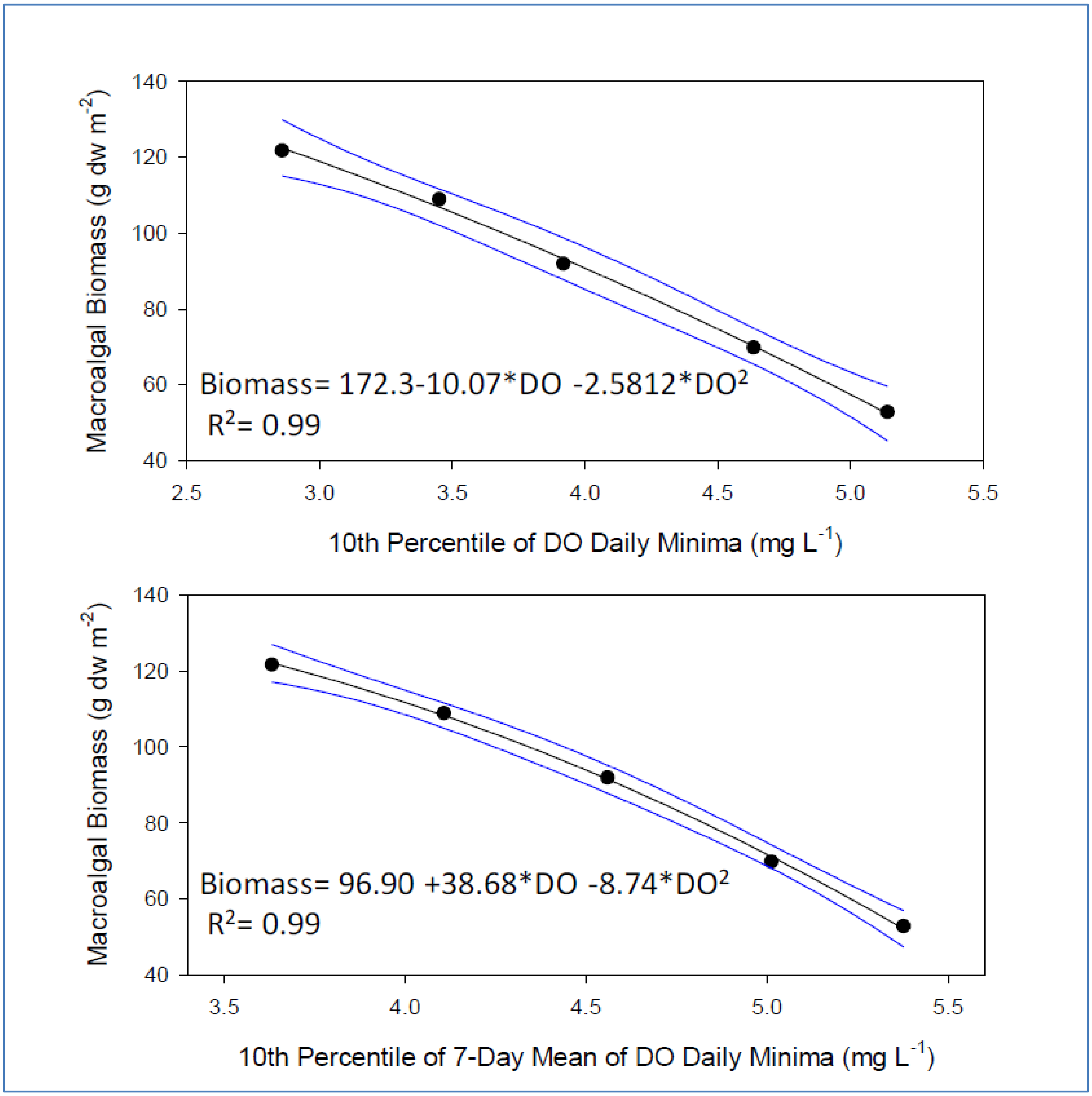
A “Good Ecological Condition” will support the designated beneficial uses.

Considering that Figure 10 summarizes data from various sources, some uncertainty exists around the initial threshold of adverse ecological effects for a particular waterbody. Taking this into consideration, Figure 10 shows that a range between 30 and 90 g dw m^{-2} of macroalgal biomass, would likely protect the Estuary’s beneficial uses.

Since not enough site-specific data were available to define a specific threshold of adverse ecological effects for the Estuary, the final macroalgal biomass numeric targets were based on dissolved oxygen.

To couple macroalgal biomass numeric targets with dissolved oxygen, this TMDL project relies on the Estuary model to build regression relationships between these two parameters. The resulting primary and secondary macroalgal biomass numeric targets of 57 and 70 g dw m^{-2} (Table 5) are based on the equations shown in Figure 11.

Figure 11
Non-linear Regression Relationships between Dry-Weather Macroalgal Biomass and Dissolved Oxygen, for Primary and Secondary Numeric Target. Blue Lines Show 95 Percent confidence intervals
(Sutula *et al.* 2016a, Figure 2.11)



The final primary and secondary macroalgal biomass numeric targets of 57 and 70 g dw m^{-2}, based on the equations shown in Figure 11, are consistent with the protective range of macroalgal biomass identified in the literature synthesis prepared by Sutula *et al.* (2016a) shown in Figure 10. This is additional evidence indicating that the chosen numeric targets are protective of beneficial uses.

The dissolved oxygen primary and secondary numeric targets (Table 5) are based on the Basin Plan's WQO (5.0 m/L dissolved oxygen) and the *State Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List* (State Policy for Section 303(d)) (7-day average of minimum dissolved oxygen values). The Basin Plan WQO for inland surface waters, enclosed bays and estuaries, and coastal lagoons and groundwater, which is used as the primary numeric target, requires that dissolved oxygen levels shall not be less than 5.0 mg/l in inland surface waters with designated MAR and WARM beneficial uses or less than 6.0 mg/l in waters with designated COLD beneficial uses.

The allowable percent exceedance associated with the secondary numeric target is based, in part, from the State Policy for Section 303(d). The State Policy for Section 303(d) states that,

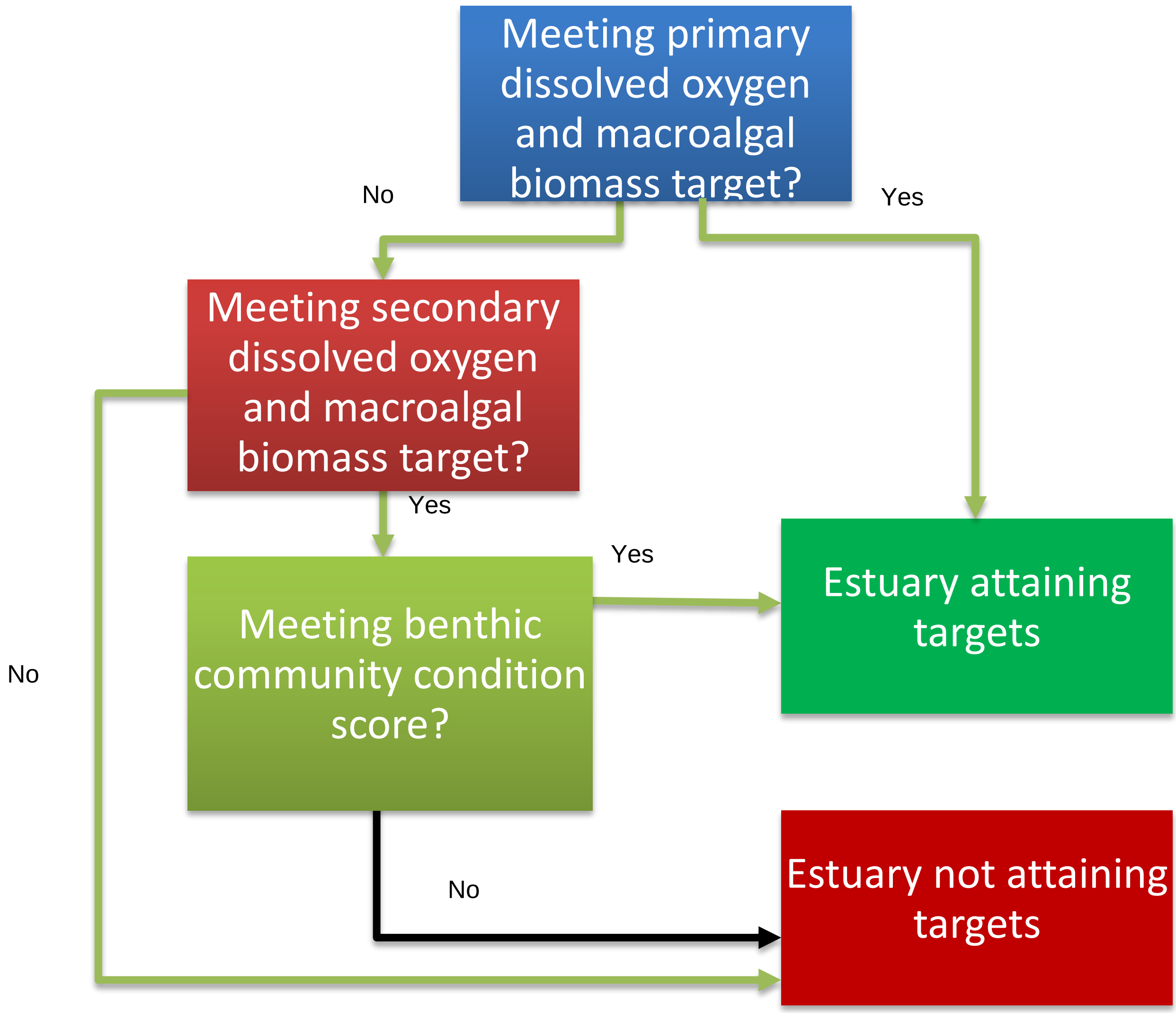
> Numeric water quality objectives for conventional pollutants are exceeded as follows:
>
> Using the binomial distribution, waters shall be placed on the section 303(d) list if the number of measured exceedances supports rejection of the null hypothesis as presented in Table 3.2. For depressed dissolved oxygen, if measurements of dissolved oxygen taken over the day (diel) show low concentrations in the morning and sufficient concentrations in the afternoon, then it shall be assumed that nutrients are responsible for the observed dissolved oxygen concentrations if riparian cover, substrate composition or other pertinent factors can be ruled out as controlling dissolved oxygen fluctuations. When continuous monitoring data are available, the seven-day average of daily minimum measurements shall be assessed. In the absence of diel measurements, concurrently collected measurements of nutrient concentration shall be assessed using applicable water quality objectives or acceptable evaluation guidelines (SWRCB 2015a).

The allowable proportion of exceedances for dissolved oxygen that will fail to reject the null hypothesis (show no impairment) are set equal to or less than 10 percent.

The Basin Plan WQO is used to set the primary numeric target using a daily minimum value, while the State Policy for Section 303(d) is used to set the secondary numeric target requiring the evaluation of 7-day average minimum dissolved oxygen concentrations using a binomial distribution test to determine impairment and to provide a characterization of ecological risk (SWRCB 2015a).

Figure 12 shows how the numeric targets should be used to evaluate attainment of numeric targets.

Figure 12
Use of Primary and Secondary NNE-based Numeric Targets to Determine if Estuary is Supporting Beneficial Uses
(Modified from LWA 2016)



In addition, a low disturbance Benthic Condition SQO score of 2.0 is included as a numeric target to confirm protection of beneficial uses.

The SQO value of equal to or less than 2.0 was adopted because this score is equivalent to a low disturbance Benthic Condition. According to the *California Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (Section V.G.), Benthic Community Condition categories are defined as follows:

> Assessment of Benthic Community Condition — Each benthic index result shall be categorized according to disturbance as described in Table 5. The disturbance categories are:
>
> > [Benthic Community Condition Score of 1.0]. Reference - A community composition equivalent to a least affected or unaffected site.
> > [Benthic Community Condition Score of 2.0]. Low disturbance - A community that shows some indication of stress, but could be within measurement error of unaffected condition.
> > [Benthic Community Condition Score of 3.0]. Moderate disturbance - Confident that the community shows evidence of physical, chemical, natural, or anthropogenic stress.
> > [Benthic Community Condition Score of 4.0]. High disturbance - The magnitude of stress is high (SWRCB 2008).

6.1.3 Summary of Stakeholder Process in Development of the Numeric Targets

The San Diego Water Board developed numeric targets using the NNE approach and by participating, with all interested parties, as part of a fact-finding process facilitated by Dave Ceppos (Center for Collaborative Policy) and Dr. Martha Sutula (SCCWRP). Stakeholders included: MS4 permittees, U.S. Marine Corps Base Camp Pendleton, agricultural dischargers, tribal representation, water districts, non-governmental organizations, and U.S. EPA Region 9 (Table 7). To begin the process of numeric target development, in late 2015 and early 2016, Dr. Martha Sutula led technical discussions during stakeholder meetings where the scientific basis for the development of numeric targets using the NNE approach was presented. Also, during these discussions historic and on-going Estuary monitoring data for all potential ecological indicators were carefully reviewed under the NNE criteria to assess their suitability for numeric target development (See Figure 9). In this collaborative process, the latest science on estuaries and several available lines of evidence were considered to establish protective numeric targets for the Estuary.

Based on stakeholder input and considerations for the feasibility of achieving these targets, the initial proposal was further refined to include benthic community condition confirmation as an additional measure to ensure beneficial use protection.

Table 7
Dischargers and Stakeholders Who Participated in Numeric Target Development Discussions

Name	Organization
Jo Ann Weber	County of San Diego
Stewart McKibbin	Riverside County Flood Control and Water Conservation District
Kyle Cook	U.S. Marine Corps Base Camp Pendleton
Greg Seaman	U.S. Marine Corps Base Camp Pendleton
Jeremy Jungreis	Rancho California Water District and Rutan & Tucker
Eva Plajzer	Rancho California Water District
Ashli Desai	Larry Walker and Associates
Edmundo Hernandez	Pechanga Band of Luiseno Indians
Casey Anderson	San Diego County Farm Bureau
Martha Sutula	Southern California Coastal Water Research Project
Chuck Katz	SPAWAR Systems Center Pacific
PF Wang	SPAWAR Systems Center Pacific
Kara Sorenson	SPAWAR Systems Center Pacific
Daniel Oros	U.S. EPA
Cindy Lin	U.S. EPA
Dave Ceppos	Center for Collaborative Policy
Roya Yazdanifard	Caltrans
Ashli Desai	Larry Walker & Associates
Sandra Jacobson	CalTrout
Scott Thomas	Stetson Engineers
Cynthia Gorham	San Diego Water Board
Hiram Sarabia	San Diego Water Board

7 SOURCE ANALYSIS

A source analysis identifies all of the known point sources and nonpoint sources of the impairing pollutant in the Watershed.

The results of this source analysis show that Municipal Separate Storm Sewer Systems (MS4s) and agricultural discharges are the two major sources of total nitrogen and total phosphorus into the Estuary during the dry-weather season (summer-dry and winter-dry).

Sources of total nitrogen and total phosphorus to the Estuary are listed by category in Table 8.

Table 8
Categories of Total Nitrogen and Total Phosphorus Sources to the Estuary

Point Sources	Nonpoint Sources	Background
• MS4 Discharges • Wastewater Treatment Plants Discharges • Industrial Sites Discharges • Construction Sites Discharges • Sanitary Sewer Spills • Private Sewer Lateral Spills • Groundwater Dewatering Discharges • Recycled Water Discharges • Comprehensive Water Management Resource Agreement (CWRMA) Releases	• Agricultural Discharges • Surfacing Polluted Groundwater from Former Agricultural Fields on Stuart Mesa • Surfacing Polluted Groundwater from Watershed • Leaking Septic Systems	• Open Space • Ocean Water

The following references were used to identify point and nonpoint sources of total nitrogen and total phosphorus:

- *Investigative Order No. R9-2006-0076, Owners and Operators of Municipal Separate Storm Sewer Systems, California Department of Transportation, Hale Avenue Resource Recovery Facility, and North County Transit District Responsible for the Discharge of Bacteria, Nutrients, Sediment, and Total Dissolved Solids into Impaired Lagoons, Adjacent Beaches, and Agua Hedionda Creek (Lagoon Order).* Available: http://www.waterboards.ca.gov/sandiego/board_decisions/adopted_orders/2006/2006_0076.pdf [Accessed 20 March, 2017]

- Mazor, R.D., Schiff K. 2007. *Surface Water Ambient Monitoring Program (SWAMP) Report on the Santa Margarita Hydrologic Unit. Technical Report 527.* Prepared for the California Regional Water Quality Control Board, San Diego Region. Southern California Coastal Water Research Project. Costa Mesa, CA. Available:http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/527_SantaMargaritaHU_Report.pdf [Accessed 17 March, 2017]

- McLaughlin, K., M. Sutula, J. Cable, and P. Fong. 2013. *Eutrophication and Nutrient Cycling in Santa Margarita Estuary, Camp Pendleton, California. Technical Report 635.* Southern California Coastal Water Research Project. Costa Mesa, CA. Available: http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/635_SantaMargaritaSlough.pdf [Accessed 20 March, 2017]

- Sutula, M., J. Butcher, J. Boschen, M. Molina. 2016. *Application of Watershed Loading and Estuary Water Quality Models to Inform Nutrient Management in the Santa Margarita River Watershed. Technical Report 933.* Southern California Coastal Water Research Project. Costa Mesa, CA. Available:www.sccwrp.org http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/933_AppOfWatershedLoading.pdf [Accessed March 20, 2017]

Additional data on sources reviewed during the TMDL project development included non-storm water MS4 outfall monitoring results submitted pursuant to the Regional MS4 Permit.

