City of Imperial Beach, California

PUBLIC WORKS DEPARTMENT

825 Imperial Beach Blvd., Imperial Beach, CA 91932 Tel: (619) 423-8311 Fax: (619) 429-4861

June 18, 2015

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

Subject: **Tijuana River WMA-PIN No. 794856:wchiu**
Final Submittal of Tijuana River Watershed Management Area Water Quality Improvement Plan

Dear Mr. Gibson:

On behalf of the Tijuana River Watershed Management Area (WMA) Responsible Parties, the City of Imperial Beach is pleased to submit the complete Water Quality Improvement Plan for the Tijuana River Watershed. This document was prepared by the City of Imperial Beach, the City of San Diego, and the County of San Diego in accordance with Permit Order R9-2013-0001. Please accept this submittal on behalf of the aforementioned responsible agencies.

Enclosed is one (1) set of certification statements and one (1) electronic copy and (1) hard copy of Tijuana River Watershed Management Area Water Quality Improvement Plan. The document will also be uploaded to the Regional Clearinghouse hosted by the County of San Diego at:
http://www.projectcleanwater.org/.

This Water Quality Improvement Plan will not be submitted to the U.S. EPA as previously directed through email by the San Diego RWCB on June 15, 2015.

If you have any questions, please give me a call at (619) 628-1370.

Sincerely,

Chris Helmer
Environmental Programs Manager, City of Imperial Beach

Enclosures:
1. CD –Tijuana River Watershed Management Area Water Quality Improvement Plan, dated June 26, 2015
2. Hard Copy – Tijuana River Watershed Management Area Water Quality Improvement Plan, dated June 26, 2015

cc: (email)
Eric Becker, San Diego, RWQCB
Wayne Chiu, San Diego RWQCB
Chris Helmer, City of Imperial Beach
Karina Danek, City of San Diego
Tracy Cline, County of San Diego

Tijuana River Watershed Management Area

WATER QUALITY IMPROVEMENT PLAN

JUNE 26, 2015

SUBMITTED TO THE SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD BY:

City of Imperial Beach | City of San Diego | County of San Diego

Regional Board PIN No. 784856:wchiu

IMPERIAL BEACH classic southern california

City of Imperial Beach, California

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City of Imperial Beach, California

PUBLIC WORKS DEPARTMENT

825 Imperial Beach Blvd., Imperial Beach, CA 91932 Tel: (619) 423-8311 Fax: (619) 429-4861

STATEMENT OF CERTIFICATION

Tijuana River Watershed Management Area, Water Quality Improvement Plan Final Document (Permit Provision F.1.b)

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

Hank Levien

Hank Levien
Director of Public Works
Imperial Beach

June 8, 2015
Date

STATEMENT OF CERTIFICATION

Tijuana River Watershed Management Area, Water Quality Improvement Plan Final Document (Permit Provision F.1.b)

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Andrew Kleis | Date 6/19/15

Drew Kleis
Deputy Director
Transportation & Storm Water Department

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TIJUANA RIVER WATERSHED MANAGEMENT AREA, WATER QUALITY IMPROVEMENT PLAN (PERMIT PROVISION F.1.B SUBMITTAL), STATEMENT OF CERTIFICATION

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

Sarah Aghassi

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

Date 5/26/15

TIJUANA RIVER WATERSHED MANAGEMENT AREA WATER QUALITY IMPROVEMENT PLAN

Prepared for

City of Imperial Beach
City of San Diego
County of San Diego

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ACKNOWLEDGEMENTS

The development of this Water Quality Improvement Plan was supported by the convening of a Consultation Panel that included representatives from the San Diego Regional Water Quality Control Board (Regional Board), environmental groups, development groups, as well as members from the public. Special thanks to Eric Becker (Regional Board representative), Paloma Aguirre and John Holder (representatives of the environmental community affiliated with Wildcoast), Steve Gruber (development community representative affiliated with the Industrial Environmental Association and Burns & McDonnell), Luis Parra (development community representative affiliated with the Building Industry Association and TRW Engineering), Mark West (resident representative affiliated with Surfrider and member of U.S. IBWC Citizens Forum Board), Chris Peregrin (at-large representative affiliated with the Tijuana Estuary as Reserve Manager), and Oscar Romo (at-large representative affiliated with Alta Terra and the University of California San Diego), for serving on the Tijuana River Watershed Management Area Consultation Panel and providing valuable insight into the content of this document.

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%	Percent
µg/L	micrograms per liter
ABLM	Ambient Bay and Lagoon Monitoring
AGR	Agricultural Supply
AQUA	Aquaculture
BDEs	Polybrominated Diphenyl Ethers
BIOL	Preservation of Biological Habitats of Special Significance
BMPs	Best Management Practice(s)
BOD	Biochemical Oxygen Demand
BPJ	Best Professional Judgment
CalRecycle	California Department of Resources Recovery and Recycling
Caltrans	California Department of Transportation
CEDEN	California Environmental Data Exchange Network
CFR	Code of Federal Regulations
CGP	Construction General Permit
COD	Chemical Oxygen Demand
COLD	Cold Freshwater Habitat
COMM	Commercial and Sport Fishing
CWA	Clean Water Act
CWC	California Water Code
DO	Dissolved Oxygen
EST	Estuarine Ecosystems
FRSH	Freshwater Replenishment
GIS	Geographic Information System
HA	Hydrologic Area
HSAs	Hydrologic Subareas
IBI	Index of Biotic Integrity
IDDE	Illicit Discharge Detection and Elimination
IGP	Industrial General Permit
IND	Industrial Service Supply
IRWM	Integrated Regional Water Management
JRMP	Jurisdictional Runoff Management Plan
Km	Kilometer
LID	Low Impact Development
LTEA	Long Term Effectiveness Assessment
LW	Lower Watershed
MAR	Marine Habitat
MBAS	Methylene Blue Activated Substances
MEP	Maximum Extent Practicable
mg/L	Milligrams Per Liter
MGD	Millions Gallons Per Day
MIGR	Migration of Aquatic Organisms
MLS	Mass Loading Station
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System

MTBE	Methyl-t-butyl Ether
MUN	Municipal and Domestic Supply
N	Nitrate
NGO	Non-governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NOLF	Naval Outlying Landing Field, Imperial Beach
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
NTU	Nephelometric Turbidity Unit
P	Phosphorus
PAH	Polynuclear Aromatic Hydrocarbons
PBDEs	Polybrominated diphenyl ethers
PDP	Priority Development Project
PFC	Permeable Friction Course
PGA	Pollutant-Generating Activity
PN	Particulate Nitrogen
POC	Carbon
PP	Particulate Phosphorus
PROC	Industrial Process Supply
RA	Responsible Agency
RARE	Rare, Threatened, or Endangered Species
REC-1	Contact Water Recreation
REC-2	Non-Contact Water Recreation
Regional Board	San Diego Regional Water Quality Control Board
ROWD	Report of Waste Discharge
SANDAG	San Diego Association of Governments
SBIWTP	South Bay International Wastewater Treatment Plant
SBOO	South Bay Ocean Outfall
SCCWRP	Southern California Coastal Water Research Project
SDSU	San Diego State University
SHELL	Shellfish Harvesting
SMARTS	Storm Water Multiple Application and Report Tracking System
SMC	Storm Water Monitoring Coalition
SPWN	Spawning, Reproduction, and/or Early Development
SSC	Suspended Sediment Concentration
State Board	State Water Resources Control Board
SUSMP	Standard Urban Storm Water Mitigation Plan
SWAMP	Surface Water Ambient Monitoring Program
TDS	Total Dissolved Solids
TMDLs	Total Maximum Daily Loads
TRNERR	Tijuana River National Estuarine Research Reserve
TRVRT	Tijuana River Valley Recovery Team
TSS	Total Suspended Solids
TWAS	Temporary Watershed Assessment Station
U.S.	United States

U.S. EPA	United States Environmental Protection Agency
USIBWC	United States International Boundary and Water Commission
UW	Upper Watershed
WARM	Warm Freshwater Habitat
WILD	Wildlife Habitat
WMA	Watershed Management Area
WMAA	Watershed Management Area Analysis
WQBEL	Water Quality Based Effluent Limitation
WQIP	Water Quality Improvement Plan
WQO	Water Quality Objective
WURMP	Watershed Urban Runoff Management Program

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ES.1. OVERVIEW

The San Diego Regional Municipal Separate Storm Sewer System (MS4) Permit adopted on May 8, 2013 includes a requirement for responsible agencies (RAs) to develop a Water Quality Improvement Plan (WQIP). This WQIP applies to the Tijuana River Watershed Management Area (WMA). In the Tijuana River WMA, the RAs include the City of Imperial Beach, the City of San Diego, and the County of San Diego.

The Tijuana River WMA is a subset of the Tijuana River Watershed. The Tijuana River Watershed encompasses a region of approximately 1,750 square miles (1.12 million acres or approximately 453,000 hectares) on both sides of the United States (U.S.)-Mexico international border between California and Mexico (County of San Diego et al., 2008).

The purpose of the WQIP is to guide jurisdictional runoff management programs toward achieving the outcome of improved water quality in receiving waters. According to the Permit, “the goal of the WQIP is to protect, preserve, and enhance the water quality and designated Beneficial Uses of waters of the state. This goal will be accomplished through an adaptive planning and management process that identifies the highest priority water quality conditions within a watershed and implements strategies on a jurisdictional basis to achieve improvements in the quality of discharges from the MS4s and receiving waters.”

This document focuses on storm water discharges from MS4s and the Permit requirements associated with addressing those discharges. Sources of pollutants or stressors may include non-point sources such as runoff from agriculture or natural areas; point sources such as treatment plants, industrial discharges and storm water discharges from MS4s or other point sources such as construction sites, industrial sites, highways, etc.; and pollutants crossing the international border from the Mexican portion of the watershed. A variety of regulations, permits, policies, and programs are in place to address these sources. However, this WQIP is specific to storm water and non-storm water discharges from MS4s only.

ES.2. Priority and Highest Priority Water Quality Conditions, Sources, and Potential Strategies

The WQIP has been developed in stages. The first set of steps included identifying priority and highest priority water quality conditions, sources of those conditions, and potential strategies to address them.

The first step in identifying the highest priority water quality conditions was to assess the state of the receiving waters in the WMA and develop a comprehensive list of the water quality conditions. An initial list of receiving water conditions and the potential priority water quality conditions were determined and are summarized in Table 2-5 and Table 2-6 in Section 2.

The initial list of receiving water conditions was modified to consider only water quality conditions that may be attributable in part to discharges from MS4s and only includes those conditions for which data are available to demonstrate that discharges from MS4s may be causing or contributing to the water quality condition. The shorter modified list constitutes the priority water quality conditions.

The priority water quality conditions were reviewed to identify those of highest priority. The selection of highest priority water quality condition considered the weight of evidence for each priority conditions and was based on a cumulative assessment of the criteria identified. The WQIP has identified several priority water quality conditions and considered multiple criteria to compare them side by side in Section 2.3. Based on this analysis, the following have been identified as the highest priority water quality conditions:

- Sedimentation / Siltation in the Tijuana River (wet weather)
- Turbidity in the Tijuana River and Tijuana River Estuary (wet weather)

An inventory of potential pollutant-generating facilities within the Tijuana Valley Hydrologic Area (HA) that may cause or contribute to sedimentation / siltation and turbidity water quality condition in the Tijuana River and Tijuana River Estuary in the Lower Watershed was considered. The Tijuana River Valley in the Lower Watershed has the highest acreage of urban land use, and therefore has the most MS4 structures. The Upper Watershed is largely undeveloped and those areas located above the reservoirs are not contributors of sediment to the Lower Watershed. Because the Lower Watershed has the highest density of MS4 facilities, the WQIP prioritizes these sources.

Highest priority sources were identified based on an assessment of the sources. Highest priority sources (listed alphabetically) include:

Facilities

- Commercial Facilities
- Industrial Facilities
- Municipal Facilities
- Waste Treatment, Storage, or Disposal

Land Areas

- Commercial
- Institutional
- Industrial
- Transportation (local roads and parking lots, etc. Excludes California Department of Transportation [Caltrans])
- Construction

MS4 Outfalls

Lower Watershed – wet weather

The Permit required the jurisdictions to work together to identify potential water quality improvement strategies that may be implemented to address the highest priority water quality condition(s). Potential strategies that can provide improvements in water quality include nonstructural and structural strategies.

The preliminary lists presented in the WQIP were developed through collaboration among the RAs and solicitation of input from the public. It should be noted that the lists of potential strategies presented were further evaluated, and a refined list of strategies was developed, as described in Section 3 and presented in Appendix H.

ES.3. Water Quality Improvement Goals, Strategies and Schedules

The WQIP establishes a numeric goal based on Total Suspended Solids (TSS) for both Sedimentation / Siltation in the Tijuana River (during wet weather) and turbidity in the Tijuana River and Tijuana River Estuary (during wet weather). TSS is a logical metric for both conditions because sedimentation, siltation and turbidity are interrelated. Baseline conditions were considered in the development of the final goal.

Progress towards meeting the final goals will be measured using interim water quality-based goals. For FY 2018, the City of San Diego will also use a performance-based interim goal. The interim water-quality based goals are presented in Table 3-3 of Section 3. Schedules for implementing strategies are RA-specific because they are based on implementation of the jurisdictional strategies. See Appendix H.

The proposed numeric goals will be met through a combination of implementation of non-structural Jurisdictional Runoff Management Plan (JRMP) strategies as well as the use of enhanced/targeted strategies. Attainment of the water quality-based numeric interim goals and implementation of the WQIP and associated strategies demonstrate progress towards meeting the final goal as indicated on Figure ES-1 below. Both the goals and implementation of strategies help to demonstrate that progress is being made toward addressing the priority water quality conditions. Additional details for the strategies are summarized in Section 3. Detailed lists of jurisdictional strategies are provided in Appendix H.

The Permit requires RAs to identify water quality improvement strategies to address the highest priority water quality conditions. The strategies were selected based on their ability to effectively and efficiently eliminate non-storm water discharges to the MS4, reduce pollutants in storm water discharges in the MS4 to the maximum extent practicable (MEP), and strive to achieve the interim and final numeric goals.

Section 3 provides a general discussion of nonstructural strategies, such as administrative policies, enforcement of municipal ordinances, education and outreach programs, rebate and incentive programs, and collaboration with WMA partners as well as a discussion of optional structural strategies, utilized as needed and if funding is identified, including those strategies that can improve water quality by removing pollutants through filtration and infiltration. As part of this step, the City of San Diego estimated the funding needs to implement the jurisdictional strategies needed to achieve the goals identified (See Appendix H.2).

ES.4. Monitoring and Assessment Program

The MS4 Permit requires the development of an integrated monitoring and assessment program that assesses progress towards achieving the numeric goals and schedules, measures progress toward addressing the highest priority water quality conditions, and evaluates each RA’s overall efforts to implement the WQIP.

The Monitoring Program has three major components:

- Receiving water monitoring,
- MS4 outfall discharge monitoring, and
- Special studies.

The receiving water monitoring includes multiple components intended to assess whether the chemical, physical, and biological conditions in receiving waters are protective, or likely protective, of beneficial uses. Long-term monitoring locations are monitored during both wet and dry conditions for water quality, along with sediment quality monitoring and participation in regional monitoring.

It should be noted that due to the binational nature of the watershed, flows generated in the upper reaches of the watershed within the U.S comingle with flows generated in Mexico prior to return to receiving waters within U.S. jurisdiction in the lower watershed and Tijuana River estuary. In addition, the watershed area within the U.S. contains federal, state, and Indian Reservation lands (Figure 1-5b) not subject to the Phase I MS4 Permit regulatory framework. Accordingly, sample results from the lower six miles of the Tijuana River and Tijuana River estuary as part of the long-term receiving water monitoring program are representative of water quality conditions influenced by discharges from entities both within the U.S. as well as Mexico, with potentially only a minor influence of RA MS4 discharges.

The dry weather MS4 outfall monitoring component has two phases. For the first phase, the RAs have performed a field screening of a certain number of outfalls, based on the total number of outfalls in their jurisdictions. For the second phase, the highest priority dry weather MS4 outfalls will then be monitored, using water quality-based methods rather than those used in the field screening program. The RAs will monitor the highest priority major MS4 outfalls with non-storm water persistent flows at least semi-annually.

For the wet weather MS4 outfall discharge monitoring component, the RAs have identified five monitoring locations representative of the residential, commercial, industrial, and mixed-use land uses within the Tijuana River WMA. These five locations will be monitored at least once per year.

The special studies will include a regional special study and a special study specific to the Tijuana River WMA. The goal of the special studies is to further investigate the highest priority water quality conditions. The regional special study is focused broadly on highest priority water quality conditions for the entire San Diego Region, while the special study specific to the Tijuana River WMA is focused on the highest priority water quality conditions in the Tijuana River WMA, as discussed in Section 2.

The regional special study is the San Diego Regional Reference Stream Study currently being conducted by the Southern California Coastal Water Research Project (SCCWRP). The study will develop numeric targets that account for “natural sources” to establish the concentrations or loads from streams in a minimally disturbed or “reference” condition. The goal of this project is to collect the data necessary to derive reasonable and accurate numeric targets for bacteria, nutrients, sediment and heavy metals, based on a reference approach.

The RAs will conduct a special study in the Tijuana River WMA to identify and prioritize the MS4 and non-MS4 sources causing or contributing to the highest priority water quality conditions. The results of the special study will assist RAs to focus strategies on sources of sediment within their jurisdictions and will help to document sources of sediment that must addressed by non-MS4 entities.

ES.5. Water Quality Improvement Plan Assessment Program

The assessment portion of the Monitoring and Assessment Program will evaluate the data collected under the monitoring programs described in Section 4.1, as well as the information collected as part of each RA's JRMP. The data collected from these two programs will be used to assess the progress of the WQIP strategies toward achieving Water Quality Improvement Goals.

Each WMA must implement an iterative approach to adapt the WQIP, monitoring and assessment program, and JRMP programs to achieving their goals. The MS4 Permit describes various triggers that may require program adaptation, including exceedances of water quality standards in receiving waters, new information, San Diego Regional Water Quality Control Board (Regional Board) recommendations, and public participation. Effectiveness assessments of JRMP programs and strategies may also trigger adaptations to the WQIP. Each trigger will result in specific adaptive management processes or actions within the timeframes specified in the MS4 Permit. The timing of the adaptive management requirements is typically either annually or at the end of the MS4 Permit term.

ES.6. Public Involvement

The Permit requires that the RAs consider public input during the development of the WQIP. The public process involved multiple opportunities for the public to participate and comment on the development of the WQIP. This participation involved two public workshops to solicit information, the convening of a consultation panel comprised of representatives of the Regional Board, the environmental groups, development groups as well as members from the public; finally the permit required that there be three public review periods to solicit comments on the development of and submittal of a draft final WQIP.

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SECTION 1 INTRODUCTION

The Tijuana River Watershed encompasses a region of approximately 1,750 square miles (1.12 million acres or approximately 453,000 hectares) on both sides of the United States (U.S.)-Mexico international border between California and Mexico (County of San Diego et al., 2008). The Mexican side of the watershed is significantly more urbanized than the U.S. portion, which is largely undeveloped. The Tijuana River Watershed Management Area (WMA), the portion under the jurisdiction of U.S., includes 467 square miles (122,300 hectares) of the watershed on the U.S. side of the border (about 27 percent of the watershed).

Due to the binational nature of the watershed, much of the overland water flow from the upper reaches of the watershed management area commingles with water that passes through the City of Tijuana before exiting through the estuary into the Pacific Ocean. As a result of this, pollutants from Mexico have a significant effect on the water quality in the Tijuana River (Tijuana River Valley Recovery Team (TRVRT), 2012; Weston Solutions, 2012). Although the major contribution of pollutants originates in Mexico, multiple land uses and pollutant generating activities also occur within the United States which can contribute to water quality issues in the Tijuana River WMA. This section includes several figures to provide geographic context for the watershed, its jurisdictional authorities, and the land uses that may be potential sources of pollutants.

Within the U.S. side, discharges from Municipal Separate Storm Sewer Systems (MS4s) may also cause or contribute to impairments in the Tijuana River WMA. Discharges specifically into and from MS4s are the focus of this document. As implied by the name, MS4s are municipal systems owned by a state, city, town, village, or other public entity that may discharge to waters of the U.S. These systems are distinct from combined sewer systems that exist in many older cities of the U.S. in which both storm water and sanitary sewage are combined in one system and conveyed to a publicly owned treatment works. MS4s are drainage systems intended to convey storm water away from developed areas and, unlike combined systems, do not generally provide treatment prior to discharge to receiving waters. As discussed in the following sections, discharges from MS4s are regulated by both Federal and State requirements.

> *What is an MS4?*
>
> - **M**unicipal
> - **S**eparate
> - **S**torm
> - **S**ewer
> - **S**ystem

1.1 DOCUMENT ORGANIZATION

This document is divided into five sections that generally follow the organization of Provision B of the Permit. As applicable, corresponding permit provisions are included below.

- **Section 1 Introduction:** This section provides context for the Water Quality Improvement Plan (WQIP) describing the regulatory framework, WQIP purpose, and WQIP development process. It also provides background information on the Tijuana River Watershed and WMA Area.
- **Section 2 Priority Water Quality Conditions (B.2):** This section identifies the highest priority water quality conditions to be addressed by the WQIP, sources of those conditions, and potential

strategies for addressing them. It also describes in detail the process to identify the highest priority water quality conditions, consistent with Permit requirements.

- **Section 3 Water Quality Improvement Goals, Strategies, and Schedules (B.3):** This section identifies and develops specific water quality improvement goals, strategies, and schedules to address the highest priority water quality condition identified within the Tijuana River WMA. As part of this step, the City of San Diego estimated the funding needs to implement the jurisdictional strategies needed to achieve the goals identified.
- **Section 4 Water Quality Improvement Monitoring and Assessment Program (B.4):** This section describes the monitoring and assessment program that will be used to monitor progress and evaluate results during the implementation of the WQIP.
- **Section 5 Iterative Approach and Adaptive Management Process (B.5):** This section describes the iterative and adaptive management procedures the Responsible Agencies (RAs) will use to modify the WQIP over time, as necessary.

1.2 REGULATORY FRAMEWORK

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act. The Act was significantly reorganized and expanded in 1972 and became commonly known as the "Clean Water Act," (United States Environmental Protection Agency (U.S. EPA), 2014).

In 1987, Congress amended the CWA establishing a framework for regulating storm water discharges from municipal storm sewers under the National Pollutant Discharge Elimination System (NPDES). Through the amendments, Congress directed the U.S. EPA to develop regulations with requirements for storm water discharges from MS4s, and required individual states to establish programs for writing permits and regulating storm water discharges. In California, the State Water Resources Control Board (State Board) and nine Regional Water Quality Control Boards (Regional Boards) serve as the principal state agencies with primary responsibility for coordination and control of water quality. The San Diego Regional Board oversees the San Diego Region for all watersheds draining into the Pacific Ocean between the Santa Ana Region and U.S. Mexico Border.

Through the Basin Plan, the Regional Board (2012) designated Beneficial Uses for the Region’s surface and ground waters as well as water quality objectives for the reasonable protection of those uses. Beneficial Uses are the “uses of water necessary for the survival or well-being of man, plants, and wildlife” (ibid). The waters of the Tijuana River WMA support a number of Beneficial Uses including warm freshwater habitat (WARM), marine habitat (MAR), and several others. See Appendix A for the full list of Beneficial Uses in the Tijuana River WMA.

A primary responsibility of the Regional Board is to issue waste discharge requirements through permits to ensure compliance with applicable provisions of the CWA. The Regional Board has issued a series of permits addressing storm water discharges from MS4s. Prior permits have focused on prescriptive, mandated activities and actions while the current permit, the fifth-term permit, “shifts focus of the permit requirements from a minimum level of actions to be implemented by the RAs to identifying outcomes to be achieved by those actions" (Regional Board, 2013).

The Regional Board adopted the fifth-term permit, Order Number R9-2013-0001, NPDES No. CAS0109266 ("the Permit"), on May 8, 2013 (Regional Board, 2013), specifying new requirements for discharges from Phase I MS4s draining to the watershed within the San Diego Region. The RAs, as they are generally referred to in this document, are responsible for complying with the Permit requirements. In the Tijuana River WMA, the RAs include the City of Imperial Beach, the City of San Diego, and the County of San Diego.

While this document focuses on storm water discharges from MS4s and the Permit requirements associated with addressing those discharges, it should be noted that additional permits and regulatory constructs are in place to address storm water discharges from other sources. For example, storm water discharges from industrial sites are covered by the Industrial General Permit (IGP) (State Board Order No. 2014-0057, effective July 1, 2015); storm water discharges from construction sites are covered by the Construction General Permit (CGP) (State Board Order No. 2012-0006-DWQ), and storm water discharges from small MS4s are covered by the small MS4 (Phase II) general permit (State Board Order No. 2013-0001-DWQ). Each is regulated by state-wide general permits issued by the State Board. Owners or operators of these entities must apply for permit coverage and comply with permit requirements to protect water quality. Both the State Board and Regional Board may also issue individual permits directly to dischargers specifying requirements for managing discharges. For example, the State Board has issued a state-wide individual permit for storm water discharges from California Department of Transportation (Caltrans) sites (State Board Order No. 99-06-DWQ), and the Regional Board has issued an individual permit to Naval Base Coronado (Regional Board Order No. R9-2009-0081) and to the U.S. International Boundary and Water Commission (USIBWC) (South Bay International Wastewater Treatment Plant (Regional Board Order No. R9-2014-0094 as amended by R9-2014-0009). Permitted entities have the primary responsibility for implementing permit requirements including the control of pollutant discharges, but RAs require Best Management Practices (BMPs) and do have inspection and have some regulatory oversight authority over some of these sites (e.g., industrial and construction) located within their jurisdiction.

Some sources are exempt from permit requirements. For example, conditional waivers that remove the need to file a Report of Waste Discharge (ROWD) and avoid the need for NPDES permit coverage are given to activities such as agriculture and nursery operations, on-site disposal systems, silvicultural operations, and animal operations. The U.S. Customs and Border Protection also received a waiver for storm water discharges during construction of the border fence along the U.S.-Mexico border due to national security. Lastly, discharges from the Mexican side of the watershed are regulated by Mexican authorities, and evidently are outside of the reach of the NPDES permits.

1.3 WATER QUALITY IMPROVEMENT PLAN

The Permit includes a requirement to develop a WQIP. The purpose of the WQIP is to guide jurisdictional runoff management programs toward achieving the outcome of improved water quality in receiving waters. According to the Permit, "the goal of the WQIP is to protect, preserve, and enhance the water quality and designated Beneficial Uses of waters of the state. This goal will be accomplished through an adaptive planning and management process that identifies the highest priority water quality conditions within a watershed and implements strategies on a jurisdictional basis to achieve improvements in the quality of discharges from the MS4s and receiving waters."

1.4 WQIP DEVELOPMENT SCHEDULE AND PUBLIC PARTICIPATION

The WQIP was developed in stages over a multi-year period. The Permit requires that the RAs consider public input during the development of the WQIP. The public process involved multiple opportunities for the public to participate and comment on the development of the WQIP. This participation has involved two public workshops to solicit information, two consultation panel meetings comprised of representatives of the Regional Board, the environmental groups, development groups as well as members from the public; and three public review periods to solicit comments on the development of and submittal of a draft final WQIP.

The first public review of the WQIP, including the priority water quality conditions, MS4 sources of those conditions, and potential strategies, occurred from June 27, 2014 until July 28, 2014. The second public review period, including the WQIP water quality improvement goals, strategies, and schedules, occurred from December 25, 2014 until January 24, 2015. The final public comment period will occur after the draft final WQIP is submitted to the Regional Board no later than June 27, 2015. Comments from each of these reviews will be considered and incorporated as needed prior to the WQIP being approval by the Regional Board. See Table 1-1.

Table 1-1
WQIP Development Milestones and Opportunities for Public Participation

Milestone	Date
Permit Effective Date	June 27, 2013
First Public Workshop	January 28, 2014
First Consultation Panel Meeting	May 12, 2014
Sections 1 and 2 of WQIP Submitted to Regional Board for Public Review	By June 27, 2014
Second Consultation Panel Meeting	October 30, 2014
Second Public Workshop	August 19, 2014
Section 3 of WQIP Submitted to Regional Board for Public Comment	December 25, 2014
Complete WQIP Submitted to Regional Board for Public Review	By June 27, 2015

1.5 TIJUANA RIVER WATERSHED AND WATERSHED MANAGEMENT AREA

1.5.1 Tijuana River Watershed

The Tijuana River Watershed covers a range of natural ecosystems – from 6,000-foot pine forest-covered mountains in the east to the tidal saltwater estuary at the mouth of the Tijuana River and sandy beaches along the Pacific shoreline in the west (TRVRT, 2012). Annual rainfall ranges from more than 22.5 inches in the inland areas to approximately ten inches or less at the coast (San Diego County Water Authority et al., 2013).

The major water features in the watershed include the Tijuana River Estuary, Tijuana River, Cottonwood Creek, Pine Valley Creek, Campo Creek, Barrett Reservoir, and Lake Morena on the U.S. side and the El Carrizo Reservoir, Abelardo L. Rodríguez Reservoir, and Río Las Palmas system on the Mexico side. The Rio Las Palmas system joins with the Cottonwood-Alamar system (primarily in the U.S.) to form the Tijuana River before crossing into the U.S. from Mexico (San Diego County Water Authority et al., 2013).

There are four major dams that control a majority of surface flow in the watershed (TRVRT, 2012): Barrett and Morena in the U.S., and Rodríguez and El Carrizo in Mexico. Water flows in the upper reaches of the Tijuana River WMA are eventually impounded in either Moreno Reservoir or Barrett Lake. Most outflows from Barrett Lake which also includes outflow from Morena Reservoir are diverted from the Tijuana River Watershed into Otay Lake located in the Otay Hydrologic Unit (Weston Solutions, Inc., 2012). The dams serve primarily to store and provide water, but they also trap pollutants such as sediment originating upstream thereby reducing their downstream movement through the watershed (TRVRT, 2012).

The border region experienced rapid urbanization in the late 20^{th} Century, especially on the Mexican side (Pauw, 1995). While the total population of the watershed is approximately 2.8 million people, only 83,000 live on the U.S. side (San Diego County Water Authority et al., 2013). Urbanization is a principal contributor to water quality impairment (National Research Council (NRC), 2009), and most of the flow of the Tijuana River Watershed below the dams drains through highly urbanized areas before discharging into the Pacific Ocean (San Diego State University (SDSU), 2005). This includes the main channel of the Tijuana River as well as other major drainages from Mexico that flow into the lower Tijuana River Valley and Estuary such as flows from Yogurt Canyon (Los Sauces), Goat Canyon (Los Laureles), and Smuggler's Gulch (Los Mataderos). Both the Tijuana River and major tributary drainages transport significant pollutants from the urbanized areas of Tijuana directly into the Tijuana River Valley (TRVRT, 2012).

Historically, the Tijuana River was an intermittent river (San Diego County Water Authority et al., 2013) that flowed primarily during the rainy season. However, the growth of the City of Tijuana brought significant non-storm water sources to the river channel from Mexico into the U.S., including discharges contaminated with raw sewage (Regional Board, 1996). As early as 1965, the City of San Diego proposed and signed an agreement to treat portions of Tijuana's sewage (Pauw, 1995). More recently, the U.S. and Mexico built the South Bay International Wastewater Treatment Plant (SBIWTP) to treat wastewater and to minimize and prevent the contamination of the Tijuana River, the estuary, and ocean shoreline from sewage flows originating from Tijuana (San Diego County Water Authority et al., 2013). The SBIWTP is owned and administered by the USIBWC and operates under contract with a private consultant. The plant treats an average daily flow of 25 million gallons per day (MGD). The USIBWC also maintains five small canyon diverters located immediately north of the border at the Silva Drain, Cãnon del Sol, Stewarts Drain, Goat Canyon, and Smuggler’s Gulch that capture and direct cross-border flows to the plant for treatment. However, during storm or significant dry weather flow events, the river often overflows the diversion system allowing sewage to discharge untreated into the United States.

1.5.2 Tijuana River WMA

Approximately 27 percent of the Tijuana River Watershed is on the U.S. side of the international border. This portion of the watershed is referred to as the Tijuana River WMA. Figure 1-1 shows the Tijuana River Watershed as well as the WMA. The Permit is limited to the WMA, and local responsibility is split among three jurisdictions: the City of Imperial Beach, the City of San Diego, and the County of San Diego (Responsible Agencies or RAs).

The Tijuana River WMA is subject to a range of sources that impact water quality. For example, the Tijuana River is often made up of commingled flow with substantial discharges from the Mexican portion of the watershed that can cause significant impacts to water quality in the Tijuana River WMA (TRVRT, 2012; Weston Solutions, Inc., 2012). Figure 1-2 provides an illustration of the relative levels of urbanization in the watershed and shows significantly more urbanization on the Mexican side of the border.

This WQIP refers to two areas of the Tijuana River WMA, the Lower Watershed and Upper Watershed, because of their unique attributes and position in the watershed. While this document considers the entire WMA, the analysis of water quality data and potential MS4 pollutant sources documented in Section 2 note that the Lower Watershed includes most of the urbanization and MS4 infrastructure in the WMA. The Lower Watershed includes the Tijuana Valley Hydrologic Area (HA) (HA Code 911.1) which includes the two following Hydrologic Subareas (HSAs), the San Ysidro (911.11) and Water Tanks (911.12). The Lower Watershed is subject to commingled flows from both Mexico and the U.S. Unlike the Lower Watershed, the Upper Watershed is rural. The Upper Watershed includes the remaining portion of the Tijuana River WMA upstream of the Tijuana Valley which includes the Potrero (911.2), Barrett Lake (911.3), Monument (911.4), Morena (911.5), Cottonwood (911.6), Cameron (911.7), and Campo (911.8) Hydrologic Areas (Figure 1-3).

Figure 1-1
Tijuana River Watershed and Watershed Management Area (WMA)

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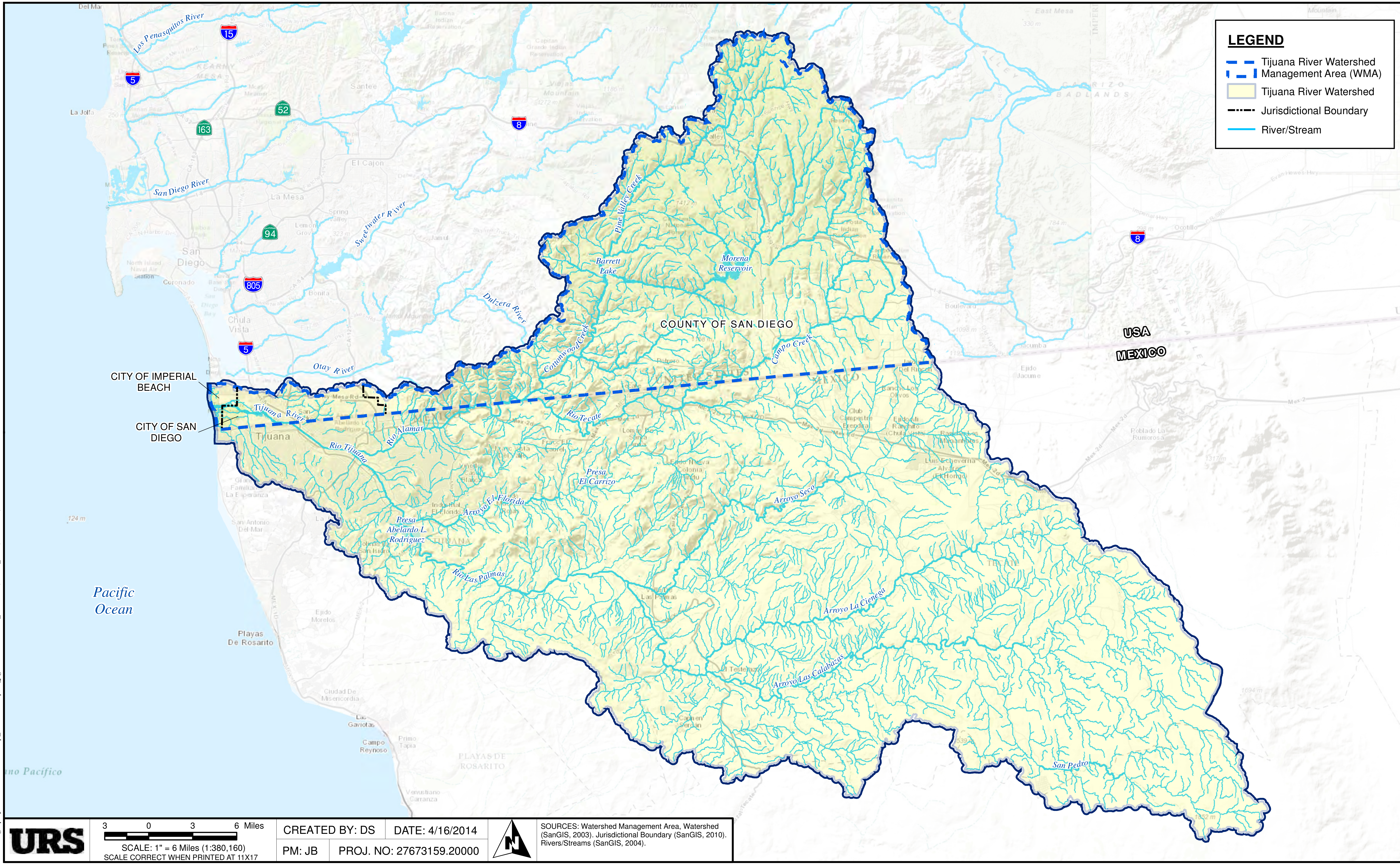

FIGURE 1-1 TIJUANA RIVER WATERSHED AND WATERSHED MANAGEMENT AREA (WMA)

Figure 1-2
Relative Locations of Urbanized Areas

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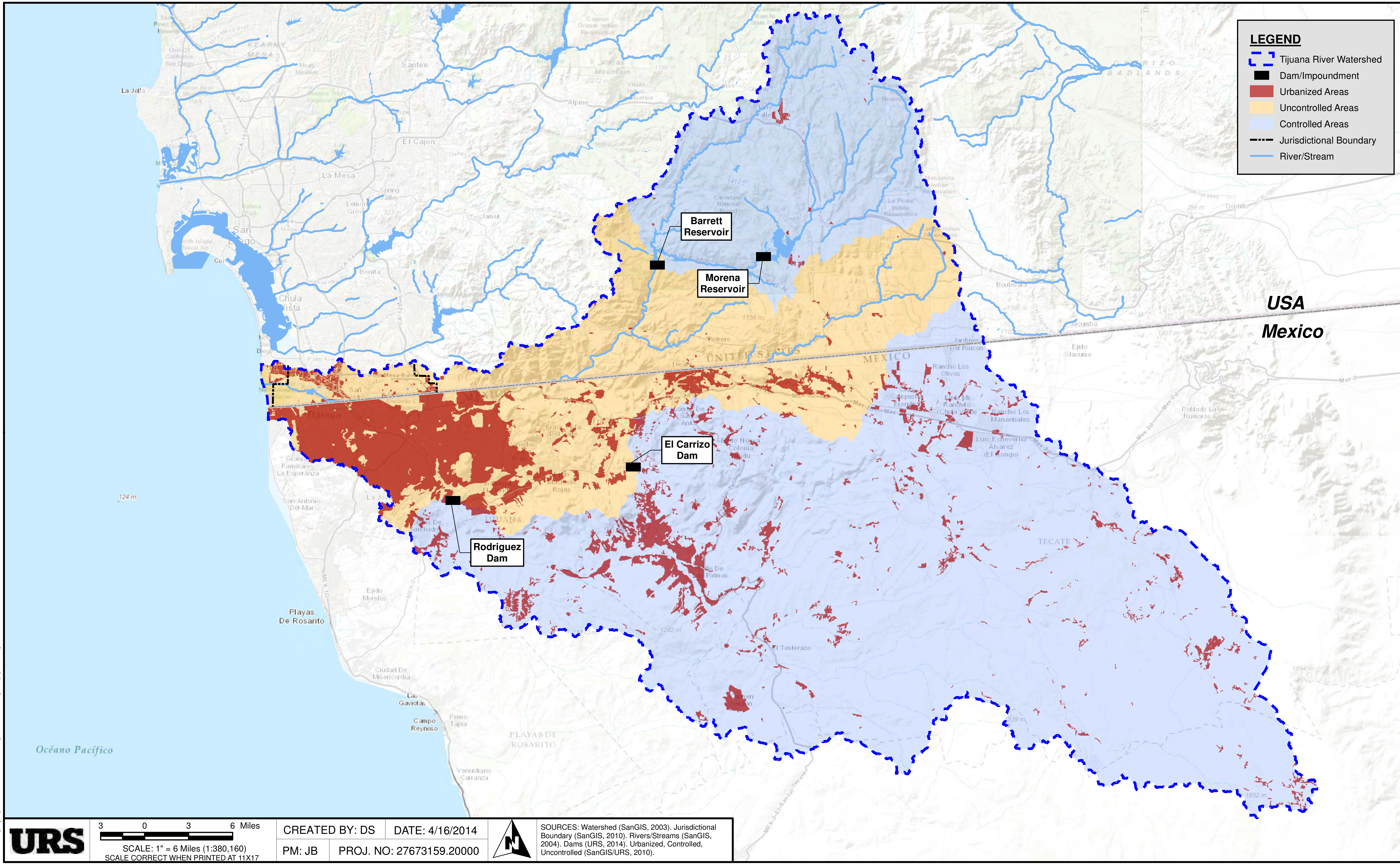

FIGURE 1-2 RELATIVE LOCATIONS OF URBANIZED AREAS

Figure 1-3
Tijuana River Watershed Management Area (WMA) and Hydrologic Areas

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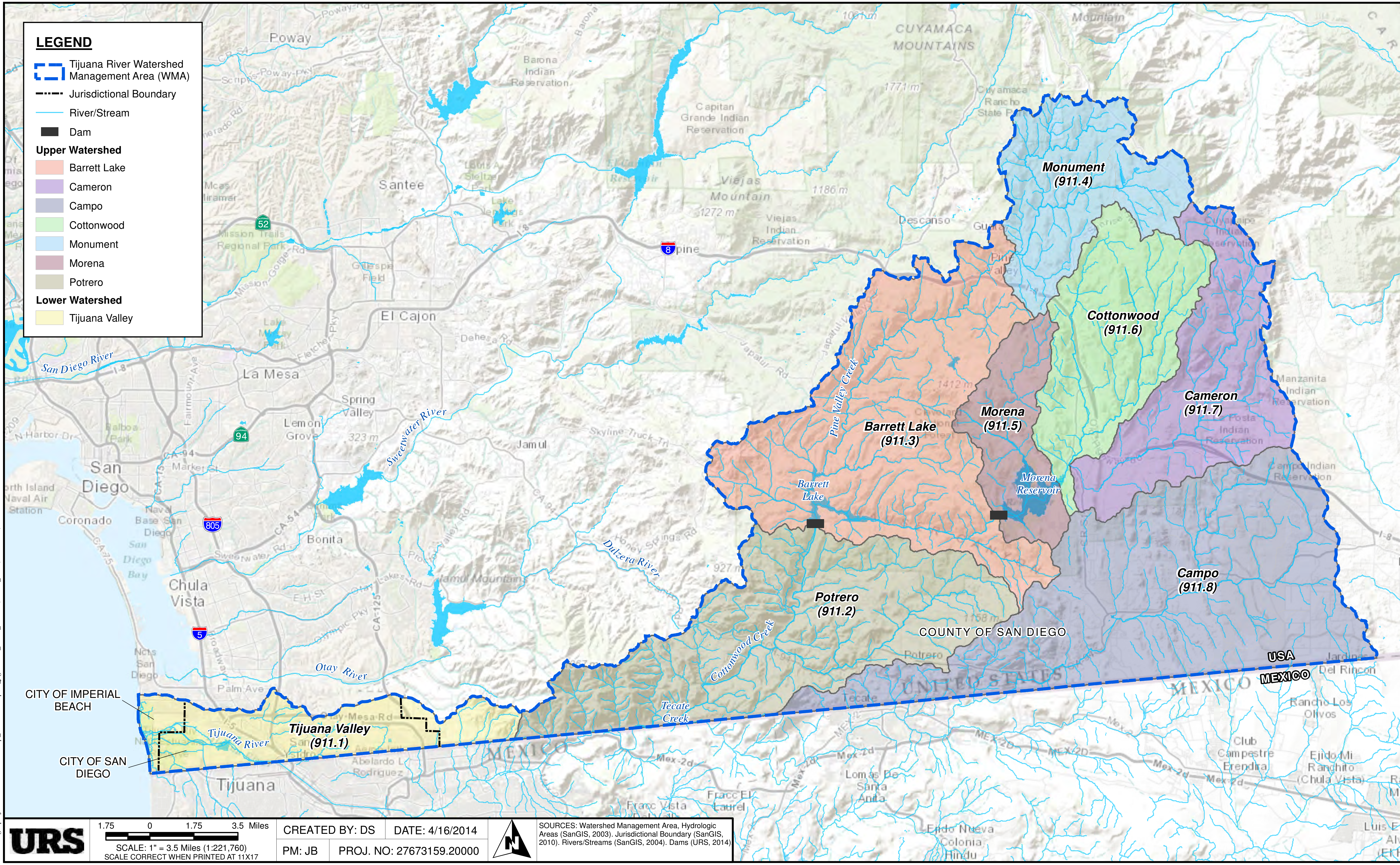

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FIGURE 1-3 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) AND HYDROLOGIC AREAS

Within the Tijuana River WMA, the range of land uses can have different impacts on water quality. Most of the land within the Tijuana River WMA is undeveloped or vacant (58 percent). Other land uses include open space parks or preserve areas (26 percent), residential (10 percent), agriculture (2 percent), freeway (1 percent), and other transportation (2 percent). The remaining uses (e.g., commercial, industrial, military, etc.) make up approximately 1 percent (SANDAG, 2012). Table 1-2 provides a breakdown of land uses by HA. The map provided as Figure 1-4 illustrates the land uses in the Tijuana River WMA and the land use differences between the Upper and Lower Watersheds. The Upper Watershed is nearly 90 percent vacant undeveloped land, open space park or preserve or other park, open space, or recreation. This compares to 55 percent for the Lower Watershed which is still relatively undeveloped compared to other watersheds in the San Diego Region. In general, the land uses in the Tijuana River WMA that would typically drain to MS4 systems and would be subject to MS4 requirements include residential, commercial, etc. These land uses make up a total of approximately 12 percent of the WMA and are located primarily in the Lower Watershed. Both the Upper and Lower Watersheds are relatively undeveloped, but the Lower Watershed encompasses around four times as much of urbanized land uses as the Upper Watershed on a percentage basis.

Discharge responsibility is another factor to consider. As defined in the Permit, a permittee to an NPDES permit is only responsible for permit conditions relating to the discharge for which it is an operator. In the case of the MS4 Permit this includes discharges from large MS4s in the San Diego Region. The San Diego County RAs are listed in Table 1a of the MS4 Permit. Each RA must achieve compliance with the MS4 discharge prohibitions outlined in the MS4 Permit through timely implementation of control measures, other actions specified in the MS4 Permit, and implementation of strategies presented in this WQIP.

The goal of this WQIP is to develop a framework to improve the surface water quality in the Tijuana River WMA by identifying and addressing impairments related to urban runoff discharges from MS4s owned and operated by RAs within the watershed, thereby furthering the CWA's objective to protect, preserve, enhance, and restore water quality.

Surface water quality is affected by many other sources in addition to MS4s. Discharges into receiving waters from non-municipal sources and activities (e.g., runoff from agriculture and industrial land uses; federal/state facilities; and Phase II permittees) have been found to adversely affect water quality in southern California. These sources are regulated separately. While discharges from these sources and activities may be considered under portions of this WQIP as inputs to the MS4, the RAs do not have jurisdictional authority over these agencies and activities. Therefore, the MS4 Permit does not specifically require that control of non-municipal sources be addressed as part of the WQIP.

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Figure 1-4
Tijuana River Watershed Management Area (WMA) Land Uses

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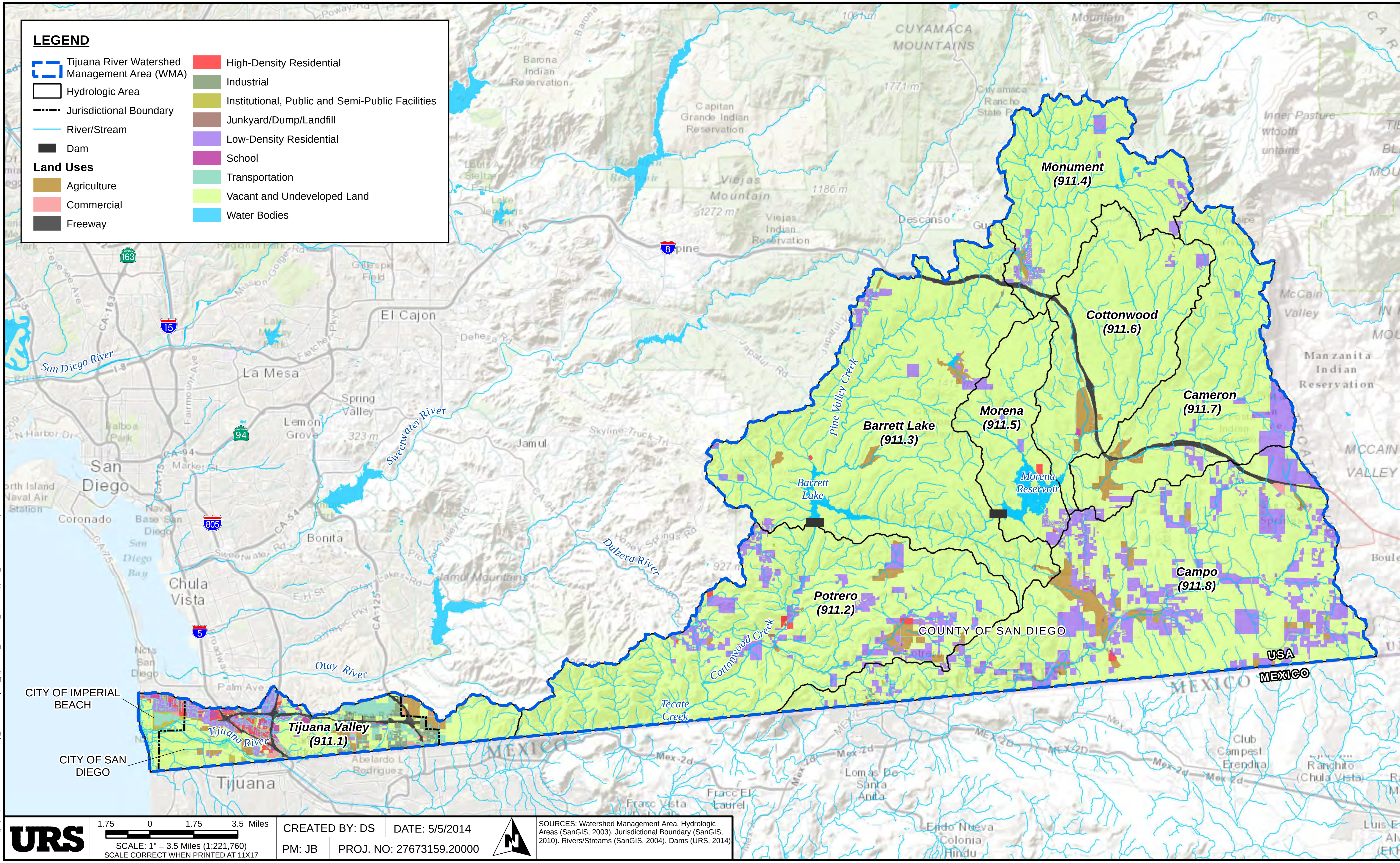

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FIGURE 1-4 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) LAND USES

Table 1-2
Land Uses in the Hydrologic Areas of the Tijuana River WMA

Hydrologic Area	Land Uses and Area (acres[1])													Total[2]
	Agriculture	Vacant and Undeveloped Land	Open Space Park or Preserve	Other Park, Open Space and Recreation	Low-Density Residential	High-Density Residential	School	Institutional, Public and Semi-Public Facilities	Commercial	Industrial	Junkyard/Dump/Landfill	Transportation	Freeway	
Lower Watershed (LW)														
Tijuana Valley (911.1)	1,109	3,630	7,075	139	1,373	605	368	375	340	1,058	20	2,646	964	19,700
Percent (%) of Lower Watershed	6%	18%	36%	1%	7%	3%	2%	2%	2%	5%	<1%	13%	5%	
Upper Watershed (UW)														
Potrero (911.2)	1,185	19,237	26,230	419	5,924	218	6	13	3	-	21	324	-	53,579
Barrett Lake (911.3)	768	34,191	21,572	44	1,224	20	-	10	-	-	-	121	398	58,349
Monument (911.4)	158	20,744	1,348	251	1,136	0	2	12	17	-	-	179	197	24,044
Morena (911.5)	-	11,069	1,419	18	779	72	-	2	1	-	-	48	-	13,408
Cottonwood (911.6)	801	26,290	239	38	291	-	30	34	-	-	-	196	585	28,503
Cameron (911.7)	816	23,338	2,860	60	2,261	0	-	18	5	-	-	135	574	30,067
Campo (911.8)	2,498	34,632	14,854	12	14,873	77	30	89	109	41	29	1,216	260	68,719
% of Upper Watershed	2%	60%	26%	1%	8%	<1%	<1%	<1%	<1%	<1%	<1%	1%	1%	
WMA Total Acreage	7,335	173,130	75,596	981	27,861	993	435	552	475	1,099	69	4,866	2,979	296,370

Source: SANDAG (2012)
[1] Excludes water bodies
[2] To convert acres to hectares, divide values by 2.47.

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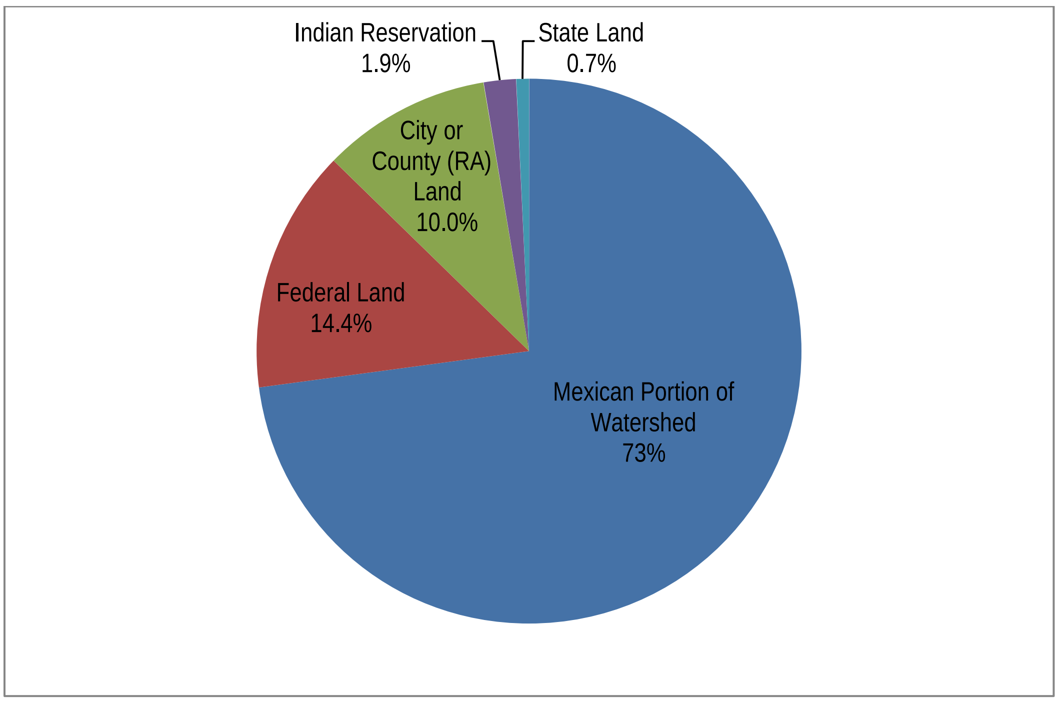
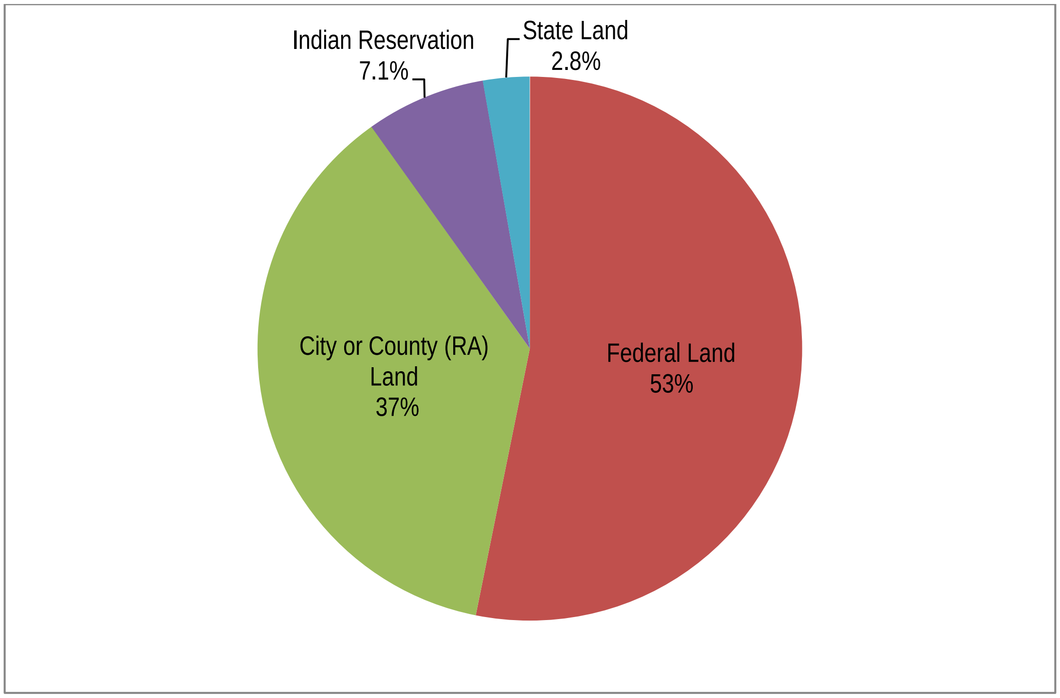
Figures 1-5a and 1-5b present the percentages of jurisdictional responsibility in the watershed and WMA. Figure 1-6a shows the portions of the WMA that are within and outside of the jurisdictions of the responsible agencies in the WMA. The hatched area corresponds to Federal, State, Tribal and other areas where RAs do not have oversight or discharge authority. This portion makes up approximately 89 percent of the WMA. The remaining 11 percent (shown on Figure 1-66) falls under the jurisdiction of the RAs, but the figure does not account for land uses over which RAs have limited responsibilities or authorities (e.g., agricultural, industrial, or school land). The scope of the WQIP is limited to improvements that can be achieved by the RAs, and thus this plan may not address all water quality issues in the Tijuana River WMA. While the focus is on those issues that can be addressed, the RAs' jurisdictional programs do address other priority pollutants. RAs recognize the need for collaboration and improved communication with non-municipal sources to improve water quality throughout the watershed.

Figure 1-5a
Land Area in the Tijuana River Watershed



Source: SANDAG (2012).

Figure 1-5b
Jurisdictional Area in the Tijuana River Watershed Management Area (WMA)



Source: SANDAG (2012).
Total WMA land area (excluding water bodies): 296,370 acres.

Figure 1-6a
Areas Outside the Discharge Responsibility of the Responsible Agencies in the Tijuana River Watershed Management Areas

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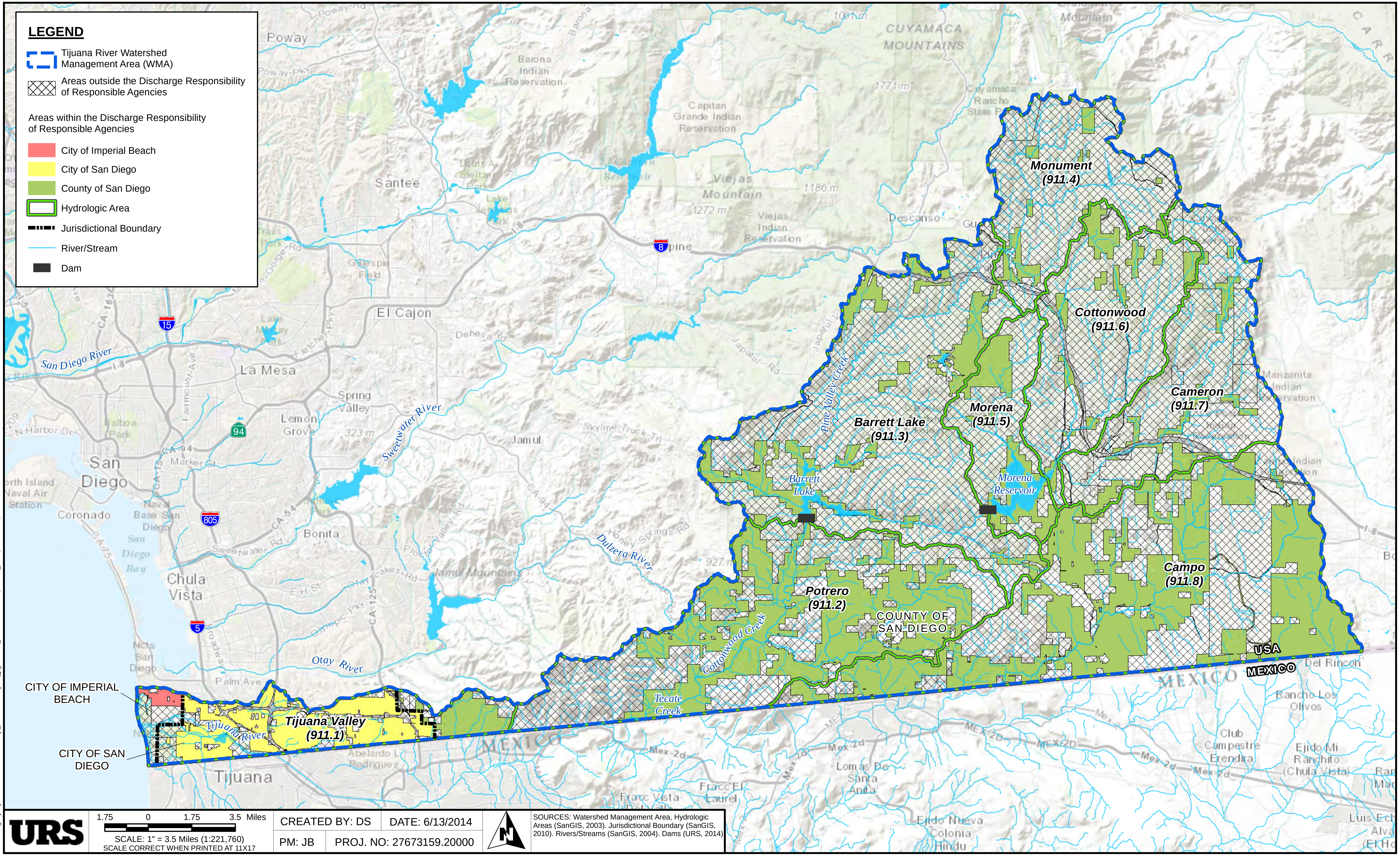

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FIGURE 1-6A AREAS OUTSIDE THE DISCHARGE RESPONSIBILITY OF THE RESPONSIBLE AGENCIES IN THE TIJUANA RIVER WATERSHED MANAGEMENT AREA

Figure 1-6b

Areas Outside the Discharge Responsibility of the Responsible Agencies in the Tijuana River Watershed Management Area (Tijuana Valley)

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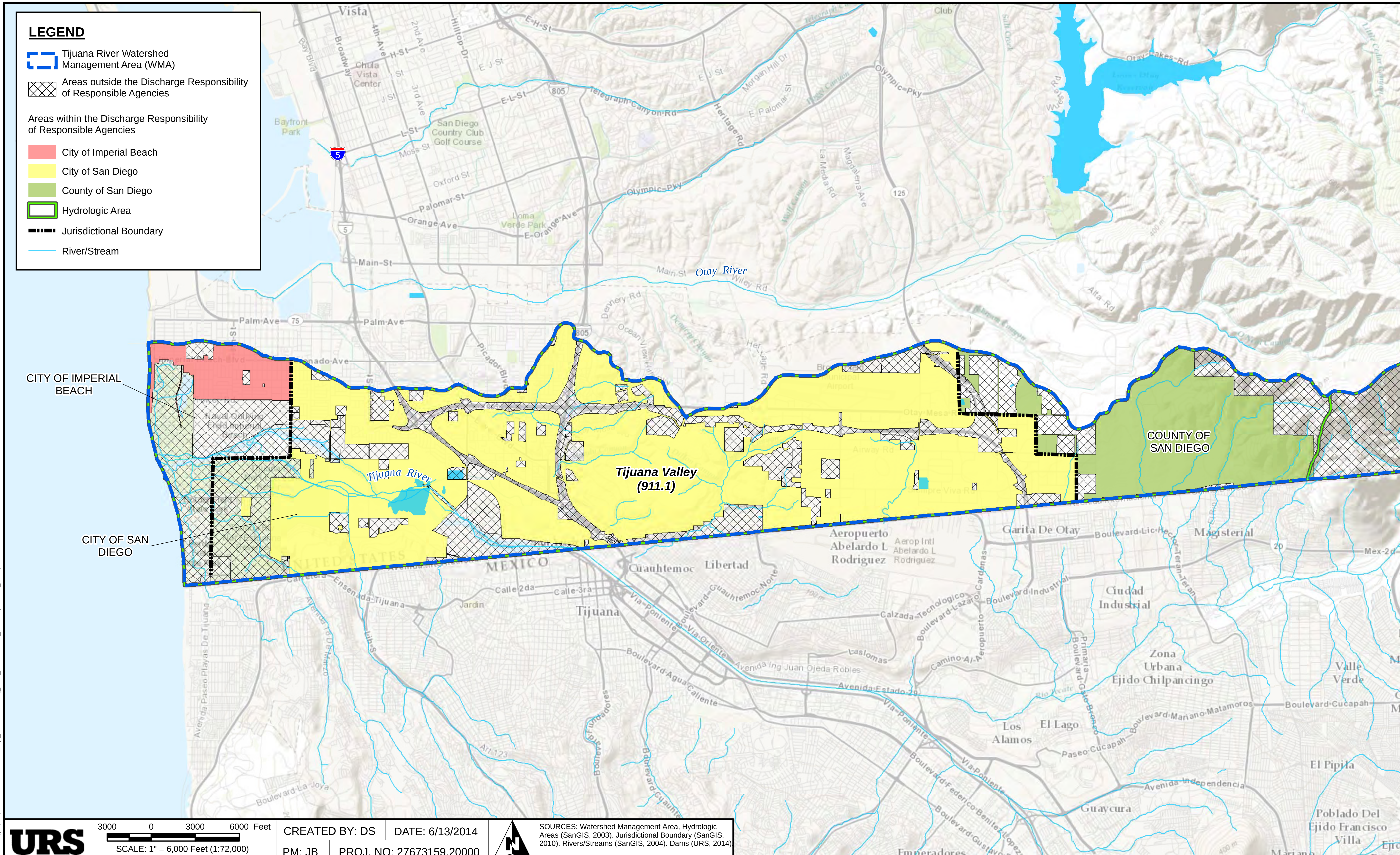

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FIGURE 1-6B AREAS OUTSIDE THE DISCHARGE RESPONSIBILITY OF THE RESPONSIBLE AGENCIES IN THE TIJUANA RIVER WATERSHED MANAGEMENT AREA (TIJUANA VALLEY)

SECTION 2 PRIORITY AND HIGHEST PRIORITY WATER QUALITY CONDITIONS, SOURCES, AND POTENTIAL STRATEGIES

This section documents the identification of receiving water quality conditions in the Tijuana River WMA as well as the subset of those conditions identified as priority and highest priority water quality conditions. In addition, the section identifies and prioritizes potential pollutant sources and/or stressors that may be contributing to the highest priority water quality conditions and potential strategies for addressing them. Table 2-1 describes the primary data and information sources that were used to develop this section.

Table 2-1
Primary Data and Information Sources

Primary Source	Description
2010 303(d) List	Section 303(d) of the Federal Clean Water Act and 40 Code of Federal Regulations (CFR) §130.7 require states to identify water bodies that do not meet water quality standards and are not supporting their Beneficial Uses. Such waters are placed on the Section 303(d) List of Water Quality Limited Segments, generally referred to as the 303(d) List. California last published its 303(d) list of impaired waters in 2010. This list was reviewed as part of the assessment of receiving water conditions, and all impairments in the Tijuana River WMA listed on the 303(d) list were included in the initial comprehensive list of water quality conditions.
Long Term Effectiveness Assessment (LTEA) (Weston Solutions, 2011)	The LTEA was required by the previous San Diego Municipal Storm Water Permit (NPDES Order No. R9-2007-0001) and directed Regional RAs to evaluate the effectiveness of jurisdictional program implementation including multiple years of water quality sampling results. The data presented in the LTEA are based on dry weather and wet weather receiving waters and urban runoff data collected from the 2005–2006 through the 2009–2010 monitoring season.
Receiving Waters and Urban Runoff Monitoring Reports (Weston Solutions, 2012, 2013)	This report summarizes and presents the findings of the annual watershed-based receiving waters monitoring program required by NPDES Order No. R9-2007-0001). This annual report summarizes dry weather and wet weather receiving waters and urban runoff data for a given reporting year. Monitoring alternates between the northern and southern watersheds and occurs in the Tijuana River WMA every other year. These reports also provided results from the Ambient Bay and Lagoon Monitoring Program as well as receiving water data collected by the Storm Water Monitoring Coalition (SMC) and the San Diego Coastkeeper.
Tijuana River Bacterial Source Identification Study – Final Report (Weston Solutions, 2012)	This report documents a study managed by the City of Imperial Beach to assess the potential sources of indicator bacteria on the U.S. side of the Tijuana River Watershed that may be impacting the Tijuana River Estuary and adjacent beaches. The study found that 99 percent of indicator bacteria loads entering the estuary and ocean during wet weather originate from undiverted flows from the Tijuana River main channel and tributary channels from Mexico. During dry weather, semi-natural best management practices (BMPs) such as soft-bottom sediments and ponds at the base of major sub-drainages prevent the large majority of dry weather flows from entering the estuary. The study also found very little hydrologic connection between watershed surface waters and the estuary.

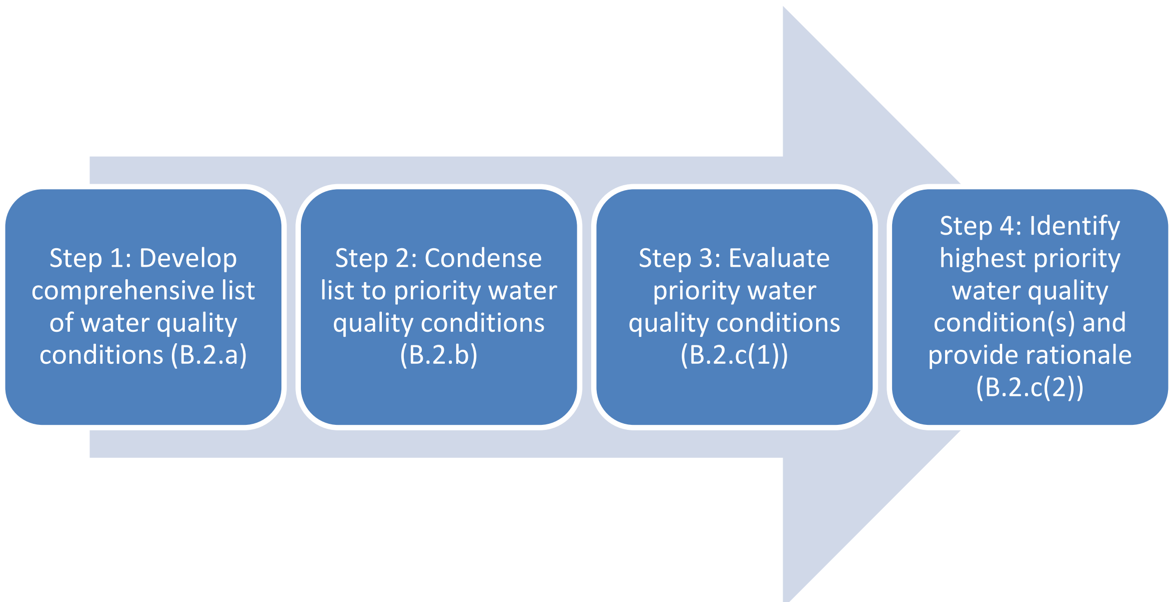
Table 2-1
Primary Data and Information Sources

Primary Source	Description
Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash, Total Maximum Daily Loads (TMDLs) (Tetra Tech, 2010):	This draft technical report was written to support the development of solids, turbidity, and trash TMDLs for the Tijuana River and Estuary. The document was not formally adopted following public review and comment, but the preliminary estimates help to inform the understanding of solids, turbidity, and trash in the WMA. The report calculates the pollutant loads from the range of sources in the watershed and includes estimates of Total Suspended Solids (TSS) concentrations in runoff by land use, based on data compiled by Ackerman and Schiff (2003) from land use monitoring programs throughout Southern California, and estimates of trash accumulation rates by land use developed by the City of Los Angeles (2002). The document source was used to develop the relative magnitudes of sediment and trash in storm water discharges by land use and the relative contributions from the MS4.

2.1 IDENTIFICATION OF RECEIVING WATER CONDITIONS

The Permit requires the RAs to assess receiving waters and potential contributing impacts from the MS4s in their WMAs and then develop a comprehensive list of priority water quality conditions as “pollutants, stressors and/or receiving water conditions that are the highest threat to receiving water quality or that most adversely affect the quality of receiving waters” (Provision B.2.c). The list of priority water quality conditions must be evaluated and then the highest priority water quality conditions to be addressed by the WQIP must be identified along with rationale for their selection. The discussion that follows describes the approach to evaluate the water quality conditions in the Tijuana River WMA consistent with Permit requirements and to identify and assess the priority and highest priority water quality conditions appearing in this WQIP. Figure 2-1 provides an overview of the process utilized to identify the highest priority water quality conditions. The relevant Permit section for each step is referenced. The steps are described in greater detail below.

Figure 2-1
Conceptual Process to Identify Highest Priority Water Quality Conditions



The first step in identifying the highest priority water quality conditions is to assess the state of the receiving waters in the WMA and develop a comprehensive list of the water quality conditions. Provision B.2.a of the Permit provides a list of nine factors that must be considered. These factors include:

1. Receiving waters listed as impaired on the CWA Section 303(d) List of Water Quality Limited Segments;
2. TMDLs adopted and under development by the Regional Board;
3. Receiving waters recognized as sensitive or highly valued by the RAs;
4. The receiving water limitations of Provision A.2;
5. Known historical versus current physical, chemical, and biological water quality conditions;
6. Available, relevant, and appropriately collected and analyzed physical, chemical, and biological receiving water monitoring data;
7. Available evidence of erosional impacts in receiving waters due to accelerated flows (i.e., hydromodification);
8. Available evidence of adverse impacts to the chemical, physical, and biological integrity of receiving waters; and
9. The potential improvements in the overall condition of the WMA that can be achieved.

Receiving water conditions were assessed through the stepwise process detailed below. Table 2-2 summarizes the results of the assessment.

2.1.1 Receiving Waters Listed as Impaired on the CWA Section 303(d) List of Water Quality Limited Segments (303(d) List)

The 2010 303(d) list includes 12 impaired water body segments impacting eight different Beneficial Uses designated in the Tijuana River WMA. The beneficial designated to the waters of the Tijuana River WMA are described in the Basin Plan and provided in Appendix A of this document. The impacted Beneficial Uses are considered again during the identification of highest priority water quality condition.

Table 2-2 below provides the name and location of the impaired water body segments in the Tijuana River WMA, the Beneficial Use(s) impaired, and the pollutant or pollutants responsible for impairment. Figure 2-2 indicates the geographical extent of the impaired water bodies. The number of impairments has increased since issuance of the previous list, specifically the Pacific Ocean listing, which was further refined to characterize smaller segments of the same receiving water. It should be noted that the five new listings are for the same impairment. The 303(d) list indicates the estimated size of the area affected by the impairment and the potential source(s) causing the impairment if known or suspected.

Table 2-2
303(d)-Listed Impaired Waters in the Tijuana River WMA

Receiving Water Segment	Pollutant																										Beneficial Uses Impacted
	Indicator Bacteria	Total Coliform	Fecal Coliform	Enterococcus	Turbidity	Solids	Sedimentation/Siltation	Trash	Total Nitrogen as N	Ammonia as Nitrogen	Phosphorus	Eutrophic	Low Dissolved Oxygen	Pesticides	Surfactants (MBAS)	Lead	Manganese	Nickel	Selenium	Thallium	Trace Elements	Synthetic Organics	Perchlorate	Color	pH	Toxicity	
Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River		•	•	•																							REC-1
Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive		•	•	•																							REC-1 SHELL
Pacific Ocean Shoreline, Tijuana HU, at Monument Road		•	•																								REC-1
Pacific Ocean Shoreline, Tijuana HU, at the US Border		•	•	•																							REC-1 SHELL
Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth		•	•	•																							REC-1
Tijuana River (6 miles afffected)	•					•	•	•	•		•	•	•	•	•				•		•	•				•	REC-1 and 2 MUN WARM
Tijuana River Estuary (1320 acres affected)	•				•			•				•	•	•		•		•		•							REC-1 and 2 COMM EST MAR
Tecate Creek (1 mile affected)																			•								WARM
Barrett Lake (125 acres affected)									•								•						•	•	•		MUN WARM
Pine Valley Creek (Upper) (3 miles affected)					•																						MUN
Morena Reservoir (104 acres affected)										•	•						•							•	•		MUN WARM
Cottonwood Creek (53 miles affected)																			•								WARM

REC-1: Contact Water Recreation – Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible.
REC-2: Non-Contact Water Recreation – Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water.
SHELL: Shellfish Harvesting – Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish for human consumption.
COMM: Commercial and Sport Fishing – Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms.
MUN: Includes uses of water for community, military, or individual water supply.
EST: Includes uses of water that support estuarine ecosystems.
MAR: Marine Habitat – Includes uses of water that support marine ecosystems.
WARM: Warm Freshwater Habitat – Includes uses that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

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Figure 2-2
Tijuana River Watershed Management Area (WMA) 303(d)-Listed Impaired Waters

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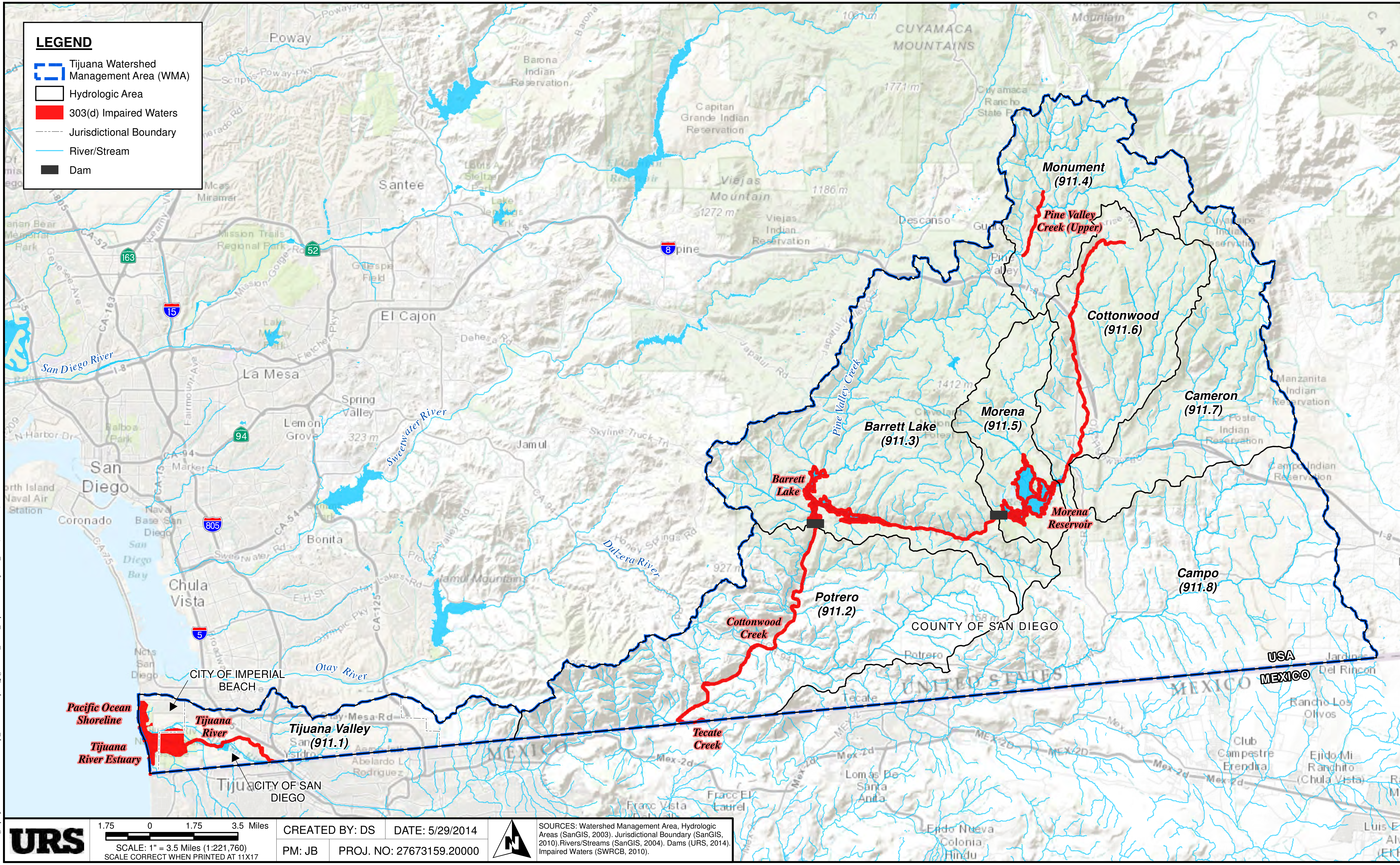

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FIGURE 2-2 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) 303(D)-LISTED IMPAIRED WATERS

2.1.2 TMDLs Adopted and under Development by the Regional Board

Provision B.2.a.(2) requires consideration of any TMDLs that have been adopted or are under development by the Regional Board as they identify priority and highest priority water conditions. The RAs note that no TMDLs have been adopted by the Regional Board. The 303(d) list indicates expected completion dates for TMDLs. Although the list indicates that a TMDL for indicator bacteria for the Tijuana River and Tijuana River Estuary was to be developed and implemented by 2010, no indicator bacteria TMDL has been developed. The list also indicates that other TMDLs for the WMA were expected to be developed and implemented between 2019 and 2020. TMDLs were under development by the U.S. EPA and the Regional Board in 2010 specific to turbidity, sediment and trash. In 2008, the Regional Board in partnership with the landowners and other stakeholders in the WMA formed the TRVRT with the goal of a Tijuana River Valley with sediment managed and trash eliminated. The Regional Board continues to support this collaborative approach to addressing these impairments to the Tijuana River WMA and has developing a Five-year Plan that will include projects to attain these goals. The Five-year Plan was endorsed by the Regional Board in March 2015. The Sediment and Trash TMDL is deferred for now while the Regional Board continues to take a stakeholder cooperation approach through a collective effort of the TRVRT (Regional Board, 2013). The Regional Board will continue to support this collaborative approach provided that there is continued progress in addressing trash and sediment impairments to the water bodies in the WMA.

2.1.3 Sensitive or Highly Valued Receiving Waters

Provision B.2.a.(3) requires that receiving waters that are recognized as sensitive or highly valued to be included in this category. These include “Waters having the Preservation of Biological Habitats of Special Significance (BIOL) Beneficial Use designation.” Waters in the Tijuana River WMA that have this designation include the portions of the Tijuana River Estuary (Regional Board, 2012) listed below:

- Tijuana Estuary Natural Preserve (designated as a Natural Preserve by the State Park and Recreation Commission),
- Tijuana River National Estuarine Research Reserve (TRNERR, designated a National Estuarine Research Reserve by the National Oceanic and Atmospheric Administration (NOAA)), including Border Field State Park, and
- Tijuana Slough National Wildlife Refuge (managed by the U.S. Fish and Wildlife Service as part of the National Wildlife Refuge System).

Because the Tijuana River Estuary is included on the list of impaired waters, it was already included on the list of water quality conditions. The “highly valued” status of the Tijuana River Estuary will be considered again as a filter in the identification of highest priority water quality condition in Section 2.4.

2.1.4 Receiving Water Limitations

Provision B.2.a.(4) requires RAs to consider Receiving Water Limitations in Provision A.2 as part of the assessment of receiving water conditions. These limitations are analyzed by reviewing available receiving water monitoring data, visual assessments, and other information on receiving water integrity, as described in the following subsections and comparing the results of those assessments to receiving water limitations. Sampling results were compared to water quality benchmarks (e.g., from the Basin Plan) to identify the frequency (as a percentage) that water quality parameters were above benchmarks. The applicable receiving water limitations are listed with the receiving water conditions identified below.

2.1.5 Available, Relevant, and Appropriately Collected and Analyzed Physical, Chemical, and Biological Receiving Water Monitoring Data

Multiple sources of receiving water monitoring data were available to further evaluate receiving water conditions in the Tijuana River WMA. The locations of these sampling stations are shown in Figure 2-3. These stations served as the primary sources of receiving water monitoring data in the Tijuana River WMA and provide information representative of receiving water quality in the upper and lower portions of the Tijuana River WMA. These included two Temporary Water Assessment Stations (TWAS-1 and TWAS-2) and one Mass Loading Station (MLS) established in the Tijuana WMA. The MLS and TWAS-2 stations are located in the Lower Watershed where land is more developed than in Upper Watershed and where flow may be influenced by contributions from the Mexican portion of the Watershed. The TWAS-1 station is located in the less urbanized Upper Watershed and monitors water quality uninfluenced by flows from Mexico. During the 2010-2011 monitoring season, no sampling occurred at the MLS, TWAS-1, or TWAS-2 station, but sampling occurred at SMC stations.

Several additional sources of data were also available to provide information on receiving water quality in the WMA including data from Ambient Bay and Lagoon Monitoring (ABLM); San Diego Coastkeeper, and the Tijuana River Bacterial Source Identification Study. Table 2-3 summarizes the receiving water sampling locations.

The receiving water monitoring data described in this subsection were reviewed and compared to receiving water limitations to identify additional receiving water conditions in the Tijuana River WMA. Receiving water conditions were identified in this WQIP when more than 25 percent of samples exceeded water quality benchmarks for a given constituent. This is consistent with the model used in the Weston Reports to identify priority constituents in which medium priority constituents were identified when more than 25 percent of samples exceeded water quality benchmarks, and high priority constituents were identified when more than 50 percent of samples exceeded benchmarks.

Table 2-4 summarizes the results of this analysis. The table presents the additional receiving water conditions identified and supporting information, including source of sampling data, temporal extent, and applicable receiving water limitation. Actual monitoring results including numbers of samples and water quality benchmarks are provided in Appendix B.

Figure 2-3
Primary Receiving Water Sampling Locations

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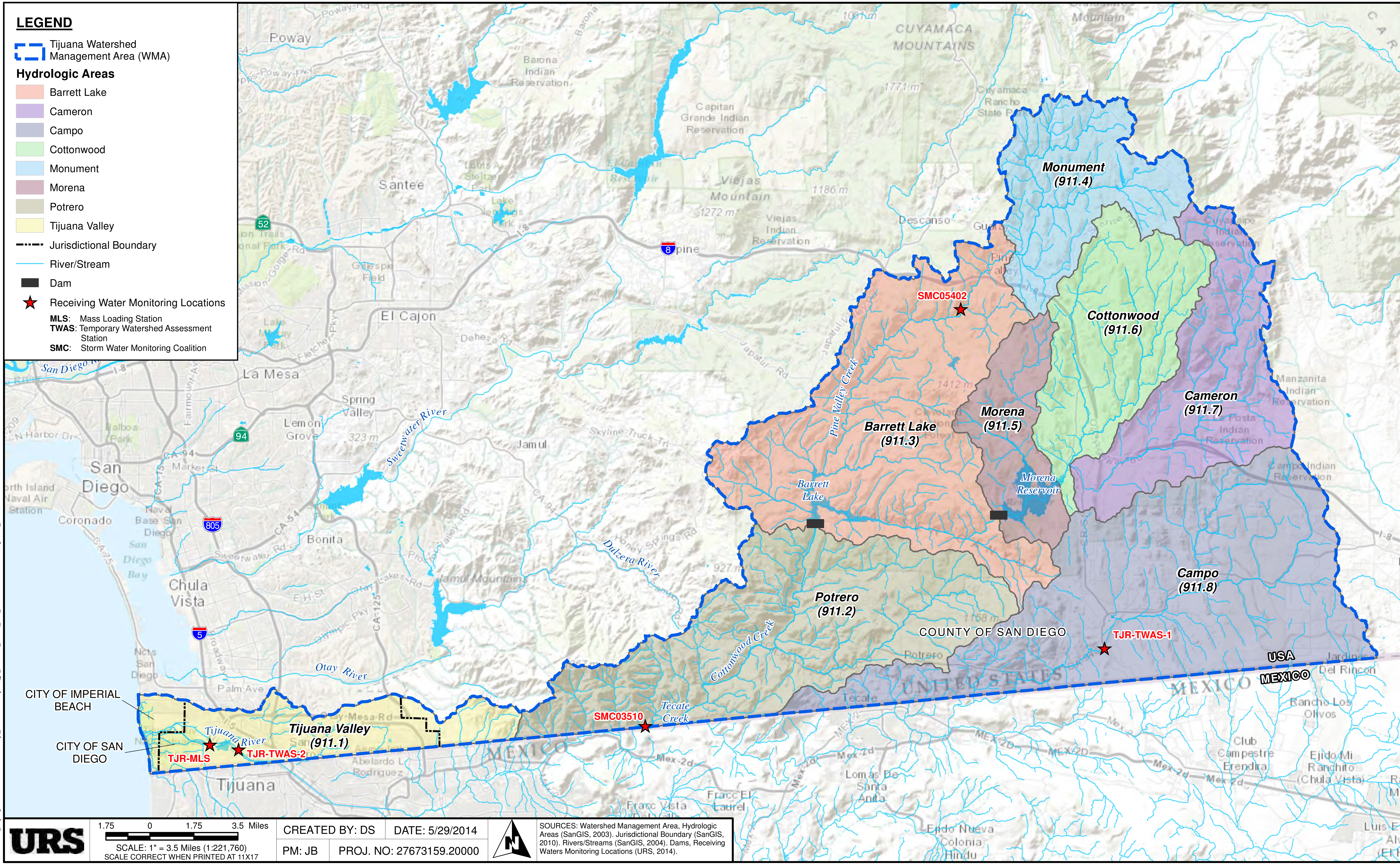

FIGURE 2-3 PRIMARY RECEIVING WATER SAMPLING LOCATIONS

Table 2-3
Description of Receiving Water Sampling Locations

Sampling Point	Overview	Constituents Sampled
TWAS-1	Station is located in Campo Creek along Forest Gate Road (911.80) and provides information on the Upper Watershed. It is representative of the composition of flows not commingled with flows originating in Mexico. Station was sampled during the 2009-2010 and 2011-2012 seasons during wet and dry weather.	• chemistry • bacteria • toxicity • synthetic pyrethroids in sediment
TWAS-2 and MLS	Both the TWAS-2 and MLS stations are located on the Tijuana River (TWAS-2 at Dairy Mart Road and MLS at Hollister Street). They provide monitoring data on flows in the Lower Watershed. Water quality at both of these sites reflects contributions of pollutants from discharges derived from sources that are located in Mexico. MLS was sampled during the 2005-2006, 2006-2007, 2008-2009, 2009-2010, and 2011-2012 seasons during wet and dry weather. TWAS-2 was sampled during the 2009-2010 season during wet and dry weather. The TWAS-2 station is no longer sampled and has not been sampled since 2010.	• chemistry • bacteria • toxicity testing • synthetic pyrethroids in sediment
SMC03510	Station is located on Tecate Creek in the Potrero HA (911.2). Sampling occurred during 2010-2011 season during dry weather.	• chemistry • toxicity • bacteria were not analyzed
SMC05402	Station is located on Pine Valley Creek (HA 911.3). Sampling occurred during 2010-2011 season during dry weather.	• chemistry • toxicity • bacteria were not analyzed
ABLM (2008)[1]	Program involved sampling at multiple locations in the Tijuana River Estuary 2008 (often referred to as Bight ’08) and again in 2011-2012.	• sediment chemistry • benthic analysis • toxicity during dry weather
San Diego Coastkeeper[1]	Sampling was conducted at 6 locations in the Tijuana River and Tijuana River Estuary during dry weather during the 2010-11 and 2011-12 seasons.	• chemistry • bacteria

Table 2-3
Description of Receiving Water Sampling Locations

Sampling Point	Overview	Constituents Sampled
Tijuana River Bacterial Source Identification Study[1]	Program involved sampling and surveys at multiple locations along the Tijuana River, in the Tijuana River Estuary, and in the surrounding areas and storm drains between 2008 and 2011, during dry weather and during three storm events.	• chemistry • bacteria • human-specific Bacteroides and enterovirus
National Estuarine Research Reserve System Data	Multiple years of water quality data sampled in the Tijuana River Estuary and main channel are available. Data set includes multi-year real time data for the estuary.	• temperature • specific conductivity • salinity • dissolved oxygen (DO) • depth • pH • turbidity • nutrients

Notes:
[1] Programs involved multiple sampling points.

Table 2-4
Additional Receiving Water Conditions Identified

Receiving Water	Receiving Water Condition	Supporting Information[1]				Temporal Extent	
		2011 LTEA	2012 Weston Report	2013 Weston Report	WURMP	Wet	Dry
Lower Watershed							
Tijuana River	Fair to poor stream substrate	MLS/TWAS-2 stations[2]					x
	Elevated TSS	MLS/TWAS-2 stations[2]		MLS station[4]		x	x
	Elevated Turbidity	MLS/TWAS-2 stations[2]		MLS station[4]		x	x
	Trash		Multiple marginal sites in 911.1				x
	Elevated Ammonia as N	MLS/TWAS-2 stations[2]		MLS station[4]		x	x
	Elevated Nitrite as N			MLS station[4]		x	
	Benthic algae	MLS/TWAS-2 stations[2]					x
	Elevated Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)	MLS/TWAS-2 stations[2]		MLS station[4]		x	x
	Benthic Alterations (poor to very poor Index of Biotic Integrity [IBI] scores)	MLS/TWAS-2 stations[2]		MLS station[4]		x	x
	Elevated oil and grease	TWAS-2 station				x	

Table 2-4
Additional Receiving Water Conditions Identified

Receiving Water	Receiving Water Condition	Supporting Information[1]				Temporal Extent	
		2011 LTEA	2012 Weston Report	2013 Weston Report	WURMP	Wet	Dry
Upper Watershed							
Tecate Creek	Elevated chloride		SMC03510 station[2]				x
	Elevated sulfate		SMC03510 station[3]				x
	Benthic Alterations (poor to very poor IBI scores)		SMC03510 station[3]				x
	Elevated Total Nitrogen as N		SMC03510 station[3]				x
	Elevated Phosphorus		SMC03510 station[3]				x
	Elevated Total Dissolved Solids (TDS)		SMC03510 station[3]				x
	Trash		SMC03510 station[3]		Pilot Trash Assessment site at Tecate Creek.		x
Campo Creek	Benthic Alterations (poor to very poor IBI scores)	TWAS-1 station[4]		TWAS-1 station[4]		x	x
	Benthic algae	TWAS-1 station[4]					x
	Elevated fecal coliforms	TWAS-1 station[4]		TWAS-1 station[4]		x	x
	Elevated *Enterococcus*	TWAS-1 station[4]		TWAS-1 station[4]			x
	Elevated TSS	TWAS-1 station[4]				x	
	Elevated Turbidity	TWAS-1 station[4]		TWAS-1 station[4]		x	

Table 2-4
Additional Receiving Water Conditions Identified

Receiving Water	Receiving Water Condition	Supporting Information[1]				Temporal Extent	
		2011 LTEA	2012 Weston Report	2013 Weston Report	WURMP	Wet	Dry
Campo Creek	Elevated Surfactants, Methylene Blue Activated Substances (MBAS)	TWAS-1 station[4]				x	
	Elevated Pesticides	TWAS-1 station[4]				x	
	Elevated TDS	TWAS-1 station[4]		TWAS-1 station[4]		x	x
	Elevated Phosphorus			TWAS-1 station[4]			x
	Toxicity	TWAS-1 station		TWAS-1 station			x
	Trash				Pilot Trash Assessment site at Tecate Creek.		x

Notes:

[1] Sample results and receiving water limitations provided in Appendix B.

[2] MLS and TWAS-2 stations combined here because of their close proximity. TWAS-2 station is no longer monitoring and has not been sampled since 2010. Results based on two samples during dry weather and nine samples during wet weather.

[3] Results based on single sample during dry weather.

[4] Results based on two samples during dry weather and two samples during wet weather.

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

Changes to the water quality conditions in the Tijuana River WMA go back at least 100 years to the early 1900s following the development of agriculture and sand and gravel mining in the Tijuana River Valley (Rempel, 1992). These activities largely eliminated previously widespread riparian vegetation. Levees were constructed and fill placed in many parts of the Valley to raise bottomlands out of the flood plain in an attempt to protect these areas from flooding. These hydromodifications are likely to have resulted in increased erosion, sediment and turbidity. Despite the change in land uses in the Tijuana River Valley from agriculture and sand and gravel mining to residential and parkland, water quality conditions continue to challenge the WMA in the Lower Watershed, particularly due to external stressors from rapid urbanization upstream that has occurred in Mexico with the growth of the Tijuana metropolitan area during the past several decades.

There are more than 2.7 million people that currently reside in the City of Tijuana (TRVRT, 2012). This urbanization has resulted in increased flows of water, including untreated sewage, from Mexico that transforms the Tijuana River from an intermittent to a perennial stream (Rempel, 1992). These increased flows that impaired water quality in the Lower Watershed led to collaborative efforts between the United States and Mexico to eliminate them. The U.S. and Mexico, through the USIBWC, represented by both U.S. and Mexican Sections enacted a 1944 Water Treaty that entrusted it with preferential attention to developing solutions to border sanitation problems. Treaty Minute No. 283 adopted in 1990 formalized agreement between the U.S. and Mexico to construct a water treatment plant and outfall to address the sewage discharges to the Tijuana River and its tributaries in Mexico. Construction of the SBIWTP and outfall began in 1997, and the plant began operations in January 1999. The wastewater underwent advanced primary treatment and discharged through the South Bay Ocean Outfall (SBOO) three miles (4.8 km) offshore of Imperial Beach under an NPDES permit with the Regional Board. USIBWC has performed an ocean monitoring program to comply with its NPDES permit since prior to the operation of the SBIWTP began. The construction and operation of the SBIWTP significantly reduced dry weather flows in the Tijuana River and those tributaries that drain directly into the Lower Watershed on the U.S. side of the international border. The SBIWTP was upgraded to secondary treatment. Construction began in 2009 and it began operation in 2011. In addition, the City of Tijuana has improved its sewers and sewage treatment capabilities in recent years; however, there are still many households that are not connected to the municipal sewer system. Trash, sediment and less frequent sewage flows continue to discharge into the Tijuana River WMA from Mexico (San Diego County Water Authority et al., 2013).

2.1.7 Available Evidence of Erosional Impacts in Receiving Waters due to Accelerated Flows

Evidence of erosional impacts was assessed utilizing the Weston Reports. Each of these reports included reference to stream bioassessments that had occurred in the Tijuana River WMA. Stream bioassessment monitoring includes a physical habitat assessment component. The results of these assessments can serve as indicators of hydromodification because bioassessments include consideration of channel stability and physical structure. The last three Weston Reports presented stream bioassessment results. For purposes of this document, sites whose physical habitat and stream substrate were identified as “fair” or “poor” were considered to have potential erosional impacts, as described below.

The 2009-2010 Weston Report (2011) presented results of observations that occurred at the TWAS-1, TWAS-2, and MLS sites. At the MLS site, the stream substrate was observed to be of poor to fair quality with mostly silt and consolidated clay. The TWAS-2 site was observed to be slightly worse with stream bed and banks of unconsolidated sand and silt and a riparian buffer lacking an upper canopy. In contrast, the TWAS-1 site was observed to be very healthy with a complex physical stream structure (i.e., mix of rocks, woody debris). The poor to fair stream substrate at both the MLS and TWAS-2 sites were identified as receiving water conditions.

In the 2010-11 Weston Report (Weston Solutions, Inc., 2012), the Tijuana River downstream of Barrett Junction (station ID SMC0315) was assessed to be fair. Observers noted that the monitoring reach had a low gradient and a substrate dominated by fine particulate sediment. In contrast, the site observed in Pine Valley Creek downstream of Interstate Highway 8 (Site ID SMC05402) was observed to be in good condition. The fair stream substrate at the SMC0315 site was identified as a receiving water condition.

In the 2011-12 Weston Report (Weston Solutions, Inc., 2013), four sites were observed. The physical habitat of the Tijuana River site near the MLS station was observed to be fair with a low gradient and substrate dominated by fine particulate sediment. The physical habitat of the Campo Creek site near the TWAS-1 station was observed to be in good condition with a high gradient streambed, complex substrate and flow regime, and undisturbed riparian zone. Two reference sites were also observed, one in Cottonwood Creek (site ID REF-California Water Code [CWC]) and another in Kitchen Creek (site ID REF-KCR). The physical habitat of both was observed to be good with a variety of rocky substrates and natural flow regimes. Consistent with the 2009-2010 assessment, the fair physical habitat at the MLS station was identified as a receiving water condition.

2.1.8 Trash Impacts

Provision B.2.a.(6)(d) requires RAs to consider available data describing trash impacts in receiving waters. Several primary data sources were used to complete this assessment including the 303(d) list, the LTEA, the two most recent Regional Monitoring Reports, and the Watershed Urban Runoff Management Program (WURMP) annual reports. Third-party data was also considered including the results of trash clean-up efforts that have been conducted by stakeholders and non-governmental organizations (NGOs), the Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash TMDLs (Tetra Tech, 2010), as well as a 2012 Transborder Trash Tracking Study (Romo and Leonard, 2012) and a trash, sediment and waste tire study conducted for the TRVRT through a grant from the California Department of Resources Recovery and Recycling (CalRecycle) (URS, 2010). Based on available information, trash in the Tijuana River and the Tijuana River Estuary are considered to be receiving water conditions. Trash is further considered as a priority water quality condition in Section 2.2.

2.1.9 Available Evidence of Adverse Impacts to the Chemical, Physical, and Biological Integrity of Receiving Waters

The monitoring reports discussed above have served as the primary documentation and evidence of adverse impacts to receiving waters. In addition to these sources, public input was considered to identify other possible water quality conditions during a public workshop held on January 28, 2014. This public data request suggested the addition of an additional concern that was not previously identified (presence of viruses and other pathogens, and specifically Hepatitis A) for the mouth of the Tijuana River at the Pacific Ocean. This additional water quality condition has been evaluated along with the others identified through this process. Viruses and specific pathogens are not generally sampled directly. Instead, indicator bacteria are sampled as surrogates. Data were not available to attribute pathogens to MS4 discharges, and thus they were not included as priority water quality conditions.

2.1.10 Potential Improvements in the Overall Condition of the Watershed Management Area that can be Achieved

Potential improvements in the overall condition of the WMA that can be achieved were considered later in the analysis in Section 2.4. This was done by considering the significance of MS4 contributions to each water quality condition, the extent to which each condition is considered controllable through MS4 management strategies, and whether the control of each condition results in simultaneous water quality benefits in the WMA.

2.1.11 Initial Comprehensive List of Receiving Water Conditions

Through the process described above, an initial list of receiving water conditions and the potential priority water quality conditions were identified and are summarized in Table 2-5 and Table 2-6. This list was modified to consider only water quality conditions that may be attributable in part to discharges from MS4s and only includes those conditions for which data are available to demonstrate that discharges from MS4s may be causing or contributing to the water quality condition.

Table 2-5
Receiving Water Conditions in the Tijuana River WMA

Receiving Water Segment	Condition																																			Beneficial Uses Impacted
	Indicator Bacteria	Total Coliform	Fecal Coliform	Enterococcus	Viruses	Turbidity	Solids/TSS	Sedimentation/Siltation	Stream Substrate	Benthic Alterations	Trash	Total Nitrogen as N	Ammonia as Nitrogen	Nitrite	Phosphorus	Eutrophic	Algae	Low DO/BOD/COD	Pesticides	Surfactants (MBAS)	Lead	Manganese	Nickel	Selenium	Thallium	Trace Elements	Chloride	Sulfate	Total Dissolved Solids	Synthetic Organics	Perchlorate	Oil and Grease	Color	pH	Toxicity	
Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River		W,D	W,D	W,D																																REC-1
Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive		W,D	W,D	W,D																																REC-1 SHELL
Pacific Ocean Shoreline, Tijuana HU, at Monument Road		W,D	W,D																																	REC-1
Pacific Ocean Shoreline, Tijuana HU, at the US Border		W,D	W,D	W,D																																REC-1 SHELL
Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth		W,D	W,D	W,D	D																															REC-1
Tijuana River	W,D		W,D	W,D		W,D	W,D	W,D	D	W,D	W,D	W,D		W	W,D	W,D	D	W,D	W,D	W,D				W,D		W,D				W,D		W			W,D	REC-1 and 2 MUN WARM
Tijuana River Estuary	W,D					W,D					W,D					W,D		W,D	W,D		W,D		W,D		W,D											REC-1 and 2 COMM EST MAR
Tecate Creek										D	D	D			D									W,D			D	D	D							WARM
Barrett Lake												W,D										W,D									W,D		W,D	W,D		MUN WARM
Pine Valley Creek (Upper)						W,D																														MUN
Morena Reservoir													W,D		W,D							W,D											W,D	W,D		MUN WARM
Cottonwood Creek																								W,D												WARM
Campo Creek			W,D	D		W	W			W,D	D				D		D			W									W,D						D	WARM

Notes:

W: Wet Weather Temporal Extent; D: Dry Weather Temporal Extent; Shading: Impairment on 303(d) List

REC-1: Contact Water Recreation – Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible.

REC-2: Non-Contact Water Recreation – Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water.

SHELL: Shellfish Harvesting – Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish for human consumption.

COMM: Commercial and Sport Fishing – Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms.

MUN: Includes uses of water for community, military, or individual water supply.

EST: Includes uses of water that support estuarine ecosystems.

MAR: Marine Habitat – Includes uses of water that support marine ecosystems.

WARM: Warm Freshwater Habitat – Includes uses that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

2.2 IDENTIFICATION OF PRIORITY WATER QUALITY CONDITIONS

A range of water quality conditions have been documented in the Tijuana River WMA as described in previous sections. Sources of pollutants or stressors may include non-point sources such as runoff from agriculture or natural areas; point sources such as treatment plants, industrial discharges and storm water discharges from MS4s or other point sources such as construction sites, industrial sites, highways, etc.; and pollutants crossing the international border from the Mexican portion of the watershed. A variety of regulations, permits, policies, and programs are in place to address these sources. However, this WQIP is specific to storm water and non-storm water discharges from MS4s only. Provision B.2.b requires consideration of several factors to identify the potential impacts to receiving waters for which discharges from MS4s may be responsible. These factors include:

1. The discharge prohibitions of Provision A.1 and the effluent limitations of Provision A.3; and
2. Available, relevant, and appropriately collected and analyzed storm water and non-storm water monitoring data from the RAs' MS4 outfalls;
3. Locations of each RA's MS4 outfalls that discharge to receiving waters;
4. Locations of MS4 outfalls that are known to persistently discharge non-storm water to receiving waters likely causing or contributing to impacts on receiving water Beneficial Uses;
5. Locations of MS4 outfalls that are known to discharge pollutants in storm water causing or contributing to impacts on receiving water Beneficial Uses; and
6. The potential improvements in the quality of discharges from the MS4 that can be achieved.

A detailed discussion of the evaluation of these six factors is provided below.

2.2.1 Discharge Prohibitions

Provision B.2.b.(1) requires consideration of the discharge prohibitions of Provision A.1 and effluent limitations of Provision A.3 as part of the assessment of impacts from MS4 discharges. These limitations are analyzed by reviewing available MS4 discharge data and comparing the monitoring results to discharge prohibitions. The applicable discharge prohibitions are listed in Appendix D with the corresponding MS4 discharge data.

2.2.2 Available, Relevant, and Appropriately Collected and Analyzed Storm Water and Non-Storm Water Monitoring Data from RAs' Outfalls

Similar to the receiving water data, results of MS4 outfall sampling were available in the primary data and information sources identified in Table 2-1, including the 2010 303(d) List, the LTEA (Weston Solutions, 2011), the two most recent Weston Reports (Weston Solutions, Inc., 2012, 2013), and the Tijuana River Bacterial Source Identification Study (Weston Solutions, 2012). These sources were reviewed to identify the subset of receiving water conditions to which MS4 discharges may be causing or contributing. The subset of receiving waters is defined as the priority water quality conditions in this WQIP.

MS4 water quality analytical results are summarized in Appendix D, including location, numbers of samples taken, and numbers of samples exceeding benchmarks. A summary of water quality conditions to which the MS4 discharges may be causing or contributing is provided below.

MS4 Sampling in San Ysidro (911.11)

- Wet Weather: TSS and fecal coliform were identified as high priority in the 2011 LTEA. Elevated bacterial indicator and turbidity levels entering MS4 discharging to the Tijuana River and Estuary documented in the Tijuana River Bacterial Source Identification Study (Weston Solutions, 2012).
- Dry Weather: Total nitrogen (calculated), total phosphorus, *Enterococcus*, MBAS, and DO were identified as high priority, and TSS was identified as medium priority in the LTEA. TDS, *Enterococcus*, and dissolved copper were identified as high priority in the 2010-11 and Weston Report. Total nitrogen (calculated), total phosphorus, *Enterococcus*, and DO were identified as high priority in the 2011-12 Weston Report. Elevated bacterial indicator and turbidity levels entering MS4 discharging to the Tijuana River and Estuary documented in the Tijuana River Bacterial Source Identification Study (Weston Solutions, 2012).

MS4 Sampling in Water Tanks (911.12)

- Wet Weather: TSS, turbidity, and dissolved copper were identified as high priority in the 2011-12 Weston Report.
- Dry Weather: Total nitrogen (calculated), total phosphorus, *Enterococcus*, and DO were identified as high priority in the 2011 LTEA.

MS4 Sampling in Barrett Lake (911.30)

- Wet Weather: Fecal Coliform was identified as high priority in the 2011-12 Weston Report.
- Dry Weather: Total nitrogen (calculated) and *Enterococcus* were identified as high priority, and total phosphorus were identified as medium priority in the LTEA. Total nitrogen (calculated), total phosphorus, and dissolved phosphorus were identified as high priority in the 2010-11 Weston Report.

MS4 Sampling in Pine (911.41)

- Wet Weather: TSS was identified as high priority, and fecal coliform was identified as medium priority in the 2011-12 Weston Report.
- Dry Weather: No dry weather MS4 sample data were available.

MS4 Sampling in Cottonwood (911.60)

- Wet Weather: TSS and fecal coliform were identified as high priority in the 2010-11 Weston Report.
- Dry Weather: Total nitrogen (calculated), TDS, and *Enterococcus* were identified as high priority in the 2011-12 Weston Report.

MS4 Sampling in Canyon City (911.82)

- Wet Weather: No wet weather MS4 sample results were available.
- Dry Weather: Dissolved phosphorus, total phosphorus, TDS, and *Enterococcus* were identified as high priority in the 2011-12 Weston Report.

MS4 Sampling in Hill (911.84)

- Wet Weather: TSS was identified as high priority in the 2010-11 Weston Report.
- Dry Weather: No dry weather MS4 samples were available.

Impairments potentially attributable to urban runoff / storm sewers according to the 303(d) list include the following:

- Total coliform, fecal coliform, and *Enterococcus* at the Pacific Ocean Shoreline.
- Trash and low DO in the Tijuana River Estuary.
- Indicator bacteria, solids, total nitrogen as N, eutrophic conditions, low DO, pesticides, synthetic organics, and toxicity in the Tijuana River.
- Total nitrogen as N in Barrett Lake.
- Phosphorus in Morena Reservoir.

A summary of the priority water quality conditions is provided in Table 2-6.

2.2.3 Locations of MS4 Outfalls

The locations of MS4 outfalls in relation to HAs and receiving waters were considered to identify whether discharges have the potential to cause or contribute to each receiving water condition in the analysis of MS4 sampling results presented in Section 2.2.2. Figures 2-4 and 2-5 identify the locations of RA's MS4 major outfalls. The vast majority of the MS4 infrastructure in the WMA is located in the Lower Watershed, as illustrated on the figure.