In addition to reviewing the information contained in the documents listed above, a watershed loading model for the Santa Margarita River Estuary (Estuary watershed loading model) was developed by Tetra Tech Inc. using the Hydrologic Simulation Program Fortran (HSPF). HSPF is capable of assessing point and nonpoint sources in large watersheds with varying land cover and management conditions. The Estuary watershed loading model was used to estimate point and nonpoint source nutrient loading to the Estuary (See Section 11.1). The Stakeholder Group agreed to use water year 2008 as the baseline year for Estuary TMDL project calculations.

Estimates for water year 2008 year-round, dry-weather, point and nonpoint source loads of total nitrogen and total phosphorus from surface water controllable sources are presented in Table 9.

Dry-weather refers to days during the summer and winter when rainfall is less than 0.10 inches during the prior 72-hour period. At-source refers to nutrient loading as measured at the edge of field or the point where the discharge exits a given land use, this does not take into account any assimilation that might take place between the point of discharge and the point where discharge enters the Santa Margarita River or the Estuary. The actual load reaching the Estuary is referred to as the delivered load.

Loading of total nitrogen and total phosphorus from all sources is shown in Table 9 below.

Table 9
Water Year 2008, Dry-Weather Loading of Total Nitrogen and Total Phosphorus to Estuary from Surface and Groundwater Sources
(Sutula *et al.* 2016a, Butcher *et al.* 2017b).

Water Year 2008 Dry-Weather Nutrient Sources by Major Categories	**At-Source TN Loads** (lbs/yr)	**Delivered TN Loads** (lbs/yr)	**At-Source TP Loads** (lbs/yr)	**Delivered TP Loads** (lbs/yr)
Watershed Groundwater	1790	1790	2574	2574
Stuart Mesa Ag Field Groundwater	6777	6777	9	9
Watershed Surface Water	116,653	46,626	7060	3785
TOTAL	**125,220**	**55,193**	**9643**	**6368**

Groundwater at-source and delivered nutrient loading estimates are found in Tables 2.3 and 2.4 in Sutula *et al.* (2016a), while the totals for at-source and delivered surface water nutrient loading estimates are published in Tables 1, 3, 5, and 7 in Butcher *et al.* (2017b). Assumed no assimilation of nutrients taking place in watershed groundwater.

Table 10
Watershed Loading Model Estimates for Water Year 2008, Dry-Weather, Surface Water Loading of Total Phosphorus and Total Nitrogen Loading to Estuary
(Sutula *et al.* 2016a, Butcher *et al.* 2017b, and County of San Diego 2017).

WY 2008 Dry Weather Surface Water Loading	**At-Source TN Loads** (lbs/yr)	**Delivered TN Loads** (lbs/yr) *****	**At-Source TP Loads** (lbs/yr)	**Delivered TP Loads** (lbs/yr) *****
Point Sources				
San Diego County MS4	74		5	
Riverside County MS4	9932		990	
U.S. Marine Corps Base Camp Pendleton Phase II MS4	530		52	
Caltrans MS4	404		46	
Nonpoint Sources				
Commercial Agricultural Dischargers - SD County	30421		1156	
Commercial Agricultural Dischargers – Riverside	43916		2166	
Commercial Agricultural Dischargers - Federal Lands	353		13	
Dairy Farms	49		5	
Controllable Source Total	**84936**		**4359**	
Uncontrolled Sources**				
Forests, Chaparral, Grasslands, Transitional, Horse Ranches, and Non-MS4 Land Uses	31717		2701	
TOTAL	**116653**	**46626**	**7060**	**3785**

* Delivered total nitrogen and total phosphorus loads are from tables 3 and 7 in Butcher *et al.* 2017b

The information presented in Table 10 was provided by the County of San Diego and Tetra Tech, Inc. to the Stakeholder Group for the purpose of calculating waste load allocations (WLAs) and load allocations (LAs) from controllable sources (County of San Diego 2017, Butcher *et al.* 2017b). Nutrient loading from uncontrolled sources was calculated by adding up total nitrogen and total phosphorus loading from forest, chaparral, grassland, horse ranches, transitional, and non-MS4 land use across the watershed (Butcher et al. 2017b).

Nutrient point source loading estimates from MS4s were calculated using 2015 and 2005 land use data provided by the County of San Diego and County of Riverside, respectively. Nonpoint source nutrient loading from agricultural discharges were calculated by adding individual nutrient loads from irrigated agriculture, non-irrigated agriculture, orchard, vineyard, and nursery land uses within a jurisdiction. Background sources from the Watershed represent the sum of nutrient loads from forests, chaparral, scrub, grassland and herbaceous land use categories.

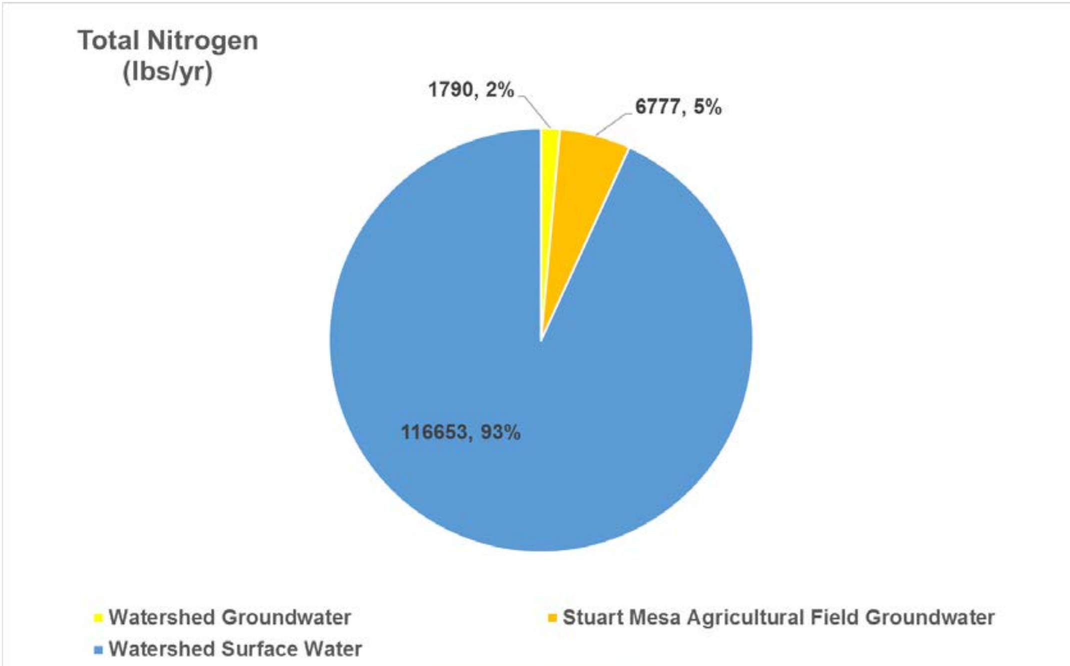
Table 11 further breaks down nonpoint source agricultural discharges by showing the portion of agricultural loads that originate within or enter an MS4.

Table 11
Estuary Watershed Loading Model Estimates of Year-Round, At-Source, Dry-Weather, Agricultural Nonpoint Source Loads of Total Nitrogen and Total Phosphorus Originating Within an MS4 or Discharging into an MS4
(County of San Diego 2017, Butcher *et al.* 2017b)

Source	2008 Total Nitrogen Loads (lbs/yr)	2008 Total Phosphorus Loads (lbs/yr)
Agricultural Dischargers - SD County	177	10
Agricultural Dischargers – Riverside	2333	238
Agricultural Dischargers - Federal Lands	1	0
Total	**2511**	**248**

Figure 13 shows all water year 2008 total nitrogen and total phosphorus loads by source.

Figure 13
At-Source Total Nitrogen and Total Phosphorus Loading to the Estuary by Source
(Sutula et al. 2016a, Butcher et al. 2017b)



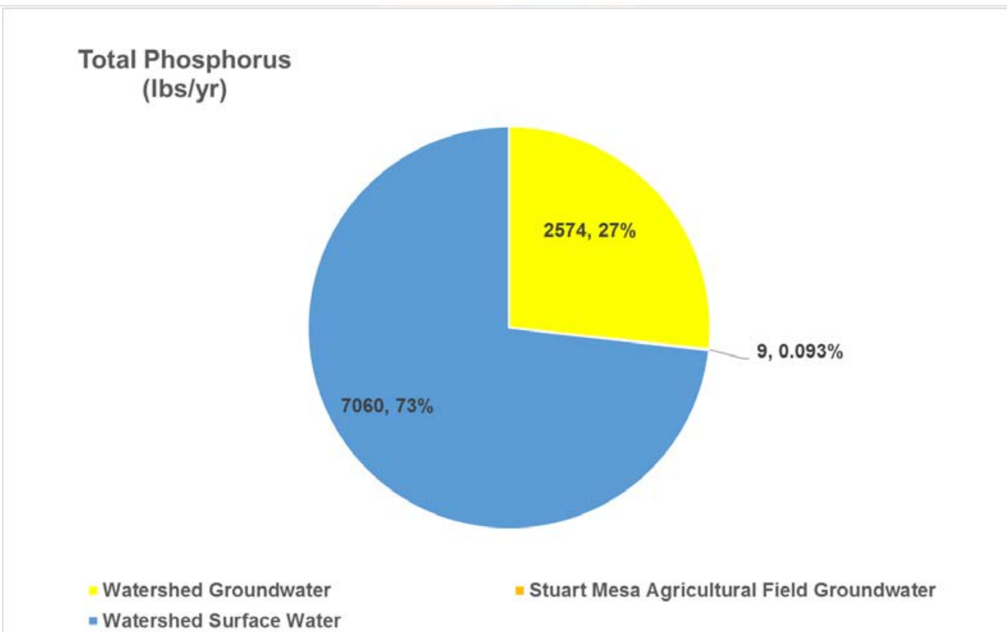
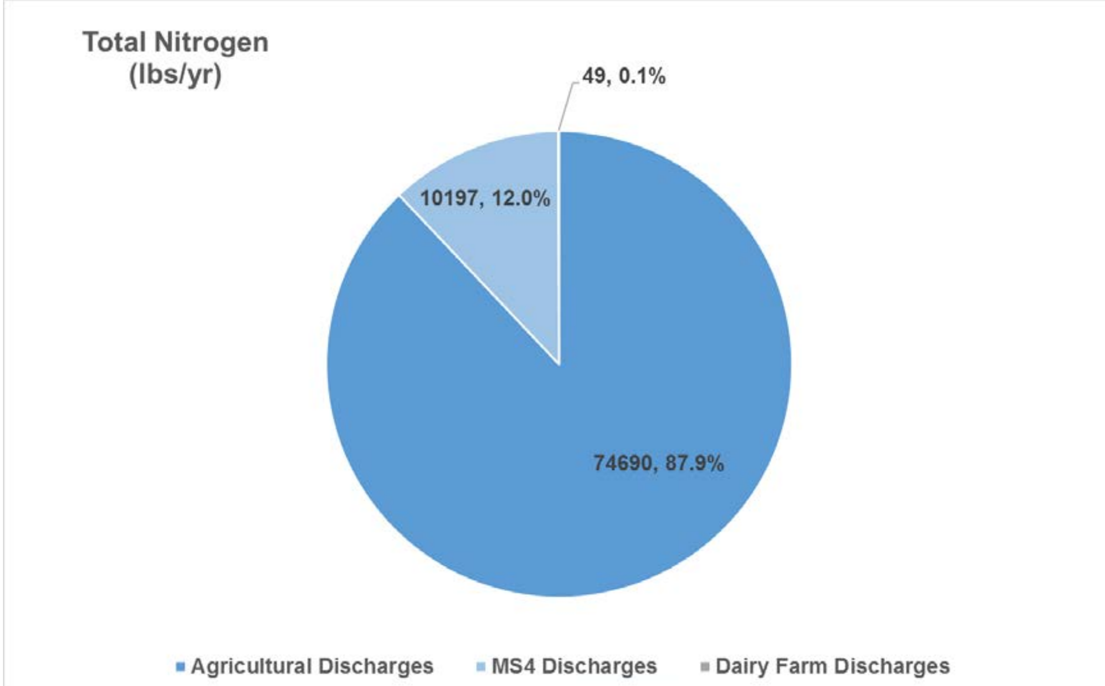
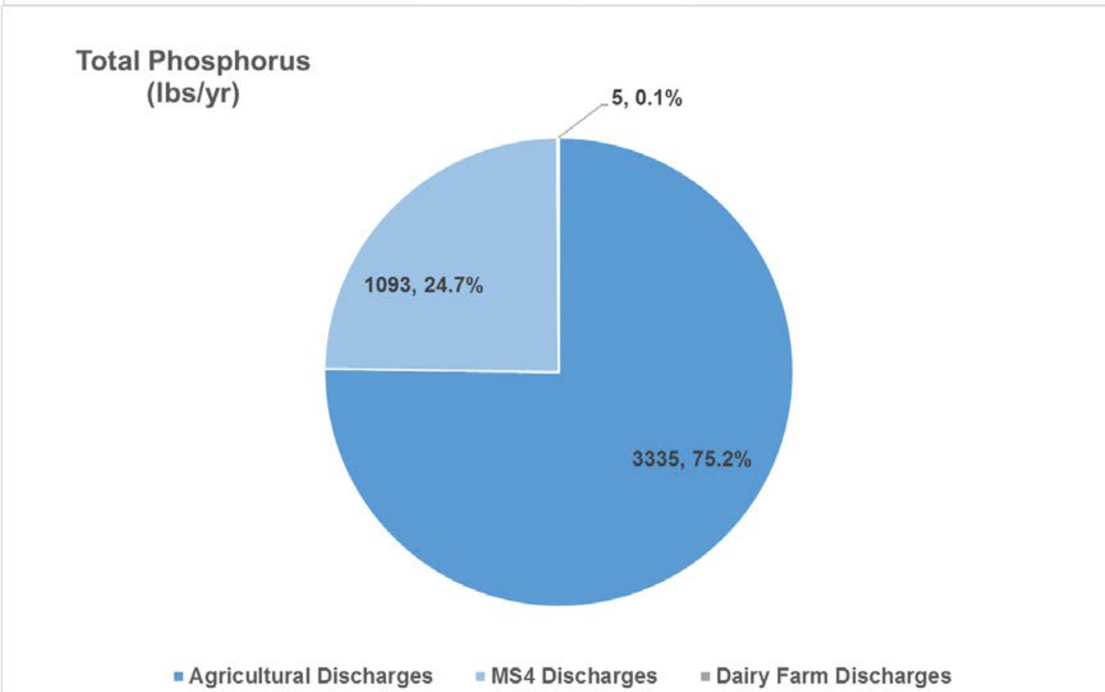


Figure 14 shows water year 2008 watershed surface water total nitrogen and total phosphorus loading category by source.

Figure 14
Surface Water Total Nitrogen and Total Phosphorus Loading to Estuary by Source





7.1 Point Sources

Point source discharges are those from specific locations like pipes, outfalls, and conveyance channels — all localized and stationary pollution sources. Section 502(14) of the Clean Water Act, defines the term "point source" as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged” (U.S. EPA 2016a). Point sources of total nitrogen and total phosphorus to the Estuary include discharges from MS4s in San Diego County and Riverside County, municipal wastewater treatment plants, industrial facilities, construction sites, sanitary sewer spills, private lateral sewer spills, as well as Cooperative Water Resource Management Agreement (CWRMA) releases (Table 8).

CWRMA is an agreement between Camp Pendleton and Rancho California Water District issued in 2002 by a federal court that includes a requirement for the release of water by Rancho California Water District into the Santa Margarita River. The CWRMA water release takes place from a pipe located at the top of the Santa Margarita River Gorge. The CWRMA release guarantees that adequate river flow is maintained throughout the year to allow for groundwater recharge, support ecosystem functions, and ensure that Camp Pendleton has an adequate drinking water supply.

The impact of this water release was analyzed by Stetson Engineers whose findings show that the CWRMA release is essential to maintain year-round flow in the Santa Margarita River (Stetson 2016). Also, according to data provided by the Rancho California Water District to the San Diego Water Board, the source water of the CWRMA release meets or exceeds existing WQOs for total nitrogen and total phosphorus and thus acts to dilute existing elevated nutrient concentrations in the Santa Margarita River (RCWD 2016). Without this release from Rancho California Water District, it is likely that parts of the Santa Margarita River could run dry, especially during times of drought and ambient total nitrogen and total phosphorus concentrations in river would likely be higher.

The Santa Margarita River Estuary watershed Phase I MS4 Permittees include: County of San Diego, County of Riverside, Riverside County Flood Control and Water Conservation District, City of Murrieta, City of Temecula, and City of Wildomar, and City of Menifee.

Since the 1996 listing of the Estuary on the CWA section 303(d) list, two important point sources of nutrients to the Estuary have been eliminated. In 2003, the Camp Pendleton Southern Wastewater Treatment plant stopped discharging treated effluent into the Estuary. Effluent from the Southern Wastewater Treatment Plant is now discharged into the Pacific Ocean via the Oceanside Ocean Outfall. Also, a groundwater dewatering point source discharge into the Estuary from North County Transportation District was removed in 2011.

In water year 2008, controllable MS4 discharges represented the largest point source of total nitrogen and total phosphorus to the Estuary, making up 12 and 23 percent of the total yearly nutrient loads in the Watershed, respectively (Figure 13). Full-year, at-source, nutrient loading during dry-weather is estimated to be 10,197 pounds of total nitrogen and 1,019 pounds of total phosphorus (Table 10) (Butcher *et al.* 2017b).

The Estuary watershed loading model finding that MS4 discharges represent the principal point source of nutrient loading to the Estuary is also supported by field data collected by the San Diego Water Board.

Historical monitoring data collected in the San Diego Region shows that MS4 outfalls are a source of total nitrogen and total phosphorus. Total nitrogen and total phosphorus discharges to receiving waterbodies from the MS4 during the dry-weather season are due in part to landscape irrigation runoff. Runoff from landscape irrigation into the Permittees' MS4 systems is prohibited by the Regional MS4 Permit. Similarly, discharges of irrigation runoff at State of California Department of Transportation (Caltrans) sites are prohibited by State Water Board Order No. 2012-0011-DWQ. Also, State Water Board Order No. 2009-0006-DWQ finds that nutrients are a pollutant of concern in recycled water and requires application rates that do not exceed the ability of landscape plants to use the nutrients or discharge from the area of application.

With respect to Municipal Wastewater Treatment Plant point sources, there are currently no live stream discharges from Wastewater Treatment Plants to the Estuary. Discharges from all wastewater treatment plants on U.S. Marine Corps Base Camp Pendleton are routed to the Pacific Ocean through the Oceanside Ocean outfall. The Oceanside Ocean outfall also routes wastewater from communities of Fallbrook and Rainbow to the Pacific Ocean. The remaining municipalities upstream treat their wastewater at the Santa Rosa Water Reclamation Facility in Riverside County, which reclaims and discharges up to 5 million gallons per day to land.

Other potential point sources of total nitrogen and total phosphorus from wastewater collection systems include sanitary sewer spills which are comparatively much smaller in magnitude relative to other Watershed sources, and are therefore are not expected to constitute significant source of nutrients to Estuary. As an example in Fiscal Year 2007, sanitary sewer spills in the Santa Margarita River watershed contributed approximately 54.4 pounds of total nitrogen and 18.8 pounds of total phosphorus. While in Fiscal Year 2017, nutrient loading from sanitary sewer spills was reduced significantly to 11.1 pounds of total nitrogen and 3.9 pounds of total phosphorus. Also, depending on the location of the sanitary sewer spill, assimilation of nutrients by plants and algae in the river can further reduce the nutrient load actually reaching the Estuary. Data on sanitary sewer overflows are available from the California Integrated Water Quality System (CIWQS):

http://www.waterboards.ca.gov/sandiego/water_issues/programs/sso/index.shtml

Another category of nutrient point sources in the Watershed are industrial facilities. Industrial facilities account for 1.1 and 1.7 percent of the total year-round, dry-weather, total nitrogen and total phosphorus loading from all sources in the Watershed, respectively (Butcher *et al*. 2017b). Industrial point sources make up 4.7 percent and 4.6 percent of the yearly total nitrogen and total phosphorus dry-weather loading from MS4s in the Watershed, respectively. Industrial facilities with pollutants exposed to storm water are subject to dual regulation by MS4 permittees and the San Diego Water Board as required under the statewide Industrial General Permit (2014-0057-DWQ) and are expected to adhere all provisions contained therein.

7.2 Nonpoint Sources

According to the U.S. EPA, “The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" (See Section 7.1) (U.S. EPA 2016a). Nonpoint source pollution can result from precipitation, agricultural land runoff, surfacing groundwater, atmospheric deposition, and hydrologic modification.

The major categories of nonpoint sources that contribute significant loads of total nitrogen and total phosphorus to the Estuary during dry-weather are agricultural discharges and surfacing groundwater (Sutula *et al.* 2016a) (See Table 8). Existing controllable agricultural discharges represent the largest overall source of nutrients to the Estuary, making up approximately 88 and 77 percent of the total nitrogen and total phosphorus yearly loads from the Watershed, respectively (Figure 13). Current year-round, at-source, nonpoint source nutrient loading from agricultural discharges in the watershed during dry-weather is estimated to be 74,690 pounds of total nitrogen and 3,385 pounds of total phosphorus (Table 9).

The regionwide water quality issues associated with agricultural discharges have led the San Diego Water Board to adopt WDRs for agricultural operations.

According to the findings in the Regionwide Agricultural WDRs (R9-2016-0004 and R9-2016-0005):

> There are more than 6,000 agricultural operations on approximately 70,000 acres of land in the San Diego Region. [Major crops grown in San Diego County include ornamental trees and shrubs, indoor flowering and foliage plants, bedding plants, while in Riverside Milk, Nursery Stock and Table Grapes are the top crops (San Diego County 2015, Riverside County 2015).] The production of crops on these lands requires disturbance to the soil and the use of various agricultural chemicals which can generate discharges of waste such as nutrients, pesticides, herbicides, fumigants, pathogens, and sediment. If not properly managed, these discharges can degrade water quality, cause or contribute to pollution and nuisance conditions, and adversely affect beneficial uses in waters of the State. The prohibitions and requirements of this General Order are intended to ensure that the discharge of wastes from Agricultural Operations are properly managed to protect, maintain, and improve water quality and prevent impairment of beneficial uses in waters of the State within the San Diego Region (Section I,I, p.6).

In addition,

> [d]ischarges from Agricultural Operations within the San Diego Region have adversely affected water quality, as documented by listings on the CWA section 303(d) List of Water Quality Limited Segments (303(d) List). The 2008 303(d) List identifies 12 water quality limited segments comprised of approximately 80 linear miles and 1,132 acres of surface waters within the San Diego Region where water quality standards were not attained and where agricultural activities were identified as a potential source of the impairment (Section I,L, p.7).

Also,

> [p]ast surface water monitoring conducted in accordance with the 2007 Conditional Waiver of Waste Discharge Requirements for Discharges from Agricultural and Nursery Operations (Agricultural Waiver) within the Santa Margarita River and San Luis Rey River watersheds in areas influenced by agricultural activities also document water quality standards exceedances. Most samples exceeded water quality objectives for total dissolved solids, total nitrogen, and total phosphorus, constituents typically associated with agricultural activities. Likewise, regional biological monitoring document water quality impacts to the biological integrity of watersheds in the San Diego Region which are influenced by agriculture. The Southern California Index of Biological Integrity Scores – a multi-metric index based on the relative abundance of tolerant and sensitive benthic macroinvertebrates – for the bioassessment ranged from 5.7 (very poor condition) to 61 (good condition). The bioassessment data showed that 50 percent of streams were in poor or very poor condition, 0 percent in fair condition and 50 percent in good or very good condition (Section I, M, pp.7-8).

The impacts of nutrient discharges from agricultural operations in the Estuary's Watershed also led to the development of nutrient TMDLs for Rainbow Creek in 2005.[3] Rainbow creek is a tributary to the Santa Margarita River. The Regionwide Agricultural WDRs also incorporate existing TMDL requirements for Rainbow Creek. Recent data from the Rainbow Creek sub-watershed shows levels of total nitrogen of 41 mg/L directly attributable to agricultural discharges (AMEC 2013).

Surfacing polluted groundwater also contributes to eutrophication in the Estuary. Polluted groundwater entering the Estuary from the surrounding Watershed is likely the result of years of infiltration of nutrients from upstream agricultural and development activities. The application of excess fertilizer to land and discharges of nutrients to surface water can result in the infiltration of nutrients into groundwater, and the build-up of large nutrient stores in subsurface waters over time. These nutrients in groundwater are eventually released back into surface waters where they can contribute to eutrophication symptoms in both the Santa Margarita River and Estuary.

The Estuary receives groundwater nutrient inputs from two major groundwater basins, the Temecula Valley and Santa Margarita Groundwater Basins, and also from groundwater below former agricultural fields west of Camp Pendleton (SWRCB 2017b). The interaction between surface water and groundwater in the Watershed is very complex and important knowledge gaps exist, primarily because of lack of field data. Knowledge gaps include: the average total nitrogen and total phosphorus concentrations in the various groundwater sources in the Watershed, and the contributions of nutrients from the various groundwater sources in the Watershed to the Estuary.

The San Diego Water Board used a computer simulation (MODFLOW groundwater model) to estimate the amount of water flowing in and out of the Santa Margarita Valley Basin and the Santa Margarita River. However, the groundwater Model is unable to simulate nutrient fluxes without the corresponding field data. To begin to address these gaps, Camp Pendleton commissioned Stetson Engineers Inc. to conduct a groundwater field study in the lower Santa Margarita River. While that work was still ongoing as of May 2017, preliminary data collected in 2016 by Stetson Engineers, Inc., shows total nitrogen and total phosphorus concentrations increase with proximity to Estuary (Stetson 2017). Stetson showed that nutrient concentrations in groundwater in the lower Santa Margarita Valley Basin are well below the groundwater WQOs for Nitrate + Nitrite (10 mg/L) and in most cases meet or exceed surface water WQOs for total nitrogen (1.0 mg/L) and total phosphorus (0.1 mg/L), with the exception of those sites closest to the Estuary.

[3] Resolution No. R9-2005-0036, A Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) to incorporate Revised Total Maximum Daily Loads for Total Nitrogen and Total Phosphorus in Rainbow Creek Watershed, San Diego County (Rainbow Creek TMDL) (Section I,M, p.7).

MODFLOW estimates provided by Stetson Engineers Inc. show that a load of approximately 80 pounds of nitrogen (NO_3-N) entered the Estuary in 2008 from the lower Santa Margarita River groundwater basin (Stetson 2017). The 2008 load into the Estuary was substantially higher than the annual average load of 60 pounds of nitrogen (NO3-N) calculated over a period of nine years from 2008 to 2016 (Stetson 2017). Similar estimates for the total phosphorus load entering the Estuary from lower Santa Margarita River are not yet available. To determine groundwater loading entering the Estuary, the Estuary model used back-calculations based on the residual needed to calibrate total phosphorus concentration in the Estuary.

Also, until 2011, Stuart Mesa (located immediately north of the Estuary and west of Camp Pendleton) was an active agricultural field that discharged nutrients to the Estuary via irrigation runoff and through surfacing of polluted groundwater.

Stuart Mesa is no longer cultivated. Despite this, remnants of polluted groundwater beneath the former fields are still being discharged into the Estuary. Measurements conducted by SPAWAR Systems Center Pacific on behalf of Camp Pendleton between 2010 and 2014 showed inorganic nitrogen (NO_3^- + NO_2^-) concentrations in the tens and hundreds of mg/L (SPAWAR 2015).

7.3 Background Sources

Background sources include non-controlled discharges from natural sources, such as nutrients entering the Estuary from the Pacific Ocean, and from forest, chaparral, and grassland land use in the Watershed. Delivered total nitrogen and total phosphorus loading to the Estuary from background sources is estimated to be 323 and 97 pounds per year, respectively (Butcher *et al.* 2017b, Table 7). These sources are not required to be reduced from 2008 levels and their contribution is factored into both the Estuary's receiving water model and watershed loading model.

8 LINKAGE ANALYSIS

The technical analysis of the relationship between pollutant loading from identified sources and the response of the waterbody to this loading is referred to as the linkage analysis (Section 3). The purpose of this linkage analysis is to quantify the maximum pollutant loading that can be received by an impaired waterbody and still attain the WQOs of the applicable beneficial uses. This numeric value is represented by the TMDL.

The linkage analysis for this TMDL project was completed by using computer models that simulate the physical and biological processes within the Watershed and the impaired receiving waterbody, and by using the final numeric targets to calculate the assimilative capacity of the Estuary. The computer models provide an estimation of the nutrient loading from watershed sources and simulate the biological response of the Estuary to loading. Numeric targets provide the key benchmark for determining when beneficial uses are being met and for determining the Estuary's assimilative capacity.

The final numeric targets for algal biomass and dissolved oxygen in the Estuary will require nutrient load reductions to levels that will not exceed the assimilative capacity of the Estuary, thus preventing the onset of eutrophic conditions and therefore protecting beneficial uses.

8.1 Sources of Total Nitrogen and Total Phosphorus Loading

The San Diego Water Board identified the major sources of total nitrogen and total phosphorus loading to the Estuary during summer-dry and winter-dry conditions by using the Estuary watershed loading model. The Estuary watershed loading model uses data on river flow, rainfall, land use, and soil type, among other parameters, to estimate at-source total nitrogen and total phosphorus loading into the Santa Margarita River and Estuary. In addition, the Estuary watershed loading model also uses assimilation coefficients that simulate uptake of nutrients by plants and algae to estimate the actual total nitrogen and total phosphorus loads delivered to the Estuary. Estuary watershed loading model results show, that during the critical period, MS4 discharges, agricultural discharges, and surfacing groundwater constitute the major sources of nutrients to the Estuary (Section 7).

The next step in the linkage analysis was to determine the response of the Estuary to nutrient loading from Watershed sources using the receiving water model or Estuary model.

8.2 Linkage Between Nutrient Loading and Biological Response of Estuary

The Estuary model simulates the biological response of the Estuary (with respect to macroalgal biomass and water column dissolved oxygen concentrations) relative to different levels of nutrient loading, using total nitrogen and total phosphorus loading from water year 2008 as a starting point or baseline. Total nitrogen and total phosphorus loads were then reduced in a step-wise fashion (by 20, 40, 60, 80, and 100 percent) and the corresponding results for macroalgal biomass and dissolved oxygen concentration were recorded to build regression equations (Sutula 2016a, Figures 2.7-2.9, and Table 2.9). These regression equations were then used to calculate the necessary load reductions (relative to the 2008 baseline) to meet the final numeric targets and establish the Estuary's assimilative capacity (Table 12).

8.3 Linkage Between Numeric Targets and Support of Sensitive Beneficial Uses

As described in Section 6, proposed macroalgal biomass and dissolved oxygen numeric targets for the Estuary would support the most sensitive beneficial uses (EST, MIGR, RARE, and SPWN) (Section 6).

The final numeric targets for the Estuary were established using the latest synthesis of scientific data on Mediterranean Estuaries completed by Sutula *et al.* (2016a). This synthesis shows that the range of macroalgal biomass values observed in estuaries under healthy conditions is between 30g to <90g dw/m^2 (Figure 10). This information is a line of evidence that ensures that the final numeric targets are protective of beneficial uses. Furthermore, numeric targets for dissolved oxygen are consistent with the Basin Plan WQOs, as well as the dissolved oxygen requirements of the sensitive fauna like Southern California Steelhead (*Oncorhynchus mykiss*) (Sutula *et al.* 2012).

The final numeric targets address the impairment by requiring nutrient load reductions to levels that will not exceed the assimilative capacity of the Estuary, thus preventing the onset of eutrophic conditions and therefore protecting beneficial uses.

9 MARGIN OF SAFETY

According to CWA section 303(d)(1)(C),

> Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 1314(a)(2) of this title as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

Thus, in the development of a TMDL a margin of safety provides a buffer of protection given uncertainties in those data used or in the calculations performed. A margin of safety can be either explicit or implicit. An explicit margin of safety sets aside a specific portion or a percentage of the TMDL (anywhere from 5-40 percent) before load allocations are determined as a safety buffer, while an implicit margin of safety provides protection by incorporating conservative or protective assumptions in the calculations.

The Estuary TMDL project employs an implicit margin by incorporating several conservative assumptions into the calculation of the TMDLs that provide an added layer of protection to beneficial uses, as explained below.

The San Diego Water Board and the Stakeholder Group agreed to use nutrient loading from water year 2008 as a baseline level to calculate the TMDLs. In 2008, large nutrient loads were being discharged directly into the Estuary from agricultural fields on Camp Pendleton and from an NCTD groundwater dewatering activities (Sutula *et al.* 2016a). The NCTD groundwater dewatering discharge was eliminated and active cultivation of the Stuart Mesa agricultural fields stopped after 2011. In spite of that, the assumption that the same level of nutrient loading is still taking place today, as was present in water year 2008, was incorporated into the Estuary model. As a result, the Estuary TMDLs require a greater load reduction (76 percent) than is likely to be needed today to achieve the proposed numeric targets.

It is important to note that while the former agricultural fields on Stuart Mesa are no longer being cultivated the potential for the discharge of soil polluted with of nutrients and other agricultural pollutants into the Estuary through surface runoff still remains. Also, monitoring by SPAWAR Systems Center Pacific has shown that the ongoing discharge of nutrients into the Estuary through rising polluted groundwater beneath the former agricultural fields continues to take place today. For that reason an effective Estuary Monitoring and Assessment Program will need to include monitoring of these discharges (SPAWAR 2015).

Using water year 2008 as the baseline year also results in an overestimation of dry weather loading into the Estuary by the watershed loading model, when compared to an average water year. The Estuary watershed loading model calculates dry weather nutrient loading, in part, by simulating soil saturation and rising groundwater into the river following rainfall and by assigning a set volume of urban irrigation discharge based on the number of during dry days in a given water year. According to Butcher *et al.* (2017a, 2017b) water year 2008 had approximately twice the rainfall when compared to the twenty year average and twice the number of dry days when compared to the average water year between 2003 and 2010. Therefore, the selection of water year 2008 as the baseline year results in much higher dry weather nutrient loading estimates. As a consequence of nutrient loading estimates being higher, the model also overestimates the load reductions needed. Therefore, the proposed load reductions are larger than what is most likely needed to achieve the numeric targets.

Another factor that results in higher nutrient load reductions than are likely needed is the fact that the Estuary model does not simulate benthic algae and vegetation. According to field measurements performed by McLaughlin *et al.* (2013) benthic algae and vegetation in the Estuary take up nutrients out of the water column creating a net flux of nutrients into the sediment. The net flux of nutrients in the Estuary model is in the opposite direction, into the water column, which results in greater water column nutrient concentrations and a need for even greater nutrient load reductions than likely necessary.

The combined effect of the conservative assumptions used to calculate the Estuary TMDLs is to require much greater load reductions than are likely necessary providing an added safety buffer for the protection to beneficial uses in the Estuary.

9.1 Consideration of Future Development in the Santa Margarita River Watershed

Future development in the Watershed could affect the loading of nutrients into the Estuary. There are three existing regulatory instruments, however, that mitigate the risk to the Estuary of increased dry-weather nutrient loading because they contain prohibitions against non-storm water discharges from entering the MS4 System:

1. The Regional MS4 Permit requires new and re-development to include design plans to effectively eliminate non-storm water discharges, with associated nutrient loads, into the MS4.

2. The County of San Diego Landscape Ordinance and Water Efficient Landscape Design Manual (Ordinance No. 10427).

3. County of Riverside Water Efficient Landscape Requirements (Ordinance No. 859)

In addition, new agricultural operations in the Watershed would be subject to the more stringent requirements of the Regionwide Agricultural WDRs. The Regionwide Agricultural WDRs have strict discharge prohibitions, effluent limitations, and receiving water limitations that prevent increasing agricultural land use from causing nuisance or pollution in receiving waters (see Section 12.3.2).