The Permit has adopted the definition of "outfall" from the federal CWA regulations as "a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the US and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the US and are used to convey waters of the US."

Figure 2-4
MS4 Major Outfalls in the Tijuana River Watershed Management Area (WMA)

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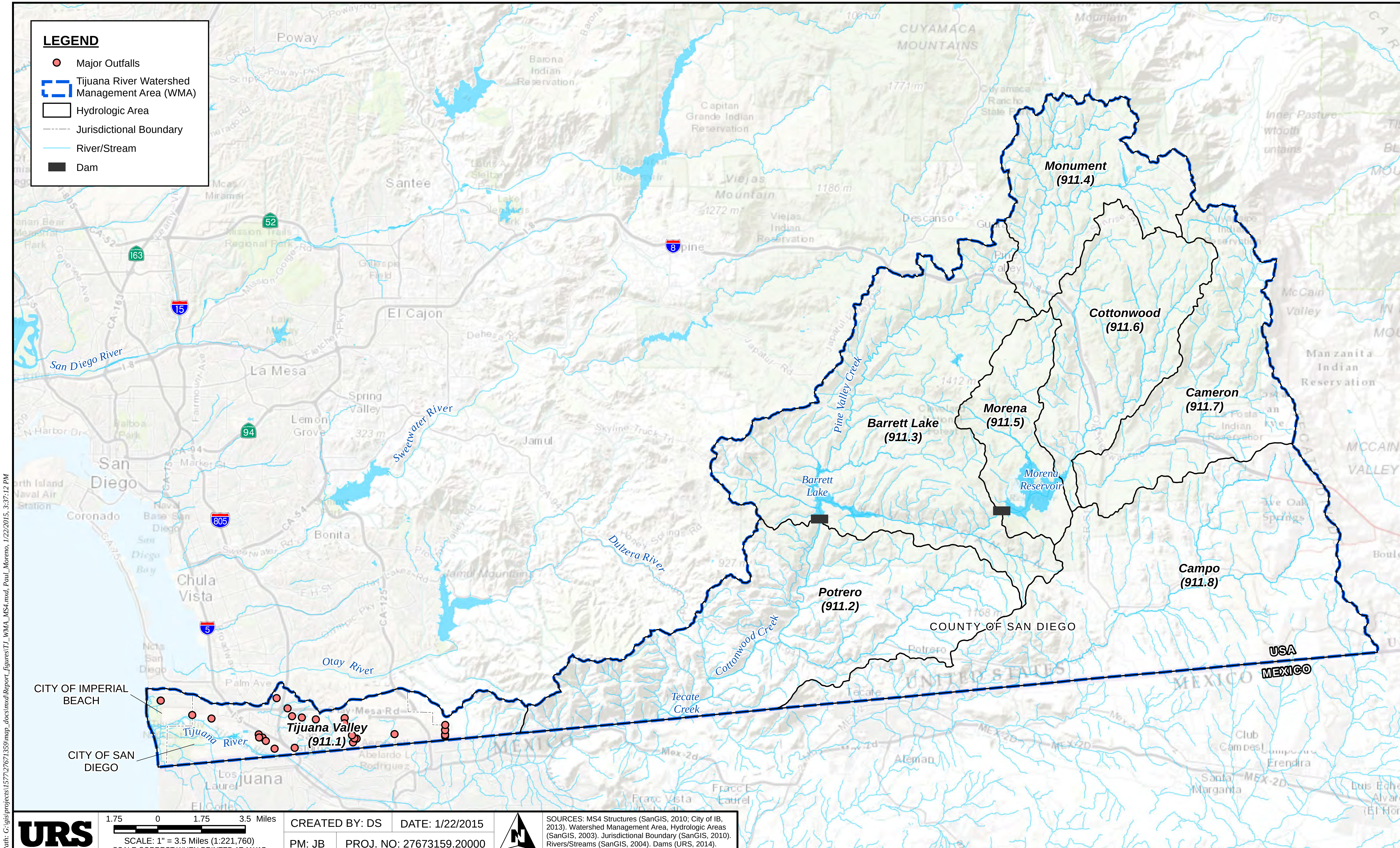

FIGURE 2-4 MS4 STRUCTURES IN THE TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA)

Figure 2-5
MS4 Major Outfalls in the Tijuana River Valley Hydrologic Area (HA)

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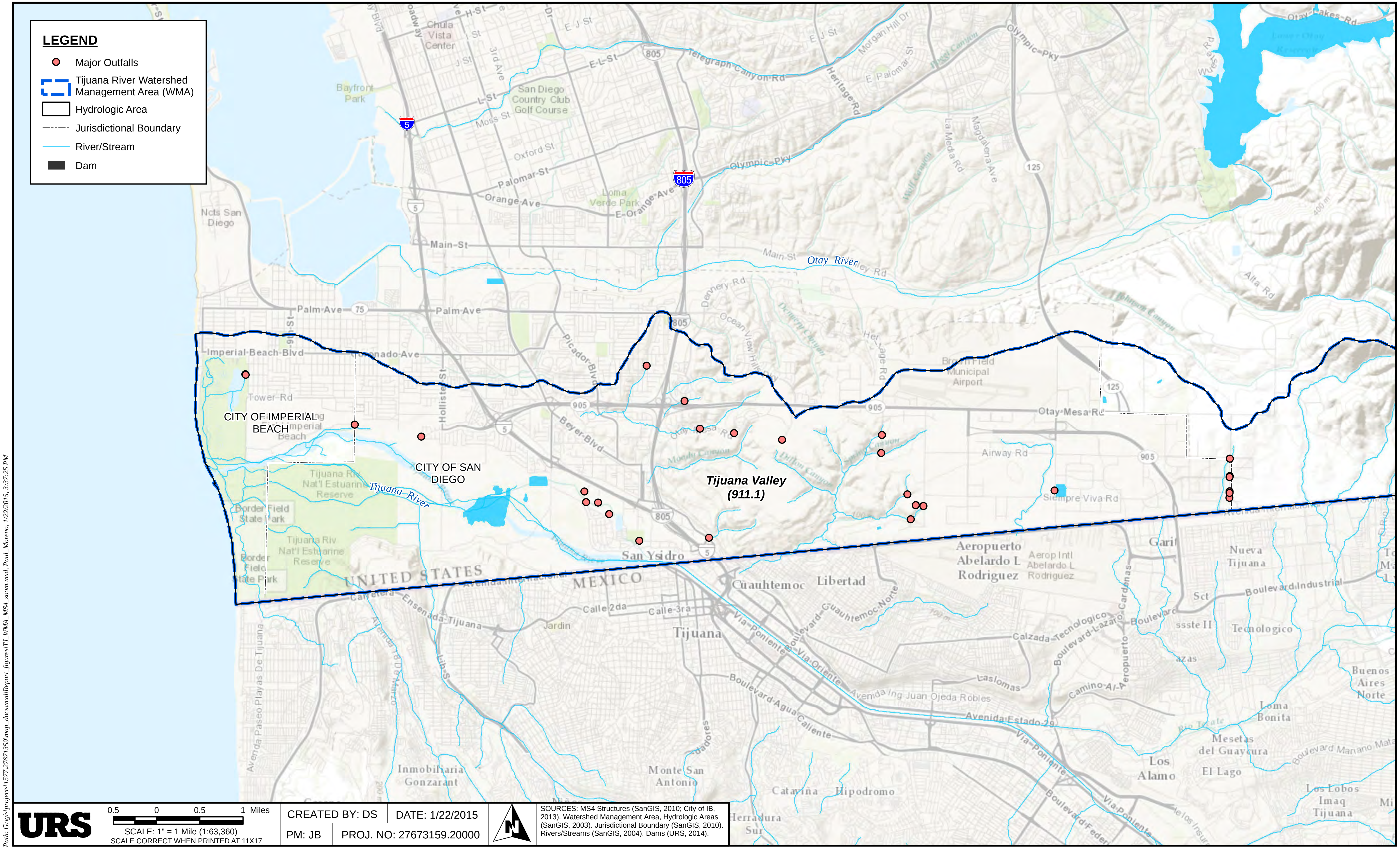


FIGURE 2-5 MS4 MAJOR OUTFALLS IN THE TIJUANA RIVER VALLEY HYDROLOGIC AREA (HA)

To identify the locations of MS4 outfalls with possible illicit discharges, dry weather illicit detection inspections were conducted. Section 2.5.1.3.1 summarizes results from these inspections. As discussed in that section, it appears that based on these inspections that dry weather flows are not a significant cause or contributor to water quality conditions in the WMA.

2.2.4 Potential Improvements in the Quality of Discharges from the MS4 that can be Achieved

Potential improvements in the quality of discharges from the MS4 that can be achieved were considered later in the analysis in Section 2.4. This was done by considering the extent to which each condition is considered controllable through MS4 management strategies and whether the control of each condition results in simultaneous water quality benefits in the WMA.

2.2.5 Priority Water Quality Conditions (Water Quality Conditions Potentially Attributed in Part to MS4s)

The RAs reviewed the above information in consideration of the locations of the MS4 outfalls described in Section 2.2.3 to develop a list of water quality conditions potentially attributed in part to MS4s. A summary list of the priority water quality conditions is provided in Table 2-6. A detailed list is provided in Appendix E.

Table 2-6
Priority Water Quality Conditions in the Tijuana River WMA

Lower Watershed	
Tijuana River	Impairment of WARM due to Sedimentation/Siltation/Solids/TSS (wet and dry weather)
	Elevated turbidity (wet and dry weather)
	Impairment of REC-1 due to indicator bacteria (wet and dry weather)
	Impairment of WARM due to low DO (wet and dry weather)
	Impairment of WARM due to nutrients (wet and dry weather)
	Impairment of REC-1 due to surfactants (MBAS) (dry weather)
	Impairment of REC-2 due to trash (wet and dry weather)
	Impairment of WARM due to pesticides (dry weather)
	Impairment of MUN due to synthetic organics (dry weather)
	Impairment of WARM due to toxicity (dry weather)
Tijuana River Estuary	Impairment of MAR due to turbidity (wet and dry weather)
	Impairment of REC-1 due to indicator bacteria (wet and dry weather)
	Impairment of MAR due to low DO (wet and dry weather)
	Impairment of REC-2 due to trash (wet and dry weather)
Pacific Ocean Shoreline	Impairment of REC-1 due to indicator bacteria (wet and dry weather)
Upper Watershed	
Campo Creek	Elevated indicator bacteria (dry weather)
	Elevated nutrients (dry weather)
	Elevated TDS (dry weather)
Barrett Lake	Impairment of WARM due to nutrients (wet and dry weather)
Morena Reservoir	Impairment of WARM due to nutrients (wet weather)

2.3 EVALUATION OF PRIORITY WATER QUALITY CONDITIONS AND SELECTION OF HIGHEST PRIORITY

Provision B.2.c(1) requires the RAs to develop a list of “priority water quality conditions as pollutants, stressors and/or receiving water conditions that are the highest threat to receiving water quality or that most adversely affect the quality of receiving waters.” This list was developed through the process detailed in Sections 2.1 and 2.2. First, a list of receiving water conditions was identified (Table 2-5). Second, that list was reviewed and reduced to include only those receiving water conditions potentially attributed to discharges from MS4s. The shorter list constitutes the priority water quality conditions. In this section, the list of priority water quality conditions is evaluated to identify the highest priority water quality condition.

2.3.1 Summary of Available Information on Priority Water Quality Conditions

The Permit requires RAs to provide information on the priority water quality conditions for the following five criteria. This information is summarized in Table 2-8 below.

(a) The Beneficial Use(s) associated with the priority water quality condition;

(b) The geographic extent of the priority water quality condition within the WMA, if known;

(c) The temporal extent of the priority water quality condition (e.g., dry weather and/or wet weather);

(d) The RAs with MS4 discharges that may cause or contribute to the priority water quality condition; and

(e) An assessment of the adequacy of and data gaps in the monitoring data to characterize the conditions causing or contributing to the priority water quality condition, including a consideration of spatial and temporal variation.

For Criteria (a) and (b), the 303(d) list indicates the Beneficial Uses and geographic extent of water quality priorities for impaired waters. For geographic extent, the length of the impaired water body segment is provided if the water body is impaired. Otherwise, the sampling location is provided.

For Criterion (c), the temporal extent was based on the timing of the sampling (i.e., whether sampling occurred during wet weather or dry weather). For this criterion, it is important to note when elevated sampling results were observed on multiple occasions.

For Criterion (d), a determination was made whether a given jurisdiction has MS4 outfalls discharges that may contribute to the downstream water quality conditions. For example, Campo Creek and Barrett Lake are located in the County of San Diego, upstream of the City of Imperial Beach and the City of San Diego. Therefore, MS4s located the County of San Diego only have the potential to discharge to these waters. It should be noted, however, that other non-MS4 sources can and do discharge to these waters such as runoff from freeways or agriculture. Conversely, the Tijuana River and Estuary are downstream of MS4 discharges from each jurisdiction, so it is assumed that the discharges from each may ultimately reach the downstream waters where they may potentially cause or contribute to the given water quality condition. It is important to note, however, that identifying the actual contribution from the Upper

Watershed may require additional sampling. For example, water in HAs 911.2 through 911.7 is generally diverted out of the watershed to Otay Lake and thus would not generally reach the Tijuana River and Estuary unless dams are overtopped. Water in HA 911.8 flows into Mexico first before returning to HA 911.1 in the Lower Watershed.

For Criterion (e), a qualitative scoring system was used to compare the range of data availability for the identified list of water quality conditions. For each water quality condition, the RAs assigned a score of low, medium, or high to describe data availability for the water quality conditions appearing in Table 2-7. The assessment of data showed a range of data availability for the priority water quality conditions described in Table 2-8. In each case, some gaps remain. The monitoring and assessment program discussed in Section 4 will provide additional information.

Table 2-7
Data Adequacy

Data Availability Score	Definition
Low	Limited MS4 and receiving water data to characterize (e.g., data are available but may be limited to one sampling event and/or one season).
Moderate	Available data/information includes moderate amount of MS4 and receiving water data for either wet and dry seasons and/or special studies or reports specific to the water quality condition.
High	Available data/information include significant MS4 and receiving water data for both wet and dry seasons and/or special studies or reports specific to the water quality condition.

Table 2-8
Consideration of Factors (a) through (e) for Priority Water Quality Conditions

Pollutant	Water Bodies Impacted	Impacted Beneficial Uses (a)	Geographic Extent (b)	Temporal Extent (c) [1]		MS4 Discharge Contributions (d)			Adequacy of Data to Characterize (e)
				Wet	Dry	City of IB	City of SD	County of SD	
Lower Watershed									
Sedimentation/Siltation/Solids/ TSS	Tijuana River	WARM	6 miles (9.6 km)	x	x	x	x	x	High
Turbidity	Tijuana River Estuary	MAR	125 acres (50 hectares)	x	x	x	x	x	High
	Tijuana River	N/A	MLS and TWAS-2 sites	x	x	x	x	x	High
Indicator Bacteria	Pacific Ocean Shoreline	REC-1	Along shoreline from U.S. Border to end of Seacoast Drive	x	x	x	x	x	High
	Tijuana River Estuary	REC-1	1320 acres (530 hectares)	x	x	x	x	x	High
	Tijuana River	REC-1	6 miles (9.6 km)	x	x	x	x	x	High
Low DO	Tijuana River Estuary	MAR	125 acres (50 hectares)	x	x	x	x	x	Moderate
	Tijuana River	WARM	6 miles (9.6 km)	x	x	x	x	x	Moderate
Nutrients	Tijuana River	WARM	6 miles (9.6 km)	x	x	x	x	x	Moderate
Surfactants (MBAS)	Tijuana River	REC-1	6 miles (9.6 km)	x	x	x	x	x	Moderate

Table 2-8
Consideration of Factors (a) through (e) for Priority Water Quality Conditions

Pollutant	Water Bodies Impacted	Impacted Beneficial Uses (a)	Geographic Extent (b)	Temporal Extent (c) [1]		MS4 Discharge Contributions (d)			Adequacy of Data to Characterize (e)
				Wet	Dry	City of IB	City of SD	County of SD	
Trash	Tijuana River	REC-2	6 miles (9.6 km)	x	x	x	x	x	High
	Tijuana River Estuary	REC-2	1320 acres (530 hectares)	x	x	x	x	x	High
Pesticides	Tijuana River	WARM	6 miles (9.6 km)	x		x	x	x	Moderate
Synthetic Organics	Tijuana River	MUN	6 miles (9.6 km)	x	x	x	x	x	Moderate
Toxicity	Tijuana River	WARM	6 miles (9.6 km)	x	x	x	x	x	Moderate
Upper Watershed									
Indicator Bacteria	Campo Creek	N/A	TWAS-1 site	x	x			x	Low
Nutrients	Barrett Lake	WARM	125 acres (50 hectares)	x	x			x	Medium
	Morena Reservoir	WARM	104 acres (42 hectares)	x	x			x	Low
	Campo Creek	N/A	TWAS-1 site	x	x			x	Low
TDS	Campo Creek	N/A	TWAS-1 site	x	x			x	Low

Notes:
[1] Extent of receiving water condition indicated with "x." Data or information attributing condition in part to MS4 discharge indicated with shading.

2.3.2 Methodology for Selecting Highest Priority Condition

Provision B.2.c.(2) requires RAs to identify the highest priority water quality condition(s) to be addressed by the WQIP and provide a rationale for their selection. The highest priority water quality conditions were selected by reviewing the information summarized in Table 2-8 in the previous section and by considering the following five additional criteria using a streamlined scoring system. A more complex approach was not employed due to limited data availability across priority conditions. The criteria are described below and the results of their consideration are summarized in Table 2-10.

1. Relative Magnitude of Pollutant/Stressor from MS4 Sources
2. Estimated percentage of MS4 Sources in HA with Relatively "High" Magnitude Pollutant Load
3. Estimated percentage of Pollutant/Stressor Attributed to the MS4
4. Controllability at Sites Discharging to MS4
5. Ability to Address Other Pollutants Simultaneously

Criterion 1

For Criterion 1, an assessment was completed to calculate a score for each water quality condition. This score represents the expected relative magnitude of each pollutant from each land use type. The scores are based on the areal distribution of existing land uses within the subwatershed that is likely to contribute to the MS4 (e.g., residential, commercial, industrial, roads, transportation, etc.) and the likely relative magnitude of pollutant load derived from each of those land uses. Note that for transportation, Caltrans was excluded from the analysis. Transportation land uses include roads, parking lots, airports, etc. within the jurisdictions of the City of Imperial Beach, City of San Diego, and County of San Diego. A weighted average was calculated for each land use. Land uses and acreages were derived from San Diego Association of Governments (SANDAG) (2012) data.

For the relative pollutant loading, a host of literature is available that presents measured or estimated pollutant loading from various urban land uses and transportation facilities. Three primary sources were used in this analysis. Table 2-9 summarizes the relative magnitude of pollutant loads in storm water discharges by land use adapted from these sources.

- **Final Technical Report Bacteria TMDLs for Beaches and Creeks (Regional Board, 2010):** This document includes estimates of fecal indicator bacteria build-up rates developed in Southern California by land use based on a study performed by the Southern California Coastal Water Research Project (SCCWRP) to support bacteria TMDL development of Santa Monica Bay (Los Angeles Regional Board, 2002 and Ackerman, 2006). This source was used to develop the relative magnitude of bacteria in storm water discharges by land use.
- **Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash TMDLs (Tetra Tech, 2010)**: This document includes estimates of TSS concentrations in runoff by land use, based on data compiled by Ackerman and Schiff (2003) from land use monitoring programs throughout Southern California, and estimates of trash accumulation rates by land use developed by the City of Los Angeles (2002). The document was not formally adopted following

public review and comment, but the preliminary estimates help to inform the understanding of solids, turbidity, and trash in the WMA.

- **Urban Storm Water Management in the United States. National Academy of Sciences (NRC, 2009):** This report includes a table summarizing relative sources of pollutants of concern for different land uses in urban areas summarized from Burton and Pitt (2002), Pitt et al. (2008), and Center for Watershed Protection and Pitt (2008). This source was used to develop the relative magnitude of the remaining pollutants in storm water discharge by land use.

To estimate an overall score for MS4 discharges in a given HA, a weighted average was calculated based on the land uses present in the HA that are likely to contribute runoff to the MS4 and the relative magnitude of pollutant loads in storm water from those land uses. The magnitudes are assigned scores of 3 for high, 2 for moderate, and 1 for low.

An example calculation for sediment in the Tijuana River is provided below. In the HA in which the Tijuana River is located, 911.1, there are 460 acres of commercial (including institutional) land, 1,053 acres of industrial land, 2,291 acres of transportation land, 1,373 acres of low density residential land use, and 577 acres of high density residential land use. As indicated by Table 2-9, commercial and residential land uses are considered moderate sources of sediments (scores of 2); industrial and transportation land uses are considered high sources of sediment (scores of 3).

The weighted average is calculated by multiplying the acreage of each land use by the score for that land use, summing the results for each land use, and dividing the sum by total acreage. The result is rounded to 1, 2, or 3 for low, moderate, or high. Analysis excludes Federal, State, Tribal and other land outside of MS4 jurisdiction.

[(460 acres of commercial * 2) + (1,053 acres of industrial * 3) + (2,291 acres of transportation * 3) + (1,373 acres of low density residential * 2) + (577 acres of high density residential * 2)] / 5,755 acres = 2.6

Notes:
Values in example exclude Federal, State, Tribal or other land outside of jurisdiction or RAs.
To convert acres to hectares, divide values by 2.47.

In the example above, a score of approximately 2.6 is calculated. This score is rounded up to 3 (high) indicating that the distribution of land uses that may be contributing storm water runoff to the MS4 is made up of a relatively high proportion of land uses with relatively high TSS concentrations, while a score closer to 1 (low) would indicate that the distribution is made of up more minor contributors. It is important to note that this scorning was based on acreages of land uses that may discharge to MS4s and could not account for site-specific conditions that may be contributing high sediment to MS4 discharges (e.g., exposed soils or steep slopes at a site, unpaved alleys, construction sites, erosion, etc.) and thus may underestimate the actual magnitude of pollutant load entering the MS4.

Table 2-9
Relative Magnitude of Pollutant Load in Storm Water Discharges by Land Use

Pollutant	Commercial[1]	Industrial	Transportation[2]	Low Density Residential	High Density Residential
Sedimentation/Siltation/Solids/TSS	Moderate	High	High	Moderate	Moderate
Turbidity	Moderate	High	High	Moderate	Moderate
Indicator Bacteria	High	Low	Low	Moderate	High
Low DO	Low	Low	Low	High	High
Nutrients	Moderate	Low	Low	Moderate	Moderate
Surfactants (MBAS)	High	Moderate	Low	Moderate	Moderate
TDS	Moderate	High	Moderate	Low	Low
Trash	High	High	Moderate	Low	Moderate
Pesticides	Moderate	Low	Low	Moderate	Moderate
Synthetic Organics	Moderate	High	High	Low	Low
Toxicity	Moderate	High	High	Low	Low

Notes:

Sources of relative magnitudes: Sediment and turbidity adapted from Ackerman and Schiff (2003). Trash adapted from City of Los Angeles (2002). Indicator Bacteria adapted from Regional Board (2010). All other pollutants adapted from NRC (2009).

For scoring calculations, high is assigned a value of 3, moderate a value of 2, and low a value of 1.

[1]Commercial includes municipal and institutional land uses.

[2]Transportation includes local transportation facilities such as parking lots. Excludes Caltrans.

Criterion 2

Criterion 2 simply calculates the areal percentage of land uses in the Tijuana Valley HA that contribute to the MS4 categorized as “high” from Table 2-9 above. For example, for indicator bacteria, both commercial and high-density residential are considered relatively high contributors of bacteria. Thus, this criterion calculates the percentage of the land uses that are commercial or high-density residential. Note, the calculation only includes land uses that are expected to contribute to the MS4.

For example, for sediment in the Tijuana River (HA 911.1), industrial and transportation land uses are considered high sources of sediment (scores of 3). The percentage of “high” sources is calculated by dividing the sum of industrial and transportation land area by the sum of all MS4 land areas.

(1,053 acres of industrial + 2,291 acres of transportation) / 5,755 acres = 58%

Criterion 3

For the Criterion 3, available data were considered to estimate the percentage of a given pollutant that may be attributed to the MS4. Estimates for this criterion were available only for sediment, bacteria, and trash. This criterion allows RAs to consider (where information is available) the relative magnitude of discharges from the MS4 related to U.S. sources exclusive of those related to the Mexican portion of the watershed. Data for these pollutants were also available to assess the relative contribution from the U.S. side of the watershed. Commingled flow is a significant factor for the presence of each of these pollutants and the contribution of these by the Mexican portion of the watershed is significant. The contribution from the Mexican side of the watershed, where information is available, is discussed in Section 2.4.

Criterion 4

For Criterion 4, the controllability of each priority water quality condition was assessed. The assessment considered the ability to control the pollutant through the use of BMPs. For example, sediment and turbidity are relatively controllable at individual sites through stabilizing exposed soils and slopes; street sweeping; installation of catch basins; filtration, and by minimizing runoff volume through the use of green infrastructure practices. Trash is considered moderately controllable through BMPs. While some control can be achieved through street sweeping or catch basins, trash management is challenging due to underlying social issues related to littering and dumping. The remaining pollutants are moderately controllable through combination of education and outreach; pollution prevention; filtration; and runoff reduction.

Criterion 5

For Criterion 5, the ability to simultaneously address multiple pollutants was considered. The assessment considered whether, while managing a given pollutant, other pollutants are also reduced. For example, bacteria, nutrients, and pesticides may adsorb to sediment particles or trash. Thus, treating for sediment or trash may lead to simultaneous reductions in these pollutants. The remaining pollutants are addressed through a range of BMPs, some of which (e.g., filtration and runoff reduction) would address multiple pollutants simultaneously.

Table 2-10 summarizes the results of the assessment of the priority water quality conditions by pollutant category. The subsections that follow discuss the assessment in detail.

Table 2-10
Criteria Used to Identify Highest Priority Water Quality Condition

Pollutant	Water Bodies Impacted	Relative Magnitude of Pollutant/ Stressor from MS4 Sources Based on Land Use[1]	Percentage of MS4 Sources in HA with Relatively "High" Pollutant Load Based on Land Use[1]	Percentage of Pollutant/ Stressor Coming From MS4[5]	Controllability through BMPs[4]	Ability to Address other Pollutants Simultaneously[4]
Lower Watershed						
Sedimentation/Siltation/Solids/TSS	Tijuana River	High	58%	Up to 4%[2]	High	High
Turbidity	Tijuana River Estuary	High	58%	-	High	High
	Tijuana River	High	58%	-	High	High
Indicator Bacteria	Pacific Ocean Shoreline	Moderate	18%	<1%[3]	Moderate	Moderate
	Tijuana River Estuary	Moderate	18%	<1%[3]	Moderate	Moderate
	Tijuana River	Moderate	18%	<1%[3]	Moderate	Moderate
Low DO	Tijuana River Estuary	Moderate	34%	-	Moderate	Moderate
	Tijuana River	Moderate	34%	-	Moderate	Moderate
Nutrients	Tijuana River	Low	0%	-	Moderate	Moderate
Surfactants (MBAS)	Tijuana River	Moderate	8%	-	Moderate	Moderate
Trash	Tijuana River	Moderate	26%	11%[2]	Moderate	Moderate
	Tijuana River Estuary	Moderate	26%	11%[2]	Moderate	Moderate
Pesticides	Tijuana River	Low	0%	-	Moderate	Moderate
Synthetic Organics	Tijuana River	Moderate	58%	-	Moderate	Moderate
Toxicity	Tijuana River	Moderate	58%	-	Low	Moderate

Table 2-10
Criteria Used to Identify Highest Priority Water Quality Condition

Pollutant	Water Bodies Impacted	Relative Magnitude of Pollutant/ Stressor from MS4 Sources Based on Land Use[1]	Percentage of MS4 Sources in HA with Relatively "High" Pollutant Load Based on Land Use[1]	Percentage of Pollutant/ Stressor Coming From MS4[5]	Controllability through BMPs[4]	Ability to Address other Pollutants Simultaneously[4]
Upper Watershed						
Indicator Bacteria	Campo Creek	Moderate	1%	-	Moderate	Moderate
Nutrients	Barrett Lake	Moderate	0%	-	Moderate	Moderate
	Morena	Moderate	0%	-	Moderate	Moderate
	Campo Creek	Moderate	0%	-	Moderate	Moderate
TDS	Campo Creek	Moderate	1%	-	Moderate	Moderate

Notes
Percentages are estimates.
[1]Scoring excludes Federal, State (e.g., Caltrans), Tribal and other land uses outside of MS4 jurisdiction in Tijuana River WMA. See Appendix F.
[2]Based on Tetra Tech (2012).
[3]Based on Weston Solutions (2012).
[4]Rationale for assigned values provided in Section 2.4.1 for Sediment and Turbidity and Section 2.4.2 for Remaining Conditions. Refers to controllability of pollutant loads conveyed through MS4.
[5]"-" Indicates no estimate available.

The selection of highest priority water quality condition considers the weight of evidence for each priority conditions and was based on a cumulative assessment of the criteria identified in Table 2-10. The detailed rationale for the selection of highest priority condition is provided in the next section. This is followed by a discussion on the remaining priority water quality conditions.

2.4 IDENTIFICATION OF HIGHEST PRIORITY WATER QUALITY CONDITIONS AND RATIONALE

The WQIP has identified several priority water quality conditions and considered multiple criteria to compare them side by side in Section 2.3. Based on this analysis, the following have been identified as the highest priority water quality conditions:

- Sedimentation / Siltation in the Tijuana River (wet weather)
- Turbidity in the Tijuana River and Tijuana River Estuary (wet weather)

Section 2.4.1 below discussions the rationale for the selection of these priority water quality conditions as the highest priority. Section 2.4.2 discusses the remaining priority water quality conditions. The highest priority conditions identified above will focus on wet weather discharges. This is because dry weather data suggest that there are no illicit discharges from the MS4s that directly discharge to receiving waters. Water generally remains standing at the outfalls or infiltrates into the ground surface.

2.4.1 Discussion of Highest Priority Water Quality Conditions

Anthropogenic sources of sediment are considered to impact water quality. Anthropogenic sources of sediment can include construction sites, erosion of disturbed or unstabilized surfaces, wind and aerial deposition, vehicle and pedestrian tracking, and dumping. This sediment can collect on paved or other surfaces in the urban environment and subsequently be re-suspended during storm events and delivered through the MS4 to receiving waters. Such sediment is often associated with other pollutants such as bacteria, nutrients, pesticides, and trash. Addressing this sediment would simultaneously address these other pollutants.

Natural sources of sediment are not the focus of this document. Rather, the focus is on anthropogenic sources of sediment originating from urbanized areas that enter the MS4. Erosion and deposition do occur naturally in streams, and bed-load sediment transport is a natural part of stream processes. Moreover, as a terminal delta of the Tijuana River system, the Tijuana River Valley is naturally a depositional area. However, when storm water runoff rates exceed natural levels, as is the case in urbanized areas, increased stream bank erosion can occur. In this case, the source of sediment can be considered anthropogenic.

The Basin Plan explains the need to manage sediment and turbidity in receiving waters. Suspended sediment in surface waters can cause harm to aquatic organisms by abrasion of surface membranes, interference with respiration, and sensory perception in aquatic fauna. This sediment can reduce photosynthesis in and survival of aquatic flora by limiting the transmittance of light and by hindering normal aquatic plant growth and development. It can be deleterious to benthic organisms, clog fish gills and interfere with respiration in aquatic fauna. It may cause the formation of anaerobic conditions. Similarly, high turbidity can adversely affect photosynthesis, which aquatic organisms depend upon for survival, by interfering with the penetration of light. High concentrations of particulate matter that produce turbidity can be directly lethal to aquatic life. Turbidity can adversely affect the use of water for drinking. The Basin Plan states that suspended sediment and turbidity shall not reach levels that cause nuisance or adversely affect Beneficial Uses (Regional Board, 2012).

Segments of both the Tijuana River and the Tijuana River Estuary are identified on the 303(d) list as impaired by sedimentation/siltation or the associated constituents solids, TSS, and turbidity. Specifically, six miles (9.7 km) of the Tijuana River in HSA 911.11 are impaired by solids and sedimentation/siltation, impacting the WARM designated Beneficial Use; and 125 acres (50 hectares) of the Tijuana River Estuary are impaired by turbidity, impacting the MAR designated Beneficial Use. The 303(d) list includes “Urban Runoff/Storm Sewers” as potential sources of the impairment of WARM due to solids. It is important to note that portions of the Tijuana River Estuary are also designated with the Beneficial Use of BIOL, as noted in Section 2.1.3. These receiving waters segments are “sensitive or highly valued,” as defined by the Permit, providing additional rationale for focus on the Tijuana River Estuary.

Assessment of sediment and turbidity impacts can be performed through the measurement of either TSS or turbidity in water samples. TSS, expressed in milligrams per liter (mg/L), indicates the concentration of solids in water that can be trapped by a filter, such as mineral and organic sediment. Turbidity, expressed in nephelometric turbidity units (NTUs), is a measurement of water clarity and indicates how much the material suspended in water decreases the passage of light through the water. Suspended materials may include soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances (U.S. EPA, 2014). Sediment load into the MS4 may also be measured through cleaning outfalls and MS4 lines.

The impacts of sediment on water quality are generally measured using the following benchmarks for TSS and turbidity. While natural levels of TSS and turbidity may exceed these values, they are useful for evaluating storm water in developed areas and provide a common reference point for comparing analytical results:

- TSS: 58 mg/L (dry weather) and 100 mg/L (wet weather)
- Turbidity: 20 NTU

Receiving water monitoring results presented in the LTEA and Weston Reports document the sediment and turbidity receiving water conditions in the Tijuana River and Tijuana River Estuary, as summarized below. Monitoring results are provided in Appendix B.

Dry Weather Receiving Water Sampling

- TSS and turbidity identified as high priority at MLS/TWAS-2 station in Tijuana River (LTEA)
- TSS identified as medium priority at MLS in Tijuana River (2013 Weston Report)
- Turbidity identified as medium priority at MLS in Tijuana River (2013 Weston Report)
- Two turbidity samples above water quality benchmarks in Tijuana River Estuary (San Diego Coastkeeper data, as presented in 2013 Weston Report)

Wet Weather Receiving Water Sampling

- TSS and turbidity identified as high priority at MLS/TWAS-2 station in Tijuana River (LTEA)
- TSS and turbidity identified as high priority at MLS in Tijuana River (2013 Weston Report)

The LTEA also identified benthic alterations as a high priority and identified hydromodification and associated high sediment loads as contributing factors. The effects of hydromodification within a watershed can cause increased sediment loads which can lead to benthic alterations resulting in low Index of IBI scores. The 2013 Weston Report identified both TSS and turbidity as having an upward trend at the MLS station.

Monitoring at MS4 outfalls and at areas draining to MS4s support the conclusion that MS4 discharges are contributing, in part, to the sedimentation/siltation and turbidity receiving water conditions in the Tijuana River and Tijuana River Estuary. Each jurisdiction includes MS4 outfalls that may contribute, in part, to the highest priority water quality conditions. Sampling results are summarized below. It should be noted that dry weather samples were generally taken in ponded water within the outfall and may not be indicative of actual discharges. Monitoring results are provided in Appendix D.

Dry Weather MS4 Sampling

- Two TSS samples above water quality benchmark at MS4 outfalls in HA 911.11 (LTEA)
- Multiple turbidity samples above water quality benchmark in areas or MS4 outfalls that drain to Tijuana River and Tijuana River Estuary during dry weather (Tijuana River Bacterial Source Identification Report)

Wet Weather MS4 Sampling

- TSS identified as medium priority in LTEA and 2013 Weston Report and high priority in 2012 Weston Report
- Turbidity identified as high priority in 2013 Weston Report
- Multiple turbidity samples above water quality benchmark in areas or MS4 outfalls draining to Tijuana River and Tijuana River Estuary (Tijuana River Bacterial Source Identification Report)

The adequacy of the data available to characterize this condition is considered "high" (see Table 2-7). In addition to receiving water and MS4 outfall monitoring data, special studies and reports specific to the water quality condition were also available to help characterize the conditions (e.g., Tijuana River Watershed Technical Support Document for Solids, Turbidity, and Trash TMDLs (Tetra Tech 2010)).

Five additional criteria were considered to select the highest priority water quality condition as discussed in Section 2.3.2. Results of this assessment are summarized in Table 2-10 and discussed below.

As presented in the Table 2-10, most of the land uses that contribute runoff into the MS4 in HA 911.1 (the HA in which the priority water quality conditions are located) generally have a relatively high magnitude of sediment and TSS load including industrial and transportation land uses. Typical facilities associated with these land uses include industrial facilities, roads and transportation facilities (excludes Caltrans). Among the types of land uses in HA 911.1 that typically drain to MS4s (commercial, industrial, transportation, and residential), 58 percent are categorized as industrial or transportation land uses which may have relatively high sediment or turbidity pollutant loads.

Sediment and turbidity may originate from a range of sources including regulated and unregulated; point- and non-point; and natural and anthropogenic sources. This document is focused on anthropogenic sources of sediment from urbanized areas conveyed through the MS4 rather than natural sources of sediment originating from pristine areas conveyed through the watershed. The Tijuana River Watershed Technical Support Document for Solids, Turbidity, and Trash TMDLs (Tetra Tech, 2010) developed estimates for the annual loads of sediment to the Tijuana River and Estuary originating from sources in the U.S. and Mexico. The report found that up to approximately 4 percent of sediment load may be originating from commercial, industrial, residential, and road land uses in the U.S. These land uses may contribute to discharge from the MS4. While the report was not formally adopted following public review and comment, the preliminary estimates help to inform the understanding of solids, turbidity, and trash in the WMA.

The ability to control sediment and turbidity at facilities within these land uses that drain to the MS4 is considered high. This is because sediment control can be accomplished through the implementation of a range of BMPs including stabilizing exposed soils and slopes; street sweeping; installation of catch basins; filtration, and by minimizing runoff volume through the use of green infrastructure practices.

The ability to address other pollutants simultaneously was also considered high. This is because a range of pollutants can co-occur with sediment. For example, bacteria, nutrients, and pesticides may adsorb to sediment particles or trash. Thus, treating for sediment or turbidity may lead to simultaneous reductions in these pollutants.

Based on the evaluation of the information and criteria summarized and described above, sedimentation / siltation in the Tijuana River (wet weather) and turbidity in the Tijuana River and Tijuana River Estuary (wet weather) have been identified as the highest priority water quality conditions in the Tijuana River WMA.

As discussed in Section 1, the MS4 makes up a small portion of the overall watershed and is one of many sources of sediment discharging to receiving waters. Collaboration among stakeholders will help to address the remaining sources. It is important to note that the binational nature of anthropogenic sediment issues in the Tijuana River WMA is well-documented (Tetra Tech, 2010, TRVRT, 2012). Rapid urbanization, construction design standards, and socioeconomic conditions in Mexico present significant challenges to watershed-based sediment management strategies. TRVRT was developed in part to address the binational challenge of anthropogenic sediment accumulation in the Lower Watershed. Actions by landowners have already provided some sediment load reduction benefits. Recent TRVRT accomplishments include the formation of a “Recovery Team” of agencies in Mexico to address sediment and trash issues, collaborative workshops with Mexican agency representatives, and coordination among legislative representatives in the U.S. and Mexico aimed to prioritize sediment and trash as an issue of international importance across the U.S.-Mexico border.

2.4.2 Discussion of Remaining Priority Water Quality Conditions

This section documents the assessment of the remaining priority water quality conditions that were not selected to be addressed through this WQIP. Although these priority water quality conditions were not selected in this analysis, these are being addressed through the Jurisdictional Runoff Management Plan (JRMP) programs. In addition, by addressing sediment, these pollutants often associated with sediment load, will be concurrently addressed. Appendix D provides detailed information on MS4 monitoring results including location, numbers of samples taken, and numbers of samples exceeding benchmarks.

2.4.2.1 Indicator Bacteria

Three water bodies are 303(d) listed as impaired for indicator bacteria (fecal, total coliform, and *Enterococcus*) in the Tijuana River WMA:

- Pacific Ocean Shoreline (four segments)
- Tijuana River Estuary (1320 acres or 534 hectares)
- Tijuana River (6 miles or 9.7 km)

In addition to the 303(d) listed segments monitoring data from TWAS-1 indicates that Campo Creek water samples exceeding water quality benchmarks for indicator bacteria. The benchmarks for bacteria are:

- 10,000 Most Probable Number (MPN)/100mL for Total Coliform;
- 4,000 MPN/100 mL for Fecal Coliform; and
- 151 MPN/100 mL for *Enterococcus*.

Receiving water monitoring results presented in the LTEA and Weston Reports were also reviewed to identify indicator bacteria water conditions in the Tijuana River and Tijuana River Estuary, as summarized below. Monitoring results are provided in Appendix B. As a result of this review, presence of indicator bacteria was also identified as a receiving water condition at Campo Creek. However, this site is not listed as impaired on the 303(d) list. During the public workshop on January 28, 2013, concerns were also raised about pathogens including viruses (Hepatitis A) along the Pacific Ocean shoreline of the Tijuana River WMA. However, no pathogen-specific data were available to further assess this condition.

Dry Weather Receiving Water Sampling

- *Enterococcus* and Fecal Coliform identified as high priority at MLS/TWAS-2 station in Tijuana River (LTEA)
- *E. coli* and *Enterococcus* detected above water quality benchmarks in Tijuana River and Estuary (San Diego Coastkeeper data, as presented in 2012 and 2013 Weston Report)
- *Enterococcus* identified as high priority at MLS in Tijuana River (2013 Weston Report)
- Multiple indicator bacteria samples above water quality benchmark in areas or MS4 outfalls that drain to Tijuana River and Tijuana River Estuary during wet weather (Tijuana River Bacterial Source Identification Report)
- *Enterococcus* identified as medium priority at TWAS-1 site in Campo Creek (LTEA) (1 out of 2 samples)
- *Enterococcus* identified as high priority (2 out of 2 samples) and fecal coliform as medium priority (1 out of 2 samples) at TWAS-1 site in Campo Creek (2013 Weston Report)

Wet Weather Receiving Water Sampling

- Fecal Coliform identified as high priority at MLS/TWAS-2 station in Tijuana River (LTEA, 2013 Weston Report)
- Multiple indicator bacteria samples above water quality benchmark in areas or MS4 outfalls draining to Tijuana River and Tijuana River Estuary (Tijuana River Bacterial Source Identification Report)
- Fecal Coliform identified as high priority at TWAS-1 site in Campo Creek (LTEA) (2 out of 2 samples)
- Fecal Coliform identified as medium priority at TWAS-1 site in Campo Creek (2013 Weston Report) (1 out of 2 samples)

Monitoring at MS4 outfalls and at areas draining to MS4s demonstrate that MS4 discharges are contributing, in part, to the indicator bacteria receiving water conditions in the Tijuana River, Tijuana River Estuary, Pacific Ocean shoreline, and Campo Creek. Sampling results are summarized below and provided in Appendix D. It should be noted that dry weather samples were generally taken in ponded water within the outfall and may not be indicative of actual discharges to receiving waters.

Dry Weather MS4 Sampling

- *Enterococci* identified as high priority in MS4 outfalls upstream of Tijuana River (LTEA and 2013 Weston Report)
- Multiple fecal indicator samples above water quality benchmark in areas or MS4 outfalls that drain to Tijuana River and Tijuana River Estuary during wet weather (Tijuana River Bacterial Source Identification Report)
- Single positive *Enterococcus* sample in MS4 outfall in 911.82 upstream of Campo Creek.

Wet Weather MS4 Sampling

- Fecal coliform identified as medium priority in MS4 outfalls upstream of Tijuana River (LTEA)
- Multiple turbidity samples above water quality benchmark in areas or MS4 outfalls draining to Tijuana River and Tijuana River Estuary (Tijuana River Bacterial Source Identification Report)

The adequacy of the data available to characterize this condition is considered “high” for the Lower Watershed and “moderate” for the Upper Watershed. Data for the Lower Watershed includes significant receiving water and MS4 outfall monitoring data as well a special study, the Tijuana River Bacterial Source Identification Study. Less monitoring data are available to characterize the condition in the Upper Watershed. Also, as noted above, only a single positive *Enterococcus* sample was reported in MS4 outfall monitoring in 911.82 upstream of Campo Creek.

As presented in Table 2-10, less than 20 percent of the land uses that contribute runoff into the MS4 in HA 911.1 (the HA that contains the Tijuana River, Tijuana River Estuary, and Pacific Ocean shoreline) generally have a high magnitude of indicator bacteria (e.g., commercial and high density residential). In

HA 911.8, the percentage of such land uses is less than 1 percent. MS4 discharges in these HAs may generally have moderate levels of indicator bacteria.

Like other pollutants, indicator bacteria may originate from a variety of sources. The analysis of land uses in the Tijuana River WMA indicates that MS4s are not a significant bacteria contributor to the impairment of REC-1 uses in the river, estuary and beach. This conclusion is also supported by the Tijuana River Bacterial Source Identification Study (Weston Solutions, 2012) which concluded that the vast majority of the pollutant loading originates outside of the U.S (99%) and not the MS4 (<1%). The Weston study was conducted to help identify sources of microbial contamination affecting area beaches. The study concluded that approximately 99 percent of the indicator bacterial loads entering the Pacific Ocean originate from flows from the main channel of the Tijuana River and tributary channels from Mexico and identified only two minor sources in the United States during dry weather. The study further concluded that less than 1 percent of the *Enterococcus* and fecal coliform loads entering the Tijuana River Estuary originate from the entire U.S. urbanized portion of the watershed. Moreover, nearly all of the samples originating from Mexico were positive for human-specific *Bacteroides* marker (indicating human fecal matter), while none of those from the U.S. drainage were positive for the marker.

The ability to control indicator bacteria at sites discharging to MS4s is considered moderate. Strategies such as pet waste control, bird control, good housekeeping, and volume reduction may reduce bacterial loads, but will have limited effect on natural levels of bacteria or bacterial regrowth in the MS4.

The ability to address other pollutants simultaneously is considered moderate. While some of the strategies used to control bacteria (e.g., good housekeeping and volume reduction) would also reduce in simultaneous reductions in co-occurring pollutants, other strategies (e.g., pet waste control, bird control, sanitary sewer leak repair) would reduce bacteria loads but would result in little or no simultaneous reductions in other pollutants.

Based on the above analysis and due to the relative small contribution of bacterial indicators from MS4s to this water quality condition in the watershed, indicator bacteria has not been elevated to a highest priority water quality condition for the WQIP.

2.4.2.2 Low Dissolved Oxygen (DO)

Two water bodies are 303(d) listed as impaired for low DO in the Tijuana River WMA:

- Tijuana River Estuary (125 acres)
- Tijuana River (6 miles or 9.7 kilometer [km])

As previously noted, the Tijuana River Estuary is impaired for MAR, and the Tijuana River is impaired for WARM. The water quality benchmarks for DO are as follows:

- BOD: 30 mg/L
- COD: 120 mg/L
- Low DO: <5 mg/L

DO levels naturally fluctuate on a diurnal and seasonal basis in the Tijuana River Estuary, and these fluctuations should be considered when interpreting the significance of analytical results. For example, DO levels range between 0.5 to 8 mg/L from May to October and from 4 to 12 mg/L from October to May. Discharges of pollutants and excess BOD/COD can lead to low DO beyond the natural range. Adequate DO is vital for aquatic life. Depression of DO levels can lead to fish kills and odors resulting from anaerobic decomposition. DO content in water is a function of water temperature and salinity (Regional Board, 2012). BOD and COD are measurements that indicate the depletion of DO in water.

Receiving water monitoring results presented in the LTEA and Weston Reports document the DO conditions in the Tijuana River and Tijuana River Estuary, as summarized below. Monitoring results are provided in Appendix B.

Dry Weather Receiving Water Sampling

- BOD and COD were identified as medium to high priority in the Tijuana River (LTEA)
- Samples with low DO in Tijuana River and Estuary (San Diego Coastkeeper, reported in 2012 and 2013 Weston Report)

Wet Weather Receiving Water Sampling

- BOD and COD were identified as medium to high priority in the Tijuana River (LTEA and 2013 Weston Report)

Data summarizing potential MS4 contributions of low DO water quality condition are summarized below. Monitoring results are provided in Appendix D.

Dry Weather MS4 Sampling

- Low DO reported at MS4 outfalls in HA 911.11 and 911.12 (LTEA)
- Low DO reported at MS4 outfalls in HA 911.11 (2013 Weston Report)

Wet Weather MS4 Sampling

- No MS4 sample results identified
- 303(d) list identifies “urban runoff/storm sewers” as potential source of low DO for both the Tijuana River and Tijuana River Estuary

Adequacy of data to characterize the DO condition is considered moderate. Both receiving water and MS4 analytical data were available to review, but special studies were not. The data confirm that low DO is a priority condition in the HA 911.1 but additional data may be needed to identify the most significant contributors through the MS4.

As presented in Table 2-9, approximately 34 percent of the land uses in HA 911.1 that contribute runoff into the MS4 are considered high magnitude sources of BOD and COD (residential land uses). Based on the areal distribution of all land uses that contribute runoff to the MS4, storm water discharges from MS4s in HA 911.1 are expected to have relatively moderate BOD and COD loads on average.

Controllability is considered moderate because multiple sources may be contributing to low DO and the source may be unknown. Potential sources may include the presence of high nutrients in receiving waters, high BOD/COD contributions, organic sediment, illicit discharges, and natural variations. To address the low DO, the most significant sources contributing to the water quality condition would have to be identified and addressed.

The ability to address other pollutants simultaneously is considered moderate. Opportunities for simultaneous reductions may exist depending on whether the source of the low DO can be identified and addressed. Addressing some sources may result in simultaneous reductions. For example, if organic debris is a primary cause, BMPs designed to trap organic debris would also likely trap sediment. If the source of the low DO is a sanitary sewer leak with high BOD, then addressing the leak would likely also reduce bacterial loads.

Due to the limited data available to directly correlate low DO to MS4 discharges and to identify priority MS4 sources of low DO, low DO has not been elevated to a highest priority water quality condition.

2.4.2.3 Nutrients

Two water bodies are 303(d) listed as impaired for nutrients in the Tijuana River WMA:

- Tijuana River (6 miles or 9.7 km)
- Barrett Lake (125 acres or 51 hectares)
- Morena Reservoir (104 acres or 42 hectares)

Each is impaired for the WARM Beneficial Use. The water quality benchmarks for nutrients are as follows:

- Total Nitrogen: 1 mg/L
- Total Phosphorus: 0.1 mg/L

According to the current and historic monitoring data nutrients were considered a high priority including:

- Wet Weather – Total Phosphorus (MLS/TWAS2)
- Dry Weather – Total Nitrogen, total phosphorus, and dissolved phosphorus (MLS/TWAS-2)

Elevated concentrations of nitrogen and phosphorus, individually or in combination with other nutrients, can lead to stimulated algae and plant growth (Regional Board, 2012).

Receiving water monitoring results presented in the LTEA and Weston Reports document the nutrient conditions in the Tijuana River, Campo Creek, Barrett Lake, and Morena Reservoir, as summarized below. Monitoring results are provided in Appendix B.

Dry Weather Receiving Water Sampling

- Dissolved/total phosphorus and total nitrogen were identified as high priority at the MLS/TWAS-2 stations in the Tijuana River (LTEA and 2013 Weston Report)
- Benthic algae (surrogate for nutrients) was identified as a high priority condition at the TWAS-1 station in Campo Creek (LTEA)
- Dissolved/total phosphorus was identified as high priority at the TWAS-1 station in Campo Creek (2012 Weston Report)
- Data sets did not include dry weather monitoring data for Barrett Lake or Moreno Reservoir.

Wet Weather Receiving Water Sampling

- Total phosphorus was identified as a high priority and dissolved phosphorus as a medium priority at the MLS/TWAS-2 stations in the Tijuana River (LTEA)
- Dissolved phosphorus and total phosphorus were identified as high priority at the MLS station in the Tijuana River (2013 Weston Report).
- Data sets did not include wet weather monitoring data for Barrett Lake or Moreno Reservoir.

Data summarizing potential MS4 contributions of nutrients are summarized below. Monitoring results are provided in Appendix D.

Dry Weather MS4 Sampling

- 8/9 MS4 samples in HSA 911.11 and 3/3 MS4 samples in HSA 911.12 exceeded water quality benchmarks for total phosphorus and nitrogen (LTEA)
- 8/9 MS4 samples in HSA 911.11 and 3/3 MS4 samples in HSA 911.12 exceeded water quality benchmarks for total nitrogen (LTEA)
- 1/3 MS4 samples in HA 911.30 (Barrett Lake HA) exceeded water quality benchmarks for total phosphorus (LTEA)
- 2/3 MS4 samples in HA 911.30 (Barrett Lake HA) exceeded water quality benchmarks for total nitrogen (LTEA)
- 1/1 MS4 sample in HA 911.60 (Cottonwood HA) exceeded water quality benchmarks for total nitrogen (2013 Weston Report)
- 1/1 MS4 sample in HSA 911.82 (Canyon City HSA) exceeded water quality benchmarks for total phosphorus (2013 Weston Report)

Wet Weather MS4 Sampling

- No MS4 sample results identified

Adequacy of data to characterize the nutrient condition is considered moderate. Both receiving water and MS4 analytical data were available to review, but special studies were not. The data confirm that the presence of elevated levels of nutrients is a priority condition in the WMA, but additional data may be needed to confirm whether the MS4 contribution of nutrients is significant and to determine the significance of the MS4 contribution.

As presented in Table 2-9, MS4 land uses listed are not considered as significant contributors of nutrients to receiving waters, and the expected contribution is expected to be low across the WMA from MS4 sources. Nutrients generally originate from agricultural sources. While agricultural land uses exist in the WMA, they often do not contribute runoff to the MS4 because of their rural locations. Agricultural sources can reduce nutrient discharges by avoiding over-application of fertilizers and over-irrigation.

Controllability of nutrients is considered moderate. Some nutrient reduction may be achieved through infiltration BMPs, but results vary. Reductions can also be achieved through minimizing or elimination the over-application of fertilizer and over-irrigation.

The ability to address other pollutants simultaneously is also considered moderate. Education programs designed to reduce overuse of fertilizers could be designed to also include discussion on pesticides, resulting in simultaneous reductions of both. Also, because of the direct relationship between nutrients and low DO, successes in controlling nutrients should result in simultaneous reductions in low DO conditions.

Due to the limited data to directly correlate nutrients to MS4 sources and to identify priority MS4 sources of nutrients, nutrients has not been elevated to a highest priority water quality condition.

2.4.2.4 Surfactants (MBAS)

The Tijuana River is listed as impaired for surfactants (MBAS) impacting the REC-1 Beneficial Use. The size of the impairment is 6 miles (9.7 km). The water quality benchmark for surfactants is 0.5 mg/L.

MBAS test measures the presence of anionic surfactant (commercial detergent) in water. Positive test results can be used to indicate the presence of domestic wastewater (Regional Board, 2012).

Receiving water monitoring results presented in the LTEA and Weston Reports document the surfactants condition in the Tijuana River.

Dry Weather Receiving Water Sampling

- Surfactants were identified as high priority at the MLS/TWAS-2 in the Tijuana River (LTEA)
- Surfactants were identified as medium priority at the MLS in the Tijuana River (2012 Weston Report)

Wet Weather Receiving Water Sampling

- Surfactants were identified as medium priority at the MLS and high priority at the TWAS-2 in the Tijuana River (LTEA)
- Surfactants were identified as medium priority at the MLS in the Tijuana River (2012 Weston Report)

Data summarizing potential MS4 contributions of surfactants are summarized below. Monitoring results are provided in Appendix D.

Dry Weather MS4 Sampling

- 1/1 MS4 sample in HSA 911.11 exceeded water quality benchmarks for surfactants (LTEA)
- 22/30 dry weather samples collected as part of the Tijuana River Microbial Source Identification study detected MBAS in MS4s above benchmark values.

Wet Weather MS4 Sampling

- No MS4 sample results

Adequacy of data to characterize surfactants is considered moderate. Both receiving water and MS4 analytical data were available to review, but special studies were not. The data confirm that the presence of surfactants is a priority condition in the WMA, but additional data may be needed to determine the significance of the MS4 contribution.

While the presence of surfactants may indicate the presence of domestic wastewater, it may also suggest illicit discharges, for example, from commercial, industrial, or residential sites. The presence of such land uses in HA 911.1 suggests the possibility that these sources may be contributors of MBAS, as presented in Table 2-9. Surfactants are moderately controllable in MS4s through better education and training and illicit discharge detection. Success in such efforts may result in simultaneous reductions of other pollutants.

Limited data exist to correlate MS4 outfall data with receiving waters, and significant data gaps exist. Due to the limited data available to directly correlate MBAS to MS4 discharges, particularly during wet weather, and the status of MBAS as a medium priority constituent in receiving waters, MBAS has not been elevated to a highest priority water quality condition.

2.4.2.5 TDS

TDS in natural waters may consist of carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrates, calcium, magnesium, sodium, potassium, iron, manganese and other substances. High total dissolved solids concentrations in irrigation waters can be deleterious to plants directly or indirectly through adverse effects on soil permeability (Regional Board, 2012).

The water quality benchmark for TDS is 500 mg/L. No receiving waters in the Tijuana River WMA are impaired for TDS. However, TDS was identified as a medium priority constituent at the TWAS-1 site in

Campo in the LTEA and a high priority constituent in the 2013 Weston Report. Receiving water monitoring results presented in the LTEA and Weston Reports document the TDS condition in the Tijuana River.

Dry Weather Receiving Water Sampling

- TDS was identified as high priority at the TWAS-1 station in Campo Creek (LTEA and 2013 Weston Report) (2/2 samples for each)

Wet Weather Receiving Water Sampling

- TDS was identified as medium priority at the TWAS-1 station in Campo Creek (LTEA) (1/2 samples)
- TDS was identified as a high priority at the TWAS-1 station in Campo Creek (2013 Weston Report) (2/2)

Data summarizing potential MS4 contributions of TDS are summarized below. Monitoring results are provided in Appendix D.

Dry Weather MS4 Sampling

- 1/1 MS4 sample exceeded water quality benchmarks for TDS in HSA 911.82.

Wet Weather MS4 Sampling

- No MS4 sample results exceeded water quality benchmarks.

Controllability of TDS through BMPs is considered moderate. Some reductions in filtration BMPs may be achieved, but results vary. Pollutant load reductions can also be achieved through source control, good housekeeping, and storm water retention. The ability to control multiple pollutants is also considered moderate. Simultaneous reductions in multiple pollutants may be achieved depending on the source or type of TDS of concern and the control method employed. For example, filtration BMPs or storm water retention may result in simultaneous reductions in other pollutants, while source control for a specific pollutant would be more focused on that pollutant.

Adequacy of data to characterize TDS is considered low. Limited MS4 analytical data (1 positive sample) were available to review. Due to the limited data available to correlate TDS to MS4 discharges, TDS has not been elevated to a highest priority water quality condition.

2.4.2.6 Trash

Both the Tijuana River and Tijuana River Estuary are listed as impaired for trash impacting the REC-2 Beneficial Use.

The Weston Reports summarize the results of dry weather trash assessments conducted annually. Sites are ranked as optimal, suboptimal, marginal, submarginal, or poor. Overall these assessments determined that trash is not an issue in many of the surveyed areas. Results from 2009 through 2012 are presented below:

- In 2009-2010, out of 44 sites, 3 were identified as poor and 11 as marginal, all within HA 911.1 (2011 Weston Report)
- In 2010-2011, out of 66 sites, 8 were identified as marginal, all within HA 911.1.
- In 2011-2012, out of 58 sites, 4 sites were identified as marginal or submarginal, all within HA 911.1.

The County of San Diego has also conducted a trash survey for the Upper Watershed as reported in the Tijuana River WURMP annual reports. The trash assessment was conducted over two fiscal years including FY10-11 and FY11-12. The County used a trash assessment method developed for the San Francisco Bay Region (see Surface Water Ambient Monitoring Program (SWAMP) (State Board, 2007). A total of 30 site visits were conducted at 10 sampling locations in the Upper Watershed.

- None of the sites were considered to be in a poor condition.
- Twenty-three of the sites received an optimal trash assessment score.
- Seven sites scored just below at sub-optimal.

Another indicator of trash impacts is the results of trash clean-up projects. The WURMP annual report summarizes the results of all of the trash clean-up projects completed in the lower portion of the watershed documenting the cleanup of hundreds of pounds of trash per event. For example:

- "Coastal Cleanup Day" in Imperial Beach resulted in the clean-up of 570 pounds of trash in 2011.
- "Creek to Bay Clean-up" resulted in the clean-up of 187 pounds of trash in 2012.

These events document trash as a receiving water condition but do not necessarily establish MS4s as a source of the trash. Trash may be transported to receiving waters through wind, non-point source runoff, littering, or cross-border flows.

The results from several additional studies also help to characterize trash in the WMA:

- **Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash TMDLs (Tetra Tech, 2010):** Report concludes that major storms are the most significant form of trash transport into the Tijuana River and Estuary. Major sources include canyon settlements in Mexican portion of watershed. Sources in U.S. include urbanized areas (e.g., commercial and residential areas) urbanized areas, high winds, and littering.

- **Report of Trash, Waste Tire and Sediment Characterization Tijuana River Valley (CalRecycle, URS, 2010):** Study identified the nature and occurrence of trash, sediment and waste tires on the ground surface in the Tijuana River Valley north of the international border and in the subsurface in the Lower Watershed. The report noted that volumes of materials observed in the valley have accumulated over an unknown period of time. A recommendation of the report is to conduct future studies to estimate the current rate of annual trash and sediment loading.
- **Los Laureles Canyon Trans-border Trash Tracking Study (Romo and Leonard, 2012):** Study focused on drainage originating from the Los Laureles Canyon and provides evidence of transborder flow of trash from Mexico to the Tijuana River WMA. The study notes that all streams in Los Laureles Canyon drain into the Tijuana River Estuary. This flow facilitates the transport of solid waste originating in the canyon to drain to the Tijuana River and flow across the U.S. border toward the Pacific Ocean. The report recommends addressing the 100 unmanaged dump sites to help control the flow of solid waste northward.

Trash is considered moderately controllable through BMPs. While some control can be achieved through street sweeping or catch basins, trash management is challenging due to underlying social issues related to littering and dumping. The ability to control other pollutants simultaneously is also considered moderate. For example, litter control would result in simultaneous reductions in pollutants if they are attached to trash (e.g., bacteria or solids). Catch basins designed to catch trash may also trap solids, but other pollutants such as TDS, nutrients, etc. would not be addressed.

While trash is a priority water quality condition and will continue to be addressed through RAs' JRMPs, it has not been elevated to a highest priority water quality condition for the WQIP. It is important to note, however, that the BMPs employed to treat sediment will result in simultaneous reductions in trash. Moreover, the State Board is developing amendments to Statewide Water Quality Control Plans for trash (Trash Amendments). The proposed Trash Amendments will include five elements: (1) Water Quality Objective, (2) Prohibition of Discharge, (3) Implementation, (4) Compliance Schedule, and (5) Monitoring. Future iterations of the WQIP may be updated to include requirements in conformance with that policy, as appropriate.

2.4.2.7 Pesticides

The Tijuana River is listed as impaired for pesticides impacting the WARM Beneficial Use. The size of the impairment is 6 miles (9.7 km). Water quality benchmarks vary by pesticide but generally fall within the range of 0.01-0.4 micrograms per liter (µg/L). Pesticides can enter receiving waters through direct discharges or through surface and ground water indirectly by drifting away from areas where pesticides are being sprayed, through surface runoff from treated fields, and by leaching or return flows from irrigation. Pesticides can concentrate in plant or animal tissues and many are considered to be carcinogenic to humans (Regional Board, 2012). The Tijuana River is impaired for pesticides impacting the WARM Beneficial Use.

Receiving water data indicate that the Tijuana River is impacted during wet weather as summarized below.

Wet Weather Receiving Water Sampling

- Malathion and Permethrin were identified as medium priorities at the MLS/TWAS-2 sites in the Tijuana River during wet weather (LTEA)
- Diazinon, Bifenthrin, and Permethrin were identified as high priority at the MLS site in the Tijuana River (2013 Weston Report)

While the 303(d) list identified “urban runoff/storm sewers” as potential sources of pesticides in the Tijuana River, available MS4 outfall sampling data have not identified pesticides as a priority constituent in MS4 discharges.

Controllability of pesticides is considered moderate. Some reductions can be achieved through minimizing or elimination the over-application of pesticides and over-irrigation. Further reductions may require banning of certain pesticides. Reductions from cross-border flows will require international outreach as many pesticides that have been banned in the U.S. are still available in Mexico. The ability to address other pollutants simultaneously is also considered moderate. Existing education programs help to reduce overuse of pesticides and fertilizers, resulting in simultaneous reductions of both. Also, because of the direct relationship between pesticides and toxicity, successes in controlling pesticides should result in simultaneous reductions in toxic conditions.

Adequacy of data to characterize pesticides is considered moderate. Due to the limited data available to correlate pesticides to MS4 discharges, pesticides have not been elevated to a highest priority water quality condition.

2.4.2.8 Synthetic Organics

The Tijuana River is impaired for synthetic organics impacting the MUN Beneficial Use. While the 303(d) List includes "Urban Runoff/Storm Sewers" as a potential source of the synthetic organics impairment, available MS4 outfall sampling data have not identified synthetic organics as a priority constituent in MS4 discharges.

Controllability of synthetic organics through BMPs is considered moderate. Some reductions in filtration BMPs may be achieved, but results vary. Pollutant load reductions can also be achieved through source control, good housekeeping, and storm water retention. The ability to control multiple pollutants is considered moderate. Simultaneous reductions in multiple pollutants may be achieved depending on the source or type of synthetic organic of concern and the control method employed. For example, filtration BMPs or storm water retention may result in simultaneous reductions in other pollutants, while source control for a specific pollutant would be more focused on that pollutant.

Due to the limited data available to directly correlate synthetic organics to MS4 discharges, synthetic organics has not been elevated as a highest priority water quality condition.

2.4.2.9 Toxicity

The Tijuana River is impaired for toxicity impacting the WARM Beneficial Use. While the 303(d) List includes "Urban Runoff/Storm Sewers" as a potential source of the toxicity impairment, available MS4 outfall sampling data have not identified toxicity as a priority constituent in MS4 discharges.

Controllability is considered moderate because multiple sources may be contributing to toxicity and the source may be unknown. Potential sources may include pesticides presently used, legacy pesticides remaining in the environment, high dissolved metals, or other sources. To address toxicity, the most significant sources contributing to the water quality condition would have to be identified and addressed.

The ability to address other pollutants simultaneously is considered moderate. Opportunities for simultaneous reductions may exist depending on whether the source of the toxicity can be identified and addressed. Addressing some sources may result in simultaneous reductions. For example, if pesticides are the primary cause, BMPs designed to reduce over-application of pesticides and over-irrigation may result in simultaneous reductions in nutrients.

Due to the limited data available to directly correlate toxicity to MS4 discharges, toxicity has not been elevated as a highest priority water quality condition.

2.5 IDENTIFICATION AND PRIORITIZATION OF SOURCES OR STRESSORS

As outlined in the discussions above, by following the process described in the Permit, sedimentation / siltation in the Tijuana River and turbidity in the Tijuana River and Tijuana Estuary within the Lower Watershed have been identified as the highest priority water quality conditions to be addressed by this WQIP. For ease of discussion, these conditions are referred to collectively as “sediment.” It is important to note that while the intent of the WQIP is to focus on the highest priority water quality condition, other pollutants will continue to be addressed as part of each RA’s JRMP. Moreover, practices that manage sediment will result in simultaneous reductions of other pollutants that co-occur with sediment (e.g., nutrients, pesticides, bacteria).

After identifying the highest priority water quality condition, the next step required by the Permit is to identify and prioritize 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. Consistent with Permit requirements, sources or stressors were identified following the process outlined in the Permit by considering the following elements. Sources were also identified through the solicitation of public input were also considered.

1. Pollutant generating facilities, areas, and/or activities within the WMA
2. Locations of the RAs’ MS4s
3. Other known and suspected sources of non-storm water or pollutants in storm water discharges to receiving waters with the WMA

4. Review of available data on dry weather screening, inspections, and complaint investigations
5. The adequacy of the available data to identify and prioritize sources and/or stressors associated with MS4 discharges that cause or contribute to the highest priority water quality conditions identified under Provision B.2.c.

Table 2-11 below summarizes the general process for identifying and prioritizing the sources.

Table 2-11
Identifying and Prioritizing Sources

Sources of Pollutants and/or Stressors	Criteria for Prioritizing
• Facilities known or suspected to discharge sediment to receiving waters via MS4s • MS4 outfalls • Other permitted discharges to receiving waters • Non-point sources • International sources	• Origin of Source: Is the source anthropogenic or natural? • Potential magnitude: What is the relative pollutant load for source type? • Controllable: Are the sources controllable by the RAs?

2.5.1 Identification Sources of Pollutants and/or Stressors

The subsections that follow describe the stepwise process used to identify potential sources of pollutants and/or stressors that may contribute to the highest priority water quality conditions. This is followed by a discussion on prioritization of sources.

2.5.1.1 Pollutant-Generating Facilities, Areas, and/or Activities

Table 2-12 provides an inventory of potential pollutant-generating facilities within the Tijuana Valley HA (911.1) that may cause or contribute to sedimentation / siltation and turbidity water quality condition in the Tijuana River and Tijuana River Estuary in the Lower Watershed. Table 2-13 provides a similar inventory for land uses in the Tijuana Valley HA (911.1). Counts of facilities were available in RAs' JRMP annual reports. Land use acreages were available through SANDAG (2012).

Table 2-12
Potential Pollutant-Generating Facilities that may Contribute to Highest Priority Water Quality Condition

Facility Type	City of Imperial Beach	City of San Diego	County of San Diego	Total
Construction Sites	69	66	1	136
Commercial Facilities	100	1,342	2	1,444
Industrial Facilities	0	99	0	99
Municipal Facilities	14	22	2	38
Treatment, Storage, or Disposal Facilities	1	19	0	20

Notes:
Source: 2011-12 JRMP Annual Report
Includes only sites within HA 911.1 in the Lower Watershed.

Table 2-13
Potential Pollutant-Generating Areas that may Contribute to Highest Priority Water Quality Condition

Area Type	City of Imperial Beach (Acres)	City of San Diego (Acres)	County of San Diego (Acres)	Total
Areas where RAs have Oversight and Discharge Responsibility				
Commercial	5	302	13	321
Institutional	14	90	35	139
Low Density Residential	237	1,124	12	1,373
High Density Residential	143	434	0	577
Transportation[1]	176	2,023	92	2,291
Vacant and Undeveloped Land	2	1,739	1,662	
Open Space Park or Preserve	9	3,246	637	3,892
Other Park, Open Space and Recreation	15	111	0	126
Areas where RAs have Oversight Responsibility Only				
Industrial	0	1,018	35	1,053
Areas where RAs do not have Oversight or Discharge Responsibility				
Federal Lands[2]	1,215	1,372	575	3,162
Caltrans	0	1,023	34	1,057
Other State Lands[3]	269	683	0	952
School Land	59	309	0	368
Agricultural	0	638	471	1,109

Notes:
Source: SANDAG (2012)
To convert acres to hectares, divide values by 2.47.
Includes only sites within HA 911.1.
[1] Includes local streets and parking lots. Excludes Caltrans.
[2] Includes California Department of Fish and Game, State Parks, and other state lands.
[3] Includes Bureau of Land Management, U.S. Fish and Wildlife, military, and other federal lands

2.5.1.2 Locations of Responsible Agencies' MS4s

The MS4 maps provided on Figures 1-1 through 1-6 and Figures 2-4 and 2-5 were reviewed as part of the source identification process. The Tijuana River Valley in the Lower Watershed has the highest acreage of urban land use and therefore has the most MS4 structures. The Upper Watershed is largely undeveloped and those areas located above the reservoirs are not contributors of sediment to the Lower Watershed. Because the Lower Watershed has the highest density of MS4 facilities, the WQIP prioritizes these sources.

2.5.1.3 Other Known and Suspected Sources of Highest Priority Condition

A number of potential sources that are not associated with the RA MS4 discharges may also contribute to sediment load within the Tijuana River WMA. Potential sources include discharges from NPDES permitted discharges and other point sources and non-point sources. NPDES permitted discharges include industrial facilities subject to the Industrial Storm Water General Permit (Order No. 2014-0057-DWQ, effective July 1, 2015); commonly referred to as the Industrial General Permit), construction sites subject to the General Permit for Discharges of Storm Water Associated with Construction Activity (Order No. 2009-0009-DWQ; commonly referred to as the Construction General Permit) and other permitted discharges. The downstream portions of the Tijuana River WMA also receive commingled flows from Mexico that are known contributors to sediment and other pollutant issues. A detailed discussion of these potential sources is presented below.

2.5.1.3.1 NPDES Permitted Discharges

NPDES permitted discharges, such as discharges covered under the State's Industrial General Permit and CGP, may contribute to the Tijuana River WMA highest priority water quality condition. Industrial facilities can discharge sediment resulting from onsite processes depending on discharge outfall characteristics. Construction sites permitted under the CGP are relatively large (>1 acre) and can contribute sediment during ground disturbance and construction activities. Discharges from industrial and construction sites can be conveyed to receiving waters through the RAs' MS4s. Three types of NPDES permits have been identified in the Tijuana River WMA. NPDES permits regulating discharges within the Tijuana River WMA are presented in Table 2-14.

Table 2-14
NPDES Permitted Discharges that may Contribute to Highest Priority Water Quality Condition

Permit Type	Number of Permits in Tijuana River WMA[2]
Industrial	47
Construction	19
Individual permits[1]	2

Sources: Storm Water Multiple Application and Report Tracking System (SMARTS) (https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp) and Regional Board (http://www.waterboards.ca.gov/sandiego/water_issues/programs/regulatory/index.shtml)

Notes:

[1] Includes NPDES permits that may be relevant to sediment: Individual NPDES permit for discharges from Naval Base Coronado, specifically, Naval Outlying Field (NOLF) and discharges from Caltrans sites.

[2] Includes permittees in the Lower Watershed only.

It should be noted that construction sites are typically transient and the number of active, permitted construction sites will vary over time. The numbers of sites appearing in Table 2-14 were generated in early 2014 from the SMARTS database maintained by the State Board. Moreover, construction sites have relatively brief periods of ground surface disturbance activities may present threats to water quality and/or sediment discharges. Accordingly, the currently active NPDES-permitted construction activity sites identified may not be representative of areas with heightened potential to discharge sediment to the MS4.

Note that coverage under these NPDES permits overlaps with the MS4 Permit. RAs have some limited regulatory oversight authority and can and do conduct inspections of these permitted sites.

2.5.1.3.2 Other Point Sources

A point source can be classified as a discrete conveyance that discharges to a receiving water. Point source discharges can be structures such as pipes, culverts, or ditches. Non-MS4 or private outfalls are point sources that may discharge sediment and/or pollutants to the MS4 or receiving waters. RAs have performed a field evaluation to assess the physical asset characteristics and downstream channel condition of a portion of the MS4 outfalls in the Tijuana River WMA. Several potential non-municipal and/or private point source discharges were identified in HA 911.1 in the City of San Diego during asset management field investigations that may contribute sediment and other pollutants to receiving waters. Follow-up investigation and analysis are needed to confirm the presence and locations of these discharges. Non-storm water sources of runoff such as water main breaks, over-irrigation, or broken sprinklers may also contribute flow that can transport sediment to receiving waters through the MS4.

2.5.1.3.3 Other Non-point Sources

Non-point sources typically flow over land and discharge to receiving waters over a broad area, which make them more difficult to manage than point sources. Potential non-point source discharges include:

- Agricultural operations: During wet weather, storm water runoff may carry sediment and other pollutants from agricultural lands to roads, storm drains, other municipal infrastructure, or directly to receiving waters. Runoff from over-irrigation during dry weather may also transport nutrients, pesticides, and sediment. Agricultural sites may operate under a discharge waiver from the Regional Board that exempts them from the discharge requirements of the current Permit. However, no such waivers are in place in the Tijuana River WMA.
- Erosion related to unimproved roadways in rural areas: There are a number of unimproved roadways along the U.S.-Mexico border and in the eastern portion of the Tijuana River WMA. The U.S. Customs and Border Protection conduct operations to support its border protection mission using a number of trails and unimproved roadways. These trails and unimproved roads can serve to concentrate storm water flows that result in erosion that may contribute to sediment and other pollutants that affect downstream water quality conditions. However, such areas in the Upper Watershed would not likely impact the conditions in the Lower Watershed.
- Homeless encampments: The exposed soils and dirt trails often associated with homeless encampments leave the ground vulnerable to erosion which may result in sediment delivery to water bodies.
- Natural sources: Natural sources of sediment include the sediment produced through erosion processes of slopes and canyons in the WMA. Aerial deposition (i.e., particulates blown and redeposited by wind) also has been identified as both a natural source and a source influenced by anthropogenic activities.

2.5.1.3.4 Commingled Flows from Mexico

The Tijuana River main stem and tributary drainages of Yogurt Canyon, Goat Canyon, and Smuggler's Gulch transport anthropogenic-derived sediment and other pollutants generated in Mexico to receiving waters. Both point and non-point sources of pollutants are present in the Mexican portion of the watershed. In Mexico, water quality is regulated by various local, state and federal agencies, depending on channel location and construction, however, requirements are generally less stringent or not enforced compared to those in the U.S. Control of sediment and pollutant discharges originating in Mexico is outside the jurisdictional authority of governmental organizations within the U.S. including the RAs.

2.5.1.4 Review of Available Data on Dry Weather Screening, Inspections, and Complaint Investigations

The most recent JRMP annual reports prepared by the RAs were reviewed to consider available data on dry weather screening, inspections, complaint investigations as well as follow up to these activities. The information helps to inform the potential magnitude of non-compliance, in particular with respect to non-storm water discharges, in the WMA. In general, non-storm water discharges were not identified as a significant issue in the WMA. The reports also demonstrated that issues identified through other inspections and investigations were addressed in timely manner.

2.5.1.4.1 Dry Weather Field Screening and Persistent Flow

The Permit requires each jurisdiction to identify persistent dry weather flows from their MS4 (Provision D.2.a.2). The permit defines persistent flow as, "the presence of flowing, pooled, or ponded water more than 72 hours after a measurable rainfall event of 0.1 inch or greater during three consecutive monitoring and/or inspection events. All other flowing, pooled, or ponded water is considered transient."

Dry weather field screening data were available in the WMA for the City of Imperial Beach and the City of San Diego in the 2013 JRMP annual reports. These data were reviewed to identify sources of sediment entering receiving waters through the MS4 during dry weather. In some cases, dry weather discharges may originate from permitted sources. In other cases, these are illicit discharges. Table 2-15 summarizes the results of these screenings.

Table 2-15
Summary of Dry Weather Field Screening and Persistent Flow

Jurisdiction	Summary of Results
City of Imperial Beach	The City of Imperial Beach inspected five stations within the Tijuana River WMA and identified one outfall requiring further investigation. After extensive sampling, visual monitoring, and upstream investigation, the City of Imperial Beach concluded that there was likely no persistent anthropomorphic flow at this location. This site continues to be included in RA outfall monitoring so any future problems will be detected through other monitoring programs.
City of San Diego	The City of San Diego inspected 36 structures within the Tijuana River Valley (City does not have any outfalls in other areas of the WMA). All instances of flow or ponding with the exception of one were limited to a single monitoring event and are therefore considered transient. One site was identified with ponded water on two separate occasions. The ponded water was attributed to over-irrigation, and the outfall is located in a large detention basin.
County of San Diego	The County of San Diego has four major outfalls in the WMA one of which is located in the Lower Watershed. None of the County outfalls had dry weather flow. Based on this preliminary data it has been determined that dry weather flows are not significant sources of the sediment water quality condition for the Tijuana River WMA.

Sources: 2011-2012 JRMP Annual Reports.

2.5.1.4.2 Facility Inspections and Complaint Investigations

Facility inspections complement the Illicit Discharge Detection and Elimination (IDDE) program and consist of informing the public about storm water and dry weather runoff. Inspections also detect potential dry weather flows discharging from facilities. Inspections may confirm whether specific types of facilities are significant sources of sediment. Facility inspections were reported based on the previous MS4 permit JRMP annual reporting requirements.

In addition to facility inspections, the RAs have implemented regional and jurisdictional storm water telephone hotlines since the issuance of the previous permit. Members of the public may report complaints to the regional hotline which is maintained by the County of San Diego and managed in collaboration with I Love a Clean San Diego. The County contacts the appropriate jurisdiction for follow-up on complaints received by the hotline. The jurisdictions also maintain separate hotlines and respond to complaints received. This public feedback helps the RAs to identify and eliminate illicit discharges. Each jurisdiction addressed complaints received by the public.

The JRMPs demonstrate that issues through the facility inspections and hotlines were resolved in a timely manner. While the JRMPs demonstrate BMP compliance in general, they also confirm the need to continue inspections and outreach to construction, commercial, industrial sites and the public to address potential sources of sediment. Recommendations will be provided in Section 4 (Monitoring and

Assessment) and Section 5 (Adaptive Management) on adjusting and refining JRMP report requirements to answer water quality-related questions.

2.5.1.5 Sources Identified with Public Input

The RAs held a public workshop on January 28, 2014. During the workshop, the RAs provided background information and preliminary findings (e.g., potential water quality conditions, sources, and strategies). The public were invited to provide input during the meeting. The public identified the following additional potential pollutant sources for sediment:

- Unpaved alleys
- Bare/Un-vegetated yards
- Illegal dumping

Appendix G provides a complete list of pollutant sources for water quality conditions identified by the public.

2.5.2 Prioritization of Sources of Sediment

In this section, the comprehensive list of potential pollutant sources of sediment is prioritized. Four criteria were used to prioritize these sources to facilitate the development of strategies to address the condition: 1) Adequacy of Data; 2) Origin of Source (anthropogenic or natural); 3) Potential magnitude of source; and 4) Controllability. Table 2-16 summarizes the results of the prioritization.

2.5.2.1 Adequacy of Data

In general, data were adequate to prioritize sources. The jurisdictional monitoring and inspection programs along with the MS4 inventory provide sufficient data were available to develop and prioritize a provisional list of known or suspected sources of sediment within the Tijuana River WMA. Additionally there is sufficient data to characterize other sources including: Contributions from other permitted sources (Phase II, Caltrans, Military operations, etc.); non-point source contribution; and contributions from across the international border. In general, sources with significant quantitative data (e.g., inventory information) were characterized as high. Sources with mostly anecdotal evidence were characterized as moderate.

2.5.2.2 Origin of Sources

Sources were categorized based on whether they are natural or anthropogenic. Sources identified as anthropogenic (i.e., those associated with human activity) were ranked higher, while sources identified with a potential natural origin were ranked lower and may be excluded from priority strategies.

2.5.2.3 Potential Magnitude of Source

While almost all of the sources identified above may contribute sediment through the MS4 to receiving waters, it is important to understand that the magnitude of the sediment discharge from the different sources varies. For example, the Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash TMDLs (Tetra Tech, 2010) summarized the magnitude of TSS load from different land uses and sources. While the report was not formally adopted following public review and comment, the preliminary estimates help to inform the understanding of solids, turbidity, and trash in the WMA. Sediment from Mexico was considered to be the most significant single source of anthropomorphic sediment. Within the U.S., agriculture was identified as the most significant non-point source. Freeways, transportation, and industrial land uses were identified as relatively high magnitude sources, and residential and commercial land uses were identified as moderate sources. Construction was identified as a moderate to high magnitude source. It should be noted that while construction sites may present one of the highest threats of sediment production, these sites are the most inspected and regulated thereby mitigating their associated risk. The Tijuana River WURMP (County of San Diego et al., 2008), also identified agriculture, grading/construction, and slope erosion as major sources of sediment. The sources identified above were categorized based on their expected magnitude based on Table 2-4 and best professional judgment (BPJ).

2.5.2.4 Source Controllability

Sources were evaluated for controllability in two ways. First, sources were ranked on how controllable they are through the implementation of BMPs. BMPs include both structural BMPs as well as nonstructural BMPs including source control. In general, controllability was considered high for discrete sites or facilities with centralized management (e.g., construction sites, commercial facilities, industrial facilities, etc.), moderate for sprawling sites or areas without centralized management (e.g., residential areas), and low for natural non-point sources or international sources (e.g., natural sources or flows from Mexican portion of watershed).

Second, sources were evaluated for RA responsibility. For some discharges, RAs have oversight responsibility only. They may inspect these discharges but are not responsible for them. For others, they have both discharge and oversight responsibility. RAs may inspect these discharges and are responsible for them. For some discharges, RAs have neither oversight responsibility nor discharge responsibility. Discharges for which RAs have neither oversight nor discharge responsibility will have an overall low priority ranking.

Table 2-16
Summary of Source Prioritization

Source	Origin of Source	Adequacy of Data[1]	Potential Magnitude of Source[2]	Controllability of Source[3]			Overall Priority[4]
				General Controllability through BMPs	Oversight Responsibility	Discharge Responsibility	
Facilities							
Construction Sites	Anthropogenic	High	Moderate to High	High	Yes	No	High
Commercial Facilities	Anthropogenic	High	Moderate	High	Yes	Yes	High
Industrial Facilities	Anthropogenic	High	High	High	Yes	No	High
Municipal Facilities	Anthropogenic	High	Moderate	High	Yes	Yes	High
Waste Treatment, Storage, or Disposal	Anthropogenic	High	High	High	Yes	No	High
Areas							
Commercial	Anthropogenic	High	Moderate	High	Yes	Yes	High
Institutional	Anthropogenic	High	Moderate	High	Yes	Yes	High
Industrial	Anthropogenic	High	High	High	Yes	No	High
Residential	Anthropogenic	High	Moderate	Moderate	Yes	Yes	Moderate
Transportation	Anthropogenic	High	High	High	Yes	Yes	High
Vacant and Undeveloped Land	Anthropogenic or Natural	Moderate	High	Low	Yes	Yes	Moderate
Open Space Park or Preserve	Natural	Moderate	High	Low	Yes	Yes/No	Low to Moderate
Other Park, Open Space and Recreation	Anthropogenic or Natural	Moderate	Moderate to High	Moderate	Yes	Yes/No	Moderate
Federal Lands	Anthropogenic or Natural	High	Moderate to High	Moderate to High	No	No	Low
Caltrans	Anthropogenic	High	High	Moderate	No	No	Low

Source	Origin of Source	Adequacy of Data[1]	Potential Magnitude of Source[2]	Controllability of Source[3]			Overall Priority[4]
				General Controllability through BMPs	Oversight Responsibility	Discharge Responsibility	
Other State Lands	Anthropogenic or Natural	High	Moderate to High	Moderate to High	No	No	Low
School Land	Anthropogenic	High	Moderate	Moderate to High	No	No	Low
MS4 Outfalls							
Lower Watershed - Dry Weather	Anthropogenic	Moderate to High	Low	High	Yes	Yes	Moderate
Lower Watershed - Wet Weather	Anthropogenic	Moderate to High	Moderate to High	Moderate	Yes	Yes	Moderate to High
Other NPDES Permitted Discharges							
Industrial	Anthropogenic	High	High	High	Yes	No	High
Construction Sites	Anthropogenic	High	Moderate to High	High	Yes	No	High
Individual	Anthropogenic	High	Moderate to High	High	Yes	No	Low
Other Point Sources							
Private outfalls	Anthropogenic	Moderate	Moderate to High	Moderate	Yes	No	Moderate
water main breaks	Anthropogenic	High	Low	Moderate	Yes	Yes	Moderate
over-irrigation	Anthropogenic	Moderate	Low	Moderate	Yes	Yes	Moderate
Other Non-Point Sources							
Agricultural operations	Anthropogenic	Moderate	Very High	Moderate	No	No	Low
Erosion of unimproved roadways	Anthropogenic	Moderate	High	Moderate	Yes	Yes	Moderate
Homeless encampments	Anthropogenic	Moderate	High	Moderate	Yes	No	Moderate
Natural sources	Natural	Moderate	High	Low	No	No	Low

Source	Origin of Source	Adequacy of Data[1]	Potential Magnitude of Source[2]	Controllability of Source[3]			Overall Priority[4]
				General Controllability through BMPs	Oversight Responsibility	Discharge Responsibility	
Additional Sources Identified by the Public							
Unpaved alleys	Anthropogenic	Moderate	High	Moderate to High	Yes	Yes	Moderate
Bare/Un-vegetated yards	Anthropogenic	Moderate	High	Moderate	Yes	Yes	Moderate
Illegal dumping	Anthropogenic	Moderate	High	Moderate	Yes	Yes	Moderate
Other							
Commingled flows from Mexico	Anthropogenic	High	Very High	Low	No	No	Low

Notes:

[1]See Section 2.5.2.1.

[2]See Section 2.5.2.3.

[3]See Section 2.5.2.4.

[4]Overall priority based on overall assessment of adequacy of data, potential magnitude of source, and controllability of source.

2.5.2.5 Summary of Highest Priority Sources

Highest priority sources were identified based on a cumulative assessment of the criteria in Table 2-16. The following preliminary list of sources that contribute to the highest priority water quality condition (sediment) have been prioritized as high priority based on the analysis described in Section 2.5. The RAs may further refine this list as they conduct special studies and implement the WQIP monitoring and assessment program. Highest priority sources (listed alphabetically) include:

Facilities

- Commercial Facilities
- Industrial Facilities
- Municipal Facilities
- Waste Treatment, Storage, or Disposal

Land Areas

- Commercial
- Institutional
- Industrial
- Transportation (local roads and parking lots, etc. Excludes Caltrans)
- Construction

MS4 Outfalls

- Lower Watershed – wet weather

2.6 PRELIMINARY LIST OF POTENTIAL WATER QUALITY IMPROVEMENT STRATEGIES

Provision B.2.e of the Permit requires RAs to evaluate the findings of their evaluation of receiving water conditions, the assessment of impacts from MS4 discharges, the identification of priority water quality conditions, and the identification of MS4 sources of pollutants and/or stressors to identify potential strategies that can result in improvements to water quality in MS4 discharges and/or receiving waters within the WMA. The highest priority water quality conditions, as identified in Section 2 of this document, are as follows:

- Sedimentation / Siltation in the Tijuana River (wet weather)
- Turbidity in the Tijuana River and Tijuana Estuary (wet weather)

In order to address highest priority water quality conditions, the Permit requires a multi-faceted urban runoff management program. The urban runoff management program is based on an integrated BMP approach. The BMP approach includes both nonstructural and structural components with the goal of using available resources to maximize the effectiveness of water quality improvement strategies in reducing sediment and other pollutant loads. Both structural and nonstructural BMP categories are defined below.

- Nonstructural BMPs are source control and pollution prevention activities intended to reduce storm water pollution that do not involve the construction of a physical component or structure to filter or treat storm water. A wide range of actions may be considered nonstructural BMPs including: education, public outreach, product bans, basic pollution-prevention retrofits, and pilot studies.
- Structural BMPs are engineered and/or constructed landscape features, permeable areas and treatment areas intended to reduce storm water pollution by filtration or treatment. Engineered and/or constructed retrofits would be considered structural.

The specific activities, geographic location and application frequency of nonstructural and structural water quality improvement strategies are subject to the adaptive management process discussed in Section 5 of this WQIP.

The Permit requires the jurisdictions to work together to identify potential water quality improvement strategies that may be implemented to address the highest priority water quality condition(s). Potential strategies that can provide improvements in water quality include nonstructural and structural strategies. The preliminary lists presented below were developed through collaboration among the RAs and solicitation of input from the public. It should be noted that the lists of strategies provided below was served as a preliminary list subject to revision. Identification of potential improvement strategies below was intended to create a list of activities that may or may not be implemented by each RA; and no commitment was made with regard to each strategy. All potential improvement strategies may not be implemented. The lists were further reviewed and refined since their initial development. Updated lists of strategies are discussed in Section 4 and presented in Appendix H.

The following two sections describe these two BMP strategy categories and provide preliminary lists of options within each category that may be implemented to address the highest priority water quality condition and other priority pollutants and stressors within the Tijuana River WMA. It should be noted that flood control is a priority for some of the jurisdictions in the Tijuana River WMA, and the ability of nonstructural and structural BMPs to also provide these benefits will be considered as water quality improvement strategies.

2.6.1 Preliminary List of Nonstructural Strategies

Nonstructural strategies are those actions and activities intended to reduce storm water pollution, which do not involve construction of a physical component or structure to filter or treat storm water. Administrative policies, enactment and enforcement of municipal ordinances, education and outreach programs, rebate and other incentive programs, and cooperation and collaboration with other watershed or regional partners are some examples of nonstructural strategies. Jurisdictions across the region have implemented these types of programs for many years, either in response to the Permit requirements or out of jurisdiction- or watershed-specific needs.

The Permit requires jurisdictions to control the contribution of pollutants to the MS4 and the discharges from the MS4 within their jurisdiction through JRMPs (MS4 Permit Provision E). The MS4 Permit requires the jurisdictions to identify the strategies selected for implementation under JRMP Provisions E.2 through E.7 as part of the WQIP. Therefore, the potential WQIP strategies are grouped within these six JRMP provisions. Potential strategies outside of these programs are considered optional strategies, per Permit Section B.3.b(1)(b). Table 2-17 provides a description of the nonstructural strategy categories.

Table 2-17
Nonstructural Strategy Categories

Strategy Category	Strategy Description
Development Planning	Program uses RAs land use and planning authority to require implementation of BMPs to address effects from new development and redevelopment.
Construction Management	Program addresses pollutant generation from construction activities associated with new development or redevelopment.
Existing Development	Program addresses pollutant generation from existing development including commercial, industrial, municipal, and residential land uses.
IDDE Program	Program proactively detects and eliminates illicit discharges and improper disposal of wastes into the MS4.
Public Education and Participation	Promotes and encourages the development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water to the maximum extent practicable (MEP), prevent controllable non-storm water discharges from entering the MS4, and protect water quality standards in receiving waters.
Enforcement Response Plan	Enforcement of each JRMP is required.
Non-JRMP Strategies	Strategies that are outside of the JRMPs, but are designed to effectively prohibit non-storm water discharges to the MS4, protect the Beneficial Uses of receiving waters from MS4 discharges, or achieve the interim and final numeric goals identified in the WQIP.

The list of potential nonstructural strategies within each category is based on the following:

- Existing programs or actions the RAs are already implementing or must implement based on MS4 Permit requirements;
- Opportunities for enhancements and refinement of JRMPs; and
- Identifying new actions or initiatives that are effective or potentially effective in other areas or programs.

The list of potential nonstructural strategies is intended to be broad and flexible to allow jurisdictional- and watershed-appropriate variation. Table 2-18 provides potential nonstructural strategies for each category identified in Table 2-17. Table 2-18 also provides pollutant reduction assumptions for each strategy and the associated water chemistry, physical, and biological benefits achieved from implementation. The assumptions are based on literature reviews, practical experience, and stakeholder input. The BMP benefits outlined in Table 2-18 are dependent on site characteristics, implementation, and the target pollutant of the program or strategy. Although the benefits are variable, estimates of the relative pollutant reduction benefits are provided as comparative reference. Pollutant reductions identify the primary (●)) pollutants, the secondary (◗) pollutants, and the pollutants that the strategy does not address (○). Estimated pollutant reductions assume typical design, land use, and geography, but can be modified to target pollutants or site-specific needs.

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
JRMP Strategies															
Development Planning															
	All Development Projects														
A.	For all development projects, administer a program to ensure implementation of source control BMPs to minimize pollutant generation at each project and implement low-impact development (LID) BMPs to maintain or restore hydrology of the area, where applicable and feasible.	MS4 Permit Section E.3.a	*Benefit varies by source control or LID BMP type.*												
B.	Provide additional BMP conditions on discretionary permits (non-priority development projects)	MS4 Permit Section E.3.a	*Benefit varies by source control or LID BMP type.*												

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
C.	Amend municipal code and ordinances, including zoning ordinances, to facilitate and encourage LID opportunities.	WQIP[3] Input, Enhancement	*Benefit varies by source control or LID BMP type.*												
D.	Train staff on LID regulatory changes and LID Design Manual.	WQIP Input, Enhancement													
	Priority Development Projects (PDPs)														
E.	For PDPs, administer a program requiring implementation of on-site structural BMPs to control pollutants and manage hydromodification. Includes confirmation of design, construction, and maintenance of PDP structural BMPs.	MS4 Permit Sections E.3.b & E.3.c	*Benefit varies by source control or LID BMP type.*												

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
F.	Update BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs.	MS4 Permit Section E.3.d	*Benefit varies by Pollutant-Generating Activity (PGA) and BMP Design Manual update.*												
	1. Amend BMP Design Manual for animal-related facilities.	WQIP Input, MS4 Permit Section E.3.d	●	○	○	●	●	●	○	○	○	◗	◗	○	◗
	2. Amend BMP Design Manual for nurseries and garden centers.	WQIP Input, MS4 Permit Section E.3.d	◗	○	●	●	●	●	○	○	○	◗	◗	○	◗
	3. Amend BMP Design Manual for auto-related uses.	WQIP Input, MS4 Permit Section E.3.d	◗	◗	◗	◗	○	○	●	○	●	◗	◗	○	◗
	4. Amend BMP Design Manual for trash areas. Require full four-sided enclosure, siting away from drains and cover. Consider retrofit requirements.	WQIP Input, MS4 Permit Section E.3.d	●	◗	◗	◗	○	●	●	◗	●	○	○	●	●

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
G.	Administer an alternative compliance program to on-site structural BMP implementation (includes identifying Watershed Management Area Analysis [WMAA] candidate projects).	MS4 Permit Section E.3.c(3)	*Benefit varies by watershed project; potential benefit for all conditions.*												
	1. Create in-lieu fee program.	MS4 Permit Section E.3.c(3)	*Benefit varies by watershed project; potential benefit for all conditions.*												
Construction Management															
H.	Administer a program to oversee implementation of BMPs during the construction phase of land development. Includes inspections at an appropriate frequency and enforcement of requirements.	MS4 Permit Sections E.4.c & E.4.d(1)	○	○	○	●	○	○	◗	○	◗	●	●	○	●

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
Existing Development															
	Commercial, Industrial, Municipal, and Residential Facilities and Areas														
I.	Administer a program to require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of existing development at appropriate frequencies and using appropriate methods.	MS4 Permit Section E.5.c	*Benefit varies by facility, area type, and PGA.*												
	1. Update minimum BMPs for existing residential, commercial, and industrial development and enforce them.	WQIP Input, MS4 Permit Section E.5.b	*Benefit varies by land use and PGA.*												
	2. Design, implement, and enforce property- and PGA-based inspections.	WQIP Input, MS4 Permit Section E.5.c	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
	3. Develop a self-reporting inspection option for select industrial and commercial facilities.	WQIP Input, Enhancement	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
J.	Proactive enforcement of storm water code violations	MS4 Permit Section E.6	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
K.	Promote and encourage implementation of designated BMPs at residential areas.	MS4 Permit Section E.5.b(2)	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	◗	◗
	1. Expand residential BMP (irrigation control, rainwater harvesting, and turf conversion) rebate programs to multi-family housing in target areas.	WQIP Input, Enhancement	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	◗	◗
	2. Residential BMP: Rainwater Harvesting (e.g. Rain Barrels)	WQIP Input, Enhancement	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	○	◗
	3. Residential BMP: Irrigation Control (Turf Conversion)	WQIP Input, Enhancement	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	◗	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
L.	Disconnection of Impervious Areas (e.g., downspout disconnection)	WQIP Input, Enhancement	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	◗	◗
M.	Develop pilot project to identify and carry out site disconnections in targeted areas.	WQIP Input, Enhancement	◗	◗	◗	◗	○	◗	○	◗	○	●	◗	◗	◗
N.	Identify and reduce incidents of power washing discharges from nonresidential sites.	WQIP Input, Enhancement	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
O.	Promote and encourage implementation of designated BMPs in nonresidential areas.		◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	◗	◗
	MS4 Infrastructure														
P.	Implement operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, detention basins, etc.).	MS4 Permit Section E.5.b(1)	*Benefit varies by strategy.*												
	1. Optimize catch basin cleaning to maximize pollutant removal.	WQIP Input, Enhancement	◗	●	○	●	○	○	○	○	●	○	○	○	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
	2. Proactively repair and replace MS4 components to provide source control from MS4 infrastructure.	WQIP Input, Enhancement	◗	●	○	●	○	◗	○	○	○	○	○	○	◗
	3. Increase frequency of open-channel cleaning and scour pond repair to reduce pollutant loads.	WQIP Input, Enhancement	◗	●	○	●	○	◗	○	○	○	○	○	○	◗
	4. Increase frequency of MS4 cleaning and O&M	WQIP Input, Enhancement	◗	●	○	●	○	◗	○	○	○	○	○	○	◗
Q.	Implement controls to prevent infiltration of sewage into the MS4 from leaking sanitary sewers and septic tanks.	MS4 Permit Section E.5.b(1)(c)(iv)	◗	○	○	●	◗	◗	○	○	○	○	○	○	◗
	1. Identify sewer leaks and areas for sewer pipe replacement prioritization including septic and private lateral issues.	WQIP Input, MS4 Permit Section E.5.b(1)(c)(iv)	◗	○	○	●	◗	◗	○	○	○	○	○	○	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
Roads, Streets, and Parking Lots															
R.	Implement operation and maintenance activities for public streets, unpaved roads, paved roads, and paved highways.	MS4 Permit Section E.5.b	◗	●	◗	●	○	●	○	◗	●	○	○	○	◗
	1. Enhance street sweeping through equipment replacement and route optimization.	WQIP Input, MS4 Permit Section E.5.b	◗	●	◗	●	○	●	○	◗	●	○	○	○	◗
	2. Initiate sweeping of medians on high-volume arterial roadways.	WQIP Input, MS4 Permit Section E.5.b	◗	●	◗	●	○	●	○	◗	●	○	○	○	◗
	3. Increase maintenance on dirt access roads and trails.	WQIP Input, Enhancement	○	○	○	●	○	○	○	○	◗	○	○	○	◗
S.	Require sweeping and maintenance of private roads and parking lots in targeted areas.	WQIP Input, Enhancement	◗	●	◗	●	○	●	○	◗	●	○	○	○	◗
T.	Street sweeping efficiency study	WQIP Input, Enhancement	◗	●	◗	●	○	●	○	◗	●	○	○	○	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
U.	Identify sites for pilot study to test Permeable Friction Course (PFC), a porous asphalt that overlays impermeable asphalt.	WQIP Input, Enhancement	◗	●	◗	●	●	◗	◗	◗	◗	●	●	○	◗
V.	Integrate LID into capital improvement and street rehabilitation projects	MS4 Permit Section E.3	◗	◗	◗	◗	◗	◗	◗	◗	○	●	◗	◗	◗
	Retrofit and Rehabilitation in Areas of Existing Development														
W.	Develop and implement a strategy to identify candidate areas of existing development appropriate for retrofitting projects and facilitate the implementation of such projects.	WQIP Input, MS4 Permit Section E.5.e(1)	*Varies by development area; potential benefit for all conditions.*												
X.	Develop and implement a strategy to identify candidate areas of existing development for stream, channel, or habitat rehabilitation projects and facilitate implementation of such projects.	WQIP Input, MS4 Permit Section E.5.e(2)	*Varies by development area; potential benefit for all conditions.*												

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
IDDE Program															
Y.	Implement IDDE Program per the JRMP. Requirements include maintaining an MS4 map, using municipal personnel and contractors to identify and report illicit discharges, maintaining a hotline for public reporting of illicit discharges, monitoring MS4 outfalls, and investigating and addressing any illicit discharges.	MS4 Permit Section E.2	*Benefit varies; potential benefit for all conditions.*												
Z.	Proactive enforcement of residential areas.	MS4 Permit Section E.2	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	◗	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
Public Education and Participation															
AA.	Implement a public education and participation program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences.	MS4 Permit Section E.7	*Varies by program.*												
	1. Expand outreach to homeowners' association common lands and HOA rebates.	WQIP Input, MS4 Permit Section E.7.a	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	○	◗
	2. Develop an outreach and training program for property managers responsible for HOAs and maintenance districts.	WQIP Input, MS4 Permit Section E.7.a	◗	◗	◗	◗	●	●	◗	◗	◗	◗	◗	○	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
	3. Improve consistency and content of websites to highlight enforceable conditions and reporting methods.	WQIP Input, MS4 Permit Section E.7.a	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
	4. Contribute to San Diego County-led effort through regional education group for outreach, education, and policy measures for the equestrian community and property owners.	WQIP Input, MS4 Permit Section E.7.a	●	○	○	◗	○	◗	○	○	○	○	○	○	◗
	5. Develop a targeted education and outreach program for homeowners with orchards or other agricultural land uses on their property.	WQIP Input, Enhancement	◗	○	○	●	●	●	○	◗	◗	◗	◗	○	◗
	6. Develop regional training for water-using mobile businesses.	WQIP Input, Enhancement	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
	7. Conduct trash cleanups through community-based organizations involving target audiences.	MS4 Permit Section E.7.b	●	●	●	●	○	○	◗	◗	●	○	○	●	●
	8. Develop education and outreach to reduce over-irrigation.	MS4 Permit Section E.7.a	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
	9. Enhance school and recreation-based education and outreach.	MS4 Permit Section E.7.a	*Benefit varies; potential benefit for all conditions.*												
BB.	Enhance education and outreach based on results of effectiveness survey and changing regulatory requirements.	WQIP Input, Enhancement	*Varies by program.*												
CC.	Provide technical education and outreach to the development community on the design and implementation requirements of the MS4 Permit and Water Quality Improvement Plan requirements.	WQIP Input, Enhancement	*Benefit varies; potential benefit for all conditions.*												

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
	1. Translate guidance materials with focus on both language and culture.	WQIP Input, Enhancement	*Varies by program.*												
DD.	Support NGO efforts in the watershed (e.g., during Tijuana River Action Month)	MS4 Permit Section E.7.b	*Varies by program.*												
Enforcement Response Plan															
EE.	Implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Enforcement Response Plan.	MS4 Permit Section E.6	*Varies by program.*												
	1. Increase enforcement of over-irrigation.	WQIP Input, MS4 Permit E.6	◗	◗	◗	◗	●	●	◗	◗	◗	●	●	◗	◗
	2. Focus locally on enforcement of water-using mobile businesses.	WQIP Input, MS4 Permit E.6	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
	3. Focus on poorly-maintained residential neighborhoods or high density residential areas.	WQIP Input, MS4 Permit E.6	◗	◗	◗	◗	●	●	◗	◗	◗	●	●	◗	◗
FF.	Increase identification and enforcement of actionable erosion and slope stabilization issues on private property and require stabilization and repair.	WQIP Input, Enhancement	◗	○	○	●	○	◗	○	◗	○	○	○	◗	◗
Optional Strategies															
GG.	Continue participating in source-reduction initiatives.	WQIP Input, Enhancement	*Varies by initiative. For example, the Brake Pad Partnership specifically targets copper in brake pads and is therefore a source-reduction initiative for metals.*												
HH.	Identify and address private sewer lateral leaks		●	○	●	◗	○	●	◗	◗	○	◗	◗	◗	◗
II.	Retrofit MS4s and outfall areas to increase infiltration and slow flow to allow sediment to settle out.	MS4 Permit Section B.3.b.(1)(b)	◗	◗	◗	●	◗	●	◗	◗	◗	◗	◗	◗	◗
JJ.	Proactively monitor for erosion, and complete minor repair and slope stabilization on municipal property.	WQIP Input, Enhancement	◗	○	○	●	○	◗	○	◗	○	○	○	◗	◗

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
KK.	Protect areas that are functioning naturally.	WQIP Input, MS4 Permit Section B.3.b.(1)(b)	◗	◗	◗	●	◗	◗	◗	◗	◗	●	●	●	●
LL.	Mapping and risk assessment of agricultural operations.	WQIP Input, Enhancement	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
MM.	Implement a program to target on-site wastewater treatment (septic) systems. May include mapping and risk assessment, inspection, or maintenance practices.	WQIP Input, Enhancement	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
NN.	Conduct a feasibility study to determine if implementing an urban tree canopy program would benefit water quality and other RA goals.	WQIP Input, Enhancement	*To be determined.*												

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
OO.	Conduct special studies to gather additional monitoring information about priority conditions or Beneficial Uses. Monitoring may include investigative measures such as geomorphic studies for sediment sources or processes.	WQIP Input, Enhancement	*Varies by initiative and project.*												
PP.	Outreach and incentive programs to encourage low maintenance and stable residential and non-residential ground covering (e.g., xeriscaping)	WQIP Input, Enhancement	*Varies by initiative and project.*												

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
QQ.	Collaborate with entities potentially including but not limited to: • Departments within the same RA; • governmental agencies (e.g., water, public health, or transportation); • Federal dischargers (e.g., Navy or Border Patrol); • NGOs including environmental and community groups; • Private corporations; • TRNERR Advisory Council; • TRVRT; • Dischargers regulated under other permits (e.g., Phase II NPDES Permit, IGP, and CGP)	WQIP Input, Enhancement	*Varies by initiative and project.*												

Table 2-18
Nonstructural Strategies for Pollutants

ID	Nonstructural Strategy	Reference[1]	Water Chemistry Benefit									Physical and Biological Benefit			
			Bacteria	Metals	Organics	Sediment[2]	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
RR.	Form joint development or participation of a study or BMP; monitoring; restoration efforts; forming watershed or subwatershed groups, including Watershed Councils; or participating in existing groups, such as Integrated Regional Water Management (IRWM) groups.	WQIP Input, Enhancement	*Varies by initiative and project.*												
SS.	Funding for collaborative strategies may include providing in-kind services, shared costs through agreements, and preparation and competition for grant funding.	WQIP Input, Enhancement	*Varies by initiative and project.*												

Notes:

[1] Reference indicates the source of the strategy. Strategies are from the MS4 Permit or the WQIP development process, including Consultation Committee and public input. Strategies identified as part of the JRMP requirements in MS4 Permit Section E.2 through E.7 are identified in the table with the appropriate MS4 Permit section. Strategies that may be implemented as part of the JRMPs, but are not specifically required in the MS4 Permit are designated as "Enhancements."

[2] Orange indicates the highest priority water quality condition for the WMA.

2.6.2 Preliminary List of Structural Strategies

Structural BMPs can be placed strategically throughout the watershed to collectively improve water quality by removing pollutants through filtration and infiltration. The effectiveness and feasibility of implementing different types of structural BMPs should be carefully considered given the BMP impact and cost to implement and maintain. Structural BMP effectiveness is often dependent on routine maintenance of each BMP. The County of San Diego is concerned specific funding sources have not been identified for the implementation of structural BMPs.

For convenience, structural water quality improvement strategies are presented according to three categories, based on scale and overall function: (1) green infrastructure, (2) multiuse treatment areas, and (3) water quality improvement BMPs, as displayed in Table 2-19. This classification is for the purposes of discussion only and is not intended to imply specific RA approaches or commitments.

Each of the three categories of structural BMPs serve important purposes, and a combination of these BMPs will be considered to evaluate their optimal level of implementation as part of this WQIP. BMPs within the three structural categories can also be designed as retrofits to both pervious and impervious areas. Accordingly, retrofitting is discussed below. These BMPs may also be identified within the alternative compliance option to on-site BMPs for development projects. Future drafts of the WQIP will discuss alternative compliance options in more detail.

The list of strategies provided in this document is intended to be broad and provide flexibility in selection and implementation. The next phase of WQIP development involves the selection of jurisdictional and watershed-specific BMPs which will provide more detail on the strategies selected. Strategies that target the highest priority conditions will be emphasized, and any strategies with multiple benefits will be favored. Consideration will be given to a comprehensive and strategic selection of structural BMPs that provide optimal effectiveness and target the highest priority water quality conditions, without resulting in unintended negative downstream impacts to sensitive habitats and other water quality conditions.

Table 2-19
Structural BMP Categories

Green Infrastructure	Multiuse Treatment Areas	Water Quality Improvement BMPs
• Bioretention • Infiltration Trench • Bioswale • Planter Box • Constructed Wetland • Permeable Pavement • Sand Filter • Vegetated Swale • Vegetated Filter Strip • Green Roof • Disconnection of Impervious Areas • Disconnection of Non-Storm Water Discharge • On-site treatment • Green Streets	• Infiltration and detention ponds • Stream, channel, and habitat rehabilitation projects • Other opportunities, including private parcel acquisition and public/private partnerships and alternative compliance programs.	• Dry weather flow separation and treatment projects. • Proprietary BMPs

2.6.2.1 Green Infrastructure

The U.S. EPA defines green infrastructure as "an approach that communities can choose to maintain healthy waters, provide multiple environmental benefits, and support sustainable communities." Green infrastructure uses vegetation and soil to manage storm water at the source and seeks to weave natural processes into the built environment (U.S. EPA, 2014) complemented with engineering and structural components such as underdrains and permeable pavement. Green infrastructure BMPs are typically integrated into site designs to remove pollutants and often have multiple uses, such as planter boxes also serving as landscaping or permeable pavement also serving as a driving surface. Green infrastructure can be implemented at the site scale (on-site treatment) or street right-of-way scale (green streets), as further discussed below. The list of potential green infrastructure BMPs includes 12 BMP types, as Table 2-20 describes.