Another potential future source of nutrient loading from the Watershed to the Estuary are onsite wastewater treatment systems (OWTS), including septic systems, which primarily treat domestic wastewater and employ subsurface disposal. Failing OWTS can contaminate groundwater and surface water with pathogens and nutrients.

To protect water quality and human health, the State Water Board adopted the *Water Quality Control Policy for Siting, Design, Operation and Maintenance of Onsite Wastewater Treatment Systems* (OWTS Policy), which was recently incorporated into Chapter 4 of the Basin Plan by the San Diego Water Board (Section 12.1). The OWTS Policy relies on local jurisdictions to permit and manage OWTS. The San Diego Water Board approved the Local Agency Management Program (LAMP) for the County of San Diego on April 27, 2015 and was adopted into San Diego County Code in July 2015.

The first San Diego County annual (FY 15-16) LAMP report shows that a total of 615 permits were issued for the installation or repair of OWTS county-wide. Out of those 615 permits, fewer than a dozen permits were issued for repairs or installation of new OWTS in the Lower Santa Margarita River (County of San Diego 2016). Any future OWTS systems installed in the Watershed are subject to the strict requirements of the OWTS Policy and are not expected to become a significant source of nutrient loading to the Estuary. The County of Riverside is expected to submit a LAMP for approval in 2018.

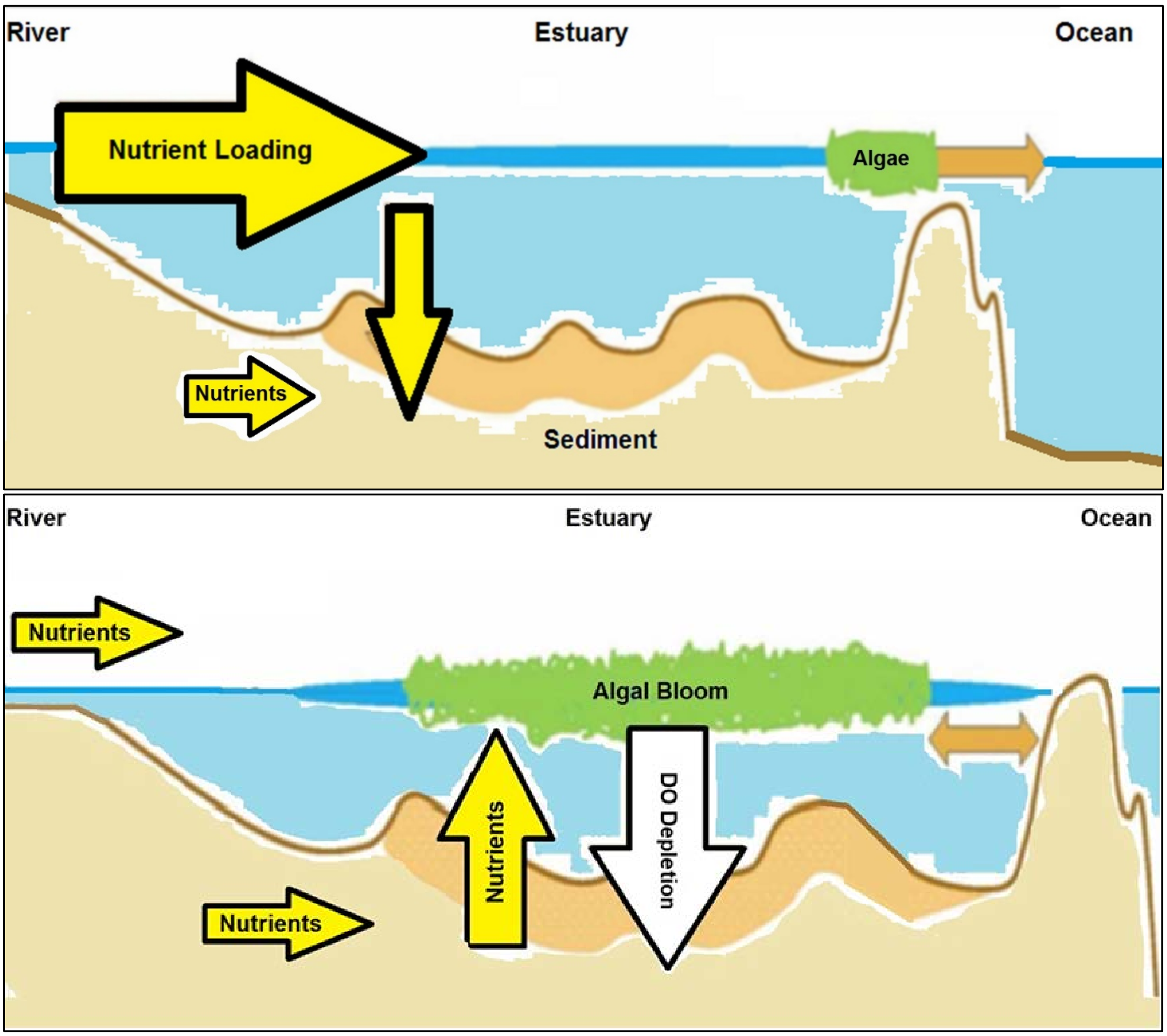
Furthermore, monitoring and assessment requirements in the Regional MS4 Permit, Regionwide Agricultural WDRs, and Phase II Small MS4 Permit will help to detect any excess nutrient loading sources and eliminate illicit discharges.

Therefore, the margin of safety (Section 9) does not need to be more stringent to address future growth in the Santa Margarita River Watershed because State and local regulations are in place to ensure future development would not have a significant effect on loading of nutrients in the MS4.

10 SEASONAL VARIATIONS AND CRITICAL CONDITIONS

Critical conditions for the Estuary include both the summer-dry (May to September) and winter-dry (October to April) weather conditions. While the most severe eutrophic conditions are likely to be encountered during the peak summer dry-weather, when the exchange with the Ocean is blocked by the accumulation of the sand berm or flow of water is too low to reach outlet (shown in Figure 15), excessive macroalgal growth has also been documented during winter-dry weather (McLaughlin *et al.* 2013). (Section 4).

Figure 15
Seasonal Influxes of Nutrients and Sediment in Santa Margarita River Estuary
(Modified from Sutula *et al*. 2016a)



McLaughlin *et al.* (2013) also determined that wet weather accumulation and deposition of organic material and sediment is not a significant “source” of total nitrogen and total phosphorus for dry-weather algal blooms in the Estuary. This finding is key to developing management strategies because in other systems organic matter and sediment deposited during the wet weather can provide additional nutrient loading and result in low dissolved oxygen conditions. However, during drought years when flow in the Santa Margarita River is decreased and the Estuary mouth remains closed for longer periods of time, more nutrients may be retained in the Estuary instead of being flushed out to the Ocean.

Allocations and reductions in the Estuary TMDLs are limited to summer-dry and winter-dry conditions. Winter-dry conditions are defined as winter days when rainfall is less than 0.10 inches during the antecedent 72-hour period.

The Estuary TMDLs can be exceeded during the wet season while the Estuary and Ocean are exchanging water via natural hydrologic connections (i.e., tides, waves, and surface flows between the Estuary and the Ocean). This does not affect permit limitations, nor imply that permit requirements should be relaxed during the wet season.

11 TMDLs, LOAD REDUCTIONS, AND ALLOCATIONS

11.1 Total Daily Maximum Loads

The TMDLs for the Estuary are the mass of total nitrogen and total phosphorus per year that the Estuary is able to assimilate and still meet the final numeric targets. Both total nitrogen and total phosphorus are seasonally limiting nutrients for algal production within the Estuary. Once the numeric targets are achieved, the water quality of the Estuary will be sufficient to support all designated beneficial uses. At that point, the impairment due to eutrophic conditions will no longer exist and the Estuary may be removed from the 303(d) list of impaired waters.

The total nutrient load that the Estuary can assimilate per year is 13,246 pounds of delivered total nitrogen and 1,528 pounds of delivered total phosphorus.

To determine the assimilative capacity of the Estuary, a receiving water computer model of the impaired waterbody (Estuary model) was developed by NAVY SPAWAR Systems Center Pacific to simulate the biological response (dissolved oxygen concentrations and macroalgal biomass) of the Estuary under various total nitrogen and total phosphorus loading conditions shown in Figure 15 (SPAWAR 2016). The Estuary model consists of the Environmental Fluid Dynamics Code (EFDC) coupled with the Water Quality Simulation Program (WASP), using 2008 nutrient loading levels as the baseline condition. 2008 nutrient loads used in the Estuary model were then reduced, until the final dissolved oxygen and macroalgal numeric targets were met, thus establishing the assimilative capacity of the Estuary.

In addition, to estimate 2008 total nitrogen and total phosphorus loading sources and the mass of nutrients actually reaching the Estuary during dry-weather, an Estuary watershed loading computer model (Estuary watershed loading model) was developed by Tetra Tech, Inc. using the Hydrologic Simulation Program Fortran (HSPF) shown in Figure 16 (Tetra Tech 2013, 2014; Sutula *et al.* 2016a; Butcher *et al.* 2017b).

Figure 16
Receiving Water Model (Estuary Model) Graphic Representation Showing Inputs and Outputs
(Modified from Sutula *et al.* 2016a)

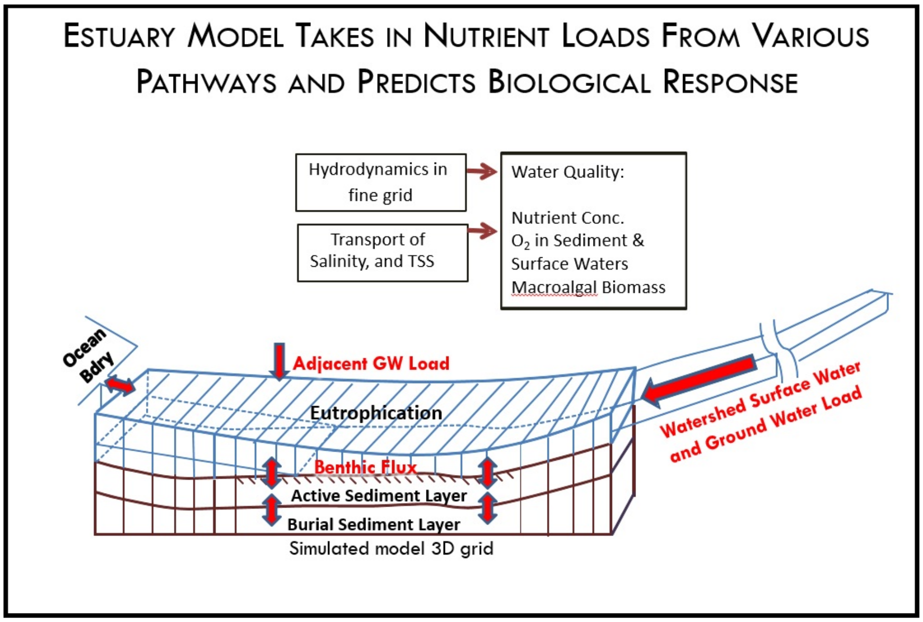
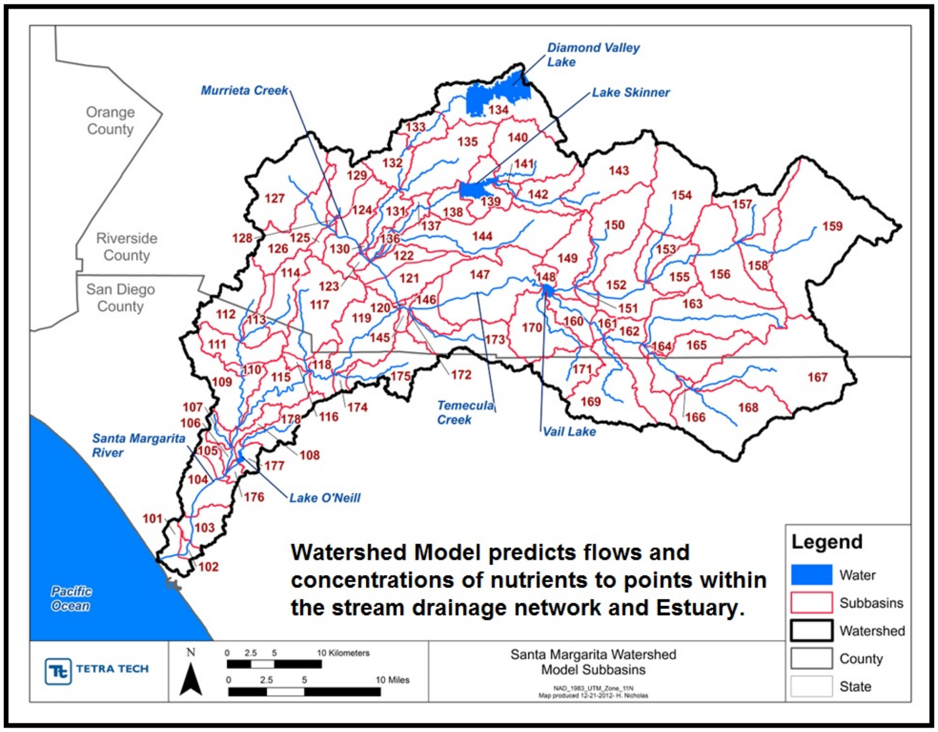


Figure 17
Estuary Watershed Loading Model Graphic Representation Showing Model Domain
(Modified from Sutula *et al.* 2016a)



Since the Estuary watershed loading model simulates flow (volume/time) and nutrient concentrations (mass/volume), the total mass of nutrients delivered to the Estuary over a period of time is obtained by the multiplying these two parameters, as shown below:

$$\frac{V}{t} \; x \; \frac{m}{V} = \frac{m}{t}$$

V = volume, m = mass, t = time

The steps for determining the assimilative capacity of the Estuary were as follows:

1. Establish final numeric targets for dissolved oxygen and macroalgal biomass, at which all beneficial uses are supported using NNE approach (Section 6.1).

2. Calibrate Estuary model using 2008 data as a baseline. Use the Estuary model to determine total load reductions, from 2008 levels, needed to achieve final numeric targets.

Based on the assimilative capacity estimated by the Estuary model, the TMDL is 13,246 pounds of delivered total nitrogen and 1,528 pounds of delivered total phosphorus per year.

The TMDLs were derived from the following calculations:

- Total Nitrogen: (55,193 pounds of delivered total nitrogen/year in 2008) x (0.24)[4] = 13,246 pounds/year

- Total Phosphorus: (6368 pounds of delivered total phosphorus/year in 2008)[4] x (0.24) = 1,528 pounds/year

3. Use Estuary watershed loading model to establish dry-weather (summer and winter) sources of total nitrogen and total phosphorus loading to the Estuary, based on hydrology and land use. Nutrient load reductions for the Estuary were set based on numeric targets in Section 6.1.2 for macroalgal biomass and dissolved oxygen (Table 5). Macroalgal biomass and dissolved oxygen values in the output of the Estuary model were paired with step-wise nutrient load reductions (by 20, 40, 60, 80 and 100 percent) in TN and TP to generate a regression relationship (Sutula *et al.* 2016a, Figures 2.8, 2.9, and Table 2.9). The results of those calculations were used to determine the nutrient load reductions necessary to achieve the final numeric targets. Necessary load reductions are shown in Table 12.

[4,4] Baseline nutrient delivered loads are shown in Table 9. Multiplying by 0.24 is equal to a 76 percent nutrient load reduction.

Table 12
Receiving Water Model Estimates of Necessary Delivered, Dry-Weather, Nutrient Load Reductions and Assimilative Capacity for Estuary According to Numeric Targets
(Sutula *et al.* 2016a)

Ecological Response Indicator	**Proposed Numeric Target**	**Required Percent Load Reduction *** (+/- 95% C.I.)	**Delivered TN TMDL** (lbs/yr)	**Delivered TP TMDL** (lbs/yr)
Dissolved Oxygen	5.0 mg/L	73 ± 3	14,902 ± 1,656	1719 ± 191
Secondary Macroalgal Biomass	70 g dw m-2	76 ± 3	13,246 ± 1,656	1,528 ± 191
Primary Macroalgal Biomass	57 g dw m^{-2}	84 ± 3	8,831 ± 1,656	1019 ± 191

The needed nutrient load reduction for all surface and ground water sources entering the Estuary is found in Table 2.9 in Sutula *et al.* (2016a). The assimilation capacities shown in in Table 12 were calculated using the total nitrogen and total phosphorus delivered load estimates provided in Table 9 (55,193 and 6,368 pounds, respectively).

The assimilative capacities shown in Table 12 include loading from all sources (both surface water and groundwater as well as natural and anthropogenic). Table 13 shows the portion of the 2008 nutrient loads attributable to anthropogenic or controllable sources.

Table 13
Waste Load Allocations and Load Allocations for Controlled Sources,
(County of San Diego 2017, Butcher *et al.* 2017b)

Water Year 2038 (after 76% reduction of all controllable sources)	**At-Source TN** (lbs/yr)	**Delivered TN** (lbs/yr)	**At-Source TP** (lbs/yr)	**Delivered TP** (lbs/yr)
Point Sources				
San Diego County MS4	18		1	
Riverside County MS4	2384		238	
U.S. Marine Corps Base Camp Pendleton Phase II MS4	127		12	
Caltrans MS4	97		11	
Nonpoint Sources				
Agricultural Dischargers - SD County	7301		277	
Agricultural Dischargers – Riverside	10540		520	
Agricultural Dischargers - Federal Lands	85		3	
Dairy Farms	12		1	
Controllable Source Total After 76% Load Reduction	20,564	**8226**	1063	**574**

Table 14 below shows a portion of the Load Allocation from Table 13 that is controllable through the MS4 Permit. Permittees will be responsible for responding to all discharges entering their MS4, consistent with Section E of the Regional MS4 Permit (Section 12.2.2).

Table 14
Load Allocations for Agricultural Discharges of Total Nitrogen and Total Phosphorus Originating Within an MS4 or Discharging into an MS4 by Jurisdiction

Source	**TN (lbs/yr)**	**TP (lbs/yr)**
Agricultural Dischargers - SD County	42.5	2.4
Agricultural Dischargers – Riverside	560	57.1
Agricultural Dischargers - Federal Lands	0.24	0
Total	**602.7**	**59.5**

To obtain total nitrogen and total phosphorus loading estimates, the Estuary watershed loading model simulates nutrient loading to the river and Estuary downstream of Diamond Valley Lake, Vail Lake, and Skinner Lake using rainfall, soil type, land use, as well as nutrient assimilation coefficients. Assimilation coefficients take into account the nutrients that are assimilated or taken up by plants and algae before reaching the Estuary (Sutula *et al.* 2016a). These loading estimates represent the sum of summer-dry and winter-dry days (303 days) during water year 2008 (10/1/2007 – 9/30/2008). Water year 2008 was a wetter than average year, with flows as high as 37.6 cfs compared to the average of 16.5 cfs (1990-2016). As mentioned in the section on Margin of Safety, higher rainfall in the model results in overestimation of dry-weather loading (Butcher *et al.* 2017a).

In the case of MS4s, nutrient loading estimates include the contributions from the MS4 outfalls and their drainage areas. Nutrient loading estimates from controllable and natural sources were used to establish final Load Allocations. Load Allocations are defined by U.S. EPA as,

> [t]he portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished (U.S. EPA 2016b).

Whereas Load Allocations (LAs) represent the sum of nonpoint sources and background (natural sources), Waste Load Allocations (WLAs) are the sum of all Point Sources.

To determine the final WLAs and LAs, a 76 percent load reduction was applied to all controllable sources (not including background or natural sources). Resulting loading estimates yields the WLAs and LAs shown in Table 13. Total nitrogen and total phosphorus WLAs and LAs by jurisdiction are shown in Figure 18 and Figure 19.

Figure 18
Allocations of At-Source Total Nitrogen by Category (lbs/yr)

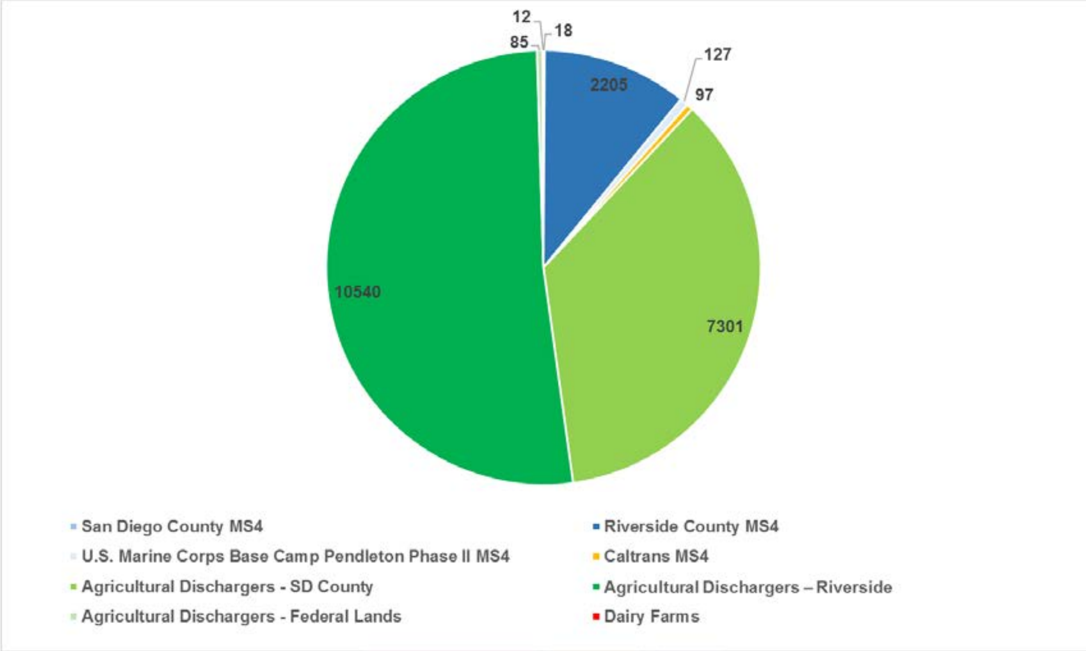
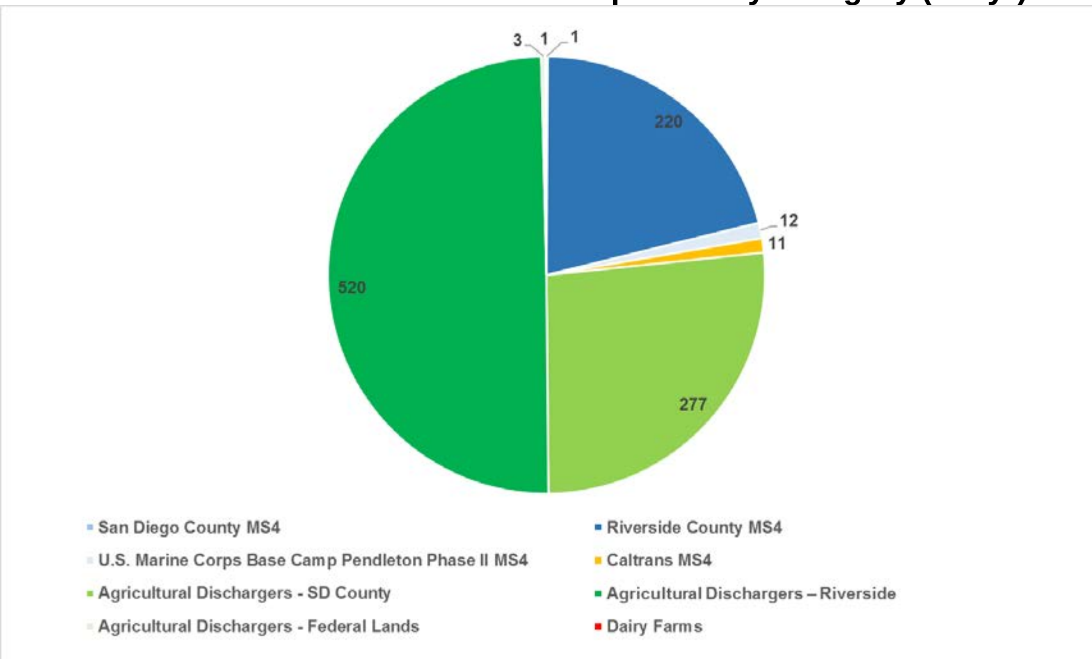


Figure 19
Allocations of At-Source Total Phosphorus by Category (lbs/yr)



The sum of delivered Waste Load Allocations and Load Allocations for total nitrogen is 8226 pounds (Table 13). The sum of delivered total phosphorus is 574 pounds (Table 13).

These WLAs and LAs are based on an assimilative capacity of 13,246 pounds per year of total nitrogen and 1,528 pounds per year of total phosphorus corresponding to a 76 percent load reduction from 2008 loading levels (Table 12).

The total nitrogen and total phosphorus load for background sources, which originate from natural sources (including the Pacific Ocean, forest, chaparral and grassland land uses), are not included in the load allocations table because load reductions of these sources are not required.

12 IMPLEMENTATION, MONITORING, AND COMPLIANCE

The Estuary is impaired for eutrophic conditions caused by excessive loading of total nitrogen and total phosphorus, requiring the development of a TMDL and an implementation plan (Section 3). The goal of the implementation plan is to ensure WQOs are met in the Estuary. Consistent with California Water Code section 13242, this implementation plan describes the actions required by dischargers, establishes a time schedule, identifies interim milestones, and outlines monitoring objectives that will be used to assess the success of implementation of this TMDL project.

12.1 Implementation Plan

The San Diego Water Board will implement the Estuary TMDL project primarily by relying on existing requirements in the Regional MS4 Permit, the Regionwide Agricultural WDRs, and the statewide Phase II Small MS4 Permit. The discharge prohibitions and limitations in these permits are expected to result in meeting the necessary total nitrogen and total phosphorus load reductions, estuary numeric targets, and the protection of beneficial uses.

In addition, to ensure that all controllable sources of total nitrogen and total phosphorus to the Estuary are adequately addressed, the San Diego Water Board will also rely, to a lesser extent, on the following statewide supporting-role permits: Caltrans MS4 Permit (2012-0011-DWQ), Construction General Permit (2009-0009-DWQ), Industrial General Permit (2014-0057-DWQ), General Discharge Requirements for Sanitary Sewer Systems Permit (Order No. 2006-0003-DWQ, as amended by 2008-0002-EXEC, 2013-0058-EXEC), Waste Discharge Requirements for Sewage Collection Agencies in the San Diego Region (Order No. R9-2007-0005), and Small Domestic Wastewater Treatment Systems Permit (Order No. WQ 2014-0153-DWQ).

Furthermore, to address any potential total nitrogen and total phosphorus loading from on-site wastewater treatment systems (septic tanks and advanced treatment systems), the San Diego Water Board will implement the statewide Onsite Wastewater Treatment Systems (OWTS) Policy (Chapter 4 of the Basin Plan) (SWRCB 2012b). Consistent with the OWTS Policy, the San Diego Water Board may adopt WDRs that require reduced nutrient concentrations in the discharge effluents, reduced nutrient loading, and or compliance with more stringent water quality objectives in receiving surface waters for the protection of beneficial uses of water resources.

The required total nitrogen and total phosphorus load reductions are expected to be achieved through the actions proposed in this Implementation Plan. The Implementation Plan will restore the beneficial uses of the Estuary, primarily through the eradication of non-storm water and illicit discharges into MS4s and the reduction and/or elimination of existing agricultural waste discharges into the Santa Margarita River and groundwater. The Stakeholders could also consider taking additional actions to restore the water quality within the Estuary to allow the public to fully enjoy the designated beneficial uses.

Key requirements of each of the primary and supporting-role permits that will be used to implement the Estuary TMDL project are discussed below.

12.2 Primary Permits Discharge Prohibitions and Effluent Limitations

The following sections describe how each of three primary permits (Regional MS4 Permit, Regionwide Agricultural WDRs, and the statewide Phase II Small MS4 Permit) that regulate significant sources of total nitrogen and total phosphorus in the Watershed have adequate requirements to achieve the necessary load reductions and numeric targets to support the most sensitive beneficial uses of the Estuary.

12.2.1 Waste Discharge Prohibitions in Basin Plan

Key Basin Plan discharge prohibitions included in the Regional MS4 Permit, the Regionwide Agricultural WDRS, and the Phase II Small MS4 Permit that can reduce and or eliminate upstream total nitrogen and total phosphorus loading to the Estuary are listed below.

According to the Basin Plan,

> Water Code section 13243 provides that a Regional Board, in a water quality control plan, may specify certain conditions or areas where the discharge of waste, or certain types of waste is not permitted. The following discharge prohibitions are applicable to any person, as defined by section 13050(c) of the Water Code, who is a citizen, domiciliary, or political agency or entity of California whose activities in California could affect the quality of waters of the state within the boundaries of the San Diego Region.

Some key discharge prohibitions listed in the Basin Plan that are applicable to all Permittees include the following:

(1) The discharge of waste to waters of the state in a manner causing, or threatening to cause a condition of pollution, contamination or nuisance as defined in Water Code section 13050, is prohibited.

(2) The discharge of waste to land, except as authorized by WDRs or the terms described in Water Code section 13264 is prohibited.

(5) The discharge of waste to inland surface waters, except in cases where the quality of the discharge complies with applicable receiving water quality objectives, is prohibited. Allowances for dilution may be made at the discretion of the Regional Board. Consideration would include streamflow data, the degree of treatment provided and safety measures to ensure reliability of facility performance. As an example, discharge of secondary effluent would probably be permitted if streamflow provided 100:1 dilution capability.

(6) The discharge of waste in a manner causing flow, ponding, or surfacing on lands not owned or under the control of the discharger is prohibited, unless the discharge is authorized by the Regional Board.

(7) The dumping, deposition, or discharge of waste directly into waters of the state, or adjacent to such waters in any manner which may permit its being transported into the waters, is prohibited unless authorized by the Regional Board.

(8) Any discharge to a storm water conveyance system that is not composed entirely of "storm water" is prohibited unless authorized by the Regional Board. [The federal regulations, 40 CFR 122.26 (b) (13), define storm water as storm water runoff, snow melt runoff, and surface runoff and drainage. 40 CFR 122.26 (b)(2) defines an illicit discharge as any discharge to a storm water conveyance system that is not composed entirely of storm water except discharges pursuant to a NPDES permit and discharges resulting from fire fighting activities.] [Section 122.26 amended at 56 FR 56553, November 5, 1991; 57 FR 11412, April 2, 1992].

(9) The unauthorized discharge of treated or untreated sewage to waters of the state or to a storm water conveyance system is prohibited.

(14) The discharge of sand, silt, clay, or other earthen materials from any activity, including land grading and construction, in quantities which cause deleterious bottom deposits, turbidity or discoloration in waters of the state or which unreasonably affect, or threaten to affect, beneficial uses of such waters is prohibited.

12.2.2 Permit and Waste Discharge Requirements for Discharges from the Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region (Order No. R9-2013-0001, (as amended by R9-2015-0001 and R9-2015-0100) - County of San Diego, Riverside County Flood Control and Water Conservation District, County of Riverside, City of Murrieta, City of Temecula, City of Menifee, and City of Wildomar.

The Estuary TMDLs can be achieved, in part, by focusing on identifying and eliminating non-storm water and illicit dry-weather sources of total nitrogen and total phosphorus discharging into the Permittees' MS4, which can include groundwater discharges into the MS4 and discharges from the MS4 to surface waters The implementation of an Illicit Discharge Detection and Elimination program by Phase I MS4 Permittees is required by the Regional MS4 Permit (Provision II.E.2).

Order No. R9-2013-0001 was adopted by the San Diego Water Board in May 2013 to replace the 2007 MS4 Permit and amended in 2015 to extend its coverage to Riverside County. The new Regional MS4 Permit (Order No. R9-2013-0001, as amended by R9-2015-0001 and R9-2015-0100) covers the County of San Diego, Riverside County Flood Control and Water Conservation District, County of Riverside, City of Temecula, City of Murrieta, and City of Wildomar. Most importantly, it prohibits non-storm water dry-weather discharges into the MS4 that could eventually reach the Estuary during the critical summer-dry and winter-dry conditions.

The Regional MS4 Permit does not apply to strictly agricultural areas, U.S. Marine Corps Base Camp Pendleton, or Caltrans. Those portions of the Watershed will be subject to the requirements under the Regionwide Agricultural WDRs (Order Nos. R9-2016-0004, and R9-2015-0005), statewide Phase II Small MS4 Permit (Order No. 2013-0001-DWQ), and the Caltrans MS4 Permit (2012-0011-DWQ), respectively, with the exception of discharges that enter Phase I MS4s. All discharges entering a Phase I MS4 are subject to the Jurisdictional Runoff Management Program requirements in section E of the Regional MS4 Permit.

The current Regional MS4 Permit removes several categories of non-storm water discharges including landscape irrigation, irrigation water, and lawn watering, from prohibition exemptions in earlier MS4 permits. As described in the Regional MS4 Permit, the San Diego Water Board and MS4 Permittees have identified these non-storm water discharges as sources of total nitrogen and total phosphorus to receiving waters in the San Diego Region. The Regional MS4 Permit states:

> Elevated dry-weather storm drain flows, composed primarily of landscape irrigation water wasted as runoff, carry pollutants that impair recreational use and aquatic habitats all along southern California's urbanized coastline. Storm drain systems carry the wasted water, along with landscape derived pollutants such as bacteria, nutrients [(total nitrogen and total phosphorus)] and pesticides, to local creeks and the ocean. Given the local Mediterranean climate, excessive perennial dry season stream flows are an unnatural hydrologic pattern, causing species shifts in local riparian communities and warm, unseasonal contaminated freshwater plumes in the near-shore marine environment (SDWB 2015a).

The Regional MS4 Permit removes the prohibition exemption for these discharges and requires Permittees to investigate and eliminate non-storm water discharges.

The Regional MS4 Permit's removal of exempted categories and its more explicit monitoring and response requirements provide a reasonable assurance that total nitrogen and total phosphorus loading to the Estuary from MS4 sources will be reduced, contributing to the restoration of water quality in the Estuary Pursuant to Provision II.E.2 - Illicit Discharge Detection and Elimination, the Permittees are required to implement a program to actively detect and eliminate illicit discharges into the MS4. Specific requirements include:

> • Provision II.E.2.d.(2): The [Permittees] must implement procedures to investigate and inspect portions of its MS4 that, based on reports or notifications, field screening, or other appropriate information, indicate a reasonable potential of receiving, containing, or discharging pollutants due to illicit discharges, illicit connections, or other sources of non-storm water.
>
> • Provision II.E.2.d.(3): The [Permittees] must initiate the implementation of procedures, in a timely matter, to eliminate all detected and identified illicit discharges and connections within its jurisdiction.
>
> • Provision II.E.2.d.(3)(b): If a Permittee identifies the source as a controllable source of non-storm water or illicit discharge or connection, the Permittees must implement its Enforcement Response Plan pursuant to Provision E.6 of the Regional MS4 Permit and enforce its legal authority to prohibit and eliminate illicit discharges to its MS4.

In addition, Pursuant to Provision II.E.2.a.(3), groundwater infiltration into the MS4 must also be addressed as an illicit discharge if either the Permittees, or the San Diego Water Board, identifies the discharge as a source of pollutants to receiving waters. Therefore, groundwater discharges identified as a source of total nitrogen or total phosphorus into the MS4 may also need to be addressed as illicit discharges and be eliminated. Additional investigations by the Permittees are necessary to determine the portion of flows discharging from its MS4 system that are uncontrolled and or unpolluted groundwater sources. With that information, the Permittees will be able to focus their illicit discharge detection program on the sources driving eutrophication in the Estuary.