Table 2-20
Green Infrastructure Descriptions

BMP	BMP Description
Bioretention	Shallow vegetated features designed to detain runoff, filter through plant roots and a biologically active soil mix, and infiltrate into the ground (or treated prior to draining via underdrain). Bioretention can be configured in nearly any shape, reservoir or bioswale, or configured as in-ground or above ground planter boxes.
Infiltration Trenches	Narrow, linear BMPs that have similar functions as bioretention areas with variable surface materials, including rock or decorative stone, designed to allow storm water to infiltrate into subsurface soils. May also include French drains.
Bioswales	Shallow, open channels designed to reduce runoff volume through infiltration and pollutant removal by filtering water through vegetation within the channel and infiltration into bioretention specific soil media. Bioswales can serve as storm water conveyance, but the primary objective is water quality enhancement (often referred to as *linear bioretention*).
Planter Box	Fully contained systems containing soil media and vegetation that function similarly to a small bioretention BMP, but include an impermeable liner and underdrain.
Constructed Wetland	Engineered, shallow marsh systems designed to control and treat storm water runoff. Particle-bound pollutants are removed through settling and other pollutants are removed through biogeochemical activity.
Permeable Pavement	Allows streets, parking lots, sidewalks, bike paths, and other impervious covers to retain their natural infiltration capacity while maintaining the structural and functional features of the materials they replace. Roads such as highways can include PFC overlays, which provide water quality benefits when traditional permeable pavement is not suitable.
Sand Filters	Treatment system that removes particulates and solids from storm water runoff by facilitating physical filtration.
Vegetated Swales	Shallow, open channels that are designed primarily for storm water conveyance. Pollutants such as trash and debris are removed by physically straining/filtering water through vegetation in the channel.
Vegetated Filter Strips	Bands of dense, permanent vegetation with a uniform slope, designed to provide pretreatment of runoff generated from impervious areas before flowing into another BMP as part of a treatment train.
Green Roofs	Roofing systems that layer a soil/vegetative cover over a waterproofing membrane and can reduce runoff through interception and evapotranspiration.
Disconnection of Impervious Areas	Reduces volume of runoff entering the MS4 by intercepting, infiltrating, filtering, treating or reusing it as it moves from the impervious surface to the drainage system. Through this practice, runoff is directed from rooftops or other impervious surfaces to pervious areas or conservation areas or to a BMP designed to infiltrate, evapotranspirate, and/or harvest the runoff.
Disconnection of non-storm water discharges	Reduces volume of non-storm water discharges entering the MS4. Similar to disconnection of impervious areas, through this practice, non-storm water discharges may be redirected to areas of infiltration (e.g., directing drainage from sumps to French drains), evapotranspiration, or harvesting.

Table 2-21 provides a list of the water quality conditions and the potential green infrastructure BMPs that can best address those conditions. Pollutant reduction assumptions were adapted from the Model Standard Urban Storm Water Mitigation Plan (SUSMP) (County of San Diego, 2012) and literature reviews. The benefits projected in Table 2-21 assume ongoing BMP maintenance.

Table 2-21
Green Infrastructure BMPs

	Water Chemistry Benefit									Physical and Biological Benefits			
BMP	Bacteria	Metals	Organics	Sediment[1]	Pesticides	Nutrients	Oil and Grease	Dissolved Minerals	Trash	Flow Rate	Volume Reduction	Habitat or Wildlife	Aquatic Life
Bioretention	●	●	●	●	●	◗	●	◗	●	●	●	○	◗
Infiltration Trenches	●	●	●	●	●	●	●	●	●	●	●	○	●
Bioswales	●	●	●	●	●	◗	●	◗	●	●	●	○	◗
Planter Boxes	●	●	●	●	●	◗	●	◗	●	◗	◗	○	◗
Permeable Pavement	◗	●	◗	●	●	◗	◗	◗	◗	●	●	○	◗
Constructed Wetlands	●	●	◗	●	●	●	◗	◗	●	●	◗	●	◗
Sand Filters	●	●	●	●	●	◗	●	○	●	◗	◗	○	◗
Vegetated Swales	◗	◗	◗	●	◗	◗	◗	○	●	◗	◗	○	◗
Vegetated Filter Strips	◗	◗	◗	●	◗	◗	◗	○	●	◗	◗	○	◗
Green Roofs	◗	◗	○	●	○	○	○	○	○	●	◗	○	◗
Disconnection of Impervious Areas	●	●	●	●	●	◗	●	◗	●	●	●	○	◗
Disconnection of Non-storm Water	◗	●	●	●	●	●	●	●	◗	◗	◗	○	◗

Notes:
[1] Orange indicates highest priority water quality condition for the WMA.
● Provides primary pollutant reduction.
◗ Provides secondary pollutant reduction.
○ Provides minimal or no pollutant reduction.

2.6.2.1.1 On-site Treatment

Any or a combination of the structural BMPs listed in Tables 2-19 and 2-20 can be applied at the site scale to capture and treat storm water runoff at the source. These small-scale projects are important to the Tijuana River WMA as a whole because collectively they can provide an effective means towards pollutant load reduction, while also attenuating peak flow, reducing discharge volume, and providing aesthetic value and improved habitat quality. These small-scale BMPs can also be retrofitted into existing developments, such as through converting parking lot medians into planter boxes or curb cutouts or asphalt into permeable pavement.

2.6.2.1.2 Green Streets

Green streets can consist of multiple BMP types including permeable pavement and bioretention. Green streets provide an opportunity to locate BMPs in the right-of-way of streets and, similar to on-site treatment, can be an effective method of treating urban storm water runoff, attenuating peak flow, and reducing discharge volume while improving community pride, land value, and habitat quality. Green streets are efficient in removing pollutants because of their proximity to pollutant-generating surfaces and the existing storm water collection system. Since green streets are predominantly in the right-of-way, these BMPs often do not have land acquisition costs and can be more conveniently accessed for maintenance activities. Attention to the location of underground utilities, however, is required when considering green streets.

2.6.2.2 Multiuse Treatment Areas

Large-scale multiuse structural BMP treatment areas such as multiuse basins and stream, riparian area, channel, and habitat rehabilitation projects can include regional BMPs that receive flows from neighborhoods or larger areas. These structural BMPs can provide multiple benefits for the purposes of flood control, ground water recharge, restoration, habitat enhancement, floodplain preservation, and recreation. These BMPs are well suited in public spaces such as active (soccer fields) and passive (parks) recreation areas.

2.6.2.2.1 Infiltration and Detention Basins

Large multiuse BMPs considered while developing the WQIP should focus on surface BMPs that provide treatment through runoff detention and infiltration. Examples include infiltration basins and dry extended detention basins. These BMPs are designed to hold runoff allowing it to evaporate into the atmosphere, infiltrate into native soils, or be transpired by vegetation, while accommodating for overflow and bypass during large storm events.

2.6.2.2.2 Stream, Channel, and Habitat Rehabilitation Projects

Stream, channel, habitat restoration or enhancement projects and floodplain preservation projects can help sustain habitat for wildlife and provide water quality benefits downstream of these activities. Each RA can identify and implement these projects based on the availability of land and need for restoration or enhancement locally.

2.6.2.2.3 Storm Water Harvesting

It should be noted that rain barrels/cisterns were covered programmatically above as a nonstructural strategy, although very large “permanent” cisterns providing water supply augmentation could also be considered and would be categorized as structural.

2.6.2.2.4 Other Opportunities

In the event that the combination of structural and nonstructural BMPs listed above are not sufficient to meet pollutant reduction targets, additional land might need to be acquired to construct multiuse treatment areas to achieve sufficient load reductions. These structural BMPs are considered a lower priority for implementation due to the high cost of land acquisition. Therefore, multiuse treatment areas on acquired private land will likely not be an initial priority for each RA. Multiuse treatment areas on private properties as part of public/private partnerships might, however, be possible through the alternative compliance option for PDPs. Those agencies or watersheds that conduct a WMA analysis will identify opportunities for these types of projects, as is further presented in Section 3 of the WQIP.

2.6.2.3 Water Quality Improvement BMPs

Water quality improvement BMPs include sediment and trash capture devices, proprietary BMPs, and dry weather flow separation and treatment projects. Trash segregation includes inlet devices, such as trash guards or trash racks, which are installed to capture trash and debris before conveyance into local water bodies. Proprietary BMPs are prefabricated commercial products such as hydrodynamic separators or catch basin filter inserts that typically aim to provide storm water treatment in space-limited areas, often using patented and innovative technologies. Proprietary BMPs typically use settling, filtration, absorptive/adsorptive materials, vortex separation, and sometimes vegetative components to remove pollutants from runoff. Dry weather flow separation and treatment projects are those identified and planned for by each respective RA to target non-storm water dry-season flows and divert these flows for treatment either on-site or to sanitary sewer systems, and ultimately wastewater treatment plants.

These BMPs may have an immediate impact to water quality in some cases, for example, if placed into existing storm drains that do not have BMPs. Establishing maintenance agreements for these BMPs will be important to ensure their long-term effectiveness as well as to avoid unintended consequences such as flooding.

SECTION 3 WATER QUALITY IMPROVEMENT GOALS, STRATEGIES AND SCHEDULES

The San Diego Regional MS4 Permit requires RAs to develop specific water quality improvement goals, strategies, and schedules to address the highest priority water quality conditions identified within each WMA. As described in Section 2, the highest priority water quality conditions identified in the Tijuana River WMA to be addressed by this WQIP are:

- Sedimentation / siltation in the Tijuana River during wet weather
- Turbidity in the Tijuana River and Tijuana River Estuary during wet weather

Sedimentation, siltation and turbidity are interrelated. Turbidity, measured in NTUs, is an optical characteristic of water expressing the degree to which light is scattered by suspended particles and molecules in water. Turbidity is affected by suspended solids. In general, turbidity increases as suspended solids concentration increases. Because reduction in TSS indicates a reduction in both sedimentation / siltation as well as a reduction in turbidity, the final numeric goals described in this section propose TSS concentration as an indicator for both of the highest priority water quality conditions.

The WQIP addresses discharges to receiving waters originating from MS4s. Consequently, these highest priority water quality conditions were identified in the context of MS4 contributions and the goals and strategies described in this section to address contributions of sediment and turbidity originating from MS4 discharges.

It should be noted that the MS4 programs implemented by the RAs include multiple elements that address a range of pollutant sources and types including but not limited to sediment and turbidity. The strategies identified and described in this WQIP are a subset of WMA strategies. The complete programs will be described by RAs in their JRMPs in greater detail.

While this WQIP addresses the highest water quality conditions of sediment and turbidity, the benefits of the strategies described are not limited to addressing sediment and turbidity only. Reductions in other pollutants in addition to sediment and turbidity, such as trash, bacteria, nutrients, metals, and other pollutants are expected as a result of implementing the strategies described below.

3.1 WATER QUALITY IMPROVEMENT GOALS

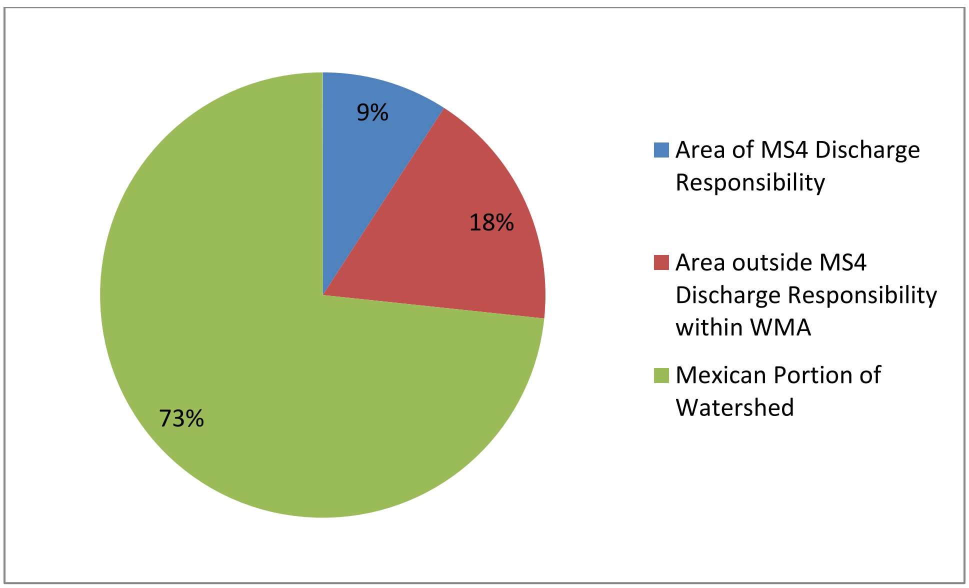
The Permit requires the identification of numeric goals to help track milestones and demonstrate progress towards addressing the highest priority water quality conditions. These include both interim and final goals. The goals are focused on the highest priority water quality conditions, but also serve as general indicators of water quality. That is, reductions in sediment and turbidity generally result in reductions in other pollutants because the pollutants adhere to sediment or are captured through the same structural or non-structural means used to capture sediment.

The Permit describes that interim and final numeric goals may take a variety of forms such as TMDL established Water Quality Based Effluent Limitations (WQBELs), action levels, pollutant concentration, load reductions, number of impaired water bodies delisted from the List of Water Quality Impaired

Segments, IBI scores, or other appropriate metrics (footnote under 6. B.3.a.(1)). The Permit allows flexibility in the identification of numeric goals, but they must be quantifiable so that progress toward and achievement of the goals is measurable. Each highest priority water quality condition may include multiple criteria or indicators. In accordance with the MS4 Permit, final goals and reasonable interim goals for each five-year period from WQIP approval to the anticipated final goal compliance date have been developed. In addition, interim goals for this MS4 Permit cycle must be identified.

Ultimately, restoration and protection of the receiving water is the desired outcome. As discussed in Sections 1 and 2, discharges from sources other than the Phase I MS4s are outside of the jurisdiction and regulatory discharge responsibility of the WQIP. These other discharges cause or contribute to impairments of receiving waters. Addressing non-MS4 sources, in particular, discharges from the Mexican side of the watershed, is beyond the scope of this WQIP. Therefore, to achieve the ultimate goal of restoring and maintaining the quality of receiving waters, all dischargers must participate and address their respective contributions. This is particularly true given that the area of discharge responsibility is limited to 9 percent of the watershed (Figure 3-1). The RAs will work to address discharges from their MS4s, however, discharges from non-MS4 sources must be addressed by those parties responsible. Only in this manner can the ultimate goal be achieved. Note that in some cases, no regulatory mechanism is in place to address certain discharges (e.g., cross border discharges).

Figure 3-1
Pie Chart of Areas within and outside of MS4 Discharge Responsibility



Notes:

(1) Percentages based on entire watershed area.

(2) The “Area outside MS4 Discharge Responsibility within WMA” (18%) consists primarily of federal, state, or tribal lands over which RAs have neither oversight nor discharge authority. However, it also includes such land uses as industrial over which RAs have oversight authority (approximately 2% of watershed area). It is anticipated that oversight authority activities such as inspections will contribute to overall pollutant load reductions.

3.1.1 Final Goals for Discharges at MS4 Outfalls

Setting goals for the water quality of the storm water discharge as opposed to the receiving water quality focuses the goals and strategies on areas over which the RAs have greater control and more closely reflects the impacts of MS4s and the effectiveness of jurisdictional programs. Receiving water quality, on the other hand, is impacted by non-MS4 sources and, in the case of the Tijuana River WMA, includes commingled flow from the Mexican portion of the watershed. Therefore, establishing a final goal in receiving waters and measuring progress towards meeting that goal in receiving waters would not be appropriate in this WMA and would not accurately document pollution contributions by the MS4s and progress by the RAs to attain interim and final goals.

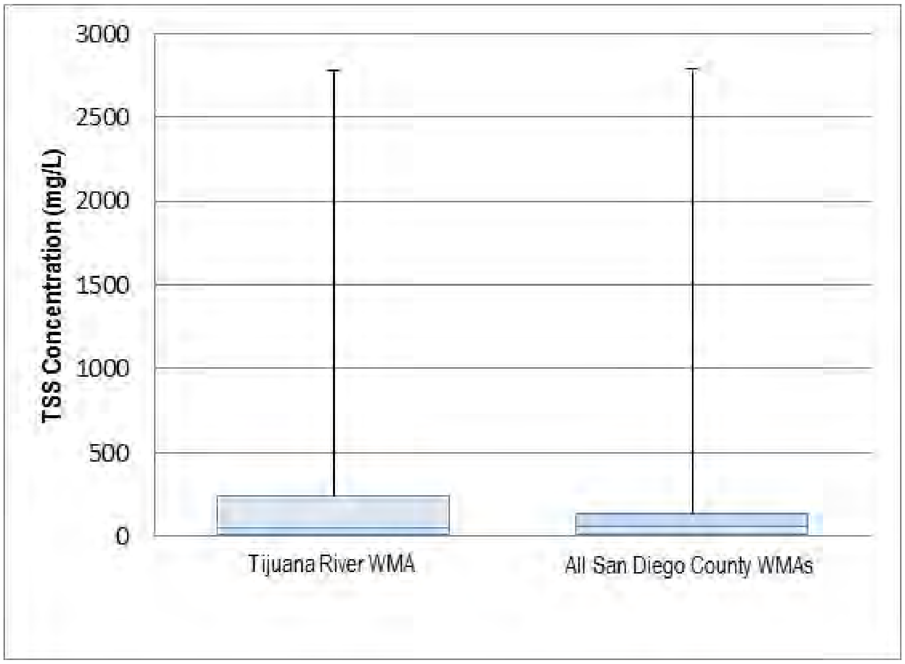
In order to establish a final goal, it is important to first understand the baseline. The Regional Board Order No. R9-2007-001 (2007 Permit) required MS4 programs to characterize constituent discharges from MS4 outfalls and to assess whether these discharges contribute to water quality impairments in receiving waters. The RAs conducted random sampling at MS4 outfalls during wet weather to characterize these discharges. Descriptive statistics for TSS analyzed as part of the Wet Weather MS4 Random Program are presented below in Table 3-1 and on Figure 3-2. In the Tijuana River WMA, the summary statistics are based on a population of 28 samples collected over the 5-year permit term throughout the Tijuana River WMA. The regional data include results for 256 samples collected from nine watersheds. The data informing this analysis are available in the annual reports submitted by the RAs to the Regional Board at the http://www.projectcleanwater.org (last viewed October 2014).

Table 3-1
Descriptive Statistics of TSS Measured at Random MS4 Sites during Wet Weather

Statistics (mg/L)	Tijuana River WMA[2] (n=28)	San Diego County WMAs[2] (n=256)
Minimum	10	10
Maximum	2730	2730
Mean	300	166
Standard Deviation	624	363
Median	44	46.5
5th percentile	10	10
95th percentile	1535	808
Truncated Mean[1]	294	158

Notes:
[1]Based on central 95th percentile of values.
[2]WMA = Watershed Management Area

Figure 3-2
Box-Whisker Plots of TSS Measured at Random MS4 Sites during Wet Weather



Note: Boxes represent 1st and 3rd quartiles. Lines within boxes represent medians. Whiskers represent range.

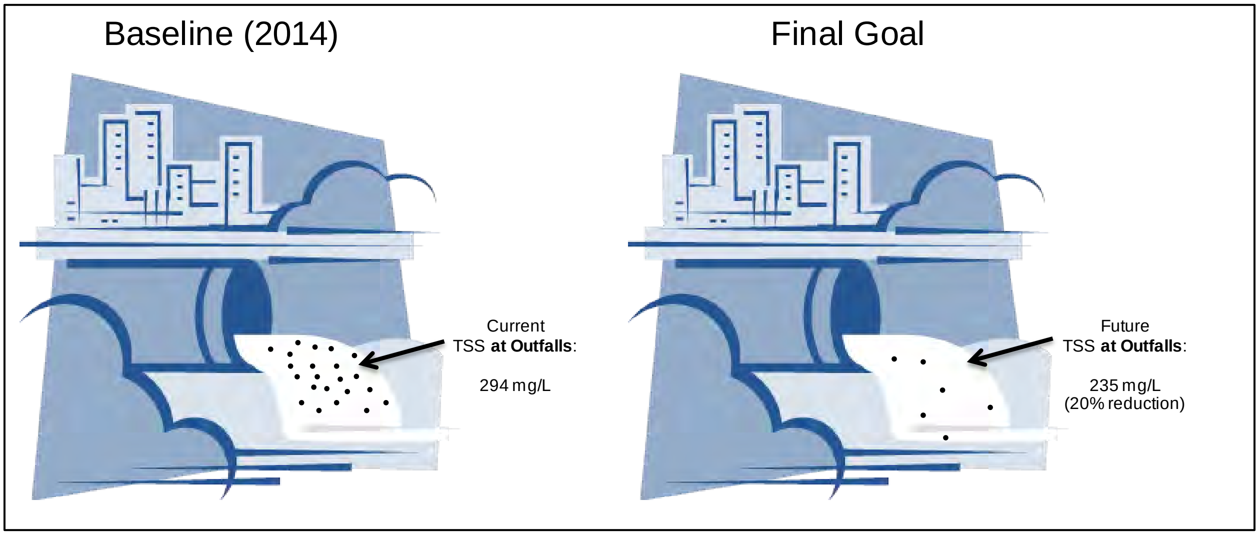
These data help to inform the understanding of baseline concentration of TSS in storm water discharges from MS4s in the San Diego region and specifically from MS4s in the Tijuana River WMA. On average, the TSS concentration in MS4 discharges during wet weather is 166 mg/L among all San Diego County WMAs and 300 mg/L in the Tijuana River WMA. However, as illustrated by Figure 3-1, the data include a maximum value that is significantly higher than the majority of the data points (i.e., 2,730 mg/L). The average is highly influenced by the outliers and skewed upward; therefore, truncated averages have also been calculated (158 mg/L for all WMAs and 294 mg/L for the Tijuana River WMA). The truncated average is based on the central 95^{th} percentile of values, and therefore excludes outliers on the upper and lower end. The baseline and the assessment of progress towards meeting the final numeric goals should be based on the truncated mean to reduce the influence of outliers.

Baseline TSS levels in receiving waters were also considered. The Basin Plan states that suspended sediment and turbidity shall not reach levels that cause nuisance or adversely affect Beneficial Uses (Regional Board, 2012). Under current conditions, the average of TSS concentrations measured at the Tijuana River Watershed MLS station is approximately 1,882 mg/L, as cited in the Tijuana River Watershed Technical Support Document for Solids, Turbidity, and Trash TMDLs (Tetra Tech, 2010).

To establish a numeric goal for storm water discharges below which discharges will not cause or contribute to impairments, it is important to understand the natural levels of sedimentation and TSS in the receiving waters. This is a question that researchers and stakeholders in the Valley continue to investigate. In the interim, this WQIP considers the MS4 and receiving water baselines and proposes final goals for TSS levels in storm water (wet weather) discharges at MS4 outfalls of 235 mg/L TSS, as illustrated on

Figure 3-3. The proposed numeric goal for MS4 discharges is nearly 90 percent below the current average levels of TSS in receiving waters. Meeting this goal will help to demonstrate that discharges from MS4s are not causing or contributing to impacts of receiving waters. The types of impacts that will be addressed include impairments to natural warm water habitat and estuarine habitats. These are discussed in Section 2.4.1.

Figure 3-3
Conceptual Illustration of Baseline and Final Numeric Goals

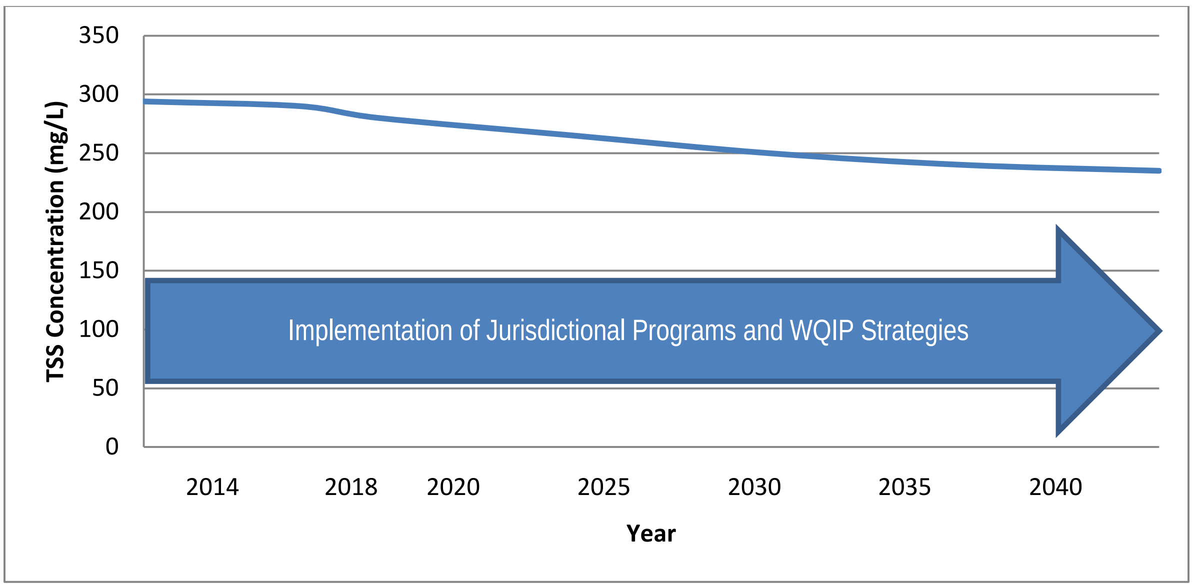


Note: based on truncated average of central 95th percentile values.

The proposed numeric goals will be met through a combination of implementation of non-structural JRMP strategies as well as the use of enhanced/targeted strategies. It is assumed that implementation of JRMP strategies will reduce sediment loads by 10 percent according to research and analysis completed by the City of San Diego (HDR, 2014). Implementation of enhanced strategies is also expected to reduce sediment loads. Estimating a reduction associated with enhanced and optional strategies will require additional investigation, but a goal of an additional 10 percent reduction in sediment loads attributable to the enhanced and optional strategies is included as a goal in this WQIP. By considering both the JRMP and optional strategies, the goal is a reduction in sediment loads in MS4 discharges of 20 percent. The WQIP uses TSS as a surrogate or indicator for sediment loads and establishes a numeric goal of a 20 percent reduction in TSS concentrations in MS4 wet weather discharges, based on the expected 20 percent reduction in sediment load. While there is not a 1:1 relationship between sediment load and TSS, the two metrics are related, and a reduction in one is expected to be accompanied by a reduction in the other. Applying the expected reductions in sediment load to TSS translates to a final numeric goal of reducing TSS in storm water discharges from MS4s from an average of 294 mg/L to an average of 235 mg/L (a 20 percent reduction from the baseline) by the year 2040. Consistent with the estimate of baseline, the measurement of progress towards meeting the final goals should be based on truncated averages that exclude outlier values. As discussed later in Section 4, the estimate of baseline may change as additional information and data become available over time, as the sample population is not robust. It should be noted that the understanding of what the baseline is may change as additional data become available over time including, for example, data collected in support of special studies.

The final water quality-based final goal (235 mg/L TSS) is accompanied by interim goals, as discussed in Section 3.1.2 (Interim Goals) and Section 3.3 (Schedules). Assessment of the progress towards meeting the final goal will be measured through evaluation of both the interim numeric goals as well as the schedule of strategies. Attainment of the water quality-based numeric interim goals and implementation of the WQIP and associated strategies demonstrate progress towards meeting the final goal as indicated on Figure 3-4 and in Table 3-2. Both the goals and implementation of strategies help to demonstrate that progress is being made toward addressing the priority water quality conditions. Additional details for the strategies summarized in Table 3-2 are provided in Section 3.2. Detailed lists of jurisdictional strategies are provided in Appendix H.

Figure 3-4
Reduction in TSS Concentration in MS4 Wet Weather Discharges through Implementation of Jurisdictional Programs and WQIP Strategies



Notes: RAs define Year as Fiscal Year as July 1st through June 30th.

Table 3-2
Wet Weather Numeric Goals for Highest Priority Water Quality Conditions – Sediment (911.11 and 911.12)

Fiscal Years	TSS Concentration (mg/L)	Percent Reduction in TSS Relative to Baseline[1,2]	Strategies Contributing to Reduction: Implement WQIP with Focus on Programmatic BMPs and use of Adaptive Management to Update Strategies to Increase Effectiveness
Baseline	294	N/A	N/A
FY2013 to FY2018[3]	↓ 290	≤5%	• Implement programmatic (non-structural) BMPs to achieve source reduction of TSS loads from major storm drain outfalls; • More stringent permit requirements; and/or • New BMPs installed as redevelopment occurs.
FY2015 to FY2020	↓ 280	5%	• Nonstructural JRMP Strategies; • Programmatic BMPs; • Focus and enhance efforts where needed based on adaptive management; • Increased BMP compliance due to increased inspections and outreach; • Enhanced nonstructural strategies such as increased inspections and outreach, clean up events, targeted catch basin cleaning and street sweeping; and/or • Adaptive management to modify JRMP and enhanced strategies based on new data from monitoring and special studies.
FY2020 to FY2025	↓ 265	10%	• Nonstructural JRMP Strategies; • Programmatic BMPs; • Updated BMPs based on adaptive management; • Increased BMP compliance due to increased inspections and outreach; • Enhanced nonstructural strategies such as increased inspections and outreach, clean up events, targeted catch basin cleaning and street sweeping; and/or • Adaptive management to modify JRMP and enhanced strategies based on new data from monitoring and special studies.
FY2025 to FY2030	↓ 250	15%	• Nonstructural JRMP Strategies; • Programmatic BMPs; • Updated BMPs based on adaptive management; • Increased BMP compliance due to increased inspections and outreach; • Enhanced nonstructural strategies such as increased inspections and outreach, clean up events, targeted catch basin cleaning and street sweeping; • Adaptive management to modify JRMP and enhanced strategies based on new data from monitoring and special studies; and/or • If interim goals are not met, identify and implement optional structural strategies (City of San Diego).

Fiscal Years	TSS Concentration (mg/L)	Percent Reduction in TSS Relative to Baseline[1,2]	Strategies Contributing to Reduction: Implement WQIP with Focus on Programmatic BMPs and use of Adaptive Management to Update Strategies to Increase Effectiveness
Baseline	294	N/A	N/A
FY2030 to FY2035	240	18%	• Nonstructural JRMP Strategies; • Programmatic BMPs; • Updated BMPs based on adaptive management; • Increased BMP compliance due to increased inspections and outreach; • Enhanced nonstructural strategies such as increased inspections and outreach, clean up events, targeted catch basin cleaning and street sweeping; • Adaptive management to modify JRMP and enhanced strategies based on new data from monitoring and special studies; and/or • If interim goals are not met, identify and implement optional structural strategies (City of San Diego).
FY2035 to FY2040	235[4]	20%	• Nonstructural JRMP Strategies • Programmatic BMPs; • Updated BMPs based on adaptive management; and/or • Incremental improvements in program management.

Notes:
[1]Percent reduction of TSS relative to baseline. TSS is being used as a surrogate for sediment.
[2]Progress toward final goals will be monitored through a subset of storm events. The County of San Diego is concerned that a funding source to construct, operate and maintain structural controls is not identified if optional structural controls are needed to meet compliance.
[3]The City of San Diego is establishing two compliance pathways for the FY 2018 interim goal: (1) Meet water quality goal of 290 mg/L average TSS concentration in MS4 wet weather discharges or (2) Develop green infrastructure policy, attain City Council approval, and construct green infrastructure BMPs to improve water quality during wet weather (3.31 acres of drainage area treated through 1 green infrastructure BMP).
[4]The proposed numeric goal for MS4 discharges is nearly 90 percent below the current average levels of TSS in receiving waters. Meeting this goal will help to demonstrate that discharges from MS4s are not causing or contributing to impacts of receiving waters.

This WQIP establishes a final numeric goal for sediment that is based on TSS concentration. TSS is easily measured. It is correlated with sediment load and is a widely used as a surrogate for overall storm water quality. The numeric goal of 20 percent decrease in average (excluding outliers) TSS concentration used in this WQIP is based on the expected decrease of 10 percent of sediment load associated with implementation of JRMP strategies in addition to a goal of a decrease of an additional 10 percent in load associated with enhanced JRMP strategies. As discussed above, TSS is used in this WQIP as a surrogate for sediment load. The baseline average concentration of TSS is 294 mg/L. The goal is to achieve a 20 percent decrease to 235 mg/L by 2040. Note that these goals may be revised as strategies are implemented and additional information becomes available, as discussed in Section 5.

The Basin Plan establishes a narrative rather than numeric goal for TSS indicating that “waters shall not contain suspended and settleable solids in concentrations of solids that cause nuisance or adversely affect beneficial uses.” The level at which TSS causes nuisance or adversely affects beneficial uses is not firmly established. Thus, while 235 mg/L of TSS is proposed as the final goal, in practice it will serve more as a benchmark. Exceedances will be investigated but should not be considered violations. TSS concentrations can be a reflection of natural sources; therefore, exceedances may not necessarily be indicative of water quality issues. As indicated above, the goal may be revised if additional information becomes available supporting the establishment of a revised goal (see Section 5).

In any case, reducing TSS and sediment levels in MS4 discharges is an appropriate goal because TSS originating from urbanized, impervious surfaces co-occurs with other pollutants and reductions in TSS and sedimentation have additional benefits by reducing loads of other pollutants that adhere to sediment or are trapped by the mechanism/method to reduce TSS. These anthropogenic sources of sediment are distinct from natural sources that are part of natural fluvial systems and necessary for healthy streams.

The narrative goal is to reduce sediment load in discharges from MS4s to the Tijuana River to the maximum extent practicable by 2040. The numeric goal associated with the narrative goal is to reduce the average concentration of TSS in storm water discharges from MS4 outfalls to 235 mg/L.

An alternative metric for the final goal and interim goals could be developed based on reductions in sediment load that enters and discharges from the MS4 into the Tijuana River and Estuary rather than on the surrogate pollutant of TSS. Setting a goal based on sediment load requires an understanding of the baseline sediment loads. Quantifying the baseline and measuring reductions could be achieved by weighing catch basin contents, street sweeping contents, and modeling. A special study to inform the baseline and inventory of sources contributing sediment is being considered in the Tijuana River WMA.

3.1.2 Interim Goals

Progress towards meeting the final goals will be measured using interim water quality-based goals. For FY 2018, the City of San Diego will also use a performance-based interim goal. The interim water-quality based goals are presented below in Table 3-3. Schedules for implementing strategies are RA-specific because they are based on implementation of the jurisdictional strategies. See Appendix H.

Table 3-3
Interim Goals by Fiscal Year

Goal by Fiscal Year (Average TSS concentration in MS4 wet weather discharge)						
Baseline	FY 2018[1]	FY 2020	FY 2025	FY 2030	FY 2035	FY 2040
294	290	280	265	250	240	235

Notes:

[1]The City of San Diego is establishing two compliance pathways for the FY 2018 interim goal: (1) Meet water quality goal of 290 mg/L average TSS concentration in MS4 wet weather discharges or (2) Develop green infrastructure policy, attain City Council approval, and construct green infrastructure BMPs to improve water quality during wet weather (3.31 acres of drainage area treated through 1 green infrastructure BMP).

3.2 WATER QUALITY IMPROVEMENT STRATEGIES

The Permit requires RAs to identify water quality improvement strategies to address the highest priority water quality conditions. The strategies were selected based on their ability to effectively and efficiently eliminate non-storm water discharges to the MS4, reduce pollutants in storm water discharges in the MS4 to the MEP, and strive to achieve the interim and final numeric goals identified in Section 3.1. Section 3.2.1 describes the strategy selection process. A general discussion of nonstructural strategies, such as administrative policies, enforcement of municipal ordinances, education and outreach programs, rebate and incentive programs, and collaboration with WMA partners, is presented in Section 3.2.2. Optional structural strategies, utilized as needed and if funding is identified, including those strategies that can improve water quality by removing pollutants through filtration and infiltration, are introduced in Section 3.2.3. The lists of nonstructural and structural strategies selected by each RA as best suited for its jurisdiction are presented in Section 3.2.4. The strategies are presented in RA-specific tables that describe the method of implementation for each strategy, the resources, and the watershed partners included in the effort. Strategies implemented on a WMA scale or through collaboration with WMA stakeholders are discussed in more detail in Section 3.2.5.

3.2.1 Strategy Selection

A list of potential strategies (nonstructural and structural) was developed by the RAs based on JRMP activities and enhancements augmented by public input and discussion (see Section 2). This list was used as a guide by RAs to identify strategies appropriate for their jurisdictions. Emphasis was given to strategies that target highest priority water quality conditions, and those that provide multiple benefits were favored. The RAs considered the triple bottom line, evaluating the environmental, economic, and social components of the strategies. Strategies that improve and promote cooperation and collaboration between the RAs and other governmental agencies (WMA groups, Caltrans, water districts, school districts) and other entities, such as NGOs, were also given high priority. RAs are also continually collaborating with internal jurisdictional departments, and these collaborating entities are presented in the jurisdictional strategies.

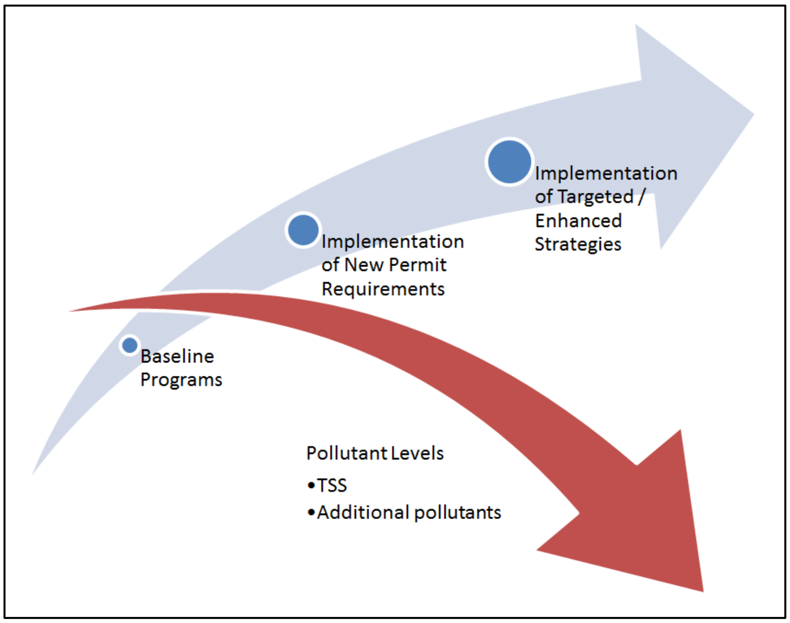
The RAs evaluated their existing programs, the potential for incorporating enhancements and new programs, and the types of optional structural BMPs that may be considered, if needed and if funding is identified. All aspects of their JRMPs were evaluated, which provided the necessary background for existing nonstructural solutions and suggested areas where enhanced or restructured activities might be more successful. It must be noted that implementation of structural BMPs is dependent on identification of funding sources and completion of environmental review. Efficiency in pollutant reduction is partly based on identifying the known and suspected areas or sources likely contributing to the highest priority water quality conditions and targeting those sources. Within the MS4, these sources include erosion from commercial, industrial, residential and other land uses; construction sites; unpaved/unmaintained roads, alleys, and trails; sediment deposition and accumulation on impervious surfaces; and erosion in and around MS4 outfalls. These sources are the focus of the strategies described below.

3.2.2 Nonstructural Strategy Development

Nonstructural reduction strategies are those actions and activities that are intended to reduce storm water pollution that do not involve construction or implementation of a physical structure to treat storm water. These strategies are also considered nonstructural by the nature of their programmatic implementation. Nonstructural strategies include: administrative policies, enacting and enforcing municipal ordinances, education and outreach programs, and incentive programs including rebates, and cooperation and collaboration with other WMA or regional stakeholders. Jurisdictions have implemented these types of programs for many years, either in response to previous MS4 Permit requirements or in response to jurisdiction- or WMA-specific needs (Regional Board, 2013).

The combination of existing efforts will be combined with new or enhanced strategies required under the new permit. The cumulative impact of these efforts will result in reduced pollutant loads over time (See Figure 3-5). Fundamentally, strategies were chosen on the basis of their expected effectiveness in reducing pollutant sources and targeting PGAs of concern in the Tijuana River WMA and their suitability and potential to be implemented by the RAs.

Figure 3-5
Pollutant Level Reduction with Increased Efforts



The list of nonstructural strategies for each RA is based on the following:

- Existing programs or actions that the RAs are already implementing based on prior (2007) MS4 Permit requirements;
- Implementing significant new requirements in the Permit;
- Enhancing and focusing existing programs or actions; and
- Identifying new optional actions or initiatives that are effective or potentially effective in other areas or programs.

It is challenging to accurately quantify most nonstructural strategy benefits in terms of pollutant load reductions, because it generally requires extensive survey and monitoring information or modelling. In addition, nonstructural strategies may target pollutants, land uses, or populations, resulting in different load reductions depending on the implementation technique.

Most nonstructural strategies implemented by the RAs are part of their JRMPs. The Permit requires RAs to control the contribution of pollutants to and discharges from the MS4 within their jurisdictions through JRMPs (Permit Provision E). The Permit requires the jurisdictions to identify the strategies being implemented by JRMP Provisions E.2 through E.7 as part of the WQIP for the highest priority water quality conditions. Strategies within JRMP categories may be broad, administrative programs or activities targeting specific sources. The Permit provides guidelines for RA implementation of each program; however, they are implemented differently depending on the unique characteristics of each jurisdiction. RAs implement strategies within their JRMPs with jurisdictional-specific approaches to best achieve the numeric goals and meet Permit requirements within their jurisdictions. Because the Permit provides flexibility in implementing strategies, each jurisdiction may not be implementing the same strategies within their JRMPs. A strategy identified as the most effective or efficient to achieve pollutant reductions in one jurisdiction may not be in other jurisdictions.

Table 3-4 describes the different categories of JRMP strategies. The relative benefit associated with water chemistry, physical, and biological improvements achieved by strategy implementation is presented in Table 3-5. The assumptions represent BPJ based on literature reviews, practical experience, and stakeholder input. The BMP benefits are dependent on site characteristics, degree or scope of implementation, and the target pollutant of the program or strategy. Although the benefits are variable, estimates of the relative pollutant reduction benefits are provided for comparative evaluation. Pollutant reductions identify the primary pollutants (●), the secondary pollutants (◗), and the pollutants that the strategy does not address (○). Estimated pollutant reductions assume typical design, land use, and geography, but can be modified to target pollutants or site-specific conditions. Additional information on JRMP implementation can be found in each RA's JRMP submitted in June 2015.

Table 3-4
JRMP Categories

Strategy Category	Strategy Description
Development Planning	Uses Responsible Agencies' land use and planning authority to require implementation of BMPs (e.g., requiring BMPs for PDPs) to address effects from new development and redevelopment.
Construction Management	Addresses pollutant generation from construction activities associated with new development or redevelopment.
Existing Development	Addresses pollutant generation from existing development, including commercial, industrial, municipal, and residential land uses. Includes stream, channel, and habitat restoration and BMP retrofitting in areas of existing development.
IDDE Program	Actively detects and eliminates illicit discharges and improper disposal of wastes into the MS4.
Public Education and Participation	Promotes and encourages the development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water to the MEP, prevent controllable non-storm water discharges from entering the MS4, and protect water quality standards in receiving waters.
Enforcement Response Plan	Describes enforcement requirements of each JRMP.

Table 3-5
JRMP Strategy Benefits

JRMP STRATEGY	Average Water Chemistry Benefit									Physical and Biological Benefit			
	Sediment[1]	Bacteria	Metals	Organics	Pesticides	Nutrients	Oil and Grease	Dissolved Solids	Trash	Flow Rate	Volume Reduction	Habitat/ Wildlife	Aquatic Life
Development Planning													
All Development Projects	*Benefit varies by source control or LID BMP type*												
PDPs	●	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
Construction Management	●	○	○	○	○	○	◗	○	◗	●	●	○	●
Existing Development													
Commercial, Industrial, Municipal, and Residential Facilities and Areas	●	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
MS4 Infrastructure	●	◗	○	○	◗	◗	○	○	○	○	○	○	◗
Roads, Streets, and Parking Lots	●	◗	●	◗	○	●	○	◗	●	○	○	○	◗
Pesticide, Herbicides, and Fertilizer Program	○	○	○	●	●	●	○	○	○	○	○	◗	●
Retrofit and Rehabilitation in Areas of Existing Development	*Varies by development area; potential benefit for all conditions.*												
IDDE Program	*Benefit varies; potential benefit for all conditions.*												
Public Education and Participation	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
Enforcement Response Plan	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗

Notes:

1. Orange cells indicate highest priority water quality condition for the WMA.

BMP = best management practice; IDDE = Illicit Discharge, Detection, and Elimination Program;
JRMP = Jurisdictional Runoff Management Program; LID = low-impact development
Pollutant reductions identify the primary pollutants (●), the secondary pollutants (◗), and the pollutants that the strategy does not address (○).

Additional strategies that fall outside a JRMP category have also been identified. These strategies are considered as optional as they are not required by Permit Provision E, but an RA has identified them as potentially effective in addressing priority water quality conditions within its jurisdiction. These strategies may not be appropriate or effective in each jurisdiction.

3.2.3 Structural Strategy Descriptions

Structural strategies, or structural BMPs, are optional strategies that can be used strategically throughout the contributing watershed to further improve water quality, if necessary, by removing pollutants through a variety of chemical, physical, and biological processes, including filtration and infiltration. These would be considered only if it is shown in later permit cycles that additional strategies are required to meet goals and if funding is identified. The effectiveness and feasibility of implementing different types of structural BMPs should be carefully considered in regard to the BMP pollutant reductions and cost to implement, operate and maintain. Moreover, structural BMP siting, construction, and other logistics must be considered. These considerations are dependent on identifying funding mechanisms to support them. Long-term structural BMP effectiveness is often dependent on the successful construction and routine maintenance of each BMP.

Similar to nonstructural strategies, structural BMPs may be chosen on the basis of their expected effectiveness in reducing pollutant loads and targeting pollutant-generating activities of concern in the Tijuana River WMA and their suitability and potential to be implemented by the RAs.

Structural BMPs were subdivided into three categories based on scale and overall function: (1) green infrastructure, (2) multiuse treatment areas, and (3) water quality improvement BMPs (Figure 3-6). These categories and their respective levels of potential implementation in the Tijuana River WMA are discussed in detail in the following sections.

Figure 3-6
Categories of Structural BMPs

Green Infrastructure	Multiuse Treatment Areas	Water Quality Improvement BMPs
• Green Streets • Bioretention • Infiltration Trenches • Bioswales • Planter Box • Constructed Wetland • Permeable Pavement • Sand Filters • Vegetated Swales • Vegetated Filter Strips • Green Roofs	• Infiltration • Detention Basins • Stream, Channel, and Habitat Rehabilitation Projects	• Trash Segregation • Proprietary BMPs • Dry Weather Flow Separation • Dry Weather Treatment Projects

3.2.3.1 Green Infrastructure

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provide habitat, flood protection, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to storm water management systems such as bioretention areas, permeable pavements, and green roofs that use natural processes to absorb, store, and treat water.

Green infrastructure typically incorporates multiple BMPs using the natural features of the site in conjunction with the goal of the site development. Multiple BMPs can be incorporated into the site development to complement and enhance the proposed layout, while also providing water quality treatment and volume reduction. Green infrastructure practices are those methods that provide control and treatment of storm water runoff on or near locations where the runoff initiates, thus providing water quality improvement and volume reduction. Rain barrels are covered programmatically as a nonstructural strategy, but are also commonly incorporated as multi-benefit components of green infrastructure systems.

Green infrastructure can provide benefits to water quality and the community at the site scale outside of the right-of-way or within the public street right-of-way (green streets). The following subsections discuss implementation of green infrastructure in these two settings.

3.2.3.1.1 Green Infrastructure Outside the Right-of-Way

Any single BMP or a combination of the BMPs can be applied at the site scale to capture and treat storm water runoff before it enters the MS4. These small-scale projects are important to the WMA as a whole because collectively they can provide an effective means toward pollutant load reduction while also attenuating peak flow, reducing discharge volume, and providing aesthetic value and improved habitat quality. These small-scale BMPs can be implemented on public parcels by municipalities and incorporated into PDPs or other projects such as redevelopment activities on private parcels. Examples of potential existing development retrofits for green infrastructure BMPs outside the right-of-way include converting parking lot medians into planter boxes and asphalt into permeable pavements.

Much of the impervious area on most parcels, regardless of land use type, consists of a combination of paved parking areas and roof tops. Those areas can often be treated using a system of green infrastructure implemented in landscape areas and replacing hardscape with comparable permeable materials. Other treatment options to be considered for areas outside the right-of-way are green roofs, infiltration trenches, sand filters, vegetated filter strips, and vegetated swales.

3.2.3.1.2 Green Infrastructure in the Right-of-Way (Green Streets)

Green streets can include multiple BMP types implemented in a linear fashion within the road right-of-way. Placing BMPs within the right-of-way provides an additional opportunity to treat urban storm water runoff, attenuate peak flow, and reduce discharge volume while improving community pride, land value, and habitat quality. Since green streets are located in the right-of-way, they have no land acquisition costs and are more conveniently accessed for maintenance activities. Green streets also provide the added benefit of treating runoff from both the roadway and adjacent contributing parcels.

The most common approaches for green streets include bioretention areas located between the edge of the pavement and the edge of the right-of-way with permeable pavement installed in the parking lanes. The configuration of the street, particularly the presence of curb and gutter, locations of underground utilities, road classifications, and sidewalk, parking, and right-of-way widths, often dictate the configuration of green streets. Options are presented below for streets with and without curb and gutter.

Curb and gutter is often used to provide a clear delineation between the travel lanes and the parkway area of the right-of-way. With this configuration, storm water is often treated through permeable pavement in the parking lanes and bioretention areas in the space between the back of the curb and the sidewalk (parkways).

Streets without curb and gutter provide direct connection for diffused runoff to be treated within the right-of-way. Often, without the delineation provided by curb and gutter, the right-of-way at the edge of the travel lane can become compacted and eventually cause erosion concerns. Implementing green street concepts could provide an opportunity to stabilize those areas.

3.2.3.2 Multiuse Treatment Areas

Large treatment structural BMPs, referred to as multiuse treatment areas, are regional facilities that receive flows from neighborhoods or larger areas and often serve dual purposes for flood control and groundwater recharge. These BMPs are often located in public spaces and can be collocated within parks or green spaces to provide excellent ecosystem services and aesthetic value to stakeholders. Bioretention areas can enhance biodiversity and beautify the urban environment with native vegetation. Large-scale facilities, such as infiltration basins or dry extended detention basins, can provide dual use as athletic fields or open spaces.

3.2.3.2.1 Infiltration and Detention Basins

Large multiuse BMPs considered in the WQIP focus on surface BMPs (on public parcels) that provide treatment through the detention and infiltration of runoff. Examples include infiltration and dry extended detention basins. These BMPs are designed to hold runoff for an extended period of time to allow water to evaporate into the atmosphere, infiltrate into native soils, or be transpired by vegetation, while accommodating for overflow and bypass during large storm events. These BMPs are well suited to public spaces such as active (soccer fields) and passive (parks) recreation areas and they raise public awareness of storm water management.

3.2.3.2.2 Stream, Channel, and Habitat Rehabilitation Projects

Natural streams, channels, and habitats serve hydrologic and ecological functions that can be compromised when these natural systems are degraded or altered. For instance, increased runoff volumes and velocities can cause erosion of stream banks or channels, which can result in mobilization of large quantities of sediment and sediment-binding pollutants into the drainage system. Degraded coastal habitats such as salt marshes, lagoons, and wetlands can disrupt biological productivity, which can lead to unhealthy or poor ecosystems.

The goal of rehabilitation projects is to improve stream or channel conditions or restore habitats through engineered enhancements. Stream or channel rehabilitation projects stabilize stream banks or enhance the stream setting to achieve water quality benefits. Stream or channel rehabilitation projects can include grading; construction of check structures, drop structures, and channel bed and bank protection measures; vegetation planting to protect channel area; and modified channel cross-sections to promote hydrologic connectivity. Habitat rehabilitation projects attempt to improve biological productivity or ecosystem functionality through the restoration of natural hydrologic processes, natural vegetation, and other baseline physical characteristics. Hydrologically-degraded systems can also encourage growth of invasive species and unwelcome changes to native habitat and species diversity. In addition to water quality and habitat improvements, other benefits of rehabilitation projects include restoration of benthic macroinvertebrates and terrestrial wildlife, which are indirect measures of water quality. These rehabilitation projects can lead to greater public understanding of water quality while serving as recreational opportunities.

3.2.3.3 Water Quality Improvement BMPs

The RAs will implement green infrastructure when feasible, but site constraints preclude use of green infrastructure in some areas. In such cases, water quality improvement BMPs may be required to protect water resources. Water quality improvement BMPs include trash capture, proprietary BMPs, and dry weather flow separation and treatment projects.

Trash segregation includes installation of inlet devices, such as trash guards or trash racks that are used to capture trash and debris before being transported into receiving waters. Proprietary BMPs are prefabricated commercial products such as hydrodynamic separators or catch basin filter inserts that typically attempt to provide storm water treatment in space-limited areas, often using patented and innovative technologies. Proprietary BMPs typically use settling, filtration, absorptive/adsorptive materials, vortex separation, and sometimes vegetative components to remove pollutants from runoff.

Dry weather flow separation and treatment projects are those identified and planned by each respective RA to target non-storm water dry season flows and to divert these flows for treatment either onsite or to sanitary sewer systems and ultimately wastewater treatment plants. In the Tijuana River Watershed, dry weather flows from the Tijuana River are diverted at the international border for subsequent treatment at the SBIWTP and/or the San Antonio de los Buenos Wastewater Treatment Plant in Mexico. Diversion structures for dry weather flows are also in place at Goat Canyon and Smuggler’s Gulch.

3.2.4 Jurisdictional Strategy Selection by RA

The types of strategies discussed in Sections 3.2.1 through 3.2.3 were considered by each RA in the development of RA-specific strategies. RAs considered their current programs, new Permit requirements, level of effort/costs, and available resources as well as the triple bottom line to develop a list of strategies and implementation approach. The following sections present strategies by individual RA and collaborative strategies that may be implemented between jurisdictions or among jurisdictions and interested stakeholders.

The information provided in the jurisdictional strategy tables (see Appendix H) provide context for when the strategy will be implemented, where, by whom, and how often. The tables also provide relative information on resource needs. As part of this step, the City of San Diego estimated the funding needs to implement the jurisdictional strategies needed to achieve the goals identified (see Appendix H.2). For strategies that will not be implemented upon approval of the WQIP, a future implementation date or a trigger date for implementation is noted. Triggers include such circumstances as receiving grant funds, for example. RAs are continually collaborating with internal jurisdictional departments, other RAs, and WMA groups and NGOs, and these collaborating entities are noted in the tables.

3.2.5 Collaborative WMA Strategies

In addition to implementing strategies on a jurisdictional basis, RAs will collaboratively implement projects within the WMA that improve water quality. Each of the RAs serves on the Steering Committee of the TRVRT that has been addressing trash and sediment in this binational watershed. The TRVRT was established in 2008, and includes over 30 stakeholders, landowners, municipalities, agencies, and NGOs on both sides of the international border. Since its formation, the TRVRT has been the venue for stakeholder collaboration. It has prepared a Recovery Strategy that identifies priority action areas and projects to meet its vision of a valley free of trash and (anthropogenic) sediment WMA strategies and projects in the Tijuana River WMA are summarized in Table 3-6 below. The Regional Board endorsed a Five-year Action Plan for the Valley in March 2015.

Table 3-6
Collaborative WMA Strategies

Strategy
Collaboration with U.S. IBWC, Binational Task Force
Collaboration with U.S EPA Border 2020
Collaboration with Good Neighbor Environmental Board (GNEB)
Collaboration with TRVRT
Collaborate with TRNERR advisory council
Collaborate with Regional Board
Support NGO efforts in the watershed (e.g., during Tijuana River Action Month) (e.g., trash clean ups)
Special study to inventory and characterize sources of sediment in the watershed
Collaboration among school districts, TRNERR, California State Parks, and County Parks & Recreation

3.2.5.1 Alternative Compliance Option for Onsite Treatment (WMAA)

The MS4 Permit allows for the implementation of offsite alternative compliance methods in lieu of meeting structural BMP design standards and/or hydromodification management criteria on the project site. To implement an alternative compliance program, a jurisdiction must first complete an optional WMAA as detailed in Permit Section B.3.b.(4). The San Diego County RAs have collectively funded and provided guidance for development of a regional WMAA. Findings of the regional WMAA, specific to the Tijuana River WMA, are described below and are provided in Appendix I. The full WMAA will be attached as an appendix to the forthcoming BMP Design Manual, currently in development under direction from the RAs.

The WMAA comprises the following three components as indicated in the Regional MS4 Permit:

1. Perform analysis and develop Geographic Information System (GIS) layers (maps) by gathering information pertaining to the physical characteristics of the WMA (referred to herein as WMA Characterization). This includes, for example, identifying potential areas of coarse sediment supply, present and anticipated future land uses, and locations of physical structures within receiving streams and upland areas that affect the watershed hydrology (such as bridges, culverts, and flood management basins).
2. Using the WMA characterization results, compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects. Such projects may include, for example, opportunities for stream or riparian area rehabilitation, opportunities for retrofitting existing infrastructure to incorporate storm water retention or treatment, or opportunities for regional BMPs, among others. Prior to implementing these candidate projects, the RAs must demonstrate that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of the onsite structural BMPs. It should be noted that compilation or evaluation of potential projects was not performed as part of this regional effort. Identification and listing of candidate projects will be performed for each WMA through the WQIP process for WMAs that elect to submit the optional WMAA as part of the WQIP.
3. Additionally, using the WMA characterization maps, identify areas within the WMA where it is appropriate to allow for exemptions from hydromodification management requirements that are in addition to those already allowed by the Regional MS4 Permit for Priority Development Projects. The RAs shall identify such cases on a watershed basis and include them in the WMAA with supporting rationale to support claims for exemptions.

The following GIS map layers were developed to characterize the hydrological and geomorphological processes within the Tijuana River WMA:

- Dominant Hydrologic Processes: A description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
- Stream Characterization: A description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral;
- Land Uses: Current and anticipated future land uses;

- Potential Critical Coarse Sediment Yield Areas; and
- Physical Structures: Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.

These GIS layers can be used to:

- Identify the nature and distribution of key macro-scale watershed processes;
- Identify potential opportunities and constraints for regional and sub-regional storm water management facilities that can play a critical role in meeting water quality, hydromodification, water supply, and/or habitat goals within the watershed;
- Assist with identifying the most appropriate management actions for specific portions of the watershed; and
- Suggest where further study is appropriate.

Alternative compliance methods can be implemented at the watershed scale (e.g., multiuse treatment area BMPs) or as green infrastructure BMPs (e.g., green streets). Regardless of scale, offsite alternative compliance BMPs mitigate pollutants not reliably retained on the project site or hydromodification impacts not reliably mitigated onsite per requirements detailed in Permit Sections E.3.c.(1) and E.3.c.(2). In addition to meeting site-specific structural BMP and hydromodification management requirements, alternative compliance methods can provide multiple benefits for the Tijuana River WMA.

In addition to allowing for alternative compliance program development, the WMAA findings can also help evaluate the feasibility of candidate projects for alternative compliance implementation (Permit Section B.3.b.(4)(b)). Copermittees are currently compiling a list of candidate projects that consider the numeric goals of the Tijuana River WMA as well as projects previously identified in JRMPs and other regulatory documents. Appendix J and the WQIP will be updated to include the final candidate project list, as that list is made available. Appendix J provides further details regarding alternative compliance options and blank alternative compliance candidate project lists.

Alternative compliance methods can be implemented at the watershed scale (e.g., multiuse treatment area BMPs) or as green infrastructure BMPs (e.g., green streets). Regardless of scale, offsite alternative compliance BMPs mitigate pollutants not reliably retained on the project site or hydromodification impacts not reliably mitigated onsite per requirements detailed in Permit Sections E.3.c.(1) and E.3.c.(2). In addition to meeting site-specific structural BMP and hydromodification management requirements, alternative compliance methods can provide multiple benefits for the Tijuana River WMA.

In addition to allowing for alternative compliance program development, the WMAA findings can also help determine the feasibility of candidate projects for alternative compliance implementation (Permit Section B.3.b.(4)(b)). RAs are currently compiling a list of candidate projects that consider the numeric goals of the Tijuana River WMA as well as projects previously identified in JRMPs and other regulatory documents. Appendix J includes the alternative compliance template. The WQIP will be updated to include the final candidate project list, as that list is made available.

3.3 SCHEDULES

The schedule for interim and final goals is provided in Section 3.1. The schedules for implementing strategies are included with the lists of strategies provided in Appendix H.

The schedules for interim and final goals are informed by the schedules for strategies. The implementation of strategies will be associated with pollutant load reductions. Both water quality-based goals and strategy milestones provide meaningful data that will help RAs to manage their programs and continually improve. Sampling will be conducted and results will be compared to interim and final goals, and it will be important to also track implementation of strategies and performance-based metrics. New strategies above and beyond JRMP will require start-up time – thus the effects of those strategies are expected to be observed in future WQIP cycles. It is important to note that the new Permit includes significant new requirements which by themselves are expected to result in reductions in pollutants in MS4 discharges, such as more stringent non-storm water discharge prohibitions, broader definition of PDP (e.g., driveways), and structural BMP performance standards.

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SECTION 4 WATER QUALITY IMPROVEMENT PLAN MONITORING AND ASSESSMENT PROGRAM

The Permit requires the development of an integrated monitoring and assessment program that assesses:

- Progress toward achieving the numeric goals and schedules provided in Section 3,
- Progress toward addressing the highest priority water quality conditions established in Section 2, and
- Each RA's overall efforts to implement the WQIP.

The Monitoring and Assessment Program incorporates requirements of Provision D of the Permit, that states: "The purpose of this provision is for the RAs to monitor and assess the impact on the conditions of receiving waters caused by discharges from the RAs' MS4s under wet weather and dry weather conditions. The goal of the Monitoring and Assessment Program is to inform the RAs about the nexus between the health of receiving waters and the water quality condition of the discharges from their MS4s. This goal will be accomplished through monitoring and assessing the conditions of the receiving waters, discharges from the MS4s, pollutant sources and/or stressors, and effectiveness of the water quality improvement strategies implemented as part of the Water Quality Improvement Plans."

The Monitoring and Assessment Program will provide tools to evaluate the priority and highest priority water quality conditions and strategies presented in Sections 2 and 3 of the WQIP. In particular, the monitoring and assessment program will evaluate progress towards the numeric goals presented in Section 3. Table 4-1 summarizes the main components of the Tijuana River WMA Monitoring and Assessment Program, which are further described below.

Table 4-1
Monitoring and Assessment Program Components for the Tijuana River WMA

Monitoring Program	Assessment Program
A. Receiving Water Monitoring (Permit Prov. D.1): 1. Long-Term Receiving Water Monitoring: Dry Weather Wet Weather 2. Regional Monitoring Participation (Permit Prov. D.1.e.(1)) 3. Sediment Quality Monitoring (Permit Prov. D.1.e.(2))	A. Receiving Water Assessments
B. MS4 Outfall Discharge Monitoring (Permit Prov. D.2): 1. Dry Weather MS4 Outfall Discharge Field Screening (Permit Prov. D.2.b.(1)) 2. Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring (Permit Prov. D.2.b.(2)) 3. Wet Weather MS4 Outfall Discharge Monitoring (Permit Prov. D.2.c)	B. MS4 Outfall Discharge Assessments: 1. Dry Weather Outfall Assessments and Illicit Discharges 2. Wet Weather Outfall Assessments and Illicit Discharges
C. Special Studies (Permit Prov. D.3)	C. Special Studies Assessments
	D. Integrated Assessment

4.1 WATER QUALITY IMPROVEMENT PLAN MONITORING PROGRAM

The components of the WQIP Monitoring Program are outlined in Table 4-2. A detailed description of the monitoring program is provided in Appendix K, WQIP Monitoring Program. Appendix K also incorporates the associated monitoring plans for each of the elements described below.

The Monitoring Program has three major components:

- Receiving water monitoring,
- MS4 outfall discharge monitoring, and
- Special studies.

The receiving water monitoring includes multiple components intended to assess whether the chemical, physical, and biological conditions in these waters are protective, or likely protective, of beneficial uses. Long-term monitoring locations are monitored for water quality during both wet and dry conditions. The program also includes monitoring for sediment quality monitoring and participation in regional monitoring programs.

The receiving water monitoring program seeks to answer the following questions.

- Long-Term Receiving Water Monitoring
    - What is the extent and magnitude of the current or potential receiving water problems?
    - Are the receiving water conditions improving or deteriorating?
- Regional Monitoring Participation
    - Are conditions in the receiving water protective, or likely protective, of Beneficial Uses?
    - What is the extent and magnitude of the current or potential receiving water problems?
- Sediment Quality Monitoring
    - What is the condition of sediments in enclosed bays or estuaries with respect to the statewide sediment quality objectives?

It should be noted that due to the binational nature of the watershed, flows generated in the upper reaches of the watershed within the U.S. commingle with flows generated in Mexico prior to return to receiving waters within U.S. jurisdiction in the Lower Watershed and Tijuana River Estuary. In addition, the watershed area within the U.S. contains federal, state, and Indian Reservation lands (Figure 1-5b) not subject to the Phase I MS4 Permit regulatory framework. Accordingly, sample results from the lower six miles of the Tijuana River and Tijuana River Estuary as part of the long-term receiving water monitoring program are representative of water quality conditions influenced by discharges from entities both within the U.S. as well as Mexico, with potentially only a minor influence from RA MS4 discharges. The MS4 outfall monitoring program also has both dry and wet weather monitoring components to identify whether non-storm water or storm water discharges from the MS4 affect receiving water quality.

The dry weather MS4 outfall monitoring component has two phases. For the first phase, the RAs have performed a field screening of a certain number of outfalls, based on the total number of outfalls in their jurisdictions. Using this outfall review, the City of San Diego has prioritized the persistently flowing outfalls, based on their potential to impact receiving water quality. The County of San Diego and City of Imperial Beach each have fewer than five major outfalls within the Tijuana River WMA. Accordingly, the County of San Diego and City of Imperial Beach will include each of the major outfalls in the dry weather MS4 outfall monitoring. Within City of San Diego jurisdiction for the second phase, the highest priority dry weather MS4 outfalls will then be monitored, using water quality-based methods than those used in the field screening program. The RAs will monitor the highest priority major MS4 outfalls (generally defined as those >36” in diameter) with non-storm water persistent flows at least semi-annually.

For wet weather MS4 outfall discharge, the RAs have identified five monitoring locations representative of the residential, commercial, industrial, and mixed land uses within the Tijuana River WMA. These five locations will be monitored at least once per year.

The MS4 outfall discharge monitoring program will address the following:

- Dry Weather MS4 Outfall Discharge Field Screening
  - Which non-storm water discharges are transient and which are persistent?
  - Which discharges should be investigated as potential illicit connection/illicit discharges?
- Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring
  - Do dry weather discharge pollutant concentrations at MS4 outfalls meet Permit action levels?
  - What is the relative contribution of discharges from MS4 outfalls to priority water quality conditions during dry weather?
  - What are the sources of persistent non-storm water flows?
- Wet Weather MS4 Outfall Discharge Monitoring
  - Do wet weather discharge pollutant concentrations at MS4 outfalls meet Permit action levels?
  - What is the relative contribution of discharges from MS4 outfalls to priority water quality conditions during wet weather?
  - How do representative MS4 outfalls discharge concentrations, loads, and flows change over time?

The special studies will include a regional study and a study specific to the Tijuana River WMA. The goal of the special studies is to further investigate the highest priority water quality conditions. The regional special study is focused broadly on highest priority water quality conditions for the entire San Diego Region, while the special study specific to the Tijuana River WMA is focused on the highest priority water quality conditions in the Tijuana River WMA, as discussed in Section 2.

The regional special study is the San Diego Regional Reference Stream Study currently being conducted by the SCCWRP. The study will develop numeric targets that account for "natural sources" to establish the concentrations or loads from streams in a minimally disturbed or "reference" condition. The goal of this project is to collect the data necessary to derive reasonable and accurate numeric targets for bacteria, nutrients, sediment and heavy metals, based on a reference approach. The Stream Reference Study was designed to answer the following questions (SCCWRP, 2013):

- How does the WQO exceedance frequency vary between summer dry weather, winter dry weather, and wet weather?
- How does the WQO exceedance frequency vary by hydrologic factors, including:
  - Size of storm (wet weather only)?

- Discharge flow rate and volume (wet and dry weather)?
- Beginning versus end of storm season (wet weather only)?

- How does the WQO exceedance frequency vary by input factors such as:
  - Size of catchment?
  - Geology?
- How does the WQO exceedance frequency vary by biotic and abiotic factors, including:
  - Algal cover and/or biofilms?
  - Water quality (e.g., temperature, DO, TSS concentration)?

The special study that will be conducted by the RAs will identify and prioritize the MS4 and non-MS4 sources causing or contributing to the highest priority water quality conditions. The results of the special study will assist RAs to identify sources of sediment within their jurisdictions and develop control strategies. The special study will also document sources of sediment generated by non-MS4 entities.

The Phase I study will use available data to perform an integrated assessment of:

- Hydrological and geomorphological conditions and processes,
- MS4 outfall and other infrastructure configuration and condition, and
- Water quality monitoring and sediment loading estimates,

as these conditions relate to sediment contributions to MS4 discharges. The goal of the study will be to generate a prioritized inventory of point sources that contribute sediment and/or other pollutants to MS4 discharges in the Tijuana River WMA. Criteria to prioritize may include magnitude of source, ability to manage, and jurisdictional authority.

The Tijuana River WMA special study is designed to answer the following:

- What types of sediment sources are present in the subwatershed areas draining to MS4 discharge outfalls?
- Can potential sediment sources be attributed to specific land use types, geographic areas or topographic features?
- What are the estimated sediment loads originating from potential sediment source locations?
- Do the sediment load estimates correlate with specific land use types, geographic areas or topographic features?
- What types of sediment source reduction BMPs for the sources identified are available to be implemented on municipal property?
- What types of sediment source reduction BMPs can be encouraged by RAs on private property?
- What is the estimated total annual sediment load reduction that will result in achieving water quality, physical and biological habitat objectives at MS4 discharge points?

The Tijuana River WMA special study will be conducted in three phases during the current Permit term. A summary of monitoring activities for the Tijuana River WMA is presented in Table 4-2.

Table 4-2
Summary of Monitoring Activities for the Tijuana River WMA

RECEIVING WATER MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.1	Long-Term Receiving Water Monitoring *Overview:* Two stations: TJR-MLS and TJR-TWAS1 3 wet weather and 3 dry weather events during Permit term Monitoring methods details: Interim Receiving Water Monitoring Plan – Appendix K
D.1.c	Dry Weather Receiving Water Monitoring See list of required analyses in Table A included in this table below. Grab samples for field parameters and other constituents as required by protocol. Flow-weighted composites for other constituents. Toxicity samples by flow-weighted composite. 3 dry weather events during Permit term: During dry season (May 1 - Sept. 30) – Event 1 During wet season (Oct. 1 - April 30); >72 hrs antecedent dry period following rainfall event of >0.1" – Event 2 At-large dry weather event – Event 3
	Table A. Long-Term Receiving Water Monitoring – Dry Weather Constituents
	Field Parameters: pH; Temperature; Specific Conductance; DO; Turbidity Analytical Parameters: *Conventional Parameters*: Total Dissolved Solids; Total Suspended Solids; Turbidity; Total Hardness; Total Organic Carbon; Dissolved Organic Carbon; Sulfate; Methylene Blue Active Substances (MBAS); Suspended Sediment Concentration (SSC)

RECEIVING WATER MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.1.c (cont)	*Nutrients:* Total Phosphorus; Dissolved Phosphorus; Orthophosphate; Nitrite; Nitrate; Total Kjeldahl Nitrogen; Ammonia *Metals (Total and Dissolved):* Antimony Arsenic; Cadmium; Chromium III; Chromium VI; Copper; Iron; Lead; Mercury; Nickel; Selenium; Silver; Thallium; Zinc *Pesticides:* Organophosphate Pesticides; Pyrethroid Pesticides *Indicator Bacteria:* Total Coliform; *Enterococcus;* Fecal Coliform *Organics* Trace elements, Synthetic organics Chronic Toxicity Testing: *Pimephales promelas* (Fathead Minnow) Larval Survival and Growth; *Ceriodaphnia dubia* (Daphnid) Survival and Reproduction; *Selenastrum capricornutum* (Green Algae) Growth;
D.1.d	Wet Weather Receiving Water Monitoring See list of required analyses in Table B included in this table below. Grab samples for field parameters and other constituents as required by protocol: Total Coliform; *Enterococcus;* Fecal Coliform Flow-weighted (24-hour or storm-length) composites for other constituents. Toxicity samples by flow-weighted composite. 3 wet weather events during Permit term: First wet weather event of the wet season (October 1 – April 30) – Event 1 Event that occurs after February 1 – Event 2 At-large wet weather event – Event 3

RECEIVING WATER MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.1.d (cont)	Table B. Long-Term Receiving Water Monitoring – Wet Weather Constituents
	Field Parameters: pH; Temperature; Specific Conductance; DO; Turbidity Analytical Parameters: *Conventional Parameters*: Total Dissolved Solids; Total Suspended Solids; Turbidity; Total Hardness; Total Organic Carbon; Dissolved Organic Carbon; Sulfate; Methylene Blue Active Substances (MBAS); Suspended Sediment Concentration (SSC) *Nutrients:* Total Phosphorus; Orthophosphate; Dissolved Phosphorus; Nitrite; Nitrate; Total Kjeldahl Nitrogen; Ammonia *Metals (Total and Dissolved):* Arsenic; Cadmium; Chromium; Copper; Iron; Lead; Mercury; Nickel; Selenium; Thallium; Zinc *Pesticides:* Organophosphate Pesticides; Pyrethroid Pesticides *Indicator Bacteria:* Total Coliform; *Enterococcus;* Fecal Coliform *Organics* Trace elements, Synthetic organics Chronic Toxicity Testing*:* *Pimephales promelas* (Fathead Minnow) Larval Survival and Growth; *Ceriodaphnia dubia* (Daphnid) Survival and Reproduction; *Selenastrum capricornutum* (Green Algae) Growth;

RECEIVING WATER MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.1.e.(1)	Regional Monitoring Participation *Storm Water Monitoring Coalition Regional Monitoring* Twenty-one (21) proposed projects over five years (2014-2019) within four study categories: *Ecosystem Characterization and Assessment* 1) Standardizing Monitoring Approaches for Wet and Dry Weather Monitoring 2) Improving Storm Water Agency Reporting and Communication 3) Characterization of Storm Water Effects 4) Contaminants of Emerging Concern 5) Characterization of Storm Water Impacts on Marine Protected Areas *Method Development and Tool Evaluation* 6) Adapt Biological Assessment Tools for non-Perennial Streams 7) Develop New Tools for Causal Assessment 8) Standardize Hydrologic Methods 9) Hydromodification Guidance of Urban Streams 10) Evaluating Potential of Remote Sensing Technology *Optimizing Management Effectiveness* 11) Optimizing Best Management Practices for Southern California 12) Flood Control Detention Retrofit to Improve water Quality Performance 13) Evaluating the Potential Benefits and Negative Impacts of On-Site Storm Water Retention 14) Improving Trash Controls and Tools to Assess Progress 15) Development of a Model Framework for a Storm Water Control Offset/Trading Program 16) Use Attainability Analysis Case Study for an Engineered Channel 17) Optimizing retrofit of Existing Urban Areas with Green Infrastructure *Foundational Scientific Understanding* 18) Improved quantification of Linkages between Nutrient Concentrations and Indicators of Beneficial Uses 19) Storm Water Effects on Ocean Acidification and Hypoxia 20) Effect of Climate Change on Storm Water Quality 21) Interaction Between Storm Water Runoff and Cyanotoxins Monitoring methods to be developed as projects are implemented. Project implementation based on collective need and availability of funding

RECEIVING WATER MONITORING	
Permit Prov./ Specific Activity	**Monitoring and Assessment Program Element**
D.1.e.(1) (cont)	*Southern California Bight Regional Monitoring* Sampling of 397 randomly selected sites in the Southern California Bight Sample each site one (1) time between July 1 and September 30, 2013 <u>Indicators:</u> *Contaminant exposure* Sediment chemistry (as outlined in <u>Table C</u> included in this table below) Debris *Biological response* Benthic infauna Fish assemblage Fish pathology Macroinvertebrate assemblage Sediment toxicity *Habitat* Grain size Sediment organic carbon <u>Planned Bight ’13 Special Studies</u> Analysis of Contaminants of Emerging Concern in Sediment Bioanalytical Screening of Sediment Extracts Sediment Toxicity Identification Evaluation in Embayments Gene Microarray Analysis of Sediment Toxicity Samples Alternative Toxicity Test Species Comparison *In situ* Toxicity Testing Using the Sediment Ecotoxicity Assessment (SEA) Ring Effects of Macrobenthic Preservation Techniques on Efficacy of Molecular and Morphological Taxonomy Adaptation to Hypoxic, High CO, Environments – Phenotypic Plasticity in Echinoderms

RECEIVING WATER MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.1.e.(1) (cont)	Table C. Bight '13 Sediment Chemistry Analytical Parameters *Conventional Parameters*: Total Organic Carbon; Grain Size *Nutrients:* Total Nitrogen; Total Phosphorus *Metals (Trace):* Aluminum; Antimony; Arsenic; Barium; Baryllium; Cadmium; Chromium; Copper; Iron; Lead; Mercury; Nickel; Selenium; Silver; Zinc *Organics:* PCB Congeners; Chlorinated Hydrocarbons; PAHs; Polybrominated Diphenyl Ethers (BDEs)
	Monitoring methods details: Bight '13 Contaminant Impact Assessment Work Plan –Appendix K Participants include the City of San Diego *2013 Regional Harbor Monitoring Program* Sampling activities include: Water Quality Monitoring; Sediment Sampling; and Trawls Nine (9) Water Quality and Sediment monitoring locations in Tijuana River; one (1) Trawl location Analyses are detailed in Table D included in this table below.

RECEIVING WATER MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.1.e.(1) (cont)	Table D. 2013 Regional Harbor Monitoring Program Analyses *Field Parameters* Specific Conductance; Temperature; pH; DO; Light Transmittance; Salinity *Water Chemistry* *Conventional Parameters* Oil & Grease; Total Organic Carbon; Dissolved Organic Carbon; MBAS *Nutrients:* Ammonia; Nitrate; Orthophosphate *Metals (Trace):* Aluminum; Antimony; Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Iron; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Silver; Thallium; Tin; Titanium; Vanadium; Zinc *Organics:* PAHs; Methyl-t-butyl Ether (MTBE) *Sediment Analyses* *Benthic Community* *Conventional Parameters* Total Solids; Total Organic Carbon; Sediment Grain Size; *Nutrients:* Total Nitrogen; Total Phosphorus; Ammonia; Nitrate; Orthophosphate *Metals (Trace):* Aluminum; Antimony; Arsenic; Barium; Beryllium; Cadmium; Chromium; Copper; Iron; Lead; Mercury; Nickel; Selenium; Silver; Zinc *Other::* PAHs; Chlorinated Pesticides; Pyrethroid Pesticides; PCB Congeners; PBDEs; Alkylphenol; Perfluorinated Compounds Acid Volatile Sulfides *Sediment Toxicity* *Eohaustorius estuaries* (amphipod) *Mytilus galloprovinvialis* (mussel) Monitoring methods details: 2013 Final Work Plan Regional Harbor Monitoring Program – Appendix K

<table>
<tr><th colspan="2">RECEIVING WATER MONITORING</th></tr>
<tr><th>Permit Prov./ Specific Activity</th><th>Monitoring and Assessment Program Element</th></tr>
<tr><td>D.1.e.(2)</td><td>Sediment Quality Monitoring

Overview:

The Southern California Bight Regional Monitoring Program is an integrated assessment of the Southern California Bight that occurs every five years from Point Conception to the Mexican border. The program assesses the ecological health of nearshore and offshore MARs as well as coastal embayments by measuring indicators of environmental condition (e.g., habitat quality, sediment contamination, toxicity, infaunal communities, and fish communities) at nearly 400 sites distributed throughout 12 different types of strata. The RAs participated in Bight ’13 in order to comply with the requirements of the 2013 Permit. Two stations were assessed within the Tijuana River Estuary in the Tijuana River WMA:

<table>
<tr><th rowspan="2">Lagoon/Estuary</th><th rowspan="2"># of Sites</th><th rowspan="2">Site ID</th><th colspan="4">Sediment Sampling</th></tr>
<tr><th>Date Sampled</th><th>Latitude</th><th>Longitude</th><th>Sample Depth (m)</th></tr>
<tr><td rowspan="2">Tijuana River Estuary</td><td rowspan="2">2</td><td>8002</td><td>8/5/2013</td><td>32.5566</td><td>-117.1283</td><td>0.4</td></tr>
<tr><td>8008</td><td>8/5/2013</td><td>32.5583</td><td>-117.1206</td><td>0.8</td></tr>
</table>

Monitoring was conducted in accordance with the San Diego County Municipal Copermittees Bight 2013 Workplan provided by SCCWRP (http://www.sccwrp.org/documents/BightDocuments/Bight13Documents.aspx).</td></tr>
<tr><td></td><td><u>Table E.</u> Sediment Quality Monitoring Constituents</td></tr>
<tr><td></td><td>Specific monitoring methods and constituents are presented in the San Diego County Municipal Copermittees Bight 2013 Workplan (Appendix M).</td></tr>
</table>

MS4 OUTFALL DISCHARGE MONITORING	
Permit Prov./ Specific Activity	**Monitoring and Assessment Program Element**
D.2.b.(1)	Dry Weather MS4 Outfall Discharge Field Screening *Objectives:* Identify non-storm water and illicit discharges within jurisdiction per Provision E.2.c Determine which discharges are transient vs. persistent flows Prioritize persistent dry weather MS4 discharges to investigate/eliminate per Provision E.2.d Visual Inspections/Observations: Number of Outfalls to Be Inspected Annually City of Imperial Beach: 3 Number of Outfalls to Be Inspected Annually City of San Diego: 30 Number of Outfalls to Be Inspected Annually County of San Diego: 4 *Requirements for Inspections:* Antecedent dry period $\geq$ 72 hours following rainfall event >0.1" prior to field screening Include elements shown in Table G of Table 5-2 and complete field form provided in the 2015-2016 Tijuana River WMA Dry and Wet Weather MS4 Outfall Monitoring Plan – Appendix K
	Table G. Field Screening Visual Observations for MS4 Outfall Discharge Monitoring Stations
	□ Station identification and location □ Presence of flow, or pooled or ponded water □ If flow is present: • Flow estimation (i.e., width of water surface, approximate depth of water, approximate flow velocity, flow rate) • Flow characteristics (i.e., presence of floatables, surface scum, sheens, odor, color) • Flow source(s) suspected or identified from non-storm water source investigation • Flow source(s) eliminated during non-storm water source identification □ If pooled or ponded water is present: • Characteristics of pooled or ponded water (i.e., presence of floatables, surface scum, sheens, odor, color) • Known or suspected source(s) of pooled or ponded water □ Station description (i.e., deposits or stains, vegetation condition, structural condition, observable biology)

MS4 OUTFALL DISCHARGE MONITORING	
Permit Prov./ Specific Activity	**Monitoring and Assessment Program Element**
D.2.b.(1) (cont	□ Presence and assessment of trash in and around station □ Evidence or signs of illicit connections or illegal dumping
	Based on Results of Inspections: a. Identify Persistent Non-Storm Water Discharges b. Prioritize Persistent Non-Storm Water Discharges to investigate/eliminate per Provision E.2.d [Persistent flow is defined as the presence of flowing, pooled, or ponded water more than 72 hours after a measureable rainfall event of 0.1 inch or greater during three consecutive monitoring and/or inspection events. All other flowing, pooled, or ponded water is considered transient.]
D.2.b.(2)	Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring *Objectives:* Determine which persistent non-storm water discharges contain concentrations of pollutants below NALs and which persistent non-storm water discharges impact receiving water quality during dry weather Prioritize outfalls with persistent dry weather flows within each RA's jurisdiction (coordinate with Permit requirements to investigate/eliminate discharges per Provision E.2.d.) *Overview:* Minimum of five (5) highest priority major outfalls per jurisdiction (or all major outfalls if <5) 2 events/year during dry weather conditions: Monitoring methods details: 2015-2016 Tijuana River WMA Dry and Wet Weather MS4 Outfall Discharge Monitoring Plan – Appendix J *Prepare Map:* Identify locations of highest priority non-storm water persistent flow MS4 outfall monitoring stations on map per Provision E.2.b.(1). *Monitoring Approach:* See list of required analyses in <u>Table H</u> included in this table below. Grab samples for field parameters and analytical parameters listed in <u>Table H</u> included in this table below. See Event Summary Table in Appendix J.

MS4 OUTFALL DISCHARGE MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.2.b.(2) (cont)	Table H. Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring Constituents
	Field Parameters: pH; Temperature; Specific Conductance; DO; Turbidity Analytical Parameters: *Conventional Parameters*: Total Dissolved Solids; Total Suspended Solids; Total Hardness; Methylene Blue Active Substances (MBAS); Turbidity; Suspended Sediment Concentration (SSC) *Nutrients:* Ammonia; Total Phosphorus; Orthophosphate; Dissolved Phosphorus Nitrite; Nitrate; Total Kjeldahl Nitrogen; Total Nitrogen *Metals (Total and Dissolved):* Cadmium; Copper; Chromium III, Chromium IV; Iron; Lead; Manganese; Nickel; Selenium; Silver; Thallium; Zinc *Indicator Bacteria:* Total Coliform; *Enterococcus;* Fecal Coliform *Pesticides:* Organophosphate Pesticides; Pyrethroid Pesticides *Organics* Trace Elements, Synthetic Organics
D.2.c	Wet Weather MS4 Outfall Discharge Monitoring *Overview:* 5 stations representative of residential, commercial, industrial, and mixed-use land uses within the WMA At least 1 of these stations for each RA within the WMA At least 1 event per station *per year* during the wet season (October 1 – April 30). *Monitoring Approach:*

MS4 OUTFALL DISCHARGE MONITORING	
Permit Prov./ Specific Activity	**Monitoring and Assessment Program Element**
D.2.c (cont)	See list of required analyses in Table I included in this table below. Grab samples for field parameters and indicator bacteria. Time-weighted or flow-weighted (24-hour or storm-length, whichever is shorter) composites at the discretion of the RA for other constituents. 3 wet weather events within the Permit term:
	See Event Summary Table in Appendix J
	Table I. MS4 Outfall Discharge Monitoring – Wet Weather Constituents
	Field Parameters: pH; Temperature; Specific Conductance; DO; Turbidity Analytical Parameters: *Conventional Parameters*: TSS; Total Hardness, Turbidity, Surfactants (MBAS); Suspended Sediment Concentration (SSC) *Nutrients:* Total Phosphorus; Dissolved Phosphorus; Nitrite; Nitrate; Total Kjeldahl Nitrogen; Ammonia; Total Nitrogen *Metals (Total and Dissolved):* Cadmium; Copper; Lead; Selenium; Nickel; Thallium; Zinc; *Pesticides:* Organophosphate Pesticides; Pyrethroid Pesticides *Organics* Trace Elements, Synthetic Organics *Indicator Bacteria:* Total Coliform; *Enterococcus;* Fecal Coliform

SPECIAL STUDIES	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.3	Special Studies *San Diego Regional Stream Reference Study Monitoring Program – See Appendix J* *Overview:* Wet weather monitoring - 3 events at 6 sites Dry weather monitoring – up to 52 weeks at 8-10 sites *Monitoring Approach:* See list of required analyses in Table J included in this table below. Wet weather monitoring – Time course pollutograph sampling (sampling of concentrations at multiple periods over the course of the storm) over the duration of the storm event and once per day on the following three days. *In-situ* field measurements will be recorded at each site to coincide with each pollutograph grab sample. Flow and precipitation will be measured throughout the duration of the storm event at each reference site, when feasible. During one wet event per site, composite sample taken over a whole day. Dry weather monitoring - Weekly grab sampling: Bacteria samples will be collected such that 5 samples will occur within each 30-day period. Biweekly nutrient sampling, includes observation of stream condition parameters (physical habitat and benthic algal chlorophyll a) Flow will be calculated weekly at each site using a hand-held Marsh-McBirney flow meter. The meter measures instantaneous velocity, which will be used with cross-sectional area measurements to calculate flow. *In-situ* field measurements to coincide with each grab sample.

MS4 OUTFALL DISCHARGE MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.3 (cont)	Table J. San Diego Stream Reference Study - Wet and Dry Weather Constituents
	Field Parameters: pH; Temperature; Specific Conductance; Turbidity; DO (only during dry weather) Analytical Parameters: *Conventional Parameters*: Total Dissolved Solids; Total Suspended Solids; Total Hardness; Alkalinity (Total Alkalinity as $CaCO_3$); Chloride; Sulfate *Nutrients:* Nitrate + Nitrite(as N); Total Kjeldahl Nitrogen; Ammonia; Total Dissolved Nitrogen; Orthophosphate (dissolved; Soluble Reactive Phosphorus); Total Phosphorus (as P) or TDP; Particulate Nitrogen & Carbon (PN, POC); Particulate Phosphorus (PP); Dissolved Organic Content *Metals (Total and Dissolved):* Cadmium; Chromium; Copper; Iron; Lead; Manganese; Nickel; Selenium; Zinc *Indicator Bacteria:* Total Coliform; *Enterococcus;* Fecal Coliform; *E.coli; Bacteroides; M.smitthii* *Toxicity*

MS4 OUTFALL DISCHARGE MONITORING	
Permit Prov./ Specific Activity	Monitoring and Assessment Program Element
D.3 (cont)	*Sediment Source Identification and Prioritization Study* *Overview:* Identify and prioritize potential sediment sources draining to MS4 discharge points, perform field verification of potential sources, and coordinate sediment load reduction efforts with responsible parties within RA jurisdictions. *Monitoring Approach:* This special study includes a three-phase approach to evaluate potential sediment sources within subwatershed areas contributing to MS4 discharges. Phase I of the study will utilize desktop assessment of existing data and aerial surveys and photos to identify potential anthropogenic sources of sediment using available data. Phase I will include a study plan and report identifying potential sources. The Phase I study will use available data to perform an integrated assessment of: • Hydrological and geomorphological conditions and processes, • MS4 outfall and other infrastructure configuration and condition, and • Water quality monitoring and sediment loading estimates, as these conditions relate to sediment contributions to MS4 discharges. The targeted outcome of the integrated existing physical conditions, infrastructure and water quality assessment is the development of a prioritized inventory of point sources that contribute sediment and/or other pollutants to MS4 discharges in the Tijuana River WMA. Data compiled as part of the Phase I identification process for the potential anthropogenic sources of sediment will be used to inform Phase II actions. Phase II actions will include field verification potential problem areas and watershed stakeholder/discharger coordination to facilitate appropriate access and authority processes for identified sediment load reduction priority areas. Phase II will include up to eight weeks of field work to gather field information, develop an inventory of sources and associated attribute data. Phase II will also include a study plan and report with GIS layer(s). Phase III actions would include collection of field samples to measure sediment loads originating from sources identified in Phase II. Data collected as part of Phase III would be designed to quantify sediment loads from various sources and contribute to future model development. Data from Phases I-III will be used for sediment load reduction project development and implement in the Tijuana River watershed.

4.2 WATER QUALITY IMPROVEMENT PLAN ASSESSMENT PROGRAM

The assessment portion of the Monitoring and Assessment Program will evaluate the data collected under the monitoring programs described in Section 4.1, as well as the information collected as part of each RA's JRMP. The data collected from these two programs will be used to assess the progress of the WQIP strategies toward achieving water quality improvement goals. This section summarizes the requirements of the four assessments listed in Table 4-1. Depending on Permit requirements, reporting will occur either annually, as part of the WQIP Annual Report, or be provided in the ROWD that the RAs must submit prior to the issuance of the next MS4 Permit.

The four primary assessments will consider the programmatic questions detailed in Section 4.1 that are subsets of the general Monitoring and Assessment Program goals to inform RAs, the Regional Board, and the public with respect to:

- Progress of RA programs to effectively prohibit non-storm water discharges to the MS4 and reduce pollutants to the MEP;
- Condition of receiving waters that receiving MS4 discharges and the progress of RAs programs toward improving water quality; and
- Effectiveness of the WQIP toward achieving these goals.

Table 4-3 provides the timeframe for when each of the assessments will take place.

Table 4-3
Water Quality Improvement Plan Assessment Timeframes

Assessment	Timeframe
Receiving Water Assessment • Long Term Dry and Wet Weather Monitoring Data • Sediment Monitoring • Regional Monitoring Programs	Annual Reporting
MS4 Outfall Discharge Assessment • Dry Weather Outfall Assessment and Illicit Discharges • Wet Weather Outfall Assessment and Illicit Discharges	Annual Reporting
Special Studies Assessment	Annual Reporting
Integrated Assessment • Strategies	Annual Reporting
Integrated Assessment • Priority Water Quality Conditions • Goals and Schedules	MS4 Permit Reporting as part of the ROWD

4.1.1 Receiving Water Assessments

The assessment of receiving waters includes evaluating the physical, chemical, and biological conditions of these waters and the condition of the sediment. The RAs will assess the status and trends of receiving water quality conditions in coastal waters, estuaries, rivers and streams in the Tijuana River WMA. This assessment includes evaluation of both dry and wet weather conditions. To the extent feasible, the receiving water assessment to be presented in the WQIP Annual Report will:

- Assess whether the conditions of the receiving waters are meeting the numeric goals;
- Identify the most critical beneficial uses to be protected to ensure the overall health of the receiving water;
- Evaluate whether those critical beneficial uses are being protected;
- Identify short-term and/or long-term improvements or degradation of those critical beneficial uses;
- Consider whether the strategies in the WQIP contribute toward achieving the interim and final numeric goals of the WQIP; and
- Identify gaps in the monitoring data needed to assess Provisions D.4.a.(2)(a)-(e).

The binational nature of the Tijuana River WMA presents a unique challenge to evaluating the physical, chemical, and biological conditions of receiving waters due to the commingled nature of flow derived from both sides of the international border. These commingled flows contribute to both water quality and the condition of the sediment with respect to assessment of progress towards numeric water quality goals, protection of Beneficial Uses, and the efficacy of WQIP-based strategy contributions towards interim and final numeric goals. RA MS4s draining highly urbanized areas discharge to the Lower Watershed where commingled flows from Mexico complicate receiving water assessments including the identification of sources. Accordingly, assessment of receiving water quality using sample results collected in the lower six miles of the Tijuana River and Tijuana River Estuary must consider the relative contribution of pollutants originating in both the U.S. and Mexico.

Additionally, the WQIP Annual Report will incorporate a Sediment Monitoring Report in accordance with the schedule included in the Sediment Monitoring Plan. The Sediment Monitoring Report will contain the following information:

- Analysis: Evaluation, interpretation, and tabulation of the water and sediment monitoring data;
- Sample Location Map: Identification of the locations, types, and number of samples on a site map; and
- California Environmental Data Exchange Network: A statement certifying that the monitoring data and results have been uploaded into the California Environmental Data Exchange Network (CEDEN).

A human health risk assessment may be conducted based on the analytical results provided in the Sediment Monitoring Report, at the direction of the Regional Board. Such an assessment could identify the extent to which the human health objective contained in the Receiving Water Limitations is attained at each monitoring station.

4.1.2 MS4 Outfall Discharge Assessments

The MS4 outfall discharge assessments include evaluating both the dry weather monitoring associated with the IDDE program and the wet weather monitoring data collected by the RAs. Details of these two separate assessments are provided below. Each RA will assess its MS4 programs individually and compile the reports as part of the Tijuana River WMA WQIP Annual Report.

Dry Weather Outfall Assessments and Illicit Discharges

Each RA must assess and report the progress of its IDDE program (required pursuant to Provision E.2) toward effectively prohibiting non-storm water and illicit discharges into the MS4s within its jurisdiction, including the following elements:

- **Identify sources of non-storm water discharges.**

  Based on the dry weather MS4 outfall discharge field screening monitoring described in Appendix J, each RA must assess and report as follows (Prov. D.4.b(1)(b)):

  - Identify the known and suspected controllable sources (e.g., facilities, areas, land uses, and pollutant-generating activities) of transient and persistent flows within the RA's jurisdiction in the Tijuana River WMA;
  - Identify sources of transient and persistent flows within the RA's jurisdiction in the Tijuana River WMA that have been reduced or eliminated; and
  - Identify modifications of the field screening monitoring locations and frequencies for the MS4 outfalls in the RA's inventory necessary to identify and eliminate sources of persistent flow non-storm water discharges.

- **Rank and prioritize non-storm water discharges.**

  Based on the data collected and applicable numeric action levels as described in Section 2 and detailed in Appendix J, the RAs must rank the MS4 outfalls in their jurisdictions according to the potential threat to receiving water quality and produce a prioritized list of major MS4 outfalls. The WQIP will be updated based on these findings and with the goal of implementing (in the order of the ranked priority list) targeted programmatic actions and source investigations to eliminate persistent non-storm water discharges and/or pollutant loads.

- **Identify sources contributing to numeric action level exceedances.**

  For the highest priority major MS4 outfalls with persistent flows that exceed numeric action limits, the known and suspected sources within its jurisdiction in the Tijuana River WMA that may cause or contribute to the numeric action level exceedances will be identified.

- **Estimate volumes and loads of non-storm water discharges.**

  Annually, an analysis of the data collected as part of the Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring Program from the highest priority major MS4 outfalls and a calculation or estimation of the non-storm water volumes and pollutant loads collectively discharged from all the major MS4s outfalls in its jurisdiction that have persistent dry weather flows during the monitoring year will be conducted. These calculations or estimates will include:

  - The percent contribution from each known source for each MS4 outfall;
  - The annual non-storm water volumes and pollutant loads collectively discharged from the RA's major MS4 outfalls to receiving waters within the RA's jurisdiction; and
  - The annual volumes and pollutant loads for sources of non-storm water not subject to the RA's legal authority that are discharged from the RA's major MS4 outfalls to downstream receiving waters.

- **Evaluate non-storm water discharge monitoring locations.**

  Based on an evaluation of the data collected from the highest priority non-storm water persistent flow MS4 outfall monitoring locations, the outfall monitoring locations may be reviewed and the list reprioritized according to one or more of the following criteria (Provision D.2.b.(2)(b)(ii)):

  - The non-storm water discharges have been effectively eliminated (i.e., there is no flowing, pooled, or ponded water) for three consecutive dry weather monitoring events;
  - The sources of the persistent flows have been identified as a category of non-storm water discharges that do not require an NPDES permit and do not have to be addressed as an illicit discharge because they were not identified as sources of pollutants (i.e., the constituents in the non-storm water discharge do not exceed numeric action limits) and the persistent flow can be reprioritized to a lower priority;
  - The constituents in the persistent flow non-storm water discharge do not exceed numeric action limits; and
  - The source(s) of the persistent flows has (have) been identified as a non-storm water discharge authorized by a separate NPDES permit.

  Where these criteria have not been met but the threat to water quality has been reduced by the RA, the highest priority persistent flow MS4 outfall monitoring stations may be reprioritized accordingly for continued dry weather MS4 outfall discharge field screening monitoring as part of the Dry Weather MS4 Outfall Discharge Field Screening Program.

  Each RA must document removal or reprioritization of the highest priority persistent flow MS4 outfall monitoring stations identified under the Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring Program in the WQIP Annual Report. When a RA removes a persistent flow MS4 outfall monitoring station, it will be replaced with the next highest prioritized major MS4 outfall of priority designated by that jurisdiction in the Tijuana River WMA. If there are no remaining qualifying major MS4 outfalls within its jurisdiction, the number of major MS4 outfalls monitored will be reduced.

- **Evaluate the effectiveness of the water quality improvement strategies.**

  As part of the ROWD, each RA will review the data collected as part of the Dry Weather MS4 Outfall Discharge Monitoring Program and findings from annual dry weather MS4 discharge monitoring assessments described above (Provisions D.4.b.(1)(c)(i)-(iv)). The evaluation will incorporate the following:

  - Identification of reductions and progress in achieving reductions in non-storm water and illicit discharges to the RA's MS4s in the Tijuana River WMA;
  - Assessment of the effectiveness of the water quality improvement strategies being implemented by the RA within the Tijuana River WMA toward reducing or eliminating non-storm water and pollutant loads discharging from the MS4s to receiving waters, and, if possible, estimation of the non-storm water volume and/or pollutant load reductions attributable to specific water quality strategies;
  - Identification of modifications necessary to increase the effectiveness of the water quality improvement strategies implemented by the RA toward reducing or eliminating non-storm water and pollutant loads discharging from the MS4s to receiving waters within its jurisdiction; and
  - Identification of data gaps in the monitoring data necessary to develop the above assessments.

Wet Weather Outfall Assessments and Illicit Discharges

The RAs will assess and report the progress of the water quality improvement strategies implemented as part of the WQIP and the JRMP toward reducing pollutants in storm water discharges from the MS4s. This is designated as the Wet Weather MS4 Outfall Discharge Monitoring Program. The assessment of this program will:

- **Estimate volumes and loads of storm water discharges.**

  As part of the WQIP Annual Report, the RAs must analyze the monitoring data collected as part of the Wet Weather MS4 Outfall Discharge Monitoring Program. This includes using a watershed model or another method to calculate or estimate the following for each monitoring year:

  - The average storm water runoff coefficient for each land use type within the Tijuana River WMA;
  - For each storm event with measurable rainfall greater than 0.1 inch, the volume of storm water and pollutant loads discharged from each of the monitored MS4 outfalls to receiving waters within the Tijuana River WMA;

  - The total flow volume and pollutant loadings discharged from each RA's jurisdiction within the Tijuana River WMA over the course of the wet season, extrapolated from the data produced from the monitored MS4 outfalls; and
  - For each storm event with measurable rainfall greater than 0.1 inch, the percent contribution of storm water volumes and pollutant loads discharged from each land use type within: (1) each hydrologic subarea with a major MS4 outfall to receiving waters, or (2) each major MS4 outfall to receiving waters.

- **Evaluate temporal trends.**

  The RAs will evaluate the data collected as part of the Wet Weather MS4 Outfall Discharge Monitoring Program and:

  - Incorporate new outfall monitoring data into time series plots for each long-term monitoring constituent for the Tijuana River WMA; and
  - Analyze statistical trends on the cumulative long-term wet weather MS4 outfall discharge water quality data set.

- **Evaluate storm water discharge monitoring locations and frequency.**

  The RAs may identify modifications to the wet weather MS4 outfall discharge monitoring locations and frequencies in order to identify pollutants in storm water discharges from the MS4s in the WMA (Provision D.2.c.(1)). The two methods available per the Permit to modify the Wet Weather MS4 Discharge Outfall Program are the following:

  - RAs may adjust the wet weather MS4 outfall discharge monitoring locations in the Tijuana River WMA, as needed, to: (1) identify pollutants in storm water discharges from MS4s and (2) guide pollutant source identification. The number of stations should be at least equivalent to the number of stations required under the MS4 Permit (Provision D.2.a.(3)(a)).
  - The RAs may adjust the analytical monitoring required for the Tijuana River WMA if historical data or other supporting information demonstrate or justify that analysis of a constituent is not necessary.

- **Evaluate Water Quality Improvement Plan assumptions.**

  The RAs will evaluate the WQIP assumptions based on the wet weather MS4 outfall monitoring data collected and the applicable storm water action limits. This evaluation will include analyzing and comparing the monitoring data used to perform the analyses and the assumptions used to develop the WQIP, particularly the strategies presented in Section 3. Additionally, the RAs will evaluate whether those analyses and assumptions should be updated as a component of the adaptive management described in Section 5.

- **Evaluate effectiveness of water quality improvement strategies.**

  As part of the ROWD, the RAs will review the data collected pursuant to Wet Weather MS4 Outfall Discharge Monitoring Program and findings from the annual wet weather MS4 discharge monitoring assessments described above (Provisions D.4.b.(2)(c)(i)-(ii)). The evaluation will:

  - Identify reductions or progress in achieving reductions in pollutant concentrations and/or pollutant loads from different land uses and/or drainage areas discharging from the RAs MS4s in the Tijuana River WMA;
  - Assess the effectiveness of water quality improvement strategies being implemented by the RAs within the Tijuana River WMA toward reducing pollutants in storm water discharges from the MS4s to receiving waters within the WMA to the maximum extent practicable (if possible, include the pollutant load reductions attributable to specific water quality strategies implemented by the RAs);
  - Identify modifications that will increase the effectiveness of the water quality improvement strategies implemented by the RAs in the Tijuana River WMA toward reducing pollutants in storm water discharges from the MS4s to receiving waters in the WMA to the maximum extent practicable; and
  - Identify data gaps in the monitoring data necessary to assess the evaluations identified above.

4.1.3 Special Studies Assessments

As part of the WQIP Annual Report, the Tijuana River WMA RAs will evaluate the results and findings from the special studies described in Appendix J. They will use the resulting data to: (1) assess their relevance to the RAs characterization of receiving water conditions, (2) understand sources of pollutants and/or stressors, and (3) control and reduce the discharges of pollutants from the MS4 outfalls to receiving waters. As with the other monitoring programs, the results of the special studies assessment may warrant modifications of or updates to the WQIP.

The Tijuana River WMA special studies will attempt to answer the following:

- What types of sediment sources are present in the subwatersheds draining to MS4 discharge outfalls?
- Are potential sediment source locations correlated with specific land use types, geographic areas or topographic features?
- What are the estimated sediment loads originating from potential sediment source locations?
- Are the sediment load estimates correlated with specific land use types, geographic areas or topographic features?
- What types of sediment source reduction BMPs for sediment load reduction priority areas are available to be implemented on municipal property?

- What types of sediment source reduction BMPs can RAs facilitate implementation on private property?
- What is the estimated total annual sediment load reduction is needed so that sedimentation is reduced to meet water quality, physical and biological habitat objectives at MS4 discharge points?

Future special studies related to BMP effectiveness that are implemented by the RAs in the Tijuana River WMA will be included in this assessment. RAs may select to report the results of BMP effectiveness studies that are being performed in other WMAs if they relate to the highest priority water quality conditions and results are expected to be transferrable to strategies planned for the Tijuana River WMA.

4.1.4 Integrated Assessment

The integrated assessment builds on the receiving water assessment, MS4 outfall discharge assessment, and special studies assessment described in Sections 4.2.1 through 4.2.3. The assessment will be conducted as part of the iterative approach and adaptive management process that is summarized here and further described in Section 5.

The RAs will integrate the data collected and analyzed as part of the Monitoring and Assessment Program, along with information collected during the implementation of the JRMP. The data will be evaluated to assess the effectiveness of the WQIP in addressing the highest priority water quality conditions and to identify whether other priority water quality conditions may need to be elevated to a highest priority water quality condition. Additionally, the integrated assessment will evaluate the progress in achieving goals and the assess effectiveness of the implemented strategies.

The Permit outlines what assessments should be included as part of the integrated assessment. Reevaluation of the priority water quality conditions and goals involves a five-step process:

(1) Re-evaluate the receiving water conditions per methodology described in Section 2.1;

(2) Re-evaluate the impacts of MS4 discharges on receiving waters per methodology provided in Section 2.2;

(3) Re-evaluate the identification of MS4 sources and/or stressors performed in Section 2.5;

(4) Identify beneficial uses in receiving waters that are protected per Receiving Water Assessment (Section 4.2.1); and

(5) Evaluate the progress toward achieving interim and final numeric goals for protecting impacted beneficial uses in receiving waters.

To re-evaluate the water quality improvement strategies a four-step process is outlined:

(1) Identify the non-storm water and storm water pollutant loads from the MS4 outfalls based on the MS4 Outfall Discharge Assessment (Section 4.2.2);

(2) Identify the non-storm water and storm water pollutant load reductions, or other improvements that are necessary to attain the interim and final numeric goals;

(3) Identify the non-storm water and storm water pollutant load reductions, or other improvements, that are necessary to demonstrate that non-storm water and storm water discharges are not causing or contributing to exceedances of receiving water limitations; and

(4) Evaluate the progress of the strategies toward achieving interim and final numeric goals for protecting beneficial uses in receiving waters.

The Monitoring and Assessment Program will be evaluated and adapted in the context of the Annual Reporting and the ROWD. The reevaluation will consider data gaps and the results of each monitoring program element. Modifications may be made to the program, but the core elements required by the Permit and described in Section 4.1 will be maintained. This limits the amount of adaptation that is possible. Potential changes could include increased frequency of sampling, the addition of a new analyte of concern, changing a monitoring location, and a changing sampling or analytical method.

As described above, the integrated assessment will evaluate the main drivers of the WQIP. The priority water quality conditions will be revaluated using the receiving water and MS4 outfall discharge assessments based on the methodology presented in Section 2. The goals and schedules presented in Section 3 will be reviewed based on the results of the receiving water and MS4 outfall discharge assessments, along with data collected as part of the JRMP. This evaluation will highlight the progress towards achievement of compliance goals. Finally, both water quality monitoring data and maintenance/observational data related to BMP effectiveness will be used to assess the strategies implemented by the RAs. Table 4-4 summarizes the assessment program components that will be used to evaluate the main drivers of the integrated assessment.

Table 4-4
Integrated Assessment Components

Water Quality Improvement Plan Driver	Assessment
Priority Water Quality Conditions	• Receiving Water Assessments • MS4 Outfall Discharge Assessments
Goals and Schedules	• Receiving Water Assessments • MS4 Outfall Discharge Assessments • JRMP Assessments
Strategies	• Special Studies Assessments for BMP Effectiveness • JRMP Assessments

Based on the timeline presented in Table 4-3, the integrated assessment for all three WQIP drivers will be performed during the development of the ROWD. Strategies will be evaluated in the WQIP Annual report based on the data collected as part of the JRMP and any new relevant BMP effectiveness data collected by the RAs.

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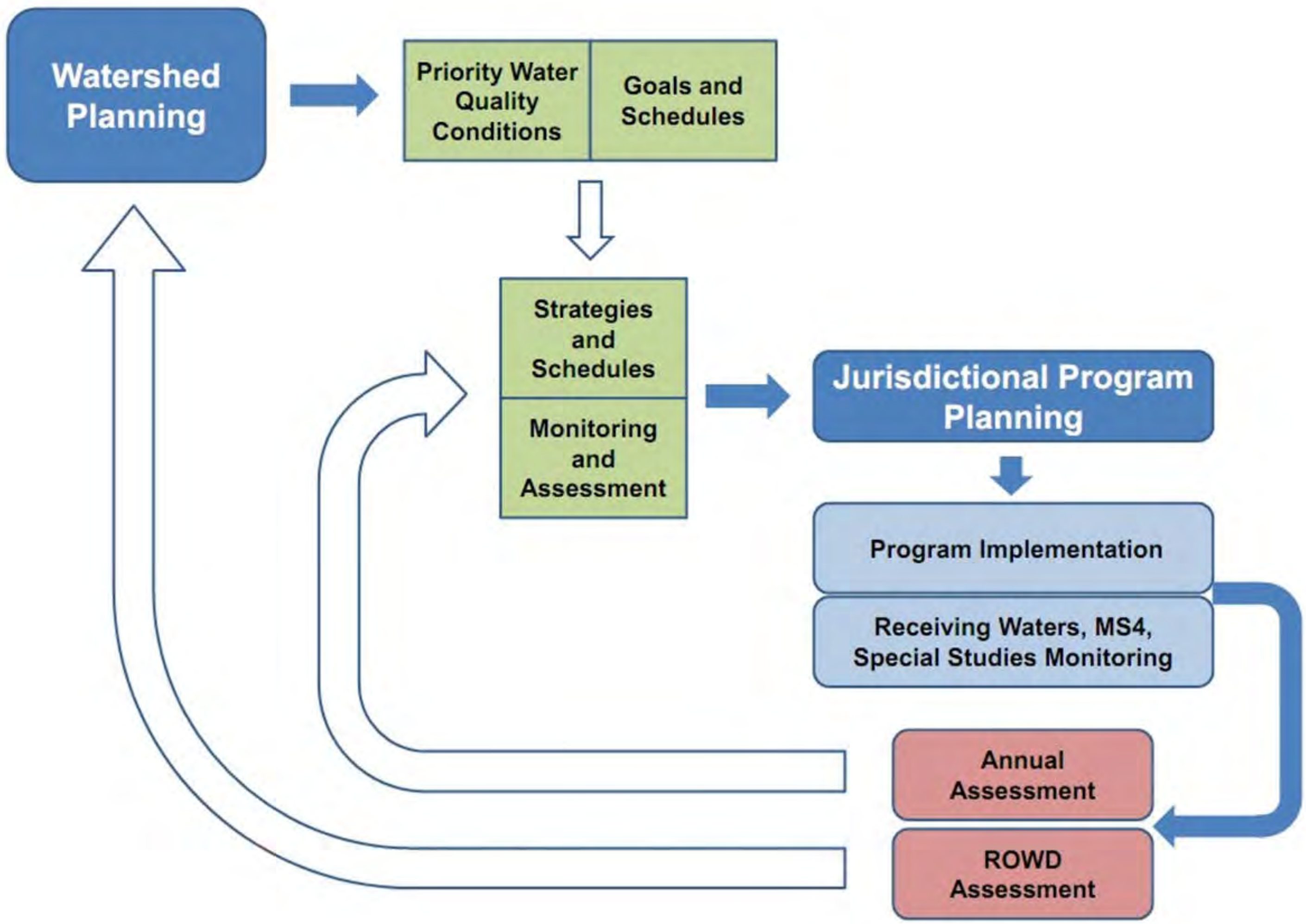
SECTION 5 ITERATIVE APPROACH AND ADAPTIVE MANAGEMENT PROCESS

Each WMA must implement an iterative approach to adapt the WQIP, monitoring and assessment program, and JRMP programs to achieving their goals. The MS4 Permit describes various triggers that may require program adaptation, including exceedances of water quality standards in receiving waters, new information, Regional Board recommendations, and public participation. Effectiveness assessments of JRMP programs and strategies may also trigger adaptations to the WQIP. Each trigger will result in specific adaptive management processes or actions within the timeframes specified in the MS4 Permit. The timing of the adaptive management requirements is typically either annually or at the end of the MS4 Permit term.

MS4 Permit requirements, annual assessments and adaptation, and ROWD assessments and adaptations, including triggers and resulting actions, are described in Sections 5.1 through 5.3.

Figure 5-1
Water Quality Improvement Plan Adaptive Management Process



5.1 PERMIT REQUIREMENTS: ITERATIVE APPROACH AND ADAPTIVE MANAGEMENT

The Permit includes the requirements for the adaptive management in multiple provisions. Provisions A.4, B.5, D.4.d, and F.2.c each contain requirements related to adaptive management. These are summarized below:

- Provision A.4 requires the WQIP to be designed and adapted to ultimately achieve compliance with the discharge prohibitions (Provisions A.1.a and A.1.c) and receiving water limitations (Provision A.2.a) specified in the MS4 Permit. It addresses the adaptive management process that may be triggered when exceedances of water quality standards persist in receiving waters.
- Provision B.5 contains specific considerations that must be included in the adaptive management process, whether performed as part of the WQIP Annual Report or as part of the ROWD. This includes the re-evaluation of priority water quality conditions; adaptation of goals, strategies, and schedules; and adaptation of the Monitoring and Assessment Program.
- Provision D.4.d contains the processes for the assessments and adaptive management that must occur in preparation of the ROWD.
- Provision F.2.c describes the requirements for updates to the WQIP that could result from implementation of the adaptive management requirements.

MS4 Permit timelines, triggers, and adaptive management processes are summarized in Table 5-1. The following sections elaborate on the adaptive management processes, including the frequencies of adaptation required by the MS4 Permit (annual versus MS4 Permit term), triggers, and resulting actions.

Table 5-1
Adaptive Management Processes for the Water Quality Improvement Plan Drivers

Water Quality Improvement Plan Drivers	Timeline	Trigger	Adaptive Management Process Considerations
Priority Water Quality Conditions	MS4 Permit Term	Report of Waste Discharge (B.5.a, D.4.d.(1))	*Provision B.5.a Iterative Approach and Adaptive Management Considerations* • Achievement of the goal of improved water quality through the implementation of strategies identified in the WQIP; • New information developed in the re-assessment of receiving water conditions, impacts from MS4 discharges, and subsequent re-evaluation of priorities; • Spatial and temporal accuracy of monitoring data; • Availability of new information and data from sources other than the JRMP programs that inform the effectiveness of implementation strategies and actions; • Recommendations from the Regional Board; and • Recommendations received through a public participation process. *Provision D.4.d(1) Integrated Assessment Considerations* • Re-evaluate the receiving water conditions and the impacts of MS4 discharges on receiving waters per the process developed in Section 2 of the WQIP. This includes the identification of beneficial uses in receiving waters that are protected per Monitoring and Assessment Program. • Re-evaluate the identification of MS4 sources and/or stressors if corresponding to elevation of a new highest priority.

Water Quality Improvement Plan Drivers	Timeline	Trigger	Adaptive Management Process Considerations
Water Quality Goals and Schedules	MS4 Permit Term	Report of Waste Discharge (B.5.b, D.4.d.(1))	*Provision B.5.b Iterative Approach and Adaptive Management Considerations* • Modifications to the priority water quality conditions based on Provision B.5.a; • Progress toward achieving numeric goals for the highest priority water quality conditions; • Progress in meeting established schedules; • New policies or regulations that may affect goals; • Reductions of non-storm water discharges; • Reductions of pollutants in storm water; • New information resulting from the re-evaluation of impacts from MS4 discharges and/or pollutants and stressors; • Efficiency in implementing the WQIP; • Recommendations from the Regional Board; and • Recommendations received through a public participation process. *Provision D.4.d(1) Integrated Assessment Considerations* • Evaluate the progress toward achieving interim and final numeric goals for protecting impacted beneficial uses in receiving waters.
Water Quality Strategies and Schedules	Annual Report	Persistent Exceedances Not Addressed (A.4.a.(2))	*Provision A.4.a(2) Integrated Assessment Considerations (Summarized in Figure 5-3)*[2] • Water quality standard exceedances for pollutants that are addressed by the WQIP; implementation of the accepted plan continues and is updated as necessary. • If MS4 discharges are causing or contributing to a new exceedance of an applicable water quality standard for pollutants that are not addressed by the WQIP, the plan will be updated as part of the WQIP Annual Report (unless directed to update it earlier by the Regional Board). • Following Regional Board approval of modifications to the WQIP, the RAs must update their JRMPs accordingly.

<table>
<tr><th>Water Quality Improvement Plan Drivers</th><th>Timeline</th><th>Trigger</th><th>Adaptive Management Process Considerations</th></tr>
<tr><td rowspan="2">Water Quality Strategies and Schedules (continued)</td><td>Annual Report</td><td>New Information (B.5.b)</td><td>Provision B.5.b Iterative Approach and Adaptive Management Considerations
• Modifications to the priority water quality conditions based on Provision B.5.a;
• Progress toward achieving numeric goals for the highest priority water quality conditions;
• Progress in meeting established schedules;
• New policies or regulations that may affect goals;
• Reductions of non-storm water discharges;
• Reductions of pollutants in storm water;
• New information resulting from the re-evaluation of impacts from MS4 discharges and/or pollutants and stressors;
• Efficiency in implementing the Water Quality Improvement Plan;
• Recommendations from the Regional Board; and
• Recommendations received through a public participation process.</td></tr>
<tr><td>MS4 Permit Term</td><td>Report of Waste Discharge (D.4.d.(2))</td><td>Provision D.4.d(2) Integrated Assessment Considerations
• Identify the non-storm water and storm water pollutant loads from the MS4 outfalls per Provision D.4.b;
• Identify the non-storm water and storm water pollutant load reductions, or other improvements that are necessary to attain the interim and final numeric goals;
• Identify the non-storm water and storm water pollutant load reductions, or other improvements, that are necessary to demonstrate that non-storm water and storm water discharges are not causing or contributing to exceedances of receiving water limitations; and
• Evaluate the progress of the strategies toward achieving interim and final numeric goals for protecting beneficial uses in receiving waters.</td></tr>
</table>

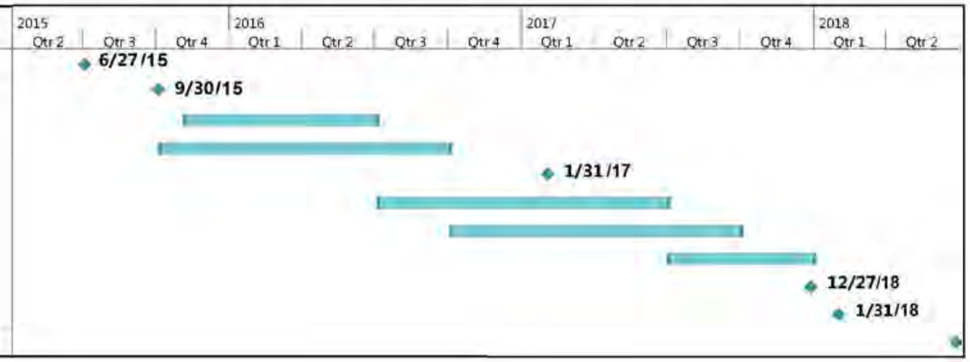
Water Quality Improvement Plan Drivers	Timeline	Trigger	Adaptive Management Process Considerations
Monitoring and Assessment Program	Annual Report	Persistent Exceedances Not Addressed (A.4.a.(2))	*Provision A.4.a(2) Integrated Assessment Considerations (Summarized in Figure 5-3)*[1] • Follow the process as described in Figure 5-3. This may potentially include modifying the monitoring program to fill data gaps. Modifications could include moving monitoring locations, adding additional sample collection, or changing type of sample collected.
		New Information (B.5.c)	*Provision B.5.c Iterative Approach and Adaptive Management Considerations* • Re-evaluate based on new information such as modified priority water quality conditions, goals, strategies, or schedules. • New information may include new regulations. • The Monitoring and Assessment Program must include the MS4 Permit required monitoring.
	MS4 Permit Term	Report of Waste Discharge (B.5.c)	*Provision B.5.c Iterative Approach and Adaptive Management Considerations* • Review Monitoring and Assessment Programs based on the requirements in Provision D. • Adjust the monitoring program to determine whether discharges from the MS4 are causing/contributing to exceedances in the receiving water when new exceedances persist; identify and address data gaps via re-assessment of monitoring locations and frequencies; adjust the monitoring program to address results of special studies.

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

Figure 5-2 provides a tentative timeline for the adaptive management process. The first WQIP Annual Report is scheduled to be submitted by the RAs to the Regional Board in January 2017. It will include an abbreviated monitoring and JRMP implementation period because the Monitoring and Assessment Program and JRMP will be effective after the approval of the WQIP. The timeline below assumes that the WQIP will be approved by the Regional Board by the end of September 2015, with implementation beginning in October 2015. The second Annual Report for current MS4 Permit cycle will be submitted in January 2018. This submittal would occur following the submittal of the ROWD that is due to the Regional Board by December 2017.

Figure 5-2
Anticipated Water Quality Improvement Plan Assessment and Reporting Timeline

Task Name	Start	Finish
Submittal of WQIP to RWQCB	6/27/2015	6/27/2015
Approval of WQIP	9/30/2015	9/30/2015
WQIP/JRMP Implementation - Year 1	11/1/2015	6/30/2016
Monitoring and Assessment Program - Year 1	10/1/2015	9/30/2016
WQIP Annual Report - Year 1	1/31/2017	1/31/2017
WQIP/JRMP Implementation - Year 2	7/1/2016	6/30/2017
Monitoring and Assessment Program - Year 2	10/1/2016	9/30/2017
Prepare Report of Waste Discharge (ROWD)	7/1/2017	12/31/2017
ROWD Due to RWQCB	12/27/2017	12/27/2017
WQIP Annual Report - Year 2	1/31/2018	1/31/2018
Permit Expiration	6/27/2018	6/27/2018



5.2 ANNUAL ASSESSMENTS AND ADAPTIVE MANAGEMENT

The MS4 Permit contains two conditions that may trigger adaptation annually:

(1) Exceedances of water quality standards in receiving waters; and

(2) New information.

In either case, modifications may be appropriate for the water quality goals, strategies, schedules, and/or Monitoring and Assessment Program. The priority water quality conditions may be modified as needed during the MS4 Permit term, but would likely be modified only as a result of assessments conducted for the ROWD.

5.2.1 Receiving Water Assessments

Evaluation of receiving water and MS4 outfall discharge data will be performed annually as part of the WQIP Annual Report (Provision F.3.b.(3)(a)). More comprehensive evaluations of receiving water data will be performed for the Transitional Monitoring and Assessment Program Report and for the ROWD (Provision D.4.a.(1)). These evaluations will summarize receiving water data collected within the Tijuana River WMA and provide information with the potential to trigger the adaptive management process described under Provision A.4.

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

- Whether the MS4 is a source of pollutants causing the exceedances to persist in the receiving waters; and
- Whether the exceedances are addressed by the WQIP.

If the receiving water exceedances are addressed under the WQIP, then the RAs will continue its implementation. If the receiving water exceedances are not addressed, then the RAs will update the plan to address the exceedances as described in Provision A.4.a.(2) and submit the updates with the WQIP Annual Report. The updates will include, as applicable:

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

The adaptive management process as required under Provision A.4 is illustrated on Figure 5-3.

5.2.2 Annual Evaluation of New Information

The adaptive management process may also be triggered as new information becomes available (Provision B.5.b). Where appropriate, modifications may be made to goals, strategies, schedules, and/or the Monitoring and Assessment Program and reported in the WQIP Annual Report. Types of new information that may trigger the adaptive management process as part of the annual assessment process are discussed below, including the potential trigger(s) for modification(s), and the resulting adaptive management process to be employed.

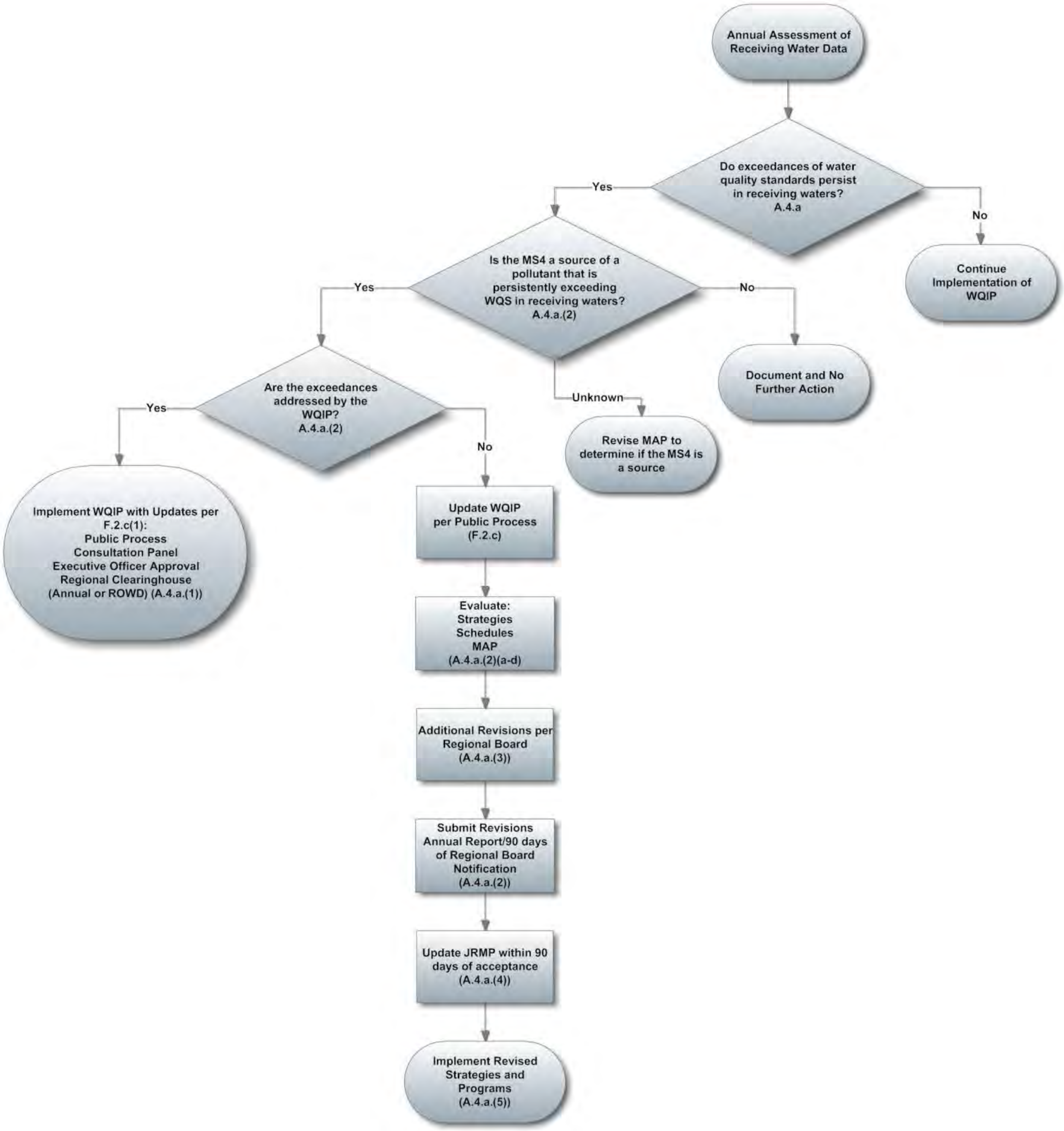
5.2.2.1 Regulatory Drivers

Where new regulations or policies are adopted that impact Tijuana River WMA planning and implementation processes in the near term, modifications to the WQIP goals, strategies, schedules, and/or monitoring and assessment plan may be warranted, and, in some cases, required. An example of a regulatory driver that may trigger modifications to the WQIP include new state policies (e.g., trash, toxicity, biological objectives, bacteria) and changes resulting from modifications to existing Permit requirements (e.g., as a result of a Permit reopener).

5.2.2.2 Special Study Results

As part of the Monitoring and Assessment Program, RAs are performing special studies related to the highest priority water quality conditions for the Tijuana River WMA. The special studies are designed to provide information related to sources of the highest priority water quality conditions within the Tijuana River WMA, will be implemented during the MS4 Permit term, and are typically performed over multiple years. As relevant data, conclusions, and lessons learned become available from these studies, the WQIP may be modified. The study results may impact the goals, strategies, schedules, and monitoring and assessment plans. Additionally, lessons learned and study results from outside the Tijuana River WMA, especially those related to the sediment and turbidity impairments, may also be incorporated into the WQIP.

Figure 5-3
Receiving Water Exceedance Process (Provision A.4)



5.2.2.3 Program Effectiveness Assessments

Strategies developed within the WQIP will be incorporated into individual RA programs through implementation of their respective JRMPs. Each RA is implementing programs that address the highest priority water quality conditions within the Tijuana River WMA. While implementation of these programs has been ongoing in many cases, refinements and enhancements to the programs provide additional focus on the particular water quality issues identified in the WQIP. Over time, RAs will utilize various assessment methods to determine the effectiveness of the program refinements. In some cases, the program effectiveness assessment results may provide useful information leading to adaptation of elements of the WQIP. Where new information is found to be valid, it may be used to modify goals, strategies, schedules, and the Monitoring and Assessment Program.

5.2.2.4 Regional Board Recommendations

The WQIP may also be adapted based on recommendations from the Regional Board. Recommendations may be a result of the public participation process, Consultation Panel recommendations, review of submitted reports, or other Regional Board interest.

5.3 MS4 PERMIT TERM ASSESSMENTS AND ADAPTIVE MANAGEMENT

The MS4 Permit also contains specific assessments to be performed during the preparation of the ROWD. The assessments are longer term in nature, occurring only once during the MS4 Permit cycle. Because the updates to the WQIP are required to undergo a full public participation process per Provision F.2.c, including reconvening the Consultation Panel, modifications will consider input from the public and Regional Board. Adaptation of WQIP elements will also consider new regulations or policies as appropriate. In the ROWD preparation, each element of the WQIP are eligible for modifications through the required adaptive management processes. Elements that will be evaluated include the water quality conditions (i.e., priorities), goals and accompanying schedules, strategies and accompanying schedules, and the Monitoring and Assessment Program.

5.3.1 Priority Water Quality Conditions

The process for selecting the highest priority water quality condition(s) is documented in Section 2 of this WQIP. Given the relatively short duration of the remainder of this MS4 Permit term after expected approval of the WQIP, the priority water quality conditions selected during the development of the WQIP will remain for the duration of the term. The priority water quality conditions will only be modified on the basis of new information assessed as part of the ROWD. Data collected during the MS4 Permit term will be used to update the analysis of the priority water quality conditions based on the methodology described in Section 2.

5.3.2 Progress Toward Achieving Goals

As part of the preparation of the ROWD, the RAs will evaluate the progress toward achieving the interim and final numeric goals described in Section 3.1. The restoration and protection of the receiving water is the desired outcome. As discussed in Section 3, discharges from sources other than the Phase I MS4s are outside of the jurisdiction and regulatory discharge responsibility of the WQIP. Note that in some cases, no regulatory mechanism is in place to address certain discharges (e.g., cross border discharges from Mexico). These other discharges cause or contribute to impairments of receiving waters, including the priority water quality conditions addressed by this WQIP. Addressing non-MS4 sources, in particular, discharges from the Mexican side of the watershed, is beyond the scope of this WQIP. Therefore, to achieve the ultimate goal of restoring and maintaining the quality of receiving waters in this watershed, all dischargers must participate and address their respective contributions. The RAs will work to address discharges from their MS4s, however, discharges from non-MS4 sources must be addressed by other responsible parties. Only in this manner can the numeric goals appearing in this WQIP be achieved.

The goals and compliance pathways will be assessed using data collected per the Monitoring and Assessment Program and JRMP along with the schedules developed in conjunction with each goal. Depending on the results of the assessment, it may be appropriate to adjust either or both of the numeric goals and/or the schedules associated with each goal.

5.3.3 Strategies and Schedules

The strategies and implementation schedules developed to address the highest priority water quality conditions in the Tijuana River WMA will be re-evaluated as part of the preparation of the ROWD. Ultimately, the effectiveness of the strategies will be based on the progress toward achieving the interim and final numeric goals. However, an evaluation of strategies based on the achievement of the interim and final numeric goals may take many years of implementation and monitoring to assess. To supplement the "goal-based" assessments, water quality and programmatic data collected over the MS4 Permit term will be incorporated into the assessment and adaptive process to modify strategies and implementation schedules as appropriate.

5.3.3.1 Water Quality Data Evaluation of Strategies

Receiving water data will be assessed as described in Section 5.1. The assessment will indicate progress toward goals and protection of beneficial uses from MS4 sources. These data may be used to evaluate the collective effectiveness of the WQIP strategies. This information will provide a "big picture" assessment of the success of the strategies over the long term.

MS4 outfall data and special studies results may provide information that is more directly linked to the implementation of individual strategies. Where possible, this information will be used to modify, eliminate, and/or develop new strategies to address the highest priority water quality conditions in the Tijuana River WMA. These data will provide the foundation for the MS4 outfall discharge assessments described in Section 5, which will evaluate the results of RA IDDE Programs and MS4 Outfall Discharge Monitoring Programs. Where strategies can be linked to measurable or demonstrable reductions of non-storm water discharges or of pollutants in storm water, appropriate modifications will be made.

5.3.3.2 Program Assessments

Where available, the results of program effectiveness assessments performed at the jurisdictional or WMA scale may also drive the adaptation of specific strategies. The level of information will vary by jurisdiction and by program, as these types of assessments are not explicitly required under the MS4

Permit. However, in many cases, the jurisdictions are performing programmatic assessments to ensure the most effective use of limited resources. These assessments have the potential to provide information to determine the effectiveness of specific strategies that is more relevant than water quality data collected at outfalls or in receiving waters, and the assessments may be a key driver in adapting strategies. In some cases, modifications to strategies may also be the result of internal jurisdictional opportunities or constraints such as increases or decreases in available funding or staffing.

5.3.4 Monitoring and Assessment Program

As part of the ROWD, the RAs will consider modifications to the Monitoring and Assessment Program, consistent with the requirements in Provision D.4.d.(3). During the MS4 Permit term, modifications must be consistent with the requirements of Provisions D.1, D.3, and D.3 (receiving water, MS4 outfall, and special study monitoring requirements, respectively), which limit the amount of adaptation that is possible. However, recommendations within the ROWD provide an opportunity to make more meaningful modifications to the Monitoring and Assessment Program. Examples of modifications to the Monitoring and Assessment Program include adjustments:

- Identify whether discharges from the MS4 are linked to exceedances in the receiving water;
- Address data gaps via re-assessment of monitoring locations and frequencies; and
- Address results of special studies.

SECTION 6 REFERENCES

Ackerman D. and K. Schiff. 2003. Modeling Storm Water Mass Emissions to the Southern California Bight. Journal of Environmental Engineering, Vol. 129(4):308-317.

Ackerman, D., and S. Weisberg. 2006. Evaluating HSPF runoff and water quality predictions at multiple time and spatial scales. 2005-2006 Southern California Coastal Water Research Project (SCCWRP) Annual Report, Costa Mesa, CA.

Borowiec, Elizabeth. Tijuana River Watershed, Baja California & CA. U.S. EPA: Region 9. May 18, 2007. Last checked March 20, 2014.

Burton, G. A., Jr., and R. Pitt. 2002. Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists, and Engineers. Boca Raton, FL: CRC Press, 911 pp.

CalRecycle, URS. 2010. Report of Trash, Waste Tire and Sediment Characterization Tijuana River Valley San Diego, California. Prepared for California Department of Resources Recovery and Recycling. Sacramento, CA. November 5, 2010.

City of Imperial Beach. Jurisdictional Urban Runoff Management Program. Annual Report 2010-2011. September 2011. Imperial Beach, CA.

City of Imperial Beach. Jurisdictional Urban Runoff Management Program. Annual Report 2011-2012. September 30, 2012. Imperial Beach, CA.

City of Los Angeles. 2002. High Trash-Generation Areas and Control Measures. Department of Public Works Bureau of Sanitation, Water Protection Division. http://www.lastormwater.org/wp-content/files_mf/trash_gen_study.pdf. Last checked May 28, 2014.

City of San Diego. Jurisdictional Urban Runoff Management Program. Annual Report Fiscal Year 2011. September 30, 2011. San Diego, CA.

City of San Diego. Jurisdictional Urban Runoff Management Program. Annual Report Fiscal Year 2012. September 30, 2012. San Diego, CA.

City of San Diego Pilot Channel Borings and Sediment Characterization Report. Final Report. Document CSD-TM-09-URS-09-01. San Diego, CA. March 16, 2011.

Clean Water Act of 1972. 33 U.S. Code §1251 et seq.

County of San Diego. Stream Bioassessment Monitoring Report, Fiscal Year 2010-2011. December 2011. San Diego, CA.

County of San Diego. Jurisdictional Urban Runoff Management Program. Annual Report Fiscal Year 2011. 2011. San Diego, CA.

County of San Diego. Jurisdictional Urban Runoff Management Program. Annual Report Fiscal Year 2012. 2012. San Diego, CA.

County of San Diego. Watershed Urban Runoff Management Program (WURMP) Fiscal Year 2010-2011 Annual Report. Tijuana River Watershed. San Diego, CA. 2012.

County of San Diego. Watershed Urban Runoff Management Program (WURMP) Fiscal Year 2011-2012 Annual Report. Tijuana River Watershed. San Diego, CA. January 31, 2013.

County of San Diego, City of Imperial Beach, and City of San Diego. Watershed Urban Runoff Management Program. March 17, 2008. San Diego, CA. http://www.projectcleanwater.org/pdf/wurmp/tj_wurmp_2008.pdf

Center for Watershed Protection and R. Pitt. 2008. Monitoring to Demonstrate Environmental Results: Guidance to Develop Local Stormwater Monitoring Studies Using Six Example Study Designs. U.S. EPA Cooperative Agreement CP-83282201-0. Washington, DC: U.S. EPA Office of Water.

Gersberg, R. M., Brown, C., Zambrano, V., Worthington, K., & Weis, D. Quality of Urban Runoff in the Tijuana River Watershed. 2000. In P. Westerhoff (ed.), The U.S.-Mexican Border Environment: Water Issues along the U.S.-Mexican Border. San Diego, CA: San Diego State University Press.

HDR. Nonstructural Non-Modeled Activity Pollutant Load Reduction Research – Addendum (Final). City of San Diego. November 5, 2014. http://www.sandiego.gov/stormwater/pdf/hdrreport.pdf. Last visited January 23, 2015.

International Boundary & Water Commission (IBWC). South Bay International Wastewater Treatment Plant (SBIWTP). http://www.ibwc.gov/Mission_Operations/sbiwtp.html.

Institute for Regional Studies of the Californias (IRSC). Tijuana River Watershed website. http://trw.sdsu.edu/English/index.html. San Diego State University. San Diego, CA. Last Modified: May 6, 2013. Last Visited: March 20, 2014.

Los Angeles Water Board. 2002. Total Maximum Daily Load to Reduce Bacterial Indicator Densities at Santa Monica Bay Beaches During Wet Weather. California Regional Water Quality Control Board, Los Angeles Region, Los Angeles, CA.

Mazor, Raphael D. and Ken Schiff. Surface Water Ambient Monitoring Program (SWAMP) Report on the Tijuana Hydrologic Unit. Final Technical Report 2007. Southern California Coastal Water Research Project. Prepared for the San Diego Regional Water Quality Control Board. January 2008. San Diego, CA.

National Research Council (NRC). Urban Stormwater Management in the United States. National Academy of Sciences. Washington, DC. 2009.

Paul, Ted. 1995. Tijuana River Pollution. TED Case Studies: An Online Journal, 4(2), 210.

Pitt, R., A. Maestre, H. Hyche, and N. Togawa. 2008. The updated National Stormwater Quality Database (NSQD), Version 3. Conference CD. 2008 Water Environment Technical Exposition and Conference, Chicago, October 2008.

Rempel, Rick. Hydrogeological Assessment of the Tijuana River Valley. California State Water Resources Control Board. February 26, 1992.

Romo, Oscar and Jennifer Hazard Leonard. Los Laureles Canyon Transborder Trash Tracking Study, Tijuana River Watershed. Cleanup and Abatement Account Grant between State Water Control Board and City of Imperial beach. Agreement No. 10-115-550 [C/A 328]. January 12, 2012.

San Diego Association of Governments (SANDAG). 2012. 2012 Land Use GIS data. Available at http://www.sandag.org/resources/maps_and_gis/gis_downloads/land.asp

San Diego County RAs. Urban Runoff Management Programs. 2011. Long-Term Effectiveness Assessment. June. San Diego, CA.

San Diego County Water Authority, City of San Diego, County of San Diego. San Diego Integrated Regional Water Management Plan. 2013. http://www.sdirwmp.org/2013-irwm-plan-update.

San Diego State University (SDSU). A Binational Vision for the Tijuana River Watershed. Institute for Regional Studies of the Californias and the Department of Geography at San Diego State University. August, 2005.

San Diego Regional Water Quality Control Board (Regional Board). Waste Discharge Requirements for the International Boundary and Water Commission U.S. Section International Wastewater Treatment Plant Discharge to the Pacific Ocean Through the South Bay Ocean Outfall San Diego County. Order No. 96-50. NPDES No. CA0108928. November 14, 1996. San Diego, CA. Last visited April 15, 2014. http://www.waterboards.ca.gov/sandiego/water_issues/programs/iwtp/docs/iwtpnpdespermit_wdr111496.pdf

San Diego Regional Water Quality Control Board (Regional Board). Email correspondence from Charles Cheng, Regional Board. December 15, 2013.

San Diego Regional Water Quality Control Board (Regional Board). Appendix J. Final Technical Report Bacteria TMDLs for Beaches and Creeks. February 10, 2010. http://www.waterboards.ca.gov/rwqcb9/water_issues/programs/tmdls/bacteria.shtml.

San Diego Regional Water Quality Control Board (Regional Board). Basin Plan. Website visited January 20, 2014. Website last updated August 28, 2012. San Diego, CA. http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan.

San Diego Regional Water Quality Control Board (Regional Board). Fact Sheet for the International Boundary and Water Commission U.S. Section.

http://www.waterboards.ca.gov/sandiego/water_issues/programs/iwtp/docs/iwtpnpdespermit_facts111496.pdf. Last Checked March 20, 2014.

San Diego Regional Water Quality Control Board (Regional Board), 2013. Order Number R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region.

San Diego State University (SDSU), 2005. Tijuana River Watershed Atlas. San Diego State University Press. Institute for Regional Studies of the Californias. San Diego, CA.

State Water Resources Control Board, 1997. Industrial Storm Water General Permit (Order No. 97-03-DWQ). Effective 1997.

State Water Resources Control Board (State Board). Surface Water Ambient Monitoring Program (SWAMP) Report on the Tijuana Hydrologic Unit. 2007. January 2008. San Diego, CA.

State Water Resources Control Board (State Board). Impaired Water Bodies. 2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report) – Statewide. San Diego, CA. http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml

State Water Resources Control Board, 2013. General Permit for Discharges of Storm Water Associated with Construction Activity. Order No. 2009-0009-DWQ. Effective July 2010; Amended by Orders 2009-0014-DWQ and 2012-0006-DWQ.

Tetra Tech. Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash TMDLs. 2010. January. San Diego, CA.

Tijuana River Valley Recovery Team (TRVRT). Recovery Strategy. 2012. Tijuana River Valley Recovery Team. Living with the Weather. January. San Diego, CA.

United States Environmental Protection Agency (U.S. EPA), 2012a. Water: Clean Water Act § 303(d) List of Impaired Waters. Website visited March 27, 2014. Website last updated March 5, 2014. http://yosemite.epa.gov/R10/WATER.NSF/TMDLs/CWA+303d+List

U.S. EPA, 2014. Monitoring and Assessing Water Quality. http://water.epa.gov/type/rsl/monitoring/. Las checked March 28, 2014.

U.S. EPA. 2014. Summary of the Clean Water Act. http://www2.epa.gov/laws-regulations/summary-clean-water-act. Last checked March 28, 2014.

Weston Solutions, Inc. Tijuana River Bacterial Source Identification Literature Review. Prepared for the City of Imperial Beach. July 2008.

Weston Solutions, Inc. Long Term Effectiveness Assessment (LTEA). 2011. http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=185%3A2011-ltea-water-quality-report&catid=16&Itemid=91 (last visited March 28, 2014).

Weston Solutions, Inc. Regional Monitoring Report. Tijuana Watershed Management Area. URM Annual Report 2010-2011. 2012. San Diego, CA.

Weston Solutions, Inc. Regional Monitoring Report. Tijuana Watershed Management Area. URM Annual Report 2011-2012. 2013. San Diego, CA.

Weston Solutions, Inc. Tijuana River Bacterial Source Identification Study – Final Report. Prepared for the City of Imperial Beach. August 2012. Imperial Beach, CA.

Weston Solutions, Inc. 2010-2011. Receiving Waters and Urban Runoff Monitoring Report (Weston Report)

Weston Solutions, Inc. 2011-2012. Receiving Waters and Urban Runoff Monitoring Report (Weston Report)

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The Beneficial Uses that are present in the Tijuana River WMA as defined by the Basin Plan are provided below:

- Agricultural Supply (AGR) includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
- Aquaculture (AQUA) includes the uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.
- Preservation of Biological Habitats (BIOL) includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.
- Cold Freshwater Habitat (COLD) includes uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.
- Commercial and Sport Fishing (COMM) includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
- 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).
- Freshwater Replenishment (FRSH) includes uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).
- Industrial Service Supply (IND) includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
- 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).
- Migration of Aquatic Organisms (MIGR) necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.
- Municipal and Domestic Supply (MUN) Includes uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
- Navigation (NAV) includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
- Industrial Process Supply (PROC) includes uses of water for industrial activities that depend primarily on water quality.

- Rare, Threatened, or Endangered Species (RARE) 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.
- 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.
- 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, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
- Shellfish Harvesting (SHELL) includes uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes.
- Spawning, Reproduction, and/or Early Development (SPWN) includes uses of water that support high quality habitats suitable for reproduction, early development and sustenance of marine fish and/or cold freshwater fish.
- Warm Freshwater Habitat (WARM) – includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.
- 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.

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Tijuana River Watershed Management Area TJR-TWAS-2 Dry Long Term Effectiveness Assessment Table

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	Tijuana River TJR-TWAS-2 3/17/10	Tijuana River TJR-TWAS-2 5/11/10	2009-2010 Exceedances	Historical Mean Ratio to Benchmark
General/Physical/Organic								
NA	Electrical Conductivity	µmhos/cm	NA	2. CCR, 5. Goldbook	2,480	2,990	-	-
CHEM-Conventional	Oil & Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL	5.3	<5	0%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	8.02	8.1	0%	NA[1]
NA	Water Temperature	Celsius	NA		22.6	26.8	-	-
Bacteriological								
BACT-Enterococci	Enterococci	MPN/100 mL	151 (a)	1. Basin Plan	**500,000**	**1,300,000**	100%	NA[1]
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	4,000	1. Basin Plan REC-1/REC-2	**9,000,000**	**5,000,000**	100%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA	1. Basin Plan	9,000,000	16,000,000	-	-
Wet Chemistry								
CHEM-Conventional	Ammonia as N	mg/L	(b)	6. U.S. EPA Water Quality Criteria (Freshwater)	**16.4**	**20**	100%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	10	8. McNeeley (1979)	**44.3**	**41**	100%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	**393**	**220**	100%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	<0.05	<0.15	0%	NA[1]
CHEM-Conventional	Surfacants (MBAS)	mg/L	0.5	1. Basin Plan	**5.8**	**3.2**	100%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	58	14. NSQD, 1. Basin Plan	**2,150**	**710**	100%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	**1,137**	**140**	100%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		24.4	18	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		21.1	25	-	-
NA	Total Organic Carbon	mg/L	NA		36.7	20	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	<0.05	0.064J	0%	NA[1]
NUTR-Total Nitrogen	Total Nitrogen (calculated)	mg/L	1	1. Basin Plan	**21.1**	**25.064**	100%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	0.1	1. Basin Plan	**4.001**	**1.7**	100%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	0.1	1. Basin Plan	**14.619**	**9**	100%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	2,100 (c)	1. Basin Plan	720	1,200	0%	NA[1]
Pesticides								
CHEM-Pesticides	Chlorpyrifos	µg/L	0.02 (acute) / 0.014 (chronic)	12. CA Dept. of Fish & Game, 2000	<0.002	<0.01	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 (acute) / 0.05 (chronic)	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon	<0.004	<0.01	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.006	<0.01	0%	NA[1]
Hardness								
NA	Total Hardness	mg $CaCO_3$/L	NA		419.7	720	-	-
Total Metals								
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.0015	0.00093	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.05	1. Basin Plan	0.0266	0.018	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	0.005	1. Basin Plan	0.0016	0.0005	0%	NA[1]
CHEM-Metals	Chromium	mg/L	0.05	1. Basin Plan	0.0348	0.023	0%	NA[1]
CHEM-Metals	Copper	mg/L	1	1. Basin Plan	0.1292	0.061	0%	NA[1]
NA	Lead	mg/L	NA		0.1495	0.052	-	-
CHEM-Metals	Nickel	mg/L	0.1	1. Basin Plan	0.0632	0.029	0%	NA[1]
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	0.001	0.00065	0%	NA[1]
CHEM-Metals	Zinc	mg/L	5	1. Basin Plan	0.4531	0.16	0%	NA[1]
Dissolved Metals								
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.0015	0.00097	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 (acute) / 0.15 (chronic)	16. 40 CFR 131.38	0.0138	0.0096	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	<0.0004	<0.0001	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.0004J	0.00028	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	<0.0008	0.003	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.00013	0.00007J	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.0144	0.011	0%	NA[1]
NA	Selenium	mg/L	NA		0.0009	0.00036J	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	<0.0005	0.0051	0%	NA[1]

(a) Water Quality Benchmark for Enterococci are based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan) 1994 (with amendments effective prior to April 25, ,2007).
(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

NA indicate no criteria or published value was available or applicable to the matrix or program.
(-) Unable to calculate because there is no criteria or published value available for the analyte.
NA[1]- Three or more years of data required to calculate the Historical Mean Ratio To Benchmark.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River Watershed Management Area TJR-TWAS-2 Wet Long Term Effectiveness Assessment Table

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	Tijuana River TJR-TWAS-2 11/28/09	Tijuana River TJR-TWAS-2 2/6/10	2009-2010 Exceedances	Historical Mean Ratio to Benchmark
General/Physical/Organic								
NA	Electrical Conductivity	µmhos/cm	NA	2. CCR, 5. Goldbook	1,129	663	-	-
CHEM-Conventional	Oil & Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000	18.8	9.9	50%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.91	7.41	0%	NA[1]
NA	Water Temperature	Celcius	NA		13.8	16.6	-	-
Bacteriological								
BACT-Enterococcus	Enterococcus	MPN/100 mL	NA	1. Basin Plan	≥16,000,000	2,400,000	-	-
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	4,000	1. Basin Plan REC-1/REC-2	5,000,000	5,000,000	100%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA	1. Basin Plan	9,000,000	≥16,000,000	-	-
Wet Chemistry								
CHEM-Conventional	Ammonia as N	mg/L	(a)	6. U.S. EPA Water Quality Criteria (Freshwater)	8.4	14.83	0%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	30	4. MSGP 2000, 8. McNeeley (1979)	76.2	66.6	100%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	111	259	50%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	0.56	<0.75	0%	NA[1]
CHEM-Conventional	Surfacants (MBAS)	mg/L	0.5	1. Basin Plan	4.05H	0.026	50%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	100	4. MSGP 2000, 1. Basin Plan	5,717.5	2,630	100%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	2,910	1,446	100%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		41.6	69.4	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		35.76	21.1	-	-
NA	Total Organic Carbon	mg/L	NA		48.2	66.6	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	3.52	<0.11	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	2	4. MSGP 2000	1.637	5.882	50%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	2	4. MSGP 2000	15.893	13.745	100%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	2,100 (b)	1. Basin Plan	560	1,770B	0%	NA[1]
Pesticides								
CHEM-Pesticides	Chlorpyrifos	µg/L	0.2 (acute) / 0.014 (chronic)	12. CA Dept. of Fish & Game, 2000	<0.002	<0.002	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 (acute) / 0.05 (chronic)	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon	<0.004	<0.004	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.006	<0.006	0%	NA[1]
Hardness								
NA	Total Hardness	mg $CaCO_3$/L	NA		174.9	658.1	-	-
Total Metals								
NA	Antimony	mg/L	NA		0.0044	0.0016	-	-
NA	Arsenic	mg/L	NA		0.0394	0.0217	-	-
NA	Cadmium	mg/L	NA		0.0025	0.0013	-	-
NA	Chromium	mg/L	NA		0.0194	0.0291	-	-
NA	Copper	mg/L	NA		0.2277	0.1351	-	-
NA	Lead	mg/L	NA		0.15854	0.1512	-	-
NA	Nickel	mg/L	NA		0.0643	0.0681	-	-
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	0.0004J	0.0009	0%	NA[1]
NA	Zinc	mg/L	NA		1.038	0.4787	-	-
Dissolved Metals								
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.006	0.0016	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 (c)	16. 40 CFR 131.38	0.0124	0.0132	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	<0.0004	<0.0004	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.0006	0.0004J	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	0.0029	0.0007J	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.00057	0.0001	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.012	0.0232	0%	NA[1]
NA	Selenium	mg/L	NA		0.0025	0.0009	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	0.0083	0.0005	0%	NA[1]
Pyrethroid								
NA	Allethrin	µg/L	NA		<0.0005	<0.0005	-	-
CHEM-Pesticides	Bifenthrin	µg/L	0.0093/0.0130*	Anderson et al., 2006	0.0178	0.0327B	100%	NA[1]
CHEM-Pesticides	Cyfluthrin	µg/L	0.344	Wheelock et al. 2004	0.0321	<0.0005	0%	NA[1]
CHEM-Pesticides	Cypermethrin	µg/L	0.683	Wheelock et al. 2004	0.5917	0.2542	0%	NA[1]
NA	Danitol	µg/L	NA		0.0048	0.0082B	-	-
NA	Deltamethrin	µg/L	NA		<0.0005	<0.0005	-	-
CHEM-Pesticides	Esfenvalerate	µg/L	0.25	Wheelock et al. 2004	0.0065	0.0137	0%	NA[1]
CHEM-Pesticides	L-Cyhalothrin	µg/L	0.2	Wheelock et al. 2004	<0.0005	0.029	0%	NA[1]
CHEM-Pesticides	Permethrin	µg/L	0.021/0.039/0.047*	Anderson et al., 2006/Wheelock et al., 2005	0.3612	<0.005	50%	NA[1]
NA	Prallethrin	µg/L	NA		<0.0005	<0.0005	-	-

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
*The lowest value presented in the range was used for conservative purposes.
NA indicate no criteria or published value was available or applicable to the matrix or program.
-Unable to calculate because there is no criteria or published value available for the analyte.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmark and the Historical Frequency Above Benchmark.
B-Anayte was detected in the associated method blank.
H-Sample received and or/analyzed past the recommended holding time.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River Watershed Management Area TJR-TWAS-1 Dry Long Term Effectiveness Assessment Table

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	Tijuana River TJR-TWAS-1 3/17/10	Tijuana River TJR-TWAS-1 5/11/10	2009-2010 Exceedances	Historical Mean Ratio to Benchmark
General/Physical/Organic								
NA	Electrical Conductivity	µmhos/cm	NA	2. CCR, 5. Goldbook	1,877	1,634	-	-
CHEM-Conventional	Oil & Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL	<5	<5	0%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.97	7.77	0%	NA[1]
NA	Water Temperature	Celsius	NA		11.9	14.9	-	-
Bacteriological								
BACT-Enterococci	Enterococci	MPN/100 mL	151 (a)	1. Basin Plan	<20	170	50%	NA[1]
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	400	1. Basin Plan REC-1/REC-2	20	<20	0%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA	1. Basin Plan	1,300	5,000	-	-
Wet Chemistry								
CHEM-Conventional	Ammonia as N	mg/L	(b)	6. U.S. EPA Water Quality Criteria (Freshwater)	<0.03	0.083J	0%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	10	8. McNeeley (1979)	<2	1.6J	0%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	13.4	20	0%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	<0.05	<0.15	0%	NA[1]
CHEM-Conventional	Surfacants (MBAS)	mg/L	0.5	1. Basin Plan	0.037	0.03J	0%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	58	14. NSQD, 1. Basin Plan	1.7J	<5	0%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	2.8	2.4	0%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		7.5	7.3	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		<1	0.46	-	-
NA	Total Organic Carbon	mg/L	NA		7.6	7.5	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	<0.05	0.11	0%	NA[1]
NUTR-Total Nitrogen	Total Nitrogen (calculated)	mg/L	1	1. Basin Plan	<1	0.57	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	0.1	1. Basin Plan	0.071	0.049	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	0.1	1. Basin Plan	0.074	0.1	0%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	500 (c)	1. Basin Plan	1,090	1,100	100%	NA[1]
Pesticides								
CHEM-Pesticides	Chlorpyrifos	µg/L	0.02 (acute) / 0.014 (chronic)	12. CA Dept. of Fish & Game, 2000	<0.002H	<0.01	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 (acute) / 0.05 (chronic)	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon	<0.004H	<0.01	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.006H	<0.01	0%	NA[1]
Hardness								
NA	Total Hardness	mg $CaCO_3$/L	NA		469	480	-	-
Total Metals								
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.0001J	0.00008J	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.05	1. Basin Plan	0.0048	0.0027	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	0.005	1. Basin Plan	<0.0004	0.0001	0%	NA[1]
CHEM-Metals	Chromium	mg/L	0.05	1. Basin Plan	0.0001J	0.00013J	0%	NA[1]
CHEM-Metals	Copper	mg/L	1	1. Basin Plan	0.0008	0.00048J	0%	NA[1]
NA	Lead	mg/L	NA		0.0003	0.00045	-	-
CHEM-Metals	Nickel	mg/L	0.1	1. Basin Plan	0.001	0.0004J	0%	NA[1]
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	0.0003J	0.00023J	0%	NA[1]
CHEM-Metals	Zinc	mg/L	5	1. Basin Plan	<0.0005	0.0012J	0%	NA[1]
Dissolved Metals								
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.0001J	0.00008J	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 (acute) / 0.15 (chronic)	16. 40 CFR 131.38	0.004	0.0024	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	<0.0004	0.0001	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	<0.0005	0.00006J	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	0.0004J	0.00043J	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	<0.0001	<0.0002	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.001	0.00033J	0%	NA[1]
NA	Selenium	mg/L	NA		0.0012	0.00027J	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	<0.0005	0.0018J	0%	NA[1]

(a) Water Quality Benchmark for Enterococi are based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan) 1994 (with amendments effective prior to April 25, ,2007).
(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

NA indicate no criteria or published value was available or applicable to the matrix or program.
(-) Unable to calculate because there is no criteria or published value available for the analyte.
NA[1]- Three or more years of data required to calculate the Historical Mean Ratio To Benchmark.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
H-Sample received and/or analyzed past the recommended holding time.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River Watershed Management Area TJR-TWAS-1 Wet Long Term Effectiveness Assessment Table

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	Tijuana River TJR-TWAS-1 12/7/09	Tijuana River TJR-TWAS-1 2/6/10	2009-2010 Exceedances	Historical Mean Ratio to Benchmark
General/Physical/Organic								
NA	Electrical Conductivity	µmhos/cm	NA	2. CCR, 5. Goldbook	289	672	-	-
CHEM-Conventional	Oil & Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000	2.6J	1.5J	0%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.61	6.54	0%	NA[1]
NA	Water Temperature	Celcius	NA		9.3	11.5	-	-
Bacteriological								
BACT-Enterococcus	Enterococcus	MPN/100 mL	NA	1. Basin Plan	17,000	5,000	-	-
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	4,000	1. Basin Plan REC-1/REC-2	8,000	6,000	100%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA	1. Basin Plan	23,000	220,000	-	-
Wet Chemistry								
CHEM-Conventional	Ammonia as N	mg/L	(a)	6. U.S. EPA Water Quality Criteria (Freshwater)	0.18	0.08	0%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	30	4. MSGP 2000, 8. McNeeley (1979)	<2H	3	0%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	52.3	68.7	0%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	0.07	<0.15	0%	NA[1]
CHEM-Conventional	Surfacants (MBAS)	mg/L	0.5	1. Basin Plan	0.76	0.039	50%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	100	4. MSGP 2000, 1. Basin Plan	413	241.3	100%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	306.5	275	100%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		15.2	9.5	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		1.78	1.148	-	-
NA	Total Organic Carbon	mg/L	NA		14.8	9.3	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	0.86	0.31	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	2	4. MSGP 2000	0.333	0.261	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	2	4. MSGP 2000	0.825	1.046	0%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	500 (b)	1. Basin Plan	286	668B	50%	NA[1]
Pesticides								
CHEM-Pesticides	Chlorpyrifos	µg/L	0.2 (acute) / 0.014 (chronic)	12. CA Dept. of Fish & Game, 2000	<0.002	<0.002	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 (acute) / 0.05 (chronic)	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon	<0.004	<0.004	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.006	<0.006	0%	NA[1]
Hardness								
NA	Total Hardness	mg $CaCO_3$/L	NA		56.9	270.6	-	-
Total Metals								
NA	Antimony	mg/L	NA		0.0002J	0.0003J	-	-
NA	Arsenic	mg/L	NA		0.0018	0.0033	-	-
NA	Cadmium	mg/L	NA		0.0003J	0.0003J	-	-
NA	Chromium	mg/L	NA		0.0018	0.0017	-	-
NA	Copper	mg/L	NA		0.0111	0.0055	-	-
NA	Lead	mg/L	NA		0.02199	0.0092	-	-
NA	Nickel	mg/L	NA		0.0027	0.0016	-	-
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	0.0002J	0.0006	0%	NA[1]
NA	Zinc	mg/L	NA		0.1257	0.0479	-	-
Dissolved Metals								
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.0002J	0.0003J	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 (c)	16. 40 CFR 131.38	0.0015	0.0025	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	<0.0004	<0.0004	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.0004J	0.0002J	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	0.0043	0.0018	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.00168	0.00006J	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.0007	0.0008	0%	NA[1]
NA	Selenium	mg/L	NA		0.0005	0.0006	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	0.0178	0.0036	0%	NA[1]
Pyrethroid								
NA	Allethrin	µg/L	NA		<0.0005	<0.0005	-	-
CHEM-Pesticides	Bifenthrin	µg/L	0.0093/0.0130*	Anderson et al., 2006	0.0058	0.0277B	50%	NA[1]
CHEM-Pesticides	Cyfluthrin	µg/L	0.344	Wheelock et al. 2004	<0.0005	<0.0005	0%	NA[1]
CHEM-Pesticides	Cypermethrin	µg/L	0.683	Wheelock et al. 2004	<0.0005	<0.0005	0%	NA[1]
NA	Danitol	µg/L	NA		<0.0005	0.0042B	-	-
NA	Deltamethrin	µg/L	NA		<0.0005	<0.0005	-	-
CHEM-Pesticides	Esfenvalerate	µg/L	0.25	Wheelock et al. 2004	<0.0005	0.0026	0%	NA[1]
NA	Fenvalerate	µg/L	NA		<0.0005	0.0081	-	-
NA	Fluvalinate	µg/L	NA		<0.0005	<0.0005	-	-
CHEM-Pesticides	L-Cyhalothrin	µg/L	0.2	Wheelock et al. 2004	<0.0005	0.027	0%	NA[1]
CHEM-Pesticides	Permethrin	µg/L	0.021/0.039/0.047*	Anderson et al., 2006/Wheelock et al., 2005	<0.005	<0.005	0%	NA[1]
NA	Prallethrin	µg/L	NA		<0.0005	<0.0005	-	-

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
*The lowest value presented in the range was used for conservative purposes.
NA indicate no criteria or published value was available or applicable to the matrix or program.
-Unable to calculate because there is no criteria or published value available for the analyte.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmark and the Historical Frequency Above Benchmark.
B-Anayte was detected in the associated method blank.
H-Sample received and/ or analyzed past the recommended holding time.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River Watershed Management Area TJR-MLS Wet Long Term Effectiveness Assessment Table

Analyte	Units	Water Quality Benchmarks	Benchmark References	2005-2006			2006-2007			2007-2008	2008-2009	2009-2010		Frequency Above Benchmarks	Mean Ratio to Benchmarks
				10/18/05	2/19/06	2/28/06	10/14/06	1/30/07	4/20/07	-	12/16/08	11/28/09	2/6/10		
General / Physical / Organic										No Samples Collected					
Electrical Conductivity	µmhos/cm	NA	2. CCR, 5. Goldbook	1,715	1,806	752	702	1,460	991		1,386	1,376	644		
Oil and Grease	mg/L	10	1 Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000	2.5	1.32	2.9	38	<5	<5		<5	6.3	16.1	22%	0.83
pH	pH units	6.5-9.0	1. Basin Plan	7.56	7.82	7.87	7.56	7.47	7.53		7.65	7.47	7.26	0%	0.00
Water Temperature	Celcius	NA		17.60	13.60	15.50	16.80	11.90	15.50		13.60	14.5	16.4		
Bacteriological															
Enterococci	MPN/100 mL	NA	1. Basin Plan	5,000,000	800,000	500,000	1,700,000	800,000	1,700,000		800,000	9,000,000	3,000,000		
Fecal Coliform	MPN/100 mL	4,000	1.Basin Plan REC-1/REC-2	>16,000,000	9,000,000	500,000	16,000,000	2,200,000	1,700,000		9,000,000	2,800,000	9,000,000	100%	1838.89
Total Coliform	MPN/100 mL	NA	1. Basin Plan	>16,000,000	16,000,000	2,200,000	16,000,000	5,000,000	5,000,000		≥16,000,000	16,000,000	≥16,000,000		
Wet Chemistry															
Ammonia as N	mg/L	(a)	6. USEPA Water Quality Criteria (Freshwater)	16	4.38	7.21	6.81	7.83	10.4		0.41	7.35	7.11	0%	0.43
Biochemical Oxygen Demand	mg/L	30	4. MSGP 2000, 8. McNeeley (1979)	23.1	28	25	15.1	77.7	67.6		82.2	74.1	>77.8	56%	1.74
Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	170	140	141	522	480	379		81	123	74.6	78%	1.95
Dissolved Organic Carbon	mg/L	NA		30.2	37.9	82.4	65	47.6	42.5		13.6	45.6	13.7		
Dissolved Phosphorus	mg/L	2	4. MSGP 2000	1.23	1.76	1.72	1.91	1.88	2.36		1.135	2.096	1.279	22%	0.85
Nitrate as N	mg/L	10	1. Basin Plan	3.54	2.65	1.45	7.62	2.34	2.36		3.08	5.06	1.4	0%	0.33
Nitrite as N	mg/L	1	1. Basin Plan	0.81	0.66	0.29	0.43	0.66	0.33		0.26	1.25	0.39	11%	0.56
Surfactants (MBAS)	mg/L	0.5	1. Basin Plan	0.5	0.6	<0.5	<0.5	<0.5	<0.5		0.60	4.65H	<0.025	33%	1.64
Total Dissolved Solids	mg/L	2,100 (b)	1. Basin Plan	1,290	532	720	460	796	424		460	460	710B	0%	0.31
Total Kjeldahl Nitrogen	mg/L	NA		16.3	14.7	7.5	9.7	21.6	11.4		10	20.2	18.5		
Total Organic Carbon	mg/L	NA		69.7	51.7	136	130	60.4	76.8		28.2	46.5	14		
Total Phosphorus	mg/L	2	4. MSGP 2000	2.45	1.98	1.83	3	1.94	3.12		3.40	5.867	6.452	67%	1.67
Total Suspended Solids	mg/L	100	4. MSGP 2000, 1. Basin Plan	764	8,140	7,780	1,560	692	1,080		2,512	2,175	4,090	100%	31.99
Turbidity	NTU	20	1. Basin Plan	129	192	147	646	197	526		1,482	1,152	2,400	100%	38.17
Pesticides															
Chlorpyrifos	µg/L	0.02 (acute) / 0.014 (chronic)	12. CA Dept. of Fish & Game, 2000	<0.01	<0.02	<0.02	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	0%	0.17
Diazinon	µg/L	0.08 (acute) / 0.05 (chronic)	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon	0.241	0.278	0.128	0.347	0.272	0.390		0.2094	<0.004	<0.004	78%	2.60
Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	0.641	<0.02	<0.02	1.940	<0.006	0.736		0.113	<0.006	<0.006	33%	0.89
Hardness															
Total Hardness	mg $CaCO_3$/L	NA		544	706	496	379	348	263		87.8	201.5	177.1		
Total Metals															
Antimony	mg/L	NA		<0.005	0.005	<0.005	0.004	0.008	0.004		0.0009	0.0027	0.0023		
Arsenic	mg/L	NA		0.014	0.019	0.012	0.025	0.009	0.009		0.0095	0.0206	0.0138		
Cadmium	mg/L	NA		<0.001	0.006	0.001	0.006	<0.001	<0.001		0.0009	0.0009	0.0013		
Chromium	mg/L	NA		<0.005	0.006	0.006	0.05	0.031	0.024		0.0093	0.0084	0.0094		
Copper	mg/L	NA		0.013	0.082	0.011	0.07	0.104	0.045		0.0693	0.0804	0.0481		
Lead	mg/L	NA		0.009	0.089	0.008	0.102	0.078	0.047		0.0594	0.05491	0.0751		
Nickel	mg/L	NA		0.025	0.050	0.017	0.037	0.032	0.023		0.0265	0.0335	0.0288		
Selenium	mg/L	0.005	16. 40 CFR 131.38	<0.005	<0.005	<0.005	<0.004	<0.004	<0.004		0.0003J	0.0006	0.0011	0%	0.34
Zinc	mg/L	NA		0.109	1.100	0.176	0.558	0.456	0.296		0.3394	0.3608	0.3405		
Dissolved Metals															
Antimony	mg/L	0.006	1. Basin Plan	<0.005	<0.005	<0.005	0.003	0.005	0.003		0.0032	0.0054	0.0029	0%	0.56
Arsenic	mg/L	0.34 (c)	16. 40 CFR 131.38	0.007	0.003	<0.001	0.004	<0.001	<0.001		0.0073	0.014	0.008	0%	0.01
Cadmium	mg/L	(d)	16. 40 CFR 131.38	<0.001	0.002	<0.001	<0.001	<0.001	<0.001		<0.0004	<0.0004	<0.0004	0%	0.05
Chromium	mg/L	(d)	16. 40 CFR 131.38	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		0.0003J	0.0007	0.0003J	0%	0.00
Copper	mg/L	(d)	16. 40 CFR 131.38	0.008	0.012	0.009	0.01	0.01	0.008		0.0019	0.0041	0.0024	0%	0.21
Lead	mg/L	(d)	16. 40 CFR 131.38	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001		0.00015	0.0007	0.0005	0%	0.04
Nickel	mg/L	(d)	16. 40 CFR 131.38	0.014	0.013	0.008	0.007	0.011	0.007		0.0048	0.0153	0.0066	0%	0.04
Selenium	mg/L	NA		<0.005	<0.005	<0.005	<0.004	<0.004	<0.004		0.0004J	0.002	0.0008		
Zinc	mg/L	(d)	16. 40 CFR 131.38	0.033	0.031	<0.020	0.021	0.02	<0.02		0.0034	0.0129	0.0058	0%	0.05
Pyrethroid															
Allethrin	µg/L	NA		NS	NS	NS	NS	NS	NS		<0.002	<0.0005	<0.0005	0%	
Bifenthrin	µg/L	0.0093/0.013*	Anderson et al. in press/Weston	NS	NS	NS	NS	NS	NS		0.0216	<0.0005	0.0265B	66%	1.733
Cyfluthrin	µg/L	0.344	San Diego Regional Monitoring Program	NS	NS	NS	NS	NS	NS		<0.002	0.0403	<0.0005	0%	0.040
Cypermethrin	µg/L	0.683	San Diego Regional Monitoring Program	NS	NS	NS	NS	NS	NS		0.1878	0.2183	0.1015	0%	0.248
Danitol	µg/L	NA		NS	NS	NS	NS	NS	NS		<0.002	<0.0005	0.0029B	0%	
Deltamethrin	µg/L	NA		NS	NS	NS	NS	NS	NS		<0.002	<0.0005	<0.0005	0%	
Esfenvalerate	µg/L	0.25	San Diego Regional Monitoring Program	NS	NS	NS	NS	NS	NS		0.0039	0.0036	0.0058	0%	0.018
L-Cyhalothrin	µg/L	0.2	San Diego Regional Monitoring Program	NS	NS	NS	NS	NS	NS		<0.002	<0.0005	0.0295	0%	0.513
Permethrin	µg/L	0.021/0.039/0.047*	Anderson et al. in press/Wheelock et al. 2005	NS	NS	NS	NS	NS	NS		0.2728	<0.005	<0.005	33%	4.410
Prallethrin	µg/L	NA		NS	NS	NS	NS	NS	NS		<0.002	<0.0005	<0.0005	0%	

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
NA indicates no criteria or published value was available or applicable to the matrix or program.
* The lowest value presented in the range was used for conservative purposes.
B-Anayte was detected in the associated method blank.
H-Sample received and or/analyzed past the recommended holding time.
J flagged values indicate that the reported result is below the reporting limit, but above the method detection limit.

Shaded text – exceeds water quality benchmark and the **CMC** water quality benchmark for metals.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River Watershed Management Area TJR-MLS Dry Long Term Effectiveness Assessment Table

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	Tijuana River TJR-MLS 3/17/10	Tijuana River TJR-MLS 5/11/10	2009-2010 Exceedances	Historical Mean Ratio to Benchmark
General/Physical/Organic								
NA	Electrical Conductivity	µmhos/cm	NA	2. CCR, 5. Goldbook	2,610	3,060	-	-
CHEM-Conventional	Oil & Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL	2.3J	<5	0%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.81	7.89	0%	NA[1]
NA	Water Temperature	Celsius	NA		16.3	19.4	-	-
Bacteriological								
BACT-Enterococci	Enterococci	MPN/100 mL	151 (a)	1. Basin Plan	**500,000**	**50,000**	100%	NA[1]
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	4,000	1. Basin Plan REC-1/REC-2	**5,000,000**	**1,300,000**	100%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA	1. Basin Plan	16,000,000	5,000,000	-	-
Wet Chemistry								
CHEM-Conventional	Ammonia as N	mg/L	(b)	6. U.S. EPA Water Quality Criteria (Freshwater)	**11.4**	**13**	100%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	10	8. McNeeley (1979)	**40.8**	**13**	100%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	**132**	64	50%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	0.45	0.21	0%	NA[1]
CHEM-Conventional	Surfacants (MBAS)	mg/L	0.5	1. Basin Plan	**4.8**	**4.5**	100%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	58	14. NSQD, 1. Basin Plan	42.5	23	0%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	**27.5**	13	50%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		20.9	19	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		14.3	14	-	-
NA	Total Organic Carbon	mg/L	NA		23.8	19	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	0.58	4.7	0%	NA[1]
NUTR-Total Nitrogen	Total Nitrogen (calculated)	mg/L	1	1. Basin Plan	**15.33**	**18.91**	100%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	0.1	1. Basin Plan	**3.135**	**4.7**	100%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	0.1	1. Basin Plan	**3.902**	**4.3**	100%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	2,100 (c)	1. Basin Plan	1,344	1,600	0%	NA[1]
Pesticides								
CHEM-Pesticides	Chlorpyrifos	µg/L	0.2 (acute) / 0.014 (chronic)	12. CA Dept. of Fish & Game, 2000	<0.002	<0.01	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 (acute) / 0.05 (chronic)	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon	<0.004	<0.01	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.006	<0.01	0%	NA[1]
Hardness								
NA	Total Hardness	mg $CaCO_3$/L	NA		422.7	550	-	-
Total Metals								
NA	Antimony	mg/L	0.006	1. Basin Plan	0.0008	0.00092	0%	NA[1]
NA	Arsenic	mg/L	0.05	1. Basin Plan	0.0067	0.0068	0%	NA[1]
NA	Cadmium	mg/L	0.005	1. Basin Plan	<0.0004	0.00005J	0%	NA[1]
NA	Chromium	mg/L	0.05	1. Basin Plan	0.0006	0.00066	0%	NA[1]
NA	Copper	mg/L	1	1. Basin Plan	0.0114	0.0096	0%	NA[1]
NA	Lead	mg/L	NA		0.00315	0.0008	-	-
NA	Nickel	mg/L	0.1	1. Basin Plan	0.0086	0.02	0%	NA[1]
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	0.0016	0.0011	0%	NA[1]
NA	Zinc	mg/L	5	1. Basin Plan	0.0205	0.021	0%	NA[1]
Dissolved Metals								
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.0008	0.00088	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 (acute) / 0.15 (chronic)	16. 40 CFR 131.38	0.0074	0.0068	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	<0.0004	0.00003J	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.0003J	0.0003	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	0.0041	0.0075	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.00047	0.0002	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.0079	0.019	0%	NA[1]
NA	Selenium	mg/L	NA		0.001	0.001	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	0.007	0.018	0%	NA[1]

(a) Water Quality Benchmark for Enterococi are based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan) 1994 (with amendments effective prior to April 25, ,2007).
(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported Value is estimated.
NA indicate no criteria or published value was available or applicable to the matrix or program.
(-) Unable to calculate because there is no criteria or published value available for the analyte.
NA[1]- Three or more years of data required to calculate the Historical Mean Ratio To Benchmark.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River WMA 2010-2011 Dry Weather Assessment
Analytical Data for SMC05402

Category Group	Analyte	Units	Water Quality Benchmarks	HSA / Benchmark References	Barrett Lake (911.30) SMC05402 7/28/2011	2010-2011 Exceedances	Historical Mean Ratio to Benchmarks	Historical Frequency Above Benchmarks
Physical Chemistry								
NA	Alkalinity	mg/L	NA		160	-	-	-
NA	Conductivity	µmhos/cm	NA		671	-	-	-
CHEM-Conventional	Dissolved Oxygen	mg/L	<5	1. Basin Plan	8.12	0%	NA[1]	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	8.3	0%	NA[1]	NA[1]
NA	Salinity	PPT	NA		0.33	-	-	-
NA	Water Temperature	Celsius	NA		20.64	-	-	-
Periphyton								
NA	Ash-Free Dry Weight	g/m²	NA		68.01	-	-	-
NA	Chlorophyll-a	mg/m²	NA		59.9	-	-	-
Wet Chemistry								
CHEM-Conventional	Ammonia as N	mg/L	(a)	6. USEPA Water Quality Criteria (Freshwater)	<0.048	0%	NA[1]	NA[1]
CHEM-Conventional	Chloride	mg/L	250 (b)	1. Basin Plan	53	0%	NA[1]	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	<0.01	0%	NA[1]	NA[1]
CHEM-Conventional	Sulfate	mg/L	250 (c)	1. Basin Plan	70	0%	NA[1]	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	58	14. NSQD, 1. Basin Plan	2	0%	NA[1]	NA[1]
NA	Orthophosphate as P	mg/L	NA		<0.00083	-	-	-
NA	Silica	mg/L	NA		36	-	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		0.12	-	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	1	0%	NA[1]	NA[1]
NUTR-Total Nitrogen	Total Nitrogen	mg/L	1	1. Basin Plan	1.2	100%	NA[1]	NA[1]
NUTR-Total Phosphorus	Total Phosphorus	mg/L	0.1	1. Basin Plan	0.02	0%	NA[1]	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids (calculated)[1]	mg/L	500 (d)	1. Basin Plan	470	0%	NA[1]	NA[1]
Hardness								
NA	Total Hardness	mg $CaCO_3$/L	NA		200	-	-	-
Total Metals								
CHEM-Metals	Arsenic	mg/L	0.05	1. Basin Plan	0.0011	0%	NA[1]	NA[1]
CHEM-Metals	Cadmium	mg/L	0.005	1. Basin Plan	<0.00002	0%	NA[1]	NA[1]
CHEM-Metals	Chromium	mg/L	0.05	1. Basin Plan	<0.000074	0%	NA[1]	NA[1]
CHEM-Metals	Copper	mg/L	1.0	1. Basin Plan	0.00032J	0%	NA[1]	NA[1]
NA	Lead	mg/L	NA		0.00004J	-	-	-
CHEM-Metals	Nickel	mg/L	0.1	1. Basin Plan	0.0006J	0%	NA[1]	NA[1]
CHEM-Metals	Selenium	mg/L	0.005	40 CFR 131.38	0.0014	0%	NA[1]	NA[1]
CHEM-Metals	Zinc	mg/L	5.0	1. Basin Plan	0.0011J	0%	NA[1]	NA[1]
Dissolved Metals								
CHEM-Metals	Arsenic	mg/L	0.34 acute / 0.15 chronic	40 CFR 131.38	0.0011	0%	NA[1]	NA[1]
CHEM-Metals	Cadmium	mg/L	(e)	40 CFR 131.38	<0.00002	0%	NA[1]	NA[1]
CHEM-Metals	Chromium	mg/L	(e)	40 CFR 131.38	<0.000074	0%	NA[1]	NA[1]
CHEM-Metals	Copper	mg/L	(e)	40 CFR 131.38	0.00029J	0%	NA[1]	NA[1]
CHEM-Metals	Lead	mg/L	(e)	40 CFR 131.38	<0.000011	0%	NA[1]	NA[1]
CHEM-Metals	Nickel	mg/L	(e)	40 CFR 131.38	0.00058J	0%	NA[1]	NA[1]
NA	Selenium	mg/L	NA		0.0013	-	-	-
CHEM-Metals	Zinc	mg/L	(e)	40 CFR 131.38	0.0016J	0%	NA[1]	NA[1]
Pyrethroids								
NA	Allethrin	µg/L	NA		<0.00085	-	-	-
CHEM-Pesticides	Bifenthrin	µg/L	0.0093	15. Anderson et al., 2006	<0.00079	0%	NA[1]	NA[1]
CHEM-Pesticides	Cyfluthrin	µg/L	0.344	17. Wheelock et al., 2004	<0.00083	0%	NA[1]	NA[1]
CHEM-Pesticides	Cypermethrin	µg/L	0.683	17. Wheelock et al., 2004	<0.00066	0%	NA[1]	NA[1]
NA	Deltamethrin	µg/L	NA		<0.0019	-	-	-
CHEM-Pesticides	Esfenvalerate	µg/L	0.25	17. Wheelock et al., 2004	<0.00098	0%	NA[1]	NA[1]
NA	Fenvalerate	µg/L	NA		<0.00098	0%	-	-
CHEM-Pesticides	L-Cyhalothrin	µg/L	0.2	17. Wheelock et al., 2004	<0.0012	0%	NA[1]	NA[1]
CHEM-Pesticides	Permethrin	µg/L	0.021	15. Anderson et al., 2006	<0.005	0%	NA[1]	NA[1]
NA	Prallethrin	µg/L	NA		<0.00092	-	-	-

<-Results less than the method detection limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for chloride is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for sulfate is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for total dissolved solids is based on the San Diego Reginal Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).
(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, may 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmarks and Historical Frequency Above Benchmarks .
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River WMA 2010-2011 Dry Weather Assessment
Analytical Data for SMC03510

Category Group	Analyte	Units	Water Quality Benchmarks	HSA Benchmark References	Marron (911.21) SMC03510 7/21/2011	2010-2011 Exceedances	Historical Mean Ratio to Benchmarks	Historical Frequency Above Benchmarks
Physical Chemistry								
NA	Alkalinity	mg/L	NA		408	-	-	-
NA	Conductivity	µmhos/cm	NA		2,458	-	-	-
CHEM-Conventional	Dissolved Oxygen	mg/L	<5	1. Basin Plan	11.24	0%	NA[1]	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	8.2	0%	NA[1]	NA[1]
NA	Salinity	PPT	NA		1.27	-	-	-
NA	Water Temperature	Celsius	NA		23.12	-	-	-
Periphyton								
NA	Ash-Free Dry Weight	g/m^2	NA		52.99	-	-	-
NA	Chlorophyll-a	mg/m^2	NA		169.9	-	-	-
Wet Chemistry								
CHEM-Conventional	Ammonia as N	mg/L	(a)	6. USEPA Water Quality Criteria (Freshwater)	0.24	0%	NA[1]	NA[1]
CHEM-Conventional	Chloride	mg/L	250 (b)	1. Basin Plan	280	100%	NA[1]	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	0.15	0%	NA[1]	NA[1]
CHEM-Conventional	Sulfate	mg/L	250(c)	1. Basin Plan	320	100%	NA[1]	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	58	14. NSQD, 1. Basin Plan	5	0%	NA[1]	NA[1]
NA	Orthophosphate as P	mg/L	NA		3.1	-	-	-
NA	Silica	mg/L	NA		34	-	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		1.5	-	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	5.45	0%	NA[1]	NA[1]
NUTR-Total Nitrogen	Total Nitrogen	mg/L	1	1. Basin Plan	7	100%	NA[1]	NA[1]
NUTR-Total Phosphorus	Total Phosphorus	mg/L	0.1	1. Basin Plan	4.5	100%	NA[1]	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids (calculated)[1]	mg/L	500 (d)	1. Basin Plan	1,721	100%	NA[1]	NA[1]
Hardness								
NA	Total Hardness	mg $CaCO_3$/L	NA		440	-	-	-
Total Metals								
CHEM-Metals	Arsenic	mg/L	0.05	1. Basin Plan	0.0037	0%	NA[1]	NA[1]
CHEM-Metals	Cadmium	mg/L	0.005	1. Basin Plan	0.00003J	0%	NA[1]	NA[1]
CHEM-Metals	Chromium	mg/L	0.05	1. Basin Plan	0.0005	0%	NA[1]	NA[1]
CHEM-Metals	Copper	mg/L	1.0	1. Basin Plan	0.0012	0%	NA[1]	NA[1]
NA	Lead	mg/L	NA		0.0001J	-	-	-
CHEM-Metals	Nickel	mg/L	0.1	1. Basin Plan	0.012	0%	NA[1]	NA[1]
CHEM-Metals	Selenium	mg/L	0.005	40 CFR 131.38	0.00048	0%	NA[1]	NA[1]
CHEM-Metals	Zinc	mg/L	5.0	1. Basin Plan	0.0044J	0%	NA[1]	NA[1]
Dissolved Metals								
CHEM-Metals	Arsenic	mg/L	0.34 acute / 0.15 chronic	40 CFR 131.38	0.0035	0%	NA[1]	NA[1]
CHEM-Metals	Cadmium	mg/L	(e)	40 CFR 131.38	0.00003J	0%	NA[1]	NA[1]
CHEM-Metals	Chromium	mg/L	(e)	40 CFR 131.38	0.00029	0%	NA[1]	NA[1]
CHEM-Metals	Copper	mg/L	(e)	40 CFR 131.38	0.0012	0%	NA[1]	NA[1]
CHEM-Metals	Lead	mg/L	(e)	40 CFR 131.38	0.00003J	0%	NA[1]	NA[1]
CHEM-Metals	Nickel	mg/L	(e)	40 CFR 131.38	0.012	0%	NA[1]	NA[1]
NA	Selenium	mg/L	NA		0.00047	-	-	-
CHEM-Metals	Zinc	mg/L	(e)	40 CFR 131.38	0.005	0%	NA[1]	NA[1]
Pyrethroids								
NA	Allethrin	µg/L	NA		<0.00085	-	-	-
CHEM-Pesticides	Bifenthrin	µg/L	0.0093	15. Anderson et al., 2006	<0.00079	0%	NA[1]	NA[1]
CHEM-Pesticides	Cyfluthrin	µg/L	0.344	17. Wheelock et al., 2004	<0.00083	0%	NA[1]	NA[1]
CHEM-Pesticides	Cypermethrin	µg/L	0.683	17. Wheelock et al., 2004	<0.00066	0%	NA[1]	NA[1]
NA	Deltamethrin	µg/L	NA		<0.0019	-	-	-
CHEM-Pesticides	Esfenvalerate	µg/L	0.25	17. Wheelock et al., 2004	<0.00098	0%	NA[1]	NA[1]
NA	Fenvalerate	µg/L	NA		<0.00098	0%	-	-
CHEM-Pesticides	L-Cyhalothrin	µg/L	0.2	17. Wheelock et al., 2004	<0.0012	0%	NA[1]	NA[1]
CHEM-Pesticides	Permethrin	µg/L	0.021	15. Anderson et al., 2006	<0.005	0%	NA[1]	NA[1]
NA	Prallethrin	µg/L	NA		<0.00092	-	-	-

<-Results less than the method detection limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for chloride is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for sulfate is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for total dissolved solids is based on the San Diego Reginal Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).
(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, may 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmarks and Historical Frequency Above Benchmarks .
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River WMA 2011-2012 Wet Weather Assessment
Analytical Data for TJR-MLS

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	TJR-MLS		2011-2012 Exceedances	Historical Frequency Above Benchmarks	Historical Mean Ratio to Benchmarks
					10/06/11	02/07/12			
General/Physical/Organic									
NA	Electrical Conductivity	µmhos/cm	NA		1,199	1,084	-	-	-
CHEM-Conventional	Oil and Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000	2.2J	6.3	0%	10%	0.60
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.57	4.76[Ω]	0%	0%	0.00
NA	Water Temperature	Celcius	NA		18.1	16.7	-	-	-
Bacteriological									
BACT-Enterococcus	Enterococcus	MPN/100 mL	NA		9,000,000	1,300,000	-	-	-
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	4,000	1.Basin Plan REC-1/REC-2	16,000,000	5,000,000	100%	100%	1214.29
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA		>16,000,000	16,000,000	-	-	-
Wet Chemistry									
CHEM-Conventional	Ammonia as N	mg/L	(a)	6. USEPA Water Quality Criteria (Freshwater)	8.9	8.5[Ω]	0%	10%	0.53
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	30	4. MSGP 2000, 8. McNeeley (1979)	45	96[†]	100%	57%	1.67
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	210	410	100%	71%	1.93
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	1.2	0.64	50%	10%	0.51
CHEM-Conventional	Surfactants (MBAS)	mg/L	0.5	1. Basin Plan	0.54	0.44	50%	38%	1.68
CHEM-Conventional	Total Suspended Solids	mg/L	100	4. MSGP 2000, 1. Basin Plan	420	1,300	100%	90%	20.31
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	220	580	100%	95%	40.69
NA	Dissolved Organic Carbon	mg/L	NA		23	16	-	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		14	23	-	-	-
NA	Total Organic Carbon	mg/L	NA		32	18	-	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	2.9	1.9	0%	0%	0.27
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	2	4. MSGP 2000	2.3	3.9	100%	29%	0.93
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	2	4. MSGP 2000	4.1	7.2	100%	71%	1.47
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	2,100 (b)	1. Basin Plan	790	650	0%	0%	0.34
Pesticides									
CHEM-Pesticides	Chlorpyrifos	µg/L	0.02 acute / 0.014 chronic	12. CA Dept. of Fish & Game, 2000	<0.01	<0.01	0%	26%	1.42
CHEM-Pesticides	Diazinon	µg/L	0.08 acute / 0.05 chronic	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon	0.15	0.09	100%	86%	4.32
CHEM-Pesticides	Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	0.35H*	0.23	0%	44%	1.12
Hardness									
NA	Total Hardness	mg $CaCO_3$/L	NA		350	420	-	-	-
Total Metals									
NA	Antimony	mg/L	NA		0.002	0.0016	-	-	-
NA	Arsenic	mg/L	NA		0.012	0.01	-	-	-
NA	Cadmium	mg/L	NA		0.00062	0.00075	-	-	-
NA	Chromium	mg/L	NA		0.016	0.021	-	-	-
NA	Copper	mg/L	NA		0.074	0.088	-	-	-
NA	Lead	mg/L	NA		0.055	0.061	-	-	-
NA	Nickel	mg/L	NA		0.027	0.028	-	-	-
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	0.001	0.0011	0%	5%	0.47
NA	Zinc	mg/L	NA		0.24	0.27	-	-	-
Dissolved Metals									
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.0039	0.0029	0%	0%	0.48
CHEM-Metals	Arsenic	mg/L	0.34 (c)	16. 40 CFR 131.38	0.0079	0.0058	0%	0%	0.01
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	0.00003J	0.00003J	0%	0%	0.03
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.00061	0.00052	0%	0%	0.00
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	0.0027	0.0024	0%	5%	0.22
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.00041	0.00037	0%	0%	0.00
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.011	0.0071	0%	0%	0.01
NA	Selenium	mg/L	NA		0.00069	0.00076	-	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	0.011	0.0083	0%	0%	0.08
Pyrethroid									
NA	Allethrin	µg/L	NA		<0.002	<0.002	-	-	-
CHEM-Pesticides	Bifenthrin	µg/L	0.0093	15. Anderson et al., 2006	0.0209	0.0253	100%	67%	NA[1]
CHEM-Pesticides	Cyfluthrin	µg/L	0.344	17. Wheelock et al., 2004	<0.002	0.025	0%	0%	NA[1]
CHEM-Pesticides	Cypermethrin	µg/L	0.683	17. Wheelock et al., 2004	0.1322	0.3644	0%	0%	NA[1]
NA	Danitol	µg/L	NA		<0.002	<0.002	-	-	-
NA	Deltamethrin	µg/L	NA		<0.002	<0.002	-	-	-
CHEM-Pesticides	Esfenvalerate	µg/L	0.25	17. Wheelock et al., 2004	<0.002	<0.002	0%	0%	NA[1]
CHEM-Pesticides	L-Cyhalothrin	µg/L	0.2	17. Wheelock et al., 2004	<0.002	0.0123	0%	0%	NA[1]
CHEM-Pesticides	Permethrin	µg/L	0.021	15. Anderson et al., 2006	1.6028	1.2961	100%	33%	NA[1]
NA	Prallethrin	µg/L	NA		<0.002	<0.002	-	-	-

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
[Ω]Result was not compared to the water quality benchmark for pH due to equipment malfunction. Ammonia water quality benchmark could not be calculated for the assessement.
[†]Result was from composite sample. The grab sample was analyzed outside of the holding time.
H*-Original result was outside of calibration range. Analysis was re-run outside of recommended holding time.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks.
(-) Unable to calculate because there is no criteria or published value available for analyte.

Shaded text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River WMA 2011-2012 Dry Weather Assessment
Analytical Data for TJR-MLS

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	TJR-MLS 12/06/11-12/07/11	TJR-MLS 05/08/12-05/09/12	2011-2012 Exceedances	Historical Frequency Above Benchmarks	Historical Mean Ratio to Benchmarks
General/Physical/Organic									
NA	Electrical Conductivity	µmhos/cm	NA		3,040	2,410	-	-	-
CHEM-Conventional	Oil and Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL	<5	<5	0%	0%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.48	7.66	0%	0%	NA[1]
NA	Water Temperature	Celcius	NA		12.3	19.6	-	-	-
Bacteriological									
BACT-Enterococcus	Enterococcus	MPN/100 mL	151 (a)	1. Basin Plan	3,000	8,000	100%	100%	NA[1]
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	4,000	1.Basin Plan REC-1/REC-2	1,300	1,700	0%	100%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA		230,000	70,000	-	-	-
Wet Chemistry									
CHEM-Conventional	Ammonia as N	mg/L	(b)	6. USEPA Water Quality Criteria (Freshwater)	7	6.6	100%	100%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	10	8. McNeeley (1979)	6	5.5	0%	100%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	58	68	0%	50%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	0.018J	0.084J	0%	0%	NA[1]
CHEM-Conventional	Surfactants (MBAS)	mg/L	0.5	1. Basin Plan	1.6	0.088	50%	100%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	58	14. NSQD, 1. Basin Plan	64	24	50%	0%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	24	33	100%	50%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		18	17	-	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		8.6	7.9	-	-	-
NA	Total Organic Carbon	mg/L	NA		18	16	-	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	<0.1	0.077J	0%	0%	NA[1]
NUTR-Total Nitrogen	Total Nitrogen (calculated)	mg/L	1	1. Basin Plan	8.618	8.061	100%	100%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	0.1	1. Basin Plan	1.8	4.1	100%	100%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	0.1	1. Basin Plan	2.6	4.7	100%	100%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	2,100 (c)	1. Basin Plan	1,500	2000	0%	0%	NA[1]
Pesticides									
CHEM-Pesticides	Chlorpyrifos	µg/L	0.02 acute / 0.014 chronic	12. CA Dept. of Fish & Game, 2000	<0.01	<0.01	0%	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 acute / 0.05 chronic	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinor	<0.01	0.0065J	0%	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43 acute / 0.1 chronic	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.01	<0.01	0%	0%	NA[1]
Hardness									
NA	Total Hardness	mg $CaCO_3$/L	NA		760	680	-	-	-
Total Metals									
NA	Antimony	mg/L	0.006	1. Basin Plan	0.00028J	0.00042J	0%	0%	NA[1]
NA	Arsenic	mg/L	0.05	1. Basin Plan	0.0036	0.0043	0%	0%	NA[1]
NA	Cadmium	mg/L	0.005	1. Basin Plan	0.00002J	0.00003J	0%	0%	NA[1]
NA	Chromium	mg/L	0.05	1. Basin Plan	0.00064	0.00086	0%	0%	NA[1]
NA	Copper	mg/L	1	1. Basin Plan	0.0013	0.0014	0%	0%	NA[1]
NA	Lead	mg/L	NA		0.00078	0.0013	-	-	-
NA	Nickel	mg/L	0.1	1. Basin Plan	0.0081	0.0089	0%	0%	NA[1]
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	0.00034J	0.00039J	0%	0%	NA[1]
NA	Zinc	mg/L	5.0	1. Basin Plan	0.0042J	0.0069	0%	0%	NA[1]
Dissolved Metals									
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.00026J	0.0004J	0%	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 acute / 0.15 chronic	16. 40 CFR 131.38	0.0033	0.0041	0%	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	<0.0001	<0.0001	0%	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.00017J	0.0002	0%	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	<0.0005	0.00059	0%	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.00003J	0.00002J	0%	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.0079	0.0086	0%	0%	NA[1]
NA	Selenium	mg/L	NA		0.00032J	0.00037J	-	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	0.0016J	0.0027J	0%	0%	NA[1]

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark for Enterococcus is based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks.
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text-exceeds water quality benchmarks and the **CCC** water quality benchmark for Ammonia.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River WMA 2011-2012 Wet Weather Assessment
Analytical Data for TJR-TWAS-1

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	TJR-TWAS-1		2011-2012 Exceedances	Historical Frequency Above Benchmarks	Historical Mean Ratio to Benchmarks
					10/05/11-10/06/11	02/07/12			
General/Physical/Organic									
NA	Electrical Conductivity	µmhos/cm	NA		1,884	1,123	-	-	-
CHEM-Conventional	Oil and Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000	<5	1.4J	0%	0%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.84	7.18	0%	0%	NA[1]
NA	Water Temperature	Celcius	NA		13.2	9.6	-	-	-
Bacteriological									
BACT-Enterococcus	Enterococcus	MPN/100 mL	NA		7,000	1,300	-	-	-
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	400	1. Basin Plan REC-1/REC-2	**1,100**	<20	50%	100%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA		9,149E	11,000	-	-	-
Wet Chemistry									
CHEM-Conventional	Ammonia as N	mg/L	(a)	6. U.S. EPA Water Quality Criteria (Freshwater)	0.13	<0.1	0%	0%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	30	4. MSGP 2000, 8. McNeeley (1979)	3.6	2.8†	0%	0%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	45	34	0%	0%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	0.016J	0.011J	0%	0%	NA[1]
CHEM-Conventional	Surfactants (MBAS)	mg/L	0.5	1. Basin Plan	0.094	0.11	0%	50%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	100	4. MSGP 2000, 1. Basin Plan	24	15	0%	100%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	14	**22**	50%	100%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		13	6.4	-	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		0.95	0.77	-	-	-
NA	Total Organic Carbon	mg/L	NA		14	7.4	-	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	0.53	0.2	0%	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	2	4. MSGP 2000	0.23	0.11	0%	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	2	4. MSGP 2000	0.41	0.22	0%	0%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	500 (b)	1. Basin Plan	**980**	**680**	100%	50%	NA[1]
Pesticides									
CHEM-Pesticides	Chlorpyrifos	µg/L	0.02 acute / 0.014 chronic	12. CA Dept. of Fish & Game, 2000	<0.01	<0.01	0%	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 acute / 0.05 chronic	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon	<0.01	<0.01	0%	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.01	<0.01	0%	0%	NA[1]
Hardness									
NA	Hardness	mg $CaCO_3$/L	NA		440	370	-	-	-
Total Metals									
NA	Antimony	mg/L	NA		0.00016J	0.00011J	-	-	-
NA	Arsenic	mg/L	NA		0.0037	0.0032	-	-	-
NA	Cadmium	mg/L	NA		0.000091J	0.000058J	-	-	-
NA	Chromium	mg/L	NA		0.00064	0.00043	-	-	-
NA	Copper	mg/L	NA		0.0026	0.0014	-	-	-
NA	Lead	mg/L	NA		0.0016	0.0012	-	-	-
NA	Nickel	mg/L	NA		0.0018	0.0012	-	-	-
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	<0.0004	0.00028J	0%	0%	NA[1]
NA	Zinc	mg/L	NA		0.013	0.0082	-	-	-
Dissolved Metals									
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.00015J	0.000096J	0%	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 (c)	16. 40 CFR 131.38	0.0026	0.0021	0%	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	0.00006J	0.00004J	0%	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.00013J	0.000084J	0%	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	0.0017	0.00089	0%	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.000091J	0.000059J	0%	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.0015	0.0011	0%	0%	NA[1]
NA	Selenium	mg/L	NA		<0.0004	<0.0004	-	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	0.0051	0.0027J	0%	0%	NA[1]
Pyrethroid									
NA	Allethrin	µg/L	NA		<0.002	<0.002	-	-	-
CHEM-Pesticides	Bifenthrin	µg/L	0.0093	15. Anderson et al., 2006	<0.002	<0.002	0%	50%	NA[1]
CHEM-Pesticides	Cyfluthrin	µg/L	0.344	17. Wheelock et al., 2004	<0.002	<0.002	0%	0%	NA[1]
CHEM-Pesticides	Cypermethrin	µg/L	0.683	17. Wheelock et al., 2004	<0.002	<0.002	0%	0%	NA[1]
NA	Danitol	µg/L	NA		<0.002	<0.002	-	-	-
NA	Deltamethrin	µg/L	NA		<0.002	<0.002	-	-	-
CHEM-Pesticides	Esfenvalerate	µg/L	0.25	17. Wheelock et al., 2004	<0.002	<0.002	0%	0%	NA[1]
CHEM-Pesticides	L-Cyhalothrin	µg/L	0.20	17. Wheelock et al., 2004	<0.002	<0.002	0%	0%	NA[1]
CHEM-Pesticides	Permethrin	µg/L	0.021	15. Anderson et al., 2006	<0.025††	<0.025††	0%	0%	NA[1]
NA	Prallethrin	µg/L	NA		<0.002	<0.002	-	-	-

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
† Result was from composite sample. The grab sample was analyzed outside of the holding time
†† Permethrin was non-detect at the method detection limit of 0.005 µg/L.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks
(-) Unable to calculate because there is no criteria or published value available for analyte.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River WMA 2011-2012 Dry Weather Assessment
Analytical Data for TJR-TWAS-1

Category Group	Analyte	Units	Water Quality Benchmarks	Benchmark References	TJR-TWAS-1 09/12/11-09/13/11	TJR-TWAS-1 05/08/12-05/09/12	2011-2012 Exceedances	Historical Frequency Above Benchmarks	Historical Mean Ratio to Benchmarks
General/Physical/Organic									
NA	Electrical Conductivity	µmhos/cm	NA		1,545	1,579	-	-	-
CHEM-Conventional	Oil and Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL	<5	1.3J	0%	0%	NA[1]
CHEM-Conventional	pH	pH units	6.5-9.0	1. Basin Plan	7.87	7.82	0%	0%	NA[1]
NA	Water Temperature	Celcius	NA		16.50	12.50	-	-	-
Bacteriological									
BACT-Enterococcus	Enterococcus	MPN/100 mL	151 (a)	1. Basin Plan	**500**	**270**	100%	50%	NA[1]
BACT-Fecal Coliform	Fecal Coliform	MPN/100 mL	400	1.Basin Plan REC-1/REC-2	110	**500**	50%	0%	NA[1]
BACT-Total Coliform	Total Coliform	MPN/100 mL	NA		8,000	1,300	-	-	-
Wet Chemistry									
CHEM-Conventional	Ammonia as N	mg/L	(b)	6. USEPA Water Quality Criteria (Freshwater)	0.076J	0.054J	0%	0%	NA[1]
CHEM-Conventional	Biochemical Oxygen Demand	mg/L	10	8. McNeeley (1979)	1.3J	0.64J	0%	0%	NA[1]
CHEM-Conventional	Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	21	11	0%	0%	NA[1]
CHEM-Conventional	Nitrite as N	mg/L	1	1. Basin Plan	<0.1	<0.1	0%	0%	NA[1]
CHEM-Conventional	Surfactants (MBAS)	mg/L	0.5	1. Basin Plan	0.049J	0.032J	0%	0%	NA[1]
CHEM-Conventional	Total Suspended Solids	mg/L	58	14. NSQD, 1. Basin Plan	4	5	0%	0%	NA[1]
CHEM-Conventional	Turbidity	NTU	20	1. Basin Plan	4.3	4.4	0%	0%	NA[1]
NA	Dissolved Organic Carbon	mg/L	NA		8.1	5.1	-	-	-
NA	Total Kjeldahl Nitrogen	mg/L	NA		0.43	0.28	-	-	-
NA	Total Organic Carbon	mg/L	NA		7.5	4.9	-	-	-
NUTR-Nitrate as N	Nitrate as N	mg/L	10	1. Basin Plan	0.067J	<0.1	0%	0%	NA[1]
NUTR-Total Nitrogen	Total Nitrogen (calculated)	mg/L	1	1. Basin Plan	0.497	0.28	0%	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Dissolved Phosphorus	mg/L	0.1	1. Basin Plan	**0.18**	**0.13**	100%	0%	NA[1]
NUTR-Total/Dissolved Phosphorus	Total Phosphorus	mg/L	0.1	1. Basin Plan	**0.25**	**0.15**	100%	0%	NA[1]
TDS-Total Dissolved Solids	Total Dissolved Solids	mg/L	500 (c)	1. Basin Plan	**1,000**	**940**	100%	100%	NA[1]
Pesticides									
CHEM-Pesticides	Chlorpyrifos	µg/L	0.02 acute / 0.014 chronic	12. CA Dept. of Fish & Game, 2000	<0.01	<0.01	0%	0%	NA[1]
CHEM-Pesticides	Diazinon	µg/L	0.08 acute / 0.05 chronic	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinor	<0.01	<0.01	0%	0%	NA[1]
CHEM-Pesticides	Malathion	µg/L	0.43 acute / 0.1 chronic	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.01	<0.01	0%	0%	NA[1]
Hardness									
NA	Total Hardness	mg $CaCO_3$/L	NA		470	420	-	-	-
Total Metals									
NA	Antimony	mg/L	0.006	1. Basin Plan	0.00007J	0.00005J	0%	0%	NA[1]
NA	Arsenic	mg/L	0.05	1. Basin Plan	0.0027	0.0031	0%	0%	NA[1]
NA	Cadmium	mg/L	0.005	1. Basin Plan	0.00004J	0.00005J	0%	0%	NA[1]
NA	Chromium	mg/L	0.05	1. Basin Plan	0.00009J	0.00009J	0%	0%	NA[1]
NA	Copper	mg/L	1	1. Basin Plan	0.00045J	<0.0005	0%	0%	NA[1]
NA	Lead	mg/L	NA		0.00039	0.00017J	-	-	-
NA	Nickel	mg/L	0.1	1. Basin Plan	0.00033J	0.0003J	0%	0%	NA[1]
CHEM-Metals	Selenium	mg/L	0.005	16. 40 CFR 131.38	<0.0004	<0.0004	0%	0%	NA[1]
NA	Zinc	mg/L	5.0	1. Basin Plan	0.0013J	0.0014J	0%	0%	NA[1]
Dissolved Metals									
CHEM-Metals	Antimony	mg/L	0.006	1. Basin Plan	0.00008J	0.00006J	0%	0%	NA[1]
CHEM-Metals	Arsenic	mg/L	0.34 acute / 0.15 chronic	16. 40 CFR 131.38	0.0023	0.0026	0%	0%	NA[1]
CHEM-Metals	Cadmium	mg/L	(d)	16. 40 CFR 131.38	0.00004J	0.00005J	0%	0%	NA[1]
CHEM-Metals	Chromium	mg/L	(d)	16. 40 CFR 131.38	0.00015J	<0.0002	0%	0%	NA[1]
CHEM-Metals	Copper	mg/L	(d)	16. 40 CFR 131.38	0.00048J	<0.0005	0%	0%	NA[1]
CHEM-Metals	Lead	mg/L	(d)	16. 40 CFR 131.38	0.00003J	<0.0002	0%	0%	NA[1]
CHEM-Metals	Nickel	mg/L	(d)	16. 40 CFR 131.38	0.00031J	0.00023J	0%	0%	NA[1]
NA	Selenium	mg/L	NA		<0.0004	<0.0004	-	-	-
CHEM-Metals	Zinc	mg/L	(d)	16. 40 CFR 131.38	0.0021J	0.0014J	0%	0%	NA[1]

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark for Enterococcus is based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks.
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

APPENDIX C

Detailed Table of Receiving Water Quality Conditions in the Tijuana River WMA

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Table C-6-1
Receiving Water Conditions in the Tijuana River WMA

Hydrologic Area	Receiving Water	Condition	Temporal Extent		Basis
			Wet	Dry	
Lower Watershed					
Tijuana Valley (911.1)	Pacific Ocean Shoreline at 3/4 mile North of Tijuana River	Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Pacific Ocean Shoreline at end of Seacoast Drive	Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus	x	x	2010 303(d) List
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Monument Road	Impairment of REC-1 due to Total Coliform and Fecal Coliform	x	x	2010 303(d) List
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at the US Border	Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus	x	x	2010 303(d) List
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth	Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus	x	x	2010 303(d) List
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth	Possible presence of pathogens including viruses and specifically Hepatitis A.		x	Public workshop testimony.
Tijuana Valley (911.1)	Tijuana River	Impairment of REC-1 due to Indicator Bacteria.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Elevated Fecal Coliforms and Enterococcus at NPDES monitoring location.	x	x	Sampling results at MLS reported in LTEA and Weston Reports.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Solids.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Sedimentation/Siltation.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Poor to fair stream substrate of mostly silt and consolidated clay.		x	Assessment at MLS station reported in LTEA and 2011-12 Weston Report.

Hydrologic Area	Receiving Water	Condition	Temporal Extent		Basis
			Wet	Dry	
Tijuana Valley (911.1)	Tijuana River	Poor stream substrate with stream bed and banks of unconsolidated sand and silt and riparian buffer lacking canopy.		x	Assessment at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Elevated TSS at NPDES sampling location.	x	x	Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Elevated Turbidity at NPDES sampling location.	x	x	Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Impairment of REC-2 due to Trash.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Presence of trash at assessment site in 911.12 HSA.		x	Assessment at trash assessment site reported in 2010-11 Weston Report.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Total Nitrogen as N.	x	x	2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Elevated Ammonia as N at NPDES sampling location.	x	x	Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Elevated Nitrite as N at NPDES sampling location.	x		Sampling results at MLS reported in Weston Report.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Phosphorus.	x	x	2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.

Hydrologic Area	Receiving Water	Condition	Temporal Extent		Basis
			Wet	Dry	
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Eutrophic conditions.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Benthic algae at NPDES sampling location.		x	Sampling results at MLS reported in LTEA and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Low DO.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Elevated BOD and COD at NPDES sampling location.	x	x	Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Pesticides.	x	x	2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Impairment of REC-1 due to Surfactants (MBAS).	x	x	2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Selenium.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Trace Elements.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Impairment of MUN due to Synthetic Organics.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Toxicity.	x	x	2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.

Hydrologic Area	Receiving Water	Condition	Temporal Extent		Basis
			Wet	Dry	
Tijuana Valley (911.1)	Tijuana River	Benthic Alterations (poor to very poor IBI scores) at NPDES monitoring location.	x	x	Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA.
Tijuana Valley (911.1)	Tijuana River	Elevated oil and grease	x		Sampling results at TWAS-2 reported in LTEA.
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of REC-1 due to Indicator Bacteria.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of MAR due to Turbidity.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of REC-2 due to Trash.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of EST due to Eutrophic Conditions.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of MAR due to Low DO.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of EST due to Pesticides.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of EST due to Lead.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of EST due to Nickel.	x	x	2010 303(d) List
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of COMM due to Thallium.	x	x	2010 303(d) List

Hydrologic Area	Receiving Water	Condition	Temporal Extent		Basis
			Wet	Dry	
Upper Watershed					
Potrero (911.2)	Tecate Creek	Impairment of WARM due to Selenium.	x	x	2010 303(d) List
Potrero (911.2)	Tecate Creek	Elevated chloride at SMC Station.		x	Sampling results at SMC03510 station reported in Weston Report
Potrero (911.2)	Tecate Creek	Elevated sulfate at SMC Station.		x	Sampling results at SMC03510 station reported in Weston Report.
Potrero (911.2)	Tecate Creek	Benthic Alterations (poor to very poor IBI scores) at SMC Station.		x	Sampling results at SMC03510 station reported in Weston Report.
Potrero (911.2)	Tecate Creek	Elevated Total Nitrogen as N at SMC Station.		x	Sampling results at SMC03510 station reported in Weston Report.
Potrero (911.2)	Tecate Creek	Elevated Phosphorus at SMC Station.		x	Sampling results at SMC03510 station reported in Weston Report.
Potrero (911.2)	Tecate Creek	Elevated TDS at SMC Station.		x	Sampling results at SMC03510 station reported in Weston Report.
Potrero (911.2)	Tecate Creek	Presence of trash.		x	Upper Watershed Trash Assessment reported in WURMP annual reports.
Barrett Lake (911.3)	Barrett Lake	Impairment of WARM due to Total Nitrogen as N.	x	x	2010 303(d) List
Barrett Lake (911.3)	Barrett Lake	Impairment of MUN due to Manganese.	x	x	2010 303(d) List
Barrett Lake (911.3)	Barrett Lake	Impairment of MUN due to Perchlorate.	x	x	2010 303(d) List
Barrett Lake (911.3)	Barrett Lake	Impairment of MUN due to Color.	x	x	2010 303(d) List
Barrett Lake (911.3)	Barrett Lake	Impairment of MUN due to pH.	x	x	2010 303(d) List

Hydrologic Area	Receiving Water	Condition	Temporal Extent		Basis
			Wet	Dry	
Monument (911.4)	Pine Valley Creek (Upper)	Impairment of MUN due to Turbidity.	x	x	2010 303(d) List
Morena (911.5)	Morena Reservoir	Impairment of MUN due to Ammonia as N.	x	x	2010 303(d) List
Morena (911.5)	Morena Reservoir	Impairment of WARM due to Phosphorus.	x	x	2010 303(d) List
Morena (911.5)	Morena Reservoir	Impairment of MUN due to Manganese.	x	x	2010 303(d) List
Morena (911.5)	Morena Reservoir	Impairment of MUN due to Color.	x	x	2010 303(d) List
Morena (911.5)	Morena Reservoir	Impairment of MUN due to pH.	x	x	2010 303(d) List
Cottonwood (911.6)	Cottonwood Creek (Tijuana River watershed)	Impairment of WARM due to Selenium.	x	x	2010 303(d) List
Campo (911.8)	Campo Creek	Benthic Alterations (poor to very poor IBI scores) at NPDES monitoring location.	x	x	Sampling results at TWAS-1 reported in LTEA and Weston Report.
Campo (911.8)	Campo Creek	Benthic algae at NPDES sampling location.		x	Sampling results at TWAS-1 reported in LTEA.
Campo (911.8)	Campo Creek	Elevated fecal coliforms at NPDES monitoring location.	x	x	Sampling results at TWAS-1 reported in LTEA and Weston Report.
Campo (911.8)	Campo Creek	Elevated *Enterococcus* at NPDES monitoring location.		x	Sampling results at TWAS-1 reported in LTEA and Weston Report.
Campo (911.8)	Campo Creek	Elevated TSS at NPDES sampling location.	x		Sampling results at TWAS-1 reported in LTEA.
Campo (911.8)	Campo Creek	Elevated Turbidity at NPDES sampling location.	x		Sampling results at TWAS-1 reported in LTEA and Weston Report.
Campo (911.8)	Campo Creek	Elevated Surfactants (MBAS) at NPDES sampling location.	x		Sampling results at TWAS-1 reported in LTEA.
Campo (911.8)	Campo Creek	Elevated Pesticides at NPDES sampling location.	x		Sampling results at TWAS-1 reported in LTEA.

Hydrologic Area	Receiving Water	Condition	Temporal Extent		Basis
			Wet	Dry	
Campo (911.8)	Campo Creek	Elevated TDS at NPDES sampling location.	x	x	Sampling results at TWAS-1 reported in LTEA and Weston Report.
Campo (911.8)	Campo Creek	Elevated Phosphorus at NPDES sampling location.		x	Sampling results at TWAS-1 reported in Weston Report.
Campo (911.8)	Campo Creek	Toxicity		x	Sampling results at TWAS-1 reported in LTEA and Weston Report.
Campo (911.8)	Campo Creek	Presence of trash.		x	Upper Watershed Trash Assessment reported in WURMP annual reports.

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Long Term Effectiveness Assessment MS4 Tables
Tijuana River Watershed Management Area MS4 Random Dry Weather 2009-2010

Analyte	Units	Water Quality Benchmarks	Benchmark References	MS4D-TJR-07 E-1B 6/1/2010
Physical Chemistry				
Conductivity	µS/cm	NA	NA	1,054
pH	pH Units	6.5-9.0	1. Basin Plan	8.07
Water Temperature	Celcius	NA	NA	20.9
General Chemistry				
Nitrate as N	mg/L	10	1. Basin Plan	4.27
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	4.28
Nitrite as N	mg/L	1	1. Basin Plan	<0.007
Phosphorus, Total*	mg/L	0.1	1. Basin Plan	0.43
Total Kjeldahl Nitrogen	mg/L	NA	NA	1.7
Total Nitrogen*	mg/L	1	1. Basin Plan	6
Total Dissolved Solids (calculated)[1]	mg/L	2100 (a)	1. Basin Plan	738
Total Suspended Solids	mg/L	58	14. NSQD	<1
Bacteriological				
Enterococcus	MPN/100 mL	151	1. Basin Plan	170
Fecal Coliforms	MPN/100 mL	4,000	1. Basin Plan	<20
Total Coliforms	MPN/100 mL	NA	1. Basin Plan	800

<-Results less than the method detection limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
*Total Nitrogen and Total Phosphorus are narrative standards in the Basin Plan based on biostimulatory responses to nutrients.
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.
(a) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River Watershed Management Area MS4 Targeted Dry Weather (2009-2010)

Analyte	Unit	WQB CMC	WQB CCC	911.1 E1B 6/3/2010	911.1 DW227 7/13/2010	911.1 DW322 7/13/2010	911.12 DW304 6/14/2010	911.12 DW304 7/13/2010	911.3 TIJ02 6/22/2010
Conductivity	µS/cm	NA	NA	1,200	NS	NS	NS	NS	NS
pH	pH Units	NA	NA	8.6	NS	NS	NS	NS	NS
Temperature	Celcius	NA	NA	19.2	NS	NS	NS	NS	NS
Ammonia as N	mg/L	NA	NA	0.65	NS	NS	NS	NS	<0.1
Nitrate as N	mg/L	10	NA	1.26	NS	NS	NS	NS	0.75
Nitrite as N	mg/L	1	NA	NS	NS	NS	NS	NS	<0.05
Total Kjeldahl Nitrogen	mg/L	NA	NA	NS	NS	NS	NS	NS	<0.5
Total Nitrogen (calculated)	mg/L	1.0	NA	NS	<0.3	5.6	2.1	NS	0.8
Orthophosphate as P	mg/L	NA	NA	0.41	NS	NS	NS	NS	0.16
Total Phosphorus	mg/L	0.10	NA	NS	0.14	0.80	0.52	NS	0.38
Total Suspended Solids	mg/L	58	NA	NS	<10	13	30	NS	<20
Total Dissolved Solids	mg/L	500 (b)	NA	840	NS	NS	NS	NS	NS
Turbidity	NTU	20	NA	5.66	NS	NS	NS	NS	NS
MBAS	mg/L	0.5	NA	1.75	NS	NS	NS	NS	NS
Dissolved Oxygen	mg/L	5	NA	NS	4.80	<1	2.00	NS	NS
Oil & Grease	mg/L	10	NA	<5	NS	NS	NS	NS	NS
Enterococcus	MPN/100 mL	151	NA	1,300	80	18,000	320	NS	230
Fecal Coliform	MPN/100 mL	400	NA	5,000	78	3,300	68	NS	170
Total Coliform	MPN/100 mL	NA	NA	170,000	4,900	130,000	2,300	NS	1,700
Chlorpyrifos	µg/L	0.02	0.014	<0.05	<0.97	<0.96	<1	NS	NS
Diazinon	µg/L	0.08	0.05	<0.05	<0.97	<0.96	<1	NS	NS
Malathion	µg/L	0.43	NA	<0.05	NS	NS	NS	NS	NS
Total Hardness	mg $CaCO_3$/L	NA	NA	307.00	290.00	340.00	290.00	NS	NS
Cadmium, Dissolved	µg/L	(e)	NA	<10	<5	<5	<5	NS	NS
Copper, Dissolved	µg/L	(e)	NA	61.00	<10	<10	<10	NS	NS
Lead, Dissolved	µg/L	(e)	NA	<50	<5	<5	<5	NS	NS
Nickel, Dissolved	mg/L	(e)	NA	NS	<0.01	<0.01	NS	<0.01	NS
Thallium, Dissolved	µg/L	(e)	NA	NS	<10	<10	<10	NS	NS
Zinc, Dissolved	µg/L	(e)	NA	147.00	<20	36.00	42.00	NS	NS

<-Results less than the reporting limit.
NA indicates no criteria or published value was available or applicable to the matrix or program.
NS indicates no sample taken.
(b) Water Quality Benchmark for Total Dissolved Solids is based on then San Diego Regional Water Quality Control Plan by watershed for the San Diego region (Basin Plan), 1994 (w/ amendments affective prior to April 25, 2007).
(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, Mat 18, 2000. The Criteria Maximum Concentration (CMC) was used.