The San Diego Water Board expects that the Permittees will use all available sources of information to assess the impact of surfacing groundwater on the Estuary including data collected as part of existing monitoring and assessment requirements in the Regional MS4 Permit, Regionwide Agricultural WDRs, and an Estuary Monitoring and Assessment Program (Section 12.3).

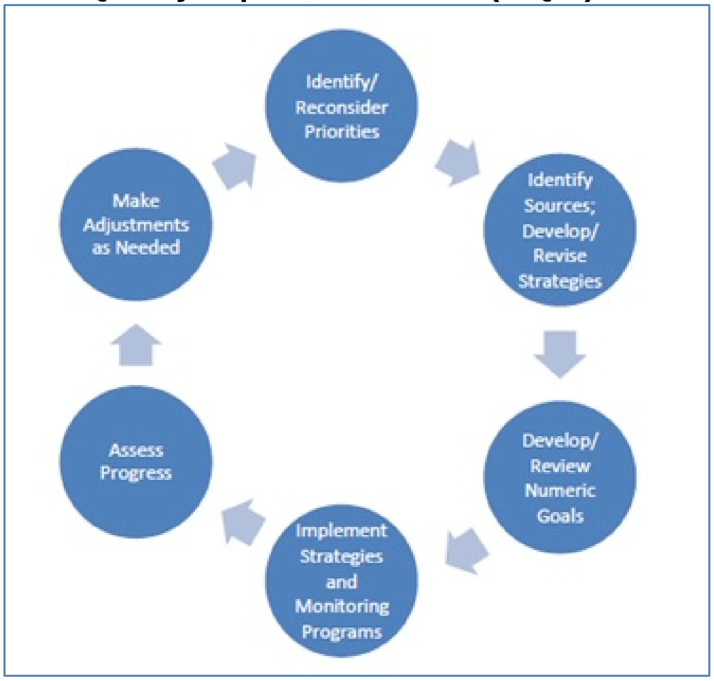
Provision II.A.1.b of the Regional MS4 Permit, states that “non-storm water discharges into the MS4s are to be effectively prohibited, through the implementation of Provision E.2, unless such discharges are authorized by a separate NPDES permit.” Pursuant to Section II.E.2, the Permittees must implement a program to actively detect and eliminate illicit discharges into the MS4. Provision II.E.2.a requires the Permittees to address all non-storm water discharges as illicit discharges unless a non-storm water discharge is either identified as a discharge authorized by a separate NPDES permit, or identified as a category of non-storm water discharges or flows that must be addressed according to specific requirements.

12.2.3 Water Quality Improvement Plan for the Santa Margarita Watershed Management Area

The Regional MS4 Permit also includes requirements for the Permittees to participate in the development and implementation of a plan to improve water quality of MS4 discharges and receiving waters within the Santa Margarita River Watershed Management Area.

The mechanism for this action is the preparation of a Water Quality Improvement Plan (Provision II.B). The purpose of the Water Quality Improvement Plan is to further the Clean Water Act’s objective to protect, preserve, enhance, and restore the water quality and designated beneficial uses of waters of the United States. The Water Quality Improvement Plans include descriptions of the highest priority pollutants or conditions in a specific watershed, goals and strategies to address those pollutants or conditions, and time schedules associated with those goals and strategies (Figure 19).

Figure 20
Water Quality Improvement Plan (WQIP) Process



Submitted Water Quality Improvement Plans for the Santa Margarita River Watershed Management Area can be found here:

http://www.waterboards.ca.gov/sandiego/water_issues/programs/stormwater/docs/wqip/santa_margarita_river/2017_01_05_B2_Santa_Margarita_RiverWQIP.pdf

Specific Water Quality Improvement Plan requirements include:

- Provision II.B.2 (d): The Permittees must identify known and suspected sources of storm water and non-storm water pollutants and/or other stressors associated with MS4 discharges that cause or contribute to the highest priority water quality conditions identified in Provision B.2.c of the Regional MS4 Permit.

- Provision II.B.3: The Permittees must identify potential strategies that can result in improvements to water quality in MS4 discharges and/or receiving waters within the Watershed Management Area.

The Regional MS4 Permit also requires the Permittees to monitor non-storm water discharges and track reductions over time, as part of their Water Quality Improvement Plans. The Regional MS4 Permit states:

> The Permittees must develop and conduct a program to monitor the discharges from the MS4 outfalls in each Watershed Management Area during dry-weather and wet weather. Following San Diego Water Board acceptance of the Water Quality Improvement Plans for each Watershed Management Area, the Permittees must conduct MS4 outfall discharge monitoring during implementation of the Water Quality Improvement Plan to assess the effectiveness of their jurisdictional runoff management programs toward effectively prohibiting non-storm water discharges into the MS4 (SDWB 2015a).

Section D.2 of the Regional MS4 Permit requires the Permittees to conduct Transitional MS4 Outfall Discharge Monitoring while the Water Quality Improvement Plan is being developed. The Transitional MS4 Outfall Discharge Monitoring requires the Permittees to inventory their MS4 outfalls and conduct field screening and monitoring in order to begin the identification and prioritization process for non-storm water discharges in the Santa Margarita River Watershed.

The Regional MS4 Permit requires Permittees to develop a Water Quality Improvement Plan for the Santa Margarita Watershed Management Area by 2018 that includes Water Quality Improvement Goals, Strategies, and Schedules to improve water quality.

Numeric goals must be incorporated into the plan and used to assess progress. The Water Quality Improvement Plan must also provide a schedule with interim and final dates for achieving numeric goals, and serves as a mechanism for the Permittees to demonstrate compliance with the Regional MS4 Permit and restoration of Estuary's beneficial uses.

Since the Water Quality Improvement Plan is enforceable under Provision II.B. of the Regional MS4 Permit, the adoption of total nitrogen and total phosphorus (nutrients) as the highest priority pollutants in the entire Santa Margarita Watershed Management Area and the inclusion of an Estuary Monitoring and Assessment Program in the Water Quality Improvement Plan would provide reasonable assurance that MS4-related waste load reductions and numeric targets would be achieved (Section 1).

An Estuary Monitoring and Assessment Program is necessary to evaluate the progress towards attainment of nutrient load reductions and numeric targets, and could be included in the Water Quality Improvement Plan. An Estuary Monitoring and Assessment Program should be designed in accordance to the Framework for Monitoring and Assessment in the San Diego Region and provide (1) documentation that the required loading reductions are achieved, and (2) confirmation that the numeric targets and TMDLs are met (Section 12.3).

Also, the results of the Permittees' efforts in implementing such a Water Quality Improvement Plan and Estuary Monitoring and Assessment Program could be used to re-evaluate the condition of the impaired Estuary during subsequent updates to the 303(d) List.

12.2.4 General Waste Discharge Requirements for Discharges from Commercial Agricultural Operations for Discharges that are Members of a Third Party Group in the San Diego Region (0rder No. R9-2016-0004) and General Waste Discharge Requirements for Discharges from Commercial Agricultural Operations for Discharges Not Participating in a Third Party Group in the San Diego Region (0rder No. R9-2016-0005) – Agricultural Operations in Santa Margarita River Watershed

The Regionwide Agricultural WDRs (R9-2016-0004 and R9-2016-0005) include strict discharge prohibitions, discharge specifications, receiving water limitations, and management practice requirements for agricultural operations. These provisions are expected to result in the reduction and or elimination of total nitrogen and total phosphorus loading to surface water and groundwater from agricultural sources to the Santa Margarita River and Estuary. Decreasing nutrient loading to the Estuary from upstream agricultural land use is essential to achieving numeric targets in the Estuary (Section 7.2). How these discharge prohibitions and limitations address potential nutrient loading from agricultural operations is described below.

The discharge prohibitions in these Regionwide Agricultural WDRs require, "[members of third party groups and individual dischargers to] comply with the Prohibitions contained in chapter 4 of the Basin Plan and any other applicable statewide water quality control plan..." (Sections IV. A-H. and III. A-H. in R9-2016-0004 and R9-2016-0005, respectively).

Specifically Chapter 4 of the Basin Plan states,

> Water Code section 13243 provides that a Regional Board, in a water quality control plan, may specify certain conditions or areas where the discharge of waste, or certain types of waste is not permitted. The following discharge prohibitions are applicable to any person, as defined by section 13050(c) of the Water Code, who is a citizen, domiciliary, or political agency or entity of California whose activities in California could affect the quality of waters of the state within the boundaries of the San Diego Region.

Important discharge prohibitions included in the Regionwide Agricultural WDRs and of relevance to the Estuary TMDL Project are listed in section 12.2.1.

These discharge prohibitions are important because agricultural land use in the Santa Margarita River Watershed contributes the largest proportion of total nitrogen and total phosphorus loading to the Estuary via two major pathways, surface runoff and surfacing groundwater. Nutrients applications by agricultural operations can be discharged as runoff into surface water or infiltrate into groundwater only to surface further downstream where groundwater and the Santa Margarita River are interconnected. The implementation of the Basin Plan discharge prohibitions should reduce and or eliminate any agricultural discharges with the potential to contribute to impairment of the Estuary.

In addition to the discharge prohibitions listed above, the Regionwide Agricultural WDRs also include discharge specifications establishing strict parameters for the quality of discharges. Discharge specifications in these Orders require, among other restrictions,

> [that] waste discharge[s] shall not contain material or substances in amounts that result in aesthetically undesirable discoloration of surface or groundwater...[that waste discharges not] form sediments which will degrade benthic communities or other aquatic life in surface waters…significantly degrade the natural light to benthic communities and other aquatic life in surface waters… (Sections V.A.1-10 and IV.A.1-10, R9-2016-0004 and R9-2016-0005, respectively).

These discharge specifications place stringent limits on permitted discharges by requiring that agricultural discharges do not result in nuisance or pollution in receiving waters.

Furthermore, the Regionwide Agricultural WDRs establish receiving water limitations that require discharges of wastes to surface waters to, "not cause or contribute to exceedance of any applicable water quality standards in any surface water or groundwater; unreasonably affect any applicable beneficial use; or cause or contribute to a condition of pollution or nuisance" (Sections VI and V).

Specifically, receiving water limitations are for nutrient concentrations in receiving waters not to exceed 1.0 mg/L TN and 0.1 mg/L TP – as required by the Basin Plan and the Rainbow Creek TMDL. Compliance with these receiving water limitations should result in very marked nutrient load reductions as recent field data show significant exceedances in receiving waters associated with agricultural operations (Section 5) (AMEC 2013).

To ensure that the discharges prohibitions, discharge specifications, and receiving water limitations listed above are met, the Regionwide Agricultural WDRs require,

> [that members and dischargers]… complete annual water quality training, prepare a Water Quality Protection Plan (WQPP), perform inspections to evaluate management practice effectiveness, and report annually on monitoring and inspection results...if monitoring results identify exceedances of water quality standards, the Agricultural Orders additionally require the preparation of a Water Quality Restoration Plan (WQRP)]… to assess the effectiveness of implemented management practices and, when necessary, require Members to identify, implement, or upgrade management practices to meet water quality standards. The General Order also requires Members in certain watersheds to implement TMDLs applicable to Agricultural Operations (Section I.P.).

In addition, monitoring requirements in the Regionwide Agricultural WDRs will complement MS4 monitoring efforts by tracking ambient Santa Margarita River water quality and ecosystem health in drainages influenced by agricultural land use ensuring that illicit agricultural discharges are detected. Also, once illicit discharges or WQO exceedances are detected, agricultural dischargers are required to develop a Water

Quality Restoration Plan that involves an iterative process until the nuisance or pollution issue is resolved.

The Regionwide Agricultural WDRs do not cover discharges from dairies in the watershed. Large dairies are required to enroll in the General Permit for Storm Water Discharges Associated with Industrial Activities (2014-0057-DWQ).

12.2.5 Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) Phase II Small MS4 General Permit (2013-0001-DWQ, as amended by 20015-0133-EXEC, 2016-069-EXEC) – U.S. Marine Corps Base Camp Pendleton

The statewide Phase II Small MS4 Permit (Order No. 2013-0001-DWQ) includes discharge prohibitions, effluent limitations, receiving water limitations, education and outreach, and water quality monitoring requirements for small MS4s.

According to U.S.EPA a small MS4 is,

> … any MS4 not already covered by the Phase I program as a medium or large MS4. The Phase II Rule automatically covers on a nationwide basis all small MS4s located in “urbanized areas” (UAs) as defined by the Bureau of the Census (unless waived by the NPDES permitting authority), and on a case-by-case basis those small MS4s located outside of UAs that the NPDES permitting authority designates (U.S. EPA 2000).

The U.S. Marine Corps Base Camp Pendleton (Camp Pendleton) has enrolled in the statewide Phase II Small MS4 Permit and is listed as a non-traditional permittee as of February 5, 2013, in Attachment B of Order No. 2013-0001-DWQ. Implementation of the Phase II MS4 Permit by Camp Pendleton is expected to result in the reduction and or elimination of total nitrogen and total phosphorus loading from Camp Pendleton’s MS4 to the river and Estuary and assist in meeting the necessary nutrient load reductions and Estuary numeric targets.

The specific sections and provisions in the statewide Phase II Small MS4 Permit that are expected to assist in reducing or eliminating nutrient loading from Camp Pendleton to the Estuary are described below.

Section B.3 includes the following discharge prohibitions:

> 1. Discharges of waste from the MS4 that are prohibited by statewide Water Quality Control Plans or applicable Regional Water Quality Control Plans (Basin Plans) are prohibited (Section 12.2.1).

In addition to including the discharge prohibitions contained in the Basin Plan, section B.3. of the permit also includes the following limitations:

> 1. Discharges through the MS4 of material other than storm water to waters of the U.S. shall be effectively prohibited, except as allowed under this Provision or as otherwise authorized by a separate NPDES permit.
>
> 2. Discharges in excess of an amount deemed to be incidental runoff shall be controlled. Regulated Small MS4s shall require parties responsible for such to implement Sections B.4.a-d below. Incidental runoff is defined as unintended amounts (volume) of runoff, such as unintended, minimal over-spray from sprinklers that escapes the area of intended use. Water leaving an intended use area is not considered incidental if it is part of the facility design, if it is due to excessive application, if it is due to intentional overflow or application, or if it is due to negligence.

Section C.1 establishes the following Effluent Limitations:

> 1. Permittees shall implement controls as required by this Order to reduce the discharge of pollutants from their MS4s to waters of the U.S. to the MEP. Permittees shall additionally reduce the discharge of pollutants (1) to achieve TMDL waste load allocations (WLAs) established for discharges by the MS4s and (2) to comply with the Special Protections for discharges to ASBS.

Also, receiving water limitations in the permit (Section D.) state that,

> Discharges shall not cause or contribute to an exceedance of water quality standards contained in a statewide Water Quality Control Plan, the California Toxics Rule (CTR), or in the applicable Regional Water Board Basin Plan.
>
> The Permittee shall comply with receiving water limitations through timely implementation of control measures/BMPs and other actions to reduce pollutants in the discharges and other requirements of this Order including any modifications. The storm water program shall be designed to achieve compliance with receiving water limitations. If exceedance(s) of water quality objectives or water quality standards persist notwithstanding implementation of other storm water program requirements of this Order, the Permittee shall assure compliance with receiving water limitations by complying with the following procedure:
>
> 1. Upon a determination by either the Permittee or the Regional Water Board that MS4 discharges are causing or contributing to an exceedance of an applicable water quality standard, the Permittee shall promptly notify and thereafter submit a report to the Regional Water Board that describes BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedance of water quality standards. The report shall include an implementation schedule.

To further ensure that these requirements are met the Phase II Small MS4 Permit also requires Camp Pendleton to implement Community Education and Outreach (Section

F.5.b) and an Illicit Discharge Detection and Elimination program (Section F.5.d).

12.2.6 Supporting Role Permits

In addition to relying on the primary permits listed above and to ensure that all potential sources of nutrient loading to the Estuary are addressed, the San Diego Water Board will also employ supporting-role statewide permits to aid in meeting the Estuary TMDL project nutrient load reductions and numeric targets. Supporting-role regional and statewide permits include the following: Caltrans MS4 Permit (2012-0011-DWQ), , Industrial General Permit (2014-0057-DWQ), Construction General Permit (2009-0009-DWQ), Water Reclamation Requirements for Recycled Water Use (Order No. WQ 2016-0068-DDW), Hydrostatic Testing and Potable Water (Order No. R9-2010-0003), Groundwater Extraction (Order No. R9-2015-0013), General Discharge Requirements for Sanitary Sewer Systems Permit (Order No. 2006-0003-DWQ, as amended by 2008-0002-EXEC, 2013-0058-EXEC), and Small Domestic Wastewater Treatment Systems Permit (Order No. WQ 2014-0153-DWQ).

How some of the key limitations contained in supporting role permits will contribute to achieving the Estuary TMDL load reductions and numeric targets is described below.

1. Statewide Storm Water Permit Waste Discharge Requirements (WDRs) for State of California Department of Transportation (2012-0011-DWQ, as amended by 2014-006-EXEC, 2014-077-DWQ, 2015-0036-EXEC).

   The Caltrans Storm Water Permit is important because several major highways under the jurisdiction of Caltrans (i.e., Interstate 5, Interstate 15, and Interstate 215) traverse the Estuary's Watershed.

   Caltrans State highways, properties, and facilities have the potential to contribute nutrient loads to the Santa Margarita River and Estuary (i.e., through non-storm water runoff from irrigation of landscaped areas). However, the Caltrans Storm Water Permit is sufficiently stringent to control nutrient loading sources to the Estuary.