Tijuana River Watershed Management Area MS4 Outfall Random Dry Weather 2008-2009

Group	Analytes	Units	Benchmarks	Source	MS4D-TJR-04 80028762 6/10/2009	MS4D-TJR-08 E-1B 6/10/2009	MS4D-TJR-09 80028768 6/10/2009
Flow	Flow	GPM	NA	NA	Ponded	Ponded	Ponded
Physical Chemistry	Conductivity	µS/cm	NA	NA	1,225	1,999	922
	pH	pH units	6.5-9.0	1. Basin Plan	8.74	7.26	9.34
	Temperature	°C	NA	NA	20.9	22.3	19.6
General Chemistry	Nitrate as N	mg/L	10	1. Basin Plan	<0.009	0.140	0.110
	Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	<0.009	0.170	0.130
	Nitrite as N	mg/L	1	1. Basin Plan	<0.007	<0.007	<0.007
	Phosphorus, Total*	mg/L	0.1	1. Basin Plan	0.09	0.60	0.52
	Total Kjeldahl Nitrogen	mg/L	NA	NA	1.8	1.8	3.0
	Total Nitrogen*	mg/L	1	1. Basin Plan	1.8	2.0	3.1
	Total Suspended Solids	mg/L	58	14. NSQD	<1.0	103	183
Bacteria	Enterococci	MPN/100 mL	151	1. Basin Plan	1,400	8,000	260
	Fecal Coliform	MPN/100 mL	400	1. Basin Plan	80	130,000	80
	Total Coliform	MPN/100 mL	NA	1. Basin Plan	300	1,600,000E	3,500

NA indicate no criteria or published value was available or applicable to the matrix or program.
< = Results less than the method detection limit
E = Result is an estimate
*Total N and Total P are narrative standards in the Basin Plan based on biostimulatory responses to nutrients

Source
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River Watershed Management Area Long Term Effectiveness Assessment Targeted MS4 Data Table (2008-2009)

Analyte	Unit	Benchmark	Source	CT-TIJ02	SD-DW227	SD-DW227	SD-DW303	SD-DW304	SD-DW322
				05/21/2009	06/15/2009	06/29/2009	06/09/2009	06/09/2009	07/06/2009
Flow									
Flow	GPM	NA	NA	405.27	Ponded	Ponded	Ponded	Ponded	Ponded
General Cheimistry									
pH	pH Units	6.5-9.0	1. Basin Plan	NS	NS	NS	NS	NS	7.34
Wet Chemistry									
Ammonia	mg/L	NA	NA	0.06	NS	NS	NS	NS	NS
Dissolved Oxygen	mg/L	NA	NA	NS	1.2	NS	8.3	4.7	1.1
Nitrate as N	mg/L	10	1. Basin Plan	0.52	NS	NS	NS	NS	NS
Nitrite as N	mg/L	NA	NA	< 0.01	NS	NS	NS	NS	NS
Organic Nitrogen	mg/L	NA	NA	0.44	NS	NS	NS	NS	NS
Total Kjeldahl Nitrogen	mg/L	NA	NA	0.5	NS	NS	NS	NS	NS
Total Nitrogen	mg/L	1	1. Basin Plan	1.03	2.93	NS	6.98	2.565	3.73
Orthophosphate as P	mg/L	NA	NA	0.01	NS	NS	NS	NS	NS
Total Phosphorus	mg/L	0.1	1. Basin Plan	0.01	0.34	NS	0.5	0.18	0.8
Total Suspended Solids	mg/L	58	NA	1	13	NS	42	< 10**	24
Total Hardness	mg/L	NA	NA	NS	320	270	330	290	380
Dissolved Metals									
Cadmium, Dissolved	mg/L	(a)	40 CFR 131.38	NS	< 0.005	NS	< 0.005	< 0.005	< 0.005
Copper, Dissolved	mg/L	(a)	40 CFR 131.38	NS	< 0.01	NS	< 0.01	< 0.01	< 0.01
Lead, Dissolved	mg/L	(a)	40 CFR 131.38	NS	< 0.005	NS	< 0.005	< 0.005	< 0.005
Nickel, Dissolved	mg/L	(a)	40 CFR 131.38	NS	NS	< 0.01	< 0.01	< 0.01	< 0.01
Thallium, Dissolved	mg/L	NA	NA	NS	< 0.01	NS	< 0.01	< 0.01	0.015
Zinc, Dissolved	mg/L	(a)	40 CFR 131.38	NS	< 0.02	NS	< 0.02	0.069	< 0.02
Pesticides									
Chlorpyrifos	µg/L	0.02	CA Dept of Fish Game 1998	NS	< 0.962**	NS	< 0.971**	< 0.98**	< 0.962**
Diazinon	µg/L	0.08	CA Dept of Fish Game 2000	NS	< 0.962**	NS	< 0.971**	< 0.98**	< 0.962**
Bacteria									
Enterococci	MPN/100 mL	151	1. Basin Plan	130	80 E	520	9,000	1,200	84,000
Fecal Coliform	MPN/100 mL	400	1. Basin Plan REC-1/REC-2	< 20	3,300	490	460	78	3,100
Total Coliform	MPN/100 mL	NA	NA	40	79,000	3,300	79,000	23,000	240,000
CMC Benchmarks for Dissolved Metals									
Cadmium, Dissolved	mg/L			NS	0.015	NS	0.016	0.014	0.018
Copper, Dissolved	mg/L			NS	0.040	NS	0.041	0.037	0.047
Lead, Dissolved	mg/L			NS	0.223	NS	0.230	0.201	0.266
Nickel, Dissolved	mg/L			NS	NS	1.085	1.286	1.153	1.449
Zinc, Dissolved	mg/L			NS	0.314	NS	0.322	0.289	0.363

E = Estimated

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

NS=Not Sampled

< = results less than the reporting limit.

** Benchmark was below detection limit, and so detection level exceedance cannot be determined.

a) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Long Term Effectiveness Assessment Targeted Dry MS4 Table (2007-2008)

Tijuana River (TIJ02)			
Group	**Analyte**	**Units**	**7/30/2008**
General Chemistry	Total Nitrogen-N	mg/L	1.36
	Total Phosphate-P	mg/L	0.013
	Total Suspended Solids	mg/L	0.5
	Phosphorus, Total	mg/L	0.026
	Turbidity	NTU	NS
Bacteria	Enterococci	MPN/100mL	500
	Fecal Coliform	MPN/100mL	20
	Total Coliform	MPN/100mL	300

NS=Not Sampled

Long Term Effectiveness Assessment MS4 Tables

Tijuana River Watershed Management Area MS4 Random Wet Weather 2009-2010

Analyte	Units	Water Quality Benchmarks	Benchmark References	MS4W-TJR-05	MS4W-TJR-05	MS4W-TJR-07	MS4W-TJR-07	MS4W-TJR-08	MS4W-TJR-08
				80028768	80028768	E-1B-02	E-1B-02	15836	15836
				12/7/2009	2/27/2010	2/5/2010	2/27/2010	1/18/2010	3/7/2010
Physical Chemistry									
Conductivity	µS/cm	NA	NA	151	183.8	180.2	122.9	50.3	237
pH	pH Units	6.5-9.0	1. Basin Plan	8.75	8.46	7.56	7.88	7.83	7.03
Water Temperature	Celcius	NA	NA	12.7	18.2	15.8	18.7	14.5	13.9
General Chemistry									
Nitrate as N	mg/L	10	1. Basin Plan	0.7	0.5	0.63	0.43	0.19	0.19
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	0.84	0.56	0.68	0.46	0.24	0.25
Nitrite as N	mg/L	1	1. Basin Plan	0.13	0.05	0.05	<0.007	<0.007	0.06
Phosphorus, Total	mg/L	2	1. Basin Plan	0.97	0.99	0.28	0.22	0.14	0.08
Total Kjeldahl Nitrogen	mg/L	NA	NA	1.3	1.5	1.6	0.6	<0.3	0.8
Total Nitrogen	mg/L	NA	NA	2.1	2.1	2.3	1.1	<0.5	1.1
Total Suspended Solids	mg/L	100	4. MSGP 2000	1,950	764	27	23	22	<1
Total Dissolved Solids (calculated)[1]	mg/L	2,100*	1. Basin Plan	106	129	126	86	35	166
Bacterialogical									
Enterococcus	MPN/100 mL	NA	NA	50,000	50,000	24,000	50,000	1,300	5,000
Fecal Coliforms	MPN/100 mL	400-4,000	1. Basin Plan	50,000	5,000	8,000	2,300	70	20
Total Coliforms	MPN/100 mL	NA	NA	140,000	130,000	60,000	80,000	3,000	2,800

<-Results less than the method detection limit
NA indicate no criteria or published value was available or applicable to the matrix or program.
*applies to hydrologic areas 911.12
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

Tijuana River Watershed Management Area MS4 Outfall Random Wet Weather 2008-2009

Group	Analyte	Units	Benchmarks	Source	MS4W-TJR-01	MS4W-TJR-02	MS4W-TJR-03	MS4W-TJR-08
					80028745	15836	80028739	E-1B
					12/15/2008	12/15/2008	2/5/2009	2/13/2009
Physical Chemistry	Conductivity	µS/cm	NA	NA	103.0	162.3	318.0	201.0
	pH	pH units	6.5-9.0	1. Basin Plan	6.07	6.77	7.55	7.37
	Temperature	°C	NA	NA	14.4	13.7	14.3	14.0
General Chemistry	Nitrate as N	mg/L	10	1. Basin Plan	-	-	1.00	0.69
	Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	0.48	1.01	1.20	0.72
	Nitrite as N	mg/L	1	1. Basin Plan	-	-	0.190	<0.007
	Phosphorus, Total	mg/L	0.1	1. Basin Plan	0.7	0.36	0.39	0.49
	Total Kjeldahl Nitrogen	mg/L	NA	NA	1.8	1.6	4.4	3.4
	Total Nitrogen	mg/L	1	1. Basin Plan	2.3	2.6	5.6	4.1
	Total Suspended Solids	mg/L	100	4. MSGP 2000	<1	<1	122	33
Bacteria	Enterococci	MPN/100mL	NA	NA	110,000	50,000	5,000	8,000
	Fecal Coliform	MPN/100mL	400	1. Basin Plan	8,000	130	300	500
	Total Coliform	MPN/100mL	NA	NA	300,000	140,000	5,000	17,000

NA indicate no criteria or published value was available or applicable to the matrix or program.
< = Results less than the method detection limit

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

Tijuana River WMA 2010-2011 MS4 Random Dry Weather

Analyte	Units	Water Quality Benchmarks	Benchmark References	MS4D-TJR-13 6176 5/16/2011
Physical Chemistry				
Conductivity	µmhos/cm	NA	NA	381
pH	pH units	6.5-9.0	1. Basin Plan	7.11
Temperature	Celsius	NA	NA	11.2
General Chemistry				
Nitrate as N	mg/L	10	1. Basin Plan	<0.05
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	<0.05
Nitrite as N	mg/L	1	1. Basin Plan	<0.05
Total Kjeldahl Nitrogen	mg/L	NA	NA	2.4
Total Nitrogen*	mg/L	1	1. Basin Plan	**2.4**
Total Phosphorus*	mg/L	0.1	4. MSGP 2000	<0.05
Total Dissolved Solids (calculated)[1]	mg/L	500 (a)	1. Basin Plan	267
Total Suspended Solids	mg/L	58	4. MSGP 2000	<20
Bacteriological				
Enterococcus	MPN/100 mL	151	NA	**300**
Fecal Coliform	MPN/100 mL	400	1. Basin Plan (REC1)	40
Total Coliform	MPN/100 mL	NA	NA	800

< - results are less than the reporting limit.

*Total Nitrogen and Total Phosphorus are narrative standards in the Basin Plan based on biostimulatory response to nutrients.

[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

(a) Water Quality Benchmark for total dissolved solids is based on the San digeo Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to
NA - No criteria or published value was available or applicable to the matrix or program.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

Tijuana River WMA 2010-2011 MS4 Targeted Dry Weather

Analyte	Units	WQB CMC	WQB CCC	911.11	911.3
				E-1B	TIJ02
				8/15/2011	7/12/2011
Electrical Conductivity	µS/cm	NA	NA	12,030	NS
pH	pH units	NA	NA	8.06	NS
Water Temperature	Celsius	NA	NA	21.7	NS
Ammonia as N	mg/L	(a)	(a)	0.782	0.1
Nitrate as N	mg/L	10	NA	1.319	5.46
Nitrite as N	mg/L	1	NA	NS	0.009E
Total Kjeldahl Nitrogen	mg/L	NA	NA	NS	1.2
Total Nitrogen (calculated)	mg/L	1	NA	NS	**6.7**
Dissolved Phosphorus	mg/L	0.1	NA	NS	**0.27**
Orthophosphate as P	mg/L		NA	0.638	NS
Total Phosphorus	mg/L	0.1	NA	NS	**0.34**
Total Suspended Solids	mg/L	58	NA	NS	1E
Total Dissolved Solids	mg/L	2,100 (b)	NA	**8,421**	NS
Turbidity	NTU	20	NA	3.05	1
Surfactants (MBAS)	mg/L	0.5	NA	0.5	NS
Oil and Grease	mg/L	10	NA	<5	NS
Enterococcus	MPN/100 mL	151	NA	**300**	130
Fecal Coliform	MPN/100 mL	400/4,000	NA	2E	130
Total Coliform	MPN/100 mL	NA	NA	22,000	800
Chlorpyrifos	µg/L	0.02	0.014	<0.05	NS
Diazinon	µg/L	0.08	0.05	<0.05	NS
Total Hardness	mg $CaCO_3$/L	NA	NA	300	NS
Cadmium, Dissolved	mg/L	(e)	(e)	<0.01	NS
Copper, Dissolved	mg/L	(e)	(e)	**0.041E**	NS
Lead, Dissolved	mg/L	(e)	(e)	<0.05	NS
Zinc, Dissolved	mg/L	(e)	(e)	0.131	NS

<-Results less than the reporting limit.

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

NS indicates no sample taken.

E indicates estimated result.

(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(b) Water Quality Benchmark for Total Dissolved Solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego region (Basin Plan), 1994 (with amendments affective prior to April 25, 2007).

(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, Mat 18, 2000. The Criteria Maximum Concentration (CMC) was used.

Tijuana River WMA 2010-2011 MS4 Random Wet Weather

Analyte	Units	Water Quality Benchmarks	Benchmark References	MS4W-TJR-01	MS4W-TJR-09	MS4W-TJR-13	MS4W-TJR-16	MS4W-TJR-18	MS4W-TJR-19
				6379	3920	6176	4173	4319	3357
				10/19/2010	2/18/2011	10/19/2010	2/18/2011	3/20/2011	3/21/2011
Physical Chemistry									
Conductivity	µmhos/cm	NA	NA	28.3	245	35.6	19.4	44.6	76.9
pH	pH units	6.5-9.0	1. Basin Plan	6.53	8.22	6.82	8.84	7.62	7.61
Water Temperature	Celsius	NA	NA	15.4	10.3	9.6	9.6	7.3	7.6
General Chemistry									
Nitrate as N	mg/L	10	1. Basin Plan	0.26	<0.05	0.48	0.16	0.07	0.11
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	0.29	0.07	0.48	0.19	0.12	0.14
Nitrite as N	mg/L	1	1. Basin Plan	<0.05	<0.05	<0.05	<0.05	0.05	<0.05
Total Kjeldahl Nitrogen	mg/L	NA	NA	1.5	2.1	1.2	1.7	1.6	2.1
Total Nitrogen	mg/L	NA	NA	1.8	2.2	1.7	1.9	1.7	2.2
Total Phosphorus	mg/L	2	4. MSGP 2000	<0.05	0.24	0.64	0.93	0.71	0.19
Total Dissolved Solids (calculated)[1]	mg/L	500 (a)	1. Basin Plan	20	172	25	14	31	54
Total Suspended Solids	mg/L	100	4. MSGP 2000	28	**121**	**2730**	**568**	**734**	99
Bacteriological									
Enterococcus	MPN/100 mL	NA	NA	TE	5,000	TE	23,000	300	80,000
Fecal Coliform	MPN/100 mL	400/4000	1. Basin Plan (REC-1/REC-2)	170	80	**13,000**	<20	<20	20
Total Coliform	MPN/100 mL	NA	NA	50,000	1,700	23,000	23,000	230	3,000

< - results are less than the reporting limit.

[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

(a) Water Quality Benchmark for total dissolved solids is based on the San digeo Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).

NA - No criteria or published value was available or applicable to the matrix or program.

TE - Tecnician error.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

Tijuana River WMA 2011-2012 MS4 Random Dry Weather

Analyte	Units	Water Quality Benchmarks	Benchmark References	911.60
				MS4D-TJR-02
				4177
				5/24/2012
Physical Chemistry				
Conductivity	µmhos/cm	NA	NA	738
pH	pH units	6.5-9.0	1. Basin Plan	8.09
Temperature	Celsius	NA	NA	17.0
General Chemistry				
Nitrate as N	mg/L	10	1. Basin Plan	<0.05
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	<0.05
Nitrite as N	mg/L	1	1. Basin Plan	<0.05
Total Kjeldahl Nitrogen	mg/L	NA	NA	1.1
Total Nitrogen*	mg/L	1	1. Basin Plan	**1**
Total Phosphorus*	mg/L	0.1	4. MSGP 2000	<0.05
Total Dissolved Solids (calculated)[1]	mg/L	500 (a)	1. Basin Plan	**517**
Total Suspended Solids	mg/L	58	4. MSGP 2000	<20
Bacteriological				
Enterococcus	MPN/100 mL	151	NA	**1,100**
Fecal Coliform	MPN/100 mL	400	1. Basin Plan (REC1)	20
Total Coliform	MPN/100 mL	NA	NA	230

< - results are less than the reporting limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
*Total Nitrogen and Total Phosphorus are narrative standards in the Basin Plan based on biostimulatory response to nutrients.
[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

(a) Water Quality Benchmark for total dissolved solids is based on the San digeo Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).

Highlighted text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

Tijuana River WMA 2011-2012 MS4 Targeted Dry Weather

Analyte	Units	WQB CMC	WQB CCC	911.11 DW322 6/19/2012	911.11 E1B 5/24/2012	911.11 E1B 7/16/2012	911.82 TIJ13 6/22/2012
pH	pH units	NA	NA	7.48	NS	NS	NS
Ammonia as N	mg/L	(a)	(a)	NS	NS	NS	0.06E
Nitrate as N	mg/L	10	NA	NS	NS	NS	<0.05
Nitrate/Nitrite as N	mg/L	10	NA	NS	NS	NS	<0.05
Nitrite as N	mg/L	1	NA	NS	NS	NS	<0.05
Total Kjeldahl Nitrogen	mg/L	NA	NA	NS	NS	NS	0.9
Total Nitrogen (calculated)	mg/L	1	NA	**2.5**	NS	NS	0.9
Dissolved Phosphorus	mg/L	0.1	NA	NS	NS	NS	**0.5**
Total Phosphorus	mg/L	0.1	NA	**0.68**	NS	NS	**0.52**
Total Suspended Solids	mg/L	58	NA	44	NS	NS	4E
Total Dissolved Solids	mg/L	500 (b)	NA	NS	NS	NS	**682**
Dissolved Oxygen	mg/L	5	NA	**4.4**	NS	NS	NS
Oil and Grease	mg/L	10	NA	NS	<1	<5	NS
Enterococcus	MPN/100 mL	151 (e)	NA	**18,000E**	**700**	36	**2,100**
Fecal Coliform	MPN/100 mL	400	NA	NS	NS	NS	130
Fecal Coliform	MPN/100 mL	4000	NA	3,300	30	700	NS
Total Coliform	MPN/100 mL	NA	NA	920,000	30,000	2,800	2,800
Chlorpyrifos	µg/L	0.02	0.014	<0.96	<0.05	<0.05	NS
Diazinon	µg/L	0.08	0.05	<0.96	<0.05	<0.05	NS
Malathion	µg/L	0.43	0.1	NS	<0.05	<0.05	NS
Total Hardness	mg $CaCO_3$/L	NA	NA	320	325	256	NS
Cadmium, Dissolved	mg/L	(f)	(f)	<0.005	<0.001	<0.001	NS
Copper, Dissolved	mg/L	(f)	(f)	0.023	0.022	0.014	NS
Lead, Dissolved	mg/L	(f)	(f)	<0.005	<0.005	<0.005	NS
Nickel, Dissolved	mg/L	(f)	(f)	0.01	NS	NS	NS
Thallium, Dissolved	mg/L	NA	NA	<0.01	NS	NS	NS
Zinc, Dissolved	mg/L	(f)	(f)	0.028	0.06	0.056	NS

<-Results less than the reporting limit.

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

E-Reported value is estimated.

NS-Not sampled.

(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(e) Water Quality Benchmark for Enterococcus is based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(f) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.

Highlighted text – exceeds water quality benchmark.

Tijuana River WMA 2011-2012 MS4 Random Wet Weather

Analyte	Units	Water Quality Benchmarks	Benchmark References	911.60	911.12	911.30	911.41	911.41	911.41
				MS4W-TJR-02	MS4W-TJR-03	MS4W-TJR-05	MS4W-TJR-06	MS4W-TJR-21	MS4W-TJR-45
				4177	15836	3008	6354	6400	6413
				12/12/2011	10/5/2011	11/4/2011	11/12/2011	3/17/2012	3/17/2012
Physical Chemistry									
Conductivity	µmhos/cm	NA	NA	535	177	60.5	79.5	40.3	21
pH	pH units	6.5-9.0	1. Basin Plan	7.79	7.65	7.81	7.61	7.35	7.31
Water Temperature	Celsius	NA	NA	9.00	18.20	10.40	11.60	11.40	9.80
General Chemistry									
Nitrate as N	mg/L	10	1. Basin Plan	<0.05	1.21	0.7	0.24	0.23	0.3
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	<0.05	1.37	0.76	0.38	0.28	0.34
Nitrite as N	mg/L	1	1. Basin Plan	<0.05	0.16	0.06	0.14	<0.05	0.05
Total Kjeldahl Nitrogen	mg/L	NA	NA	1.7	6.2	1.2	1.8	<0.5	<0.5
Total Nitrogen	mg/L	NA	NA	1.7	7.6	2	2.2	<0.5	<0.5
Total Phosphorus	mg/L	2	4. MSGP 2000	<0.05	0.21	0.06	0.21	0.22	0.53
Total Dissolved Solids (calculated)[1]	mg/L	500 (a)	1. Basin Plan	374.5	123.9	42.4	55.7	28.2	14.7
Total Suspended Solids	mg/L	100	4. MSGP 2000	<20	<20	31	**272**	55	**220**
Bacteriological									
Enterococcus	MPN/100 mL	NA	NA	500	3,000	5,000	3,000	2,200	17,000
Fecal Coliform	MPN/100 mL	400/4000	1. Basin Plan (REC-1/REC-2)	20	70	**1,400**	**500**	110	40
Total Coliform	MPN/100 mL	NA	NA	1,300	6,000	240,000	50,000	1,400	5,000

< - results are less than the reporting limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F
(a) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007). Benchmark does not apply to 911.1.

Highlighted text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

Tijuana River WMA 2011-2012 MS4 Targeted Wet Weather

Analyte	Units	Water Quality Benchmarks	Benchmark References	911.12			
				MS4T-TJR-RISE	MS4T-TJR-PEAK	MS4T-TJR-FALL	MS4-TJR
				11/4/2011	11/4/2011	11/4/2011	EMC
Physical Chemistry							
Electrical Conductivity	µmhos/cm	NA		141.3	76	68.7	101.6
pH	pH units	6.5-9.0	1. Basin Plan	7.45	7.68	6.61	7.45
Water Temperature	Celsius	NA		15.8	14	13.1	14.6
Bacteriological							
Enterococcus	MPN/100 mL	NA		70,000	14,000	8,000	36,030
Fecal Coliform	MPN/100 mL	4,000	1.Basin Plan REC-1/REC-2	700	230	300	430
Total Coliform	MPN/100 mL	NA		7,000	5,000	8,000	6,203
General Chemistry							
Ammonia as N	mg/L	(a)	6. USEPA Water Quality Criteria (Freshwater)	0.32	0.24	0.15	0.26
Biochemical Oxygen Demand	mg/L	30	4. MSGP 2000, 8. McNeeley (1979)	11	3.5	3.3	6.5
Chemical Oxygen Demand	mg/L	120	4. MSGP 2000	**130**	83	24	94
Chloride	mg/L	NA (b)	1. Basin Plan	10	2.8	2.9	5.9
Dissolved Phosphorus	mg/L	2	4. MSGP 2000	0.09	0.055	0.048	0.069
Nitrate as N	mg/L	10	1. Basin Plan	1.1	0.2	0.18	0.59
Nitrate/Nitrite as N	mg/L	10	1. Basin Plan	1.1	0.24	0.21	0.61
Nitrite as N	mg/L	1	1. Basin Plan	0.068J	0.037J	0.032J	0.050
Oil and Grease	mg/L	10	1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000	1.6J	<1.3	1.7J	1.2
Sulfate	mg/L	NA (c)	1. Basin Plan	8.8	3.1	2.5	5.5
Surfactants (MBAS)	mg/L	0.5	1. Basin Plan	**0.6**	0.036J	0.05	0.282
Total Dissolved Solids	mg/L	NA (d)	1. Basin Plan	80	46	40	60
Total Hardness	mg $CaCO_3$/L	NA		62	52	25	52
Total Kjeldahl Nitrogen	mg/L	NA		2.7	1.4	0.57	1.84
Total Nitrogen	mg/L	NA		3.8	1.6	0.79	2.43
Total Phosphorus	mg/L	2	4. MSGP 2000	0.37	0.33	0.1	0.31
Total Suspended Solids	mg/L	100	4. MSGP 2000, 1. Basin Plan	**390**	**350**	32	**319**
Turbidity	NTU	20	1. Basin Plan	**52**	**47**	**24**	**46**
Organophosphorus Pesticides							
Chlorpyrifos	µg/L	0.02 acute / 0.014 chronic	12. CA Dept. of Fish & Game, 2000	<0.014	<0.014	<0.0069	0.0065
Diazinon	µg/L	0.08 acute / 0.05 chronic	12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon	<0.01	<0.01	<0.0052	0.0046
Malathion	µg/L	0.43	13. CA Dept. of Fish & Game, 1998, 5. Goldbook	<0.015	<0.015	<0.0076	0.0069
Total Metals							
Antimony, Total	mg/L	NA		0.0019	0.0014	0.00063	0.00150
Arsenic, Total	mg/L	NA		0.0022	0.0019	0.001	0.0019
Cadmium, Total	mg/L	NA		0.00057	0.00046	0.00018	0.00046
Chromium, Total	mg/L	NA		0.0094	0.008	0.0023	0.0077
Copper, Total	mg/L	NA		0.037	0.026	0.01	0.028
Lead, Total	mg/L	NA		0.057	0.044	0.007	0.0440
Manganese, Total	mg/L	NA		0.17	0.15	0.033	0.141
Nickel, Total	mg/L	NA		0.01	0.0073	0.0023	0.0077
Selenium, Total	mg/L	0.005	16. 40 CFR 131.38	0.00035J	<0.00028	<0.00028	0.00023
Zinc, Total	mg/L	NA		0.44	0.27	0.081	0.315
Dissolved Metals							
Antimony, Dissolved	mg/L	0.006	1. Basin Plan	0.0011	0.00056	0.00035J	0.00076
Arsenic, Dissolved	mg/L	0.34 (e)	16. 40 CFR 131.38	0.00097	0.00083	0.00081	0.00089
Cadmium, Dissolved	mg/L	(f)	16. 40 CFR 131.38	0.000098J	0.00003J	0.000054J	0.000063
Chromium, Dissolved	mg/L	(f)	16. 40 CFR 131.38	0.00071	0.00042	0.00033	0.00053
Copper, Dissolved	mg/L	(f)	16. 40 CFR 131.38	**0.012**	0.0049	**0.0046**	**0.0079**
Lead, Dissolved	mg/L	(f)	16. 40 CFR 131.38	0.00083	0.00029	0.00028	0.00052
Nickel, Dissolved	mg/L	(f)	16. 40 CFR 131.38	0.0032	0.00075J	0.00084	0.00182
Selenium, Dissolved	mg/L	NA		0.00039J	<0.00028	<0.00028	0.00025
Zinc, Dissolved	mg/L	(f)	16. 40 CFR 131.38	0.065	0.0096	0.021	0.0353

<-Results less than the method detection limit.

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

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(b) Water Quality Benchmark for chloride is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(c) Water Quality Benchmark for sulfate is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(d) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(e) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

(f) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.

H-Samples analyzed/and or received past recommended holding time.

J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmark.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

APPENDIX E

Detailed Table of Priority Water Quality Conditions in the Tijuana River WMA

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Table F-1
Receiving Water Conditions Potentially Attributed in Part to MS4 Discharges (Priority Water Quality Conditions)

Hydrologic Area	Receiving Water	Condition (indicated with "x" in next column)	Temporal Extent[1]		Data or Information Attributing MS4 Discharge (indicated with shading in previous column)
			Wet	Dry	
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River	Impairment of REC-1 due to Total Coliform.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River	Impairment of REC-1 due to Fecal Coliform.	x	x	Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River	Impairment of REC-1 due to *Enterococcus*.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive	Impairment of REC-1 due to Total Coliform.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive	Impairment of REC-1 due to Fecal Coliform.	x	x	Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive	Impairment of REC-1 due to *Enterococcus*.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Monument Road	Impairment of REC-1 due to Total Coliform.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.

Hydrologic Area	Receiving Water	Condition (indicated with “x” in next column)	Temporal Extent[1]		Data or Information Attributing MS4 Discharge (indicated with shading in previous column)
			Wet	Dry	
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Monument Road	Impairment of REC-1 due to Fecal Coliform.	x	x	Wet: MS4 sampling results presented in LTEA.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at the US Border	Impairment of REC-1 due to Total Coliform.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at the US Border	Impairment of REC-1 due to Fecal Coliform.	x	x	Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at the US Border	Impairment of REC-1 due to *Enterococcus*.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth	Impairment of REC-1 due to Total Coliform.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth	Impairment of REC-1 due to Fecal Coliform.	x	x	Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth	Impairment of REC-1 due to *Enterococcus*.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River	Impairment of REC-1 due to Indicator Bacteria.	x	x	Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.

Hydrologic Area	Receiving Water	Condition (indicated with "x" in next column)	Temporal Extent[1]		Data or Information Attributing MS4 Discharge (indicated with shading in previous column)
			Wet	Dry	
Tijuana Valley (911.1)	Tijuana River	Elevated fecal coliforms at NPDES monitoring location.	x	x	Wet: MS4 sampling results presented in LTEA. Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report.
Tijuana Valley (911.1)	Tijuana River	Elevated *Enterococcus* at NPDES monitoring location.		x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Solids.	x	x	Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report. Dry: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Sedimentation/Siltation.	x	x	Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report.
Tijuana Valley (911.1)	Tijuana River	Elevated TSS at NPDES sampling location.	x	x	Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report. Dry: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River	Elevated Turbidity at NPDES sampling location.	x	x	Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report. Dry: MS4 sampling results presented in LTEA.
Tijuana Valley (911.1)	Tijuana River	Impairment of REC-2 due to Trash.	x	x	Tijuana River Watershed Technical Support Document includes storm water runoff and dry weather runoff as sources of trash in the Tijuana River and Estuary.

Hydrologic Area	Receiving Water	Condition (indicated with "x" in next column)	Temporal Extent[1]		Data or Information Attributing MS4 Discharge (indicated with shading in previous column)
			Wet	Dry	
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Total Nitrogen as N.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Phosphorus.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Eutrophic conditions.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Low DO.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River	Elevated BOD and COD at NPDES sampling location.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report.
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Pesticides.	x		303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River	Impairment of REC-1 due to Surfactants (MBAS).	x	x	Dry: MS4 sampling results presented in LTEA.
Tijuana Valley (911.1)	Tijuana River	Impairment of MUN due to Synthetic Organics.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.

Hydrologic Area	Receiving Water	Condition (indicated with “x” in next column)	Temporal Extent[1]		Data or Information Attributing MS4 Discharge (indicated with shading in previous column)
			Wet	Dry	
Tijuana Valley (911.1)	Tijuana River	Impairment of WARM due to Toxicity.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of MAR due to Turbidity.	x	x	Wet and Dry: Tijuana River Bacterial Source Identification – Final Report
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of RECT-1 due to Indicator Bacteria.	x	x	Wet and Dry: Tijuana River Bacterial Source Identification – Final Report
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of REC-2 due to Trash.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as Potential Source. Tijuana River Watershed Technical Support Document includes storm water runoff and dry weather runoff as sources of trash in the Tijuana River and Estuary.
Tijuana Valley (911.1)	Tijuana River Estuary	Impairment of MAR due to Low DO.	x	x	Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Barrett Lake (911.3)	Barrett Lake	Impairment of WARM due to Total Nitrogen as N.	x	x	Dry: MS4 sample results presented in LTEA and 2010-11 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Monument (911.4)	Pine Valley Creek (Upper)	Impairment of MUN due to Turbidity.	x	x	Wet: MS4 sample results presented in 2011-12 Weston Report.

Hydrologic Area	Receiving Water	Condition (indicated with "x" in next column)	Temporal Extent[1]		Data or Information Attributing MS4 Discharge (indicated with shading in previous column)
			Wet	Dry	
Morena (911.5)	Morena Reservoir	Impairment of WARM due to Phosphorus.	x	x	303(d) List includes "Urban Runoff/Storm Sewers" as potential source.
Campo (911.8)	Campo Creek	Elevated *Enterococcus* at NPDES sampling location.		x	Dry: MS4 sample results presented in 2011-12 Weston Report.
Campo (911.8)	Campo Creek	Elevated Phosphorus at NPDES sampling location.		x	Dry: MS4 sample results presented in 2011-12 Weston Report.
Campo (911.8)	Campo Creek	Elevated TDS at NPDES sampling location.	x	x	Dry: MS4 sample results presented in 2011-12 Weston Report.

Notes:

"X" indicates temporal extent of receiving water condition.

Shading indicates temporal extent of MS4 outfall monitoring data.

APPENDIX F

Calculation of Relative Magnitude of Pollutant/Stressor from MS4 Sources

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Calculations for 911.1

	Total Acres	Relative Magnitude of Pollutant Load										
		Sedimentation/Siltation/ Solids/TSS	Turbidity	Indicator Bacteria	Low DO	Nutrients	Surfactants (MBAS)	TDS	Trash	Pesticides	Synthetic Organics	Toxicity
Commercial	460	2	2	3	1	2	3	2	3	2	2	2
Industrial	1053	3	3	1	1	1	2	3	3	1	3	3
Transportation	2291	3	3	1	1	1	1	2	2	1	3	3
Low Density Residential	1373	2	2	2	3	2	2	1	1	2	1	1
High Density Residential	577	2	2	3	3	2	2	1	2	2	1	1
	Average Pollutant Load Magnitude Weighted by Land Area Acreages	2.6	2.6	1.6	1.7	1.4	1.7	1.8	2.0	1.4	2.2	2.2
	Percentage of Land Area Scored "High"	58%	58%	18%	34%	0%	8%	18%	26%	0%	58%	58%

Calculations for 911.3

	Total Acres	Relative Magnitude of Pollutant Load										
		Sedimentation/Siltation/ Solids/TSS	Turbidity	Indicator Bacteria	Low DO	Nutrients	Surfactants (MBAS)	TDS	Trash	Pesticides	Synthetic Organics	Toxicity
Commercial	0	2	2	3	1	2	3	2	3	2	2	2
Industrial	0	3	3	1	1	1	2	3	3	1	3	3
Transportation	116	3	3	1	1	1	1	2	2	1	3	3
Low Density Residential	1224	2	2	2	3	2	2	1	1	2	1	1
High Density Residential	18	2	2	3	3	2	2	1	2	2	1	1
	Average Pollutant Load Magnitude Weighted by Land Area Acreages	2.1	2.1	1.9	2.8	1.9	1.9	1.1	1.1	1.9	1.2	1.2
	Percentage of Land Area Scored "High"	9%	9%	1%	91%	0%	0%	0%	0%	0%	9%	9%

Note: Municipal and institutional land uses are included with commercial in this analysis.

Calculations for 911.5

	Total Acres	Relative Magnitude of Pollutant Load										
		Sedimentation/Siltation/ Solids/TSS	Turbidity	Indicator Bacteria	Low DO	Nutrients	Surfactants (MBAS)	TDS	Trash	Pesticides	Synthetic Organics	Toxicity
Commercial	3	2	2	3	1	2	3	2	3	2	2	2
Industrial	0	3	3	1	1	1	2	3	3	1	3	3
Transportation	48	3	3	1	1	1	1	2	2	1	3	3
Low Density Residential	779	2	2	2	3	2	2	1	1	2	1	1
High Density Residential	72	2	2	3	3	2	2	1	2	2	1	1
	Average Pollutant Load Magnitude Weighted by Land Area Acreages	2.1	2.1	2.0	2.9	1.9	1.9	1.1	1.1	1.9	1.1	1.1
	Percentage of Land Area Scored "High"	5%	5%	8%	94%	0%	0%	0%	0%	0%	5%	5%

Calculations for 911.8

	Total Acres	Relative Magnitude of Pollutant Load										
		Sedimentation/Siltation/ Solids/TSS	Turbidity	Indicator Bacteria	Low DO	Nutrients	Surfactants (MBAS)	TDS	Trash	Pesticides	Synthetic Organics	Toxicity
Commercial	105	2	2	3	1	2	3	2	3	2	2	2
Industrial	69	3	3	1	1	1	2	3	3	1	3	3
Transportation	1204	3	3	1	1	1	1	2	2	1	3	3
Low Density Residential	11804	2	2	2	3	2	2	1	1	2	1	1
High Density Residential	77	2	2	3	3	2	2	1	2	2	1	1
	Average Pollutant Load Magnitude Weighted by Land Area Acreages	2.1	2.1	1.9	2.8	1.9	1.9	1.1	1.1	1.9	1.2	1.2
	Percentage of Land Area Scored "High"	10%	10%	1%	90%	0%	1%	1%	1%	0%	10%	10%

Note: Municipal and institutional land uses are included with commercial in this analysis.

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Conditions

- Viruses: Hep A – River Mouth
- Pathogens

Sources

- Military Operations – Naval Outlying Field (NOLF)
- Agriculture/Ranches
- Unpaved alleys
- Bare/Un-vegetated yards
- Oils on surfaces
- Illegal dumping
- Aerial deposition – Border crossing (Prevailing winds: west and east)
- Encampments
- Agricultural debris/Residuals
- Food vendors/Stands

Strategies

- Focus on culture – Not just translate
- Targeted trash campaign at border crossing: Increase trash receptacles, public areas, (Disneyland study " 26 steps")
- Discarding packaging
- Street sweeping efficiency studies
- Cleanup events
- Bioremediation – metals, bacteria
- Limit home oil/Fluid changes
- Residential Rain Harvesting
- Recycling/Disposal events
- More coordination – Navy, Border Patrol
- Recycling plastics
- Non – native invasive removal / wetland restoration
- Cultural trash ethics – education
- Communication strategy
- Junkyards – E. San Ysidro
- Cigarette butt collection/receptacles

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Appendix H.1 City of Imperial Beach Strategies, Schedules, and Funding Needs

Appendix H.2 City of San Diego Strategies, Schedules, and Funding Needs

Appendix H.3 County of San Diego Strategies, Schedules, and Funding Needs\

Appendix H.1

City of Imperial Beach Strategies, Schedules, and Funding Needs

Appendix H.1 City of Imperial Beach Strategies

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
Jurisdictional Strategies											
Illicit Discharge, Detection, and Elimination (IDDE) Program											
IB-01	Imperial Beach Illicit Discharge Detection and Elimination Program	MS4 Permit, Section E.2.	Investigate and eliminate dry weather discharges and illegal connections to the MS4. Utilize appropriate enforcement actions to achieve compliance. Maintain database of ICIDs.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-02	Proactive enforcement of storm water violations and WQIP priority pollutants	Enhancement	Proactively identify storm water violations with an emphasis on WQIP priorities of sediment and trash.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-03	Storm Water GIS database and Maps	MS4 Permit E.2.b.1	Maintain the storm water GIS database and generate maps to support the WQIPs for each watershed	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	GIS Admin and Env Division
IB-04	Dry weather field screening of MS4 outfalls	MS4 Permit E.2.C, Enhancement	Perform visual assessment of major MS4 outfalls per Permit Section E.2.C. Visually inspect all MS4 outfalls annually including Navy and Caltrans.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-04a	Persistent dry weather flow monitoring	MS4 Permit E.2.b.1	Dry weather field screening will identify major MS4 outfalls with persistent dry weather flow, which will receive monitoring in accordance with Permit provision D.2.b.(2).	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
Development Planning											
Non-Priority Development Projects											
IB-05	Provide storm water BMP conditions during the development review phase for non-Priority Development Projects	MS4 Permit, Section E.3.a	Administer a program to ensure implementation of source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area, where applicable and feasible.	City-wide	TBD	TBD	TBD	FY16	Ongoing	Development Permit Fee and General Fund	Community Development and Public Works
IB-05a	Provide enhanced storm water BMP conditions for non-PDP (Standard Development Projects) with improvement valuation greater than $50,000	Enhancement	Standard Development Projects that get assessed with an improvement valuation greater than $50,000 require an additional review by the Public Works Department for public improvement conditions which include specific project conditions for storm water BMPs.	City-wide	TBD	TBD	TBD	FY16	Ongoing	Development Permit Fee and General Fund	Public Works
Priority Development Projects (PDPs)											
IB-06	Provide storm water BMP conditions during the development review phase for Priority Development Projects.	MS4 Permit, Sections E.3.b, E.3.c, E.3.e	Priority Development Projects as defined by IBMC 8.32 requires BMP certification by City Engineer to meet treatment and retention standards in the Imperial Beach BMP Design Manual.	City-wide	TBD	TBD	TBD	FY16	Ongoing	Development Permit Fee and General Fund	Community Development ,Public Works, and City Engineer
IB-07	City of Imperial Beach BMP Design Manuel	MS4 Permit Section E.3.d	Update IBMC and BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-08	Long-term Structural BMP Maintenance Agreement	MS4 Permit Section E.3.c.4	Require legal agreement, covenant, CEQA mitigation requirement, and/or conditional use permit to ensure long-term maintenance of structural BMPs.	City-wide	TBD	TBD	TBD	FY16	Ongoing	Development Permit Fee and General	Community Development

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
										Fund	
IB-09	Review and update Long-term Structural BMP Maintenance Agreement	Enhancement	During each new MS4 Permit cycle provide a review and update to the City's BMP long-term maintenance agreement for PDPs.	City-wide	TBD	TBD	TBD	FY18	As needed	General Fund	Env Division and City Attorney
IB-10	Structural BMP Maintenance Verification and Inspection	MS4 Permit Section E.3.e.3	Provide annual inspections of high priority structural BMPs and periodic inspections of remaining BMPs at PDP sites.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-11	Maintain a watershed database of PDP and BMPs	Enhancement	Create and maintain a watershed database of PDPs, structural BMPs, and long-term maintenance agreements in GIS.	City-wide	TBD	TBD	TBD	FY18	Ongoing	General Fund	Env Division and GIS Admin
IB-12	Watershed Management Area Analysis (WMAA) and alternative compliance program	Enhancement	Collaborate with regional Copermittees on development of the WMAA and alternative compliance program for PDPs.	Regional	TBD	TBD	TBD	FY16	Ongoing	Env Division Budget	Env Division
Green Streets											
IB-13	Consider retrofit of impervious areas, LIDs, and EPA Green Streets guidance in the design phase for Capital Improvement Projects (CIPs)	Enhancement	The City considers retrofit of impervious areas, LIDs, and EPA Green Streets guidance with the City Engineer in the design phase for all CIPs where practical, feasible, or required by Priority Development status.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Public Works
Construction Management											
IB-14	Approval of a Storm Water Management Plan or equivalent plan for discretionary projects	MS4 Permit, Sections E.4.a	Discretionary project applicants must submit and receive approval of a Storm Water Management Plan (or for Construction General Permit a Storm Water Pollution Prevention Plan) prior to receiving a building, grading, or demolition permit.	City-wide	TBD	TBD	TBD	FY16	Onging	Development Permit Fee and General Fund	Community Development

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
IB-14a	Inspect and verify implementation of construction management BMPs for discretionary projects	MS4 Permit, Sections E.4.c and E.4.d and enhancement	Verify implementation of construction BMPs at discretionary projects though inspections at the beginning of construction activities, prior to rain events, and during any subsequent visit to the project site.	City-wide	TBD	TBD	TBD	FY16	Onging	Develop ment Permit Fee and General Fund	Building Official
IB-14b	Maintain a continuous inventory of construction sites and enforcement actions for discretionary projects	MS4 Permit, Sections E.4.b and E.4.d(3)	For discretionary projects maintain a continuous inventory on the City's HTE database system of active construction sites and notes on enforcement actions.	City-wide	TBD	TBD	TBD	FY16	Onging	Develop ment Permit Fee and General Fund	Community Development
IB-15	Approval of a Storm Water Management Plan or equivalent plan for public capital projects	MS4 Permit, Sections E.4.a	Contractors for capital projects must submit and receive approval of a Storm Water Management Plan (or for Construction General Permit a Storm Water Pollution Prevention Plan) prior to receiving a notice to proceed.	City-wide	TBD	TBD	TBD	FY16	Onging	General Fund and CIP Budget	Public Works
IB-15a	Inspect and verify implementation of construction management BMPs for capital projects	MS4 Permit, Sections E.4.c and E.4.d and enhancement	Verify implementation of construction BMPs at capital projects though daily inspections.	City-wide	TBD	TBD	TBD	FY16	Onging	General Fund and CIP Budget	Public Works Inspector
IB-15b	Maintain a continuous inventory of construction sites and enforcement actions for capital projects	MS4 Permit, Sections E.4.b and E.4.d(3)	For capital projects maintain a continuous inventory active construction projects and enforcement actions in Daily Inspection Reports.	City-wide	TBD	TBD	TBD	FY16	Onging	General Fund and CIP Budget	Public Works Inspector
IB-16	Annual update to construction management database	MS4 Permit, Sections E.4.d	The Environmental Division will annually collate the construction inventory and inspection/enforcement records from both public and private projects into a comprehensive database.	City-wide	TBD	TBD	TBD	FY16	Onging	General Fund	Env Division

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
Existing Development											
Commercial, Industrial, Municipal, and Residential Facilities and Areas											
IB-17	Minimum BMPs for municipal areas and activities, commercial facilities, and residential areas	MS4 Permit, Section E.5.b	The IBMC 8.30 establishes minimum BMPs and the water quality improvement strategies established in the JRMP requires implementation of BMPs that are specific to the facility, area type, and pollutant generating activity. Minimum BMPs get reviewed and updated at least once per Permit cycle.	City-wide	TBD	TBD	TBD	FY16	Onging	General Fund	Public Works
IB-18	Maintain an annual watershed bases inventory of municipal, commercial, and residential facilities	MS4 Permit, Section E.5.a	At the beginning of each FY update the City's GIS database of existing development inventory of municipal, commercial, and residential facilities.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division and GIS
IB-19	Inspect and verify implementation of BMPs at municipal areas and facilities	MS4 Permit, Section E.5.c	The responsibility to implement and maintain various municipal BMPs is a task shared by every employee in the Public Works Department. The Environmental Division will verify implementation of BMPs through an onsite annual inspection.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division
IB-20	Inspect and verify implementation of BMPs at commercial businesses	MS4 Permit, Section E.5.c and Enhancement	The Environmental Division will perform an onsite inspection of each commercial business at least once per permit cycle in addition to performing targeted monthly neighborhood inspections, which include commercial areas.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division
IB-21	Neighborhood inspection program	MS4 Permit, Section E.5.c and Enhancement	The Environmental Division conducts monthly neighborhood specific visual inspections of existing developed areas. These inspections allow for focused and targeted inspections that are	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
			informed by WQIP or Jurisdictional priorities.								
IB-22	Maintain inspection tracking records and violation reports for areas of existing development	MS4 Permit, Section E.5.c.3	Inspection records are maintained according to the Permit violations are tracked on the ICID database.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division
IB-23	Inspection of U.S. Navy MS4	Enhancement	Perform annual inspection of NOLF outfall and MS4 channels on Navy property.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division
IB-24	Street sweeping program	MS4 Permit, Section E.5.b.1 and Enhancement	Weekly: Commercial areas, Ocean Lane, and parking lots Twice per month: Beachfront posted residential areas Monthly: Non-beachfront residential areas and paved alleys	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division and Contractor
IB-25	Collection of illegally dumped material in alleys and public right-of-way	MS4 Permit, Section E.5.b.1 and Enhancement	Illegally dumped materials in City alleys are cleaned up weekly every Thursday by EDCO and Public Works crews collect items left in the public right-of-way.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division and Contractor
IB-26	Home front cleanup event	Enhancement	The City in partnership with EDCO host an annual drop off event for the disposal of any item for residents of Imperial Beach.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division and Contractor
IB-27	Pet waste bag program	MS4 Permit, Section E.5.b and Enhancement	The City maintains 10 pet waste bag dispensers twice per week.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Grounds and Facilities Division
IB-28	Pesticide, herbicide, and fertilizer management	MS4 Permit, Section E.5.b	The City implements an IPM program to minimize the application of chemicals.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Grounds and Facilities Division
IB-29	Sewer system management	MS4 Permit, Section E.5.b.1.c	The operation and maintenance of the sewer collection system is a top priority and managed in accordance with the City's SSMP.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env and Sewer Divisions

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
IB-30	Special event permits	MS4 Permit, Section E.5.b	The City provides storm water BMP conditions on special event permits or conditional use permits.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Public Works and Public Safety Dept
IB-31	Residential household hazardous waste program	MS4 Permit, Section E.5.b.2	The City partners with the City of Chula Vista to offer free disposal of HHW for residents.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division
IB-32	Catch basin and MS4 line O&M	MS4 Permit, Section E.5.b.1.c and Enhancement	The City annually inspects and cleans catch basins and MS4 line.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env and Sewer Divisions
IB-33	Open drainage channels and outfalls O&M	MS4 Permit, Section E.5.b.1 and Enhancement	The City annually cleans and maintains open drainage channels and outfall locations.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env, Streets, and Sewer Divisions, and Contractor
IB-34	LID BMPs O&M	MS4 Permit, Section E.5.b.1 and Enhancement	The City provides scheduled maintenance activities for various LID facilities.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Grounds and Facilities Division and Contractor
IB-35	Storm drain inlet filters O&M	MS4 Permit, Section E.5.b.1 and Enhancement	The City maintains through contract multiple inlet filters located on municipal facilities or at high trash generating areas.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Env Division and Contractor
IB-36	Vertech interceptor O&M	MS4 Permit, Section E.5.b.1 and Enhancement	The City maintains a Vortech separator storm drain CDS unit at 10th and Imperial Beach Blvd.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Sewer Division
IB-37	Storm water diverters O&M	MS4 Permit, Section E.5.b.1 and Enhancement	The City maintains 2 major storm water diverts along the beachfront at Palm Ave and Date Ave that diverts urban runoff and first flush rain events into the sanitary sewer. The City also maintains 3 vehicle and equipment washing	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Sewer Division

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
			diverters for Public Works, Fire Station, and Lifeguards.								
Retrofit and Rehabilitation in Areas of Existing Development											
IB-38	Integrate LID retrofits where feasible into CIP rehabilitation projects	MS4 Permit, Section E.5.e and Enhancement	The City evaluates the implementation of LIDs into the design of CIPs where practical and feasible.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	CIP Manager
IB-39	Eliminate residential and commercial curb cuts	MS4 Permit, Section E.5.e and Enhancement	The City no longer allows storm water curb cuts for private properties and will eliminate existing curb cuts through redevelopment projects.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Streets Division, Contractor, and Private Property Owners
IB-40	Encourage LID retrofits of residential and commercial areas for non-PDP redevelopment projects	MS4 Permit, Section E.5.e and Enhancement	During the plan check phase the City evaluates non-PDP redevelopment projects for enhanced public improvement conditions to treat storm water.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund	Public Works and Community Development Depts
IB-41	Partner with local, state, and federal agencies to retrofit non-jurisdictional areas	MS4 Permit, Section E.5.e and Enhancement	The City partners with local, state, and federal agencies to improve water quality and wildlife habitat in areas not outside the jurisdictional control of the City.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund and Grants	Env Division
Enforcement Response Plan											
IB-42	Storm water code enforcement	Permit Section E.6	Implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Enforcement Response Plan.	City-wide	TBD	TBD	TBD	FY 16	Ongoing	General Fund and Grants	Env and Code Enforcement Divisions

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
Public Education and Participation											
IB-43	Storm water management education program	MS4 Permit, Section E.7	Manage the implementation of a public education and participation program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-44	Provide education opportunities to development community	MS4 Permit, Section E.7 and Enhancement	Contractors and developers are trained through face-to-face meetings with the Community Development Department and the Publics Works Department during the permitting process, through inspections, and through investigations of illegal discharges. Educational brochures are used as part of the permitting process and web resources are available.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund and Permit Fees	Public Works and Community Development Depts
IB-45	Provide education to municipal departments and personnel	MS4 Permit, Section E.7 and Enhancement	Multiple training opportunities provided to municipal staff. Annual training is provided to PW department. Monthly code enforcement working group, weekly Community Development department, and weekly staff meetings provide opportunities to discuss storm water issues.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-46	Provide education opportunities to commercial businesses	MS4 Permit, Section E.7 and Enhancement	Education to businesses provided through storm water brochure provided during business license application and renewal. Education is also provided through inspections and enforcement actions.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
IB-47	Provide education to residents, general public, and school children	MS4 Permit, Section E.7 and Enhancement	The general public receives educational information in the City's website, quarterly EDCO newsletter, printed materials at offices, through community presentations, ILACSD school presentations, community events, regional events, and various other methods.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-48	Provide education to underserved community.	MS4 Permit, Section E.7 and Enhancement	Education materials are provided in both English and Spanish. The environmental division incorporates the underserved community in most education activities, which is particularly important to IB due to the large Spanish speaking community.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-49	Review printed storm water educational materials	MS4 Permit, Section E.7	Review printed materials such as brochures at least once per permit cycle.	City-wide	TBD	TBD	TBD	FY17	Ongoing	General Fund	Env Division
IB-50	Update electronic website information	MS4 Permit, Section E.7	Annually update storm water information on the City's website.	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-51	Encourage public participation in community events	MS4 Permit, Section E.7 and Enhancement	The City provides or supports multiple community clean up and awareness events throughout the year. Examples include: Creek to Bay, Tijuana River Action Month, Home Front Cleanup, Citywide Garage Sale, Fiesta del Rio, Sun and Sea Festival	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division
IB-52	Collaborate with regional education and outreach efforts	MS4 Permit, Section E.7	Collaborate with regional Copermittee education and outreach programs	City-wide	TBD	TBD	TBD	FY16	Ongoing	General Fund	Env Division

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
Additional Structural Strategies											
IB-53	Improvements to dirt alleys in the City	Enhancement	The unimproved dirt alleys in the City are a significant source of sediment tracking into the street and a major maintenance concern for the City and residents alike. The City is working on a phased program to improve the alleys that utilize a green streets approach to manage storm water runoff.	City-wide	Sediment	911.1	Optional	FY18	Ongoing	General Fund and Grants	Public Works
IB-54	Partner with State and Federal agencies to restore wetlands, native habitat, and enhance public access along San Diego Bay	Enhancement	Partner with FWS to enhance public access along San Diego Bay and continue existing partnerships on wetland restoration of the Salt Ponds in San Diego Bay and native habitat restoration of upland areas.	910.2	All	910.2	Optional	FY16	Ongoing	Grants	Public Works
IB-55	Partner with local, State, and Federal agencies to address binational pollution issue with the Tijuana River	Enhancement	The City participates in multiple collaborative efforts to address pollution concerns in the Tijuana River. Successful efforts include working partnerships with the Tijuana River Recovery Team, Tijuana River National Estuary Research Reserve Advisory Council, International Boundary and Water Commission Citizen's Forum, the International Boundary and Water Commission Treaty Minute, and EPA Border 2020 Program.	911.1	All	911.1	Optional	FY16	Ongoing	Grants, RWQCB, and legislation	Environmental Div
IB-56	Update Tijuana River plume tracking model	Enhancement	Work with Regional Board staff, County DEH, Scripps Institute of Oceanography, and local stakeholders to update the Tijuana River plume tracking model to help protect public health along the Imperial Beach shoreline.	Pacific Ocean	Bacteria		Optional	FY16	Needed	Grants and RWQCB	Environmental Div

Template ID	Strategy	Permit Reference	Implementation Approach/Level of Effort	Location (Sub watershed, Outfall, etc.)	Source (Pollutant, PGA, etc.)	Priority	Jurisdictional or Optional	Implementation Year (or Trigger if Optional)	Frequency of Implementation	Cost or Funding Strategy	Responsible City Department and Other Collaborating Departments or Agencies
IB-57	Elm Ave (Seacoast Dr. to 7th Ave) Street Improvements	Enhancement	The City received State grant funds for street improvements around Mar Vista High School to improve pedestrian safety. Trash and street flooding are known issues around the high school. The City will evaluate storm water drainage improvements and BMPs to control trash and other pollutants with the project.	911.1	Trash	TBD	Optional	FY18	Ongoing	General Fund and Grants	Public Works
IB-58	H-outfall drainage basin BMP study	Enhancement	The City's main commercial area along HWY 75 drains to the H-outfall, which is tidally impacted by the San Diego Bay. The drainage area is also extremely flat and subject to flooding. A study is needed to evaluate the appropriate BMP options to capture trash and other pollutants that will not contribute to the existing flooding concerns in the area.	910.2	Trash	910.2	Optional	FY17	Needed	General Fund	Public Works
IB-59	Implement storm water BMP recommendations for the H-outfall drainage basin BMP Study	Enhancement	The results of the BMP study will allow the City to prioritize the implementation of BMPs to control trash and other pollutants for the H-outfall drainage basin.	910.2	Trash	910.2	Optional	After completion of Study	Needed	General Fund and Grants	Public Works

Appendix H.2
City of San Diego Strategies, Schedules, and Funding Needs

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H.1 City of San Diego Strategies and Funding Needs

The City of San Diego (City) has identified water quality improvement strategies that are expected to provide the greatest benefits to the watershed and its residents, businesses, communities within the City's jurisdictional boundaries.

Strategies were selected by evaluating the following considerations, in descending priority:

- Potential to reduce pollutant loads for the highest priority condition condition(s)
- Potential to reduce loads for other pollutants (including priority water quality conditions)
- Cost effectiveness
- Feasibility and ease of implementation
- Social impacts and benefits
- Other[1] impacts and benefits

The strategies that provide the best value, most return on investment, and greatest range of benefits will be recommended, as needed, as the City moves forward in its water quality improvement efforts. The recommended strategies chosen will be consistent with those already identified in the Comprehensive Load Reduction Plans (CLRPs) for various TMDLs in the San Diego Region.

The City is currently developing a framework to evaluate potential other benefits the recommended strategies may provide beyond improved water quality. These additional benefits may be financial, environmental, or societal. The recommended strategies will be scored based on the number of other benefits they provide, and may guide future updates to the Water Quality Improvement Plan.

The cumulative storm water quality benefits of the recommended strategies identified in this Plan are needed to achieve the level of effort needed to demonstrate progress toward achieving the Water Quality Improvement Plan's (Plan) interim and final numeric goals. It is important to note that these strategies are subject to change through the iterative, adaptive management process set forth in this Water Quality Improvement Plan. Through the adaptive management process the City will be able to implement strategies and assess their impact to water quality and use new available information to refine, modify, remove, replace, or add strategies which will ensure the most effective suite of strategies are being implemented. Therefore, actual implementation of strategies is dependent upon both approval of funding in future annual budgets and adjustments that may occur as part of the iterative process.

[1] Other benefits refer to outcomes of a strategy beyond water quality improvements. Other benefits can include reduced air pollution, increased water conservation, watershed protection, public open space, aesthetics-induced property value increases, and increased business investments.

The recommended strategies will be implemented by the City; they are not intended to be implemented by private entities (e.g., development, business, industry, etc.). Some of the City's strategies, such as development planning, may have implications for private entities. The City has also developed a schedule as a best estimate of the shortest amount of time required to plan and implement the strategies. A compliance analysis using a watershed model was conducted to identify the strategies required to be implemented to meet interim and final goals. The adaptive management process provides the framework to evaluate progress toward meeting the goals and allows for modification of strategies. As strategies are modified, the compliance analysis will be updated as needed to provide assurance that numeric goals will be met.

Optional strategies are activities that may be implemented by the City at any time at its discretion. Unlike the recommended strategies, optional strategies have not been determined to be necessary in order to achieve the Plan's interim and final numeric goals.

The City's Storm Water Division leads the City's efforts to protect and improve water quality and reduce flood risk. These activities include but are not limited to: public education, employee training, water quality monitoring, source identification, code enforcement, watershed management, and Best Management Practices development/implementation within the City's jurisdictional boundaries. The Storm Water Division is also tasked with providing the most efficient storm drain system operation and maintenance services including inspection, maintenance, and repair of storm drain systems in the public right of way and drainage easements. The complete list of strategies undertaken by the Storm Water Division is presented in this section.

The City has developed projected funding needs that will be used to submit annual budget requests to secure the resources necessary to comply with the Municipal Permit. These funding needs include four general categories:

(1) Storm Water Division funding needs to implement day-to-day operational JRMP activities as required by Provision E in the Municipal Permit;

(2) Storm Water Division funding needs for flood risk management programs associated with the JRMP, such as infrastructure repair and replacement;

(3) Storm Water Division funding needs for activities managed by the Storm Water Division to meet the goals identified in the WQIP; and

(4) Funding needs for City departments and divisions other than the Storm Water Division to implement day-to-day operational JRMP activities, as required by the Municipal Permit. Examples of JRMP activities include administration, training, and best management (BMP) implementation.

The City's Storm Water Division funding needs (which represent the first three categories above) are presented below as "City of San Diego" funding needs, but do not include funding needs for other City departments and divisions to implement required JRMP activities (category four above) because the recommended strategies included in this plan only apply to the City's

Storm Water Division. For more information about the funding needs for non-Storm Water Division departments and divisions, please refer to the fiscal analysis in the City's Jurisdictional Runoff Management Plan (Section 10). Table H-1 presents the projected funding needs to implement the Tijuana River WMA Water Quality Improvement Plan through FY40. The compliance period for Tijuana River WMA is through FY40, when the final goals are expected to be met. Twenty five year funding needs (FY16 - FY40) for the Tijuana River WMA are presented for JRMP activities, flood risk management programs, and Water Quality Improvement Plan activities by funding source: the City's General Fund (GF) or Capital Improvement Projects (CIP) funds. The General Fund is generally used for nonstructural strategies, design support, and operations and maintenance (O&M) of structural projects. CIP funding is used during the design and construction phase of structural projects. The source of the funding needs is the Storm Water Division's 2015 Watershed Asset Management Plan (WAMP) Cost Update, which will be made available on the Storm Water Division's website[2] in July 2015.

Figure H-1 illustrates the projected fiscal year annual funding needs over the 25-year compliance period for the Storm Water Division to implement its JRMP activities, flood risk management programs, and Water Quality Improvement Plan activities in the Tijuana River WMA. Figure H-2 shows the projected fiscal year GF and CIP funding needs for each of these years. Figure H-3 and Figure H-4 show the projected fiscal year GF and CIP funding needs, respectively, by category for each of these years.

The recommended strategies selected are presented in Table H-1. The City's schedule table is found Table H-2.

[2] http://www.sandiego.gov/stormwater/plansreports/

Table H-1
City of San Diego Projected Fiscal Year Funding Needs by Funding Source and Category for the Tijuana River WMA (FY16-40)1

General Fund	
Water Quality Improvement Plan	$14,229,156
JRMP	$63,013,719
Flood Risk Management	$53,439,279
Sub Total General Fund	$130,682,154
CIP	
Water Quality Improvement Plan	$0
JRMP	$0
Flood Risk Management	$26,756,432
Sub Total CIP	$26,756,432
Total	
25 FY Tijuana River WMA Total Need	$157,438,586

1. Does not include funding needs for other City of San Diego Departments or Divisions to implement JRMP required activities.

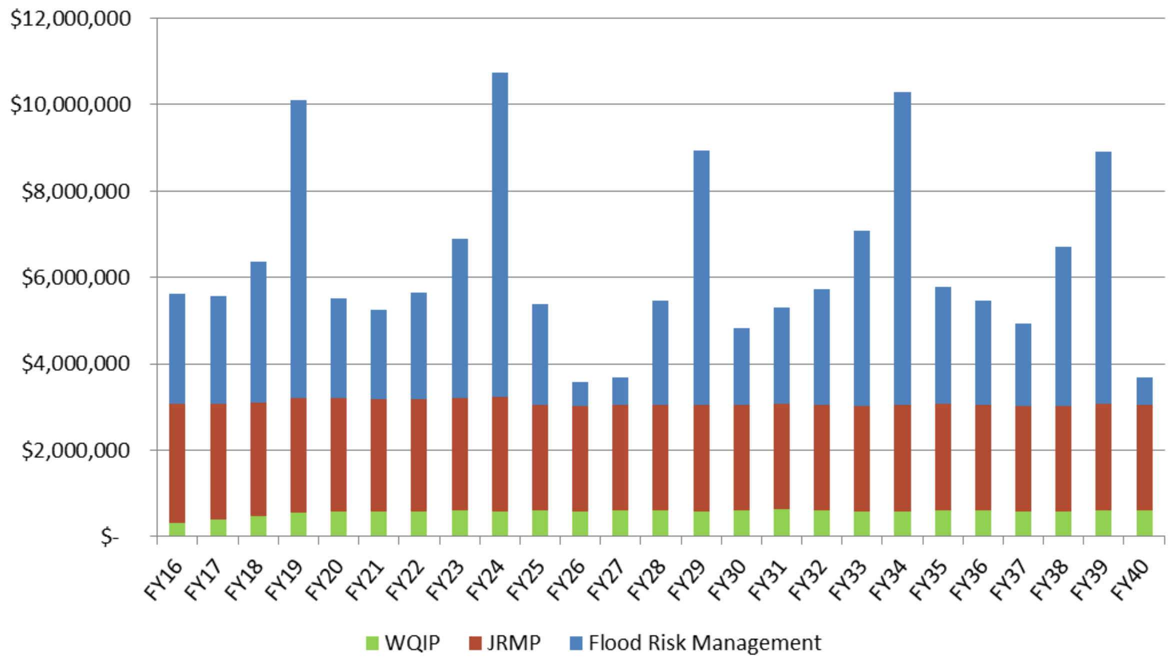

Figure H-1
City of San Diego Projected Fiscal Year Annual Funding Needs by Category for the Tijuana River WMA

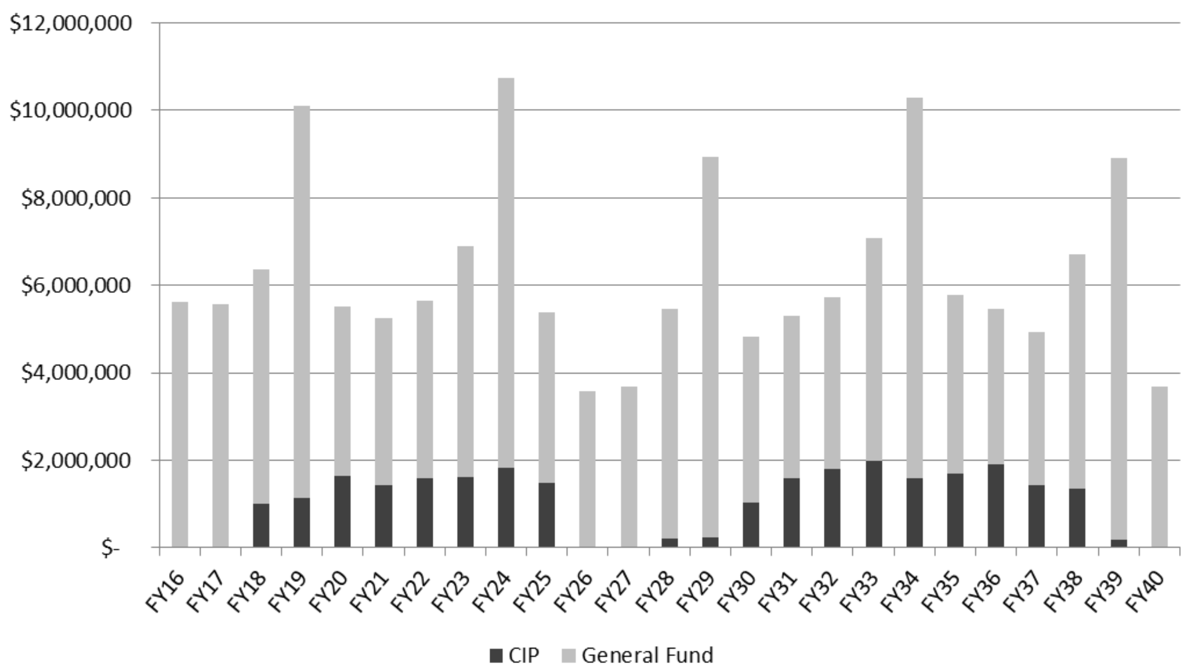

Figure H-2
City of San Diego Projected Fiscal Year Annual Funding Needs by Funding Source for the Tijuana River WMA

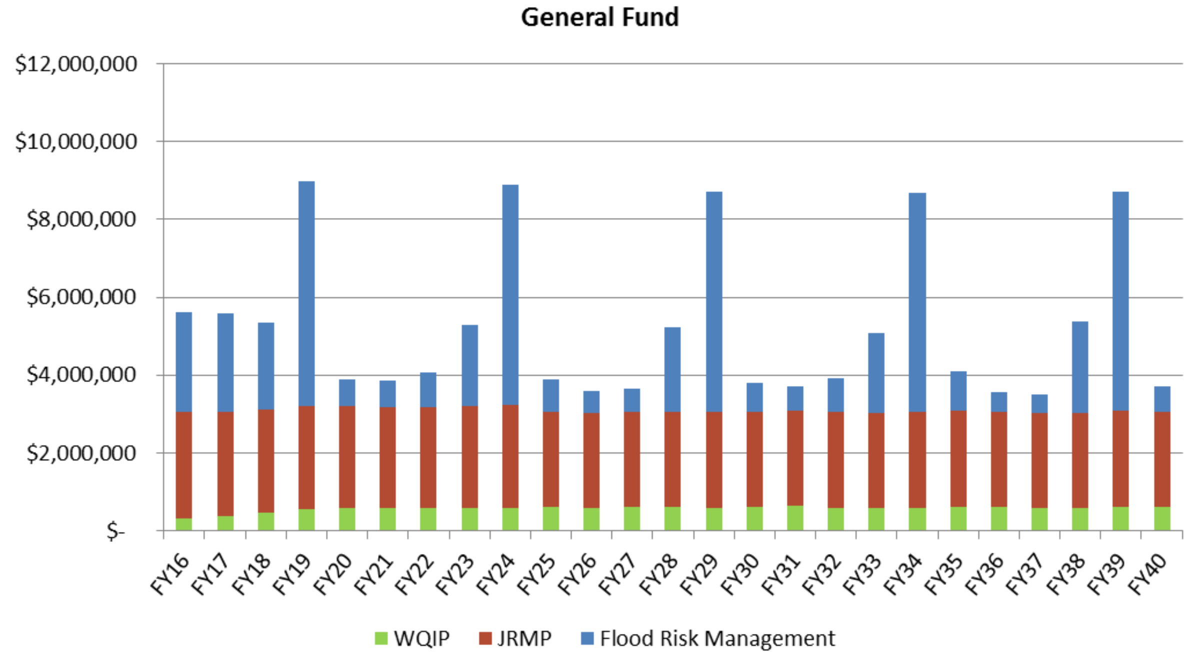

Figure H-3
City of San Diego Projected Fiscal Year Annual General Fund Funding Needs for the Tijuana River WMA

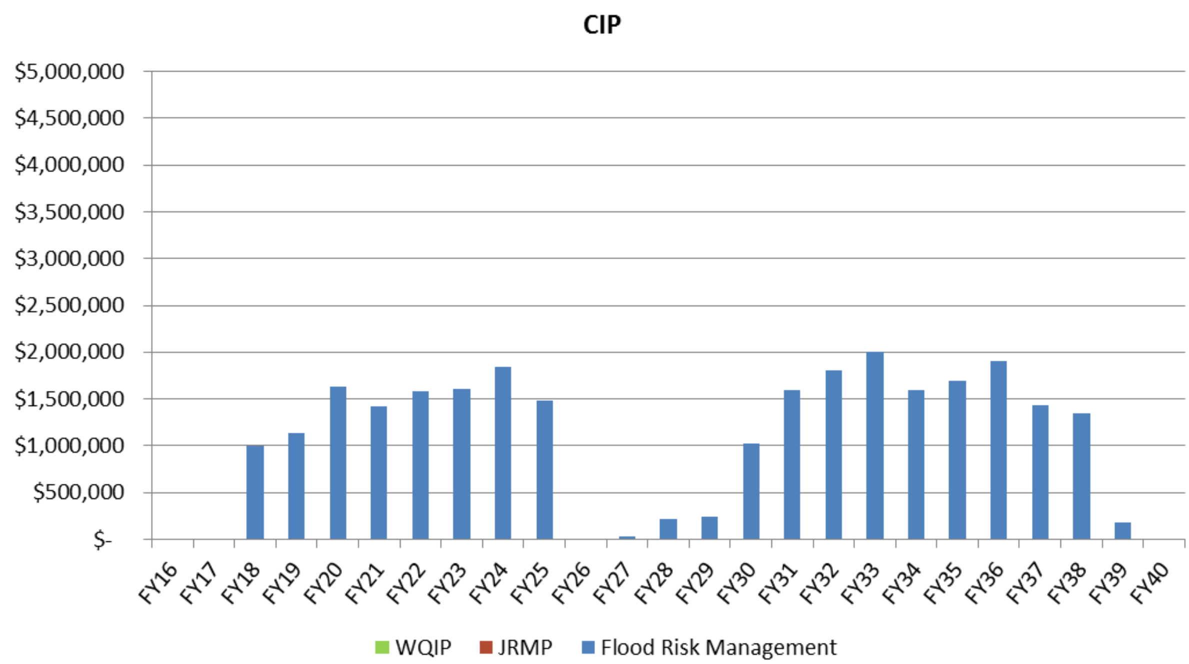

Figure H-4
City of San Diego Projected Fiscal Year Annual CIP Funding Needs for the Tijuana River WMA

Table H-1 City of San Diego Jurisdictional Strategies

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
Jurisdictional Strategies						
Development Planning						
All Development Projects						
CSD-1	Establish guidelines and standards for all development projects; provide technical support related to implementation of source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area or implement easements to protect water quality, where applicable and feasible. Includes internal coordination and collaboration between City departments (DSD, PWD, and Engineering) to improve success and long-term benefits of BMPs.	Refer to JRMP Section 4.	City-wide	Prior to FY16	Ongoing	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-1.1	Investigation and research of emerging technology.	Annually the Construction & Development Standards Group identifies new tasks to conduct literature review, communication with researchers outside of the City, physical testing and experimentation of new or emerging technologies, and other research with the goal of updating tools available for reducing pollutant loads from development and redevelopment sites.	City-wide	Prior to FY16	As needed	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-1.2	Approve and implement a green infrastructure policy.	The City will begin developing a policy in FY16 that will increase the green infrastructure requirements for City CIP projects. This policy will be coordinated with ongoing efforts to update City design manuals and LID design standards for public LID BMPs.	City-wide	FY16 (Begin)	As needed	T&SW with DSD and PWD
CSD-1.3	Develop Design Standards for Public LID BMPs.	Improve quality of design to ensure efficiency and reliability in public designs.	City-wide	FY14-FY15	As needed	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-1.4	Outreach to impacted industry regarding minimum BMP requirement updates.	Affects commercial, industrial, and residential development.	City-wide	FY15	As needed	TBD
CSD-2	Train staff on LID regulatory changes and LID practices.	Formal training is required for all staff involved in development plan review to increase knowledge of LID BMPs. Goal of training associated with LID practices and regulations is to promote LID implementation and to avoid adverse conditions such as trees planted within swales, or planned drainage patterns which obstruct or inhibit LID performance.	City-wide	FY16	As needed	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-3	Amend municipal code and ordinances, including zoning ordinances, to facilitate and encourage LID opportunities to support compliance with the MS4 Permit and TMDLs in a reasonable manner. Ensure consistency with the City of San Diego's BMP Design Manual. Update the Storm Water Standards Manual accordingly.	Municipal codes and ordinances will be brought to City Council for consideration to encourage LID implementation (e.g., runoff detention and filtration using natural filters and stormwater retention for reuse). LID stormwater management will be encouraged in proposed codes and ordinances associated with development and redevelopment projects, which are brought to City Council for consideration.	City-wide	FY15	As needed	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-4	Create a manual that outlines right-of-way design standards.	Create a manual that includes flood control performance standards, permanent BMP elements design standards, design standards for green streets and other BMPs, and maintenance access. Provides drainage and streets design standards. Opportunity to merge various existing manuals and provide consistency.	City-wide	FY15	One time	T&SW with DSD and PWD

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
CSD-5	Provide technical education and outreach to the development community on the design and implementation requirements of the MS4 Permit and Water Quality Improvement Plan requirements.	Technical education and outreach to the development community includes outreach on design standards, City design manuals, and the WMAA.	City-wide	Prior to FY16	Ongoing	T&SW with DSD
Priority Development Projects (PDPs)						
CSD-6	For PDPs, provide technical support to other City departments to ensure implementation of on-site structural BMPs to control pollutants and manage hydromodification by developing City wide storm water development standards and design guidelines.	Coordinate with other City departments to promote and confirm a thorough understanding of requirements for implementing structural BMPs that control pollutants and manage hydromodification. Included in that understanding are requirements to confirm proper design and construction through processes controlled by other City departments.	City-wide	FY16	Ongoing	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-6.1	Institute a program to verify and enforce maintenance and performance of treatment control BMPs.	Refer to JRMP Section 4.5.	City-wide	FY16	Ongoing	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-7	Update BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs.	Refer to JRMP Section 4.	City-wide	FY15	Every 5 years/ permit cycle	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-7.1	Amend BMP Design Manual for trash areas. Require full four-sided enclosure, siting away from storm drains and cover. Consider the retrofit requirement.	Amend BMP Design Manual and zoning standards/requirements which address reduction of pollutants for common areas of trash build-up (e.g. restaurants, supermarkets, "big box" retail stores with food, pet stores). Most effective method for source control of bacteria and trash is to employ four-sized trash enclosures with a cover over trash areas.	City-wide	FY15	One time	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-7.2	Amend BMP Design Manual for animal-related facilities, such as such as animal shelters, "doggie day care" facilities, veterinary clinics, breeding, boarding and training facilities, groomers, and pet care stores.	Amend BMP Design Manual and zoning requirements (including retrofits) to provide supplemental standards for animal facilities (including animal shelters, dog daycares, veterinary clinics, groomers, pet car stores, and breeding, boarding, and training facilities). Supplemental standards may include requiring covered trash enclosures, identification of landscaped relief areas on site plans, ensuring drainage connections and treatment swales for areas that will not drain to the sanitary sewer, as well as inspection of grading, drainage, and landscaping for outdoor exercise areas.	City-wide	FY15	One time	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-7.3	Amend BMP Design Manual for nurseries and garden centers.	Amend BMP Design Manual to provide supplemental standards for plant nurseries and garden centers. Standards will focus on reducing irrigation runoff, and loading of sediment, pesticides, and nutrients. Measures may include: covered outdoor storage, green waste management BMPs, improved irrigation efficiency to reduce dry-weather runoff, and containment of runoff from impervious areas where plants and materials are stored.	City-wide	FY15	One time	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-7.4	Amend BMP Design Manual for auto-related uses.	Amend BMP Design Manual to provide supplemental standards for automotive-related uses to reduce loading of metals, oils, grease, and trash. Measures may include: four-sized covered trash enclosures, and careful review of auto-related usage areas (e.g. garage bays at repair shops) for grading, drainage, and drain connections to sanitary sewer systems.	City-wide	FY15	One time	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
CSD-8	Develop and administer an alternative compliance program for on-site structural BMP implementation (includes identifying Watershed Management Area Analysis [WMAA] candidate projects). Refer to Section 4.2.5.	Refer to JRMP Section 4.2.3.1.	City-wide	FY15	Ongoing	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-8.1	Create a fund that allows habitat acquisition, protection enhancement, and restoration in conjunction with other cooperating entities including community groups, academic institutions, state county, and federal agencies, etc.	This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) funding to address MS4 discharges is identified and secured, 2) staff resources are identified and secured, 3) partners have been identified and formal MOUs have been developed, and 4) consensus and community support has been achieved.	City-wide	Optional	TBD	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
Construction Management						
CSD-9	Coordinate with other City departments to promote and confirm a thorough understanding of requirements for implementing temporary BMPs that control sediment and other pollutants during the construction phase of projects. Included in that understanding are requirements to inspect at appropriate frequencies and effectively enforce requirements through process controlled by other City departments.	Refer to JRMP Section 5.	City-wide	FY16	Ongoing	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
Existing Development						
Commercial, Industrial, Municipal, and Residential Facilities and Areas						
CSD-10	Administer a program to require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of existing development at appropriate frequencies and using appropriate methods.	Refer to JRMP Sections 6, 7, and 8.	City-wide	FY16	Ongoing	T&SW with DSD, PUD, & PWD
CSD-10.1	Update minimum BMPs for existing residential, commercial, and industrial development. Specific updates to BMPs include required street sweeping, catch basin cleaning, and maintenance of private roads and parking lots in targeted areas.	Refer to JRMP Appendix IX.	City-wide	FY15	Every 5 years	T&SW
CSD-10.2	Outreach to property managers and trash haulers to elevate the emphasis of power washing as a pollutant source.	Emphasis will be placed on non-compliant washing as an enforceable violation.	City-wide Residential, commercial and industrial areas	FY15	Ongoing	T&SW
CSD-10.3	Implement property based inspections.	Property-based inspections increase awareness and responsibility for individual properties to tackle issues associated with trash, landscapes, and parking areas. Expanding beyond the business-level inspections will achieve different and more effective opportunities for education, outreach, inspection, and enforcement to encourage water conservation strategies.	City-wide	Prior to FY16	Ongoing	T&SW
CSD-10.4	Review policies and procedures to ensure discharges from swimming pools meet permit requirements.	Verify and bring to City Council for consideration an update (as needed) for the City's Municipal Code (43.0301) to meet new permit requirements for swimming pool discharges.	City-wide	FY15	As needed	T&SW, City Attorney (Civil & Criminal)

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CSD-11	Promote and encourage implementation of designated BMPs for residential and non-residential areas.	Landscape-based rebates are a "gateway" for adoption of other beneficial practices and are one of the nonstructural methods which address impacts from single-family residential areas (City of San Diego 2011 program development background study). Residential incentives can include: education and training (neighborhood watershed field days), and aggressive subsidies or rebates for grass replacement and rainwater harvesting. Existing programs will be expanded overall, and also have targeted expansion within specific subwatershed, particularly with highest water quality priority conditions.	City-wide Residential and Commercial Areas	Prior to FY16	Ongoing	T&SW with DSD, PUD, PWD, MWD, CWA & local water agencies
CSD-11.1	Residential and Commercial BMP: Rain Barrel	The existing PUD rebate program will continue for residential properties and expand for commercial properties for water collection, conservation, and reuse with rain barrels.	City-wide Residential Areas	Prior to FY16	Ongoing	T&SW with DSD, PUD, PWD, & local water agencies
CSD-11.2	Residential and Commercial BMP: Grass Replacement	The existing PUD grass replacement cash rebate program will continue and expand for residential and commercial properties. Program encourages a reduction in water use through the conversion of non-artificial grass to water wise plant material, while maintaining a high level of living landscape to benefit the environment. Program does not allow for conversion to artificial turf.	City-wide Residential and Commercial Areas	Prior to FY16	Ongoing	T&SW with DSD, PUD, PWD, & local water agencies
CSD-11.3	Residential and Commercial BMP: Downspout Disconnect	Disconnecting downspouts provide alternate runoff pathways from rooftops, sidewalks, driveways, and roads. Disconnecting downspouts from residential areas to pervious land can allow for depression storage and infiltration.	City-wide Residential and Commercial Areas	FY16	Ongoing	T&SW with DSD, PUD, PWD, & local water agencies
CSD-11.4	Residential and Commercial BMP: Microirrigation	The existing PUD micro-irrigation rebate program will continue and increase for residential and commercial properties. Application of microirrigation aims to improve the efficiency of landscape irrigation through the precise application of water.	City-wide Residential Areas	Prior to FY16	Ongoing	T&SW with DSD, PUD, PWD, & local water agencies
CSD-11.5	Provide Onsite Water Conservation Surveys.	Provide free onsite water conservation surveys to commercial and residential customers to reduce overirrigation and to encourage water conservation.	City-wide Residential and Commercial Areas	Prior to FY16	Ongoing	T&SW with DSD, PUD, PWD, & local water agencies
MS4 Infrastructure						
CSD-12	Implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, channels as allowed by resource agencies, detention basins, pump stations, etc.) for water quality improvement and for flood control risk management.	Refer to JRMP Section 7.	City-wide	FY16	Ongoing	T&SW
CSD-12.1	Enhanced catch basin cleaning to increase pollutant removal (between 2-4 times per year in medium priority areas in the rainy season).	To increase pollutant load removal, catch basins will be cleaned between 2-4 times per year in medium priority areas in the rainy season. The City of San Diego's pilot study found that major pollutants may vary from neighborhood to neighborhood (yard waste versus trash and sediment). Implementation may be adapted based on catch basin record keeping and cleaning optimization. Increase in frequency will be phased over 4 Fiscal Years.	Tijuana River WMA: Medium priority areas identified in pilot study	FY16	Ongoing	T&SW

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
CSD-12.2	Increased frequency of catch basin inspection and as-needed cleaning.	For every segment of channel that is cleared, the City will conduct an inspection and as-needed cleaning of every catch basin within 100 feet of the cleared segment of channel. Additional inspection and as-needed cleaning will occur every three months for one year after the segment of channel is cleared.	Tijuana River WMA (15 open channel segments)	FY13	5 years (ends FY18)	T&SW
CSD-12.3	Proactively repair and replace MS4 components to provide source control from MS4 infrastructure.	In order to limit inflow of pollutants and reduce pollutant loads, proactive measures will be taken to improve, repair, and replace MS4 components. The City of San Diego will start a multi-year program of repairing and replacing storm drain pipes to reduce sediment loading to the MS4. Development of an assessment management program and bond issues will be addressed. Exploration of daylighting pipes will take place where feasible and appropriate.	City-wide	FY16	Ongoing	T&SW
CSD-12.4	Replacement of hard assets including storm drains and structures.	Refer to JRMP Section 7.	City-wide	FY16	Ongoing	T&SW
CSD-13	Coordinate with other City departments (PUD) to implement controls to prevent infiltration of sewage into the MS4 from leaking sanitary sewers.	Refer to JRMP Section 7.	City-wide	FY16	Ongoing	T&SW with PUD
CSD-13.1	Identify sewer leaks and areas for sewer pipe replacement prioritization.	Risk assessment to include identifying targeted areas (age, location, proximity to MS4), coming up with methodology, pilot, desktop exercise/analysis.	City-wide	FY16	As needed	T&SW with PUD
Roads, Street, and Parking Lots						
CSD-14	Implement operation and maintenance activities for public streets, unpaved roads, paved roads, and paved highways.	Refer to JRMP Section 7.	City-wide	FY16	Ongoing	T&SW
CSD-14.1	Initiate sweeping of medians on high-volume arterial roadways.	Medians of roadways are also a potential source of pollutants. Consider implementing or increasing sweeping of medians. Consider mechanical and hand sweeping techniques.	City-wide	FY17	Ongoing	T&SW
CSD-14.2	Implement additional street sweeping (Settlement Agreement).	City shall increase street sweeping frequency by prioritizing high traffic commercial routes adjacent to maintained channel with vacuum-assisted sweeper for every 400 linear feet of vegetation that is removed (except for removal of invasive species, e.g., Arundo) within a drainage area. Sweeping shall be conducted in median areas that are not subject to regular sweeping routes, and shall occur at a frequency of at least once per quarter for one calendar year after maintenance.	Tijuana River WMA	FY13	5 years (ends FY18)	T&SW
Pesticide, Herbicides, and Fertilizer BMP Program						
CSD-15	Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications.	Refer to JRMP Sections 7, 8, and 9.	City-wide	FY16	Ongoing	T&SW with Parks and Rec

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
Retrofit and Rehabilitation in Areas of Existing Development						
CSD-16	Develop and implement a strategy to identify candidate areas of existing development appropriate for retrofitting projects and facilitate the implementation of such projects.	Refer to JRMP Appendix XIX. The Offsite Alternative Compliance Program will include methods for identifying and assessing potential retrofit projects in existing development areas. Retrofit project selection will be based upon a variety of factors including proximity to high priority water quality conditions, potential pollutant load removal effectiveness, and feasibility of implementation. The program will include protocols related to funding mechanisms for project construction and long-term maintenance, payment and credit structures, and water quality equivalency standards.	City-wide	TBD	Ongoing	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-17	Develop and implement a strategy to identify candidate areas of existing development for stream, channel, or habitat rehabilitation projects and facilitate implementation of such projects.	Refer to JRMP Appendix XIX. The Offsite Alternative Compliance Program (Appendix I) will include methods for identifying and assessing potential stream, channel, or habitat rehabilitation projects in existing development areas. Rehabilitation project selection will be based upon a variety of factors including existing stream or habitat degradation, potential future cumulative stream or habitat impacts, and feasibility of implementation. The program will include protocols related to funding mechanisms for project construction and long-term maintenance, payment and credit structures, and water quality equivalency standards.	City-wide	TBD	Ongoing	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
Illicit Discharge, Detection, and Elimination (IDDE) Program						
CSD-18	Implement Illicit Discharge, Detection, and Elimination (IDDE) Program per the JRMP. Requirements include: maintaining an MS4 map, using municipal personnel and contractors to identify and report illicit discharges, maintaining a hotline for public reporting of illicit discharges, monitoring MS4 outfalls, and investigating and addressing any illicit discharges.	Refer to JRMP Section 3.	City-wide	Prior to FY16	Ongoing	T&SW
Public Education and Participation						
CSD-19	Implement a public education and participation program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences.	Refer to JRMP Section 9.	City-wide	Prior to FY16	Ongoing	T&SW
CSD-19.1	Continue implementation of a Pet Waste Program.	Pet Waste Program includes outreach on "Scoop the poop", installation of posts for dispensers, distribution of lawn signs, and attendance at dog-related community activities.	City-wide	Prior to FY16	Ongoing	T&SW with Parks and Rec
CSD-19.2	Promote and encourage implementation of designated BMPs in commercial and industrial areas.	Provide education and outreach on BMPs for commercial businesses and industrial facilities.	City-wide Non-residential Areas	Prior to FY16	Ongoing	T&SW with PUD; Funding: Prop 84 and water districts (MWD)

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
CSD-19.3	Expand outreach to homeowners' association (HOA) common lands and HOA incentives.	Approaches to consider include: offering incentives to HOAs and maintenance districts to adopt water-conserving/efficiency and stormwater-reduction changes to their landscapes, irrigation, and maintenance; conducting workshops with property managers; providing supplemental standards, inspection, or enforcement for HOA-managed properties.	City-wide	FY16	Ongoing	T&SW
CSD-19.4	Develop an outreach and training program for property managers responsible for HOAs and maintenance districts.	Approaches to engage HOAs and property managers include: conducting workshops with property managers, providing supplemental standards, inspections or enforcement around HOA properties, and offering incentives to HOAs and maintenance districts to adopt changes to landscapes, irrigation, or maintenance which promote water conservation or stormwater reduction. Property managers are also a target for enhanced outreach.	City-wide	FY16	Ongoing	T&SW
CSD-19.5	Enhance and expand trash cleanups through community-based organizations involving target audiences.	Increase effectiveness and reach of trash/beach cleanups and community based efforts by engaging community groups to self-define and carry-out trash clean-ups. Longstanding partnerships and sponsorships with I Love A Clean San Diego and others are recommended to be continued and enhanced. To effectively target stream clean-up efforts, focus on partnerships with community organizations which provide strong engagement with target audiences and communities.	City-wide	FY16	Ongoing	T&SW; Park and Rec
CSD-19.6	Improve consistency and content of websites to highlight enforceable conditions and reporting methods.	Websites will be updated to provide a user-friendly format and clarity for stormwater violations, conditions which citizens can and should report, and how to make such reports. Examples of reports for common incidents will be developed and posted which may vary locally and regionally. Photographs of allowable practices as well as illegal practices should be shown for utmost clarity. Displaying hotline numbers prominently on the website and near the photographs of illegal practices will ensure that those seeking to report will be able to do so easily. Also ensure hotline number and website are searchable and can be retrieved by simple internet searches.	City-wide	Prior to FY16	Ongoing	T&SW
CSD-19.7	Develop a targeted education and outreach program for homeowners with orchards or other agricultural land uses on their property.	Educate residents on practices of small-scale or on-site composting to protect local water quality. May include targeted education of owners of chickens. Outreach can be coordinated through the San Diego County Agriculture, Weights, and Measures division. This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) funding to address MS4 discharges is identified and secured and 2) staff resources are identified and secured.	Tijuana River WMA	Optional	TBD	T&SW with County of San Diego Ag, Weights, and Measures
CSD-19.8	Enhance school and recreation-based education and outreach.	Develop curriculum and establish distribution in public schools. Includes education on water conservation.	City-wide	FY15	Ongoing	T&SW, PUD with community-based organization
CSD-19.9	Develop education and outreach to reduce irrigation runoff.	Example approaches to reduce or eliminate irrigation runoff may include: education and outreach, prohibition, enhanced enforcement of existing prohibitions, and pilot projects such as the City of Del Mar's pilot door hanger project.	City-wide	Prior to FY16	Ongoing	T&SW with PUD

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
CSD-19.10	Develop regional training for water-using mobile businesses.	Consider development of supplemental standards for mobile businesses including: covered trash enclosures, careful review of washing areas (grading, drainage, landscaping, sanitary sewer system connectivity), and appropriate signage (either through zoning for retrofits or "best fix" approaches, or through BMP Design Manual standards). Businesses may include carpet cleaners, tile installers, plumbers, etc.	City-wide	FY16	Ongoing	T&SW
CSD-19.11	Enhance education and outreach based on results of effectiveness survey and changing regulatory requirements.	Use effectiveness surveys to enhance existing education and outreach programs while proactively keeping up with and incorporating changing regulatory requirements.	City-wide	FY16	Ongoing	T&SW
CSD-19.12	Continue to promote and encourage implementation of Integrated Pest Management (IPM) for residents and businesses.	The City will continue to provide education on IPM techniques during presentations and on the City's Think Blue website.	City-wide	Prior to FY16	Ongoing	T&SW
Enforcement Response Plan						
CSD-20	Continue to implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Storm Water Code Enforcement Unit's Standard Operating Procedures (SOPs) - Enforcement Response Plan.	Refer to JRMP Appendix XIII.	City-wide	Prior to FY16	Ongoing	T&SW with PUD, other City enforcement compliance programs
CSD-20.1	Increase enforcement of irrigation runoff.	Increased enforcement policies against irrigation runoff will be established in tandem with the education and outreach programs on how these actions lead to pollutant loading. By shifting to property-based inspections irrigation runoff can be handled as enforceable violations once the public is well-informed.	City-wide	FY16	Ongoing	T&SW
CSD-20.2	Increase enforcement of water-using mobile businesses.	In addition to education, pollution associated with mobile business sources can be handled through policy, code development, inspections of business practices, and enforcement.	City-wide	FY16	Ongoing	T&SW
CSD-21	Increase enforcement of all minimum BMPs for existing residential, commercial, and industrial development.	Increased enforcement of existing development minimum BMPs.	City-wide	FY16	As needed	T&SW
CSD-22	Increase enforcement associated with property-based inspections.	Shifting inspections from businesses-specific to property-based will increase effectiveness and sense of responsibility and ownership. Education and outreach must be followed up with inspection and enforcement of regulations to encourage proper landscape and water conservation strategies.	City-wide	FY16	Ongoing	T&SW
CSD-23	Increase enforcement of sweeping and maintenance of private roads and parking lots in targeted areas.	Refer to Minimum BMPs in JRMP (Appendix IX).	City-wide	FY16	Ongoing	T&SW
CSD-24	Increase identification and enforcement of actionable erosion and slope stabilization issues on private property and require stabilization and repair.	Eroding and unstable slope areas on private property (excluding construction sites) will be identified as potential sediment loading sources and subject to enforcement. In the short term, this will target enhanced inspection and enforcement programs to ensure inspectors address erosion and slope instability for the purpose of education.	City-wide	FY16	Ongoing	T&SW

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
Additional Nonstructural Strategies						
CSD-25	Conduct a Comprehensive Benefits Analysis to identify benefits other than water quality that are applicable to each of the specific WQIP strategies.	The analysis identifies which other benefits apply to each strategy, and documents the assumptions making those linkages. The delineation of other benefits to strategies includes a general description of each benefit, and a listing of the assumptions that were made to link those benefits to strategies. In addition, the other benefits are characterized with respect to who is directly affected: the city, local residents, local businesses, or visitors. This analysis may be used as part of the adaptive management process to modify future strategies.	City-wide	FY15	One time	T&SW
CSD-26	Address and clean up trash from transient encampments with collaboration from the Homeless Outreach Team.	Coordinate with the Homeless Outreach Team to respond to transient encampment trash complaints.	City-wide	FY16	Ongoing	T&SW with Police, ESD, Urban Corps, Alpha Project
CSD-27	Continue participating in source reduction initiatives.	Source reduction initiatives are ultimately the most effective measure to remove pollutants from surface waters, where feasible. Bans or progressive phase-outs that may be considered include: leaf blowers, plastic bags, architectural copper (generally a legacy issue), as well as prohibiting or more aggressively regulating vehicle washing. Additional source reduction initiatives to consider include pesticide sales at hardware stores and irrigation supply stores.	City-wide	Prior to FY16	Ongoing	T&SW
CSD-27.1	Coordinate with Fleet Services to replace City-owned vehicle brake pads with copper-free brake pads as they become commercially available.	Consider legislative mandate and cooperative implementation of copper-free brake pads on city-owned vehicle to reduce pollutant deposition.	City-wide	FY18	Ongoing	T&SW, ESD with PWD (Fleet Services)
CSD-28	Proactively monitor for erosion, and complete minor repair and slope stabilization on municipal property.	Actively identify and repair eroding slopes that may be contributing to sediment loading. Prepare an inventory and assessment of eroding areas and their risk to surface waters. Follow assessment with a schedule for ongoing inspection and stabilization (potentially based on a number or percentage of sites annually). Consider Caltrans program as a template.	City-wide	FY16	Ongoing	T&SW
CSD-29	Lower Tijuana River WMA Sediment Source Characterization Study	The study will provide an inventory and descriptions of sediment sources in the lower Tijuana River Watershed Management Area. The study will utilize a combination of pre-and post-storm visual observations and sediment load measurements. The study will focus on municipal properties; unmaintained yards; dirt roads, trails, and unpaved alleys; large commercial areas; and other significant developed or impervious areas. The study will build upon the findings of the Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash TMDLs (2010).	Tijuana River WMA	FY16	One time	T&SW, TJ WMA Copermittees
CSD-29.1	Participate in Reference Watershed Study.	The San Diego Regional Reference Stream Study (currently being conducted by the Southern California Coastal Water Research Project). The study will develop numeric targets that account for “natural sources” to establish the concentrations or loads from streams in a minimally disturbed or “reference” condition. Refer to Section 5.1 for further details.	Region-wide	Prior to FY16	One time	T&SW, SCCWRP, Regional copermittees
CSD-29.2	Conduct a Cost of Service Study.	Conduct a Cost of Service Study that will examine the full cost of flood control and storm water strategies needed to comply with storm water regulations for the City of San Diego. The City of San Diego’s Watershed Asset Management Plan will be used as the basis for the study.	City-wide	FY16	One time	TBD

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
CSD-30	Conduct Sustainable Return on Investment (SROI) analysis to estimate strategies' co-benefits and impacts to the public and the private sector on a common scale.	SROI is an economics-based framework for evaluating quantitative and qualitative performance metrics and monetizing them, if possible, along a triple bottom line (i.e. financial, societal, and environmental). This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) funding to address MS4 discharges is identified and secured, 2) staff resources are identified and secured, 3) partners have been identified and formal MOUs have been developed, and 4) consensus and community support has been achieved.	City-wide	Optional	TBD	T&SW and public participation
CSD-31	Collaborate with the County, if a County-led regional social services effort is established, to provide sanitation and trash management for individuals experiencing homelessness and determine if the program is suitable and appropriate for jurisdictional needs to meet goals.	Support a non-profit or consortium to provide sanitation services associated with hygiene as well as trash management for persons experiencing homelessness. Rented or purchased shower/sanitary trailers providing mobile showers may be organized at specifically scheduled locations and times. This provision has been proposed as a method for preventing surface water usage for sanitation and bathing, as well as opportunity for outreach and referral by social service agencies. The trash management services will include providing trash bags, trash collection areas, and shower/sanitary facilities at centers which provide daytime shelter to their clients, or on a mobile-basis for known transit camps. This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) funding to address MS4 discharges is identified and secured, 2) staff resources are identified and secured, 3) partners have been identified and formal MOUs have been developed, and 4) consensus and community support has been achieved.	City-wide	Optional	TBD	T&SW
CSD-32	Identify strategy, resources, and funding to support mapping and assessment of agricultural operations.	Prepare and maintain an inventory of the locations of agricultural operations. Identify agricultural land close to receiving waters and/or MS4 system and conducting a site reconnaissance to assess if discharges are likely to occur and develop a series of follow-up actions specific to those risks. Coordinate with other City of San Diego departments that own and lease land for agricultural uses. This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) funding to address MS4 discharges is identified and secured and 2) staff resources are identified and secured.	Tijuana River WMA	Optional	TBD	PUD with T&SW
CSD-33	Participate in an assessment to determine if implementation of an urban tree canopy (UTC) program would benefit water quality and other City goals, where feasible.	Perform a feasibility study to determine if implementing an UTC program would be beneficial to the City's goals. UTC intercepts rainfall through increased coverage of leaves, branches, and stems and reduces runoff from the storm drainage system. Benefits associated with enhancing an UTC include reducing heat island effects and air pollution in addition to aesthetics and community benefits. Where feasible, native trees will be utilized to prevent invasive trees from migrating to open spaces and to conserve water. This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) funding to address MS4 discharges is identified and secured and 2) staff resources are identified and secured.	City-wide	Optional	TBD	Planning Dept. with T&SW, SANDAG, and Nature Conservancy

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
CSD-34	Conduct a feasibility study to test Permeable Friction Course (PFC), a porous asphalt that overlays impermeable asphalt.	Perform an assessment to determine the feasibility of implementing PFC on City streets. PFC, an overlay of porous asphalt, is an innovative roadway material that improves driving conditions in wet weather and water quality. Placed in a layer 25-50mm thick on top of regular impermeable pavement, PFC allows rainfall to drain within the porous layer rather than on top of the pavement. PFC has also been shown to reduce concentrations of pollutants commonly observed in highway runoff. PFC incorporates stormwater treatment into the roadway surface and does not require additional right-of-way. This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) funding to address MS4 discharges is identified and secured and 2) staff resources are identified and secured.	City-wide	Optional	One time	T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community
CSD-35	As opportunities arise and funding sources are identified, protect areas that are functioning naturally by avoiding impervious development and degradation on unpaved open space areas, creating permanent open space protections on undeveloped city-owned land, and accepting privately-owned undeveloped open areas.	This strategy may be implemented if there is interest in participation by the public or private entity with current control of the land. This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) identification of partners, if needed (public, private, non-profit), 2) identification of costs and potential sources of funding, 3) final agreement by public or private entity with current control of the land, 4) final agreement by all other participating partners including acceptance by intended land- or asset-owning City department, and 5) funding in place.	City-wide	Optional	TBD	TBD
CSD-36	Participate in a watershed council or group if one is established.	This strategy may be implemented at any time at the City's discretion if the following triggers are met: 1) partners have been identified and formal MOUs have been developed and 2) consensus and community support has been achieved.	City-wide	Optional	TBD	TBD
CSD-37	Prohibit introduction of invasive plants in new development and redevelopment projects.	Coordinate with the City's Development Services Department to continue to prohibit introduction of invasive species such as Arundo donax and Cortaderia selloana for new development or redevelopment projects as specified in the City's municipal code for landscape.	City-wide	Prior to FY16	Ongoing	T&SW with DSD
Green Infrastructure						
CSD-38	If interim load reduction goals are not met and green infrastructure is required, publicly-owned parcels will be identified as potential opportunities for green infrastructure implementation.	Construction, operation, and maintenance of bioretention and permeable pavement. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured.	Prioritized public parcels in Tijuana WMA	Optional	TBD	T&SW with PWD; Potential to collaborate with transit agencies, public school districts, and state and federal agencies

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
Green Streets						
CSD-39	If interim load reduction goals are not met and green infrastructure is required, the additional acreage of bioretention and permeable pavement may be implemented through green streets if potential opportunities for green infrastructure implementation on public parcels are not available.	This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured.	Tijuana River WMA	Optional	TBD	T&SW with PWD
Multiuse Treatment Areas						
Infiltration and Detention Basins						
CSD-40	Cesar Chavez Community Center	Proposed retrofit for additional water quality mitigation. Addition of a hydromodification BMP in the grass and shrub area adjacent to the northwest corner of the parking lot extending west behind the baseball field and using the open space in the northwest corner of the park. Diverts storm water runoff from a drainage area of approximately 3.31 acres. The retrofit will treat runoff from 0.003 acre of impervious surface.	Tijuana River WMA	FY15	Ongoing	T&SW with PWD
CSD-41	Otay Mesa Drainage Improvements - Detention Basin	New detention basin per Otay Mesa Community Plan update EIR. Address recurrent roadway flooding problems by improving surface and/or subsurface drainage facilities in conjunction with private development or redevelopment projects. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, 4) partners have been identified and formal MOUs have been developed, and 5) permits required by regulatory agencies are secured.	Tijuana River WMA	Optional	TBD	T&SW with PWD
CSD-42	Otay Truck Route Widening Phase 3 - La Media Rd along border fence	New detention basin will be installed on La Media Rd along border fence.	Tijuana River WMA	Prior to FY16	Ongoing	T&SW with PWD
Stream, Channel and Habitat Rehabilitation Projects						
CSD-43	If interim load reduction goals are not met and additional stream, channel, and habitat rehabilitation projects are required, implement as needed.	This strategy may be triggered as 1) funding to address MS4 discharges is identified and secured, 2) staff resources are identified and secured, 3) partners have been identified and formal MOUs have been developed, 4) permits required by regulatory agencies are secured, and 5) recommendations from the community are identified and consensus and community support has been achieved.	Areas identified during feasibility studies	Optional	TBD	T&SW
Water Quality Improvement BMPs						
Proprietary BMPs						
CSD-44	Fire Station #29 - 198 West San Ysidro Blvd.	4 drainage inserts planned for implementation on San Ysidro Blvd.	Tijuana River WMA	Prior to FY16	Ongoing	T&SW with PWD

ID	Strategy	Implementation Approach	Location	Implementation or Construction Year Start	Frequency of Implementation	Responsible City Department and Other Collaborating Departments or Agencies
Dry Weather Flow Separation and Treatment Projects						
CSD-45	If interim load reduction goals are not met and additional dry weather flow separation and treatment projects are required, implement as needed.	Construction of dry weather flow separation and treatment projects, where identified. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, and 4) permits required by regulatory agencies are secured.	Downstream reaches where persistent dry weather flows have been observed	Optional	TBD	T&SW with PWD
Trash Segregation						
CSD-46	If interim load reduction goals are not met and additional trash segregation projects are required, implement as needed.	Construction of trash segregation (Trash Guards, etc.) projects, where identified. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, and 4) permits required by regulatory agencies are secured.	High-loading areas city-wide	Optional	TBD	T&SW with PWD

DSD= Development Services Department; PUD = Public Utilities Department; PWD = Public Works Department; T&SW = Transportation and Storm Water Division; WAMP = Watershed Asset Management Plan; "Refer to Section X" will be updated upon submittal of the City's JRMP in June 2015; TBD = will be determined during the next fiscal year.