   The Caltrans NPDES permit includes a requirement to effectively prohibit non-storm water discharges into the MS4s. In addition, this Order requires Caltrans to design all landscapes to comply with the California Department of Water Resources Water Efficient Landscape Ordinance. Where the California Department of Water Resources Water Efficient Landscape Ordinance conflicts with a local water conservation ordinance, the Department shall comply with the local ordinance (see Section 6.3.2 for a summary of local ordinances) (SWRCB 2017c).

2. General Permit for Storm Water Discharges Associated with Industrial Activities(2014-0057-DWQ)

This NPDES storm water permit is important because the operation of industrial facilities in the Santa Margarita Watershed can result in the discharge of total nitrogen and total phosphorus to surface water or groundwater. Such industrial facilities could include, but are not limited to, : fertilizer manufacturers, phosphate manufacturing, landfills, sewage or wastewater treatment works, and dairies. Furthermore, the federal Clean Water Act requires the regulation of industrial discharges to waters of the United States. According to the State Water Board's Storm Water Program:

> Section 402 p of the Federal Clean Water Act requires industries that fall under certain Standard Industrial Classification (SIC) codes and that discharge [storm water] into a storm drain system or to surface waters to obtain a National Pollutant Discharge Elimination System (NPDES) permit. In California, these industrial facilities may comply with the Clean Water Act Section 402(p) by applying for coverage under the State's General Permit for [storm water discharges associated with industrial activities] (Industrial General Permit) or by applying for an individual NPDES Permit.
>
> The Industrial General Permit is an NPDES permit that regulates [storm water] discharges from any facility associated with 10 broad categories of industrial activities. These categories of industrial activities are based on the SIC codes. The State Water Resources Control Board (State Water Board) and Regional Water Quality Control Boards (collectively, the Water Boards) enforce the Industrial General Permit (SWRCB 2017e).

To prevent industrial storm water discharges from becoming a significant source of nutrients to surface water or groundwater in the Estuary's Watershed,

> The Industrial General Permit requires the implementation of Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to achieve performance standards, as well as the development of a Storm Water Pollution Prevention Plan (SWPPP) and a monitoring plan. The SWPPP identifies the site-specific sources of pollutants and describes the best management practices implemented at the facility to prevent dry weather runoff and to reduce pollutants in storm water discharges.

Annually, dischargers are to submit an ad hoc report, and an annual report to the State Water Board via the online database system SMARTS. SMARTS stands for Storm Water Multiple Application and Report Tracking System.[5]

Upon submission of an industrial facility's storm water discharge

[5] https://www.waterboards.ca.gov/water_issues/programs/stormwater/smarts/

data, SMARTS compares laboratory results to benchmarks known as numeric action levels (NALs) to determine if the facility's SWPPP is effective in preventing pollutants from discharging in storm water. Industrial dischargers who exceed benchmarks (0.68 mg/L of nitrate-nitrite and 2.0 mg/l total phosphorus) are placed in a higher risk category with more stringent monitoring and pollution control requirements until they eliminate the source of pollution from their facility.

In addition, the Industrial General Permit contains Regional Water Board adopted and/or U.S. EPA established/approved TMDLs, including the Rainbow Creek TMDL. Industrial General Permit facilities in the Rainbow Creek sub-watershed must monitor their discharges for total nitrogen and total phosphorus (SWRCB 2017e, Attachment E).

Limitations contained in this
permit are protective of beneficial uses and consistent with the Estuary TMDL.

3. Construction General Permit (Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ)

   Because soils can contain significant amounts of nutrients and construction activities cause erosion, regulation of construction site storm water is important to prevent runoff from becoming a significant source of total nitrogen and total phosphorus to surface waters and groundwater.

   The NPDES Construction General Permit for storm water discharges associated with construction and land disturbance activities prohibits non-storm water discharges, other than potable water line flushing. Potable water is not a suspected significant source of total nitrogen and total phosphorus. Potable water line flushing is subject to technology-based BMP requirements to meet water quality standards. The limitations contained in this General Permit are protective of beneficial uses and consistent with the Estuary TMDL.

   Also, the Construction General Permit prohibits the discharge of pollutants other than storm water and non-storm water discharges authorized by this General Permit or another NPDES permit and incorporates the discharge prohibitions contained in the Basin Plan (Section 12.2.1).

   The implementation of the prohibitions and limitations contained in the Construction General Permit should reduce and or eliminate any significant nutrient sources from construction site runoff in the Estuary's Watershed.

4. Water Reclamation Requirements for Recycled Water Use (Order No. WQ 2016-0068-DDW)

State Water Board Order WQ-2016-0068-DDW defines recycled water as, *"water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource."* The regulation of recycled water use is important because it can contain significant amounts of total nitrogen and total phosphorus and improper management (i.e., direct discharge to receiving waters or groundwater) could result in additional nutrient loading to the Santa Margarita River and the Estuary.

The use of recycled water in the Santa Margarita River Watershed will not contribute to additional nutrient loading, because section A.1 of the Order requires that,

> The treatment, storage, distribution, or use of recycled water shall not cause or contribute to a condition of pollution as defined in Water Code section 13050(l) or nuisance as defined in Water Code section 13050(m).

In addition the Water Reclamation Requirements for Recycled Water Use also require compliance with the discharge prohibitions in Chapter 4 of the Basin Plan (Section 12.2.3).

5. Hydrostatic Testing and Potable Water (Order No. R9-2010-0003)

   This NPDES permit regulates discharges of hydrostatic test water and potable water to surface waters and storm drains or other conveyance systems within the San Diego Region. Potable water is not a suspected significant source of total nitrogen and total phosphorus (SDWB 2010).

6. Groundwater Extraction (Order No. R9-2015-0013)

   This NPDES permit regulates groundwater extraction and similar discharges to surface waters within the San Diego Region. It requires effluent to comply with discharge limits that are protective of water quality. Enrollees are typically temporary construction sites that require excavation and dewatering. Section V of the Order imposes effluent specifications and discharge limitations for total nitrogen and total phosphorus of 1.0 and 0.1 mg/L, respectively (SDWB 2015b).

   The limitations contained in this permit are protective of beneficial uses and consistent with the Estuary TMDL.

7. Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. 2006-0003-DWQ, as amended by 2008-0002-EXEC, 2013-0058-EXEC) and Waste Discharge Requirements for Sewage Collection Agencies in the San Diego Region (Order No. R9-2007-0005)

These orders establish waste discharge requirements for sanitary sewer collection systems. Both prohibit the discharge of untreated sewage to waters of the State. Order No. R9-2007-0005 further prohibits the discharge of untreated sewage at any point upstream of a sewage treatment plant.

The prohibitions and limitations contained in these permits are sufficient to prevent sanitary sewer systems in the Estuary's Watershed from becoming a significant source of total nitrogen and total phosphorus.

Records of spills in the Estuary's watershed are available on-line at:
http://www.waterboards.ca.gov/water_issues/programs/ciwqs/publicreports.shtml#sso
In combination, these statewide and regional supporting-role permits will ensure that all controllable sources of total nitrogen and total phosphorus to the Estuary are addressed and that the necessary nutrient load reductions and numeric targets are met and beneficial uses are protected.

12.3 Estuary Monitoring and Assessment Program

The following section presents guidelines for the design and implementation of an Estuary Monitoring and Assessment Program (Monitoring and Assessment Program) based on the San Diego Water Board's guidance document entitled, *A Framework for Monitoring and Assessment in the San Diego Region* (SDWB 2012).

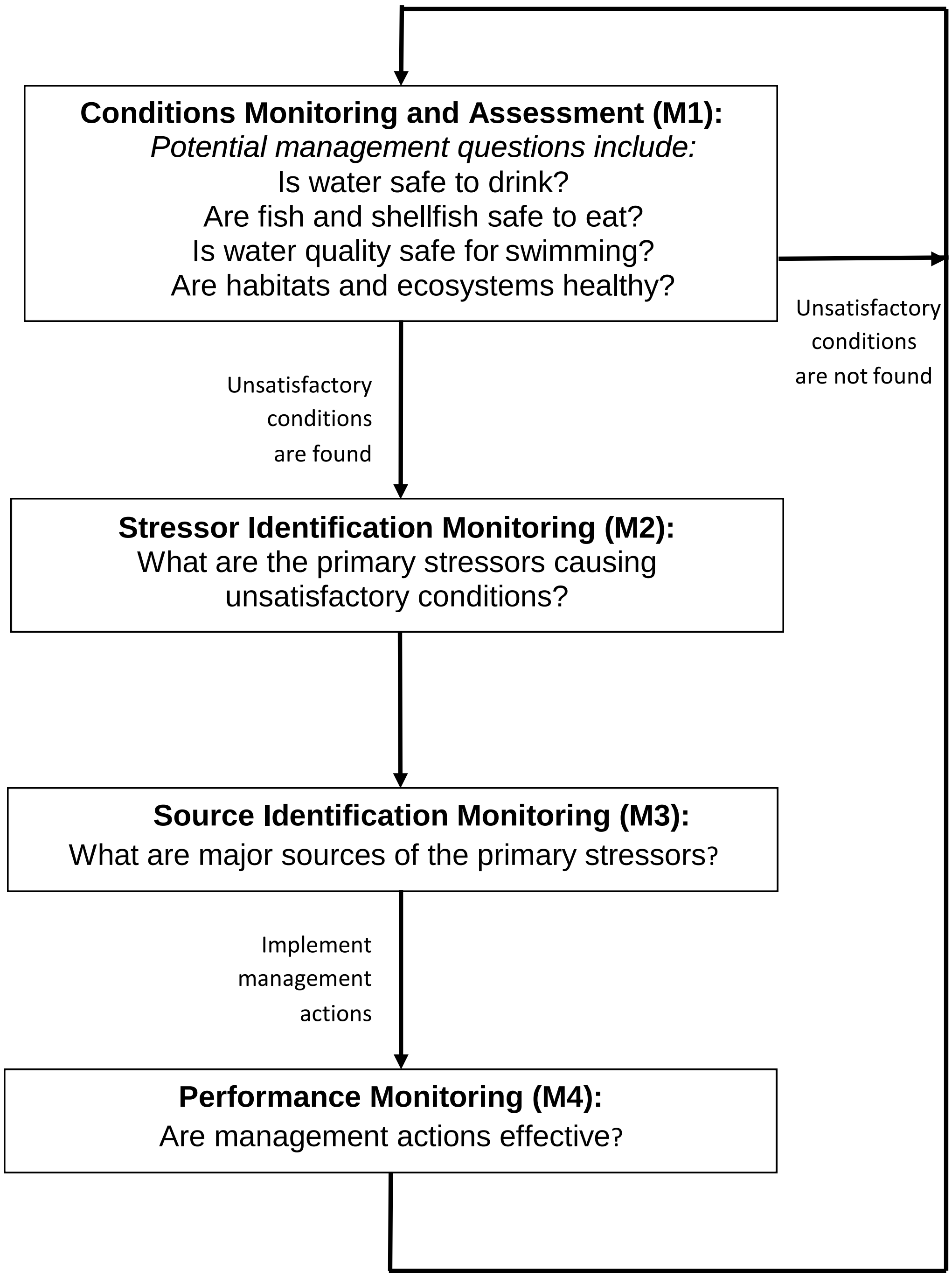
The Monitoring and Assessment Program is critical to evaluate the effectiveness of the requirements in the Regional MS4 Permit, Regionwide Agricultural WDRs, statewide Small MS4 Phase II Permit, and supporting role permits (Section 12.1) towards achieving the necessary nutrient loading reductions and meeting the proposed Estuary numeric targets.

Permittees should consider including an Estuary Monitoring and Assessment Program Plan in the Water Quality Improvement Plan for the Santa Margarita Watershed Management Area (Section 12.2.3). The San Diego Water Board will request that the Estuary TMDL Monitoring and Assessment Program Plan adhere to the guidelines presented below. Doing so would constitute reasonable assurance that reliable tools to assess the progress of the Estuary TMDLs are in place (Section 1).

In addition, the information collected as part of the Monitoring and Assessment Program can be used to develop cost-effective plans to eliminate prohibited flows into the Santa Margarita River and Estuary, and take any additional actions necessary to achieve the necessary nutrient loading reductions and the numeric targets for the Estuary.

The Estuary Monitoring and Assessment Program should be carried out in conformance with the guidance provided in the *Framework for Monitoring and Assessment in the San Diego Region* (SDWB 2012). A schematic summary of the Framework for Monitoring and Assessment and is shown in Figure 20 below:

Figure 21
Summary of Framework for Waterbody-Oriented Monitoring and Assessment
(SDWB 2012)



The Framework for Monitoring and Assessment outlines four key questions to be addressed by the Estuary Monitoring and Assessment Program including:

- Are habitats and ecosystems healthy (M1)?
- What are the primary stressors causing unsatisfactory conditions (M2)?
- What are the major sources of the primary stressors (M3)?
- Are management actions effective (M4)?

As a minimum the Estuary Monitoring and Assessment Program should be designed to include the following questions:

1. Are impacts to the most sensitive beneficial uses (EST, MIGR, RARE, and SPWN) due to biostimulatory substances being reduced, as measured by progress towards achieving numeric targets for dissolved oxygen, macroalgal biomass, and benthic community condition score?

2. Are dry-weather nutrient loads into the Santa Margarita River and Estuary being reduced by the necessary 76 percent from each Permittee's MS4?

3. Is Watershed loading of total nitrogen and total phosphorus to the Estuary reduced to levels necessary to meet and sustain the numeric targets?

Ideally, the tasks needed to conduct monitoring and assessment will be developed by the permittees and submitted to the San Diego Water Board for review and approval (Section 1). If not, then the San Diego Water Board could consider other options, such as a water quality Investigative Order pursuant to Water Code section 13267 to establish an appropriately informative monitoring and assessment plan. A likely scope of work to develop the Estuary TMDL Monitoring and Assessment Program should include:

1. A Monitoring and Assessment Program Work Plan and Quality Assurance Project Plan.

2. A description of how the Monitoring and Assessment Program addresses the questions (M1-M4) in the Framework for Monitoring and Assessment, including the three key questions presented above.

3. A description of how the Monitoring and Assessment Program Plan can reliably measure progress towards meeting the necessary total nitrogen and total phosphorus load reductions and the Estuary numeric targets.

4. Submittal of annual monitoring reports, including submittal of data to the California Environmental Exchange Network (CEDEN).

5. Conducting the Estuary Monitoring and Assessment Program for a minimum of 10 years, or until numeric targets are shown to be consistently attained.

An effective Estuary Monitoring and Assessment Program should monitor nutrient loading into the Estuary, numeric target attainment, and support of beneficial uses in the Estuary. It is expected that the Estuary Monitoring and Assessment Program will collect scientifically defensible data on nutrient loading (total nitrogen and total phosphorus) from surface water and groundwater sources, numeric target attainment (dissolved oxygen, macroalgal biomass, and benthic community condition), as well as overall water quality (temperature, pH, conductivity/salinity, turbidity, water depth, and flow as appropriate). The Program should be sufficiently robust to reliably identify sources of excess nutrient loads entering the Estuary, determine causal factors contributing to impairment of the Estuary, and assess the attainment of beneficial uses.

In addition, the Program should be developed and implemented in accordance to the Ten-Step Process outlined in the Framework for Monitoring and Assessment (SDWB 2012).

In addition, monitoring by NAVY SPAWAR Systems Center Pacific has shown that the ongoing discharge of nutrients into the Estuary through rising polluted groundwater beneath the former agricultural fields continues to take place today. For that reason an effective Estuary Monitoring and Assessment Program will need to include monitoring of these discharges (SPAWAR 2015).

The expected requirements for an Estuary Monitoring and Assessment Program necessary to ensure that data are collected in a manner that will be applicable to the water quality standards and for compliance uses are shown in Table 15. These expected requirements should ensure that data are collected and assessed using methodologies that are accepted in the scientific community and approved according to State policy, something that is vital to the success of this project.

The Estuary Monitoring and Assessment Program should be implemented upon approval of the Resolution R9-2018-TBD and continue for at least 10 years or until it is shown that numeric targets have been attained and will be sustained.

Table 15
Example Estuary Monitoring and Assessment Guidelines

Parameter	Duration/Time Frame	Depth	Sites	Frequency	Method
Dissolved Oxygen (mg/l and percent saturation) Include: Temperature, pH, Salinity, Turbidity, and water depth	Year round	Near-surface ~ 0.5 meter	2 sites: I-5 bridge and Stuart Mesa bridge	continuous monitoring at 15 min. intervals	Data sonde with optical sensor
Macroalgal Biomass, Macroalgal, and ambient TN and TP, and water depth	April – October	Intertidal and or subtidal within the three regions of Santa Margarita Estuary - below I-5 bridge, above Stuart Mesa bridge until vegetation changes, and between the two bridges.	A total of 30 grid samples for each parameter collected throughout the estuary using a stratified random distribution according to size of each of the three estuary regions. Macroalgal biomass samples harvested representatively from each of three regions	Monthly	Macroalgal collection and processing procedures used by McLaughlin *et al.* (2012, 2013a, 2013b) and other applicable regional or statewide protocols.
SQO Benthic Community Condition and sediment %OC, sediment %N and %P, sediment grain size, and aRPD	Standard indexing period	At depths that align with the macroalgal sampling (so that relationships between the SQO and other parameters are logically inferred).	Three randomly distributed sites for each of three regions in estuary.	Once per year in the summer.	Standard SQO methods (Sediment Quality Assessment Technical Support Manual, SCCWRP Tech Report 582, 2009). Once accepted methods are developed to monitor algal biomass effects (eutrophication effects) upon benthic macroinvertebrate communities, they may be considered for use.
MS4 TN and TP Loading to Santa Margarita River and or Estuary	April - October		A minimum of one Mass Loading site downstream of each Permittee's MS4, including one at lowermost portion of the Santa Margarita River. Mass loading measurements at lowermost site conducted at outgoing tide (MLLW).	Monthly	As per Regional MS4 Permit mass loading monitoring requirements

Monitoring will fall into one of two categories, chemical or biological monitoring, to establish whether 1) the primary and secondary numeric targets are being met, and 2) the estuary is meeting its beneficial uses and support its ecological functions.