Table H-2 City of San Diego Annual Schedule

Legend
Construction
Ongoing Implementation/ O&M
As needed/Design

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
Jurisdictional Strategies																													
Development Planning																													
All Development Projects																													
CSD-1	Establish guidelines and standards for all development projects; provide technical support related to implementation of source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area or implement easements to protect water quality, where applicable and feasible. Includes internal coordination and collaboration between City departments (DSD, PWD, and Engineering) to improve success and long-term benefits of BMPs.	City-wide	Prior to FY16	Ongoing																									
CSD-1.1	Investigation and research of emerging technology.	City-wide	Prior to FY16	As Needed																									
CSD-1.2	Approve and implement a green infrastructure policy.	City-wide	FY16 (Begin)	As Needed																									
CSD-1.3	Develop Design Standards for Public LID BMPs.	City-wide	FY14-FY15	As Needed																									
CSD-1.4	Outreach to impacted industry regarding minimum BMP requirement updates.	City-wide	FY15	As Needed																									
CSD-2	Train staff on LID regulatory changes and LID practices.	City-wide	FY16		As Needed																								
CSD-3	Amend municipal code and ordinances, including zoning ordinances, to facilitate and encourage LID opportunities to support compliance with the MS4 Permit and TMDLs in a reasonable manner. Ensure consistency with the City of San Diego's BMP Design Manual. Update the Storm Water Standards Manual accordingly.	City-wide	FY15	As Needed																									
CSD-4	Create a manual that outlines right-of-way design standards.	City-wide	FY15	One time																									
CSD-5	Provide technical education and outreach to the development community on the design and implementation requirements of the MS4 Permit and Water Quality Improvement Plan requirements.	City-wide	Prior to FY16	Ongoing																									
Priority Development Projects (PDPs)																													
CSD-6	For PDPs, provide technical support to other City departments to ensure implementation of on-site structural BMPs to control pollutants and manage hydromodification by developing City wide storm water development standards and design guidelines.	City-wide	FY16		Ongoing																								
CSD-6.1	Institute a program to verify and enforce maintenance and performance of treatment control BMPs.	City-wide	FY16		Ongoing																								

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
CSD-7	Update BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs.	City-wide	FY15	Cycle																									
CSD-7.1	Amend BMP Design Manual for trash areas. Require full four-sided enclosure, siting away from storm drains and cover. Consider the retrofit requirement.	City-wide	FY15	One time																									
CSD-7.2	Amend BMP Design Manual for animal-related facilities, such as such as animal shelters, "doggie day care" facilities, veterinary clinics, breeding, boarding and training facilities, groomers, and pet care stores.	City-wide	FY15	One time																									
CSD-7.3	Amend BMP Design Manual for nurseries and garden centers.	City-wide	FY15	One time																									
CSD-7.4	Amend BMP Design Manual for auto-related uses.	City-wide	FY15	One time																									
CSD-8	Develop and administer an alternative compliance program for on-site structural BMP implementation (includes identifying Watershed Management Area Analysis [WMAA] candidate projects). Refer to Section 4.2.5.	City-wide	FY15	Ongoing																									
CSD-8.1	Create a fund that allows habitat acquisition, protection enhancement, and restoration in conjunction with other cooperating entities including community groups, academic institutions, state county, and federal agencies, etc.	City-wide	Optional	If triggered, begin planning, acquiring funding and resources																									
Construction Management																													
CSD-9	Coordinate with other City departments to promote and confirm a thorough understanding of requirements for implementing temporary BMPs that control sediment and other pollutants during the construction phase of projects. Included in that understanding are requirements to inspect at appropriate frequencies and effectively enforce requirements through process controlled by other City departments.	City-wide	FY16		Ongoing																								
Existing Development																													
Commercial, Industrial, Municipal, and Residential Facilities and Areas																													
CSD-10	Administer a program to require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of existing development at appropriate frequencies and using appropriate methods.	City-wide	FY16		Ongoing																								
CSD-10.1	Update minimum BMPs for existing residential, commercial, and industrial development. Specific updates to BMPs include required street sweeping, catch basin cleaning, and maintenance of private roads and parking lots in targeted areas.	City-wide	FY15	Cycle																									

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
CSD-10.2	Outreach to property managers and trash haulers to elevate the emphasis of power washing as a pollutant source.	City-wide Residential, commercial and industrial areas	FY15	Ongoing																									
CSD-10.3	Implement property based inspections.	City-wide	Prior to FY16	Ongoing																									
CSD-10.4	Review policies and procedures to ensure discharges from swimming pools meet permit requirements.	City-wide	FY15	As Needed																									
CSD-11	Promote and encourage implementation of designated BMPs for residential and non-residential areas.	City-wide Residential and Commercial Areas	Prior to FY16	Ongoing																									
CSD-11.1	Residential and Commercial BMP: Rain Barrel	City-wide Residential Areas	Prior to FY16	Ongoing																									
CSD-11.2	Residential and Commercial BMP: Grass Replacement	City-wide Residential and Commercial Areas	Prior to FY16	Ongoing																									
CSD-11.3	Residential and Commercial BMP: Downspout Disconnect	City-wide Residential and Commercial Areas	FY16		Ongoing																								
CSD-11.4	Residential and Commercial BMP: Microirrigation	City-wide Residential Areas	Prior to FY16	Ongoing																									
CSD-11.5	Provide Onsite Water Conservation Surveys.	City-wide Residential and Commercial Areas	Prior to FY16	Ongoing																									

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
MS4 Infrastructure																													
CSD-12	Implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, channels as allowed by resource agencies, detention basins, pump stations, etc.) for water quality improvement and for flood control risk management.	City-wide	FY16		Ongoing																								
CSD-12.1	Enhanced catch basin cleaning to increase pollutant removal (between 2-4 times per year in medium priority areas in the rainy season).	Tijuana River WMA: Medium priority areas identified in pilot study	FY16		Ongoing																								
CSD-12.2	Increased frequency of catch basin inspection and as-needed cleaning.	Tijuana River WMA (15 open channel segments)	FY13																										
CSD-12.3	Proactively repair and replace MS4 components to provide source control from MS4 infrastructure.	City-wide	FY16		Ongoing																								
CSD-12.4	Replacement of hard assets including storm drains and structures.	City-wide	FY16		Ongoing																								
CSD-13	Coordinate with other City departments (PUD) to implement controls to prevent infiltration of sewage into the MS4 from leaking sanitary sewers.	City-wide	FY16		Ongoing																								
CSD-13.1	Identify sewer leaks and areas for sewer pipe replacement prioritization.	City-wide	FY16		As Needed																								
Roads, Street, and Parking Lots																													
CSD-14	Implement operation and maintenance activities for public streets, unpaved roads, paved roads, and paved highways.	City-wide	FY16		Ongoing																								
CSD-14.1	Initiate sweeping of medians on high-volume arterial roadways.	City-wide	FY17			Ongoing																							
CSD-14.2	Implement additional street sweeping (Settlement Agreement).	Tijuana River WMA	FY13																										
Pesticide, Herbicides, and Fertilizer BMP Program																													
CSD-15	Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications.	City-wide	FY16		Ongoing																								
Retrofit and Rehabilitation in Areas of Existing Development																													
CSD-16	Develop and implement a strategy to identify candidate areas of existing development appropriate for retrofitting projects and facilitate the implementation of such projects.	City-wide	TBD																										

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
CSD-17	Develop and implement a strategy to identify candidate areas of existing development for stream, channel, or habitat rehabilitation projects and facilitate implementation of such projects.	City-wide	TBD																										
Illicit Discharge, Detection, and Elimination (IDDE) Program																													
CSD-18	Implement Illicit Discharge, Detection, and Elimination (IDDE) Program per the JRMP. Requirements include: maintaining an MS4 map, using municipal personnel and contractors to identify and report illicit discharges, maintaining a hotline for public reporting of illicit discharges, monitoring MS4 outfalls, and investigating and addressing any illicit discharges.	City-wide	Prior to FY16	Ongoing																									
Public Education and Participation																													
CSD-19	Implement a public education and participation program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences.	City-wide	Prior to FY16	Ongoing																									
CSD-19.1	Continue implementation of a Pet Waste Program.	City-wide	Prior to FY16	Ongoing																									
CSD-19.2	Promote and encourage implementation of designated BMPs in commercial and industrial areas.	City-wide Non-residential Areas	Prior to FY16	Ongoing																									
CSD-19.3	Expand outreach to homeowners' association (HOA) common lands and HOA incentives.	City-wide	FY16		Ongoing																								
CSD-19.4	Develop an outreach and training program for property managers responsible for HOAs and maintenance districts.	City-wide	FY16		Ongoing																								
CSD-19.5	Enhance and expand trash cleanups through community-based organizations involving target audiences.	City-wide	FY16		Ongoing																								
CSD-19.6	Improve consistency and content of websites to highlight enforceable conditions and reporting methods.	City-wide	Prior to FY16	Ongoing																									
CSD-19.7	Develop a targeted education and outreach program for homeowners with orchards or other agricultural land uses on their property.	Tijuana River WMA	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-19.8	Enhance school and recreation-based education and outreach.	City-wide	FY15	Ongoing																									
CSD-19.9	Develop education and outreach to reduce irrigation runoff.	City-wide	Prior to FY16	Ongoing																									
CSD-19.10	Develop regional training for water-using mobile businesses.	City-wide	FY16		Ongoing																								
CSD-19.11	Enhance education and outreach based on results of effectiveness survey and changing regulatory requirements.	City-wide	FY16		Ongoing																								
CSD-19.12	Continue to promote and encourage implementation of Integrated Pest Management (IPM) for residents and businesses.	City-wide	Prior to FY16	Ongoing																									

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
Enforcement Response Plan																													
CSD-20	Continue to implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Storm Water Code Enforcement Unit's Standard Operating Procedures (SOPs) - Enforcement Response Plan.	City-wide	Prior to FY16	Ongoing																									
CSD-20.1	Increase enforcement of irrigation runoff.	City-wide	FY16		Ongoing																								
CSD-20.2	Increase enforcement of water-using mobile businesses.	City-wide	FY16		Ongoing																								
CSD-21	Increase enforcement of all minimum BMPs for existing residential, commercial, and industrial development.	City-wide	FY16		As needed																								
CSD-22	Increase enforcement associated with property-based inspections.	City-wide	FY16		Ongoing																								
CSD-23	Increase enforcement of sweeping and maintenance of private roads and parking lots in targeted areas.	City-wide	FY16		Ongoing																								
CSD-24	Increase identification and enforcement of actionable erosion and slope stabilization issues on private property and require stabilization and repair.	City-wide	FY16		Ongoing																								
Additional Nonstructural Strategies																													
CSD-25	Conduct a Comprehensive Benefits Analysis to identify benefits other than water quality that are applicable to each of the specific WQIP strategies.	City-wide	FY15	One time																									
CSD-26	Address and clean up trash from transient encampments with collaboration from the Homeless Outreach Team.	City-wide	FY16		Ongoing																								
CSD-27	Continue participating in source reduction initiatives.	City-wide	Prior to FY16	Ongoing																									
CSD-27.1	Coordinate with Fleet Services to replace City-owned vehicle brake pads with copper-free brake pads as they become commercially available.	City-wide	FY18				Ongoing																						
CSD-28	Proactively monitor for erosion, and complete minor repair and slope stabilization on municipal property.	City-wide	FY16		Ongoing																								
CSD-29	Lower Tijuana River WMA Sediment Source Characterization Study	Tijuana River WMA	FY16		One time																								
CSD-29.1	Participate in Reference Watershed Study.	Region-wide	Prior to FY16	One time																									
CSD-29.2	Conduct a Cost of Service Study.	City-wide	FY16		One time																								
CSD-30	Conduct Sustainable Return on Investment (SROI) analysis to estimate strategies' co-benefits and impacts to the public and the private sector on a common scale.	City-wide	Optional	If triggered, begin planning, acquiring funding and resources																									

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
CSD-31	Collaborate with the County, if a County-led regional social services effort is established, to provide sanitation and trash management for individuals experiencing homelessness and determine if the program is suitable and appropriate for jurisdictional needs to meet goals.	City-wide	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-32	Identify strategy, resources, and funding to support mapping and assessment of agricultural operations.	Tijuana River WMA	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-33	Participate in an assessment to determine if implementation of an urban tree canopy (UTC) program would benefit water quality and other City goals, where feasible.	City-wide	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-34	Conduct a feasibility study to test Permeable Friction Course (PFC), a porous asphalt that overlays impermeable asphalt.	City-wide	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-35	As opportunities arise and funding sources are identified, protect areas that are functioning naturally by avoiding impervious development and degradation on unpaved open space areas, creating permanent open space protections on undeveloped city-owned land, and accepting privately-owned undeveloped open areas.	City-wide	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-36	Participate in a watershed council or group if one is established.	City-wide	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-37	Prohibit introduction of invasive plants in new development and redevelopment projects.	City-wide	Prior to FY16	Ongoing																									
Green Infrastructure																													
CSD-38	If interim load reduction goals are not met and green infrastructure is required, publicly-owned parcels will be identified as potential opportunities for green infrastructure implementation.	Prioritized public parcels in Tijuana WMA	Optional	If triggered, begin planning, acquiring funding and resources																									
Green Streets																													
CSD-39	If interim load reduction goals are not met and green infrastructure is required, the additional acreage of bioretention and permeable pavement may be implemented through green streets if potential opportunities for green infrastructure implementation on public parcels are not available.	Tijuana River WMA	Optional	If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to construct additional green streets projects.																									
Multiuse Treatment Areas																													
Infiltration and Detention Basins																													
CSD-40	Cesar Chavez Community Center	Tijuana River WMA	FY15																										
CSD-41	Otay Mesa Drainage Improvements - Detention Basin	Tijuana River WMA	Optional	If triggered, begin planning, acquiring funding and resources																									
CSD-42	Otay Truck Route Widening Phase 3 - La Media Rd along border fence	Tijuana River WMA	Prior to FY16																										

ID	Strategy	Location	Implementation or Construction Year Start	FY 15 and Earlier	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34	FY 35	FY 36	FY 37	FY 38	FY 39	FY 40
Stream, Channel and Habitat Rehabilitation Projects																													
CSD-43	If interim load reduction goals are not met and additional stream, channel, and habitat rehabilitation projects are required, implement as needed.	Areas identified during feasibility studies	Optional	If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to implement rehabilitation projects.																									
Water Quality Improvement BMPs																													
Proprietary BMPs																													
CSD-44	Fire Station #29 - 198 West San Ysidro Blvd.	Tijuana River WMA	Prior to FY16																										
Dry Weather Flow Separation and Treatment Projects																													
CSD-45	If interim load reduction goals are not met and additional dry weather flow separation and treatment projects are required, implement as needed.	Downstream reaches where persistent dry weather flows have been observed	Optional	If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to implement dry weather flow separation projects.																									
Trash Segregation																													
CSD-46	If interim load reduction goals are not met and additional trash segregation projects are required, implement as needed.	High-loading areas city-wide	Optional	If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to implement trash segregation projects.																									

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Appendix H.3
County of San Diego Strategies, Schedules, and Funding Needs

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Strategy	Program Type (see notes at bottom)	Permit Reference	Sources	Frequency	Schedule
Jurisdictional Runoff Management Programs (JRMP) Strategies					
Illicit Discharge, Detection, and Elimination (IDDE) Program					
Maintain MS4 map to facilitate IDDE program	Base	MS4 Permit, Section E.2.b(1)	N/A	Annually	FY15
Use municipal personnel/contractors to identify and report ICIDs	Base	MS4 Permit, Section E.2.b(2)	IC/IDs	ongoing	ongoing
updated focused training for County field staff	Enhanced		all pollutants	Annually	FY16
Effluent on the ground (EOG), SSO data	Base	MS4 Permit, Section E.2.b( )	OWTS/SSO	ongoing	ongoing
work with the Department of Environmental Health to address septic system failures	Base		human sources	ongoing	ongoing
Maintain a hotline and email address for public reporting of potential ICIDs.	Base	MS4 Permit, Section E.2.b(3)	IC/IDs	ongoing	ongoing
Refer homeless issue complaints to Sheriff or appropriate jurisdictions	Base		human sources	ongoing	ongoing
Bilingual hotline answered by I Love a Clean San Diego (ILACSD; live operator) with multiple avenues for online reporting	Enhanced		IC/IDs	ongoing	FY16
investigate the feasibility of developing a pilot program (including training) - volunteer surveillance program; develop public facing mobile phone application (2 years out)	Optional		IC/IDs	TBD/in dev.	FY16
Implement practices and procedures to address spills that may discharge into MS4	Base	MS4 Permit, Section E.2.b(4)	IC/IDs	ongoing	ongoing
coordination with responsible sewer agencies	Base		SSOs	ongoing	FY16
coordination with internal County wastewater departments	Base		SSOs	ongoing	ongoing
septic system rebate program with availability of grant funding	Optional		OWTS	ongoing	FY16
develop a pilot online septic system maintenance outreach program in collaboration with the Department of Environmental Health	Optional committed		OWTS	ongoing	ongoing
Implement practices and procedures to prevent/limit infiltration of seepage from sanitary sewers	Base	MS4 Permit, Section E.2.b(5)	Sewer infrastructure	ongoing	ongoing
Coordinate with upstream Copermittees and/or entities to prevent ID from upstream sources into the MS4	Base	MS4 Permit, Section E.2.b(6)	IC/IDs	ongoing	ongoing
Monitor MS4 outfalls for discharges of potential ICIDs	Base	MS4 Permit, Section E.2.c	Persistent/ transient flows	Once per year	ongoing
Develop and implement a strategy for investigating and addressing ICIDs.	Base	MS4 Permit, Section E.2.d	IC/IDs	One time	FY15
Collaborate with watershed partners to evaluate feasibility of invasive plant and animal removal	Optional		encampments	ongoing	ongoing
Development Planning					
All development projects: Implement source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area, where applicable and feasible.	Base	MS4 Permit, Section E.3.a	new and redevelopment	ongoing	ongoing
Priority Development Projects: In addition to requirement for all development projects, PDPs must implement onsite structural BMPs to control pollutants and manage hydromodification.	Base	MS4 Permit, Sections E.3.b & E.3.c	new and redevelopment	ongoing	ongoing

Strategy	Program Type (see notes at bottom)	Permit Reference	Sources	Frequency	Schedule
Update BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs.	Base	MS4 Permit, Section E.3.d	new and redevelopment	in development	FY16
BMP Manual Training - Internal	Base		new and redevelopment	one time	FY16
BMP Manual Training - External	Enhanced		new and redevelopment	one time	FY16
Implement a program that requires and confirms PDP structural BMPs are designed, constructed, and maintained to remove pollutants.	Base	MS4 Permit, Section E.3.e	new and redevelopment	ongoing	ongoing
Enforce legal authority established for all development projects to achieve compliance.	Base	MS4 Permit, Section E.3.f	new and redevelopment	ongoing	ongoing
updates to county ordinance related to land development; reference to updated BMP manual	Base		new and redevelopment	one time	FY15
Investigate feasibility of developing a Green Streets Program	Optional		All	TBD	TBD
Construction Management					
Maintain and update a watershed-based inventory of all construction projects issued a local permit that allows ground disturbance or soil disturbing activities.	Base	MS4 Permit, Section E.4.b(1)	Construction: waste management, portable toilets	quarterly	FY16
Implement or require implementation of BMPs that are site specific, seasonally appropriate and construction phase appropriate. Includes inspections at an appropriate frequency and enforcement of requirements.	Base	MS4 Permit, Sections E.4.c & E.4.d(1)	Construction: waste management, portable toilets	TBD/in dev.	ongoing
Enforce legal authority established for all its inventoried construction sites to achieve compliance.	Base	MS4 Permit, Section E.4.e	Construction: waste	as necessary	ongoing
updates to county ordinance related to construction; reference to existing grading ordinance	Base		Construction: waste management, portable toilets	one time	FY15
Internal Training on Construction Management	Base	MS4 Permit, Section E.7.a(3)	Construction: waste management, portable toilets	Annual	ongoing
Existing Development					
Maintain and update a watershed-based inventory of all existing development within its jurisdiction that may discharge a pollutant load to and from the MS4.	Base	MS4 Permit, Section E.5.a	ICMR	annual	on going
improvements to tracking watershed based inventories via consolidated database	Optional committed		ICMR	one time	FY16
Designate a minimum set of BMPs required for all inventories existing development, including special event venues. The designated minimum BMPs must be specific to facility or area types and pollutant generating activities, as appropriate.	Base	MS4 Permit, Section E.5.b	ICMR	one time	on going
Equestrian BMP Handbook	Optional Committed	County Program	equestrian land uses	one time	FY16
Require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types and pollutant generating activities, as appropriate.	Base	MS4 Permit, Section E.5.c	ICMR	ongoing	ongoing

Strategy	Program Type (see notes at bottom)	Permit Reference	Sources	Frequency	Schedule
pet waste management and outreach in County Parks	Enhanced		municipal parks	ongoing	ongoing
Implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, detention basins, etc.).	Base	MS4 Permit, Section E.5.b.(1)(c)(ii)	MS4	Annual	ongoing
Implementation of operation and maintenance activities for County maintained streets, unpaved roads, paved roads, and paved highways	Base	MS4 Permit, Section E.5.b.(1)(c)(iii)	transportation corridors	per JRMP	ongoing
Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications.	Base	MS4 Permit, Section E.5.b(1)(d)	ICMR	ongoing	ongoing
Promote and encourage implementation of designated BMPs at residential areas.	Base	MS4 Permit, Section E.5.b(2)	residential	ongoing	FY16
Conduct inspections of inventoried existing development to ensure compliance	Base	MS4 Permit, Section E.5.c	ICMR	20% per year, all within 5 years	FY16
focused residential inspections based on strategic assessments (modeling, MST, persistent flows, regulatory, monitoring data, SFR/MFR (112 RMAs based on HSA)	Enhanced		residential	20% per year, all within 5 years	FY16
Investigating the feasibility of a residential inspections tracking program via mobile platform - miles, violations, etc.	Optional Committed		residential	ongoing with inspections	FY16
Investigating the feasibility of improvements to inspections data tracking through mobile phone applications	Optional		ICRM		FY16
Enforce legal authority established for all inventoried existing development to achieve compliance	Base	MS4 Permit, Section E.5.d	ICMR	ongoing	ongoing
updates to county ordinance related to existing development; reference to existing guidance documents	Enhanced		ICMR	one time	FY15
Develop a strategy to identify candidate areas of existing development appropriate for retrofitting projects and facilitate the implementation of such projects.	Base	MS4 Permit, Section E.5.e(1)	municipal areas	internal and WMAA	FY15
promote rain barrel incentive programs	Enhanced		residential/ commercial	ongoing	ongoing
collaborate with partner agencies to promote incentive programs for BMP retrofits	Enhanced		residential/ commercial	ongoing	ongoing
Investigate the feasibility of developing and implementing an incentive program for BMP Retrofits	Optional committed				
Promote Live Turf Replacement Incentive Program as part of the public-private partnership	Enhanced		residential/ commercial	ongoing	SLP - FY16; others ongoing
Develop a strategy to identify candidate areas of existing development for stream, channel, and/or habitat rehabilitation projects and facilitate implementation of such projects.	Base	MS4 Permit, Section E.5.e(2)	municipal	internal and WMAA	FY15
Outreach and Public Participation					
Promote Water Smart Incentive for Outdoor Water Efficiency as part of the public-private partnership	Enhanced		residential/ commercial	ongoing	SLP - FY16; others ongoing
Develop Sustainable Landscapes Program based on available grant funding	Optional		residential/ commercial	ongoing	FY16
develop, improve, distribute outreach materials for existing development	Enhanced		ICMR	ongoing	ongoing
outreach presentations to elementary, middle, and high school students	Enhanced		ICMR	ongoing	ongoing
outreach to mobile landscaping service providers	Enhanced		ICMR	ongoing	ongoing
Sponsor Trash Collection Events	Enhanced	County Program	existing land use	multiple	ongoing
Educational Workshops (e.g., IPM, manure management)	Enhanced	County Program	residential	ongoing	ongoing

Strategy	Program Type (see notes at bottom)	Permit Reference	Sources	Frequency	Schedule
Education & Outreach Effectiveness Survey	Enhanced	County Program	ICMR	annual	ongoing
Enforcement Response Plan					
Implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Enforcement Response Plan.	Base	MS4 Permit, Section E.6	all MS4 related sources	ongoing	ongoing
Notify the SDWB by email (Nonfilers_R9waterboards.ca.gov) within five (5) calendar days of issuing escalated enforcement to a construction site that poses a significant threat to water quality as a result of violations or other noncompliance	Base	MS4 Permit E.6.e.(1)	construction	ongoing	FY16
Notify the SDWB by email (Nonfilers_R9waterboards.ca.gov) any persons required to obtain coverage under the statewide Industrial General Permit and Construction General Permit and failing to do so, within five (5) calendar days from the time the Copermittee become aware of the circumstances.	Base	MS4 Permit E.6.e.(2)	industrial	ongoing	FY16
Public Education and Participation					
Implement a public education and participation program to promote and encourage development of programs, management practices and behaviors that reduce the discharge of pollutants in storm water prioritized by high risk behaviors, pollutants of concern, and target audiences.	Base	MS4 Permit, Section E.7	MS4 sources	ongoing	ongoing
Physical Strategies (Structural Controls from CLRP and others)					
Investigate feasibiliity of Incentives	Optional	MS4 Permit, Section B.3.e	Irrigation Runoff	TBD	existing development programs
Investigate feasibility of Detention basins	Optional	MS4 Permit, Section B.3.e	TBD	TBD	land development programs
Investigate feasibility of Treatment systems	Optional	MS4 Permit, Section B.3.e	TBD	TBD	land development programs
Investigate feasibility of Retrofitting projects in areas of existing development	Optional	MS4 Permit, Section B.3.e	TBD	TBD	potential for implementation via alternative compliance program
Investigate feasibility of Stream, channel, and/or habitat rehabilitation projects	Optional	MS4 Permit, Section B.3.e	TBD	TBD	potential for implementation via alternative compliance program
Optional Strategies developed during WQIP process					
Consider development of incentive programs for water conservation (turf replacement, smart irrigation controllers, irrigation modifications, sustainable landscapes, rain barrels), in collaboration with water agencies and others, to reduce priority pollutants.	Optional				
Consider development of incentive programs, in collaboration with the Department of Environmental Health, for pumping septic systems in high risk areas adjacent to waterways (within 600 ft) or stormwater system; subject to grant funding	Optional				
Consider partnerships with Master Gardeners to provide education opportunities on water use and practices for gardening	Optional				
Consider collaboration with community groups to provide “boots on the ground” local information to focus implementation efforts on reducing bacteria and other pollutants, close to the source	Optional				

Strategy	Program Type (see notes at bottom)	Permit Reference	Sources	Frequency	Schedule
Consider collaboration with COSD internal departments to leverage mutually beneficial projects to promote retrofits to include installation of controls to address priority pollutants, if feasible.	Optional				
Consider collaboration with watershed partners to encourage consistent messaging to specific targeted audiences (commercial, residents, and others) to conserve water and mitigate dry weather flows	Optional				
Consider collaboration with watershed partners on Round 4 of Proposition 84 IRWM grant opportunities to fund targeted educational programs, building of structural controls (brick and mortar projects), or incentive programs to reduce runoff	Optional				
Consider collaboration with watershed partners and Regional Water Quality Control Board on effective measures to reduce potential impact of pollutant loads to waterways from unauthorized encampments	Optional				
Consider collaboration with wastewater agencies to identify where sewer and stormwater infrastructure are in close proximity and confirm the absence of flow at nearby stormwater MS4 outfall during dry weather	Optional				
In collaboration with the Department of Environmental Health, consider developing program for on-site wastewater treatment (septic) systems. May include mapping and risk assessment, inspection, or maintenance practices.	Optional				
Implement full scale residential pet waste projects (commitments, large property, urban)	Optional				
Consider investigating diverting persistent dry weather flows from storm drains to sanitary sewer, where feasible	Optional				
Consider the design of structural controls for persistent unpermitted dry weather flows where outreach has been unsuccessful and groundwater has been ruled out	Optional				
Consider collaboration with the Department of Agriculture, Weights and Measures (AWM) to evaluate and reprioritize the AWM's stormwater program to determine inspection priorities.	Optional				

Program Type Notes:

Base - Indicates requirements of the MS4 Permit that the County will implement.

Enhanced - Base program that has been enhanced beyond the MS4 Permit requirements. The enhanced portions of these strategies would be implemented if needed and if funding is available.

Optional - Strategies that are not required by the MS4 Permit. These strategies would be implemented if needed and if funding is available. Those that are "**committed**" are currently funded this fiscal year (FY14-15) and/or being undertaken or planned for undertaking.

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Tijuana River Watershed Management Area Analysis

Lake Henshaw

September 8, 2014

Prepared for:
San Diego County Copermittees

Prepared by:

Geosyntec consultants
engineers | scientists | innovators

RICK Engineering Company

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ACRONYMS AND ABBREVIATIONS

%	percent
>	greater than
<	less than
BMP	Best Management Practice
CB	Coarse Bedrock
CEG	Certified Engineering Geologist
CIP	Capital Improvement Project
CLRP	Comprehensive Load Reduction Plan
CSI	Coarse Sedimentary Impermeable
CSP	Coarse Sedimentary Permeable
E_P	Erosion Potential
ET	Evapotranspiration
FB	Fine Bedrock
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
FSI	Fine Sedimentary Impermeable
FSP	Fine Sedimentary Permeable
GIS	Geographic Information System
GLU	Geomorphic Landscape Unit
HA	Hydrologic Area
HCP	Hydromodification Control Plan
HMP	Hydromodification Management Plan
HRU	Hydrologic Response Unit
HSA	Hydrologic Sub Area
HSG	Hydrologic Soil Group
IRWM	Integrated Regional Water Management
JURMP	Jurisdictional Urban Runoff Management Plan
LDW	Land Development Workgroup
LID	Low Impact Development
MAP	Mean Annual Precipitation

ACRONYMS AND ABBREVIATIONS continued

MHPA	Multiple Habitat Planning Area
MS4	Municipal Separate Storm Sewer System
MSCP	Multiple Species Conservation Program
NED	National Elevation Dataset
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
PDP	Priority Development Project
RCB	Reinforced Concrete Box
RCP	Reinforced Concrete Pipe
SCAMP	Southern California Aerial Mapping Project
SCCWRP	Southern California Coastal Water Research Project
SD	San Diego
SDRWQCB	San Diego Regional Water Quality Control Board
S_P	Sediment Supply Potential
SSURGO	Soil Survey Geographic Database
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WMA	Watershed Management Area
WMAA	Watershed Management Area Analysis
WQIP	Water Quality Improvement Plan
WURMP	Watershed Urban Runoff Management Plan

1. Introduction

1.1. Background

On May 8, 2013 the California Regional Water Quality Control Board, San Diego Region adopted Order No. R9-2013-0001; NPDES No. CAS 0109266, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region (Regional MS4 Permit). The Regional MS4 Permit, which became effective on June 27, 2013, replaces the previous MS4 Permits that covered portions of the Counties of San Diego, Orange, and Riverside within the San Diego Region. There were two main goals for the Regional MS4 Permit:

1. To have more consistent implementation, as well as improve inter-agency communication (particularly in the case of watersheds that cross jurisdictional boundaries), and minimize resources spent on the permit renewal process.
2. To establish requirements that focused on the achievement of water quality improvement goals and outcomes rather than completing specific actions, thereby giving the Copermittees more control over how their water quality programs are implemented.

To achieve the second goal, the Regional MS4 Permit requires that Water Quality Improvement Plans (WQIPs) be developed for each Watershed Management Area (WMA) within the San Diego Region. As part of the development of WQIPs, the Regional MS4 Permit provides Copermittees an option to perform a Watershed Management Area Analysis (WMAA) through which watershed-specific requirements for structural BMP implementation for Priority Development Projects can be developed for each WMA. This report presents the Copermittees' approach and results for the regional elements of the WMAA developed for the San Diego County area.

1.2. Watershed Management Area Analysis (WMAA)

The Regional MS4 Permit, through inclusion of the WMAA, provides an optional pathway for Copermittees to develop an integrated approach for their land development programs by promoting evaluation of multiple strategies for water quality improvement and development of watershed-scale solutions for improving overall water quality in the watershed. The WMAA comprises the following three components as indicated in the Regional MS4 Permit:

1. Perform analysis and develop Geographic Information System (GIS) layers (maps) by gathering information pertaining to the physical characteristics of the WMA (referred to herein as WMA Characterization). This includes, for example, identifying potential areas of coarse sediment supply, present and anticipated future land uses, and locations of physical structures within receiving streams and upland areas that affect the watershed hydrology (such as bridges, culverts, and flood management basins).
2. Using the WMA Characterization results, compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects. Such projects may include, for example, opportunities for stream or riparian area

rehabilitation, opportunities for retrofitting existing infrastructure to incorporate storm water retention or treatment, or opportunities for regional BMPs, among others. Prior to implementing these candidate projects the Copermittees must demonstrate that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of the onsite structural BMPs. Note, compilation or evaluation of potential projects was not performed as part of this regional effort. Identification and listing of candidate projects will be performed for each WMA through the WQIP process for WMAs that elect to submit the optional WMAA as part of the WQIP.

3. Additionally, using the WMA Characterization maps, identify areas within the watershed management area where it is appropriate to allow for exemptions from hydromodification management requirements that are in addition to those already allowed by the Regional MS4 Permit for Priority Development Projects. The Copermittees shall identify such cases on a watershed basis and include them in the WMAA with supporting rationale to support claims for exemptions.

1.3. Scope of Work for Regional WMAA

In July 2013, the Copermittees elected to fund a regional effort to develop elements of the regional WMAA for the 9 San Diego-area WMAs within the County of San Diego that are currently subject to the Regional MS4 Permit, which include:

- Santa Margarita River (for portion in San Diego County)
- San Luis Rey River
- Carlsbad
- San Dieguito River
- Los Peñasquitos
- Mission Bay & La Jolla Watershed
- San Diego River
- San Diego Bay
- Tijuana River (for portion in San Diego County)

The regional-level information developed through this effort is intended to provide consistency across WMAs and serve as the foundation for developing watershed-specific information for each WMA to be developed through the WQIP process. The regional effort scope of work included:

1. Development of GIS map layers that characterize the WMAs using data previously collected, readily available, and provided by the Copermittees, including:
    a. Description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
    b. Description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral;

   c. Current and anticipated future land uses;
   d. Potential coarse sediment yield areas; and
   e. Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.
2. Development of a Microsoft® Excel (Excel) template for use by Copermittees to compile lists of candidate projects for an optional alternative compliance program.
3. Development of additional criteria and analyses to support reinstating the following proposed exemptions that were originally developed in the approved 2011 Final Hydromodification Management Plan but not included in the Regional MS4 Permit unless provided by the Copermittees in the WMAA. In addition, development of the associated Hydromodification Applicability/Exemption Mapping.
   a. Exempt River Reaches including:
      i. San Diego River;
      ii. Otay River;
      iii. San Dieguito River;
      iv. San Luis Rey River; and
      v. Sweetwater River
   b. Stabilized Conveyance Systems Draining to Exempt Water Bodies
   c. Highly Impervious/Highly Urbanized Watersheds and Urban Infill, and
   d. Tidally Influenced Lagoons (where data/study provided)

The scope of work for the regional effort excluded performing analysis within the following areas unless data was readily available, as Copermittees do not have jurisdiction over these areas:

1. State Lands;
2. U.S. Departments of Defense land;
3. U.S. National Forest land;
4. U.S. Department of Interior land and
5. Tribal land

Additional description of excluded areas, for the purposes of the Regional WMAA, is indicated in Section 2.3 Land Uses.

1.4. Project Process

The process for developing the Regional WMAA included close coordination with the Land Development Workgroup (LDW) at key points during the project. The LDW is composed of the 21 San Diego-area Copermittees and serves to develop and implement regional land development plans and programs necessary to support the requirements of the Regional MS4 Permit. The consultant team (Geosyntec Consultants and Rick Engineering Company) presented preliminary project assumptions and methodologies proposed to be used to develop the Regional WMAA to meet the requirements of the Regional MS4 Permit in December 2013. The consultant team incorporated workgroup feedback from this meeting and subsequently presented the preliminary Regional WMAA project results to the LDW in March 2014, again to receive direction and incorporate input on the preliminary results. Subsequently, the draft report was released to the public in July 2014, by a public workshop that included Consultation Panel members from each of the WMAs on July 29, 2014. This version of the report including all of the input described above is being issued for optional inclusion into the respective WQIP Provision B.3 submittals to the SDRWQCB in December 2014.

1.5. Report Organization

This report is organized as follows:

- Chapter 1 provides the project background and purpose;
- Chapter 2 describes the technical basis for characterizing the WMA;
- Chapter 3 describes the template that can be used by Copermittees to compile the list of candidate projects;
- Chapter 4 summarizes the analyses performed to support reinstating select exemptions from hydromodification control requirements for PDPs;
- Chapter 5 presents the WMAA conclusions;
- Chapter 6 presents the references used for the WMAA;
- Attachment A presents the exhibits and additional supporting information for watershed management area characterization;
- Attachment B presents the exhibits and additional supporting information for hydromodification management applicability/exemptions;
- Attachment C expands on the structure of the geodatabase that hosts the GIS data developed by the WMAA; and
- Attachment D provides a crosswalk between the Regional MS4 Permit requirements for WMAA and this report.

1.6.Terms of Reference

The work described in this report was conducted by Geosyntec Consultants (Geosyntec) and Rick Engineering Company (RICK) on behalf of the County of San Diego and the regional Copermittees.

2. Watershed Management Area Characterization

Watershed health and function are strongly influenced by hydrological and geomorphological processes occurring in the watershed. Both hydrological response and geomorphological response of the watershed are dependent on a variety of physical characteristics of the watershed. To this end, the Regional MS4 Permit specifies a set of data that is required to adequately characterize overall watershed processes as a foundation to enhancing integration and effectiveness of watershed management and water quality programs. The following GIS map layers were developed to characterize the hydrological and geomorphological processes within the Tijuana River WMA:

- Dominant Hydrologic Processes: A description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
- Stream Characterization: A description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral;
- Land Uses: Current and anticipated future land uses;
- Potential Critical Coarse Sediment Yield Areas; and
- Physical Structures: Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.

These GIS layers can be used to:

- Identify the nature and distribution of key macro-scale watershed processes;
- Identify potential opportunities and constraints for regional and sub-regional storm water management facilities that can play a critical role in meeting water quality, hydromodification, water supply, and/or habitat goals within the watershed;
- Assist with determining the most appropriate management actions for specific portions of the watershed; and
- Suggest where further study is appropriate.

2.1. Dominant Hydrologic Processes

The Regional MS4 Permit identifies in the provisions related to the WMAA that a description of dominant hydrologic processes within the watershed must be developed, with GIS layers (maps) as output. The Permit specifically calls for processes "*such as areas where infiltration or overland flow likely dominates*." These particular aspects of the hydrological mechanics of watersheds are particularly important when attempting to understand the macro-scale opportunities for locating projects that take advantage of either capturing overland flow for treatment or for infiltration.

Investigation of the dominant hydrologic processes in the San Diego-area watersheds indicates that evapotranspiration (ET) is the most dominant hydrologic process for the region based on review of a published study (Sanford and Selnick, 2013). ET is the sum of evaporation and plant transpiration in the hydrologic cycle that transports water from land surfaces to the atmosphere. This is conclusion is supported by comparing the 30-year average annual rainfall for the study area (San Diego County east of the peninsular divide) of between 15 and 18 inches per year (San Diego County, 2005) to the average annual ET rates. According to the California Irrigation Management Information System (CIMIS) Reference Evapotranspiration Map (CIMIS, 1999), the study area (within Zones 4, 6, and 9) experiences annual reference ET of 46.6, 49.7 and 59.9 inches, respectively. Therefore, theoretically, if all of the annual precipitation for the San Diego-area watersheds remained stationary where it fell and did not either infiltrate or runoff to local waterbodies where it would be conveyed downstream ultimately to the ocean, it all would be consumed by ET. As such, the effect of ET on the overall hydrologic processes within the San Diego watersheds is a function of the temporal scale over which it acts. Precipitation events often produce runoff in these watersheds, particularly in the urbanized portions, based on the topography and land cover that tend to accelerate the conveyance of runoff downstream rather than collecting, storing, or spreading out that then would maximize the effect of ET.

Because this study is focused on developing information and mapping for the portion of the hydrologic process that informs watershed management decisions, i.e., locating beneficial projects in areas of greatest opportunity, the next tier of dominant hydrologic processes are studied and mapped by this project. As such, the study area was characterized, based on the methodology described in the following section, according to the predicted fate of runoff within the watersheds being either overland flow or infiltration after considering the effects of ET (as well as an intermediate category of interflow). Areas that were mapped as overland flow do not necessarily preclude infiltration but rather indicate the dominant expected process that runoff would experience if not intercepted for the express purpose of infiltrating storm water runoff. The Model BMP Design Manual will provide more detailed guidance and procedures for determining the potential for infiltrating captured storm water at the project level irrespective of the mapping produced in the WMAA. To reiterate, the WMAA mapping is to provide macro-scale processes for high-level analysis and to inform decisions affecting regional scales. Furthermore, the Model BMP Design Manual will indicate the degree to which site-scale BMPs can expect to benefit from ET or how ET is considered in the sizing of BMPs. In brief, typical storm water BMPs only store water for a few days and therefore are not really capable of significant volume disposal through ET. However, pervious area dispersion (i.e., directing storm water runoff to flat areas for spreading and infiltration) has appreciable benefits with regard to ET and is a practice promoted in the BMP Design Manual.

The processes of interest are further defined as follows:

Overland flow: This process can be thought of as the inverse of infiltration; precipitation reaching the ground surface that does not immediately soak in must run over the land surface (thus, "overland" flow). It reflects the relative rates of rainfall intensity and the soil's infiltration capacity: wherever and whenever the rainfall intensity exceeds the soil's infiltration capacity, some overland flow will occur. Most uncompacted, vegetated soils have infiltration capacities of one to several inches per hour at the ground surface, which exceeds the rainfall intensity of even unusually intense storms. In contrast, pavement and hard surfaces reduce the effective infiltration capacity of the ground surface to zero, ensuring overland flow regardless of the meteorological attributes of a storm, together with a much faster rate of runoff relative to vegetated surfaces.

Infiltration and groundwater recharge: These closely linked hydrologic processes are most apparent near ephemeral and perennial conveyances in the San Diego region. Their widespread occurrence is expressed by the common absence of surface-water channels on even steep (undisturbed) hillslopes. Thus, on virtually any geologic material on all but the steepest slopes (or bare rock), infiltration of rainfall into the soil is inferred to be widespread, if not ubiquitous. With urbanization, changes to the process of infiltration are also quite simple to characterize: some (typically large) fraction of that once infiltrating water is now converted to overland flow.

Interflow: Interflow takes place following storm events as shallow subsurface flow (usually within 3 to 6 feet of the surface) occurring in a more permeable soil layer above a less permeable substrate. In the storm response of a stream, interflow provides a transition between the rapid response from surface runoff and much slower stream discharge from deeper groundwater. In some geologic settings, the distinction between "interflow" and "deep groundwater" is artificial and largely meaningless; in others, however, there is a strong physical discrimination between "shallow" and "deep" groundwater movement. Development reduces infiltration and thus interflow as discussed previously, as well as reducing the footprint of the area supporting interflow volume.

The datasets used, methodology for creating the dominant hydrologic processes maps, and the results are described in the sections below.

2.1.1. Datasets Used for identifying dominant hydrologic processes

The following datasets were used in the analysis:

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3rd Arc Second (~10 meter cells) digital elevation model for San Diego County
Soils Data	SanGIS	2013	NRCS (SSURGO) Database for San Diego County downloaded from SanGIS
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS

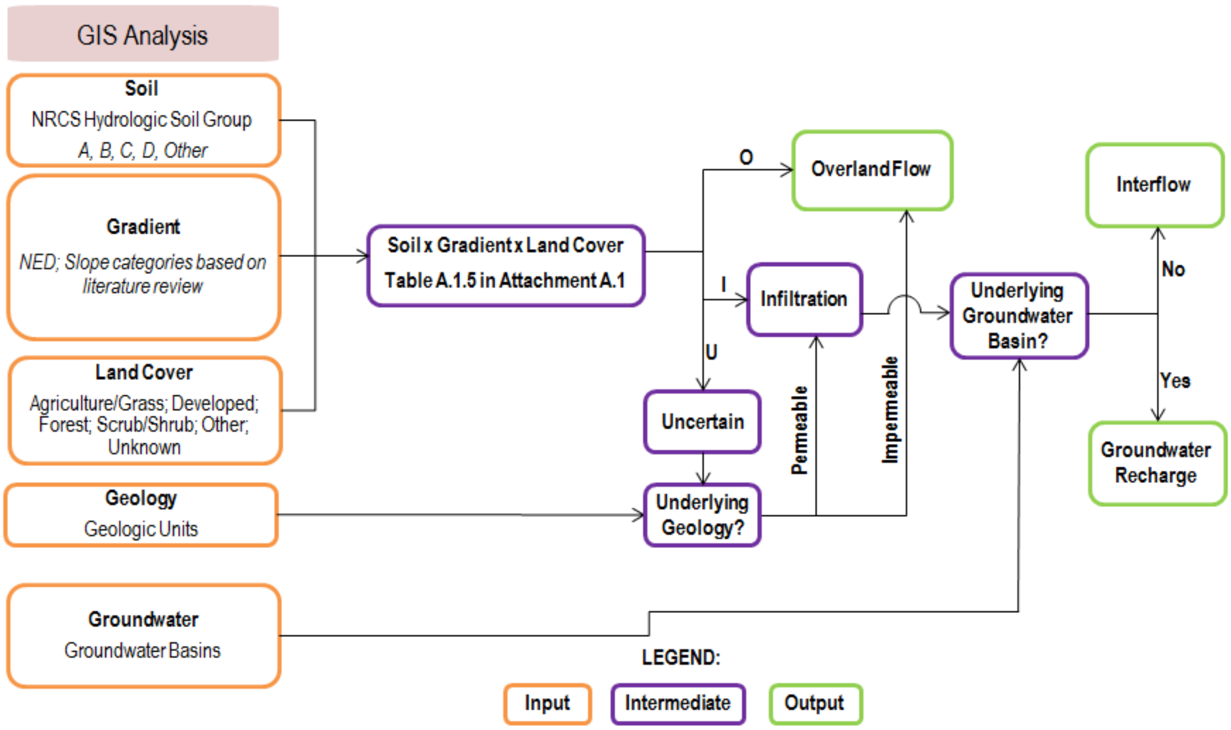
Dataset	Source	Year	Description
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30'x60' Quadrangle, Southern California, United States Geological Survey, Southern California Aerial Mapping Project (SCAMP), Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	"Geologic Map of California," California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale
Groundwater Basins	SanGIS	2013	Groundwater Basins in San Diego County downloaded from SanGIS

2.1.2. Methodology/Assumptions/Criteria for identifying dominant hydrologic processes

The methodology used to describe dominant hydrologic processes is based on recommendations included in the Southern California Coastal Water Research Project's (SCCWRP) Technical Report 605 titled "Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge" (SCCWRP, 2010). The foundation for this analysis was to incorporate the Report's concept of grouping common hydrologic attributes into Hydrologic Response Units (HRUs). The report states the following:

> *"Grouping common hydrologic attributes across a watershed into a tractable number of Hydrologic Response Units (HRUs: a term first used by England and Holtan 1969) has become a well-established approach for condensing the near-infinite variability of a natural watershed into a tractable number of different elements. The normal procedure for developing HRUs is to identify presumptively similar rainfall–runoff characteristics across a watershed by combining spatially distributed climate, geology, soils, land use, and topographic data into areas that are approximately homogeneous in their hydrologic properties (Green and Cruise 1995, Becker and Braun 1999, Beven 2001, Haverkamp et al. 2005). As noted by Beighley et al (2005), this process of merging the landscape into discrete HRUs is a common and effective method for reducing model complexity and data requirements. Using watershed characteristics to predict runoff is the explicit task of hydrologic models, and there is a host of such models available for application to hydromodification evaluation. For purposes of "screening," however, the goal is simplicity and ease of application even if the precision of the resulting analysis is crude."*

The following process describes the methodology used to define Hydrologic Response Units (HRUs) and then relate the HRUs to the dominant hydrologic processes (i.e., overland flow, interflow, and groundwater recharge) in the Tijuana River WMA.



The first step is to define the HRUs. Once these are defined, the remaining steps determine the dominant hydrologic process.

1. **Integrate data sets used to determine HRU**: Categories for soil type, gradient, and land cover were defined based on readily available GIS datasets for the region and classifications found in relevant literature, as indicated below. The different combinations of these three categories comprise the distinct HRUs.

   - **Soil Categories**: based on National Resource Conservation Service (NRCS) Hydrologic Soil Group (HSG) classifications, which are commonly used to describe runoff/infiltration potential of soils on a regional scale. These categories include: A, B, C, and D. HSG A soils have the lowest runoff potential, while HSG D soils have the highest runoff potential.

   - **Gradient Categories**: based on slope ranges found in a review of relevant literature identified in Chapter 6. The spatial processing of the slope categories utilized the United States Geologic Survey (USGS) National Elevation Dataset (NED). Slopes were grouped (bins) into the following ranges: 0% to 2%; 2% to 6%; 6% to 10%; and greater than 10%. The 2% and 6% slope thresholds were based on slope ranges included in Table A.1.1 (McCuen, 2005) presented in Attachment A.1. This table provides runoff coefficients as a function of slope, soil group, land cover, and return period and was used for subsequent steps in the mapping effort. The 10% slope threshold was used in SCCWRP's Technical

Report 605 (SCCWRP, 2010) and is a logical cutoff since slopes steeper than 10% are assumed to be dominated by overland flow.

- **Land Cover Categories**: were defined using the Ecology Vegetation GIS map layer developed by the City of San Diego, the County of San Diego and SANDAG and downloaded from SanGIS (2013). The vegetation categories in the GIS layer were grouped (Table A.1.2 in Attachment A.1) to match the following categories used in SCCWRP's Technical Report 605 (SCCWRP, 2010): Agriculture/Grass; Developed; Forest; Scrub/Shrub, Other (Water), and Unknown.

2. **Evaluate Land Cover**: Land cover categories for Agriculture/Grass, Forest, Scrub/Shrub and Other were related to land use categories defined in Table A.1.1 as shown in Table A.1.3 in Attachment A.1. Relating a land use category for the Developed land cover category was not necessary because all Developed cover was assumed to have overland flow as its dominant hydrologic process.

3. **Determine Hydrology Characteristics for Land Covers**: For each of the land cover/land use categories listed in Table A.1.3, the ratio of precipitation lost to evapotranspiration (i.e. an evapotranspiration coefficient) was estimated using Table A.1.1 using the process described below. Since precipitation is considered to be the sum of the resulting runoff, infiltration, and evapotranspiration, the coefficients for these three hydrologic pathways sum to one, as indicated below.

   Runoff Coefficient + Infiltration Coefficient + Evapotranspiration Coefficient = 1

   i) **Estimate Evapotranspiration**: To estimate the evapotranspiration (ET) coefficient for each land cover, first the runoff coefficient was identified in Table A.1.1 for the highest runoff potential (i.e., Group D soil and 6%+ slope) and most common storm conditions (i.e., storm recurrence intervals less than 25 years). The infiltration for these high runoff conditions was assumed to be negligible, resulting in an infiltration coefficient of zero. Since the sum of the three coefficients should sum to one, the ET coefficient was assumed to be the remaining difference (i.e., ET Coefficient = 1 – Runoff Coefficient). The ET coefficient calculated for the highest runoff potential was then applied to all soil types and slopes within that land use category. The calculated ET coefficient for each applicable HRU is provided in Table A.1.4 in Attachment A.1. The ET coefficient for HRUs that have a Developed land cover or a gradient greater than 10% were not calculated since these HRUs were assumed to have overland flow as the dominant hydrologic process.

   ii) **Estimate Infiltration**: The infiltration coefficient for each applicable HRU (i.e., combination of soil, gradient, and land cover) was estimated by subtracting both the runoff coefficient, provided in Table A.1.1, and the ET coefficient, calculated in step 3(i), from one (i.e., Infiltration Coefficient = 1 – Runoff Coefficient – ET Coefficient). The calculated infiltration coefficient for each applicable HRU is provided in Table A.1.4 in Attachment A.1.

   iii) **Estimate Runoff**: For each applicable HRU, the runoff coefficient was divided by the infiltration coefficient to obtain a ratio representing the potential for runoff or infiltration. The higher the ratio, the greater the potential for runoff to be a more dominant hydrologic process than infiltration. Similarly, the lower the ratio, the greater the potential for infiltration to be a more dominant hydrologic process than runoff. The calculated runoff to infiltration ratios are provided in Table A.1.4 in Attachment A.1.

4. **Associate Runoff and Infiltration to HRUs**: The following designations were assigned to each applicable HRU based on the runoff to infiltration ratio (i.e., runoff coefficient/infiltration coefficient). These designations were based on best engineering judgment with the underlying assumption that if a runoff or infiltration coefficient is more than 50% greater than its counterpart, then the prevailing process is considered dominant.

   - HRUs with runoff to infiltration ratios greater than 1.5 (3:2 ratio) were assumed to have relatively high runoff and overland flow was considered its dominant hydrologic process. These HRUs are designated by the letter “O” (Overland flow is dominant process) in Tables A.1.4 and A.1.5 in Attachment A.1.

   - HRUs with runoff to infiltration ratios less than 0.67 (2:3 ratio) were assumed to have relatively high infiltration and its dominant hydrologic process was either interflow or groundwater recharge, based on analysis described in subsequent steps. These HRUs are designated by the letter “I” (Interflow is dominant process) in Tables A.1.4 and A.1.5.

   - For HRUs with runoff to infiltration ratios between, and including, 1.5 and 0.67 it was uncertain whether it was dominated by overland flow or infiltration. These HRUs are designated by the letter “U” (Dominant process is uncertain) in Tables A.1.4 and A.1.5.

   - For HRUs that have a Developed land cover or a gradient greater than 10%, the runoff to infiltration ratios were not calculated because these HRUs were assumed to have overland flow as the dominant hydrologic process. These HRUs are designated by the letter “O” (Overland flow is dominant process) in Table A.1.5.

5. **Uncertain HRUs Assignment**: For HRUs with an uncertain designation (“U”) in Table A.1.5 in Attachment A.1, the underlying regional geology (Kennedy and Tan, 2002 & 2008; Todd, 2004 and Jennings et al., 2010) was used to evaluate whether overland flow or infiltration were dominant. If the underlying geology was considered impermeable, then these uncertain areas were considered to have overland flow as its dominant hydrologic process. If the underlying geology was considered permeable, then these uncertain areas were considered to be dominated by infiltration. The determination of whether a geologic unit is impermeable or permeable was based on desktop evaluation and the best professional judgment of a Certified Engineering Geologist (CEG). This analysis was performed in GIS and is illustrated in the flowchart above.

6. **Associate Infiltration HRUs with Known Groundwater Basins**: For HRUs with relatively high infiltration and have a designation of "I" in Table A.1.5 in Attachment A.1, the presence or absence of a regional groundwater basin (SanGIS, 2013) underlying these areas determined whether the dominant hydrologic process was designated as interflow or groundwater recharge. The groundwater recharge hydrologic process was assigned as dominant for those applicable areas which had an underlying groundwater basin. The interflow hydrologic process was assigned as dominant for those applicable areas which did not have an underlying groundwater basin directly below it. This analysis was performed in GIS and is illustrated in the flowchart above.
7. **Resulting HRU Data:** The resulting GIS map of dominant hydrologic processes was reviewed by engineering professionals familiar with the hydrology in the County of San Diego to confirm that the mapping is consistent with their experience working in the region.

2.1.3. Results for identifying dominant hydrologic processes

The resulting GIS map showing the spatial distribution of dominant hydrologic processes (i.e., overland flow, interflow, and groundwater recharge) within the Tijuana River WMA is provided in Attachment A.1. An ArcMap document file which presents the results from each step of the methodology is included in Attachment C, as well as a Google Earth KMZ file. Based on this analysis, overland flow is the predominant hydrologic process in all this WMA, which is consistent with the experience of engineering professionals familiar with the hydrology of the County of San Diego.

Summary of Deliverables for Dominant Hydrologic Processes

Format	Item	Description	Location
Report	Figure	"Dominant Hydrologic Processes"	Attachment A.1
GIS	Map Group Title	Hydrologic Processes	Attachment C.1
	Map Layer Title	Soil Land Cover Slope Hydrologic Response Unit Initial Rating Permeability Groundwater Basin Dominant Hydrologic Processes	
	Geodatabase Feature Dataset	HydrologicProcesses	
	Geodatabase Feature Class	HRUAnalysis	
	Geodatabase Geometry Type	Polygon	
KMZ [1]	KMZ File Name	Dominant Hydrologic Processes	Attachment C.2

[1] To enhance the utilization of this data, the Dominant Hydrological Processes map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).

2.1.4. Limitations for identifying dominant hydrologic processes

The resulting GIS map layer only lists the dominant hydrological process (i.e., an HRU assigned a dominant process of overland flow can also experience small amounts of infiltration) and provides a useful, rapid framework to perform screening-level analysis that is appropriate for watershed-scale planning studies. When more precise estimates are required for a particular site and subarea it is recommended that this analysis be augmented with site-specific analysis.

2.2.Stream Characterization

For the purpose of WMAA, the Regional MS4 Permit requires a description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral. Under the Regional WMAA, this analysis was prepared for 27 streams throughout the San Diego Region agreed upon by the consultant team and Copermittees. Within the Tijuana River WMA, stream characterization and detailed mapping is provided for Tijuana River and Cottonwood Creek as shown on the exhibit titled "Watershed Management Area Streams" located in Attachment A.2.

2.2.1. Datasets Used for stream characterization

The following data were referenced for the purpose of stream characterization:

- USGS National Hydrography Dataset, downloaded from USGS November 2013
- USGS 7.5-minute quadrangles, compiled image of quadrangles covering San Diego County, various dates
- Floodplains: "National Flood Hazard Layer," provided by Federal Emergency Management Agency October 2012
- Various datasets provided by Copermittees depicting existing storm water conveyance infrastructure within their jurisdictions.
- Aerial photography by Digital Globe dated 2012

2.2.2. Methodology/Assumptions/Criteria for stream characterization

The analysis was prepared by digitizing each of the 27 streams based on review of data listed above. Within the pre-existing datasets depicting streams, floodplains, or infrastructure, no single dataset included a complete, accurate alignment of each stream. Digitizing the streams based on review of all of the data listed above allowed creation of GIS linework with a continuous corrected alignment for each stream. The following data were recorded as GIS attributes for each stream as the stream was digitized:

- River name
- Reach type (engineered or natural, constrained or un-constrained)
- Bed material
- Bank material
- Hydrographic category (perennial or intermittent)

The attributes listed above were collected manually based on interpretation of the reference data. Assumptions used in making the interpretations are listed below. The ***Hydrographic Category*** section below will provide the rationale as to why perennial and intermittent were the hydrographic categories chosen for this WMAA and not perennial and ephemeral.

Note that stream classification was not prepared within areas of Federal/State/Indian lands unless data was readily available. Stream lines were prepared within these areas for continuity, but some data fields were not populated within these areas.

Reach Type

Streams were classified as either engineered or natural, and either constrained or un-constrained. See the exhibit titled, "Watershed Management Area Streams by Reach Type" in Attachment A.2. The purpose of this exercise was to identify whether the stream has been modified by human activity within the stream itself, which may include addition of crossing structures, stabilization of banks, dredging, or any other human activity. This aids the identification of physical structures including stream armoring, constrictions, grade control, and other modifications as required by the Regional MS4 Permit.

Classification of the streams as either "**engineered"** or **"natural"** was based on the following criteria:

Engineered

- A classification of "engineered" was assigned where the stream itself has been modified by human activity.
- All culvert/bridge/pipe crossings either provided in the Copermittes' storm water conveyance system data or clearly visible on the aerial photo have been assigned as engineered within the limits of the crossing.
- If the Copermittees did not provide storm water conveyance system data for the dirt road crossings/dip sections the streams have been assigned as engineered within the limits of the crossing. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, they were assigned as engineered.
- Golf courses have been assigned as engineered.
- If aerial photography showed large water bodies (lake, pond, irrigation pond, etc.) they were assigned as engineered.
- If the storm water conveyance system data provided by the Copermittees has identified the stream as "rockbs", the assumption has been made that these streams have rocks on their bottom and the sides ("bs"), and have been assigned as engineered.
- Sand mining operations have been assigned as engineered. Sand mining is an operation that is in continuous flux and does not typically result in a discrete, engineered geometry in any given channel cross section until restoration is implemented at the conclusion of the sand mining operation. It is assigned as engineered to acknowledge human alteration of the stream.

Natural

- Streams that have no apparent alteration within the stream itself by human activity have been assigned as natural.

Classification of the streams as either **"constrained"** or **"un-constrained"** was based on the following criteria:

Constrained

- All culvers/bridge/pipe crossings either provided in the Copermittes' storm water conveyance system data or clearly visible on the aerial photo have been assigned as constrained.
- If the Copermittees did not provide storm water conveyance system data for the dirt road crossings/dip sections the streams have been assigned as constrained. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, they were assigned as constrained.
- Golf courses have been assigned as constrained if located within the Federal Emergency Management Agency (FEMA) floodway based on the "National Flood Hazard Layer" data.
- The USGS National Hydrographic Dataset in their hydrographic category had assigned some reaches as artificial paths. In these situations and if the aerial photography shows large water bodies (lake, pond, irrigation pond, etc.) these streams have been assigned as constrained.
- Sand mining operations located within the FEMA floodway based on the "National Flood Hazard Layer" have been assigned as constrained.

Un-constrained

- Golf courses have been assigned as un-constrained if not located within the FEMA floodway based on the "National Flood Hazard Layer" data.
- Sand mining operations not located within the FEMA floodway based on the "National Flood Hazard Layer" data have been assigned un-constrained.
- If the stream is located within the FEMA floodway based on the "National Flood Hazard Layer" and there is available land in the floodway fringe (the area between the floodway and the 100-yeaer floodplain) the area has been assigned un-constrained. Note that there may be only one side or both sides of the stream with available land in the floodway fringe therefore a note was added as to which side of the stream is constrained and un-constrained.
- If the stream is located within a FEMA 100-year floodplain based on the "National Flood Hazard Layer" data with no floodway and the FEMA floodplain width is not within an existing development or bordered by roads have been assigned as un-constrained.

Bed Material and Bank Material

The following bed and bank materials were identified:

- Concrete
- Riprap
- Pipe / culvert
- Earth

The assumptions made to identify the streams bed and bank materials were based on the following criteria:

- If the data provided by the Copermittees provided information about the stream bed and bank material, the provided data was used for the bed and bank material.
- Generally the data provided by the Copermittees did not identify the crossing type (pipe, box culvert, bridge with or without piers, etc.) or the material (RCP, RCB, earth, riprap, concrete, etc.). In that case, all culvert/bridge/pipe crossings were assigned as pipe/culvert for the bed and bank material.
- If the Copermittees did not provide data for the dirt road crossings/dip sections the bed and bank material have been assigned as pipe/culvert. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, the bed and bank material have been assigned as earth.
- If aerial photography showed large water bodies (lake, pond, irrigation pond, etc.) they were assigned as earth bed and bank material. The USGS National Hydrographic Dataset in their hydrographic category had assigned some of these types of reaches as artificial paths.
- Sand mining operations within the stream have been assigned as earth for bed and bank material.
- If the Copermittees did not provide data for the stream material the bed and bank material have been assigned based on the aerial photography.

See exhibits titled, "Watershed Management Area Streams by Bed Material" in Attachment A.2.

After stream bed and bank material was classified, earthen reaches were further classified by geologic group. This was accomplished by intersecting the streams with the geologic group layer that had been prepared for use in the dominant hydrologic process and potential coarse sediment yield analyses. The result is displayed in exhibits titled, "Watershed Management Area Streams by Geologic Group" in Attachment A.2.

Hydrographic Category

Streams were classified as "perennial" or "intermittent." See exhibits titled, "Watershed Management Area Streams by Hydrographic Category" in Attachment A.2. Classification was obtained from the USGS National Hydrography Dataset (NHD). The definitions of these categories in the USGS National Hydrography Dataset are:

- **Perennial**: Contains water throughout the year, except for infrequent periods of severe drought.
- **Intermittent**: Contains water for only part of the year, but more than just after rainstorms and at snowmelt.

While the specific Regional MS4 Permit language requested classification of perennial or ephemeral, rather than perennial or intermittent, the data that was referenced in order to classify streams did not include "ephemeral" streams. For reference, the USGS National Hydrography Dataset definition of "ephemeral" is: "contains water only during or after a local rainstorm or heavy snowmelt." None of the stream reaches in the study were classified as ephemeral in the NHD dataset, therefore none are classified as ephemeral in the WMAA product. The City of San Diego provided a map titled “City of San Diego Stream Survey” dated April 3, 2013 prepared by AMEC that shows streams that are “dry” and streams that are “flowing”. This information in conjunction with the other parameters listed in this section was used to determine if a stream was perennial or intermittent.

USGS NHD includes hydrographic category classification for many of the streams. However data was not available for all reaches of all streams. In order to classify reaches of streams that did not already contain this data in NHD, these assumptions were made:

- The USGS NHD information for the stream hydrographic category has been used when available.
- When USGS NHD has “artificial paths” for portions of the stream, the hydrographic category of the upstream portion of the stream have been assigned to the stream unless other assumptions took precedence.
- If aerial photography shows large waterbody (lake, pond, irrigation pond, etc.) perennial has been assumed for the hydrographic category.
- For ponded areas shown on the aerial photography and if the USGS 7.5-minute quadrangles shows cross hatching for the area, intermittent has been assigned unless the upstream portion of the stream was assigned as perennial pursuant to the USGS National Hydrography Dataset then assigned perennial for the ponded area.
- USGS has a dashed line for intermittent streams. USGS has a solid line for perennial streams. In some situations this information was used to assist in the determination of assigning perennial or intermittent to a stream.

2.2.3. Results for stream characterization

The 27 streams and data are contained in a GIS file titled "SD_Regional_WMAA_Streams" located in Attachment C. The streams are shown in watershed maps included in Attachment A.2.

Summary of Deliverables for Stream Characterization

Format	Item	Description	Location
Report	Title of Figures	• "Watershed Management Area Streams" • "Watershed Management Area Streams by Hydrographic Category" • "Watershed Management Area Streams by Bed Material" • "Watershed Management Area Streams by Geologic Group" • "Watershed Management Area Streams by Reach	Attachment A.2

Format	Item	Description	Location
		Type"	
GIS	Map Group Title	Not Grouped	Attachment C.1
	Map Layer Title	SD_Regional_WMAA_Streams	
	Geodatabase Feature Dataset	Streams	
	Geodatabase Feature Class	SD_Regional_WMAA_Streams	
	Geodatabase Geometry Type	Line	
KMZ [1]	KMZ File Name	SD_Regional_WMAA_Streams	Attachment C.2
[1] To enhance the utilization of this data, the Stream Characterization map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).			

In addition to the 27 streams that were subject of detailed analysis, NHD streams have been included on maps and within the geodatabase for reference. The NHD stream alignments have not been corrected and in some cases may be inconsistent with the existing infrastructure. The NHD streams are contained in a GIS file titled, "SD_NHD_Streams."

2.2.4. Limitations for stream characterization

- Only a desktop analysis was performed and no field verification was conducted.
- Infrastructure is only based on storm water conveyance system data provided by Copermittees or clearly visible on aerial photography. If the Copermittee used a numbering or lettering system for describing bed and bank material for example, since the metadata was not provided the bed and bank material could not be verified.
- In some instances concrete channels cannot be identified on aerial photography if it is filled with sediment and/ or vegetation.

2.3.Land Uses

For the purpose of the WMAA, the Regional MS4 Permit requires a description of current and anticipated future land uses. This is presented in the final GIS deliverable as "Land Use Planning" and includes the following representations of land uses in the watersheds: existing land uses, planned land uses, developable lands, redevelopment and infill areas, floodplains, Multiple Species Conservation Program (MSCP) designated areas, and areas not within the Copermittees' jurisdictions (tribal lands, state lands, and federal lands).

2.3.1. Datasets Used for land uses

The following existing regional datasets were referenced to meet this requirement:

- Municipal boundaries: "Municipal_Boundaries" dated August 2012, available from SanGIS/SANDAG
- Ownership: "Parcels" dated December 2013, available from SanGIS/SANDAG
- Existing land use: "SANGIS.LANDUSE_CURRENT" dated December 2012, available from SanGIS/SANDAG (existing land use)
- Planned land use: "PLANLU" (Planned Land Use for the Series 12 Regional Growth Forecast (2050)), dated December 2010, available from SanGIS/SANDAG
- Developable land: "DEVABLE" (Land available for potential development for the Series 12 Regional Growth Forecast), dated December 2010, available from SanGIS/SANDAG
- Redevelopment and infill areas: "REDEVINF" (Redevelopment and infill areas for the Series 12 Regional Growth Forecast), dated December 2010, available from SanGIS/SANDAG
- Floodplains: "National Flood Hazard Layer" provided by Federal Emergency Management Agency October 2012
- Multiple Species Conservation Program (MSCP), total of four datasets available from SanGIS/SANDAG: "MHPA_SD," dated 2012, (Multiple Habitat Planning Areas for City of San Diego); "MSCP_CN," dated 2009 (designations of the County of San Diego's Multiple Species Conservation Program South County Subregional Plan); "MSCP_EAST_DRAFT_CN," dated 2009 (draft East County MSCP Plan); and "Draft_North_County_MSCP_Version_8.0_Categories," dated 2008 (draft North County MSCP Plan)

2.3.2. Methodology/Assumptions/Criteria for land uses

The existing regional datasets for existing land use, planned land use, developable land, redevelopment and infill areas, floodplains, and MSCP designated areas were referenced with no modifications. Areas not within the Copermittees' jurisdictions (tribal lands, state lands, and federal lands) were compiled from SanGIS parcel data (December 2013) based on the "ownership" value. The owners listed below were excluded from the Copermittees jurisdictions and represent the "Federal/State/Indian" layer, which is displayed on various maps included in Attachment A.2.

- Bureau of Land Management
- California Department of Fish and Game
- Indian Reservations
- Military Reservations

- Other Federal
- State
- State of California Land Commission
- State Parks
- U.S. Fish and Wildlife Service
- U.S. Forest Service

When available, relevant data from these areas was included in analyses (e.g., developable land areas within Federal/State/Indian areas). Stream lines were prepared within these areas for continuity. However, stream classification (e.g., bed and bank material) was not prepared within these areas unless data was readily available (e.g., hydrographic category data available from NHD)

2.3.3. Results for land uses

The existing regional datasets are compiled into the Geodatabase in a group titled, "Land Use Planning." Current and anticipated future land uses are depicted in watershed maps included in Attachment C. Federal/State/Indian Lands are also referenced on all other map exhibits included in Attachment A.2.

Summary of Deliverables for Land Uses

Format	Item	Description	Location
Report	Title of Figures	• "Existing Land Use" • "Planned Land Use" • "Developable Land" • "Redevelopment and Infill Areas"	Attachment A.3
GIS	Map Group Title	Land Use Planning	Attachment C.1
	Map Layer Title	Municipal Boundaries Federal/State/Indian Lands SanGIS_ExistingLandUse SanGIS_PlannedLandUse SanGIS_DevelopableLand SanGIS_RedevelopmentandInfill FEMA Floodplain MHPA_SD MSCP_CN MSCP_EAST_DRAFT_CN Draft_North_County_MSCP_Version_8_Categories	
	Geodatabase Feature Dataset	LandUsePlanning	
	Geodatabase Feature Class	SanGIS_MunicipalBoundaries Federal_State_Indian_Lands SanGIS_ExistingLandUse SanGIS_PlannedLandUse	

Format	Item	Description	Location
		SanGIS_DevelopableLand SanGIS_RedevelopmentandInfill FEMA_NFHL SanGIS_MHPA_SD SanGIS_MSCP_CN SanGIS_MSCP_EAST_DRAFT_CN SanGIS_Draft_North_County_MSCP_Version_8_Categories	
	Geodatabase Geometry Type	Polygon	
KMZ [1]	KMZ File Name	Municipal Boundaries Federal/State/Indian Lands Floodplains Due to file size limitations, SanGIS land use datasets were not converted to KMZ.	Attachment C.2
[1] To enhance the utilization of this data, the Land Uses map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).			

2.3.4. Limitations

Some jurisdictions may have compiled GIS land use layers that include more detailed or more current information than the regional datasets available from SanGIS. SanGIS layers were selected for the Regional WMAA to provide consistent land use characterization region-wide, and to provide for repeatability of GIS analyses when a land use layer is required for input data. The definition of non-Copermittee areas identified in this document as "Federal/State/Indian Lands" is for the Regional WMAA. Some WQIPs may define non-Copermittee areas differently.

2.4.Potential Critical Coarse Sediment Yield Areas

The Regional MS4 Permit identifies in the provisions related to the WMAA that potential coarse sediment yield areas within the watershed be identified, with GIS layers (maps) as output. With regard to the function and importance of coarse sediment, SCCWRP Technical Report 667 titled “Hydromodification Assessment and Management in California” states the following:

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

This report identifies the potential critical coarse sediment yield areas for the Tijuana River WMA in compliance with this permit provision. The applied datasets and methodologies for identifying the coarse sediment yield areas, along with their respective results, are described in the sections below.

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

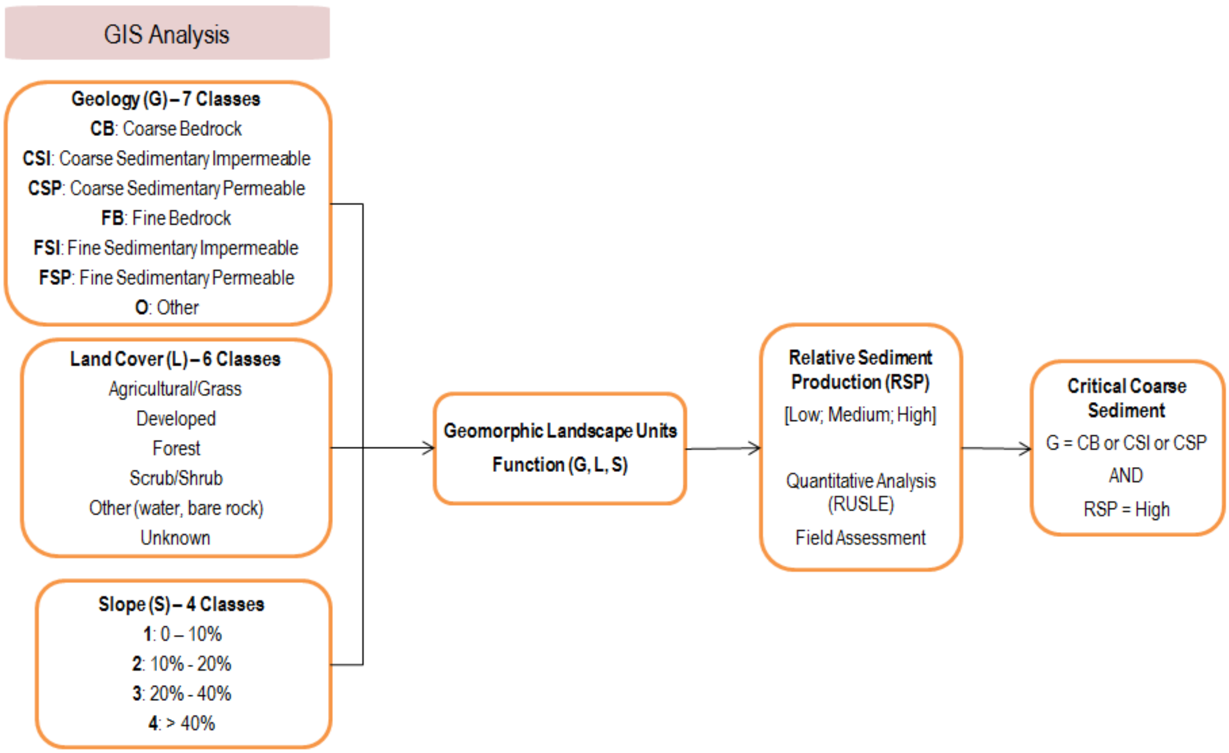
The following datasets were used in the analysis

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3rd Arc Second (~10 meter cells) digital elevation model for San Diego County
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30’x60’ Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30’x60’ Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30’x60’ Quadrangle, Southern California, United States Geological Survey, Southern California Areal Mapping Project (SCAMP), Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	“Geologic Map of California,” California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale

2.4.2. Methodology/Assumptions/Criteria for identifying potential critical coarse sediment yield areas

The methodology used to identify coarse sediment yield areas is based on Geomorphic

Landscape Unit (GLU) methodology presented in the SCCWRP Technical Report 605 titled "Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge" (SCCWRP, 2010). Geomorphic Landscape Units characterize the magnitude of sediment production from areas through three factors judged to exert the greatest influence on the variability on sediment-production rates: geology types, hillslope gradient, and land cover. The GLU approach provides a useful, rapid framework to identify sediment-delivery attributes of the watershed. The process to integrate these factors into GLUs is indicated in the flow chart below.



The following steps were used to define Geomorphic Landscape Units (GLUs), which were then related to the coarse sediment and critical coarse sediment yield areas in the Tijuana River WMA.

1. **Integrate data sets used to determine GLU:** Categories for geology, gradient, and land cover were defined based on readily available GIS datasets for the region and classifications found in relevant literature listed in Chapter 6. The different combinations of these categories make up distinct GLUs.

   - **Geologic Categories**: based on methodology listed in Attachment A.4.1 of Attachment A.4. Resulting geologic categories from this analysis are: Coarse Bedrock (CB), Coarse Sedimentary Impermeable (CSI), Coarse Sedimentary Permeable (CSP), Fine Bedrock (FB), Fine Sedimentary Impermeable (FSI), Fine Sedimentary Permeable (FSP), and Other (O). An exhibit showing the regional geology groupings is presented in Attachment A.4.

- **Land cover categories**: defined using the Ecology Vegetation GIS map layer developed by the City of San Diego, the County of San Diego and SANDAG which were downloaded from SanGIS (2013). The vegetation categories in the GIS layer were grouped (Table A.1.2 in Attachment A.1) to match the following categories used in SCCWRP's Technical Report 605 (SCCWRP, 2010): Agriculture/Grass; Developed; Forest; Scrub/Shrub, Other (Water) and Unknown.

- **Gradient Categories**: based on slope ranges found in a review of relevant literature (GLU methodology applied in California) listed in Chapter 6. The spatial processing of the slope categories utilized the USGS National Elevation Dataset (NED). Slope ranges used include: 0% to 10%, 10% to 20%, 20% to 40%, and greater than 40%.

2. **GLU Union Results**: GIS mapping exercise for the study area resulted in 166 GLUs within the 9 WMAs in San Diego County. Table A.4.2 in Attachment A.4 provides the list of the 166 GLUs.

For implementing hydromodification management performance standards in the Regional MS4 Permit, the Copermittees need to identify Critical Coarse Sediment Yield areas in the study region. To provide information on the identification of Critical Coarse Sediment yield, the study assumed that critical coarse sediment would be generated from GLUs that are composed of geologic units likely to generate coarse sediment (based on the methodology listed in Step 3) and have the potential for high relative sediment production (as estimated using the methodology listed in Step 4).

3. **Define Pertinent Geologic groups**: the geologic groups (Attachment A.4.1) considered in this study to have the potential to generate coarse sediment are Coarse Bedrock (CB), Coarse Sedimentary Impermeable (CSI), and Coarse Sedimentary Permeable (CSP). An exhibit showing the regional geologic grouping is presented in Attachment A.4.

4. **Relate GLU to Sediment Production**: For assigning GLUs with a relative sediment production, the following methodology was utilized:

   - Conducted quantitative analysis to assign relative sediment production. Analysis was performed based on the assumption that sediment production from an area is proportional to the soil loss from the area, as evaluated using standard soil loss equation. Detailed analysis steps are documented in Attachment A.4.2;

   - To validate the quantitative assignment above, a qualitative field assessment was conducted for 40 sites. Site selection and findings from the field assessment is documented in Attachment A.4.3.

   - The result of the field assessment indicated a 65% match between field conditions and the quantitative assignments. The mismatches are attributed to differences in percent land cover as assumed for the quantitative analysis and those observed in the field. As such, the quantitative assignments were considered to be valid for the purposes of assigning relative sediment production.

2.4.3. Results for identifying potential critical coarse sediment yield areas

The resulting GIS maps showing the spatial distribution of geologic grouping and critical coarse sediment yield areas within the Tijuana River WMA are provided in Attachment A.4. An ArcMap document which presents the results from each step of the methodology is included in Attachment C. Based on this analysis it was estimated that 18 % of the study area is a potential critical coarse sediment yield area.

As a result of the regional-scale datasets, and commensurate data resolution, used to map the potential critical coarse sediment yield areas, some areas may have been mapped that in reality do not produce critical coarse sediment as they are existing developed areas. As such, an opportunity for jurisdictions to incorporate more refined data into the preliminary WMAA GIS dataset based on local knowledge and review of current aerial images was provided. The County of San Diego provided augmented data in the Tijuana River WMA for their respective jurisdictional area.

Summary of Deliverables for Potential Critical Coarse Sediment Yield Areas

<table>
<tr><th>Format</th><th>Item</th><th>Description</th><th>Location</th></tr>
<tr><td>Report</td><td>Figures</td><td>“Geologic Grouping”
"Potential Critical Coarse Sediment Yield Areas"</td><td>Attachment A.4</td></tr>
<tr><td rowspan="5">GIS</td><td>Map Group Layer Name</td><td>Potential Coarse Sediment Yield</td><td rowspan="5">Attachment C.1</td></tr>
<tr><td>Map Layer Title</td><td>Geologic Grouping
Land Cover
Slope Category
Geomorphic Landscape Unit
Potential Coarse Sediment Yield Area
Relative Sediment Production
Potential Critical Coarse Sediment Yield Area</td></tr>
<tr><td>Geodatabase Feature Dataset</td><td>PotentialCoarseSedimentYield</td></tr>
<tr><td>Geodatabase Feature Class</td><td>GLUAnalysis
PotentialCoarseSedimentYieldAreas
PotentialCriticalCoarseSedimentYieldAreas</td></tr>
<tr><td>Geodatabase Geometry Type</td><td>Polygon</td></tr>
<tr><td>KMZ [1]</td><td>KMZ File Name</td><td>Potential Critical Coarse Sediment Yield Areas</td><td>Attachment C.2</td></tr>
<tr><td colspan="4">[1] To enhance the utilization of this data, the Geomorphic Landscape Unit Analysis is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).</td></tr>
</table>

2.4.4. Limitations for identifying potential critical coarse sediment yield areas

The resulting GIS layers were developed using regional datasets and provide a useful, rapid framework to perform screening-level analysis that is appropriate for watershed-scale planning studies. The methodology used to identify potential coarse sediment yield areas does not account for instream sediment supply and sediment production from mass failures like landslides which are difficult to estimate on a regional scale without performing extensive field investigation. This data set also does not account for potential existing impediments that may hinder delivery of coarse sediment to receiving waters or downstream locations within the watershed as this was beyond the scope of a regional study. Where more precise estimates are required for a particular site or subarea it is recommended that this analysis be augmented with site-specific analysis. It is also recognized that this regional data set is a function of the inherent data resolution and therefore may not conform to all site conditions, or does not reflect changes to particular areas that have occurred since the underlying data was developed. As such, the WMAA data for the potential critical coarse sediment yield areas should be verified in the field according to the procedures outlined in the Model BMP Design Manual and/or jurisdiction specific BMP Design Manual.

2.5. Physical Structures

The Regional MS4 Permit requires the Copermittees to identify information regarding locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins with GIS layers (maps) as output, for each WMA being analyzed for the purpose of developing watershed-specific requirements for structural BMP implementation. This study identified the physical structures using a desktop-level analysis for the stream(s) identified in Section 2.2 in compliance with this permit provision.

2.5.1. Approach for identifying physical structures

The intent of this portion of the WMAA project was to provide an initial assessment of the structures of interest for the stream(s) identified in Section 2.2. This desktop-level analysis was conducted primarily as a visual survey of aerial imagery and FEMA flood insurance study (FIS) profiles where available. The collected information was entered into a GIS layer for inclusion into the overall WMAA geodatabase containing the characterization layers required by the Regional MS4 Permit. To support overall WMA characterization, the information derived in this task provides insight into water and sediment movement through the watershed (SCCWRP, 2012), the opportunities and limitations for infrastructure retrofits and also informs efforts to identify appropriate locations for habitat or riparian area rehabilitation in relation to proximate infrastructure. Specific information regarding how the survey was performed and the attributes of the generated data is presented in Attachment A.5. Note that concrete channels, pipes/culverts, riprap or other artificial stream armoring, and basins have also been identified in the linework generated for the streams (see Section 2.2).

2.5.2. Results for identifying physical structures

The resulting GIS mapping provided in Attachment A.5 shows the spatial locations of the physical structures within the mapped stream(s).

Summary of Deliverables for Physical Structures

Format	Item	Description	Location
Report	Figure	Watershed Management Area Streams by Reach Type with Channel Structures	Attachment A.5
GIS	Map Group Layer Name	Channel Structures	Attachment C.1
	Map Layer Title	Channel Structures	
	Geodatabase Feature Dataset	ChannelStructures	
	Geodatabase Feature Class	ChannelStructures	
	Geodatabase Geometry Type	Point	
KMZ [1]	Kmz File Name	ChannelStructures	Attachment C.2

[1] To enhance the utilization of this data, the Physical Structures map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).

3. Template for Candidate Project List

The Regional MS4 Permit requires each WMA to use the results from the WMA characterization to compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects should an agency or jurisdiction opt to develop an alternative compliance program. Copermittees must first conclude that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of structural BMPs onsite prior to implementing these candidate projects as alternative compliance projects.

The Copermittees elected to identify potential candidate projects as a separate effort from this regional project, and therefore the process for identifying candidate projects is not documented in this report. Instead, this project only developed a template, in a spreadsheet format, for use by the Copermittees to compile lists of potential candidate projects. The template is intended to enhance regional consistency of the information that is gathered for candidate projects. The template spreadsheet file was distributed to the Copermittees on January 28, 2014. A table of the template components is indicated below:

Column	Primary Heading	Secondary Heading	Guidance for Completing the Project List
A	Project Identifier	-	Unique identifier for the project.
B	Watershed Management Area	-	Dropdown menu to select the watershed management area the project is located in
C	Hydrologic Area (HA)	-	Dropdown menu to select the hydrologic area the project is located in Select a WMA in column B for HA (Column C) dropdown menu to activate.
D	Hydrologic Subarea (HSA)	-	Dropdown menu to select the hydrologic subarea the project is located in. Select a HA in column C for HSA (Column D) dropdown menu to activate.
E	Jurisdiction	-	Dropdown menu to select the jurisdiction the project is located in. Select a HSA in column D for Jurisdiction (Column E) dropdown menu to activate.
F	Project Name	-	Indicate the name of the project.
G	Ownership	Type	Dropdown menu to select if the project is a public project, private project, or public-private partnership.
H	Ownership	Ownership Information	List the details for the owner.
I	Project Location	Address	List the address of the project site.
J	Project Location	APN	List the APN of the parcel.
K	Project Location	Latitude	List the latitude of the project site.
L	Project Location	Longitude	List the longitude of the project site.

Column	Primary Heading	Secondary Heading	Guidance for Completing the Project List
M	Project Origination/ Originator	Name	List the name of the report/organization/individual that provided the idea for the project. Potential origination sources: WQIP, WMAA, JURMPs, WURMPs, CLRPs, IRWM, MSCP, MHPA, Other.
N	Project Origination/ Originator	Contact Information	Link or report title if the proposed project is from a report [or] contact information if from an organization/individual.
O	Project Category	-	Drop Down menu to select the project category; In addition to the 6 project categories explicitly listed in the Regional MS4 Permit, the drop down menu also has a category "Other project types allowed by the MS4 Permit". Example for “Other” project types are agency CIP programs such as Green Streets, LID conversions (medians, parks), agency filter installation, etc.
P	Specific Project Type	-	List the subcategory of the project; for example, list Regional BMP type (i.e. infiltration basin, wetland, etc.).
Q	Potential Pollutant	-	Identify the potential pollutant(s) that can be treated by the proposed project.
R	Project Size & Parameters	Contributing Drainage Area (acres)	List the contributing drainage area to the project.
S	Project Size & Parameters	Parcel Size (acres)	List the size of the parcel the project is located on.
T	Project Size & Parameters	Project Footprint (acres)	List the size of the project footprint.
U	Project Size & Parameters	Parameters (with units as necessary)	Parameters needed to quantify benefits from the project; i.e. for an infiltration basin, list the water quality volume, long-term infiltration rate, depth of the basin, etc.
V	Regulatory Requirement	-	Indicate if the project is proposed to meet particular regulatory requirement such as TMDL, etc.
W	Project Timeline	-	Indicate if a project must be implemented by certain date to meet a grant deadline or other time commitment.
X	Other Notes	-	List any other relevant notes; for example, when retrofitting existing infrastructure project category is selected, input parameters needed to quantify benefits from existing infrastructure into this column as these will be needed to estimate additional benefits that can be used for alternative compliance. If N/A is selected in any dropdown menus, add additional explanation in here

4. Hydromodification Management Applicability/Exemptions

Hydromodification, which is caused by both altered storm water flow and altered sediment flow regimes, is largely responsible for degradation of creeks, streams, and associated habitats in the San Diego Region. The purpose of the hydromodification management requirements in the Regional MS4 Permit is to maintain or restore more natural hydrologic flow regimes to prevent accelerated, unnatural erosion in downstream receiving waters.

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

The March 2011 Final HMP identified certain exemptions from hydromodification management requirements by presenting "HMP applicability criteria." The Regional MS4 Permit maintains some of these HMP applicability criteria. However, some of the applicability criteria are not included under the Regional MS4 Permit unless the area or receiving water is mapped in the WMAA. The intent of this Section is to provide mapping of areas exempt from hydromodification management requirements, and provide supporting technical analyses for exemptions that are recommended by the WMAA.

4.1. Additional Analysis for Hydromodification Management Exemptions

This section documents additional analysis performed to evaluate the following exemptions that were originally part of the approved 2011 Final Hydromodification Management Plan but were not included in the current Regional MS4 Permit and provides recommendation based on the results from the analysis performed if these exemptions should be reinstated through WMAA:

- Exempt River Reaches
- Stabilized Conveyance Systems Draining to Exempt Water Bodies
- Highly Impervious Watersheds and Urban Infill and
- Tidally Influenced Lagoons

4.1.1. Exempt River Reaches

There are no river reaches currently recommended for exemption from hydromodification management requirements in the Tijuana River WMA. Potential river reach exemptions may be studied using the recommended approach documented in the Regional WMAA. Refer to the Regional WMAA for the criteria and an example exemption studies that were prepared for the five river reaches included in the San Diego County Final HMP dated March 2011.

4.1.2. Stabilized Conveyance Systems Draining to Exempt Water Bodies

There are no stabilized conveyance systems currently recommended for exemption from hydromodification management requirements in the Tijuana River WMA. If engineered conveyance systems that are stabilized with materials other than concrete, such as riprap, turf reinforcement mat, or vegetation, including rehabilitated stream systems, are identified as potential candidates for exemption, they may be studied and may be recommended exempt if they meet specific criteria presented in the Regional WMAA for this exemption. Refer to the Regional WMAA for the criteria and an example study that was prepared for Forester Creek in the San Diego River WMA.

4.1.3. Highly Impervious/Highly Urbanized Watersheds and Urban Infill

Based on evaluation of the highly impervious/highly urbanized watershed and urban infill exemptions presented in the March 2011 Final HMP, and comparison with more recent research prepared for the Ventura County Hydromodification Control Plan (Ventura County HCP) (Final Draft dated September 2013), resurrection of these exemptions from the March 2011 Final HMP was not recommended by the Regional WMAA. The research prepared in support of the Ventura County HCP determined lower thresholds of additional impervious area (ranging from 0.44% to 1.65%) than the limit presented in the San Diego County Final HMP dated March 2011 (3%). No areas within the Tijuana River WMA are currently recommended for highly impervious/highly urbanized watershed or urban infill exemption.

4.1.4. Tidally Influenced Lagoons

There are no areas recommended for exemption from hydromodification management requirements under the tidally influenced lagoons category in the Tijuana River WMA. Refer to the Regional WMAA for further information regarding this exemption.

5. Conclusions

5.1. Watershed Management Area Characterization

The WMA Characterization data was developed using available regional data to further understand the macro-scale watershed characteristics and processes in the Tijuana River WMA. The Regional MS4 Permit allows for flexibility in complying with land development requirements when using the information developed in the WMAA to improve water quality planning and implementation associated with land development. This dataset will assist with identifying the opportunities and constraints for watershed-scale projects and management decisions based (as opposed to piecemeal project identification) and provides Copermittees the ability to exercise the option to create an alternative compliance program that offers the opportunity to develop watershed-specific alternatives to universal onsite structural BMP implementation. The characterization data includes:

Characterization Data	Utilization Potential
Dominant Hydrologic Process: • Overland flow • Infiltration • Interflow	• Identify areas for enhanced infiltration or collection of storm water for treatment • Implement management measures that correspond to pre-development conditions – promotes long-term channel stability and health • Increases understanding of the natural functioning of the watershed and what has been (or is at risk of being) altered by urbanization.
Stream Characterization: • Reach type • Bed material • Bank material • Hydrographic category • Channel Structures	• Preliminary dataset that can be used to conduct stream power evaluations • Identify channel systems for preservation or restoration • Identification of appropriate space for channel processes to occur (e.g., flood plain connectivity) • Insight to sensitivity of receiving stream reach • Indicates the features within channels that affect water and sediment

Characterization Data	Utilization Potential
	movement through the watershed
Land Use: • Existing • Future	• Foresight (identifies relative risks, opportunities, or constraints) in comparing future to existing land uses, i.e., areas that may be more/less vulnerable to adverse impacts to changes in storm water runoff associated with development • Encourage infill development
Potential Critical Coarse Sediment Yield Areas	• Preservation of areas or function that contributes critical sediment within the watershed to stream armoring/stability • Assist with identifying potentially susceptible stream reaches that require uninterrupted coarse sediment supplies to remain stable • Dual goal of open space conservation

Regarding the identification of the potential critical coarse sediment yield areas in the WMAA using readily available regional datasets, it is anticipated that when more precise estimates for potential critical coarse sediment yield areas are required for a particular site or subarea that this regional study will be augmented with site-specific analysis. Development projects must avoid critical sediment yield areas or implement measures that allow critical coarse sediment to be discharged to receiving waters, such that there is no net impact to the receiving water to meet the requirements of the Regional MS4 permit. As such, projects should consult the Model BMP Design Manual and/or jurisdiction specific BMP Design manual for options to meet the Regional MS4 Permit requirements. It is anticipated that the data will not be static but will be enhanced over time through future studies or field assessments that will refine what is currently a macro-level data set.

5.2. Template for Candidate Project List

It is anticipated the Copermittees that elect to develop alternative compliance programs will conduct a separate exercise to nominate potential candidate projects for inclusion into the WQIPs using the template developed for this project.

5.3. Hydromodification Management Exemptions

Attachment B.2 presents hydromodification management applicability/exemption mapping for the Tijuana River WMA. The mapping includes receiving waters that are exempt based on the Regional MS4 Permit or recommended exempt based on studies.

Receiving waters that are **exempt** based on the Regional MS4 Permit include:

- The Pacific Ocean
- Lakes and Reservoirs
- Existing underground storm drains or concrete-lined channels draining directly to the ocean

There are no additional exemptions recommended based on studies in the Tijuana River WMA.

6. References

Becker, A. and P. Braun. 1999. Disaggregation, aggregation and spatial scaling in hydrological modeling. Journal of Hydrology 217:239-252.

Beighley, R.E., T. Dunne and J.M. Melack. 2005. Understanding and modeling basin hydrology: Interpreting the hydrogeological signature. Hydrological Processes 19:1333-1353.

Beven, K.J. 2001. Rainfall-Runoff Modelling, The Primer. John Wiley. Chichester, UK.

Brown and Caldwell. 2011. Final Hydromodification Management Plan Prepared for County of San Diego, California.

Chang Consultants. 2013. Hydromodification Exemption Analyses for Select Carlsbad Watersheds. Study prepared for City of Carlsbad, California.

County of San Diego, 2010. Impervious Surface Coefficients for General Land Use Categories for Application within San Diego County. County of San Diego, Department of Planning and Land Use

England, C.B. and H.N. Holtan. 1969. Geomorphic grouping of soils in watershed engineering. Journal of Hydrology 7:217-225.

Fischenich, C. 2001. Stability Thresholds for Stream Restoration Materials. USAE Research and Development Center ERDC TN-EMRRP-SR-29, 10 pp.

Geosyntec Consultants. 2013. Ventura County Hydromodification Control Plan (HCP) Prepared for Ventura Countywide Stormwater Quality Management Program.

Greene, R.G. and J.F. Cruise. 1995. Urban watershed modeling using geographic information system. Journal of Water Resources Planning and Management - ASCE 121:318-325.McCuen, R.H. 2005. Hydrologic Analysis and Design. 3rd Edition. Pearson Prentice Hall. Upper Saddle River, New Jersey. pp 378.

Haverkamp, S., N. Fohrer and H.-G. Frede. 2005. Assessment of the effect of land use patterns on hydrologic landscape functions: A comprehensive GIS-based tool to minimize model uncertainty resulting from spatial aggregation. Hydrological Processes 19:715-727.

Hawley, R.J., and Bledsoe, B.P. 2011. "How do flow peaks and durations change in suburbanizing semi-arid watersheds? A southern California Study," Journal of Hydrology, Elsevier, Vol 405, pp 69-82.

Hawley, R.J., and Bledsoe, B.P. 2013. "Channel enlargement in semiarid suburbanizing watersheds: A southern California case study," Journal of Hydrology, Elsevier, Vol 496, pp 17-30.

Hoag, J.C,. and J. Fripp. 2005. Streambank Soil Bioengineering Considerations for Semi-Arid Climates. Riparian/Wetland Project Information Series No. 18, May 2005, 15 pp.

Jennings, C.W., Gutierrez, C., Bryant, W., Saucedo, G., and Wills, C., 2010. "Geologic Map of California," California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale. http://www.conservation.ca.gov/cgs/cgs_history/PublishingImages/GMC_750k_MapRele ase_page.jpg

Kennedy, M.P., and Peterson, G.L., 1975. “Geology of the San Diego Metropolitan Area, California, Del Mar, La Jolla, Point Loma, La Mesa, Poway, and SW1/4 Escondido 7.5 minute quadrangles,” California Division of Mines and Geology, Bulletin 200, 1:24,000 scale.

Kennedy, M.P., and Tan, S.S., 1977. “Geology of National City, Imperial Beach, and Otay Mesa Quadrangles, Southern San Diego Metropolitan Area, California,” California Division of Mines and Geology, Map Sheet 29, 1:24,000 scale.

Kennedy, M.P., and Tan, S.S., 2002. “Geologic Map of the Oceanside 30’x60’ Quadrangle, California,” California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale. http://www.quake.ca.gov/gmaps/RGM/oceanside/oceanside.html

Kennedy, M.P., and Tan, S.S., 2008. “Geologic Map of the San Diego 30’x60’ Quadrangle, California,” California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale. http://www.quake.ca.gov/gmaps/RGM/sandiego/sandiego.html

National Resources Conservation Service (NRCS). U.S. Department of Agriculture. n.d. SSURGO computerized soils and interpretive maps (automating soil survey maps). Soil Data Mart. Online Database. http://soildatam art.nrcs.usda.gov/County.aspx?State=CA.

RBF Consulting, 2013. Santa Margarita Regional Hydromodification Management Plan. Prepared for Riverside County Copermittees

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool and D.C. Yoder, 1997. Predicting Soil Erosion by Water. A guide to conservation planning with Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703.

Rodgers, T.H., 1965. “Geologic Atlas of California - Santa Ana Sheet,” California Geological Survey, Map No. 019, 1:250,000 scale. http://www.quake.ca.gov/gmaps/GAM/santaana/santaana.html

San Diego Regional Water Quality Control Board. 2013. National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region. Order No. R9-2013-0001. NPDES No. CAS0109266.

Sanford, W.E. and D.L. Selnick, 2013. Estimation of evapotranspiration across the conterminous United States using a regression with climate and land-cover data. Journal of the American Water Resources Association, Vol.49, No.1.

SanGIS, 2013. http://www.sangis.org/download/index.html

Santa Paula Creek Watershed Planning Project: Geomorphology and Channel Stability Assessment. Final Report, 2007. Prepared by Stillwater Sciences for Santa Paula Creek Fish Ladder Joint Powers Authority and California Department of Fish and Game.

SCCWRP, 2010. Hydromodification Screening Tools: GIS-based Catchment analyses of Potential Changes in Runoff and Sediment Discharge. Technical Report 605.

SCCWRP, 2012. Hydromodification Assessment and Management in California. Eric D. Stein; Felicia Federico; Derek B. Booth; Brian P. Bledsoe; Chris Bowles; Zan Rubin; G.

Mathias Kondolf and Ashmita Sengupta. Technical Report 667

Soar, P.J., and Thorne, C.R., 2001. Channel Restoration Design for Meandering Rivers. US Army Corps of Engineers, Final Report, ERDC/CHL CR-01-1. September 2001.

State Water Resources Control Board (2009). Order 2009-0009-DWQ, NPDES General Permit No. CAS000002: National Pollutant Discharges Elimination System (NPDES) California General Permit for Storm Water Discharge Associated with Construction and Land Disturbing

Stillwater Sciences and TetraTech. 2011. Watershed Characterization Part 2: Watershed Management Zones and Receiving-Water Conditions. Report prepared for California State Central Coast Regional Water Quality Control Board, 52 pp.

Strand, R.G. 1962. "Geologic Atlas of California - San Diego-El Centro Sheet," California Geological Survey, Map No. 015, 1:125,000 scale. http://www.quake.ca.gov/gmaps/GAM/sandiegoelcentro/sandiegoelcentro.html

Todd, V.R., 2004. "Preliminary Geologic Map of the El Cajon 30'x60' Quadrangle, Southern California," United States Geological Survey, Southern California Areal Mapping Project (SCAMP), Open File Report 2004-1361, 1:100,000 scale. http://pubs.usgs.gov/of/2004/1361/

USGS, 2013. National Elevation Dataset

Tijuana River
Watershed Management Area Analysis
ATTACHMENTS

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September 8, 2014

Prepared for:
San Diego County Copermittees

Prepared by:

Geosyntec consultants

engineers | scientists | innovators

RICK ENGINEERING COMPANY

ATTACHMENT A

WATERSHED MANAGEMENT AREA CHARACTERIZATION

ATTACHMENT A.1

DOMINANT HYDROLOGICAL PROCESS

A.1 Dominant Hydrological Process

Table A.1.1: Runoff Coefficients versus Land Use, Hydrologic Soil Group (A, B, C, D), and Slope Range

	A			B			C			D		
Land Use	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+
Cultivated land	0.08[a]	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14[b]	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential lot size 1/8 acre	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Residential lot size 1/4 acre	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Residential lot size 1/3 acre	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Residential lot size 1/2 acre	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Residential lot size 1 acre	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

[a] Runoff coefficients for storm recurrence intervals less than 25 years.

[b] Runoff coefficients for storm recurrence intervals of 25 years or longer.

Source: Table 7-9 in *Hydrologic Analysis and Design* (McCuen, 2005)

Table A.1.2: Land Cover Grouping

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
1	42000 Valley and Foothill Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
2	42100 Native Grassland		Agricultural/Grass
3	42110 Valley Needlegrass Grassland		Agricultural/Grass
4	42120 Valley Sacaton Grassland		Agricultural/Grass

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
5	42200 Non-Native Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
6	42300 Wildflower Field		Agriculture/Grass
7	42400 Foothill/Mountain Perennial Grassland		Agriculture/Grass
8	42470 Transmontane Dropseed Grassland		Agriculture/Grass
9	45000 Meadow and Seep		Agriculture/Grass
10	45100 Montane Meadow		Agriculture/Grass
11	45110 Wet Montane Meadow		Agriculture/Grass
12	45120 Dry Montane Meadows		Agriculture/Grass
13	45300 Alkali Meadows and Seeps		Agriculture/Grass
14	45320 Alkali Seep		Agriculture/Grass
15	45400 Freshwater Seep		Agriculture/Grass
16	46000 Alkali Playa Community		Agriculture/Grass
17	46100 Badlands/Mudhill Forbs		Agriculture/Grass
18	Non-Native Grassland		Agriculture/Grass
19	18000 General Agriculture	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Agriculture/Grass
20	18100 Orchards and Vineyards		Agriculture/Grass
21	18200 Intensive Agriculture		Agriculture/Grass
22	18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches		Agriculture/Grass
23	18300 Extensive Agriculture - Field/Pasture, Row Crops		Agriculture/Grass
24	18310 Field/Pasture		Agriculture/Grass
25	18310 Pasture		Agriculture/Grass
26	18320 Row Crops		Agriculture/Grass
27	12000 Urban/Developed		Developed
28	12000 Urban/Develpoed		Developed
29	81100 Mixed Evergreen Forest	Forest	Forest
30	81300 Oak Forest		Forest
31	81310 Coast Live Oak Forest		Forest
32	81320 Canyon Live Oak Forest		Forest
33	81340 Black Oak Forest		Forest
34	83140 Torrey Pine Forest		Forest
35	83230 Southern Interior Cypress Forest		Forest
36	84000 Lower Montane Coniferous Forest		Forest
37	84100 Coast Range, Klamath and Peninsular Coniferous Forest		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
38	84140 Coulter Pine Forest	Forest	Forest
39	84150 Bigcone Spruce (Bigcone Douglas Fir)-Canyon Oak Forest		Forest
40	84230 Sierran Mixed Coniferous Forest		Forest
41	84500 Mixed Oak/Coniferous/Bigcone/Coulter		Forest
42	85100 Jeffrey Pine Forest		Forest
43	11100 Eucalyptus Woodland	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Forest
44	60000 RIPARIAN AND BOTTOMLAND HABITAT	Riparian and Bottomland Habitat	Forest
45	61000 Riparian Forests		Forest
46	61300 Southern Riparian Forest		Forest
47	61310 Southern Coast Live Oak Riparian Forest		Forest
48	61320 Southern Arroyo Willow Riparian Forest		Forest
49	61330 Southern Cottonwood-willow Riparian Forest		Forest
50	61510 White Alder Riparian Forest		Forest
51	61810 Sonoran Cottonwood-willow Riparian Forest		Forest
52	61820 Mesquite Bosque		Forest
53	62000 Riparian Woodlands		Forest
54	62200 Desert Dry Wash Woodland		Forest
55	62300 Desert Fan Palm Oasis Woodland		Forest
56	62400 Southern Sycamore-alder Riparian Woodland		Forest
57	70000 WOODLAND	Woodland	Forest
58	71000 Cismontane Woodland		Forest
59	71100 Oak Woodland		Forest
60	71120 Black Oak Woodland		Forest
61	71160 Coast Live Oak Woodland		Forest
62	71161 Open Coast Live Oak Woodland		Forest
63	71162 Dense Coast Live Oak Woodland		Forest
64	71162 Dense Coast Love Oak Woodland		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
65	71180 Engelmann Oak Woodland	Woodland	Forest
66	71181 Open Engelmann Oak Woodland		Forest
67	71182 Dense Engelmann Oak Woodland		Forest
68	72300 Peninsular Pinon and Juniper Woodlands		Forest
69	72310 Peninsular Pinon Woodland		Forest
70	72320 Peninsular Juniper Woodland and Scrub		Forest
71	75100 Elephant Tree Woodland		Forest
72	77000 Mixed Oak Woodland		Forest
73	78000 Undifferentiated Open Woodland		Forest
74	79000 Undifferentiated Dense Woodland		Forest
75	Engelmann Oak Woodland		Forest
76	52120 Southern Coastal Salt Marsh	Bog and Marsh	Other
77	52300 Alkali Marsh		Other
78	52310 Cismontane Alkali Marsh		Other
79	52400 Freshwater Marsh		Other
80	52410 Coastal and Valley Freshwater Marsh		Other
81	52420 Transmontane Freshwater Marsh		Other
82	52440 Emergent Wetland		Other
83	44000 Vernal Pool	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Other
84	44320 San Diego Mesa Vernal Pool		Other
85	44322 San Diego Mesa Claypan Vernal Pool (southern mesas)		Other
86	13100 Open Water	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
87	13110 Marine		Other
88	13111 Subtidal		Other
89	13112 Intertidal		Other
90	13121 Deep Bay		Other
91	13122 Intermediate Bay		Other
92	13123 Shallow Bay		Other
93	13130 Estuarine		Other
94	13131 Subtidal		Other
95	13133 Brackishwater		Other

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
96	13140 Freshwater	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
97	13200 Non-Vegetated Channel, Floodway, Lakeshore Fringe		Other
98	13300 Saltpan/Mudflats		Other
99	13400 Beach		Other
100	21230 Southern Foredunes	Dune Community	Scrub/Shrub
101	22100 Active Desert Dunes		Scrub/Shrub
102	22300 Stabilized and Partially-Stabilized Desert Sand Field		Scrub/Shrub
103	24000 Stabilized Alkaline Dunes		Scrub/Shrub
104	29000 ACACIA SCRUB		Scrub/Shrub
105	63000 Riparian Scrubs	Riparian and Bottomland Habitat	Scrub/Shrub
106	63300 Southern Riparian Scrub		Scrub/Shrub
107	63310 Mule Fat Scrub		Scrub/Shrub
108	63310 Mulefat Scrub		Scrub/Shrub
109	63320 Southern Willow Scrub		Scrub/Shrub
110	63321 Arundo donnax Dominant/Southern Willow Scrub		Scrub/Shrub
111	63330 Southern Riparian Scrub		Scrub/Shrub
112	63400 Great Valley Scrub		Scrub/Shrub
113	63410 Great Valley Willow Scrub		Scrub/Shrub
114	63800 Colorado Riparian Scrub		Scrub/Shrub
115	63810 Tamarisk Scrub		Scrub/Shrub
116	63820 Arrowweed Scrub		Scrub/Shrub
117	31200 Southern Coastal Bluff Scrub	Scrub and Chaparral	Scrub/Shrub
118	32000 Coastal Scrub		Scrub/Shrub
119	32400 Maritime Succulent Scrub		Scrub/Shrub
120	32500 Diegan Coastal Sage Scrub		Scrub/Shrub
121	32510 Coastal form		Scrub/Shrub
122	32520 Inland form (> 1,000 ft. elevation)		Scrub/Shrub
123	32700 Riversidian Sage Scrub		Scrub/Shrub
124	32710 Riversidian Upland Sage Scrub		Scrub/Shrub
125	32720 Alluvial Fan Scrub		Scrub/Shrub
126	33000 Sonoran Desert Scrub		Scrub/Shrub
127	33100 Sonoran Creosote Bush Scrub		Scrub/Shrub
128	33200 Sonoran Desert Mixed Scrub		Scrub/Shrub
129	33210 Sonoran Mixed Woody Scrub		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
130	33220 Sonoran Mixed Woody and Succulent Scrub		Scrub/Shrub
131	33230 Sonoran Wash Scrub		Scrub/Shrub
132	33300 Colorado Desert Wash Scrub		Scrub/Shrub
133	33600 Encelia Scrub		Scrub/Shrub
134	34000 Mojavean Desert Scrub		Scrub/Shrub
135	34300 Blackbush Scrub		Scrub/Shrub
136	35000 Great Basin Scrub		Scrub/Shrub
137	35200 Sagebrush Scrub		Scrub/Shrub
138	35210 Big Sagebrush Scrub		Scrub/Shrub
139	35210 Sagebrush Scrub		Scrub/Shrub
140	36110 Desert Saltbush Scrub		Scrub/Shrub
141	36120 Desert Sink Scrub		Scrub/Shrub
142	37000 Chaparral		Scrub/Shrub
143	37120 Southern Mixed Chaparral		Scrub/Shrub
144	37120 Southern Mixed Chapparal		Scrub/Shrub
145	37121 Granitic Southern Mixed Chaparral		Scrub/Shrub
146	37121 Southern Mixed Chaparral		Scrub/Shrub
147	37122 Mafic Southern Mixed Chaparral	Scrub and Chaparral	Scrub/Shrub
148	37130 Northern Mixed Chaparral		Scrub/Shrub
149	37131 Granitic Northern Mixed Chaparral		Scrub/Shrub
150	37132 Mafic Northern Mixed Chaparral		Scrub/Shrub
151	37200 Chamise Chaparral		Scrub/Shrub
152	37210 Granitic Chamise Chaparral		Scrub/Shrub
153	37220 Mafic Chamise Chaparral		Scrub/Shrub
154	37300 Red Shank Chaparral		Scrub/Shrub
155	37400 Semi-Desert Chaparral		Scrub/Shrub
156	37500 Montane Chaparral		Scrub/Shrub
157	37510 Mixed Montane Chaparral		Scrub/Shrub
158	37520 Montane Manzanita Chaparral		Scrub/Shrub
159	37530 Montane Ceanothus Chaparral		Scrub/Shrub
160	37540 Montane Scrub Oak Chaparral		Scrub/Shrub
161	37800 Upper Sonoran Ceanothus Chaparral		Scrub/Shrub
162	37830 Ceanothus crassifolius Chaparral		Scrub/Shrub
163	37900 Scrub Oak Chaparral		Scrub/Shrub
164	37A00 Interior Live Oak Chaparral		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
165	37C30 Southern Maritime Chaparral	Scrub and Chaparral	Scrub/Shrub
166	37G00 Coastal Sage-Chaparral Scrub		Scrub/Shrub
167	37K00 Flat-topped Buckwheat		Scrub/Shrub
168	39000 Upper Sonoran Subshrub Scrub		Scrub/Shrub
169	Diegan Coastal Sage Scrub		Scrub/Shrub
170	Granitic Northern Mixed Chaparral		Scrub/Shrub
171	Southern Mixed Chaparral		Scrub/Shrub
172	11000 Non-Native Vegetation	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Unknown
173	11000 Non-Native VegetionVegetation		Unknown
174	11200 Disturbed Wetland		Unknown
175	11300 Disturbed Habitat		Unknown
176	13000 Unvegetated Habitat		Unknown
177	Disturbed Habitat		Unknown

Table A.1.3: Related Land Cover and Land Use Categories

Land Cover per San Diego County	Land Use per Table A.1.1
Agriculture/Grass	Meadow
Forest	Forest
Scrub/Shrub	Average (Meadow, Forest)
Unknown/Other	Meadow

Table A.1.4: Applicable Hydrologic Response Unit Calculations

Land Cover	Soil	Gradient	Runoff Coeff.	ET Coeff.	Infiltration Coeff.	Runoff/ Infiltration Ratio	Hydrologic Process Designation
Agriculture/Grass	A	0-2%	0.10	0.60	0.30	0.33	I
Agriculture/Grass	A	2-6%	0.16	0.60	0.24	0.67	U
Agriculture/Grass	A	6-10%	0.25	0.60	0.15	1.67	O
Agriculture/Grass	B	0-2%	0.14	0.60	0.26	0.54	I
Agriculture/Grass	B	2-6%	0.22	0.60	0.18	1.22	U
Agriculture/Grass	B	6-10%	0.30	0.60	0.10	3.00	O
Agriculture/Grass	C	0-2%	0.20	0.60	0.20	1.00	U
Agriculture/Grass	C	2-6%	0.28	0.60	0.12	2.33	O
Agriculture/Grass	C	6-10%	0.36	0.60	0.04	9.00	O
Agriculture/Grass	D	0-2%	0.24	0.60	0.16	1.50	U
Agriculture/Grass	D	2-6%	0.30	0.60	0.10	3.00	O
Agriculture/Grass	D	6-10%	0.40	0.60	0.00	infinite	O

Land Cover	Soil	Gradient	Runoff Coeff.	ET Coeff.	Infiltration Coeff.	Runoff/ Infiltration Ratio	Hydrologic Process Designation
Forest	A	0-2%	0.05	0.80	0.15	0.33	I
Forest	A	2-6%	0.08	0.80	0.12	0.67	U
Forest	A	6-10%	0.11	0.80	0.09	1.22	U
Forest	B	0-2%	0.08	0.80	0.12	0.67	U
Forest	B	2-6%	0.11	0.80	0.09	1.22	U
Forest	B	6-10%	0.14	0.80	0.06	2.33	O
Forest	C	0-2%	0.10	0.80	0.10	1.00	U
Forest	C	2-6%	0.13	0.80	0.07	1.86	O
Forest	C	6-10%	0.16	0.80	0.04	4.00	O
Forest	D	0-2%	0.12	0.80	0.08	1.50	U
Forest	D	2-6%	0.16	0.80	0.04	4.00	O
Forest	D	6-10%	0.20	0.80	0.00	infinite	O
Scrub/Shrub	A	0-2%	0.08	0.70	0.23	0.33	I
Scrub/Shrub	A	2-6%	0.12	0.70	0.18	0.67	U
Scrub/Shrub	A	6-10%	0.18	0.70	0.12	1.50	U
Scrub/Shrub	B	0-2%	0.11	0.70	0.19	0.58	I
Scrub/Shrub	B	2-6%	0.17	0.70	0.14	1.22	U
Scrub/Shrub	B	6-10%	0.22	0.70	0.08	2.75	O
Scrub/Shrub	C	0-2%	0.15	0.70	0.15	1.00	U
Scrub/Shrub	C	2-6%	0.21	0.70	0.10	2.16	O
Scrub/Shrub	C	6-10%	0.26	0.70	0.04	6.50	O
Scrub/Shrub	D	0-2%	0.19	0.70	0.12	1.50	U
Scrub/Shrub	D	2-6%	0.23	0.70	0.07	3.29	O
Scrub/Shrub	D	6-10%	0.30	0.70	0.00	infinite	O

Hydrologic Process Designation: I = Interflow; O = Overland Flow; U = Uncertain

Table A.1.5: Hydrologic Response Unit Designations

Land Cover	Slope	Soil Type				
		A	B	C	D	Other (fill/water)
Agriculture/ Grass/Unknown/ Other	0-2%	I	I	U	U	U
	2-6%	U	U	O	O	U
	6-10%	O	O	O	O	O
	>10%	O	O	O	O	O
Developed	0-2%	O	O	O	O	O
	2-6%	O	O	O	O	O
	6-10%	O	O	O	O	O
	>10%	O	O	O	O	O
Forest	0-2%	I	U	U	U	U
	2-6%	U	U	O	O	U
	6-10%	U	O	O	O	U
	>10%	O	O	O	O	O
Scrub/Shrub	0-2%	I	I	U	U	U
	2-6%	U	U	O	O	U
	6-10%	U	O	O	O	U
	>10%	O	O	O	O	O

Hydrologic Process Designation: I = Interflow; O = Overland Flow; U = Uncertain

Exhibit Showing Dominant Hydrologic Processes

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

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ATTACHMENT A.2

STREAM CHARACTERIZATION

Watershed Management Area Streams

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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Miles 0 25 50 100 150

Watershed Management Area Streams by Hydrographic Category

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Miles 0 25 50 100 150

NORTH

Watershed Management Area Streams by Bed Material

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

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Watershed Management Area Streams by Geologic Group

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

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Watershed Management Area Streams by Reach Type

Tijuana Watershed - HU 911.00, 467 mi2

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ATTACHMENT A.3

LAND USES

Existing Land Use

Tijuana Watershed - HU 911.00, 467 mi2

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Planned Land Use

Tijuana Watershed - HU 911.00, 467 mi2

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Developable Land

Tijuana Watershed - HU 911.00, 467 mi2

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Redevelopment and Infill Areas

Tijuana Watershed - HU 911.00, 467 mi2

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ATTACHMENT A.4

POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS

A.4.1 Geology Grouping

Geologic grouping was based on the mapped geologic unit as determined by published geologic mapping information. The following describes the methodology utilized to determine bedrock or sedimentary characteristics, anticipated grain size, and suitability for infiltration. A complete list of the various geologic maps used in this evaluation is listed in Chapter 6.

Due to the various mapped scales of the published data and differing mapped unit names, the geologic units were initially compiled into similar categories where possible. For example, the Lindavista Formation is mapped as unit Ql on geologic maps at a scale of 1:24,000 but correlates to the same unit Qvop8 on geologic maps at a scale of 1:100,000. Following the compilation of geologic unit names, the units were differentiated between crystalline bedrock and sedimentary formations based on geologic characterization and material behavior. The Point Loma Formation for example, is a Cretaceous-age sandstone, but it was classified as a "coarse bedrock" unit due to its indurated and resistant nature.

For each site location, the predominant geologic units were then described as "coarse" or "fine" based on typical weathering characteristics of the bedrock units, or primary grain size of the sedimentary units. For example, granodiorite or tonalite crystalline rock typically weathers to a coarse material such as a silty sand and therefore was classified as "coarse," compared to a gabbro which generally weathers to a sandy clay and was characterized as "fine." Sedimentary formations can be more variable, such as the Mission Valley Formation. In this case, the Mission Valley Formation was characterized as "coarse" since the unit is predominantly comprised of sandstone even if it does contain localities of siltstone and claystone within the unit.

To further characterize the sedimentary formations, these units were evaluated for suitability of infiltration. Since no field investigations were performed for this evaluation to determine permeability, the differentiation between impermeable and permeable were based on the age of the geologic unit with the assumption that relatively younger sedimentary units of Pleistocene-age or younger (<1.6 mya) would be more susceptible to surface water infiltration. Geology grouping of different map units is presented in Table A.4.1

Table A.4.1 Geologic grouping for different map units

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
gr-m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
grMz	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Jcr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jhc	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jsp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ka	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kdl	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgbf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgdf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgh	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm1	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm2	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm3	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm4	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgu	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Khg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ki	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kis	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJem	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJld	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Klb	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klh	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Km	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmgp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpa	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kqbd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kt	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ktr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kvc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwsr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Mzd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzq	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzs	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
sch	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Kp	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ql	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
QTf	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ec	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
K	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
Kccg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kcs	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kl	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ku	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvof	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tp	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tpm	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tscu	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsd	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdcg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsm	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tso	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tst	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tt	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tta	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmv	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsi	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa11	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa12	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa13	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoc	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop1	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvop11a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop12	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop13	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop2	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop3	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop4	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop5	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop6	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsa	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qof	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Q	Jennings; CA	Coarse	Sedimentary	Permeable	CSP
Qa	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qd	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qmb	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qw	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qt	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa1-2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa2-6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa5	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa7	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qoc	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qc	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qu	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop2-4	San Diego 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop3	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop4	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop6	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qya	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyc	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Mzu	San Diego & Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
gb	Jennings; CA	Fine	Bedrock	Impermeable	FB
JTRm	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kat	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kc	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgb	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
KJvs	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kmv	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Ksp	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kvsp	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kwmt	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Qv	Jennings; CA	Fine	Bedrock	Impermeable	FB
Tba	San Diego 30' x 60'	Fine	Bedrock	Impermeable	FB
Tda	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tv	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tvsr	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgdfg	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Ta	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tcs	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Td	San Diego & Oceanside	Fine	Sedimentary	Impermeable	FSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
	30' x 60'				
Td+Tf	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qls	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tm	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tf	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tfr	El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
To	San Diego & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qpe	San Diego & Oceanside 30' x 60'	Fine	Sedimentary	Permeable	FSP
Mexico	San Diego 30' x 60'	NA	NA	Permeable	Other
Kuo	San Diego 30' x 60'	NA (Offshore)	NA	Permeable	Other
Teo	San Diego & Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Tmo	Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Qmo	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
QTso	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
af	San Diego & Oceanside 30' x 60'	Variable, dependent on source material	Sedimentary		Other

A.4.2 Quantitative Analysis

Soil loss estimates for each Geomorphic Landscape Unit were estimated using the Revised Universal Soil Loss Equation (RUSLE; Renard et al. 1997) listed below:

$$A = R \times K \times LS \times C \times P$$

Where

A = estimated average soil loss in tons/acre/year

R = rainfall-runoff erosivity factor

K = soil erodibility factor

LS = slope length and steepness factor

C = cover-management factor

P = support practice factor; assumed 1 for this analysis

Regional datasets used to estimate the inputs required to estimate the soil loss from each GLU are listed in table below:

Dataset	Source	Download year	Description
RUSLE – R Factor	SWRCB	2014	Regional R factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_R_Factor/
RUSLE – K Factor	SWRCB	2014	Regional K factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_K_Factor/
RUSLE – LS Factor	SWRCB	2014	Regional LS factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_LS_Factor/
RUSLE – C Factor	USEPA	2014	Regional C factor map was downloaded from http://www.epa.gov/esd/land-sci/emap_west_browser/pages/wemap_mm_sl_rusle_c_qt.htm#mapnav

GIS analysis was used to calculate the area weighted estimate of R, K, LS and C factors using the regional datasets listed in the table above. For the developed land cover the C factor was then adjusted to 0 from the regional estimate to account for management actions implemented on developed sites (e.g. impervious surfaces). Soil loss estimates ranged from 0 to 15.2 tons/acre/year.

For evaluating the degree of relative risk to a stream solely arising from changes in sediment and/or water delivery SCCWRP Technical Report 605, 2010 states:

> *"The challenge in implementing this step is that presently we have insufficient basis to defensibly identify either low-risk or high-risk conditions using these metrics. For example, channels that are close to a threshold for geomorphic change may display significant morphological changes under nothing more than natural year-to-year variability in flow or sediment load.*

- *Acknowledging this caveat, we nonetheless anticipate that changes of less than 10% in either driver are unlikely to instigate, on their own, significant channel changes. This value is a conservative estimate of the year-to-year variability in either discharge or sediment flux that can be accommodated by a channel system in a state of dynamic equilibrium. It does not "guarantee," however, that channel change may not occur—either in response to yet modest alterations in water or sediment delivery, or because of other urbanization impacts (e.g., point discharge of runoff or the trapping of the upstream sediment flux; see Booth 1990) that are not represented with this analysis.*
- *In contrast, recognizing a condition of undisputed "high risk" must await broader collection of regionally relevant data. We note that >60% reductions in predicted sediment production have resulted in both minimal (McGonigle) and dramatic (Agua Hedionda) channel changes, indicating that "more data" may never provide absolute guidance. At present, we suggest using predicted watershed changes of 50% or more in either runoff (as indexed by change in impervious area) or sediment production as provisional criteria for requiring a more detailed evaluation of both the drivers and the resisting factors for channel change, regardless of other screening-level assessments. Clearly, however, only more experience with the application of such "thresholds," and the actual channel conditions that accompany them, will provide a defensible basis for setting numeric standards."*

The following criterion was developed using the suggestions listed above and then used to assign relative sediment production rating to each GLU:

- Low: Soil Loss < 5.6 tons/acre/year [GLUs that have a soil loss of 0 to 5.6 tons/acre/year produces around 10% of the total coarse sediment soil loss from the study area]
- Medium: 5.6 tons/acre/year < Soil Loss < 8.4 tons/acre/year
- High: > 8.4 tons/acre/year [GLUs that have a soil loss greater than 8.4 tons/acre/year produces around 42% of the total coarse sediment soil loss from the study area]

Results from the quantitative analysis are summarized in Table A.4.2.

Table A.4.2 Relative Sediment Production for different Geomorphic Landscape Units

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CB-Agricultural/Grass-1	52883	0.20	4.67	0.14	50	6.5	Medium	No
CB-Agricultural/Grass-2	40633	0.21	5.19	0.14	56	8.3	Medium	No
CB-Agricultural/Grass-3	32617	0.22	6.04	0.14	57	10.6	High	Yes
CB-Agricultural/Grass-4	11066	0.23	7.38	0.14	57	13.5	High	Yes
CB-Developed-1	39746	0.22	3.77	0	49	0	Low	No
CB-Developed-2	32614	0.22	4.28	0	50	0	Low	No
CB-Developed-3	15841	0.22	4.86	0	49	0	Low	No
CB-Developed-4	1805	0.22	5.63	0	48	0	Low	No
CB-Forest-1	32231	0.20	6.38	0.14	39	6.8	Medium	No
CB-Forest-2	38507	0.20	7.20	0.13	45	8.8	High	Yes
CB-Forest-3	55303	0.20	8.14	0.13	48	10.6	High	Yes
CB-Forest-4	38217	0.20	9.95	0.14	50	13.6	High	Yes
CB-Other-1	1036	0.20	5.52	0.13	45	6.5	Medium	No
CB-Other-2	317	0.20	6.46	0.13	45	7.9	Medium	No
CB-Other-3	296	0.20	6.96	0.14	43	8.3	Medium	No
CB-Other-4	111	0.21	6.84	0.14	41	8.2	Medium	No
CB-Scrub/Shrub-1	88135	0.20	5.66	0.14	33	5.3	Low	No
CB-Scrub/Shrub-2	143694	0.20	6.51	0.14	37	6.8	Medium	No
CB-Scrub/Shrub-3	246703	0.21	7.33	0.14	41	8.4	Medium	No
CB-Scrub/Shrub-4	191150	0.21	8.28	0.14	42	9.8	High	No
CB-Unknown-1	1727	0.21	5.32	0.13	44	6.3	Medium	No
CB-Unknown-2	1935	0.21	5.95	0.13	44	7.1	Medium	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CB-Unknown-3	1539	0.22	6.21	0.13	44	7.7	Medium	No
CB-Unknown-4	278	0.22	6.61	0.13	44	8.4	High	Yes
CSI-Agricultural/Grass-1	14609	0.34	2.72	0.14	39	4.8	Low	No
CSI-Agricultural/Grass-2	9059	0.37	3.61	0.14	47	8.7	High	Yes
CSI-Agricultural/Grass-3	10096	0.38	3.99	0.14	47	9.8	High	Yes
CSI-Agricultural/Grass-4	2498	0.37	4.33	0.14	47	10.5	High	Yes
CSI-Developed-1	82371	0.28	2.51	0	39	0	Low	No
CSI-Developed-2	22570	0.30	2.66	0	41	0	Low	No
CSI-Developed-3	13675	0.30	2.89	0	40	0	Low	No
CSI-Developed-4	3064	0.27	3.20	0	39	0	Low	No
CSI-Forest-1	449	0.27	4.26	0.13	43	6.6	Medium	No
CSI-Forest-2	611	0.25	5.11	0.13	44	7.5	Medium	No
CSI-Forest-3	716	0.29	4.43	0.13	44	7.4	Medium	No
CSI-Forest-4	348	0.30	4.49	0.13	43	7.6	Medium	No
CSI-Other-1	319	0.31	2.50	0.13	32	3.2	Low	No
CSI-Other-2	83	0.27	3.01	0.13	39	4.3	Low	No
CSI-Other-3	45	0.28	3.03	0.13	39	4.5	Low	No
CSI-Other-4	13	0.24	4.01	0.14	39	5.2	Low	No
CSI-Scrub/Shrub-1	9051	0.26	3.53	0.13	39	4.7	Low	No
CSI-Scrub/Shrub-2	10802	0.27	4.36	0.13	41	6.3	Medium	No
CSI-Scrub/Shrub-3	28220	0.26	4.82	0.13	41	6.7	Medium	No
CSI-Scrub/Shrub-4	20510	0.26	5.52	0.13	41	7.8	Medium	No
CSI-Unknown-1	5292	0.28	2.38	0.13	36	3.1	Low	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CSI-Unknown-2	2074	0.29	2.98	0.13	40	4.5	Low	No
CSI-Unknown-3	2171	0.27	3.04	0.13	39	4.2	Low	No
CSI-Unknown-4	676	0.26	3.04	0.13	38	3.8	Low	No
CSP-Agricultural/Grass-1	59327	0.22	3.01	0.14	44	4.0	Low	No
CSP-Agricultural/Grass-2	8426	0.23	3.81	0.14	42	5.2	Low	No
CSP-Agricultural/Grass-3	2377	0.24	4.05	0.14	41	5.6	Low	No
CSP-Agricultural/Grass-4	291	0.22	6.28	0.14	52	10.1	High	Yes
CSP-Developed-1	85283	0.27	2.10	0	42	0	Low	No
CSP-Developed-2	7513	0.26	2.77	0	42	0	Low	No
CSP-Developed-3	2317	0.27	2.70	0	40	0	Low	No
CSP-Developed-4	272	0.27	2.76	0	38	0	Low	No
CSP-Forest-1	14738	0.22	4.52	0.14	44	6.0	Medium	No
CSP-Forest-2	3737	0.22	5.99	0.14	45	8.2	Medium	No
CSP-Forest-3	1858	0.21	6.42	0.14	45	8.5	High	Yes
CSP-Forest-4	484	0.21	7.62	0.14	48	10.2	High	Yes
CSP-Other-1	7404	0.23	2.61	0.14	39	3.2	Low	No
CSP-Other-2	343	0.24	3.68	0.13	40	4.8	Low	No
CSP-Other-3	126	0.24	3.76	0.13	40	4.9	Low	No
CSP-Other-4	17	0.24	4.19	0.13	39	5.3	Low	No
CSP-Scrub/Shrub-1	22583	0.23	3.75	0.14	41	4.8	Low	No
CSP-Scrub/Shrub-2	8938	0.24	5.63	0.14	40	7.1	Medium	No
CSP-Scrub/Shrub-3	7186	0.23	6.15	0.13	39	7.5	Medium	No
CSP-Scrub/Shrub-4	2609	0.22	7.16	0.14	43	9.3	High	Yes

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CSP-Unknown-1	6186	0.25	2.63	0.13	40	3.4	Low	No
CSP-Unknown-2	744	0.27	3.49	0.13	39	4.8	Low	No
CSP-Unknown-3	350	0.28	3.32	0.13	38	4.5	Low	No
CSP-Unknown-4	78	0.28	3.26	0.13	40	4.5	Low	No
FB-Agricultural/Grass-1	6103	0.25	5.49	0.14	49	9.2	High	No
FB-Agricultural/Grass-2	7205	0.25	5.87	0.14	51	10.1	High	No
FB-Agricultural/Grass-3	6730	0.24	6.43	0.14	53	11.3	High	No
FB-Agricultural/Grass-4	2586	0.22	8.62	0.14	57	15.2	High	No
FB-Developed-1	10116	0.28	3.94	0	46	0	Low	No
FB-Developed-2	9075	0.28	4.41	0	45	0	Low	No
FB-Developed-3	5499	0.27	4.72	0	44	0	Low	No
FB-Developed-4	785	0.27	5.08	0	43	0	Low	No
FB-Forest-1	3780	0.21	7.24	0.13	39	8.0	Medium	No
FB-Forest-2	7059	0.21	7.53	0.13	43	8.8	High	No
FB-Forest-3	13753	0.22	8.02	0.13	43	9.7	High	No
FB-Forest-4	8899	0.26	9.63	0.13	35	11.5	High	No
FB-Other-1	172	0.26	5.72	0.13	44	8.6	High	No
FB-Other-2	75	0.26	5.97	0.13	38	7.7	Medium	No
FB-Other-3	76	0.28	6.27	0.13	34	7.6	Medium	No
FB-Other-4	36	0.31	6.70	0.13	33	8.6	High	No
FB-Scrub/Shrub-1	10297	0.24	6.94	0.14	36	8.3	Medium	No
FB-Scrub/Shrub-2	25150	0.25	7.24	0.14	38	9.0	High	No
FB-Scrub/Shrub-3	70895	0.25	7.89	0.13	38	10.0	High	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FB-Scrub/Shrub-4	70679	0.26	9.05	0.14	39	12.1	High	No
FB-Unknown-1	654	0.30	5.33	0.13	37	7.6	Medium	No
FB-Unknown-2	829	0.29	5.26	0.13	40	7.9	Medium	No
FB-Unknown-3	1062	0.29	5.54	0.13	39	8.2	Medium	No
FB-Unknown-4	299	0.28	6.02	0.13	38	8.4	High	No
FSI-Agricultural/Grass-1	8462	0.32	3.91	0.13	24	3.9	Low	No
FSI-Agricultural/Grass-2	4979	0.33	4.29	0.13	31	5.7	Medium	No
FSI-Agricultural/Grass-3	4808	0.34	4.26	0.13	34	6.3	Medium	No
FSI-Agricultural/Grass-4	1055	0.35	4.11	0.13	36	6.7	Medium	No
FSI-Developed-1	9953	0.29	3.09	0	34	0	Low	No
FSI-Developed-2	4972	0.31	3.22	0	37	0	Low	No
FSI-Developed-3	3350	0.29	3.30	0	36	0	Low	No
FSI-Developed-4	763	0.28	3.31	0	37	0	Low	No
FSI-Forest-1	186	0.33	4.62	0.13	37	7.2	Medium	No
FSI-Forest-2	217	0.35	4.47	0.13	39	7.9	Medium	No
FSI-Forest-3	262	0.37	4.71	0.13	40	9.2	High	No
FSI-Forest-4	111	0.36	4.73	0.13	40	9.2	High	No
FSI-Other-1	266	0.31	3.11	0.13	24	2.9	Low	No
FSI-Other-2	81	0.30	3.29	0.13	25	3.1	Low	No
FSI-Other-3	56	0.31	3.04	0.13	27	3.2	Low	No
FSI-Other-4	15	0.29	3.57	0.13	33	4.4	Low	No
FSI-Scrub/Shrub-1	2241	0.27	4.46	0.13	29	4.5	Low	No
FSI-Scrub/Shrub-2	3911	0.28	4.96	0.13	31	5.7	Medium	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FSI-Scrub/Shrub-3	7590	0.29	5.05	0.13	34	6.3	Medium	No
FSI-Scrub/Shrub-4	3502	0.30	5.14	0.13	37	7.5	Medium	No
FSI-Unknown-1	1117	0.29	2.83	0.13	27	3.0	Low	No
FSI-Unknown-2	780	0.30	3.44	0.13	32	4.3	Low	No
FSI-Unknown-3	855	0.29	3.41	0.13	31	4.0	Low	No
FSI-Unknown-4	285	0.28	3.21	0.13	32	3.7	Low	No
FSP-Agricultural/Grass-1	13	0.22	2.22	0.13	40	2.5	Low	No
FSP-Agricultural/Grass-2	3	0.22	2.59	0.13	40	3.0	Low	No
FSP-Agricultural/Grass-3	2	0.22	2.69	0.13	40	3.2	Low	No
FSP-Agricultural/Grass-4	0	0.20	2.94	0.12	40	2.9	Low	No
FSP-Developed-1	180	0.26	2.85	0	40	0	Low	No
FSP-Developed-2	13	0.25	2.69	0	40	0	Low	No
FSP-Developed-3	8	0.21	2.25	0	40	0	Low	No
FSP-Developed-4	0	0.21	2.29	0	40	0	Low	No
FSP-Forest-1	8	0.22	2.29	0.14	40	2.9	Low	No
FSP-Forest-2	5	0.20	2.22	0.14	40	2.5	Low	No
FSP-Forest-3	0	0.20	2.22	0.14	40	2.5	Low	No
FSP-Other-1	1307	0.20	2.38	0.14	40	2.7	Low	No
FSP-Other-2	34	0.21	2.36	0.14	40	2.7	Low	No
FSP-Other-3	8	0.22	2.56	0.13	40	3.0	Low	No
FSP-Other-4	0	0.43	4.35	0.12	40	9.3	High	No
FSP-Scrub/Shrub-1	147	0.23	2.68	0.14	40	3.3	Low	No
FSP-Scrub/Shrub-2	18	0.23	2.55	0.14	40	3.3	Low	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FSP-Scrub/Shrub-3	4	0.20	2.23	0.14	40	2.6	Low	No
FSP-Scrub/Shrub-4	0	0.20	1.70	0.12	40	1.7	Low	No
FSP-Unknown-1	40	0.20	1.87	0.13	40	1.9	Low	No
FSP-Unknown-2	5	0.20	1.99	0.12	40	2.0	Low	No
FSP-Unknown-3	1	0.20	2.39	0.12	40	2.4	Low	No
O-Agricultural/Grass-1	2433	0.20	2.93	0.14	34	2.8	Low	No
O-Agricultural/Grass-2	112	0.21	3.44	0.14	32	3.2	Low	No
O-Agricultural/Grass-3	30	0.23	3.89	0.13	32	3.8	Low	No
O-Agricultural/Grass-4	1	0.26	6.47	0.13	37	7.9	Medium	No
O-Developed-1	8327	0.27	1.37	0	39	0	Low	No
O-Developed-2	474	0.25	2.12	0	40	0	Low	No
O-Developed-3	157	0.26	3.07	0	41	0	Low	No
O-Developed-4	26	0.24	3.89	0	41	0	Low	No
O-Forest-1	235	0.22	6.15	0.13	43	7.6	Medium	No
O-Forest-2	67	0.21	5.07	0.13	45	6.6	Medium	No
O-Forest-3	45	0.21	5.43	0.13	47	7.3	Medium	No
O-Forest-4	20	0.20	5.95	0.13	59	9.0	High	No
O-Other-1	9362	0.25	3.86	0.13	36	4.3	Low	No
O-Other-2	344	0.24	3.32	0.13	35	3.5	Low	No
O-Other-3	120	0.23	4.86	0.13	35	5.0	Low	No
O-Other-4	37	0.22	5.64	0.13	39	6.6	Medium	No
O-Scrub/Shrub-1	688	0.22	4.83	0.13	40	5.7	Medium	No
O-Scrub/Shrub-2	224	0.22	5.80	0.13	36	6.3	Medium	No

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
O-Scrub/Shrub-3	209	0.22	6.47	0.13	41	7.5	Medium	No
O-Scrub/Shrub-4	96	0.22	6.62	0.13	44	8.2	Medium	No
O-Unknown-1	1236	0.28	1.60	0.12	26	1.5	Low	No
O-Unknown-2	62	0.27	1.48	0.13	36	1.8	Low	No
O-Unknown-3	15	0.29	3.52	0.13	38	4.9	Low	No
O-Unknown-4	7	0.34	3.87	0.12	40	6.6	Medium	No

GLU Nomenclature: Geology – Land Cover – Slope Category

Geology Categories:

CB Coarse Bedrock

CSI Coarse Sedimentary Impermeable

CSP Coarse Sedimentary Permeable

FB Fine Bedrock

FSI Fine Sedimentary Impermeable

FSP Fine Sedimentary Permeable

O Other

Slope Categories:

1 0%-10%

2 10% - 20%

3 20% - 40%

4 > 40%

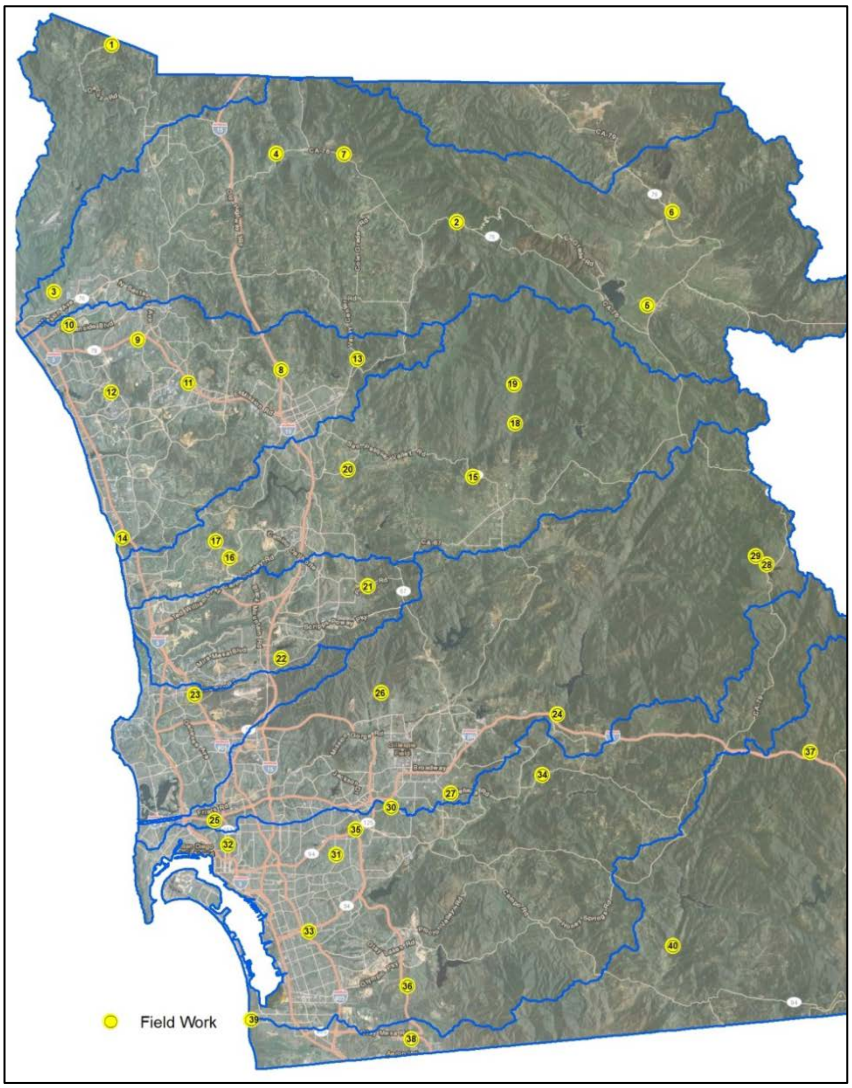
A4.3 Field Assessment

Site Selection:

Forty locations were selected from the study region for field assessment. Sites were selected such that they are accessible by existing road network based on review of satellite imagery and are uniformly distributed considering the following criteria:

- Geologic grouping
- Land cover
- Slope category
- WMA
- Jurisdiction

Yellow circles in the figure below shows the 40 locations for which field assessment was performed.



Pre-Field Activities

Prior to conducting field activities, the consultant team reviewed available published geologic information at each site location and prepared satellite imagery of each site using Google Earth™. Pre-field activities consisted of evaluating site access at each location using aerial imagery and logistics were coordinated based on regional site location to maximize field efficiency.

Site Reconnaissance

Site reconnaissance was performed at forty locations between 22 January and 7 February 2014 by a team of geologists. The reconnaissance consisted of:

- Visual soil classification,
- Assessing existing vegetative cover (0-100%),
- Qualitative assignment of existing sediment production (low, medium, and high) [based on existing vegetative cover],
- Qualitative assignment of potential sediment production (low, medium, and high)[assuming there is 0% vegetative cover], and
- Identifying existing erosional features.

Descriptions and visual classifications of the surficial materials were based on the Unified Soil Classification System (USCS). Underlying geologic units were confirmed where exposed formations were observed within the individual site limits.

SITE AND GEOLOGIC CONDTIONS

Our knowledge of the site conditions has been developed from a review of available geologic literature, previous geologic and geotechnical investigations by the consultant team in the study region, professional experience, site reconnaissance, and field investigations performed for this study.

Surface Conditions

Site locations were sited in open space with the exception of sites ID-27, -30, and -31 which were situated within developed areas with paved streets and sidewalks. The surface conditions at the site locations were characterized by sloping terrain varying from relatively flat (< 5%) to very steep slopes (> 40%). At the time of our reconnaissance the natural hillsides along the areas of interest were covered by varying degrees of moderate to dense growth scrub brush, low grasses, and scattered trees.

Existing erosional and geomorphic features at each site location were identified where possible. The observed erosional features included notable drainages, rilling, scour, and sediment accumulation. Observed geomorphic features included areas of minor slope instability and surficial slumping. Several sources of ground disturbance were identified during the site reconnaissance included active grading operations and bioturbation.

An evaluation of the existing and potential sediment production for each site was determined based on surface conditions. Sediment production was assigned as “high, medium, or low” based on the existing conditions and consultant team’s professional experience.

Surficial Deposits

Surficial deposits, including topsoil, alluvium, colluvium, slopewash, and residual soils are present in portions of the study area within the natural drainages and mantling the slope areas. The composition and grain size of these materials are variable depending on the age, parent sources, and mode of deposition.

Geologic Conditions

Our knowledge of the subsurface conditions at the site locations is based on a review of available published geologic information, professional experience, site reconnaissance, previous explorations and geotechnical investigations performed by the consultant team in the study region.

Field Assessment Photo Log

Field Visit ID-1
GLU: CB-Scrub/Shrub-4

View: Looking southwest

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 90%

Field Visit ID-2
GLU: CB-Forest-4

View: Looking north

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 95%

Field Visit ID-3

GLU: CSI-Agricultural/ Grass-3

View: Looking southwest

Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover:

95-100%

Field Visit ID-4

GLU: CSI-Scrub/Shrub-2

View: Looking north

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 70%

	**Field Visit ID-5** **GLU: CSP-Agricultural/ Grass-1** View: Looking southwest Existing sediment production: Low to Med Potential sediment production: Med Existing veg. cover: 90%

	**Field Visit ID-6** **GLU: CSP-Agricultural/ Grass-3** View: Looking east Existing sediment production: Low to Med Potential sediment production: Low to Med Existing veg. cover: Southeast slope ~50% Northeast slope ~70%

Field Visit ID-7

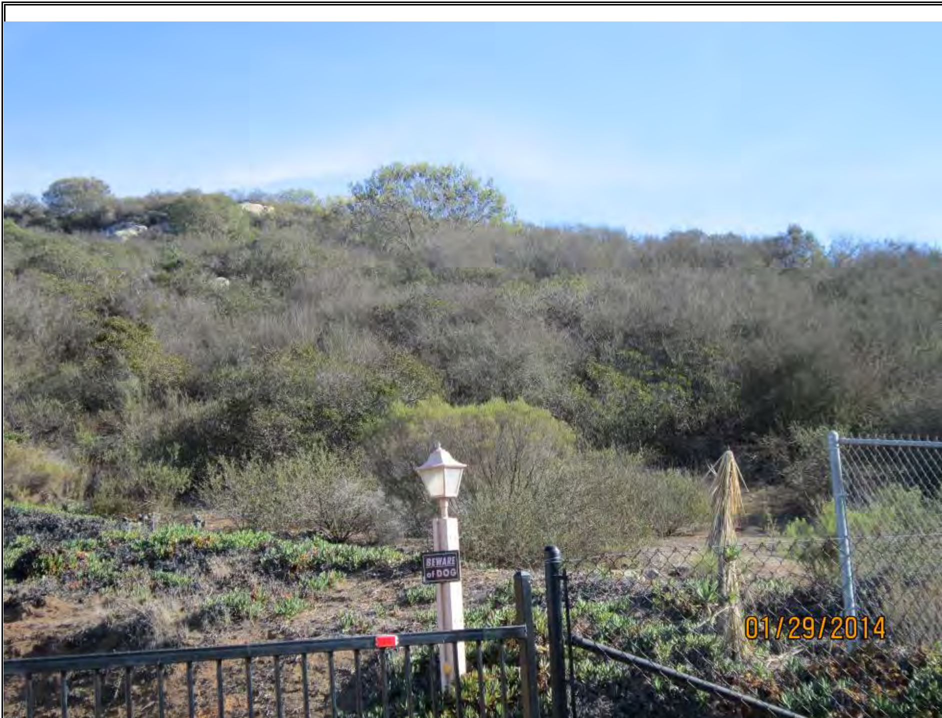
GLU: CSP-Forest-3

View: Looking east

Existing sediment production: Med to High

Potential sediment production: High

Existing veg. cover: 75-80%



Field Visit ID-8

GLU: CB-Scrub/Shrub-3

View: Looking southeast

Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover: 90-95%

Field Visit ID-9

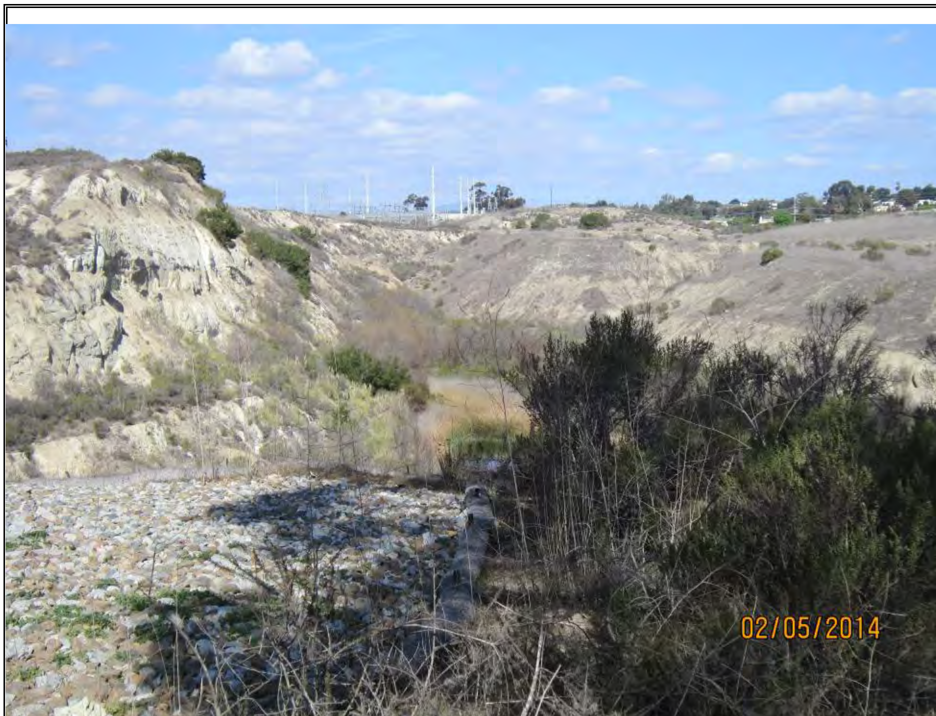
GLU: CB-Agricultural/ Grass-2

View: Looking northwest

Existing sediment production: Low to Med

Potential sediment production: Med

Existing veg. cover: 70%



Field Visit ID-10

GLU: CSI-Unknown-2

View: Looking north

Existing sediment production: Med to High

Potential sediment production: High

Existing veg. cover: 75%

	**Field Visit ID-11** **GLU: CSI-Agricultural/ Grass-2** View: Looking east Existing sediment production: Low Potential sediment production: Med Existing veg. cover: 85%

	**Field Visit ID-12** **GLU: CSP-Unknown-2** View: Looking southwest Existing sediment production: Low Potential sediment production: Low to Med Existing veg. cover: 50%

Field Visit ID-13

GLU: CSP-Scrub/Shrub-2

View: Looking southeast

Existing sediment production: Med

Potential sediment production:

Med to High

Existing veg. cover: 80-85%

Field Visit ID-14

GLU: FSP-Scrub/Shrub-1

View: Looking northeast

Existing sediment production: Low

Potential sediment production:

Low to Med

Existing veg. cover:

95-100%

Field Visit ID-15

GLU: CB-Agricultural/ Grass-4

View: Looking west

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 95%

.

Field Visit ID-16

GLU: CB-Agricultural/ Grass-3

View: Looking south

Existing sediment production: High*

Potential sediment production: High

Existing veg. cover: 90-95%

* Area was burned in 2014 fires after the field assessment so existing sediment production was adjusted to High (based on potential sediment production) from Medium

Field Visit ID-17

GLU: CSI-Scrub/Shrub-4

View: Looking west

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 95%

Field Visit ID-18

GLU: CSP-Forest-1

View: Looking southwest

Existing sediment production: Low to Med

Potential sediment production: Med

Existing veg. cover: 80%

Field Visit ID-19

GLU: CSP-Scrub/Shrub-3

View: Looking southwest

Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover: 60%

Field Visit ID-20

GLU: CSP-Unknown-1

View: Looking southeast

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 95%

Field Visit ID-21

GLU: CB-Unknown-3

View: Looking northwest

Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover: 50-60%

Field Visit ID-22

GLU: CSI-Forest-3

View: Looking east

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 60%

Field Visit ID-23

GLU: CSI-Scrub/Shrub-1

View: Looking north

Existing sediment production: Low

Potential sediment production: Low

Existing veg. cover: 80%

Field Visit ID-24

GLU: CB-Unknown-4

View: Looking northeast

Existing sediment production: Low to Med

Potential sediment production: High

Existing veg. cover: 80%

Field Visit ID-25

GLU: CSI-Agricultural/ Grass-4

View: Looking east

Existing sediment production: Low

Potential sediment production: Med-High

Existing veg. cover: 95%

Field Visit ID-26

GLU: CSI-Scrub/Shrub-3

View: Looking east

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 100%

.

Field Visit ID-27

GLU: CSP-Developed-2

View: Looking north

Existing sediment production: Low

Potential sediment production: Low

Existing veg. cover: 30-35%

.

Field Visit ID-28

GLU: CSP-Agricultural/ Grass-2

View: Looking north

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 90-95%

.

	**Field Visit ID-29** **GLU: FB-Forest-3** View: Looking northwest Existing sediment production: Med Potential sediment production: High Existing veg. cover: 80-85%

	**Field Visit ID-30** **GLU: CB-Developed-4** View: Looking northeast Existing sediment production: Low Potential sediment production: Med Existing veg. cover: 70% .

	**Field Visit ID-31** **GLU: CSI-Developed-3** View: Looking north Existing sediment production: Low Potential sediment production: Low Existing veg. cover: 30-35%

	**Field Visit ID-32** **GLU: CSI-Unknown-3** View: Looking west Existing sediment production: Low to Med Potential sediment production: Med Existing veg. cover: 70-75%

Field Visit ID-33
GLU: CSP-Scrub/Shrub-1

View: Looking northeast

Existing sediment production: Low to Med

Potential sediment production:

Med to High

Existing veg. cover: 70%

Field Visit ID-34
GLU: CSP-Developed-2

View: Looking south

Existing sediment production: Low

Potential sediment production: Low

Existing veg. cover: 95%

Field Visit ID-35

GLU: FB-Scrub/Shrub-3

View: Looking northeast

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 90-95%

Field Visit ID-36

GLU: FSI-Agricultural/ Grass-2

View: Looking northeast

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 95%

Field Visit ID-37

GLU: CB-Forest-3

View: Looking southeast

Existing sediment production: Med-High

Potential sediment production: High

Existing veg. cover: 75-80%

Field Visit ID-38

GLU: CSI-Agricultural/ Grass-1

View: Looking northeast

Existing sediment production: Low

Potential sediment production: Med

Existing veg. cover: 85%

Field Visit ID-39

GLU: CSP-Developed-1

View: Looking west

Existing sediment production: Low

Potential sediment production: Low

Existing veg. cover: 30-35%

Field Visit ID-40

GLU: CSP-Scrub/Shrub-4

View: Looking south

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 90-95%

Geologic Group

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Potential Critical Coarse Sediment Yield Areas

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

ATTACHMENT A.5

PHYSICAL STRUCTURES

A.5 Physical Structures

The desktop-level analysis to identify existing physical structures within the nine watershed management areas within the San Diego region utilized the following GIS data sources:

- ESRI ArcMap, Google Earth, and Google Maps products
- Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) Flood Profiles and FEMA Flood Insurance Rate Map (FIRM)
- National Flood Hazard Layer (NFHL)
- Municipal master drainage plans (as provided)
- San Diego Geographic Information Source (SanGIS) Municipal Boundaries and Hydrologic Basins
- United States Geological Survey (USGS) National Hydrography Dataset (NHD) California data
- Stream data generated as indicated in Section 2.2

The following documents the process used to identify the physical structures along the reaches and the resulting GIS data:

- The process began by importing the data sources indicated above into a single ArcMap document that served as a master map file from which all further analysis proceeded.
- The data were screened and selected for inclusion as appropriate to the project scope.
- Point features were placed along river reach line segments to coincide with visually identified structures, utilizing different feature symbols according to the type of infrastructure.
- In the case of levees, the point was placed at the downstream-most end of the FEMA NFHL Shapefile. All point features generated in this task appear in the GIS shapefile.
- Municipal boundaries intersecting river reaches were identified to identify the applicable municipal drainage plan data.
- Point feature attributes and associated information for Physical Structures GIS shapefile is indicated in Table A.5.1 below.

Table A.5.1: Structure Identification Point Feature Attribute Development and Information

Attribute	Description
Struct_ID	The Structure ID field provides a six-digit identification number based upon the structure's specific location within a watershed. The first three digits in the code reflect the structure's Hydrologic Unit (HU) Basin number (ranging between 902-911 for Region 9, as defined in the Water Quality Control Plan for the San Diego Basin). The subsequent three digits reflect the structure's location along the reach, ascending along the channel from the headwaters to tailwaters (ranging between 001-999, beginning at the confluence and increasing in the upstream direction).

Attribute	Description
WMA	The Watershed Management Area field provides the name of the watershed in which the structure exists. The WMA corresponds with the HU identified in the first three digits in the Struct_ID (e.g., 911, Tijuana Watershed).
Channel_ID	The Channel ID field provides the name of the channel in which the structure exists.
Struct_Typ	The Structure Type field classifies known structures as one of the following types:, Bridge, Culvert, Dam, Energy Dissipater, Flood Management Basin, Flood Wall, Grade Control, Levee, Pipeline, Weir.
Struct_Dtl	The Structure Detail field provides known quantitative information for multi-section culverts.
Struct_Mtl	The Structure Material field provides known qualitative information for structure material composition.
Struct_Shp	The Structure Shape field provides known geometric information for culvert shapes, and is classified as one of the following types: Arch, Box, Pipe.
Jurisd_ID	The Jurisdiction ID field, when applicable, provides the known separate structure identification number developed and utilized by the jurisdiction or entity responsible for creating and distributing the coinciding structure Shapefile data used for this analysis. This number was copied from the coinciding external Shapefile data attribute field best representing a unique jurisdiction or entity-based identification number (external Shapefile data received from regional WMAA data call; for jurisdictional information, see "Other" attribute field). Coinciding external Shapefile data was used to determine various structure attributes.
Plan_ID	The Plan ID field, when applicable, provides the known structure plan number corresponding with the Jurisdiction ID. This number was copied from the coinciding external Shapefile data attribute field best representing a unique plan number received from the regional WMAA data call (external Shapefile data received from regional WMAA data call; for jurisdictional information, see "Other" field). Coinciding external Shapefile data was used to determine various structure attributes.
Diameter	The Diameter field, when applicable, provides the known diameter (in US feet) for culverts.
Length	The Length field, when applicable, provides the known length (in US feet) for select structure types. When lengths were determined using FEMA FIS Flood Profiles, the scaled horizontal distances along the indicated roadway or channel slope were used.
Width	The Width field, when applicable, provides the known width (in US feet) for select structure types.
Height	The Height field, when applicable, provides the known height (in US feet) for select structure types. When heights were determined using FEMA FIS Flood Profiles, the scaled vertical distances from channel bed to indicated roadway bottom were used.
US_Invert	The Upstream Invert field, when applicable, provides the known upstream invert elevation (in US feet) for select structure types.
DS_Invert	The Downstream Invert field, when applicable, provides the known downstream invert elevation (in US feet) for select structure types.

Attribute	Description
RD_EL_NAVD	The Roadway Elevation (NAVD) field, when applicable, provides the known roadway elevation (in US feet, NAVD) for select structure types. When roadway elevations were determined using FEMA FIS Flood Profiles, the horizontal projection onto the vertical grid scales were used.
Loc_Descr	The Location Description field, when applicable, provides information for structures crossing a known roadway. In nearly all cases, Google Earth imagery was used to determine the roadway name.
Other	The Other field is used to convey any information not present within the preceding fields. Typically, "other" information includes jurisdictional, plan, and supplemental dimensions for a given structure.

Example Structure Identification

The following example demonstrates the structure identification process for a discrete structure (ID 907029) along the San Diego River. The San Diego River is located in the San Diego River watershed (WMA 907). Scanning the river from lower to higher reached, a new point feature was placed at the road crossing over the San Diego River as indicated in Figure A.5.1. Select attributes of this particular structure were available from the FEMA NFHL as displayed in the highlighted boxes in Figure A.5.1. Additional attributes such as the culvert height, length, roadway elevation, and name were also determined from the FIS Flood Profile as indicated in Figure A.5.2. Satellite imagery (e.g., Google) was used to verify the existence of structure. In this case, the most current Google Map data indicated that the culvert still exists and that the roadway name has been changed to Qualcomm Way. When structures could not be verified with satellite imagery, the structure identification was based solely upon the information provided or readily available and was not physically verified in the field. Figure A.5.3 displays an example of imagery used to identify structures.

Figure A.5.1: Typical ArcMap Window

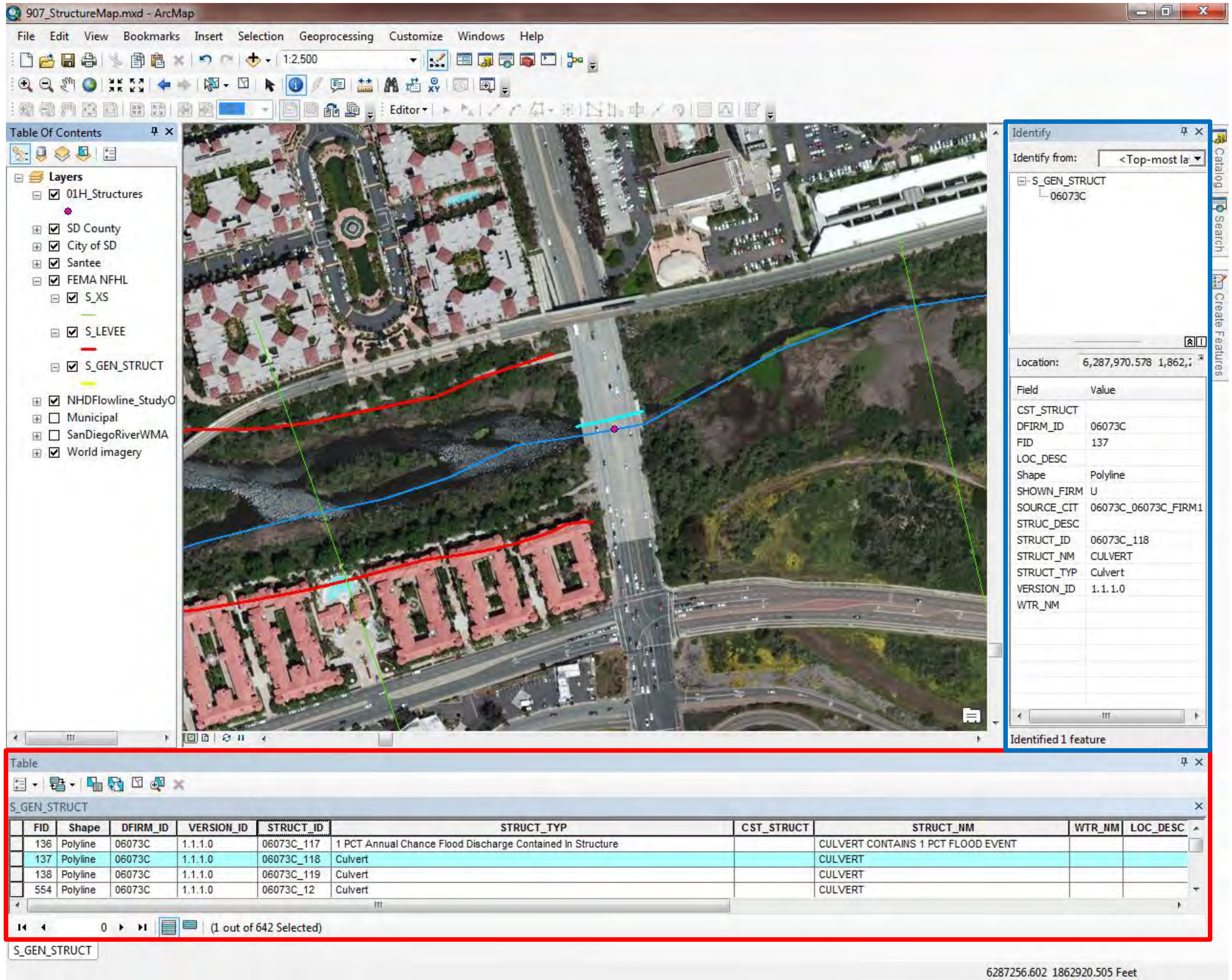
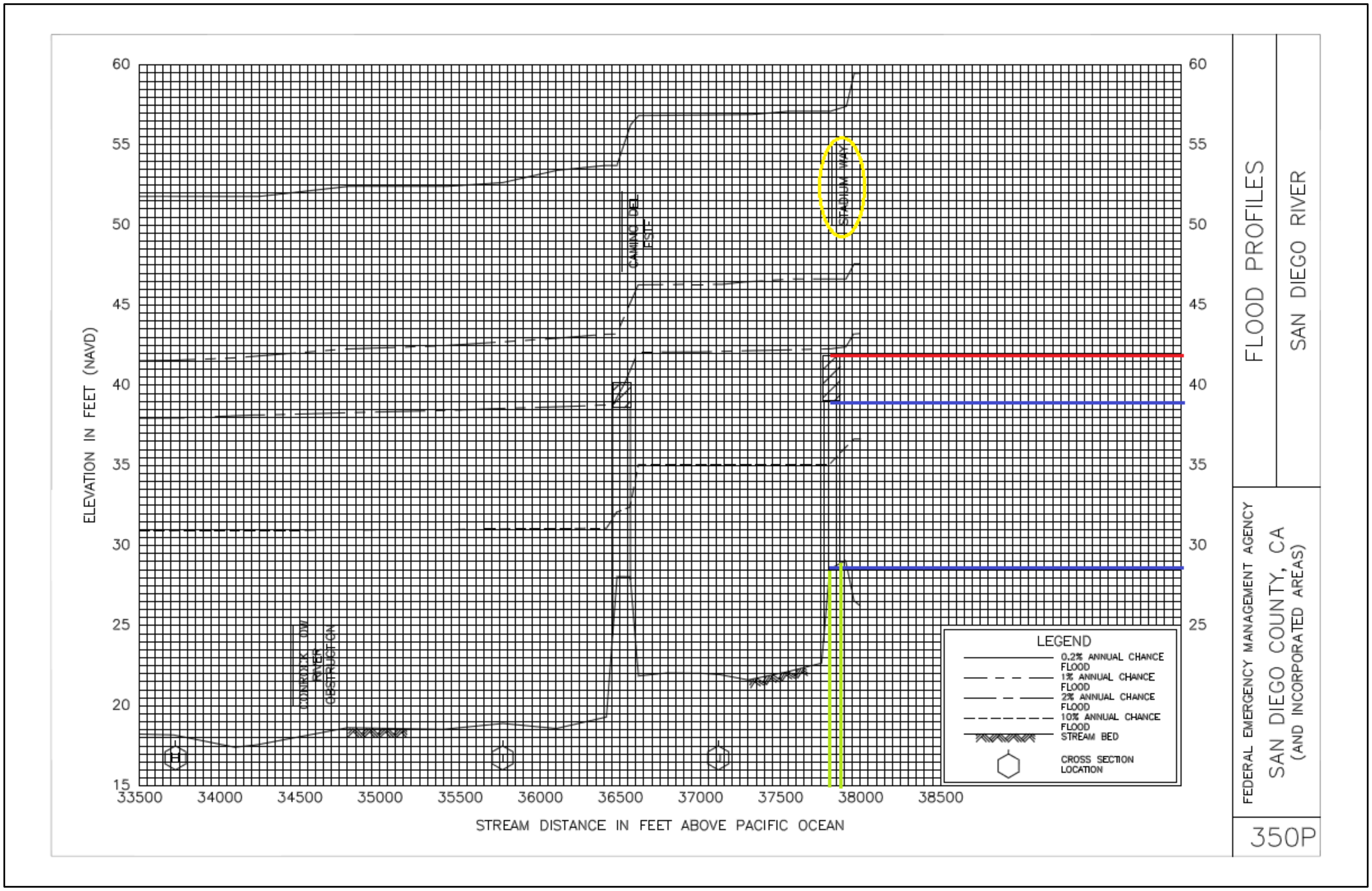


Figure A.5.2: Typical FEMA FIS Flood Profile



Legend: roadway elevation (red), roadway name (yellow), culvert height (blue), culvert width (green)

Figure A.5.3: Google Map Imagery for Structure Identification

The following bridge structure dimensional attributes were included in the point feature attributes:

- length 110 feet
- height 10 feet
- roadway elevation 41.9 feet

The attribute table associated with the identified structure included in the GIS shapefile is indicated in Table A.5.2.

Table A.5.2: Structure 907029 Attribute Table

Attribute	Description
Struct_ID	907029
WMA	San Diego
Channel_ID	San Diego River
Struct_Typ	Culvert
Struct_Dtl	
Struct_Mtl	
Struct_Shp	
Jurisd_ID	06073C_118
Plan_ID	06073C_06073C_FIRM1
Diameter	0
Length	110
Width	0
Height	10
US_Invert	0
DS_Invert	0
RD_EL_NAVD	41.9
Loc_Descr	Qualcomm Way
Other	Info from FEMA NFHL shapefile data/FIS FP V.9-350P

Watershed Management Area Streams with Channel Structures

Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

ATTACHMENT B

HYDROMODIFICATION MANAGEMENT EXEMPTION MAPPING

Receiving Waters and Conveyance Systems Exempt from Hydromodification Management Requirements

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

ATTACHMENT C
ELECTRONIC FILES

Electronic Folder titled “Tijuana_WMAA_Attachment C Electronic_Data.zip” Contents:

1. ArcMap 10.0 and 10.1 map files created for purpose of viewing Regional WMAA data
   - WMAA_09_Tijuana_Data_2014_0908_v10.mxd
   - WMAA_09_ Tijuana _Data_2014_0908_v101.mxd
2. ESRI Geodatabase titled " WMAA_09_ Tijuana _Data_2014_0908_v10.gdb" containing the following data:
   - WatershedBoundaries
     - Watershed_Boundaries
   - HydrologicProcesses
     - HRUAnalysis
   - Streams – description of existing streams in the watershed
     - SD_Regional_WMAA_Streams (streams selected for detailed analysis)
     - SD_NHD_Streams (portion of NHD dataset included for reference)
   - LandUsePlanning
     - SanGIS_ExistingLandUse
     - SanGIS_PlannedLandUse
     - SanGIS_DevelopableLands
     - SanGIS_RedevelopmentandInfill
     - SanGIS_MunicipalBoundaries
     - Federal_State_Indian_Lands
     - SanGIS_MHPA_SD
     - SanGIS_MSCP_CN
     - SanGIS_MSCP_EAST_DRAFT_CN
     - SanGIS_Draft_North_County_MSCP_Version_8_Categories
   - PotentialCoarseSedimentYield
     - GLUAnalysis
     - PotentialCoarseSedimentYieldAreas
     - MacroLevelPotentialCriticalAreas
     - PotentialCriticalCoarseSedimentYieldAreas
   - ChannelStructures
     - ChannelStructures
   - HydromodExemptions
     - Exempt_Systems
     - Exempt_Bodies
   - Floodplains: included for reference
     - FEMA_NFHL
   - Baselayers: included for reference
     - SanGIS_Lakes
     - link to ESRI World Imagery (internet connection is required to access ESRI World Imagery basemap)

Electronic Folder titled “Mission Bay La Jolla _WMAA_Attachment C Electronic_Data.zip” Contents, continued:

3. Google Earth – KMZ file titled: “WMAA_09_ Tijuana _Data_2014_0908_GoogleEarth.kmz”**,** containing the following data:
   - WatershedBoundaries
   - Streams
     - SD Regional WMAA Streams (streams selected for detailed analysis)
     - SD NHD Streams (portion of NHD dataset included for reference)
   - LandUsePlanning
     - Municipal Boundaries
     - Federal/State/Indian Lands
   - ChannelStructures
   - HydromodExemptions
     - Exempt_Systems
     - Exempt_Bodies
   - Floodplains: included for reference
     - FEMA Floodplain
   - Dominant Hydrologic Processes
   - Potential Critical Coarse Sediment Yield Areas

Notes:

- Open a map file (with extension .mxd) using ArcMap to view the data.
- All data contained in the geodatabase is loaded into the map.

ATTACHMENT D
REGIONAL MS4 PERMIT CROSSWALK

Table below provides a linkage between the Regional MS4 Permit requirements for WMAA and this report.

Regional MS4 Permit Provision	Regional WMAA Report
B.3.b.(4)(a)	Chapter 2; Section 5.1; Attachment A and Attachment C
B.3.b.(4)(a)(i)	Section 2.1; Attachment A.1 and Attachment C
B.3.b.(4)(a)(ii)	Section 2.2; Attachment A.2 and Attachment C
B.3.b.(4)(a)(iii)	Section 2.3; Attachment A.3 and Attachment C
B.3.b.(4)(a)(iv)	Section 2.4; Attachment A.4 and Attachment C
B.3.b.(4)(a)(v)	Section 2.5; Attachment A.5 and Attachment C
B.3.b.(4)(b)	Chapter 3 and Section 5.2
B.3.b.(4)(c)	Chapter 4; Section 5.3; Attachment B and Attachment C

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Memorandum

Date: June 17, 2015

To: Sheri McPherson, Project Manager, County of San Diego

Gladys Gonzalez, Land Use Environmental Planner II, County of San Diego

From: Venkat Gummadi and Trevor Alsop, Geosyntec Consultants

Laura Henry, RICK Engineering

Subject: Regional Watershed Management Area Analysis Hydromodification Exemption Analysis – Memorandum to Document Factors of Safety Contract No. 537081; Task Order No. 23

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1. BACKGROUND

The Draft Regional Watershed Management Area Analysis (WMAA) that was submitted to the San Diego Regional Water Quality Control Board in January 2015 included analyses to evaluate hydromodification exemptions in accordance with the Regional MS4 Permit provision B.3.b.(4)(c) for the following receiving water bodies:

- Major River Reaches
  - Otay River from Outfall at San Diego Bay to Interstate 805;
  - San Diego River from Pacific Ocean to confluence with San Vicente Creek;
  - San Dieguito River from upstream edge of the railroad crossing to Lake Hodges Dam;
  - San Luis Rey River from Pacific Ocean to upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15; and
  - Sweetwater River from San Diego Bay to Sweetwater Reservoir Dam.

- Stabilized Conveyance Systems Draining to Exempt Water Bodies
    - Methodology for exemption stabilized conveyance systems; and
    - Forester Creek stabilized reach from the confluence with the San Diego River to Prospect Avenue.

This memorandum summarizes the implicit factors of safety used while performing the hydromodification exemption analysis.

2. MAJOR RIVER REACHES

Hydromodification impacts can be caused due to increase in flows, changes in sediment transport capacity and changes in sediment supply to the streams. In order to evaluate the cumulative impacts due to development and determine if hydromodification exemption could be recommended, an erosion potential (Ep) analysis was used to evaluate the increase in flows and changes in sediment transport capacity to the selected receiving waters for the built-out condition. In addition, sediment supply potential (Sp) analysis was used to evaluate the changes in sediment supply. The implicit factors of safety in each analysis are presented as follows:

1.1 <u>Erosion Potential:</u>

The analysis conducted to evaluate the Ep metric for the selected water bodies has three fundamental implicit (non-quantified) factors of safety including:

1. The analysis assumes all impervious area in the watershed is directly connected impervious area. In actuality, some portion of these impervious areas will sheet flow through pervious areas prior to discharging to the streams. This dispersion will result in attenuation of flow rates and durations that are not accounted for while estimating the sediment transport capacity of the built-out condition. This conservative assumption provides an implicit factor of safety.

2. New priority development projects, including projects that are proposed to be exempt from hydromodification management requirements through the Regional WMAA study, must implement retention BMPs to the extent feasible if participation in alternative compliance is not selected or allowed. This requirement will result in attenuation of flow rates and durations that are not accounted for while estimating the sediment transport capacity of the built-out condition. This conservative assumption provides an implicit factor of safety.

3. Redevelopment priority development projects in the watershed that do not directly discharge to the exempt river reach must mitigate flows to the pre-developed condition. This will result in over mitigation of flow rates and durations for redevelopment projects which are not accounted for while estimating the sediment transport capacity of the built-out condition. This conservative assumption provides an implicit factor of safety.

If the above three factors were quantified in the analysis, it is anticipated that the resultant Ep would be smaller than the Ep reported in the Regional WMAA.

1.2 Sediment Supply:

The Technical Advisory Committee, formed to provide input on the development of the 2011 San Diego County Final Hydromodification Management Plan, indicated (based on field observations and years of historical perspective) that the above river reaches have very low gradients, were depositional (aggrading), have very wide floodplain areas when in the natural condition, and that the effects of cumulative watershed impacts to these reaches are minimal provided that outfalls to the rivers have properly sized energy dissipation, and hence could be exempt from hydromodification management.

Since these river systems are depositional, they can support some losses in sediment supply as these systems seek equilibrium prior to experiencing hydromodification. Available literature consulted for this analysis indicates that having less than a 10% reduction in sediment supply for an equilibrated system is unlikely to instigate, as an independent condition, significant channel changes. Based on the analysis performed in Regional WMAA, the losses in sediment supply was estimated to be less than 7% (30% factor; Appendix B.1.1.3); and when considering these rivers to be depositional, provides an implicit factor of safety.

3. STABILIZED CONVEYANCE SYSTEMS DRAINING TO EXEMPT WATER BODIES

To qualify for exemption, an engineered stabilized conveyance system must meet the following criteria:

- It must be demonstrated that shear stress in the engineered conveyance system will be less than critical shear stress when the system conveys the 10-year flow rate determined based on the Hawley & Bledsoe 2011 equation presented in "How do flow peaks and durations change in suburbanizing semi-arid watersheds? A southern California case study," (Hawley, R.J., and Bledsoe, B.P. 2011). Critical shear stress shall be determined from

"Stability Thresholds for Stream Restoration Materials" (Fischenich 2001) or similar published data.

This means that an engineered stabilized conveyance system could be exempt if it will be non-erosive in the range of flows relevant to hydromodification management. Determination that the conveyance system is non-erosive would be established when the shear stress in the conveyance system at Q_{10} (determined using specific procedures relevant for hydromodification management different from flood control Q_{10}, herein "HMP Q_{10}") is less than critical shear stress. A "stabilized" channel means an engineered channel stabilized with materials other than concrete (e.g., riprap, turf reinforcement mat, vegetation, including rehabilitated channels). Critical shear stress (the maximum shear stress the stabilizing material can tolerate without movement) for such channels can be determined from reference sources. When the shear stress in the conveyance system is less than critical shear stress, there is no excess shear stress or "work" (i.e., erosion) occurring in the system.

This criteria is conservative because it requires shear stress be evaluated at a flow rate relevant to hydromodification management, and <u>no</u> excess shear stress (i.e., no work, no erosion) to occur at the study flow rate. This is a significant change from the exemption criteria for stable, unlined channels that was presented in the Final HMP, which only required evaluation of the channel capacity and did not require evaluation of shear stress in the channel.

For Forester Creek, recommended for exemption in the Regional WMAA and San Diego River WMAA, the upper range of geomorphically-effective flows based on procedures presented in the referenced Hawley & Bledsoe paper was 836 cfs, and the HMP Q_{10} was 2,120 cfs based on the Hawley & Bledsoe equation. Forester creek can convey approximately 2,150 cfs before critical shear stress is reached in the cross section that is expected to be the most sensitive (i.e., the cross section with a combination of narrow geometry and steep slope that is expected to experience the greatest shear stress at any given flow rate).

Forester Creek is stabilized with vegetation, and therefore would have a relatively low allowable shear stress compared to other stabilizing materials. The same exemption study process would be applied for channels stabilized with other materials such as riprap, which can tolerate greater shear stress than vegetation.

In addition to the criteria to determine that a conveyance system is stable, the Regional WMAA sets limitations on the use of the exemption: it is only for engineered conveyance systems that are stabilized, no natural channels, and the engineered conveyance system must continue uninterrupted to an exempt water body.

* * * * *

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Appendix J.1

Project Identifier	Watershed Management Area	Hydrologic Area (HA)	Hydrologic Subarea (HSA)	Jurisdiction	Project Name	Ownership		Project Location				Project Origination/Originator		Project Category	Specific Project Type	Potential Pollutant	Project Size & Parameters				Regulatory Requirement	Project Timeline	Other Notes
						Type	Owner Information	Address	APN	Latitude	Longitude	Name	Contact Information				Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)			
Example 1	San Diego River	Lower San Diego	Mission San Diego[907.11]	SAN DIEGO	Ocean Beach Athletic Area Robb Field	Public	City of San Diego	Ocean Beach Athletic Area Robb Field San Diego, CA, 92107	76002900	32.753	-117.242	CLRP Phase II	http://www.sandiego.gov/stormwater/pdf/sdrclrpupdate.pdf	Regional BMPs	Subsurface Detention Gallery	Multiple (Primary: Bacteria)	315	11.3	2.3	Treatment Volume: 6.8 acre-ft Ponding Depth: 3 ft Draw Down Time: 48 hrs (estimate)	TMDL	Future (Year to be determined)	
Example 2	San Luis Rey River	Lower San Luis	Mission[903.11]	OCEANSIDE	Talone Lake	Public-private partnership	Talone Conservancy Corp	Fraze Rd & Hwy 76 Oceanside, CA 92057	16155122	33.239	-117.294	CLRP	http://www.projectcleanwater.org/images/stories/Docs/San-Luis-Rey/SLR_CLRP_Final_Oct2012.pdf	Retrofitting existing infrastructure	Wetlands/Wet Pond	Multiple (Primary: Bacteria)	1096	37	8	Treatment Volume: 32 acre-ft Permanent Pool Depth: 4 ft Hydraulic Residence Time: 24 hrs	TMDL	Future (Year to be determined)	BMP under existing condition might not be properly functional
Example 3	San Diego River	N/A	N/A	N/A	SDR - County Green Streets	Public	San Diego County	N/A	N/A	N/A	N/A	CLRP	http://www.projectcleanwater.org/images/stories/Docs/San-Diego-River/SDR_CLRP_Final_Oct2012.pdf	Other project types allowed by MS4 Permit	Green Streets	Multiple (Primary: Bacteria)	N/A	N/A	N/A	Varies; Refer to the report	TMDL	Future (Year to be determined)	Green Streets are proposed for county roads within San Diego County jurisdicition in San Diego River

Appendix J.2

Tijuana River WMAA candidate Projects in the City of San Diego

Project Identifier	Watershed Management Area	Jurisdiction	Ownership	Project Location				Project Size & Parameters				Other Notes
			Owner Information	Address	APN	Latitude (X-Coordinate)	Longitude (Y-Coordinate)	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	
Public Parcels Identified as Suitable for Further Assessment to Determine Feasibility of Retrofitting with Green Infrastructure												
Parcels on this list that are 0.25 acres or greater have been assessed using broad assumptions necessary for computer modeling and were found to be potentially effective as an opportunity for contributing to load reduction goals. Considerable further assessment would be required before determining any of these sites to be viable retrofit sites for implementation of Green Infrastructure. That assessment includes verifying public ownership, determining if land use agreements and financing can be established, assessing feasibility based upon further investigation of physical site constraints at a project design level, and determining that construction and necessary approvals, including approvals from regulatory agencies other than the City of San Diego, can be completed within the time constraints in the Municipal Storm Water Permit that pertain to Alternative Compliance.												
Public Parcels Identified as Suitable for Further Assessment to Determine Feasibility of Retrofitting												
Parcels on this list have been assessed using broad assumptions necessary for computer modeling and were found to be potentially effective as an opportunity for contributing to load reduction goals. Considerable further assessment would be required before determining any of these sites to be viable retrofit. That assessment includes verifying public ownership, determining if land use agreements and financing can be established, assessing feasibility based upon further investigation of physical site constraints at a project design level, and determining that construction and necessary approvals, including approvals from regulatory agencies other than the City of San Diego, can be completed within the time constraints in the Municipal Storm Water Permit that pertain to Alternative Compliance.												
Project Concept for Green Streets Retrofits – Quantity and Location of Suitable City Streets To-Be-Determined												
The City of San Diego is in the process of identifying potential public street locations that could feasibly be retrofitted with Green Infrastructure and provide a meaningful contribution to pollutant load reduction goals. As locations become verified for feasibility and effectiveness, funding mechanisms under an Alternate Compliance program could potentially be used to fill gaps in construction and maintenance funding necessary for the project to go forward. This is pending the ability to establish suitable legal mechanisms and verify that approvals and construction can be completed within the time constraints in the Municipal Storm Water Permit that pertain to Alternative Compliance.												
Project Concept for Stream or Riparian Area Rehabilitation – Exact Location To-Be-Determined												
The City of San Diego is in the process of identifying potential stream or riperian project locations to provide a meaningful contribution to pollutant load reduction goals. As locations become verified for feasibility and effectiveness, funding mechanisms under an Alternate Compliance program could potentially be used to fill gaps in construction and maintenance funding necessary for the project to go forward. This is pending the ability to establish suitable legal mechanisms and verify that approvals and construction can be completed within the time constraints in the Municipal Storm Water Permit that pertain to Alternative Compliance.												
1	TJR	City of SD	SANDAG wetlands mitigation project, Interstate 5 impact mitigation, TJR estuary; owner TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
2	TJR	City of SD	TJR estuary habitat restoration, between Monument Road and Pacific Ocean; Owner TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
3	TJR	Mexico	TJR watershed trash cleanup and revegitation projects in Mexico; Owner TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
4	TJR	City of SD	Smugglers Gulch, stream restoration and stabilization; Owner TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
5	TJR	City of SD	Goat Canyon, stream restoration and stabilization; Owner TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	

Appendix J.3

						Ownership		Project Location				Project Origination/Originator					Project Size & Parameters												
Project Identifier	Watershed Management Area	Hydrologic Area (HA)	Hydrologic Subarea (HSA)	Jurisdiction	Project Name	Type	Owner Information	Address	APN	Latitude	Longitude	Name	Contact Information	Project Category	Specific Project Type	Potential Pollutant	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	Regulatory Requirement	Project Timeline	Other Notes	Watershed Number	Secondary Category	Originating Report	E-Mail	Phone	Contact Address
TJ-1	Tijuana	Tijuana Valley	San Ysidro	SAN DIEGO	Tijuana River Valley Regional Park Proposed 60.2 AC Restoration Project	Public	COUNTY OF SAN DIEGO	N/A	6370107300	1783595.291	6308310.111	Rick Engineering Company		Stream or Riparian Rehabilitation	Habitat Restoration				60.2					911.11	Floodplain Preservation	Tijuana River Valley Regional Park, Area Specific Management DIrectives, June 22, 2007 (Final_TJ_ASMD_6_22_07.pdf	rcronquist@rickengineering.com	619-291-0707	
TJ-2	Tijuana	Tijuana Valley	San Ysidro	IMPERIAL BEACH	Tijuana River Nave/SD County/other		UNITED STATES OF AMERICA	N/A	6350800100	1784169.138	6299165.075	River Partners												911.11			info@riverpartners.org	(530) 894-5401	
TJ-6	Tijuana	Tijuana Valley	San Ysidro	SAN DIEGO	Tijuana River Valley Regional Park Proposed 60.2 AC Restoration Project	Public	COUNTY OF SAN DIEGO	HIGHWAY 94	6370107300	1783595.291	6308310.111	Rick Engineering Company		Stream or Riparian Rehabilitation	Habitat Restoration				60.2					911.11	Floodplain Preservation	Tijuana River Valley Regional Park, Area Specific Management DIrectives, June 22, 2007 (Final_TJ_ASMD_6_22_07.pdf	rcronquist@rickengineering.com	619-291-0707	
TJ-7	Tijuana	Morena	undefined	S.D. COUNTY	Bioretention Basin	Private	HALL TRUST 06-01-92	Quail Road and Morena View	6060820100	1827095.399	6483734.355	Miles Safa		retrofitting	Construction of bioretention basin	pollutants from street surface flow	0	0	0		2013 permit		May have potential to earn credit toward a CIP project that has problem meeting water quality/hydromodification requirements on site. This property has soil type "B" indicating that biorention is suitable for this site.	911.5	groundwater recharge		miles.Safa@sdcounty.ca.gov	858-694-3890	County of San Diego 5510 Overland Avenue San Diego, CA, 92123
TJ-3	Tijuana	Campo	Canyon City	S.D. COUNTY	highway run-off into creek that feeds to riparian area and Campo Creek		RYDBERG VICTORIA	N/A	6541001400	1795169.447	6476511.205	Billie Jo Jannen												911.82			jannen@inbox.com	619-415-6298	28736 Highway 94 -- this is also the address where CalTrans is directing this run-off.
TJ-4	Tijuana	Campo	Canyon City	S.D. COUNTY	Campo Valley reclamation	Private	Barry deVorzan	Unknown/several	6550902600	1805248.29	6492697.158	Billie Jo Jannen		Floodplain	wetland/creek	nitrates, road run-	500			area shown on map	unknown	urgent	This area provides water for all of	911.82	Groundwater	community	jannen@inbox.com	619-415-6298	28736 Highway 94
TJ-5	Tijuana	Campo	Canyon City	S.D. COUNTY	possible sewage pollution	Private	Mountain Empire RV	29146 Highway 94,	6560600800	1795390.76	6480867.573	Billie Jo Jannen		Floodplain		sewage, household						urgent	The owners have dammed a	911.82	Water Supply		jannen@inbox.com	619-415-6298	28736 Highway 94, Campo

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SECTION 1 INTRODUCTION

This municipal separate storm sewer system (MS4) outfall monitoring work plan satisfies the requirements of the San Diego Regional Water Quality Control Board (Regional Board) Order R9-2013-0001 (MS4 Permit) Provision D.2. for the 2015-2016 fiscal/monitoring year for the Tijuana River Watershed Management Area (WMA). This work plan assumes the reader is familiar with the requirements of MS4 Permit and the Tijuana River Water Quality Improvement Plan within which this work plan is contained.

To assess potential impacts on receiving water and identify potential pollutant sources, the RAs are required to monitor the wet weather and non-storm water discharges from the MS4 outfalls in the Tijuana River WMA during implementation of the Tijuana River Water Quality Improvement Plan to assess the effectiveness of their jurisdictional runoff management programs (JRMPs) toward effectively prohibiting non-storm water discharges into the MS4 and reducing pollutants in storm water discharges from their MS4s to the maximum extent practicable (MEP) (Regional Board 2013).

Table 1-1 presents the RAs, land area, and percent of area within the Tijuana River WMA. Table 1-2 presents areas within the Tijuana River WMA that are currently listed on the United States Environmental Protection Agency (USEPA) 303(d) list. Figure K-1 provides an illustration of the Tijuana River WMA, jurisdictional boundaries, and proposed monitoring locations.

Table 1-1
Responsible Agencies within the Tijuana River WMA

Responsible Agency	Land Area (acres)	Percent of WMA
City of Imperial Beach	2,146	0.7%
City of San Diego	14,026	4.7%
County of San Diego	282,669	94.6%

Table 1-2
Applicable 303(d) Listed Analytes within the Tijuana River WMA

Receiving Water Segment	Pollutant																									
	Indicator Bacteria	Total Coliform	Fecal Coliform	Enterococcus	Turbidity	Solids	Sedimentation/Siltation	Trash	Total Nitrogen as N	Ammonia as Nitrogen	Phosphorus	Eutrophic	Low Dissolved Oxygen	Pesticides	Surfactants (MBAS)	Lead	Manganese	Nickel	Selenium	Thallium	Trace Elements	Synthetic Organics	Perchlorate	Color	pH	Toxicity
Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River		•	•	•																						
Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive		•	•	•																						
Pacific Ocean Shoreline, Tijuana HU, at Monument Road		•	•																							
Pacific Ocean Shoreline, Tijuana HU, at the US Border		•	•	•																						
Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth		•	•	•																						
Tijuana River (6 miles afffected)	•					•	•	•	•		•	•	•	•	•				•		•	•				•
Tijuana River Estuary (1320 acres affected)	•				•			•				•	•	•		•		•		•						
Tecate Creek (1 mile affected)																			•							
Barrett Lake (125 acres affected)									•								•						•	•	•	
Pine Valley Creek (Upper) (3 miles affected)					•																					
Morena Reservoir (104 acres affected)										•	•						•							•	•	
Cottonwood Creek (53 miles affected)																			•							

Figure K-1.

Tijuana River Watershed Management Area (WMA) MS4 Outfall and Receiving Water Monitoring Locations

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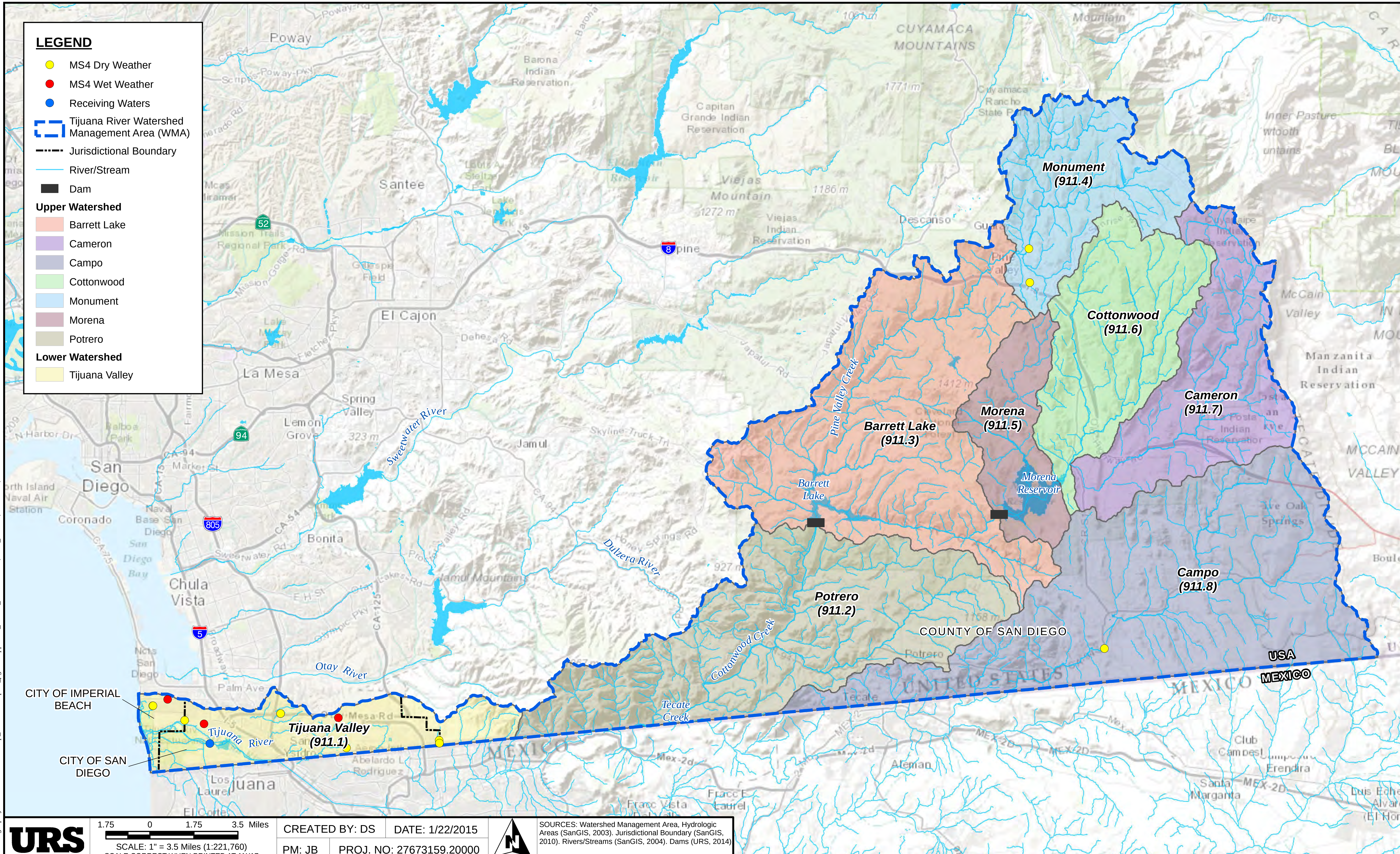

FIGURE K-1 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) MS4 OUTFALL AND RECEIVING WATER MONITORING LOCATIONS

SECTION 2 MONITORING

This section details the monitoring required to comply with the MS4 Permit.

2.1 NON-STORM WATER MS4 OUTFALL DISCHARGE MONITORING

Each RA is required to perform non-storm water MS4 outfall prioritization and monitoring to aid in the identification of non-storm water and illicit discharges within their respective jurisdictions as required by Provision D.2.b of the MS4 Permit.

2.1.1 MS4 Outfall Inventory

The RAs have identified the known major MS4 outfalls[1] that discharge directly to receiving waters within their respective jurisdictions within the Tijuana River WMA. The identified major MS4 outfalls have been geo-located on respective Geographic Information System (GIS) jurisdictional maps[2] of the Tijuana River WMA as required by Provision D.2.a.(1) of the MS4 Permit. Each RA will maintain, confirm, and updated their respective maps during annual field screening (Section 2.1.2). The respective jurisdictional MS4 maps contain the following items that, at a minimum, will be confirmed and updated during annual field screening as applicable:

- Segments of the MS4 owned, operated, and maintained by the RA;
- Known locations of inlets that discharge and/or collect runoff into the RA's MS4;
- Known locations of connections with other MS4s not owned or operated by the RA;
- Known locations of MS4 outfalls and private outfalls that discharge runoff collected from areas within the RA's jurisdiction;
- Segments of receiving waters within the RA's jurisdiction that receive and convey runoff discharged from the RA's MS4 outfalls;
- Locations of the MS4 outfalls within each RA's respective jurisdiction; and
    - Latitude and longitude of MS4 outfall point of discharge;
    - Watershed Management Area;
    - Hydrologic subarea;
    - Outlet size;
    - Accessibility (i.e. safety and without disturbance of critical habitat);
    - Approximate drainage area; and
    - Classification of whether the MS4 outfall is known to have persistent non-storm water flows, transient non-storm water flows, no non-storm water flows, or unknown non-storm water flows.

[1] A major outfall is defined as 36 inches or larger in diameter

[2] Geo-located MS4 outfall maps are not included in the work plan due to size

- Locations of the selected non-storm water persistent flow MS4 outfall discharge monitoring stations within each RA's respective jurisdiction (Section 2.1.3).

Table 2-1 presents the number of identified major outfalls in the Tijuana River WMA by RA.

Table 2-1
Number of Identified Major Outfalls by RA in the Tijuana River WMA

RA	Identified Major Outfalls
City of Imperial Beach	3
City of San Diego	30
County of San Diego	4

2.1.2 Field Screening

Each RA is required to conduct field screening to determine which non-storm water MS4 outfall discharges are transient flows and which are persistent flows, and prioritize the non-storm water MS4 discharges that will be investigated and eliminated in accordance with the Illicit Discharge Detection and Elimination (IDDE) program.

2.1.2.1 Major Outfall Selection and Screening Frequency

Per the requirements of Provision D.2.a.(2).(a) of the MS4 Permit, the number of major outfalls required to be screened is dependent upon the number of known major outfalls present in a RA's inventory. The requirements are as follows:

- For RAs with fewer than 125 known major MS4 outfalls that discharge to receiving waters within a WMA, at least 80 percent of the outfalls are required be visually inspected two times per year during non-storm water conditions.
- For RAs with 125 major MS4 outfalls or more, but fewer than or equal to 500 that discharge to receiving waters within a WMA, all the outfalls is required be visually inspected at least annually during non-storm water conditions.
- For RAs with more than 500 major MS4 outfalls that discharge to receiving waters within a WMA, at least 500 outfalls are required to be visually inspected at least annually during non-storm water conditions. RAs with more than 500 major MS4 outfalls within a WMA are required to identify and prioritize at least 500 outfalls to be inspected considering the following:
    - Assessment of connectivity of the discharge to a flowing receiving water;
    - Reported exceedances of NALs in water quality monitoring data;
    - Surrounding land uses;
    - Presence of constituents listed as a cause for impairment of receiving waters in the WMA listed on the Clean Water Act (CWA) section 303(d) List; and
    - Flow rate.

- For an RA with portions of its jurisdiction in more than one WMA and more than 500 major MS4 outfalls within its jurisdiction, at least 500 major MS4 outfalls within its inventory are required to be visually inspected at least annually during non-storm water conditions. RAs with more than 500 major MS4 outfalls in more than one WMA are required to identify and prioritize at least 500 outfalls to be inspected considering the following:
    - Assessment of connectivity of the discharge to a flowing receiving water;
    - Reported exceedances of NALs in water quality monitoring data;
    - Surrounding land uses;
    - Presence of constituents listed as a cause for impairment of receiving waters in the Watershed Management Area listed on the CWA section 303(d) List; and
    - Flow rate.
- Inspections of major MS4 outfalls conducted in response to public reports and staff or contractor reports and notifications may count toward the required visual inspections of MS4 outfall discharge monitoring stations.

Based on these criteria, Table 2-2 details the number of major outfalls that each respective RA will inspect within their respective jurisdictions and frequency[3] within the Tijuana River WMA. The location of the major MS4 outfalls which will be screened by each RA are included in Appendix A.

Table 2-2
MS4 Outfall Screening Number and Frequency by RA

RA	Number of Outfalls	Frequency
City of Imperial Beach	3	Two times per year
City of San Diego	30	Two times per year
County of San Diego	4	Two times per year

2.1.2.2 Field Screening Visual Observations

During a field screening visual observation inspection, each MS4 outfall selected for screening will be inspected following at least 72 hours of dry weather following any storm event producing greater than 0.10” of rainfall within a 24-hour period. Table 2-3 details the visual observations that will be recorded during each field screening visual observation inspection. A copy of the field observation form that will be used to record field screening visual observations is included in Appendix B.

[3] The field screening monitoring frequencies and locations for the MS4 outfalls in RAs respective inventories may be modified to aid in the identification and elimination of sources of persistent flow non-storm water discharges in accordance with the highest priority water quality conditions identified in the WQIP, provided the requisite number of visual inspections are performed.

Table 2-3
Field Screening Visual Observations for MS4 Outfall Discharge Monitoring Stations

Field Observations

• Station identification and location
• Presence of flow, or pooled or ponded water
• If flow is present:
  o Flow estimation (i.e. width of water surface, approximate depth of water, approximate flow velocity, flow rate)
  o Flow characteristics (i.e. presence of floatables, surface scum, sheens, odor, color)
  o Flow source(s) suspected or identified from non-storm water source investigation
  o Flow source(s) eliminated during non-storm water source identification
• If pooled or ponded water is present:
  o Characteristics of pooled or ponded water (i.e. presence of floatables, surface scum, sheens, odor, color)
  o Known or suspected source(s) of pooled or ponded water
• Station description (i.e. deposits or stains, vegetation condition, structural condition, observable biology)
• Presence and assessment of trash in and around station
• Evidence or signs of illicit connections or illegal dumping

2.1.2.3 Illicit Discharge Detection and Elimination

Based on the field screenings the RAs will conduct follow up investigations under the IDDE program as applicable. The IDDE program is part of each respective RA's JRMP and thus, is not included in this monitoring plan.

2.1.3 Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring

Each RA is required to perform non-storm water persistent flow MS4 outfall discharge monitoring to determine if persistent non-storm water discharges may be impacting receiving water quality.

2.1.3.1 Outfall Prioritization and Selection

Based upon the field screening, the highest priority water quality conditions identified in the Water Quality Improvement Plan, and any additional criteria developed by the RA (e.g. historical data), the RAs are required to prioritize their respective major outfalls. Each RA is required to select, at a minimum, five high priority major MS4 outfalls with non-storm water persistent flows. Each respective RA will monitor the five selected major MS4 outfalls within its jurisdiction. In the event that a RA has fewer than five major outfalls, then the RA is required to monitor each of the known major MS4 outfalls with persistent flows within its respective jurisdiction within the Tijuana River WMA. Table 2-4 details the major outfalls selected for monitoring within each jurisdiction within the Tijuana River WMA. Figure K-2 illustrates the location of the selected major MS4 outfalls for dry weather monitoring within the Tijuana River WMA by jurisdiction.

Table 2-4
Selected Locations for Non-Storm Water Persistent Flow Monitoring

Jurisdiction	Station ID	Outfall Location Latitude	Outfall Location Longitude
City of Imperial Beach	IB_E1A	32.572874	-117.12315
	IB_E1B	32.572874	-117.12315
	IB_ F	32.572795	-117.12309
City of San Diego	SD-DW0224	32.564575	-117.10139
	SD-DW0304	32.549406	-116.99104
	SD-DW1032	32.568977	-117.03604
	SD-DW1034	32.551811	-117.05301
	SD-DW1151	32.554197	-116.92789
County of San Diego	CT-MS4-TIJ-001	32.6087	-116.47461
	CT-MS4-TIJ-002	32.8198	-116.52623
	CT-MS4-TIJ-003	32.83939	-116.52688
	CT-MS4-TIJ-004	32.55246	-116.92768

Figure K-2
Tijuana River Watershed Management Area (WMA) MS4 Outfall Dry Weather Monitoring Locations

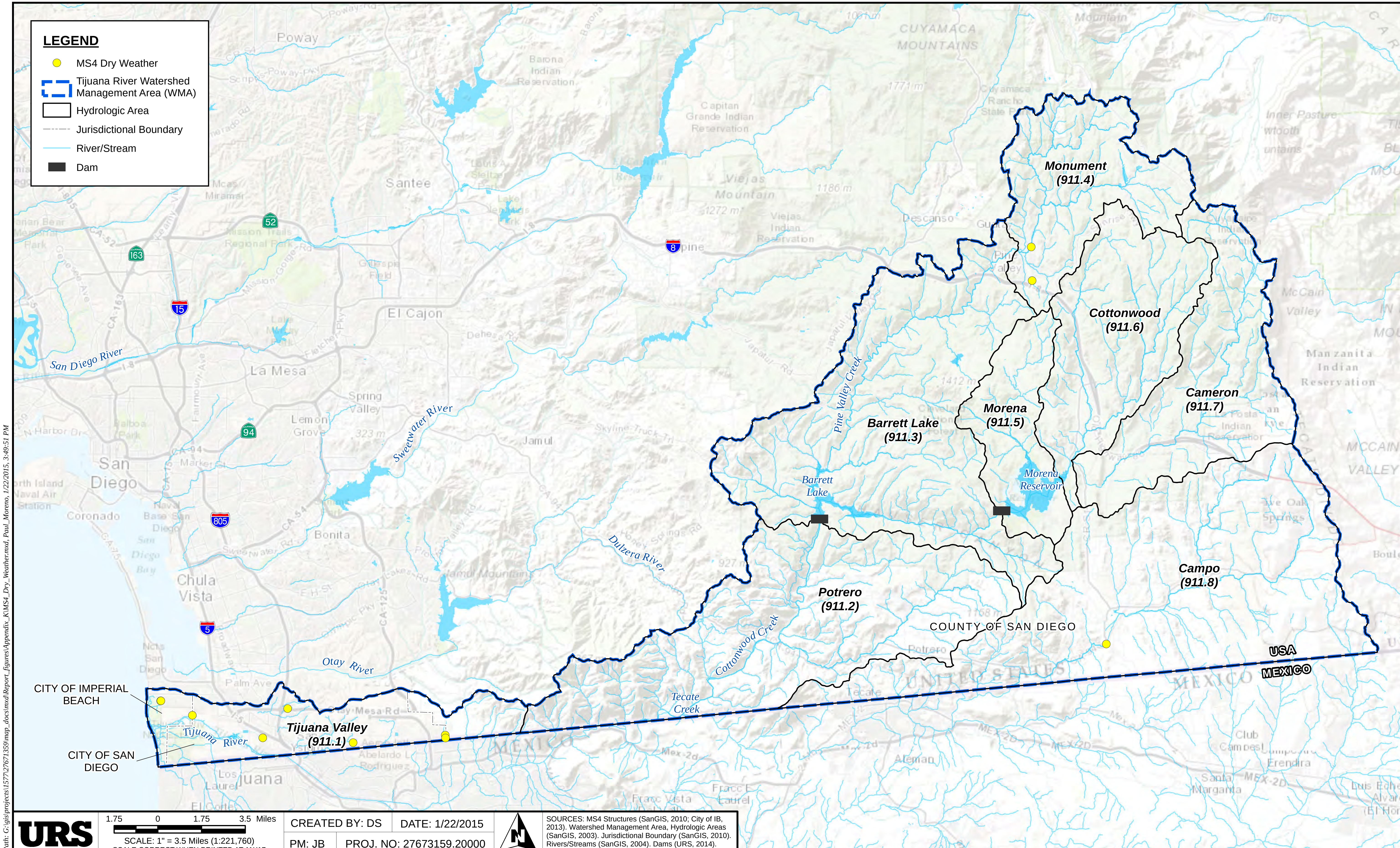

FIGURE K-2 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) MS4 OUTFALL DRY WEATHER MONITORING LOCATIONS

2.1.3.2 Monitoring Frequency

Each of the selected major outfalls detailed in Table 2-4 will be monitored twice during the 2015-2016 fiscal/monitoring year. An alternate major outfall may be substituted for a selected major outfall in the event that one of the following criteria becomes applicable:

- The non-storm water discharges have been effectively eliminated (i.e. no flowing, pooled, or ponded water) for three consecutive non-storm water monitoring events[4] .
- The source(s) of the persistent flows has been identified as a category of non-storm water discharges that does not require an NPDES permit and does not have to be addressed as an illicit discharge because it was not identified as a source of pollutants.
- The constituents in the persistent flow non-storm water discharge do not exceed non-storm water action levels (NALs).
- The source(s) of the persistent flows has been identified as a non-storm water discharge authorized by a separate NPDES permit.

2.1.3.3 Field Observations

During the two annual monitoring events field observations consistent with Table 2-3 will be recorded at each of the selected major outfall persistent flow monitoring sites. The dry weather field observation form is presented in Appendix C.

2.1.3.4 Field Monitoring

During the two annual monitoring events the parameters detailed in Table 2-5 will be recorded from *in-situ* measurements at each of the selected major outfall persistent flow monitoring sites.

Table 2-5
Field Monitoring Parameters

Parameters
pH
Temperature
Specific conductivity
Dissolved oxygen
Turbidity

[4] Meeting this criterion during a single monitoring year is unlikely, thus it is presented in this Work Plan for informational purposes only.

2.1.3.5 Analytical Monitoring

During the two annual monitoring events, provided sufficient measurable flow is present, samples will be collected for analysis by an analytical laboratory. Grab samples will be collected according to the procedures described in Section 3.2.1, and will follow Surface Water Ambient Monitoring Program (SWAMP) protocols[5] .

The required analyses[6] are based upon the following four groupings of constituents:

1. Constituents contributing to the highest priority water quality conditions identified in the Tijuana River WMA Water Quality Improvement Plan;
2. Constituents listed as a cause for impairment of receiving waters in the Tijuana River WMA as listed on the 303(d) list;
3. Applicable non-storm water action level (NAL) constituents listed in Provision C.1 of the MS4 Permit; and
4. Constituents listed in Table D-7 of the MS4 Permit.

Table 2-6 details the analyses required for each of the selected MS4 outfall persistent flow monitoring. Analytical methods and detection limits for each analyte are provided in Appendix D.

2.2 STORM WATER MS4 OUTFALL DISCHARGE MONITORING

Each RA is required to perform wet weather MS4 outfall prioritization and monitoring to aid in the identification of pollutants in storm water discharges from the MS4s and to guide pollutant source identification efforts.

[5] Flow or Time Weighted composite sampling may also be performed at the discretion of the RA.

[6] If, during a monitoring event, the RA identifies and eliminates the source of the persistent flow non-storm water discharge, the sample will not be analyzed.

Table 2-6
Non-Storm Water Persistent Flow Required Analysis by Site

Analyte	City of Imperial Beach			City of San Diego					County of San Diego			
	IB_E1A	IB_E1B	IB_F	SD-DW0224	SD-DW0304	SD-DW1032	SD-DW1034	SD-DW1151	CT-MS4-TIJ-001	CT-MS4-TIJ-002	CT-MS4-TIJ-003	CT-MS4-TIJ-004
Conventional Parameters												
Total Hardness[1]	√	√	√	√	√	√	√	√	√	√	√	√
TDS[1]	√	√	√	√	√	√	√	√	√	√	√	√
TSS[1,2,3]	√	√	√	√	√	√	√	√	√	√	√	√
MBAS[3,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Turbidity[2,3]	√	√	√	√	√	√	√	√	√	√	√	√
Suspended Sediment Concentration[2,3]	√	√	√	√	√	√	√	√	√	√	√	√
Indicator Bacteria												
Total Coliform[1,3]	√	√	√	√	√	√	√	√	√	√	√	√
Fecal Coliform[1,3,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Enterococcus[1,3,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Inorganic Analytes												
Cadmium (Dissolved)[1,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Cadmium (Total)[1,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Chromium III (Dissolved)[4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Chromium III (Total)[4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Chromium VI (Dissolved)[4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Chromium VI (Total)[4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Copper (Dissolved)[1,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Copper (Total)[1,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Iron (Dissolved)[4B]	√	√	√	√	√	√	√	√	√	√	√	√
Iron (Total)[4B]	√	√	√	√	√	√	√	√	√	√	√	√
Lead (Dissolved)[1,3,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Lead (Total)[1,3,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Manganese (Dissolved)[4B]	√	√	√	√	√	√	√	√	√	√	√	√
Manganese (Total)[4B]	√	√	√	√	√	√	√	√	√	√	√	√
Nickel (Dissolved)[3,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Nickel (Total) [3,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Selenium (Dissolved)[3]										√	√	
Selenium (Total)[3]										√	√	
Silver (Dissolved)[4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Silver (Total)[4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Thallium (Total)[3]	√	√	√									
Thallium (Dissolved)[3]	√	√	√									

Analyte	City of Imperial Beach			City of San Diego					County of San Diego			
	IB_E1A	IB_E1B	IB_F	SD-DW0224	SD-DW0304	SD-DW1032	SD-DW1034	SD-DW1151	CT-MS4-TIJ-001	CT-MS4-TIJ-002	CT-MS4-TIJ-003	CT-MS4-TIJ-004
Zinc (Dissolved)[1,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Zinc (Total)[1,4A,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Nutrients												
Total Phosphorus[1,3,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Dissolved Phosphorus[2]	√	√	√	√	√	√	√	√	√	√	√	√
Orthophosphate[1,2]	√	√	√	√	√	√	√	√	√	√	√	√
Nitrite[1,3]	√	√	√	√	√	√	√	√	√	√	√	√
Nitrate[1,3]	√	√	√	√	√	√	√	√	√	√	√	√
TKN[1,3]	√	√	√	√	√	√	√	√	√	√	√	√
Ammonia[1,3]	√	√	√	√	√	√	√	√	√	√	√	√
Total Nitrogen[3,4B]	√	√	√	√	√	√	√	√	√	√	√	√
Pesticides												
Organophosphate Pesticides[3]	√	√	√	√	√							
Pyrethroid Pesticides[3]	√	√	√	√	√							
Organics												
Trace Elements[3]	√	√	√	√	√							
Synthetic Organics[3]	√	√	√	√	√							

Notes:

1. Parameter listed in Table D-7 of the MS4 Permit.
2. Parameter contributes to a highest priority water quality condition identified in the Tijuana River WMA Water Quality Improvement Plan.
3. Parameter listed as a cause for impairment of receiving waters in the Tijuana River WMA on the 303(d) list.

4A. Parameter listed in NALs for discharges from MS4s to Bays, Harbors, and Lagoons/Estuaries (MS4 Permit Provision C.1.a(2))

4B. Parameter listed in NALs for discharges from MS4s to Inland Surface Waters (MS4 Permit Provision C.1.a(3))

*Nitrate and nitrite may be combined and reported as nitrate+nitrite

2.2.1 Outfall Prioritization and Selection

The RAs may adjust the wet weather MS4 outfall discharge monitoring locations in the Tijuana River WMA, as needed, to identify pollutants in storm water discharges from MS4s, to guide pollutant source identification efforts in accordance with the highest priority water quality conditions identified in the Tijuana River WMA Water Quality Improvement Plan.

The requirements for outfall monitoring location selection are as follows:

- At least five (5) wet weather MS4 outfall discharge monitoring stations that are representative of storm water discharges from areas consisting primarily of residential, commercial, industrial, and typical mixed-use land uses present within the Tijuana River WMA; and
- At least one (1) wet weather MS4 outfall discharge monitoring station for each RA within the Tijuana River WMA.

The selected outfalls are listed in Table 2-7. Figure K-3 illustrates the location of the RAs' selected wet weather MS4 outfall discharge monitoring sites within the Tijuana River WMA.

Table 2-7.
Selected Major Outfalls for MS4 Outfall Storm Water Monitoring

Site ID	Jurisdiction	Outfall Size (in.)	Outfall Type	Outfall Location
IB_F	City of Imperial Beach	TBD[1]	Pipe	~32º 34' 35.89 ~-117 º 07' 23.13
SD-DW0223	City of San Diego	240 x 60	Culvert	32.562647 -117.088167
SD-DW1022	City of San Diego	60	Pipe	32.566834 -116.996656
SD-DW1032	City of San Diego	42	Outfall	~32.568977 ~-117.036042
CT-MS4-TIJ-004	County of San Diego	TBD[1]	Outfall	~32º 38' 08.63 116 º 55' 39.67

[1]Pipe diameter to be determined.

Figure K-3
Tijuana River Watershed Management Area (WMA) MS4 Outfall Wet Weather Monitoring Locations

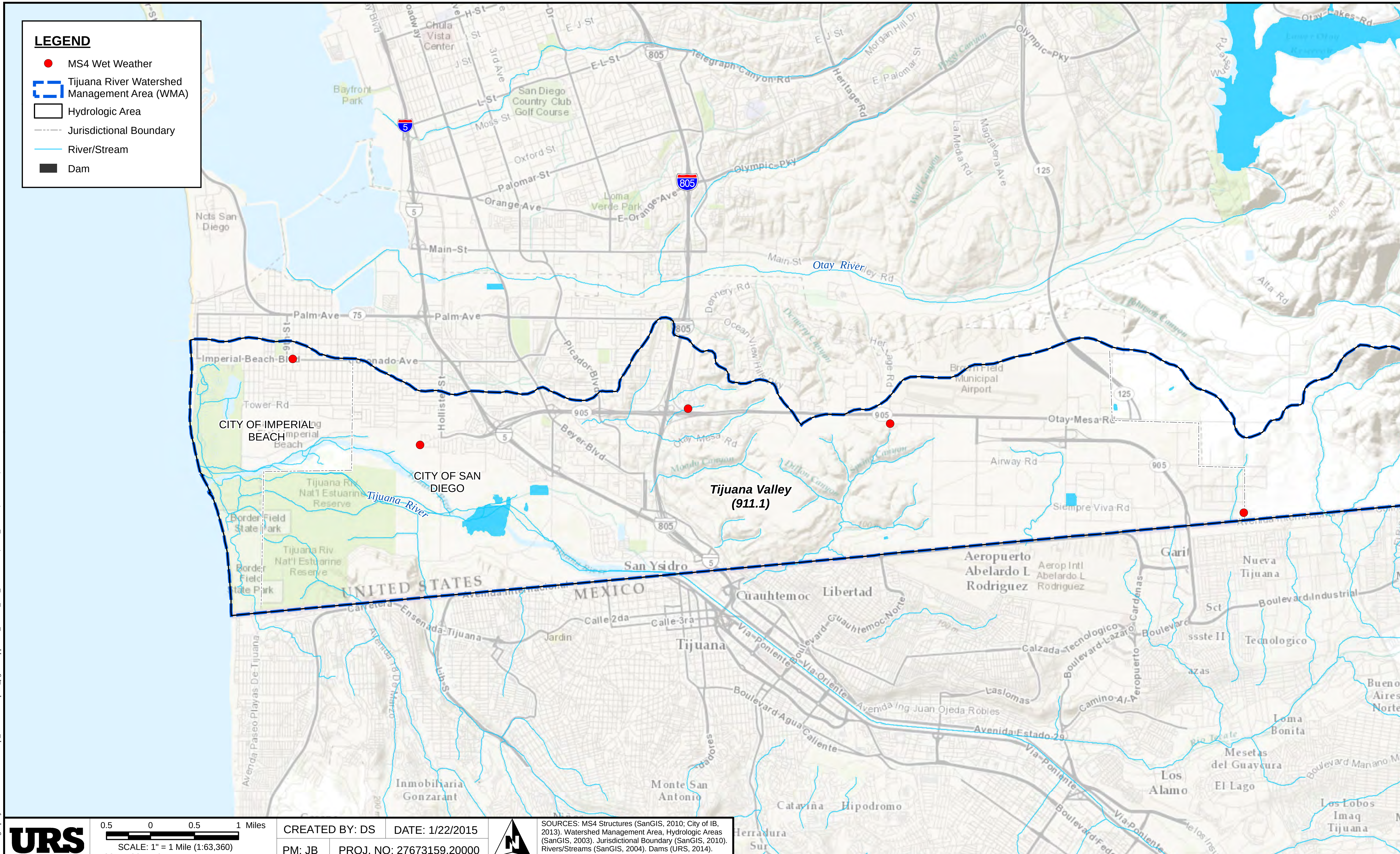

FIGURE K-3 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) MS4 OUTFALL WET WEATHER MONITORING LOCATIONS

Path: G:\gis\projects\1577\27673159\map_docs\mxd\Report_figures\Appendix_K\MS4_Wet_Weather.mxd, Paul_Moreno, 1/22/2015, 3:57:49 PM

2.2.2 Monitoring Frequency

Each RA will monitor their wet weather MS4 outfall discharge monitoring station(s) in the Tijuana River WMA one (1) time during the 2015-2016 fiscal/monitoring year[7].

2.2.3 Field Observations

During the wet weather monitoring event, the following narrative descriptions and observations will be recorded at each wet weather MS4 outfall discharge monitoring station:

- Narrative description of the monitoring event.
- Location
- Date
- Duration of the storm event
- Storm event rainfall total.
- Antecedent dry period.
- Flow hydrograph and volume estimations as detailed in Section 3.2.2.

2.2.4 Field Monitoring

During the wet weather monitoring event, the RAs will monitor and record the parameters in Table 2-5 at each wet weather MS4 outfall discharge monitoring station. Field observations and monitoring will be documented on the storm water field observation form presented in Appendix E.

2.2.5 Analytical Monitoring

During the wet weather monitoring event, samples will be collected for analysis by an analytical laboratory.

- Grab samples will be collected for the analytes listed in Table 2-8, according to the procedures detailed in Section 3.1.2.1.
- Analytes amenable to composite sampling will be composited over the course of the storm using time-weighted automated sampling[8] , according to the procedures in Section 3.1.2.2.

---

[7] The RAs may conduct additional monitoring in order to identify pollutants in storm water discharges from the MS4s causing or contributing to the highest priority water quality conditions or to guide pollutant source identification efforts. This effort would be above and beyond permit requirements.

[8] Flow weighted composite sampling may also be utilized at the discretion of the RA.

Table 2-8
Wet Weather MS4 Grab Samples.

Parameters
pH[1]
Temperature[1]
Specific conductivity[1]
Dissolved oxygen[1]
Turbidity[1]
Hardness
Indicator Bacteria
Analytical Methods not amenable to grab sampling (e.g. Suspended Sediment Concentration)

1. This analyte will be monitored *in-situ.*
Per MS4 Permit Provision D.2.c.(5).(a), analytes that are field measured are not required to be analyzed in a laboratory.

The required analyses[9] are based upon the following four groupings of constituents:

1. Constituents listed in Table D-7 of the MS4 Permit
2. Constituents contributing to the highest priority water quality conditions identified in the Tijuana River WMA Water Quality Improvement Plan;
3. Constituents listed as a cause for impairment of receiving waters in the Tijuana River WMA as listed on the 303(d) list; and
4. Applicable storm water action level (SAL) constituents listed in Provision C.2 of the MS4 Permit.

Table 2-9 details the analyses required for each of the selected wet weather MS4 outfall discharge monitoring locations. Sample collection will follow SWAMP protocols. Analytical methods and detection limits for each analyte are provided in Appendix F.

[9] The RAs may adjust the analytical monitoring required for the Tijuana River WMA if they are able to provide information demonstrating that analysis of the constituent is not necessary.

Table 2-9
Storm Water Required Analysis by Site

Analyte	City of Imperial Beach	City of San Diego			County of San Diego
	IB_F	SD-DW0223	SD-DW1022	SD-DW1032	CT-MS4-TIJ-004
Conventional Parameters					
Total Hardness[1]	√	√	√	√	√
Turbidity[2,3,4]	√	√	√	√	√
TDS[1]	√	√	√	√	√
TSS[1,2]	√	√	√	√	√
SCC[2]	√	√	√	√	√
MBAS[3]		√	√	√	√
Indicator Bacteria					
Total Coliform[1,3]	√	√	√	√	√
Fecal Coliform[1,3]	√	√	√	√	√
Enterococcus[1,3]	√	√	√	√	√
Inorganic Analytes					
Cadmium (Dissolved)[1,4]	√	√	√	√	√
Cadmium (Total)[1,4]	√	√	√	√	√
Copper (Dissolved)[1,4]	√	√	√	√	√
Copper (Total)[1,4]	√	√	√	√	√
Lead (Dissolved)[1,3,4]	√	√	√	√	√
Lead (Total)[1,3,4]	√	√	√	√	√
Nickel (Dissolved)[3]	√				
Nickel (Total)[3]	√				
Selenium (Dissolved)[3]		√	√	√	√
Selenium (Total)[3]		√	√	√	√
Thallium (Total)[3]	√				
Thallium (Dissolved)[3]	√				
Zinc (Total)[1,4]	√	√	√	√	√
Zinc (Dissolved)[1,4]	√	√	√	√	√
Nutrients					
Total Phosphorus[1,3,4]	√	√	√	√	√
Dissolved Phosphorus[3]		√	√	√	√
Orthophosphate[1]	√	√	√	√	√

Analyte	City of Imperial Beach	City of San Diego			County of San Diego
	IB_F	SD-DW0223	SD-DW1022	SD-DW1032	CT-MS4-TIJ-004
Nitrite[1,3,4]	√	√	√	√	√
Nitrate[1,3,4]	√	√	√	√	√
Total Nitrogen[3]	√	√	√	√	√
Ammonia[1,3]	√	√	√	√	√
TKN[1,3]	√	√	√	√	√
Pesticides					
Organophosphate Pesticides[3]	√	√	√	√	√
Pyrethroid Pesticides[3]	√	√	√	√	√
Organics					
Trace Elements[3]		√	√	√	√
Synthetic Organics[3]		√	√	√	√

Notes:
1. Parameter listed in Table D-7 of the MS4 Permit
2. Parameter contributes to a highest priority water quality condition identified in the Tijuana River WMA Water Quality Improvement Plan.
3. Parameter listed as a cause for impairment of receiving waters in the Tijuana River WMA on the 303(d) list.
4. Parameter listed in SALs for discharges of storm water from the MS4 (MS4 Permit Provision C.2.a)

SECTION 3 METHODOLOGIES AND EQUIPMENT

This section describes the methodologies and equipment that are proposed to be used to complete the MS4 outfall monitoring program for the Tijuana River WMA, as well as the installation and maintenance procedures.

Flow estimation and water quality sampling are dynamic processes which may require modification based on current site and channel conditions. Thus, the methodologies presented are subject to modification or substitution in order to meet the requirements of this monitoring program described in Section 2.

3.1 FLOW ESTIMATION METHODOLOGIES

3.1.1 Non-Storm Water Flow Estimation

During non-storm water screening and MS4 outfall monitoring, flow will be estimated visually and/or manually using one of the methodologies detailed in Section 3.2.2 of the USEPA document *NPDES Storm Water Guidance Document* (USEPA 1992) which is included in Appendix G. These methodologies include, but are not limited to the “float method” and the “bucket and stopwatch method”.

3.1.2 Storm Water Flow Estimation

Flow hydrograph and volume estimations will be captured utilizing estimated flow rates in accordance with the Section 3.2.1 of the USEPA document *NPDES Storm Water Sampling Guidance Document* (USEPA, 1992) which is presented in Appendix H.

Due to flood control concerns typically associated with MS4 outfalls during storm events, a primary measurement device such as a weir or flume is unlikely to be selected. Thus, a lower profile secondary flow measurement device, such as an area-velocity senor or bubbler pressure transducer, are recommended for flow estimation from MS4 Outfalls.