Chemical monitoring includes collecting data for dissolved oxygen and other standard water quality field measurements. Dissolved oxygen is used as a primary and secondary numeric target. Biological monitoring includes data collection for macroalgal biomass, and benthic macroinvertebrate community condition. Macroalgae biomass is used as a primary and secondary numeric target, and benthic community condition score is used as a secondary target.

Monitoring requirements in the Regional Phase I MS4 permit, statewide Phase II Small MS4 permit, and Regionwide Agricultural WDRs are expected to complement monitoring guidelines listed in Table 15. If needed, monitoring requirements in the permits listed above may be expanded by the San Diego Water Board to collect data necessary to track the progress of the Estuary TMDL project through the adoption of an Investigative Order.

Annual monitoring reports, including raw monitoring data and GIS data should be submitted to the San Diego Water Board. The reports should detail the results of the previous year's monitoring, discuss the effectiveness of the management efforts, and identify new information from the monitoring that informs the relationship between numeric targets and beneficial use impacts in the Estuary. The report should also identify any recommended changes to the monitoring approach to better assess load reductions, beneficial use impacts, improve sample and data collection, or improve understanding of the monitoring results.

The information provided by the Monitoring and Assessment Program can be used by the dischargers to adaptively manage load reduction efforts, and assess the need for and/or effectiveness of alternative management measures in the Estuary (e.g. mouth management, habitat restoration).

Alternative approaches to monitoring and assessing nutrient load reductions and the attainment of numeric targets in the Estuary may be shown to be as effective as those described above. The guidelines provided in this section are meant to serve as a starting point for the development and continued refinement of an Estuary Monitoring and Assessment Program.

12.3.1 Use of Monitoring Data

The following methods should be used to analyze the monitoring data for comparison to Estuary numeric targets (Section 6.1.2).

Dissolved Oxygen:

1. Determine daily minimum. The Estuary will be considered in attainment of the primary dissolved oxygen numeric target if the daily minimum dissolved oxygen concentration is equal to or greater than 5.0 mg/l.
2. Calculate 7-day average of daily minimum. Estuary should be considered in attainment of secondary dissolved oxygen numeric target if average of 7-day daily minimum is equal to or greater than 5.0 mg/l (with a 10% allowable exceedance).

Macroalgal Biomass:

1. Calculate the mean macroalgal biomass for each ten consecutive samples for each of the three Estuary regions by averaging the results for all sites in each region.
2. Targets will be attained in the Estuary if the running average for at least two out of three regions in two consecutive months are meeting and sustaining either the primary or secondary macroalgal biomass target.

Benthic Community Condition Score:

1. Determine score for each site and assess potential causes of benthic community degradation if observed.
2. Targets will be attained in the Estuary if at least the running average for two of three regions are meeting the target.

Each target will be evaluated in the context of the other targets to determine attainment for the Estuary, as shown in Figure 12 in Section 6.1.2.

For all other parameters, the Estuary will be considered in attainment if there are no persistent exceedances as determined by the guidelines found in section 4 (California Delisting Factors) of the State Policy for Section 303(d) (SWRCB 2015a).

Monitoring of the Estuary is necessary to ensure Estuary numeric targets are being met and beneficial uses are restored commensurate with reduced watershed nutrient loading into the Santa Margarita River and Estuary. Also, a minimum of 10 years of monitoring is necessary to allow adequate time to document dissolved oxygen, macroalgal biomass, and benthic community condition score response in the Estuary to reduced nutrient loading conditions.

Monitoring may be suspended, lessened, or ceased by the San Diego Water Board if there is sufficient data to indicate that the efforts taken by all dischargers to reduce loading of nutrients to the Estuary have worked and that the numeric targets will be reached andsooner than 2038 and likely to be sustained sooner than 2038.

In addition, Permittees may conduct special studies to determine if site specific WQOs that protect the most sensitive beneficial uses of the Estuary are appropriate. Site specific WQOs are adopted through the Basin Plan Amendment process. The San Diego Water Board will need to review and consider any proposed changes.

12.3.2 Estimated Cost of Estuary Monitoring and Assessment Program

The actual cost will be based on the scope of work developed by the Permittees. Table 16 provides a summary of the anticipated costs based on the assumption presented above.

Table 16
Estimated Costs Associated to Develop and Conduct Estuary Monitoring and Assessment Program

Task	Estimated Yearly Monitoring and Reporting Cost	Estimated Cost for Ten Years of Monitoring and Reporting
Prepare Workplan and QAPP	One Time Cost	$TBD
Field Work	$TBD	$TBD
Laboratory Analysis, Materials, Supplies	$TBD	$TBD
Report Preparation	$TBD	$TBD
Estimated Total	$TBD	$TBD

13 OTHER CONSIDERATIONS

The source analyses identified the MS4 system, agricultural discharges, and surfacing polluted groundwater as the main sources contributing nutrients into the Estuary. Because the current MS4 permit contains control limits adequate to achieve the WLA, no modifications to its discharge limits are necessary to meet the TMDL. The numeric targets should be met as soon as the Phase I and Phase II MS4 Permittees and agricultural dischargers achieve existing NPDES and WDR requirements, respectively. MS4 Permittees are required to effectively eliminate controllable dry-weather sources of total nitrogen and total phosphorus into their MS4s, and agricultural operators are required to eliminate illicit nutrient discharges from agricultural operations. Once the numeric targets are met and sustained, the San Diego Water Board will take the necessary actions to delist the Estuary from the 303(d) list for eutrophic conditions. The proposed restoration approach for the Estuary falls under U.S EPA Category 5-alternative for impaired waters on the CWA 303(d) list. A U.S.EPA Category 5 impaired water body is one for which evidence shows at least one beneficial use is not supported and a TMDL is needed.
In accordance with U.S. EPA:

> Impaired waters on the CWA 303(d) list for which a State develops and pursues an alternative restoration approach shall remain on the CWA 303(d) list (i.e., Category 5) and still require TMDLs until WQS are achieved. EPA has created an optional subcategory under Category 5—subcategory 5-alternative—as an organizing tool to clearly articulate which listed waters have such alternative approaches, and to provide transparency to the public. In addition, this subcategory will facilitate tracking alternative restoration approaches in these CWA 303(d) listed waters.
>
> Because waters for which alternative restoration approaches are pursued still remain on the CWA 303(d) list, EPA will not take action to approve or disapprove a State's alternative restoration approach under CWA 303(d). Therefore, as long as such waters with alternative restoration plans remain on the CWA 303(d) list, EPA's review of the list would not be affected or delayed by whether development of a TMDL or an alternative restoration plan is pursued.
>
> EPA will take into account a State's description of its alternative restoration approach to determine whether it is appropriate for such waters to be in subcategory 5-alternative and whether to include such approaches under the CWA 303(d) performance measures. EPA does not expect that all of the activities or controls to carry out an alternative restoration approach must be fully implemented, or that WQS must have been achieved, before the alternative restoration approach can be reported as a plan under the CWA 303(d) performance measures. However, the alternative restoration approach does need to clearly demonstrate how WQS will be achieved for EPA to include it under the CWA 303(d) performance measures (U.S. EPA 2016c).

U.S. EPA further distinguishes a subcategory 5-alternative and Category 4b as follows:

Subcategory 5-alternative

1) This includes impaired waters on the CWA 303(d) list (i.e., Category 5) for which a State has developed an alternative restoration approach to meet WQS.

2) These impaired waters shall remain on the CWA 303(d) list until WQS are achieved or a TMDL is developed. Taking into account the severity of the pollution and uses, such waters might be assigned lower priority for TMDL development as alternative restoration approaches expected to meet WQS are pursued in the near-term.

3) For these impaired waters, the State has decided not to pursue a Category 4b demonstration that "other pollution control requirements" required are stringent enough to implement any water quality standard consistent with 40 CFR 130.7(b)(1)(iii).

4) As long as such waters remain on the CWA 303(d) list, EPA's review of the list would not be affected or delayed by whether a TMDL or an alternative restoration approach is pursued.

5) EPA will consider the adequacy of the State's description of the alternative restoration approach in determining whether to include such an approach under the CWA 303(d) performance measures.

Category 4b

1) As noted in the "Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions,"11 Category 4b includes impaired waters for which a State has provided sufficient demonstration that there are other pollution control requirements sufficiently stringent to achieve applicable WQS within a reasonable period of time.

2) These impaired waters are not included in the State's CWA 303(d) list consistent with 130.7(b)(1)(iii) (Category 5).

3) EPA reviews and approves the exclusion of such waters from Category 5 consistent with CWA requirements (U.S. EPA 2016c).

Means of Compliance – Process for Revising the TMDL Project

The Estuary TMDL project may be revised based on new science, new scientifically defensible data, or other relevant finding of the San Diego Water Board. Revision of the Estuary TMDL project could be made as a triennial review work item.

13.1 Incorporating the TMDL Project into the Basin Plan is Not Required

In accordance with State Water Board Resolution No. 2005-0050 and the associated guidance document, entitled *A Process for Addressing Impaired Waters in California* (Impaired Waters Guidance Document), the implementation plan developed to address the Santa Margarita River Estuary eutrophication impairment does not require a Basin Plan amendment because implementation of existing permits will correct Estuary impairment.

13.2 Scientific Peer Review

While no rulemaking is occurring to adopt or implement this TMDL project, peer review was still completed to ensure a high level of scientific rigor. Section 57004 of the California Health and Safety Code requires the submission of the scientific basis for any rulemaking to an external peer review for evaluation prior to taking an action on the proposed rule. Section 57004 defines a rule as a regulation or a policy adopted by the State Water Board that has the effect of a regulation or adopted to implement or make effective a regulation. The TMDL project implements an existing standard and relies on existing requirements for implementation. Therefore it does not meet the conditions that require a scientific peer review. However, should subsequent monitoring and assessment of the Estuary indicate a lack of meaningful progress toward achieving the numeric targets, the San Diego Water Board may consider a rulemaking TMDL, in which case the peer review conducted would serve to satisfy the Health and Safety Code requirements.

13.3 California Environmental Quality Act

The California Environmental Quality Act (CEQA) is codified at Public Resources Code Section 21000 *et seq.* The CEQA Guidelines are codified at Title 14 California Code of Regulations section 15000 *et seq.*

This project is an action to assure the restoration of beneficial uses in the Estuary by enforcing the laws, regulations, and standards administered by the San Diego Water Board.[6] As such, it is categorically exempt from the provisions of CEQA pursuant to Public Resources Code sections 15308 (for Class 8 exemptions) and 15321 (for Class 21 exemptions).

- Class 8 consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Construction activities and relaxation of standards allowing environmental degradation are not included in this exemption.

[6] State Water Board implementation regulations are in 23 CCR Chapter 27, §3720 *et seq.* and available at: http://www.waterboards.ca.gov/laws_regulations/docs/wrregs.pdf

- Class 21(a) consists of actions by regulatory agencies to enforce or revoke a lease, permit, license, certificate, or other entitlement for use issued, adopted, or prescribed by the regulatory agency or enforcement of a law, general rule, standard, or objective, administered or adopted by the regulatory agency.

An exemption is justified because no standards will be relaxed to allow environmental degradation and there is no reasonable possibility that the investigative projects or activities will have a significant negative effect on the environment. Therefore, this action is also exempt from CEQA provisions in accordance with section 15061(b)(3) of Chapter 3, Title 14 of the California Code of Regulations because it can be seen with certainty that there is no possibility that the activity in question may have a significant negative effect on the environment. CEQA will be complied with as necessary when and if remedial actions are proposed.

A Basin Plan amendment to include a traditional rule-making TMDL would trigger CEQA. In accordance with CEQA, most Basin Plan amendments, including TMDL amendments, must also undergo an evaluation of the environmental impacts of complying with the amendment, and an evaluation of the costs of complying with the amendment.

13.4 Stakeholder and Public Participation

Beginning in 2011 and throughout 2017, extensive stakeholder participation opportunities were provided at every step during the development of this draft TMDL project to the Santa Margarita Watershed Nutrient Initiative Stakeholder Group. In 2016 and 2017, twelve stakeholder meetings and a CEQA scoping meeting were held. Topics discussed at these meetings included, but where not limited to:

- Results of Estuary impairment assessment,
- Conceptual model development,
- Potential impacts of the Estuary TMDL project,
- NNE approach,
- Estuary and Watershed numeric model development,
- Numeric targets and corresponding load reductions, and
- Nutreint load reduction and Estuary numeric target monitoring.

Work products and meeting minutes are available on-line at:

http://www.projectcleanwater.org/santa-margarita-watershed-nutrient-initiative-stakeholder-group/ [Accessed 18 May 2017]

Additional materials associated with the Estuary TMDL project are available on the San Diego Water Board's website here:

http://www.waterboards.ca.gov/sandiego/water_issues/programs/tmdls/santa_margarita_river_estuary.shtml [Accessed 18 May 2017]

14 Estuary TMDL Project Schedule

A detailed schedule for the implementation of the TMDL project and attainment of the numeric targets has been developed by the San Diego Water Board using input from stakeholders. Additional specific actions, including additional milestones should be provided in the Water Quality Improvement Plan to be submitted by the MS4 Permittees. In addition, to ensure that permittees are making timely progress towards attainment of the Estuary's beneficial uses interim numeric goals have been developed. The schedule of activities needed to achieve the numeric targets by 2038 and interim numeric goals are presented in Tables 17 and 18.

The proposed schedule is reasonable because it is consistent with the schedule of other TMDLs adopted by the San Diego Water Board, it contains interim milestones at 5, 10, and 15 years from the effective date, and allows enough time for Permittees to implement permit requirements and for management actions to have an appreciable effect on the impairment of the Estuary.

The effective date of the Estuary TMDL project will be the approval date for Resolution R9-2018-TBD. 2017-###. If at any point during the implementation plan, monitoring data or special studies indicate that WLA will be attained but the Estuary's numeric targets may not be achieved, the San Diego Water Board shall reconsider the TMDL project to modify WLAs to ensure that the Estuary's numeric targets is attained.

Table 17
Compliance Schedule

Activity	Month(s)	Year(s)
All permittees (Phase I MS4, Phase II MS4, and Agricultural Operations) continue to implement current programs addressing dry-weather non-storm water and illicit discharges	Year Round	2018-2038
San Diego Water Board approval of Santa Margarita River Water Management Area Water Quality Improvement Plan	TBD	2018
Phase I MS4 permittees begin implementation of the strategies in the Water Quality Improvement Plan through revised JRMPs	Upon approval of WQIP by San Diego Water Board	2018
Updates to the Phase I MS4 permittees Jurisdictional Runoff Management Programs (JRMPs) to implement Water Quality Improvement Plan Strategies	Upon approval of WQIP by San Diego Water Board	2018
Renewal of Regional MS4 Permit (Order No. R9-2013-0001	TBD	2018
Permittees implement Estuary Monitoring and Assessment Program and other monitoring requirements in Regional MS4 Permit, Phase II Small MS4 Permit, Regionwide Agricultural WDRs	Upon approval by San Diego Water Board	2018, and yearly thereafter
Submission by Phase I MS4 permittees of Water Quality Improvement Plan Annual Report (including the Annual Monitoring Report for Santa Margarita River Estuary Monitoring and Assessment Program)	Based on date of approval of WQIP by San Diego Water Board	Upon approval, and yearly thereafter
Submission by Phase I Small MS4 permittees of annual reports showing compliance with all applicable permit requirements and progress towards taking specific actions that prioritize the elimination of illicit discharges and dry-weather discharges to receiving waters in the Santa Margarita River Estuary watershed within five years		2018 and yearly thereafter
Submission by statewide Phase II Small MS4 permittees of annual reports showing compliance with all applicable permit requirements and progress towards the elimination of illicit discharges and dry-weather discharges to receiving waters in the Santa Margarita River Estuary watershed within five years		2018 and yearly thereafter
Submission of annual reports by Regionwide Agricultural WDR permittees showing compliance with all applicable WDR requirements and progress towards eliminating illicit discharges and reducing or eliminating excess nutrient loading to receiving waters and groundwater in the Santa Margarita River Estuary watershed within five years		2018 and yearly thereafter

Activity	Month(s)	Year(s)
Revision of existing Regionwide Agricultural WDRs (R9-2016-0004 and R9-2016-0005) in accordance with California Water Code section 13263(c)		2021*
Assessment of progress towards meeting the interim numeric goals	Based on date of adoption of R9-2018-TBD	2022, 2026, 2030, 2034, and 2038
Permittees and San Diego Water Board assesses effectiveness of actions to date (including potential revisions to numeric targets, strategies, responsible parties, and schedules)	Based on date of adoption of R9-2018-TBD	2022, 2026, 2030, 2034, and 2038
40 Percent progress towards necessary load reduction (30.4 percent relative to water year 2008) and significant and consistent progress towards meeting numeric targets	Based on date of adoption of R9-2018-TBD	2022
60 Percent progress towards necessary load reduction (45.6. percent relative to water year 2008) and significant and consistent progress towards meeting numeric targets	Based on date of adoption of R9-2018-TBD	2026
75 Percent progress towards necessary load reduction (57 percent relative to water year 2008) and significant and consistent progress towards meeting numeric targets	Based on date of adoption of R9-2018-TBD	2030
90 Percent progress towards necessary load reduction (68.4) percent relative to water year 2008) and significant and consistent progress towards meeting numeric targets	Based on date of adoption of R9-2018-TBD	2034
100 Percent progress towards necessary load reduction (76 percent relative to water year 2008) and significant and consistent progress towards meeting numeric targets	Based on date of adoption of R9-2018-TBD	2038
Projected attainment of final numeric targets		2038

* Revision of existing Regionwide Ag WDRs could take place sooner at discretion of San Diego Water Board

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Appendix 1

Application of Watershed Loading and Estuary Water Quality Models to Inform Nutrient Management in the Santa Margarita River Watershed

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