If a secondary measurement device is selected, an American Sigma 950 flow meter (or equivalent) will be used. The American Sigma 950 flow meter can be connected to an automated sampler through a 4-20 milliampere (mA) range output. In this configuration, the flow meter provides a method to control or pace the sampler, and store sampling data and other auxiliary data. The flow meter will measure and log estimated flow, rainfall, and sample history.

The flow meter will utilize one of a variety of sensor types to measure flow velocity and/or level depending on the site conditions. The sensors that may be used include:

- Submerged area-velocity (AV) sensor;
- Submerged AV sensor with a bubbler;
- Pressure transducer level sensor;
- Pressure bubbler level sensor;

- Low profile velocity sensor; or
- Ultrasonic sensor (Hach, 2009).

Should a flow meter be utilized, one-minute average flow and rainfall data will be recorded during monitored storm events. The flow meter converts instantaneous flow into total runoff volume. Data containing storm and hydrological information is electronically stored in the flow meter, with each monitoring event stored separately. The recorded information includes:

- Flow rates.
- Time of peak flow rate.
- Cumulative rainfall.
- Rainfall intensity.
- Discharge volume totals.
- Time of each sample.
- Success or failure of each sample.

3.2 WATER QUALITY SAMPLING

3.2.1 Grab Sample Collection

Grab samples will be collected directly into the laboratory supplied sampling jars if possible (hand, grab pole, or decontaminated bucket). An automated sampler may be used to collect grab samples only if manual sample collection is determined to be infeasible. The decision regarding the method of sample collection will be made on a case-by-case basis by the field sampling team and documented.

3.2.2 Composite Sample Collection

For wet weather events, a time-weighted[10] composite sample will be collected over the length of the storm event or a 24 hour period, whichever is shorter. At least one sample aliquot every 30 minutes will be collected during a storm event. The automated sampler will be programmed to collect 500-milliliter (mL) sample aliquots in a 19-L borosilicate glass bottle.

The representativeness of any composite sample depends on many factors. Best professional judgment will be used to determine whether samples with questionable representativeness will be analyzed. Ideally, the following criteria will be achieved, but these are not considered requirements.

- A minimum of 20 sample aliquots during the monitoring event
- Collection of sample aliquots from the onset of rainfall until flow returns to within 10% of base flow or sampling has been undertaken for 24 hours

[10] Flow weighted composite sampling may be utilized at the discretion of the RA.

- Sample aliquots that represent at least 75% of the monitoring event total flows or a 24-hour time period
- If flow weighted composite sampling is utilized, sufficient sample pacing so that the stream flow does not lead to the automated sampler becoming outpaced (i.e., unable to keep up with required sample collection)

If automated compositing is not feasible, a composite sample will be collected using a minimum of 4 grab samples, collected during the first 24 hours of the storm water discharge, or for the entire storm water discharge if the storm event is less than 24 hours.

The typical automated sampler used for this project is an American Sigma 900 MAX or equivalent system, which consists of an intake strainer, Teflon-lined intake tubing, flexible silicon pump tubing, a peristaltic pump, and sample bottles. Depending on the sampling program, the samplers will be programmed to collect time-weighted composite samples throughout a monitoring event.

The intake strainers will be securely fastened at the desired sampling point in the runoff flow stream. Attempts will be made to collect samples from the middle of the water column. The intake tubing will be securely fastened to the intake strainer and will be housed in protective conduit to the point where the tubing enters the monitoring equipment enclosure. The intake tubing will be attached to the flexible silicon pump tubing at the sampler. The flexible silicon pump tubing will run through the sampler peristaltic pump to fill the sample bottle.

3.2.2.1 Installation of Monitoring Equipment

Field teams will mount equipment securely using best professional judgment. Sampler tubing and wiring will be routed through conduits that will be placed between the monitoring locations and the sampling equipment or enclosures. Above-ground instruments will be protected within a site equipment enclosure. Depending on site configuration, enclosures may be semi-permanent (installed before monitoring begins and removed only when the monitoring program ends) or temporary. Exposed conduit, intakes, and sensors will be securely fastened using stainless steel brackets, screws, and anchors. Once the study is completed, monitoring equipment will be removed except for the enclosures.

The American Sigma 900MAX automated samplers and American Sigma 950 flow meters will be powered by 12-VDC rechargeable gel cell power sources.

Monitoring equipment will be mounted within fiberglass or metal enclosures that will be bolted to concrete or wooden monitoring foundations or chained to nearby structure or vegetation and locked to secure the monitoring equipment.

3.2.2.2 Maintenance and Calibration of Monitoring Equipment

Maintenance and calibration of monitoring equipment will be performed during installation and prior to monitoring events. A calibration log will be maintained for calibrations performed in the field. Prior to monitoring events, field teams will verify that the batteries are sufficiently charged, that the automated samplers and flow monitoring equipment are calibrated and active, and that the system pumps are functioning as designed. The flow sensors should be cleared of debris. Additional preparation for monitoring events includes performing general equipment inspections to confirm that the sites are operational.

The Sigma 950 flow meters will be calibrated using the procedures described in the Sigma 950 operations and maintenance (O&M) manual (Hach Catalogue No. 3314). For flow meter calibration, the recorded water level will be checked by operation of the flow meter while the sensor device measures water of a known depth. Level adjustments can be made directly on the flow meter. Results that deviate significantly from the known level and do not maintain an adjusted offset will be documented and the equipment will be replaced or repaired. Velocity cannot be calibrated; therefore, if a low profile velocity sensor reports erroneous velocity measurements it will be replaced.

The American Sigma 900MAX sampler will be calibrated using the procedures described in the American Sigma 900MAX O&M manual (Hach Catalogue No. DOC026.53.00742). For automated sampler calibration, the aliquot volume will be calibrated using a graduated flask or beaker.

Calibration of flow meters and automated samplers will be conducted prior to installation, and per the calibration frequencies discussed in Table 3-1.

Table 3-1
Calibration of Field Sampling Equipment and Monitoring Instruments

Equipment	Calibration Description	Responsible Person	Frequency	SOP Reference
Sigma 950 flow meter (level only)	Water level check against known levels	Sampling Team	Semi-annually	Sigma 950 O&M Manual 3314
Sigma 900MAX automated sampler	Aliquot calibration	Sampling Team	Semi-annually	Sigma 900MAX Sampler O&M Manual DOC026.53.00742

Notes:
O&M = operations and maintenance.
SOP = standard operating procedure.

SECTION 4 STORM WATER EVENT MONITORING LOGISTICS

Storm events will be considered viable for mobilization if they are predicted to produce at least 0.10 inch of rainfall in the drainage area with at least a 70% chance of rainfall. Each storm of at least 0.1 inch of rainfall must be separated by a minimum of 72 hours, and the forecasted storm volume within + 50% of the average storm volume and duration for the region. These mobilization criteria must be met at least 24 hours prior to the anticipated onset of rainfall. For the purposes of these criteria, storm forecasts will be obtained from the National Weather Service website (http://www.wrh.noaa.gov/sgx/).

For each monitoring event, a narrative description of the station, which includes the location, date, and duration of the storm event(s) sampled; rainfall estimates of the storm event; and the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event, will be recorded.

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SECTION 5 PERSONNEL

Water quality monitoring tasks require a variety of skills and positions. The recommended personnel include:

- Project Manager.
- Sampling Manager.
- Field Technicians.

Project Manager – During monitoring events, the Project Manager will monitor the status of the monitoring stations via communication with field crews. The Project Manager must be able to obtain and interpret the most recent weather forecasts to provide guidance to field technicians on when samples should be collected. It is also the responsibility of the Project Manager to notify personnel of shift start- and end-time changes.

The Project Manager must have excellent decision-making and dispatch skills as well as a thorough understanding of the project requirements. If an assistant fills this position, the consultant's Project Manager should be available to answer questions.

Sampling Manager – The Sampling Manager is a technically-skilled, experienced field supervisor and is the most experienced member of the field team. This position requires a thorough understanding of project requirements, sampling procedures, and equipment operations. The Sampling Manager will communicate frequently with the Project Manager to determine task priorities. The Sampling Manager will also monitor the ability of field teams to complete their shifts safely and effectively, and will notify the Project Manager of the need for relief teams. The Sampling Manager must be able to troubleshoot the common problems that could be experienced by any of the field teams, and will be responsible for directing the procedures at each site visit and for making sure that data are recorded properly. The Sampling Manager will also provide on-site weather observations for the Project Manager.

Field Technicians – The Sampling Manager will usually have one to three field technicians assisting. This will be dependent on the number of sites being monitored for a given storm event. Field technicians are field personnel trained in water quality sample collection and Health and Safety issues. Field technicians may also be used as couriers.

5.1 MONITORING EVENT PREPARATION

Monitoring for flow and water quality of runoff requires considerable planning prior to an actual monitoring event occurring. Obtaining representative samples and complete flow data is only possible using well-trained and alert field teams. The uncertainty of weather forecasts coupled with abrupt changes in the weather can greatly alter the expected workload. It is critical to plan and prepare for numerous aspects of the field effort well in advance of a storm event. Each pre- and post-event mobilization team should be made up of two field individuals. A Staffing Plan, which designates personnel and equipment required for each facet of monitoring, will be completed for each potential monitoring event.

The Staffing Plan should include the following:

- Personnel assigned for monitoring.
- Shift (e.g., start-up and relief).
- Equipment mobilization.
- Communication channels.

Field teams will not be mobilized during or near certain holidays if either the mobilization or the laboratory analysis is projected to continue through that holiday. This includes the following holidays and dates:

- Thanksgiving: November 26 and 27, 2015.
- Christmas: December 24 and 25, 2015.
- New Year's: December 31, 2015, and January 1, 2016.

5.1.1 Weather Tracking

Weather will be tracked for monitoring purposes from October 1 to April 30 of each monitoring year. Throughout the wet weather season, several sources of weather information will be periodically monitored. The National Weather Service webpage will be the primary source used to determine whether and when to mobilize monitoring crews.

5.1.2 Storm Selection Criteria

The following criteria will be used to determine whether to mobilize for an impending storm event:

- Storm forecasts must meet criteria at least 48 hours prior to the onset of rain;
- A storm must be forecast to produce at least 0.25 inch of rain;
- The probability of precipitation must be greater than 70 percent; and
- A storm event must be preceded by at least 72 hours of dry conditions (<0.10 inch of precipitation in a 24 hour period).

The field sampling manager and/or project manager may modify the criteria on a storm by storm basis, in consultation with the RAs.

5.1.3 Station Preparation

Prior to a monitoring event, stations will be made ready for monitoring. These preparations include verifying that the automated samplers and flow monitoring equipment are calibrated and active, and that the system pumps are functioning as designed. The flow sensors should be cleared of debris. Additional preparation for monitoring events includes performing general equipment inspections to confirm that the sites are operational.

A maintenance program will be performed for monitoring equipment before each wet weather event. Maintenance will include checking the performance of the equipment, checking power supplies and replacing batteries as required, inspecting and clearing intake structures, checking the status of instrumentation desiccant, and performing any necessary equipment repairs to keep the monitoring equipment operational.

Field teams will verify that the automated sampler has been reset and that it has been programmed properly.

5.1.4 Additional Sampling Gear

Equipment needed for water quality sampling includes: sampling equipment and containers, safety equipment, personal rain gear, storm kits, mobile phones, and vehicles equipped with safety equipment. The necessary equipment should be loaded into the appropriate vehicles early in the preparation sequence. During the monitoring season, field crews will utilize the safety equipment, personal rain gear, and other site maintenance equipment listed in Table 5-1.

Table 5-1
Storm Kit Equipment and Mobilization List

Storm Kit Equipment List	Mobilization List
Flashlights (2) Maps High-quality alkaline D-cell batteries Spare sample labels Pencils and indelible markers Desiccant (packages and jar) Diagonal clipper Electrical tape Cable ties (assorted sizes) Utility knife Ziploc bags (assorted sizes) Nitrile gloves Keys Sampling pole for grab samples Manhole lifter	Field notebook (including Job Hazard Analysis (JHA) and Tailgate Safety Meeting Forms) Paper towels Spare chains of custody Sample control paperwork Extra-fine indelible markers Sample bottles Reagent-grade, analyte-free deionized water (3-gallon jug) from the laboratory Cellular phone Personal rain gear Digital or disposable camera Necessary safety gear (see Appendix J - *Health and Safety Plan*)

5.1.5 Communication Channels

Communication channels will be established for personnel to contact each other before and during the event. Cellular telephone communication links to field teams are essential for efficient water quality monitoring because the Project Manager and the Sampling Manager will need to track the location and workload of each field team and direct them to priority tasks. The project field notebook will include phone lists with home, work, and cellular numbers of the field team, and work numbers for primary laboratory contacts and RA personnel to aid in communication.

5.1.6 Data Retrieval

After each successful water quality monitoring event, flow and rainfall data will be downloaded from the flow meter.

SECTION 6 SAMPLE IDENTIFICATION, TRANSPORT, AND CUSTODY

6.1 SAMPLE PRESERVATION

6.1.1 Grab Sample

Once a grab sample is collected it will be sealed, labeled, and placed directly into a cooler with wet ice sufficient to maintain a sample temperature of four degrees Celsius or less and under chain of custody (COC).

6.1.2 Composite Sample

Composite samples will be collected into a 19-L borosilicate glass bottle. These bottles will be kept in protective buckets with wet ice sufficient to maintain a sample temperature of four degrees Celsius or less and under chain of custody. Following completion of a sampling event, they will be sealed and labeled. Composite sample bottles will remain under COC during each sampling event.

6.2 SAMPLE LABELING

Water quality sample bottles will be pre-labeled, to the extent possible, before each monitoring event. Pre-labeling bottles simplifies field activities and leaves only date, time, sample ID, and sampling personnel names to be filled out in the field. Each sample collected will be labeled with the following information:

- Project name
- Monitoring program
- Event number
- Date and time(24 hour time)
- Site ID number
- Bottle __ of __ (for multi-bottle samples)
- Collected by
- Analysis type
- Preservation (if applicable)

6.3 CHAIN-OF-CUSTODY FORMS

COC forms will be pre-printed along with the bottle labels. These forms will contain at a minimum the same data as the sample labels do. The COC forms will be completed in the field with dates, times, and sample team names, and will be cross-checked with the bottle labels. For composite samples, the start of the holding time will be considered to be the time that the last sample aliquot was collected. An example COC is presented in Appendix I.

COC procedures will be followed for each sample throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. For each sample, data will be recorded on a COC form the day it is collected. Data entries will be made manually, in indelible ink. Corrections will be made by drawing a single line through the error (leaving the original information legible), writing in the correct information, then dating and initialing the change. Blank lines and spaces on the COC form will be lined out, dated, and initialed by the individual maintaining custody. If used, electronic COC (eCOC) forms generated from a custom field application will be emailed directly to the laboratory and QA officer.

A sample will be considered to be in one's custody if they are:

- In the custodian's possession or view,
- In a secured location (under lock) with restricted access, or
- In a container that is secured with an official seal so that the sample is unlikely to be accessed without breaking the seal.

Each person in custody of samples will sign the COC form validating that the samples were not left unattended without being properly secured. Copies of all COC forms will be retained in the project files.

6.4 SAMPLE TRANSPORT

Transport of the samples will be coordinated with the laboratories by the project manager. Samples will be transported to the selected analytical laboratory by the field team, a lab courier, or a shipping company.

Specific sample-handling procedures are as follows:

- Coolant ice will be sealed in separate double plastic bags and placed in the shipping containers for subsamples.
- Individual sample containers (post-compositing and subsampling) will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.
- Upon transfer of sample possession to the analytical laboratory, each person responsible for custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the receiver will record the condition of the samples on a sample receipt form. COC forms will be used internally in the laboratory to track sample handling and final disposition.

SECTION 7 QUALITY ASSURANCE AND QUALITY CONTROL

7.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL

This section presents quality assurance/quality control (QA/QC) activities associated with field sampling. Field QA/QC samples will be used to evaluate potential contamination and sampling errors applicable to automated composite samples and grab samples that may be introduced prior to submittal of the samples to the analytical laboratory.

7.1.1 Training

Field personnel will be trained in the use of the monitoring equipment and clean sampling techniques along with appropriate health and safety protocols (Appendix J). The Health and Safety plan must be reviewed and updated as required prior to each monitoring event.

Each field team member will review the Health and Safety Plan and consult with the Sampling Manager if they have any questions before mobilization. The Sampling Manager will train field personnel in sampling protocols and procedures in accordance with this Monitoring Plan. Field training also will be provided before the beginning of the wet season to make field personnel aware of the project-specific goals and objectives

7.1.2 *In-situ* Field Measurements

The quality of *in-situ* field data will be assessed by accuracy and completeness. Applicable quantitative goals for field data are presented in Table 7-1.

Table 7-1
***In-Situ* Field Measurement Data Quality Objectives**

Parameter	Range	Accuracy	Resolution	Completeness
Electrical Conductivity	0 to 100 mS/cm	± 0.5% of reading + 0.001 mS/cm	0.001 to 0.1 mS/cm (range-dependant)	90%
pH	0 to 14 units	±0.2 units	0.01 unit	90%
Temperature	-5 to +50 ˚C	±0.15 ˚C	0.01 ˚C	90%
Dissolved Oxygen	0 to 50 mg/L	0 to 20 mg/L ±0.01 mg/L or 1% of reading, whichever is greater; 20 to 50 mg/L ±15% of reading.	0.01 mg/L	90%
Turbidity	0 to 1,000 NTU	±2% of reading or 0.3 NTU, whichever is greater	0.1 NTU	90%

Notes:
˚C - degrees Celsius
mg/L - milligrams per liter
mS/cm - milliSiemens per centimeter
NTU - nephelometric turbidity units

7.1.3 Field Quality Control Samples

The field QA/QC samples that will be utilized are field blanks, field duplicates, and equipment blanks. Sample types, measurement objectives, and frequencies based on SWAMP guidelines are summarized in Table 7-2.

Table 7-2
Field Quality Control Samples

Sample Type	Measurement Objective			Frequency of Analysis
	Field Duplicate	Field Blank	Equipment Blank	
Conventionals	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	5% of total project sample count
Indicator Bacteria	RPD<25%[(c)]	Negative Response	Negative Response	5% of total project sample count
Metals	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	5% of total project sample count
Nutrients	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	5% of total project sample count
Solid Parameters	RPD<25%[(a)]	<RL for target analyte	<RL for target analyte	5% of total project sample count
Organics	Per method	<RL for target analyte	<RL for target analyte	5% of total project sample count
Toxicity	NA	NA	NA	NA

Notes:
RL = reporting limit.
RPD = relative percent difference.

a. NA if native concentration of either sample<RL.
b. For equipment blanks, the frequency is 5% per batch or lot. A batch is defined as the group of bottles that have been cleaned at the same time, in the same manner, or, if decontaminated bottles are sent directly from the manufacturer, the batch would be the lot designated by the manufacturer in their testing of the bottles.
c. Field duplicates are not a current SWAMP requirement for indicator bacteria. However, the collection and analysis of a field duplicate is recommended.

7.1.3.1 Equipment Blanks

The selected analytical laboratory will clean the 19-L sample bottles, Teflon-lined tubing, silicone pump tubing, silicone bottle stoppers, and stainless steel sample intake strainers. The following blank samples will be created for analysis:

- One blank sample representative of the cleaned silicone and Teflon-lined tubing. Blank water will be passed through at least 10% of cleaned tubing and be representative of both silicone and Teflon-lined tubing.
- One blank representing the bottles and stoppers. Blank water will be passed into/over at least 10% of cleaned bottles and stoppers.

The analytical laboratory will analyze the equipment blanks for total organic carbon and total metals at a minimum. The analytical laboratories will analyze blank water from the cleaned sampling equipment at the same detection level proposed for sample analysis; this will verify that the sampling equipment in contact with sample water is clean and is not a likely source of contamination.

If a blank sample produces an analyte detection above the RL, the equipment will be cleaned and blanked again. Cleaned and blanked sampling equipment will not be deployed for sampling until an acceptable blank analysis has occurred unless directed by the RAs.

7.1.3.2 Field Duplicates

A field duplicate sample will be collected during each of the two non-storm water events and one storm water monitoring event. A field duplicate of *in-situ* parameters will not be performed.

7.1.3.3 Field Blanks

A field blank sample will be prepared during each of the two non-storm water monitoring events. A field blank will not be conducted during the storm water monitoring event. The field blanks will be created by pouring laboratory-grade distilled, deionized water into laboratory supplied bottles at one of the monitoring sites.

7.1.4 Inspection/Acceptance of Supplies and Consumables

Sample bottles (provided by the laboratory) and collection equipment will be inspected prior to their use. Procured supplies will be examined for damage prior to use per Table 7-3.

Field supplies will be stored at the sampling team's offices; laboratory supplies will be stored at the laboratory. Inspection and testing requirements for laboratory supplies are covered in the laboratory's QA/QC procedures.

Table 7-3
Inspection/Acceptance Testing Requirements for Consumables and Supplies

Project-Related Supplies/ Consumables	Inspection/Testing Specifications/Source	Acceptance Criteria	Frequency	Responsible Party
Pre-cleaned sample bottles	Closed bottle	Lids screwed on bottles	100%	Sampling Team
Composite sample bottles	Laboratory cleaned	Pass blanking analysis	Clean bottles each monitoring event	Laboratory/Sampling Team
Silicone tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Laboratory/Sampling Team
Teflon tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Laboratory/Sampling Team
Gloves	New box	New box	As needed	Sampling Team

7.1.5 Field Audits

The project manager may conduct spot verifications that field activities are being conducted in accordance with this work plan, and has the authority to issue a stop work order on sample collection. Identified non-conformances will be discussed in the Water Quality Improvement Plan annual report.

7.1.6 Field Corrective Action

The project manager will be responsible for correcting equipment malfunctions during field sampling. In the case of field instruments, problems will be addressed through cleaning the instrument, repairing it, or replacing parts or the entire instrument, as warranted. Field crews will carry basic spare parts and consumable supplies with them, and will have access to spare parts.

7.2 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

This section addresses QA/QC activities associated with laboratory analyses. Laboratory QA/QC samples provide information to assess potential laboratory contamination, analytical precision, and accuracy. Analytical quality assurance for this program includes the following:

- Employing analytical chemists trained in the procedures to be followed.
- Adherence to documented procedures, United States Environmental Protection Agency (USEPA) approved methods, and written Standard Operating Procedures (SOPs).
- Calibration of analytical instruments.
- Use of quality control samples, internal standards, surrogates, and Standard Reference Materials (SRMs).
- Complete documentation of sample tracking and analysis.

Internal laboratory quality control checks will include the use of laboratory replicates, method blanks, matrix spikes/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCSs). The quality control checks performed by constituent class is presented in Table 7-4. The frequency of the laboratory QA/QC samples is presented in Appendix K.

Table 7-4
Laboratory Quality Control Samples by Constituent Class

Laboratory Quality Control	Constituent Class							
	Conventionals	Indicator Bacteria	Inorganic Analytes	Nutrients	Solid Parameters	Acute Toxicity	Chronic Toxicity	Synthetic Organic Compounds
Calibration Standard	✓	–	✓	✓	–	–	–	–
Calibration Verification	✓	–	✓	✓	–	–	–	✓
Laboratory Blank	✓	✓	✓	✓	✓	–	–	✓
Reference Material	✓	–	✓	✓	–	–	–	✓
Matrix Spike	✓	–	✓	✓	–	–	–	✓
Matrix Spike Duplicate	✓	–	✓	✓	–	–	–	✓
Laboratory Duplicate	✓	✓	✓	✓	✓	–	–	–
Internal Standard	✓	–	✓	–	–	–	–	✓
Sterility Checks	–	✓	–	–	–	–	–	–
Laboratory Positive Control	–	✓	–	–	–	–	–	–
Laboratory Negative Control	–	✓	–	–	–	–	–	–
Laboratory Water Control	–		–	–	–	✓	✓	–
Conductivity/Salinity Control Water	–	–	–	–	–	✓	✓	–
Additional Control Water	–	–	–	–	–	✓	✓	–
Sediment Control	–	–	–	–	–	✓	✓	–
Reference Toxicant Tests	–	–	–	–	–	✓	✓	–
Tuning	–	–	–	–	–	–	–	✓
Surrogate	–	–	–	–	–	–	–	✓
Calibration	–	–	–	–	–	–	–	✓

7.2.1 Data Quality Objectives

Data quality objectives (DQOs) are quantitative and qualitative statements that define project objectives and specify the acceptable ranges of field sampling and laboratory performance. Numeric DQOs for *in-situ* measurements and water samples are listed in Appendix K. DQOs for this project will include the following:

- Accuracy
- Precision

- Completeness

Accuracy describes how close the measurement is to its true value. Accuracy is the measurement of a sample of known concentration and comparing the known value against the measured value. The accuracy of chemical measurements will be checked by performing tests on a standard prior to and/or during sample analysis. A standard is a known concentration of a certain solution. Standards can be purchased from chemical or scientific supply companies. Standards might also be prepared by a professional partner (e.g., a commercial or research laboratory). The concentrations of the standards should be within the mid-range of the equipment. Recovery measurements are determined by spiking a replicate sample in the laboratory with a known concentration of the analyte. Accuracy of the project data will be determined by comparing results from MS/MSDs, LCSs, field blanks, and equipment blanks to the accuracy objectives specified in Appendix K.

Precision describes how well repeated measurements agree. The evaluation of precision described here applies to repeated measurements and samples collected in the field (field duplicates) or the laboratory (laboratory replicates and MS/MSDs). Precision measurements will be determined by comparing results from field duplicates, laboratory replicates and MSD to the precision objectives specified in Appendix K. Relative Percent Differences (RPDs) will be calculated to determine the precision between duplicate samples. This calculation is presented in Equation 1.

$$RPD = \frac{abs\left[x_1 - x_2\right]}{0.5 * \left(x_1 + x_2\right)} \qquad \text{Equation 1}$$

where:

abs is the absolute value.
x_1 is measurement 1.
x_2 is measurement 2.

Completeness is the fraction of planned data that must be collected to fulfill the statistical criteria of the project. There are no statistical criteria that require a certain percentage of data. However, the anticipated target is 90%. This accounts for adverse weather conditions, safety concerns, and equipment problems. The project team determined completeness by comparing the number of measurements planned to be collected with the number of measurements actually collected that are deemed valid. An invalid measurement would be one that does not meet the sampling method requirements. Completeness will be measured as a percentage of the number of samples collected that meet the respective DQOs compared to the anticipated number of samples. This calculation is presented in Equation 2.

$$Completenss = \frac{Actual\ number\ of\ samples\ collected}{\Pr oject\ required\ total\ samples\ to\ be\ collected} * 100 \qquad \text{Equation 2}$$

7.2.2 Instrument/Equipment Calibration and Frequency

Laboratory equipment will be calibrated based on manufacturer recommendations and in accordance with the method and laboratory SOP. The laboratory SOP is maintained by the respective Laboratory Directors and QA officers, and is available upon request.

7.2.3 Corrective Action

Corrective action will be taken when an analysis is deemed suspect. Reasons a sample may be considered suspect consist of exceedances of the RPD ranges, spike recoveries, and blanks. The corrective action may vary from analysis to analysis, but typically will involve the following:

- Check of procedures.
- Review of documents and calculations to identify possible errors.
- Error correction.
- Re-analysis of the sample extract, if available, to see if results can be improved.
- Reprocessing and re-analysis of additional sample material, if it is available.

Malfunctions that occur during data collection and laboratory analyses will be the responsibility of the field crew or laboratory conducting the work, respectively. In the case of field instruments, problems will be addressed through instrument cleaning, repair, or replacement of parts or the instrument, as warranted. Field crews should carry basic spare parts and consumables with them, and have access to spare parts. The laboratories have procedures in place to follow when failures occur, and have identified individuals responsible for corrective action and developed appropriate documentation as needed.

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SECTION 8 ASSESSMENT AND REPORTING

The RAs within the Tijuana River WMA are required to submit a Water Quality Improvement Plan Annual Report for the 2015-2016 reporting year by January 31, 2017. The results of the wet and dry weather MS4 outfall discharge monitoring data collected under this work plan will be presented in that report. The following will be reported at a minimum:

- Applicable data will be presented in tabular form.
- Applicable data will be presented in graphical form.
- A summary of the removal or re-prioritization of the highest priority persistent flow MS4 outfall monitoring stations[11].

[11] Persistent flow MS4 outfall monitoring stations that have been removed will be replaced with the next highest prioritized MS4 outfall in the respective RA's jurisdiction in the Tijuana River WMA, unless there are no remaining qualifying major MS4 outfalls within the RA's jurisdiction in the WMA.

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SECTION 9 REFERENCES

Hach. 2009. Catalog Number 3314: Sigma 950 Flow Meter User Manual. August, 2009. Available online at: http://www.hachflow.com/pdf/3314_950.pdf.

San Diego Regional Water Quality Control Board (Regional Board). 2010. *Revised TMDL for Indicator Bacteria, Project I–Twenty Beaches and Creeks in the San Diego Region (including Tecolote Creek)*. Resolution No. R9-2010-0001. Approved February 10. http://www.waterboards.ca.gov/sandiego/water_issues/programs/tmdls/docs/bacteria/updates_022410/2010-0210_BactiI_Resolution&BPA_FINAL.pdf.

United States Environmental Protection Agency (USEPA). 1992. NPDES Storm Water Sampling Guidance Document (EPA-833-B-92-001). July, 1992. Available online at: http://www.epa.gov/npdes/pubs/owm0093.pdf.

United States Environmental Protection Agency (USEPA). 1998. Environmental Monitoring and Assessment Program Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Wadeable Streams.

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Toxicity Identification Evaluation / Toxicity Reduction Evaluation Implementation Draft Work Plan

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LIST OF ACRONYMS

2007 Permit	RWQCB Order No. R9-2007-0001
2013 Permit	RWQCB Order No. R9-2013-0001
BMP	best management practice
BSA	bovine serum albumin
CLRP	Comprehensive Load Reduction Plan
Copermittees	San Diego Regional Copermittees
EDTA	ethylenediaminetetraacetic acid
IWC	instream waste concentration
JRMP	Jurisdictional Runoff Management Plan
LC_{50}	median lethal concentration
LID	low impact development
MAP	Monitoring and Assessment Plan
MEP	maximum extent practicable
MS4	multiple separate storm sewer system
NOEC	no observed effect concentration
NPDES	National Pollutant Discharge Elimination System
PBO	piperonyl butoxide
QA/QC	quality assurance/quality control
RWQCB	Regional Water Quality Control Board
SMC	Stormwater Monitoring Coalition
SPE	solid phase extraction
STS	sodium thiosulfate
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TIE	toxicity identification evaluation
TMDL	Total Maximum Daily Load
TRE	toxicity reduction evaluation
TST	Test of Significant Toxicity
USEPA	United States Environmental Protection Agency
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan
WURMP	Watershed Urban Runoff Management Program

UNITS OF MEASURE

ppt	parts per thousand
%	percent
<	less than
>	greater than

1.0 INTRODUCTION

In May of 2013, San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001 (2013 Permit) was adopted. Provision B of the 2013 Permit requires Copermittees in each Watershed Management Area (WMA) to develop a Water Quality Improvement Plan (WQIP) which, per Provision B.4, incorporates a Monitoring and Assessment Program (MAP). Also, per Provision D.1.c.(4)(f), "*If chronic toxicity is detected in receiving waters, the Copermittees must discuss the need for conducting a TIE/TRE in the assessments required under Provision D.4.a.(2), and develop a plan for implementing the TIE/TRE to be incorporated in the Water Quality Improvement Plan*."

A toxicity identification evaluation (TIE) is defined by the 2013 Permit as "*A set of procedures for identifying the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests*." A toxicity reduction evaluation (TRE) is defined as "*A study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices and best management practices. A TIE may be required as part of the TRE, if appropriate*."

This Work Plan outlines the process used to identify chronic toxicity in receiving waters, as well as guidance to prioritize the need to implement a TIE/TRE based on the magnitude and persistence of chronic toxicity. The Work Plan refers to the appropriate references for detailed sampling and analytical/toxicity test methods specific to the TIE/TRE treatment process. An example of a potential TRE decision process for receiving water samples (Stormwater Monitoring Coalition (SMC) Model Monitoring Technical Committee, 2004) is presented in Figure 1-1. The process should be modified on location-specific and pollutant-specific basis, and a detailed work plan should be developed for the implementation of a pollutant reduction program once the specific pollutant(s) causing toxicity exceedances are identified.

This Work Plan focuses primarily on the implementation of the TIE/TRE process, recognizing the limitations of utilizing TRE guidance developed for point source discharges. Receiving water stations potentially capture pollutants from many sources with runoff flows and contaminant concentrations likely more variable than those from point source discharges. However, with modifications to the TRE guidance developed for point source discharges, a TRE may be conducted to attempt to identify sources of toxicity, propose mitigation measures for these sources, and conduct follow-up studies to confirm toxicity reduction. Any activities that result in consistently reducing toxicity to an acceptable level may be considered TRE activities (USEPA 2001).

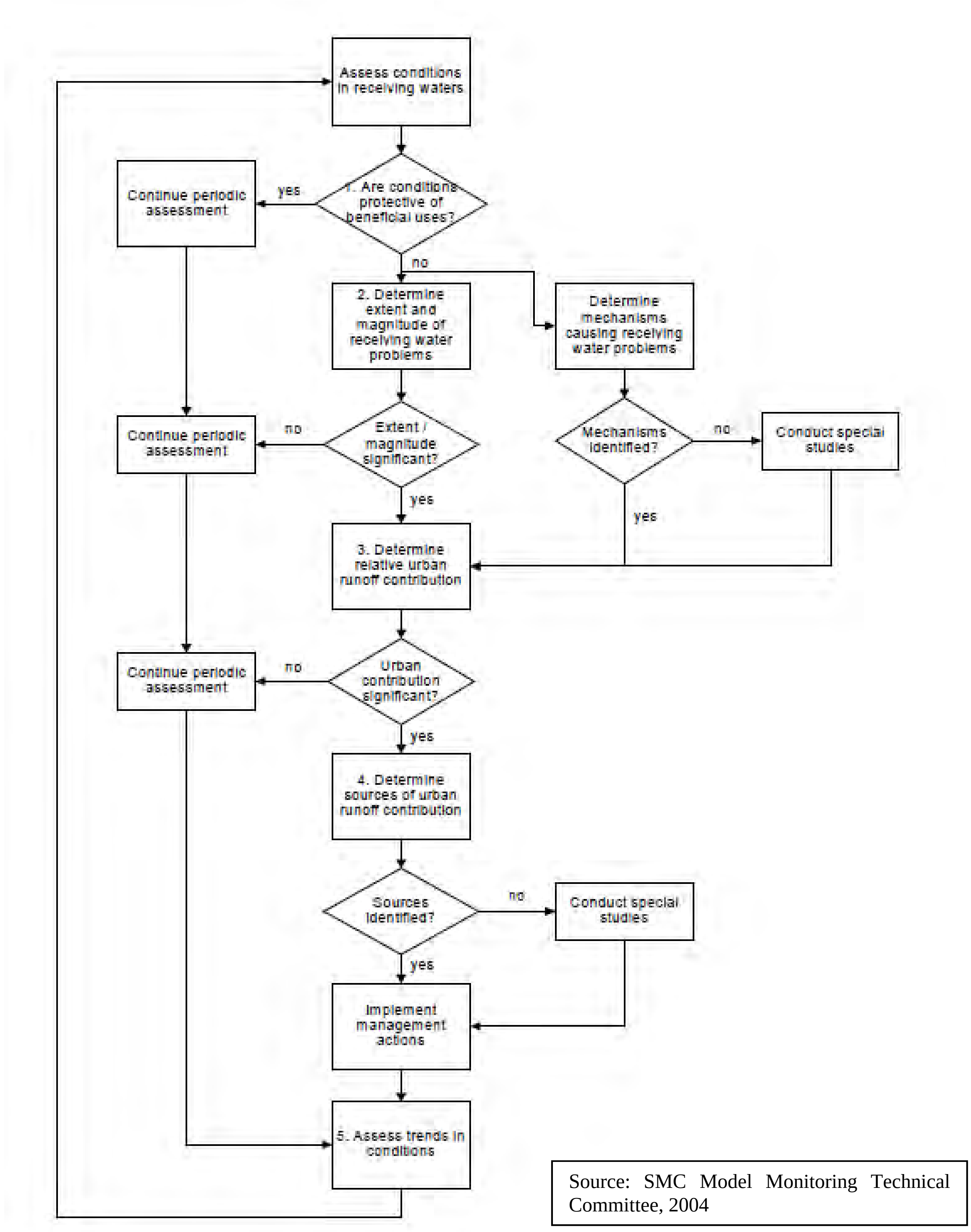

Figure 1-1. Example Receiving Water Monitoring and TIE/TRE Decision Framework

2.0 RECEIVING WATER TOXICITY TESTING

Receiving water monitoring is conducted by the San Diego Regional Copemittees (Copermittees) in accordance with Provision D of the 2013 Permit and chronic toxicity is one of the parameters evaluated in both wet and dry weather receiving water samples. Under the long-term monitoring requirements of the 2013 Permit, chronic toxicity tests are conducted in accordance with Provision D.1.c.(4)(e) as summarized in Table 2-1. Toxicity is evaluated using the Test of Significant Toxicity (TST) as outlined in the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (USEPA, 2010). The TST approach assigns a Pass or Fail result based on whether the organism response observed at the chronic instream waste concentration (IWC) of 100 percent (%) receiving water is significantly different from that in the control treatment. When chronic toxicity is observed in receiving water samples (i.e., the sample receives a “Fail” based on the TST), implementation of a TIE/TRE process following the phased approach described in subsequent sections will be considered, as appropriate.

Table 2-1. Transitional and Long-Term Receiving Water Toxicity Tests

Organism	Endpoint	Toxicity Threshold	USEPA Protocol
Monitoring in accordance with Order No. R9-2013-0001, Salinity < 1 ppt			
Ceriodaphnia dubia	Chronic survival and reproduction	Pass/Fail	EPA-821-R-02-013
Selenastrum capricornutum	Chronic growth		
Pimephales promelas	Chronic survival and growth		
Monitoring in accordance with Order No. R9-2013-0001, Salinity $\geq$ 1 ppt			
Strongylocentrotus purpuratus	Chronic development	Pass/Fail	EPA-600-R-95-136

3.0 TIE/TRE PROCESS

3.1 Information and Data Acquisition

Prior to initiating the TIE/TRE process, an evaluation of sampling and toxicity testing procedures should be conducted to assess whether toxicity may have been introduced during these procedures or errors may have been made. This may include a review of the following:

- Sampling equipment decontamination procedures
- Field and laboratory logs
- Laboratory reports

If all test acceptability criteria are met and no errors are identified, Copermittees will consider implementing the TIE/TRE process. Conducting a TIE is often the first step to identifying the toxicant.

3.2 TIE Testing

TIEs may be conducted in accordance with USEPA guidance for characterizing, identifying, and confirming toxicity (USEPA 1991, 1992, 1993a, and 1993bPriority may be given to stations exhibiting significant and persistent toxicity that has not previously been characterized and where analytical results indicate that a specific toxicant may be causing or contributing to toxicity. The sample may be evaluated for TIE suitability using the following assessments:

- Presence of Persistent Toxicity: toxicity is considered persistent if more than 50% of samples (generally during a monitoring year) collected at a station receive a “Fail” based on the test of significant toxicity (TST) .
- Magnitude of Toxicity: based on past experience, a 50% response rate(i.e. 50% of test organisms respond in a 100% receiving water sample) can provide a reasonable opportunity for a successful TIE.
- Previous Characterization: TIEs are generally prioritized for receiving water stations where previous TIEs have not characterized the pollutant(s) causing toxicity. However, TIE/TRE procedures should not be ruled out for previously characterized stations since contributor(s) to toxicity may change over time.

The TIE approach is divided into three phases, as described in USEPA (1991) and summarized as follows:

- Phase I – characterizes the physical/chemical nature of the constituent(s) which cause or contribute to toxicity. Such characteristics as solubility, volatility and filterability are determined without specifically identifying the toxicants.
- Phase II – utilizes methods to specifically identify toxicants.
- Phase III – utilizes methods to confirm the suspected toxicants.

Phase I (characterization) manipulations of receiving water samples generally include those presented in Table 3-1.

Table 3-1. Phase I TIE Receiving Water Sample Manipulations

Physical and Chemical Manipulations on Receiving Water Samples	Purpose of Test
Baseline	Confirms toxicity is still present in the sample at time of TIE testing
Filtration	Detects particulates or particulate-bound toxicants
Aeration	Detects volatile, oxidizable, sublatable, or spargeable compounds
Ethylenediaminetetraacetic acid (EDTA) addition	Detects cationic metals (e.g., cadmium)
Sodium thiosulfate (STS) addition	Detects oxidative compounds (e.g., chlorine)
Solid phase extraction (SPE) over C18 column (may be followed by methanol elution)	Detects non-polar organics and some surfactants (methanol elution adds toxicity back to sample)
Piperonyl butoxide (PBO) addition	Detects organophosphate pesticides and pyrethroids

Carboxyl esterase addition*	Hydrolyzes pyrethroids
Bovine serum albumin (BSA) addition	Protein BSA is used as a control for the carboxyl esterase
Temperature reduction	Increases toxicity of pyrethroid pesticides
pH adjustment	Detects pH-dependent toxicants (e.g., ammonia and sulfides)
* Carboxylesterase addition has been used in recent studies to help identify pyrethroid-associated toxicity (Wheelock et al., 2004; Weston and Amweg, 2007). However, this treatment is experimental in nature and should be used along with other pyrethroid-targeted TIE treatments (e.g., PBO addition).	

Adjustments may be made to these TIE protocols if specific contaminants are suspected to be contributing to toxicity. For example, total dissolved solids (TDS) controls and/or mock effluents to mimic TDS concentrations observed in samples are often added to the treatments listed in Table 3-1 if ionic imbalance or elevated TDS are suspected. Toxicity due to ionic imbalance occurs when ion concentrations are not within the tolerance range of the selected test organism; utilizing *S. purpuratus* for toxicity tests conducted for samples with salinity > 1 ppt may help to alleviate this common issue, especially during dry weather.

Phase II and III TIEs may be necessary, depending whether the Phase I determination of toxicant class is sufficient for identifying pollutants for outfall monitoring and/or identifying source control measures. If necessary, Phase II and III procedures may include toxicant removal and add-back, serial additions, and/or toxicant spiking experiments in accordance with USEPA 1993a and 1993b.

It should be noted that, due to intermittent toxicity and/or toxicity resulting from multiple toxicants, TIEs are not always conclusive. In such cases, conducting toxicity tests with additional organisms (SMC Model Monitoring Technical Committee, 2004) and/or serially identifying toxicants (USEPA, 2001) may help characterize observed toxicity. When a receiving water sample exhibits persistent toxicity of a high magnitude, as is generally the case when TIEs are conducted, TIEs are typically successful (USEPA, 2001).

3.3 Toxicity Source Evaluation

Once any toxicants have been identified during the TIE process, Copermittees must discuss the need for conducting a TRE. The following sections provide an outline for developing specific monitoring elements intended to focus the effort in locating the source(s) of the pollutant(s).

If urban runoff is suspected as a significant source of the pollutant(s) characterized by a TIE to be a contributor to toxicity at a receiving water station, source identification procedures may need to be considered. An evaluation of chemistry and bioassessment data for the receiving water station and chemistry data for upstream outfalls may help to confirm whether urban runoff is a significant source of the pollutant(s) causing toxicity and may justify further source identification procedures.

More comprehensive source identification procedures, if warranted, may include compiling descriptions of all potential sources to the receiving water station, determining actual sources and their relative magnitudes, and quantitatively estimating loads from these sources. A model for a source identification investigation study is outlined in the *Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California* (SMC Model Monitoring Technical Committee, 2004) and more detailed source identification study methodology is outlined in USEPA (1993c) and by Pitt (2004). The general approach may include a combination of the components presented in Figure 3-1.

Desktop Assessment

- Delineate tributary drainage area and MS4 infrastructure draining to receiving water, as well as responsible agencies to be involved in TRE and investigations.
- Identify upstream land uses and watershed activities which may represent contributing sources of pollutant(s) causing toxicity.
- Compile and evaluate existing data for upstream MS4 from MS4 inventory.
- Leverage observation and monitoring data from other programs such as for example:
  - *Industrial Permit*
  - *Construction Permit*
  - *IC/ID Program*

Initial Field Assessment

- Implement initial upstream MS4 investigations, sampling for pollutant(s) identifed in TIE to be causing toxicity. Prioritize investigations based on MS4 inventory and other factors.
- Types of Investigations to conisder may include::
  - Visual/Observation
  - Upstream MS4 Transect Surveys
  - Land Use or Activity Based Source Investigations
  - Special Studies

Watershed Planning

- Review existing water quality plans and programs (i.e. WQIPs, CLRPs, TMDL implementation plans, WURMPs, JRMPs) for pollutant sources, watershed priorities, and existing institutional activities and BMPs implemented locally. Cross-reference effectiveness to reducing pollutant(s) causing observed toxicity.
- Identify local water quality criteria and habitat health criteria to establish triggers for source investigations.
- Develop source investigation report and work plan based on existing guidance.

Figure 3-1. The Toxicity Source Evaluation Approach

Source identification efforts may coordinate with monitoring and assessment activities necessary for compliance with the following Provisions:

- Provision A.4.a.(2) – If it is determined that discharges from the MS4 are causing or contributing to a new exceedance of an applicable water quality standard not addressed by the WQIP, update the WQIP with the water quality improvement strategies implemented or to be implemented, the implementation schedule, and the monitoring and assessment program updates intended to track progress toward achieving compliance.

- Provision B.2.d – identify and prioritize known and suspected sources of stormwater and non-stormwater pollutants from MS4 outfalls that contribute to the highest priority water quality conditions, as identified in the WQIP.
- Provision B.3 – identify water quality improvement goals and strategies to address the highest priority water quality conditions, as identified in the WQIP.
- Provision D.2.b – perform dry weather MS4 outfall monitoring to identify non-storm water flows and illicit discharges within its jurisdiction and to prioritize these discharges for investigation and elimination.
- Provision D.2.c – perform wet weather MS4 outfall monitoring to identify pollutants in storm water discharges from the MS4, guide pollutant source identification efforts, and determine compliance with applicable Total Maximum Daily Loads (TMDLs).
- Provision D.3 – conduct special studies related to the highest priority water quality conditions. Provision D.3.c specifies that special studies related to pollutant and/or stressor source identification should include a compilation of known information on the pollutant and/or stressor, an identification of data gaps intended to be filled by the studies, and a monitoring plan which includes, among other required elements, a prioritization of sources of the pollutant and/or stressor.
- Provision E.2 – implement a program to detect and eliminate illegal discharges and improper disposal into the MS4.

If no source can be identified as a major contributor to receiving water toxicity, more intensive follow-up studies may be required.

3.4 Toxicity Control Evaluation

Using the results from the TRE elements conducted to this point, alternatives for reducing receiving water toxicity may be identified and the most feasible approach(es) may be selected. Pollution Prevention measures are designed to target pollutants and wastes before they are generated, while Source Controls are designed to reduce or eliminate pollutants before entering the MS4. These measures may include outreach, incentive programs, regulatory controls, and enforcement activities, as well as broader “true source controls” that must be implemented at a national or state level (e.g., product regulation). Institutional Programs, such as street sweeping, MS4 cleaning and repair, and other institutional services are typically maintenance activities implemented by agencies at various targeted frequencies to meet pollutant load reduction goals and minimum National Pollutant Discharge Elimination System (NPDES) Permit compliance criteria. Treatment Controls include structural systems designed to remove pollutants from stormwater and non-stormwater flows and may include a variety of low impact development (LID) and best management practices (BMPs) (e.g., infiltration-type, bioremediation, treatment trains, etc.). These BMPs are intended to protect receiving waters by eliminating or reducing the discharge of pollutants to the maximum extent practicable (MEP). Advantages and disadvantages of BMP alternatives should be considered, and appropriate BMPs should be selected based on site-specific conditions and pollutant(s) of concern. An integrated approach using a combination of Pollution Prevention measures, Institutional Programs, and Treatment Controls may be appropriate if more than one pollutant is identified to be causing or contributing to toxicity, or if the source is unknown. These three components of the toxicity control evaluation are shown in Figure 3-2.

Figure 3-2. Components of Toxicity Control Evaluation

3.5 Toxicity Control Implementation

Once the selected toxicity control method(s) are implemented, monitoring may be continued and possibly accelerated to confirm that toxicity reduction objectives are being met. Depending on the location and pollutant(s) being evaluated, some of this monitoring may be satisfied by Permit-required monitoring of receiving water and outfall locations (see Section 3.3).

Compliance with the monitoring and assessment requirements of the 2013 Permit, including Provision D.1.c.(4)(f) which requires the implementation of the TIE/TRE process described in this Work Plan, is intended to meet the discharge and receiving water limitations outlined in the 2013 Permit to the MEP. Updates to the monitoring programs developed to comply with these provisions will be incorporated into the WQIP through the adaptive management process outlined in Provisions B.4 and B.5 in order to continually monitor effectiveness and re-evaluate the programs.

3.6 Quality Assurance/Quality Control

A quality assurance/quality control (QA/QC) program for the TIE/TRE should be developed in order to ensure reliability of data collected throughout the process. The QA/QC program should include the QA/QC objectives, sample collection and preservation techniques, chain of custody procedures, analytical QA/QC, laboratory equipment maintenance, QA/QC training requirements, documentation and reporting procedures, and corrective action protocols (USEPA, 1993c). In addition, toxicology and analytical laboratories should be experienced and qualified to conduct the TIE/TRE.

3.7 TIE/TRE Limitations

There are inherent limitations associated with the TIE/TRE process summarized in this Work Plan, including the difficulty of characterizing intermittent toxicity (USEPA, 1993c) and/or toxicity resulting from multiple toxicants (USEPA, 2001). In addition, existing TRE guidance was developed primarily for point source discharges from wastewater treatment plants whereas receiving waters potentially capture pollutants from many sources and contain contaminants at more variable concentrations than those from a wastewater treatment facility, especially during a storm event.

4.0 REFERENCES

CWP (Center for Watershed Protection) and R. Pitt. 2004. *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*. EPA Cooperative Agreement X-82907801-0. Washington, D.C. USEPA Office of Water. October 2004.

RWQCB (Regional Water Quality Control Board). 2013. *California Regional Water Quality Control Board San Diego Region, Order No. R9-2013-0001, NPDES No. CAS0109266, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region*. May 2013.

USEPA (U.S. Environmental Protection Agency) 2010. National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document. EPA 833-R-10-003. Office of Wastewater Management. June.

USEPA (United States Environmental Protection Agency). 1991. *Methods for Aquatic Toxicity Identification Evaluations. Phase I Toxicity Characterization Procedures.* EPA/600/6-91/003. EPA Office of Research and Development. Second Edition. February 1991.

USEPA (United States Environmental Protection Agency). 1992. *Toxicity Identification Evaluation. Characterization of Chronically Toxic Effluents, Phase I.* EPA/600/6-91/005F. EPA Office of Research and Development. May 1992.

USEPA (United States Environmental Protection Agency). 1993a. *Methods for Aquatic Toxicity Identification Evaluations. Phase II Toxicity Characterization Procedures for Samples Exhibiting Acute and Chronic Toxicity*. EPA/600/R-92/080. EPA Office of Research and Development. September 1993.

USEPA (United States Environmental Protection Agency). 1993b. *Methods for Aquatic Toxicity Identification Evaluations. Phase III Toxicity Characterization Procedures for Samples Exhibiting Acute and Chronic Toxicity*. EPA/600/R-92/081. EPA Office of Research and Development. September 1993.

USEPA (United States Environmental Protection Agency). 1993c. Investigation of inappropriate pollutant entries into storm drainage systems. Office of Research and Development, Washington, DC. EPA/600/R-92/238.

USEPA (United States Environmental Protection Agency). 1995. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*. First Edition. EPA-600-R-95-136. EPA Office of Water. August 1995.

USEPA (United States Environmental Protection Agency). 1999. *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants.* EPA/833B-99/002. EPA Office of Wastewater Management. August 1999.

USEPA (United States Environmental Protection Agency). 2001. *Clarifications Regarding Toxicity Reduction and Identification Evaluations in the National Pollutant Discharge Elimination System Program*. Office of Wastewater Management. March 27, 2001.

USEPA (United States Environmental Protection Agency). 2002. *Short-term Methods for Evaluating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. Fourth Edition. EPA-821-R-02-013. EPA Office of Water. October 2002.

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San Diego County Municipal Copermittees
Bight 2013 Workplan
FINAL

Prepared For:

County of San Diego Municipal Copermittees

July 25, 2013

San Diego County Municipal Copermittees Bight 2013 Workplan

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July 25, 2013

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Appendix A
Station Location Maps

Appendix B
Bight '13 Contaminant Impact Assessment Workplan

Appendix C
Bight '13 Contaminant Impact Assessment Quality Assurance Manual

1.0 INTRODUCTION

The purpose of this workplan is to outline the activities that will be conducted by the San Diego Regional Copermittees (Copermittees) to contribute in-kind services to the Southern California Bight 2013 Regional Monitoring Program (Bight '13). This is a working document coinciding with the development of the Bight '13 Program.

Background

The aquatic health of the San Diego estuaries and lagoons have been assessed as part of the previous Bight Surveys in 2003 (Bight '03) and 2008 (Bight '08). It has also been assessed in the Copermittees' three-year Ambient Bay and Lagoon Monitoring (ABLM) Program from 2003-2005 and from 2010-2012. Additionally in 2008, the sediment conditions within San Diego estuaries were evaluated following the protocols of the State Water Resources Control Board's (SWRCB) *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (referred to as Sediment Quality Objectives (SQOs)). This section provides an overview of the Bight '03, Bight '08, and ABLM study results relevant to San Diego estuaries.

2003 and 2008 Bight Surveys

The Bight program is a regional assessment of the Southern California Bight (Bight) organized every five years by the Southern California Coastal Water Research Project (SCCWRP), conducted from Point Conception to the Mexican border. Bight Surveys were initiated in 1994 based on recommendations received from marine monitoring program reviews by the National Academy of Sciences in 1989. SCCWRP is the lead coordinating agency for the Bight Surveys, bridging the regulated and regulatory communities. Previous surveys have been conducted in 1994, 1998, 2003, and 2008. Detailed information related to previous Bight surveys as well as information regarding the current Bight '13 survey can be found on the SCCWRP website at: http://www.sccwrp.org/Documents/BightDocuments.aspx.

In Bight '03, the ecological health of Southern California estuaries was assessed and compared to conditions found in coastal and offshore areas. As part of the Coastal Ecology Bight Study, sediment chemistry, toxicity, and benthic communities were measured at 60 stations in estuaries and embayments, with most of the sampling effort allocated to the Los Angeles region. Out of all surveyed marine habitats, embayments were found to have lower sediment quality in comparison to nearshore and offshore environments. Trace metals and total polyaromatic hydrocarbons (PAHs) had higher concentrations in sediments from embayments, especially within marinas and urban estuaries. Marinas and estuaries (particularly in Los Angeles) also contained the greatest incidence of sediment toxicity. Toxicity was present in 50% of the marina area and 41% of the estuarine area. Furthermore, assessments of benthic community condition indicated that most of the moderate and high disturbance of benthic infauna occurred in embayments.

The Bight '08 Survey represented the first effort to monitor and evaluate results in accordance with the SQO Policy across Southern California's embayments. The SQOs are based on a multiple lines of evidence (MLOE) approach in which the lines of evidence (LOE) are sediment toxicity, sediment chemistry, and benthic community condition. The MLOE results were integrated through the evaluation of the severity of biological effects and the potential for chemically mediated effects to provide a final station level assessment. In Bight '08, sediment chemistry, toxicity, and benthic communities were measured at 60 stations in estuaries and embayments with 40 stations allocated to the San Diego region. Similar to Bight ’03 results, embayments were again found to have lower sediment quality in comparison to nearshore and offshore environments. Approximately 27% of embayments within the Bight were considered contaminant impacted with at least half of the area in marinas and estuaries exhibiting contamination. Trace metals such as zinc, PAHs, and current use pesticide concentrations were observed in many estuaries as a result of urban runoff from adjacent watersheds. Marinas and estuaries also contained the greatest incidence of sediment toxicity with substantial toxicity present in 24% of marina sediments and 22% of estuary sediments. In addition, approximately 59% of southern California’s estuaries and 37.4% of marinas had benthic communities in poor condition.

Ambient Bay and Lagoon Monitoring

The Copermittees conducted a three year ABLM to assess San Diego’s lagoons from 2003 through 2005. The ABLM program applied a weight of evidence approach using a triad assessment of indicators which included chemistry, toxicity, and benthic infaunal communities to evaluate the sediment quality in the lagoons. The program design used a targeted approach to assess the finest grain size and highest total organic carbon. This approach was used to conservatively assess if the areas in the lagoons that were likely to be impacted exceeded published benchmarks or exhibited toxic effects. Three discreet samples were collected and composited into one composite sample for each lagoon per year. The three years of data were compiled to form a baseline of information, providing a worst case benchmark for comparison of future sampling results. Based on the ABLM study, San Diego County lagoon’s sediment health was rated as fair based on the triad of indicators Sediment contamination was low during sampling years, as was toxicity. However, benthic infaunal communities were generally more disturbed than would have been expected based on the chemistry and toxicity data. Given that the ABLM study utilized composite sampling, future studies are needed to better understand the spatial distribution of conditions within San Diego estuaries.

The Copermittees also conducted a three year ABLM program from 2010 through 2012. By building on information gained through the 2003-2005 ABLM and the Bight ’08 Survey, it was determined that special studies within each lagoon would provide more relevant information for addressing the permit management questions. Because the data collected previously were more indicative of stressors to the benthic community and did not suggest relationships to chemical influences, the 2010-2012 ABLM Program focused on benthic community assessments. Priority was given to those lagoons that had impacted benthos with associated toxicity or with the presence of chemistry exceedances. During the three year period, five lagoons/estuaries were monitored including Agua Hedionda Lagoon, Sweetwater River Estuary, San Elijo Lagoon, Batiquitos Lagoon, and Tijuana River Estuary. The sediment qualities of the five lagoons/estuaries were evaluated utilizing the SQO tool. Sampling consisted of water quality sampling for chemistry and physical parameters and sediment sampling for chemistry, toxicity, and benthic infaunal assessments. Each sampling site included three replicate samples to evaluate benthic conditions and one replicate water quality site. Data for this study were collected using methods consistent with previous data from this program, the Bight program, and SQOs to allow for comparisons to the past and likely data needs of the future. The majority of sites assessed exhibited minimal to low chemistry exposure, low to no toxicity, and low to high benthic disturbance. Comparisons to the benthic community from previous studies, as well as the analysis of the water quality, revealed that disturbances to the benthic community at the majority of the sites were most likely associated with natural biological variation and physical disturbances rather than chemically mediated effects.

Regulatory Commitment
The San Diego Region Municipal NPDES Permit Order No. 2013-0001 (Permit) was adopted on May 8, 2013. Section D.1.e.(1).(b) of the Permit requires the Copermittees to participate in the Southern California Bight Regional Monitoring.

The Copermittees' Regional Monitoring Workgroup has indicated it will participate in the Bight '13 Survey by providing in-kind services. The Copermittees have agreed to contribute to the Bight '13 Survey by sampling up to 22 lagoon stations within the San Diego Region.

Participation by the Copermittees in the Bight '13 Survey will provide data useful in addressing the goals of the Monitoring and Assessment Sections of the Permit. Furthermore, the Copermittee's contribution to the Bight Survey will build on an existing dataset that provides a regional assessment of the coastal marine health, while simultaneously providing a local assessment of the San Diego Region Lagoons.

Technical Approach
This workplan is designed to provide data needed to answer questions related to the Southern California Bight, the San Diego Region, and the individual lagoons of study. Lagoons/estuaries selected for the Bight '13 program will be chosen based on whether or not they meet the requirements of the SQO tool (i.e. salinity, subtidal, open to ocean, etc.) and sampling stations will be located using a tessellated random sampling design consistent with Bight protocols.

The Copermittees data will be used to provide data needed to answer the following Bight '13 Contaminant Impact Assessment (CIA) (formerly Coastal Ecology) Program questions:

- *What is the extent and magnitude of direct impact from sediment contaminants?*
- *What is the trend in extent and magnitude of direct impacts from sediment contaminants?*

In addition, the Copermittees lagoon sampling effort will be used to satisfy the first iteration of sampling required for this Permit term in accordance with the Sediment Quality Monitoring requirements in Section D.1.e.(2) and the SQO Policy. Any stations with SQO results other than unimpacted or likely unimpacted will require follow-up evaluations in subsequent monitoring years within the Permit term in accordance with the SQO Policy.

2.0 SAN DIEGO REGIONAL COPERMITTEES BIGHT '13 WORKGROUP PARTICIPATION

The San Diego Regional Copermittees are participating in the CIA workgroup. This workgroup is the core of the Bight Program. This study will be used to assess sediment quality (chemistry, toxicity, and benthic community health) in nine of San Diego's lagoons. The CIA Workplan is included in Appendix B.

3.0 COASTAL ECOLOGY MAIN GROUP CURRENT PROGRAM DESIGN

The lagoons/estuaries selected for the Bight ’13 program were chosen based on whether or not they meet the requirements of the SQO tool (e.g., salinity, subtidal, open to ocean, etc.). Sampling stations will be located using a tessellated random sampling design consistent with Bight protocols. Samples will be collected in areas considered to be in the lagoon or estuarine environments with salinities $\geq$ 25 ppt. Sampling will occur one time at each location during the summer of 2013 and is tentatively scheduled to occur from July through September 2013.

Nine lagoons/estuaries were selected in the San Diego Region for inclusion in the Bight ’13 program and are presented as follows:

1. Santa Margarita Estuary
2. Agua Hedionda Lagoon
3. Batiquitos Lagoon
4. San Elijo Lagoon
5. San Dieguito Lagoon
6. Los Peñasquitos Lagoon
7. San Diego River Estuary
8. Sweetwater River Estuary
9. Tijuana River Estuary

Maps of the nine lagoons/estuaries are provided in Appendix A.

Lagoons/estuaries that were excluded from the Bight ’13 Program, as well as the reasons for their exclusion, are presented below:

1. San Luis Rey River Estuary – not identified as suitable from National Wetlands Inventory due to depth/low salinity.
2. Loma Alta Slough– Too small, closed during summer months, low salinity.
3. Buena Vista Lagoon – Freshwater, closed lagoon.
4. Famosa Slough – Too small for program, somewhat disconnected from marine environment.

Several of the lagoons do require annual maintenance dredging at the ocean inlet to ensure that flows are not restricted. This dredging is typically restricted to the areas near the mouth and often occurs in late spring. Maintenance dredging is not expected to affect stations selected for the lagoon sample draw. In the event a sample location occurs in an area that was recently dredged, an alternate sample will be randomly selected outside of the area of influence.

3.1 Sediment Design and Program

Sediment samples will be collected in accordance with the Bight ’13 sampling protocols. Weston’s staff is attending all Bight ’13 field technical sub-workgroup meetings to ensure that samples will be collected following all Bight protocols. Sediment samples will be collected using a Van Veen grab sampler and analyzed for chemistry, toxicity, and benthic community.

Chemistry

The Bight ’13 program core sediment chemistry list is presented in Table 3-1. Sediment samples will be analyzed according to Bight ’13 protocols. Additional chemistry analyses provided by the Bight Program from other participating agencies as special studies are included in Table 3-2.

Table 3-1. Bight ’13 Sediment Analytical List, Methods, and Detection Limits

Group/Analyte	Method	Units	RL*	Laboratory
General Parameters				
Total Solids	EPA 160.3	% Wet Weight	0.05	Physis
Particle Size Distribution	Laser Particle Size	µm	-	City of San Diego
Total Organic Carbon	EPA 9060A	% Dry Weight	0.1	Physis
Total Nitrogen	EPA 9060A	%	0.1	Physis
Total Phosphorus	SM 4500-P E	mg/g	0.05	Physis
Trace Metals				
Aluminum (Al)	EPA 6020	µg/dry g	5	Physis
Antimony (Sb)	EPA 6020	µg/dry g	10	
Arsenic (As)	EPA 6020	µg/dry g	1.6	
Barium (Ba)	EPA 6020	µg/dry g	0.05	
Beryllium (Be)	EPA 6020	µg/dry g	0.2	
Cadmium (Cd)	EPA 6020	µg/dry g	0.09	
Chromium (Cr)	EPA 6020	µg/dry g	16	
Copper (Cu)	EPA 6020	µg/dry g	7	
Iron (Fe)	EPA 6020	µg/dry g	5	
Lead (Pb)	EPA 6020	µg/dry g	9.3	
Mercury (Hg)	EPA 245.7	µg/dry g	0.03	
Nickel (Ni)	EPA 6020	µg/dry g	4.2	
Selenium (Se)	EPA 6020	µg/dry g	1	
Silver (Ag)	EPA 6020	µg/dry g	0.2	
Zinc (Zn)	EPA 6020	µg/dry g	30	
Synthetic Pyrethroids				
Allethrin	GCMS-NCI	ng/dry g	0.5	Physis
Bifenthrin	GCMS-NCI	ng/dry g	0.5	
Cyfluthrin	GCMS-NCI	ng/dry g	0.5	
Cypermethrin	GCMS-NCI	ng/dry g	0.5	
Danitol (Fenpropathrin)	GCMS-NCI	ng/dry g	0.5	
Deltamethrin	GCMS-NCI	ng/dry g	0.5	
Esfenvalerate	GCMS-NCI	ng/dry g	0.5	
Fenvalerate	GCMS-NCI	ng/dry g	0.5	
L-Cyhalothrin	GCMS-NCI	ng/dry g	0.5	

Group/Analyte	Method	Units	RL*	Laboratory
Permethrin	GCMS-NCI	ng/dry g	0.5	
Prallethrin	GCMS-NCI	ng/dry g	0.5	
Organochlorine Pesticides				
2,4'-DDT	EPA 8270	ng/dry g	0.5	Physis
4,4'-DDT	EPA 8270	ng/dry g	0.5	
2,4'-DDD	EPA 8270	ng/dry g	0.5	
4,4'-DDD	EPA 8270	ng/dry g	0.5	
2,4'-DDE	EPA 8270	ng/dry g	0.5	
4,4'-DDE	EPA 8270	ng/dry g	0.5	
4,4'-DDMU	EPA 8270	ng/dry g	0.5	
alpha-Chlordane	EPA 8270	ng/dry g	0.5	
gamma-Chlordane	EPA 8270	ng/dry g	0.5	
Oxychlordane	EPA 8270	ng/dry g	0.5	
cis-nonachlor	EPA 8270	ng/dry g	0.5	
trans-nonachlor	EPA 8270	ng/dry g	0.5	
Polychlorinated Biphenyls (PCBs) Congeners				
PCB-18	EPA 8270	ng/dry g	7.5	Physis
PCB-28	EPA 8270	ng/dry g	7.5	
PCB-37	EPA 8270	ng/dry g	7.5	
PCB-44	EPA 8270	ng/dry g	7.5	
PCB-49	EPA 8270	ng/dry g	7.5	
PCB-52	EPA 8270	ng/dry g	7.5	
PCB-66	EPA 8270	ng/dry g	7.5	
PCB-70	EPA 8270	ng/dry g	7.5	
PCB-74	EPA 8270	ng/dry g	7.5	
PCB-77	EPA 8270	ng/dry g	7.5	
PCB-81	EPA 8270	ng/dry g	7.5	
PCB-87	EPA 8270	ng/dry g	7.5	
PCB-99	EPA 8270	ng/dry g	7.5	
PCB-101	EPA 8270	ng/dry g	7.5	
PCB-105	EPA 8270	ng/dry g	7.5	
PCB-110	EPA 8270	ng/dry g	7.5	
PCB-114	EPA 8270	ng/dry g	7.5	
PCB-118	EPA 8270	ng/dry g	7.5	
PCB-119	EPA 8270	ng/dry g	7.5	
PCB-123	EPA 8270	ng/dry g	7.5	
PCB-126	EPA 8270	ng/dry g	7.5	
PCB-128	EPA 8270	ng/dry g	7.5	

Group/Analyte	Method	Units	RL*	Laboratory
PCB-138	EPA 8270	ng/dry g	7.5	
PCB-149	EPA 8270	ng/dry g	7.5	
PCB-151	EPA 8270	ng/dry g	7.5	
PCB-153	EPA 8270	ng/dry g	7.5	
PCB-156	EPA 8270	ng/dry g	7.5	
PCB-157	EPA 8270	ng/dry g	7.5	
PCB-158	EPA 8270	ng/dry g	7.5	
PCB-167	EPA 8270	ng/dry g	7.5	
PCB-168	EPA 8270	ng/dry g	7.5	
PCB-169	EPA 8270	ng/dry g	7.5	
PCB-170	EPA 8270	ng/dry g	7.5	
PCB-177	EPA 8270	ng/dry g	7.5	
PCB-180	EPA 8270	ng/dry g	7.5	
PCB-183	EPA 8270	ng/dry g	7.5	
PCB-187	EPA 8270	ng/dry g	7.5	
PCB-189	EPA 8270	ng/dry g	7.5	
PCB-194	EPA 8270	ng/dry g	7.5	
PCB-201	EPA 8270	ng/dry g	7.5	
PCB-206	EPA 8270	ng/dry g	7.5	
Polynuclear Aromatic Hydrocarbons				
1-Methylnaphthalene	EPA 8270	ng/dry g	50	Physis
1-Methylphenanthrene	EPA 8270	ng/dry g	50	
1,6,7-Trimethylnaphthalene	EPA 8270	ng/dry g	50	
2,6-Dimethylnaphthalene	EPA 8270	ng/dry g	50	
2-Methylnaphthalene	EPA 8270	ng/dry g	50	
Acenaphthene	EPA 8270	ng/dry g	50	
Acenaphthylene	EPA 8270	ng/dry g	50	
Anthracene	EPA 8270	ng/dry g	50	
Benz[a]anthracene	EPA 8270	ng/dry g	50	
Benzo[a]pyrene	EPA 8270	ng/dry g	50	
Benzo[b]fluoranthene	EPA 8270	ng/dry g	50	
Benzo[e]pyrene	EPA 8270	ng/dry g	50	
Benzo[g,h,i]perylene	EPA 8270	ng/dry g	100	
Benzo[k]fluoranthene	EPA 8270	ng/dry g	50	
Biphenyl	EPA 8270	ng/dry g	50	
Chrysene	EPA 8270	ng/dry g	50	
Dibenz[a,h]anthracene	EPA 8270	ng/dry g	100	
Fluoranthene	EPA 8270	ng/dry g	50	

Group/Analyte	Method	Units	RL*	Laboratory
Fluorene	EPA 8270	ng/dry g	50	
Indeno[1,2,3-c,d]pyrene	EPA 8270	ng/dry g	100	
Naphthalene	EPA 8270	ng/dry g	50	
Perylene	EPA 8270	ng/dry g	50	
Phenanthrene	EPA 8270	ng/dry g	50	
Pyrene	EPA 8270	ng/dry g	50	
Polybrominated Diphenyl Ethers (PBDEs)				
BDE 17	GCMS-NCI	ng/dry g	0.1	Physis
BDE 28	GCMS-NCI	ng/dry g	0.1	
BDE 47	GCMS-NCI	ng/dry g	0.1	
BDE 49	GCMS-NCI	ng/dry g	0.1	
BDE 66	GCMS-NCI	ng/dry g	0.1	
BDE 85	GCMS-NCI	ng/dry g	0.1	
BDE 99	GCMS-NCI	ng/dry g	0.1	
BDE 100	GCMS-NCI	ng/dry g	0.1	
BDE 138	GCMS-NCI	ng/dry g	0.1	
BDE 153	GCMS-NCI	ng/dry g	0.1	
BDE 154	GCMS-NCI	ng/dry g	0.1	
BDE 183	GCMS-NCI	ng/dry g	0.1	

*Actual RLs provided by Physis may be lower than those required by the Bight '13 Monitoring Program.

Table 3-2. Additional Chemical Analyses Conducted as Special Studies in Sediments from San Diego Lagoons

Group/Analyte	Laboratory
Contaminants of Emerging Concern (CECs)	Physis/Calscience/Weck

Toxicity

Sediment toxicity samples will be collected and analyzed following the Bight '13 protocols. The Bight '13 program will use the following toxicity tests:

- *Eohaustorius estuarius* - 10 day amphipod test.
- *Mytilus galloprovincialis* - 48 hour sediment-pore water interface.

Additional toxicity analyses provided by the Bight Program from other participating agencies as special studies are included in Table 3-3.

Table 3-3. Additional Toxicity Analyses Conducted as Special Studies in Sediments from San Diego Lagoons

Special Study	Laboratory
Sediment Toxicity Identification Evaluation in Embayments	SCCWRP/ABC Labs/LACSD/Nautilus
Gene Microarray Analysis of Sediment Toxicity Samples	SCCWRP/Bight ’13 toxicity testing laboratories
Alternative Toxicity Test Species Comparison	LACSD/Bight ’13 toxicity testing laboratories

Benthic Community Assemblage

Benthic community assemblage samples will be collected and analyzed following Bight ’13 protocols. Samples will be processed and preserved in the field. Samples initially will be sorted to five major phyletic groups for distribution to taxonomists who will identify organisms to species. Weston’s taxonomists will utilize the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) Edition 8 for nomenclature and orthography. Additionally, Bight quality assurance/quality control (QA/QC) procedures will be followed both during sorting and during subsequent taxonomic identifications.

3.2 Water Quality Sampling

Water quality parameters will be measured at each sediment location prior to the sediment sample collection. Field parameters will be collected using a YSI 6600 data sonde at 6” below surface, mid depth, and 6” above the bottom. Data collected at each site include temperature, depth, salinity, dissolved oxygen, and pH. Salinity measurements must be above 25 ppt in order to meet the acceptability criteria for sampling.

Table 3-4. Water Quality Parameters

Analyte	Method/Instrument	Units	Reporting Limit	Laboratory
pH	Field/YSI 6600	pH Units	1-14	Field
Salinity	Field/YSI 6600	PPT	1-75	Field
Temperature	Field/YSI 6600	°C	0-100	Field
Dissolved oxygen	Field/YSI 6600	mg/l	0.2	Field

3.3 Prevention of the Spread of Aquatic Invasive Species

Southern California marine waters are known to have a number of aquatic invasive species. Weston field scientists are aware of and can identify the macro flora and fauna in the region (e.g., *Caulerpa taxifolia*, *Musculista senhousia*, and *Mytilus galloprovincialis*). Since the vessels to be used in the project are routinely stored on dry land, fouling organisms are not anticipated to be an issue. However, many invasive species are difficult to detect and may be entrained in muds, sediment, or the water column, additional measures are recommended.

In order to prevent the spread of aquatic invasive species from one lagoon or harbor to another, the following precautions will be taken:

- All boat surfaces will be inspected for mud/sediment and aquatic vegetation when initially hauled out from a given water body. Any observed sediment or vegetation will be cleaned off the boat at the site, including the trailer wheels and frame.
- All sampling equipment will be inspected for mud/sediment and aquatic vegetation and cleaned as necessary. Most equipment will be rinsed and decontaminated at the completion of each sampling station, and a final inspection will be conducted prior de-mobilizing and before leaving each water body.
- All personal gear, especially footwear, will be inspected and cleaned before leaving each water body.
- No site water will be transferred between water bodies or discharged from one to another.

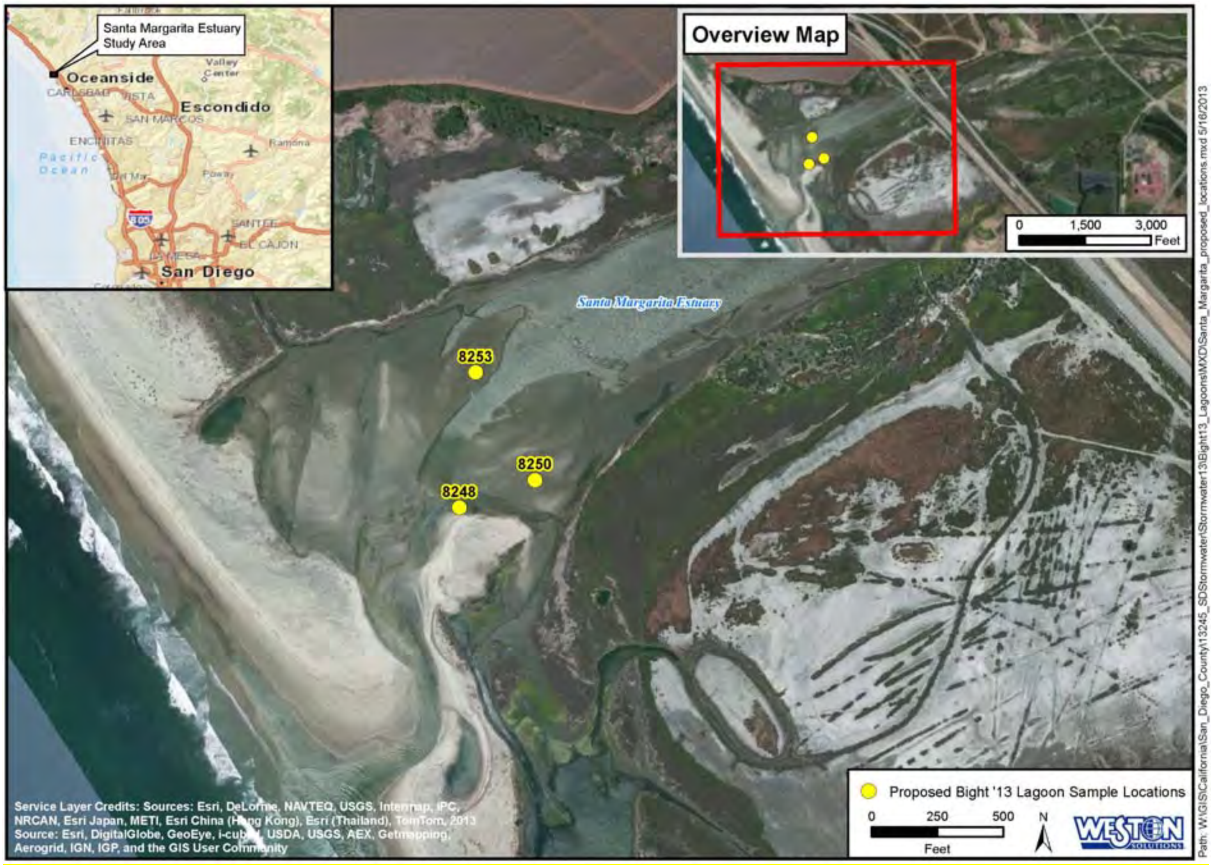
4.0 DATA MANAGEMENT AND REPORTING

The current workplan provides for data collection and submittal of electronic deliverables to SCCWRP. All sample results will be reviewed for adherence to the quality guidelines provided by the individual technical workgroups. Results will undergo thorough quality control review, will be entered into a data sharing template, and will be submitted to SCWWRP.

Data analysis and reporting will be included in the first Transitional Annual Monitoring Report due to the RWQCB in January 2015 prior to the release of the Bight '13 work product in approximately 2018.

APPENDIX A

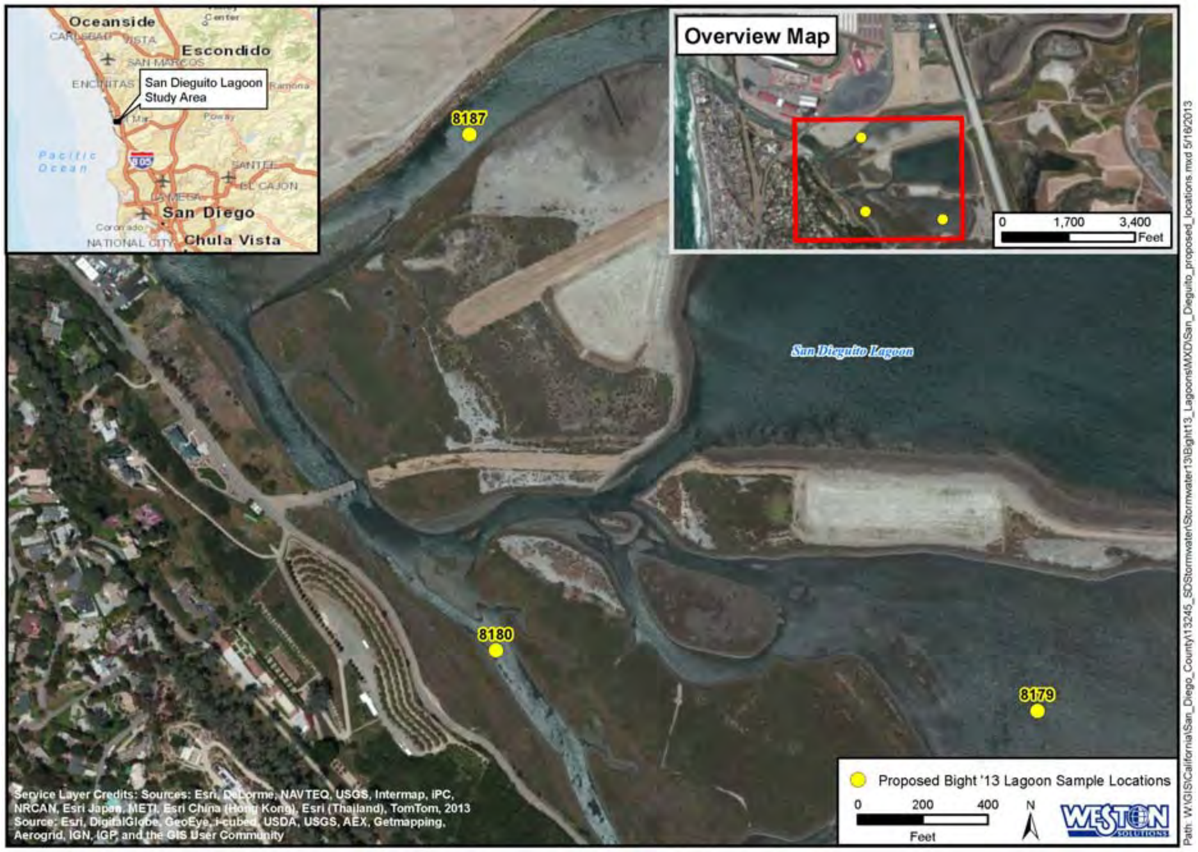
Station Location Maps


Santa Margarita Estuary Study Area
Oceanside
Escondido
San Diego
Overview Map
0 1,500 3,000 Feet
Santa Margarita Estuary
8253
8250
8248
Proposed Bight '13 Lagoon Sample Locations
0 250 500 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

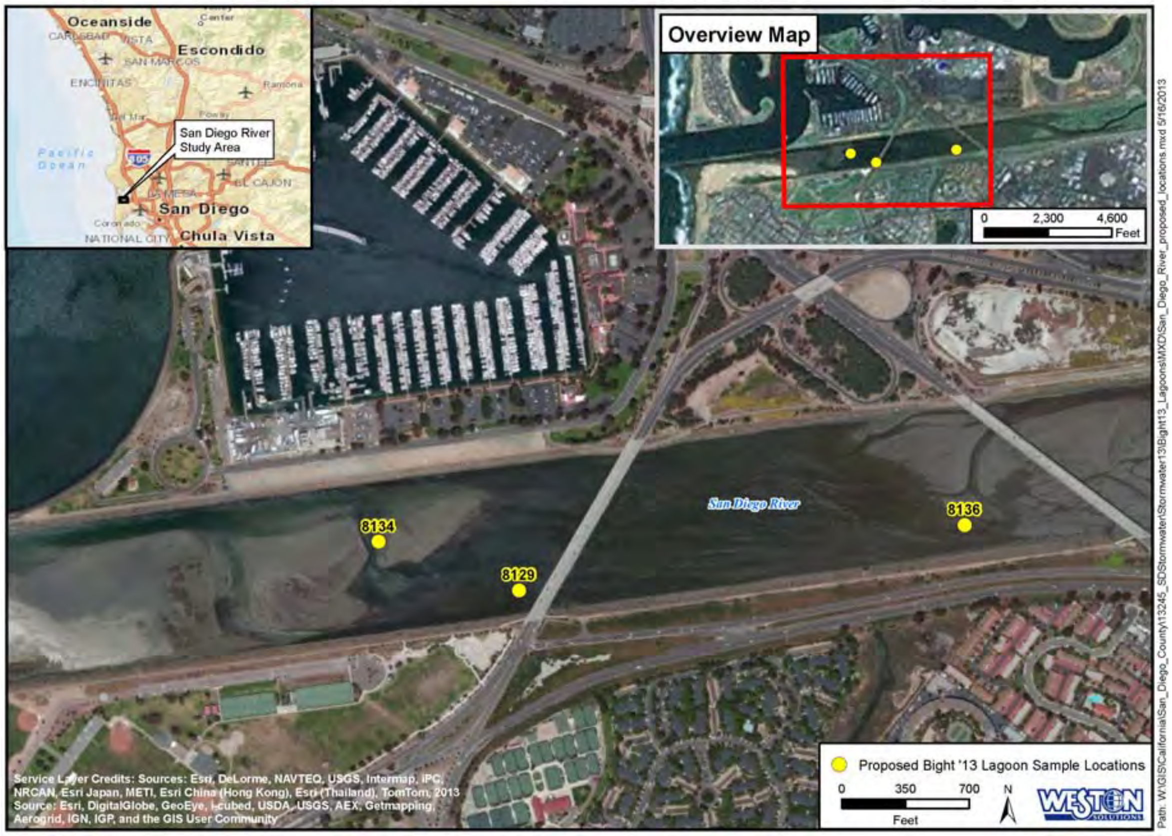

Oceanside
Escondido
Agua Hedionda Lagoon Study Area
San Diego
Chula Vista
Overview Map
0 0.5 1 Miles
Agua Hedionda Lagoon
8218
8222
8219
Proposed Bight '13 Lagoon Sample Locations
0 500 1,000 Feet
WESTON SOLUTIONS


Oceanside
Escondido
Batiquitos Lagoon Study Area
San Diego
Chula Vista
Overview Map
0 2,000 4,000 Feet
Batiquitos Lagoon
8205
8202
8200
Proposed Bight '13 Lagoon Sample Locations
0 350 700 Feet
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community


Overview Map
0 1,200 2,400 Feet
8188
San Elijo Lagoon
8189
Oceanside
Escondido
San Elijo Lagoon Study Area
San Diego
Chula Vista
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community


Oceanside
Escondido
San Dieguito Lagoon Study Area
Pacific Ocean
San Diego
Chula Vista
Overview Map
0 1,700 3,400 Feet
8187
San Dieguito Lagoon
8180
8179
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community


Oceanside
Escondido
Los Peñasquitos Lagoon Study Area
Pacific Ocean
San Diego
Chula Vista
Overview Map
0 1,500 3,000 Feet
8176
Los Peñasquitos Lagoon
8169
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community


Oceanside
Escondido
Carlsbad
Vista
San Marcos
Encinitas
Ramona
Del Mar
Poway
Pacific Ocean
San Diego River Study Area
Santee
El Cajon
La Mesa
San Diego
Coronado
National City
Chula Vista
Overview Map
0 2,300 4,600 Feet
San Diego River
8134
8129
8136
Proposed Bight '13 Lagoon Sample Locations
0 350 700 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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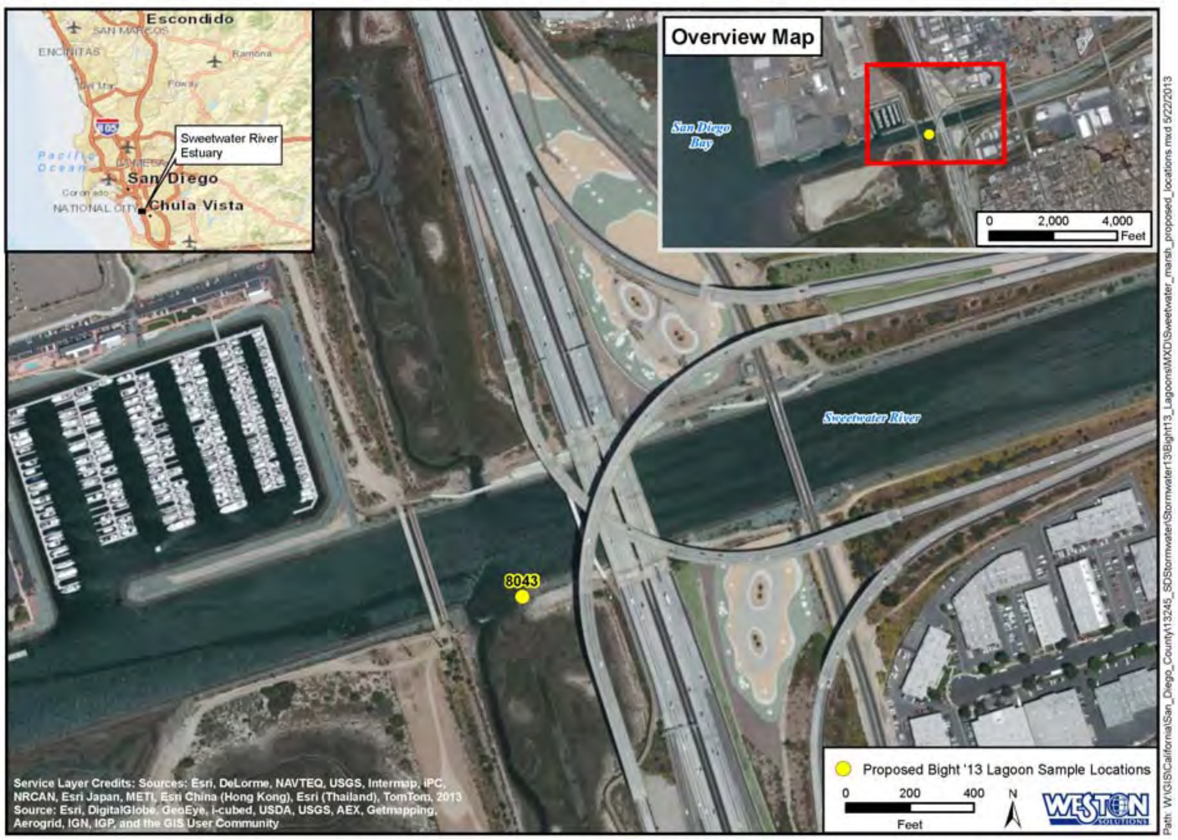
Escondido
San Marcos
Encinitas
Ramona
Del Mar
Poway
Pacific Ocean
Sweetwater River Estuary
La Mesa
San Diego
Coronado
National City
Chula Vista
Overview Map
San Diego Bay
0 2,000 4,000 Feet
Sweetwater River
8043
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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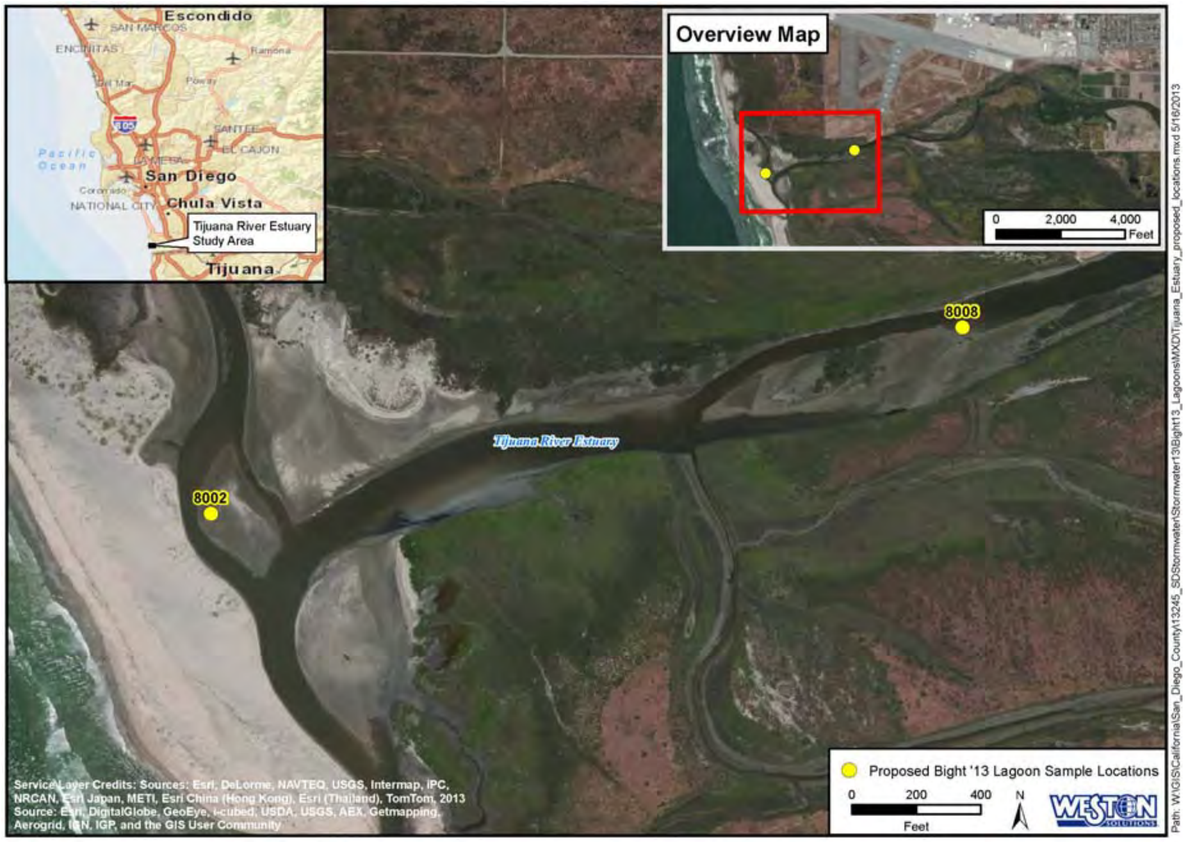
Overview Map
0 2,000 4,000 Feet
Escondido
San Diego
Chula Vista
Tijuana
Tijuana River Estuary Study Area
8008
8002
Tijuana River Estuary
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

APPENDIX B

Bight '13 Contaminant Impact Assessment Workplan (Separate attachment)

APPENDIX C

Bight '13 Contaminant Impact Assessment Quality Assurance Manual (Separate attachment)

San Diego County Municipal Copermittees
2014 Sampling and Analysis Plan
for
Bight '13 Follow-Up Investigations
FINAL

Prepared For:

County of San Diego Municipal Copermittees

May 2014

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Prepared For:

County of San Diego Municipal Copermittees

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ACRONYMS AND ABBREVIATIONS

ABLM	Ambient Bay and Lagoon Monitoring
ALS	ALS Environmental
ANOSIM	analysis of similarities
APHA	American Public Health Association
ASTM	American Society for Testing and Materials
AVS-SEM	acid volatile sulfide – simultaneously extracted metals
Bight '03	Bight 2003 Regional Monitoring Program
Bight '08	Bight 2008 Regional Monitoring Program
Bight '13	Bight 2013 Regional Monitoring Program
BRI	Benthic Response Index
Cal EPA	California Environmental Protection Agency
CA LRM	California Logistic Regression Model
$CdCl_2$	cadmium chloride
COC	chain-of-custody
Copermittees	San Diego Regional Copermittees
CSI	Chemical Score Index
$CuCl_2$	copper chloride
CVAA	cold vapor atomic absorption
DD	decimal degrees
DGPS	Differential Global Positioning System
DO	dissolved oxygen
DOC	dissolved organic carbon
EC_{50}	median effective concentration
ER-L	effects range–low
ER-M	effects range–median
GC/MS	gas chromatography/mass spectrometry
HSD	honestly significant difference
IBI	Index of Biotic Integrity
ICP-AES	inductively coupled plasma-atomic emission spectrometry
ICP/MS	inductively coupled plasma/mass spectrometry
ID	inner diameter
LC_{50}	median lethal concentration
LOE	line of evidence
MDLs	method detection limits
MDS	multidimensional scales
$MgSO_4$	magnesium sulfate
MLOE	multiple lines of evidence
Nautilus	Nautilus Environmental
NCI	negative chemical ionization
NH_4	ammonium chloride
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
pH	hydrogen ion concentration

P_{MAX}	maximum probability model
PRIMER	Plymouth Routines in Multivariate Ecological Research
QA	quality assurance
QC	quality control
RBI	Relative Benthic Index
RIVPACS	River Invertebrate Prediction and Classification System
SAP	Sampling and Analysis Plan
SCAMIT	Southern California Association of Marine Invertebrate Taxonomists
SCCWRP	Southern California Coastal Water Research Project
SIM	selective ion monitoring
SIMPER	similarity percentages
SM	Standard Methods
SOPs	Standard Operating Procedures
SP	solid phase
SQOs	Sediment Quality Objectives
SVOCs	semi-volatile organic compounds
SWI	sediment-water interface
SWRCB	State Water Resources Control Board
TIE	toxicity identification evaluation
TOC	total organic carbon
TSS	total suspended solids
USEPA	United States Environmental Protection Agency
Weck	Weck Laboratories, Inc.
WESTON	Weston Solutions, Inc.
WGS 84	World Geodetic System 1984

UNITS OF MEASURE

cm	centimeter
°C	degrees Celsius
L	liter
µg/kg	microgram per kilogram
µm	micrometer
m	meter
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
mm	millimeter
ppt	parts per thousand
%	percent

1.0 INTRODUCTION

The purpose of this Sampling and Analysis Plan (SAP) is to outline the activities that will be conducted by the San Diego Regional Copermittees (Copermittees) to satisfy the Sediment Quality Objective (SQO) requirement for possibly impacted sites identified as part of the Bight 2013 Lagoon Sediment Monitoring (Bight '13).

In 2003, the State Water Resources Control Board (SWRCB) initiated a program to develop SQOs for enclosed bays and estuaries. The primary objective is to protect benthic communities and aquatic life from exposure to contaminants in sediment. The Phase I SQOs are based on a multiple lines of evidence (MLOE) approach in which the lines of evidence (LOE) are sediment toxicity, sediment chemistry, and benthic community condition, as described in the *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (SWRCB and California Environmental Protection Agency [Cal EPA], 2009) (Sediment Control Plan). Phase I SQOs have been approved by the SWRCB and Office of Administrative Law. Regional Water Quality Control Board Order R9-2013-0001 (Permit) requires the Copermittees to perform sediment monitoring to assess compliance with sediment quality receiving limits applicable to MS4 discharges to enclosed bays and estuaries in accordance with the Sediment Control Plan. The Permit also requires the Copermittees to participate in Bight Regional Monitoring. The Copermittees participated in the Bight '13 Contaminant Impact Assessment Program by conducting lagoon monitoring during summer 2013. A total of 22 sample stations were collected throughout the nine lagoons/estuaries within the San Diego Region. Of the 22 sample stations four were identified as possibly impacted with one site in each of the following lagoons: Agua Hedionda Lagoon, Batiquitos Lagoon, San Dieguito Lagoon, and San Diego Estuary. The four possibly impacted sites were recommended for follow-up activities. This SAP details the follow-up investigations to confirm and characterize the possibly impacted lagoon sites.

1.1 Background

The aquatic health of the San Diego estuaries and lagoons were assessed as part of the previous Bight Surveys in 2003 (Bight '03), 2008 (Bight '08), and most recently during 2013 (Bight '13). Lagoons and estuaries were also assessed in the Copermittees' three-year Ambient Bay and Lagoon Monitoring (ABLM) Program from 2003-2005 and from 2010-2012. Additionally in 2008-2013, the sediment conditions within San Diego estuaries were evaluated following the protocols of the Sediment Control Plan.

1.2 Regulatory Commitment

The San Diego Permit was adopted on May 8, 2013. Section D.1.e.(1).(b) of the Permit requires the Copermittees to participate in the Southern California Bight Regional Monitoring. The Copermittees' Regional Monitoring Workgroup participated in the Bight '13 Survey by providing in-kind services. The Copermittees contributed to the Bight '13 Survey by sampling up to 22 lagoon stations within the San Diego Region. This participation provides data useful in addressing the goals of the Monitoring and Assessment Sections of the Permit and satisfies the requirements of the Sediment Control Plan. Furthermore, the Copermittee's contribution to the Bight Survey will build on an existing dataset that provides a regional assessment of the coastal marine health, while simultaneously providing a local assessment of the San Diego Region Lagoons.

In accordance with the Sediment Control Plan follow-up confirmation monitoring will be conducted for the results with possibly impacted SQO scores. One location in each of the following lagoons received a possibly impacted SQO score:

- Agua Hedionda Lagoon (Bight 13' Station 8222)
- Batiquitos Lagoon (Bight 13' Station 8202)
- San Dieguito Lagoon (Bight 13' Station 8179)
- San Diego River Estuary (Bight 13' Station 8136)

The remaining 18 stations were classified with unimpacted or likely unimpacted SQO scores. Based on the Bight '13 Lagoon Monitoring, the following lagoons do not require any follow-up actions at this time:

- Santa Margarita River Estuary
- San Elijo Lagoon
- Los Penasquitos Lagoon
- Sweetwater River Estuary
- Tijuana River Estuary

1.3 Technical Approach

This SAP is designed to provide data needed to answer questions related to characterizing the possibly impacted sites identified during the Bight '13 Monitoring Program. The goal is to characterize whether physical, chemical, or other potential stressors are contributing to the observed conditions in each follow-up lagoon location. The study follows a similar approach as during the previous follow-up studies conducted from 2010-2012 as part of the ABLM Program. However, special considerations will be needed and are discussed for each lagoon.

2.0 MATERIALS AND METHODS

2.1 Field Collection Program

Based on the results from the Bight '13 Lagoon Monitoring, sediment quality follow-up monitoring will be conducted in focused study areas in Agua Hedionda Lagoon, Batiquitos Lagoon, San Dieguito Lagoon, and San Diego River Estuary. One location in each of the lagoons/estuaries received a possibly impacted SQO score. To confirm the result at each location to determine response to changes in the physical environment, a sufficient number of samples must be collected to examine the patterns. Each sampling site will include three replicate samples of benthic condition (benthic community condition, sediment toxicity, sediment chemistry) on a relatively small spatial scale (10-15 meters [m]), and one replicate water quality station placed at the original location. The water quality characteristics are expected to be similar on smaller spatial scales; therefore, only one water quality station will be used to describe the water quality within each of the sample sites.

To determine the physical and chemical factors that influence the distribution of organisms the following metrics will be used:

1. Sediment quality (3 samples per water quality station):
    a. Sediment physical and chemical analyses at the four lagoons/estuaries: grain size, total organic carbon (TOC), metals, synthetic pyrethroids, organochlorine pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs), ammonia, nutrients, total sulfides
    b. Additional sediment chemical analyses at San Diego River Estuary to determine bioavailability of metals to benthic organisms: acid volatile sulfide – simultaneously extracted metals (AVS-SEM)
    c. Sediment toxicity
        i. 10-day acute solid phase (SP) test with the amphipod *Eohaustorius estuarius*
        ii. 48-hr sediment-water interface (SWI) test with the mussel larvae *Mytilus galloprovincialis*
    d. Benthic community
        i. Traditional taxonomic techniques will be used to describe benthic communities
        ii. SQO benthic indices and marine indices will be calculated for comparison
    e. Stressor Identification Studies may be conducted based on a review of sediment quality objective results and data comparisons
2. Water quality measurements will be collected at one water quality station in each lagoon/estuary. A YSI 6600 Multiparameter Water Quality Sonde will be deployed for a minimum of two weeks at each water quality station. In addition, discrete water samples will be collected. Data to be collected will include:
    a. Temperature
    b. Salinity
    c. Dissolved oxygen (DO)
    d. Hydrogen ion concentration (pH)
    e. Dissolved organic carbon (DOC)
    f. Chlorophyll-a
    g. Nutrients (total nitrogen and total phosphorus)
    h. TSS

Prior to all field activities, encroachment permits will be obtained from the respective agency maintaining jurisdiction over the lagoon to be monitored (permits should be obtained within 2 months prior to the planned sampling). All sampling equipment will be deployed using inflatable Zodiac® type vessels or other applicable vessel.

Analytical chemistry for sediment and water will be provided by ALS Environmental (ALS) and Weck Laboratories, Inc. (Weck). Nautilus Environmental (Nautilus) will perform biological testing for SP and SWI analyses. Benthic infaunal and grain size analysis will be conducted by Weston Solutions, Inc (WESTON).

2.1.1 Sampling Locations

The proposed follow-up sampling locations for each of the four lagoons/estuaries are presented in Table 2-1. The Bight '13 station for which the follow-up monitoring is occurring is also provided for reference. Each of the four lagoons/estuaries consists of one sampling site. As described above, each sampling site includes three replicate samples of benthic condition (benthic community condition, sediment toxicity, sediment chemistry), and one replicate water quality station placed at the original Bight '13 location. Specific locations of each sampling site are presented in maps on the following pages (Figure 2-1 through Figure 2-4).

Table 2-1. Sample Locations and Analyses

Lagoon or Estuary	Bight '13 Site ID	ABLM 2014 Site ID	Latitude	Longitude	Analysis
Agua Hedionda Lagoon	8222	AH14	33.14010	-117.32430	Water Quality/Chemistry
		AH14-A	33.14020	-117.32421	Sediment Chemistry, Toxicity, and Benthic Infauna
		AH14-B	33.13998	-117.32423	
		AH14-C	33.14009	-117.32446	
Batiquitos Lagoon	8202	BL14	33.08810	-117.29130	Water Quality/Chemistry
		BL14-A	33.08823	-117.29128	Sediment Chemistry, Toxicity, and Benthic Infauna
		BL14-B	33.08804	-117.29117	
		BL14-C	33.08803	-117.29142	
San Dieguito Lagoon	8179	SDL14	32.96610	-117.25250	Water Quality/Chemistry
		SDL14-A	32.96621	-117.25240	Sediment Chemistry, Toxicity, and Benthic Infauna
		SDL14-B	32.96597	-117.25245	
		SDL14-C	32.96612	-117.25266	
San Diego River Estuary	8136	SDR14	32.75790	-117.22740	Water Quality/Chemistry
		SDR14-A	32.75801	-117.22731	Sediment Chemistry, AVS-SEM, Toxicity, and Benthic Infauna
		SDR14-B	32.75777	-117.22734	
		SDR14-C	32.75791	-117.22756	

Figure 2-1. Proposed Sampling Locations within Agua Hedionda Lagoon

Figure 2-2. Proposed Sampling Locations within Batiquitos Lagoon

Figure 2-3. Proposed Sampling Locations within San Dieguito Lagoon

Figure 2-4. Proposed Sampling Locations within San Diego River Estuary

2.1.2 Navigation

All station locations will be pre-plotted prior to sampling activities. Locations will be located using a Furuno GP 1650D Differential Global Positioning System (DGPS) or similar type GPS. The system uses U.S. Coast Guard differential correction data, and is accurate within 10 ft. All final station locations will be recorded in the field using positions from the DGPS.

2.1.3 Sediment Sampling and Handling

Benthic sediments will be collected using a stainless steel, 0.1-m^2 Van Veen grab sampler (Figure 2-5). A sample will be determined to be acceptable if the surface of the grab is even, there is minimal surface disturbance, and there is a penetration depth of at least five centimeters (cm). Rejected grabs will be discarded and re-sampled. Upon retrieval, if the grab is acceptable, the overlying water will be carefully drained, and the sediment will be processed depending on analysis and use. Data will be logged onto field data sheets (Appendix A). All Van Veen equipment will be cleaned prior to sampling. Between sampling locations, the Van Veen grab sampler and stainless steel scoop will be rinsed with site water. Sediment grabs will be collected for the following analyses: benthic infauna, chemistry, grain size, and toxicity.

Samples collected for benthic infaunal analysis will be rinsed through a 1.0 millimeter (mm) mesh screen. The material retained on the screen will be transferred to a labeled quart jar. A 7 percent (%) magnesium sulfate ($MgSO_4$) seawater solution will be added to relax the collected specimens. After 30 minutes, the samples will be fixed in a 10% buffered formalin solution.

Sediment chemistry and toxicity samples will be collected from the top 5 cm of the grab using a pre-cleaned stainless steel scoop. Sediment within 1 cm of the sides of the grab will be avoided to prevent interaction of any contaminants and the steel sampling device. Approximately 10 liters (L) of sediment will be collected for acute and chronic toxicity testing and placed in clean food-grade polyethylene bags. Sediment for chemical analyses will be placed in 250 milliliter (mL) certified clean glass jars with Teflon®-lined lids. Sediment collected for grain size will be placed in quart-sized Ziploc™ bags. All sediment samples will be logged on a chain-of-custody (COC) form (see Section 2.1.7) and placed in a cooler on ice until delivered to WESTON's Carlsbad Office. At WESTON, sediment samples will be stored at 4 degrees Celsius (°C) in the dark until delivered to the appropriate laboratory for analysis. ALS will analyze the sediment samples for metals, PCBs, PAHs, organochlorine pesticides, ammonia, total sulfides, AVS-SEM (only for San Diego River Estuary), total nitrogen, total phosphorus, percent solids, and TOC. Weck will analyze the sediment for synthetic pyrethroids. WESTON will conduct the grain size and benthic infaunal analysis. Nautilus will perform the acute and chronic toxicity testing.

Figure 2-5. Van Veen Grab Sampler

2.1.4 Water Quality Sampling and Handling

Water quality sampling will be conducted using YSI 6600 Multiparameter Water Quality Sondes. The YSI meter will be deployed for a minimum of two weeks at each water quality station to capture both the spring and neap tide. Water quality data collected will include depth, temperature, salinity, DO, and pH. YSI sondes will be attached to an anchored mounting support and placed horizontally approximately six inches above the SWI. A surface buoy will be used to mark the location of the sonde unless it poses a navigational hazard. The sondes will be set up to log data at 15 minute intervals. Recorded sonde data will be saved in the unit's internal memory until downloaded on a computer upon retrieval from the field.

In addition, discrete water samples will be collected 6 inches above the sediment water interface using a Niskin bottle. Water samples will be transferred to labeled containers for analysis of TSS, DOC, chlorophyll-a, total nitrogen, and total phosphorus.

All water samples will be logged on a COC form (see Section 2.1.7) and placed in a cooler on ice until delivered to WESTON's Carlsbad Office. At WESTON, water samples will be stored at 4°C in the dark until shipped or delivered to Weck for analysis. All water samples will be delivered within 24 hours of collection.

2.1.5 Prevention of the Spread of Aquatic Invasive Species

Southern California marine waters are known to have a number of aquatic invasive species. WESTON field scientists are aware of and can identify the macro flora and fauna in the region (e.g., *Caulerpa taxifolia*, *Musculista senhousia*, and *Mytilus galloprovincialis*). Since the vessels to be used in the project are routinely stored on dry land, fouling organisms are not anticipated to be an issue. However, many invasive species are difficult to detect and may be entrained in muds, sediment, or the water column, additional measures are recommended.

In order to prevent the spread of aquatic invasive species from one lagoon or harbor to another, the following precautions will be taken:

- All boat surfaces will be inspected for mud/sediment and aquatic vegetation when initially hauled out from a given water body. Any observed sediment or vegetation will be cleaned off the boat at the site, including the trailer wheels and frame.
- All sampling equipment will be inspected for mud/sediment and aquatic vegetation and cleaned as necessary. Most equipment will be rinsed and decontaminated at the completion of each sampling station, and a final inspection will be conducted prior to de-mobilizing and before leaving each water body.
- All personal gear, especially footwear, will be inspected and cleaned before leaving each water body.
- No site water will be transferred between water bodies or discharged from one to another.

2.1.6 Shipping

Prior to shipping, sample containers will be placed in sealable plastic bags and securely packed inside the cooler with ice. COC forms will be filled out (see Section 2.1.7), and the original signed COC forms will be inserted in a sealable plastic bag and placed inside the cooler. The cooler lids will be securely taped shut and then delivered to the analytical laboratories listed in Table 2-2.

Table 2-2. Analytical Laboratories and Shipping Information

Laboratory	Volume (per sample)	Analyses Performed	Shipping Information
Nautilus Environmental	5L sediment (SP toxicity testing), 5L (SWI toxicity testing),	Toxicity testing (SP and SWI)	Nautilus Environmental 4340 Vandever Avenue San Diego, CA 92120
ALS Environmental	500 mL sediment	Sediment chemistry	ALS Environmental 1317 South 13th Ave Kelso, WA 98626
Weck Laboratories, Inc	250 mL sediment, 2L water	Sediment (synthetic pyrethroids only) and water chemistry	Weck Laboratories 14859 E. Clark Ave City of Industry, CA 91745
Weston Solutions, Inc.	250 mL sediment, benthic infaunal samples (varies)	Grain size and benthic infaunal analysis	Weston Solutions, Inc. 5817 Dryden Place, Ste 101 Carlsbad, CA 92008

2.1.7 Documentation of Chain-of-Custody

This section describes the program requirements for sample handling and COC procedures. Samples are considered to be in custody if they are: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession are COC records, field log books, and field tracking forms. COC procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or sample group (sample form provided in Appendix B). Each person who has custody of the samples will sign the form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sample identification
- Sample collection date and time
- Any special notations on sample characteristics
- Initials of the person collecting the sample
- Date the sample was sent to the laboratory
- Shipping company and waybill information

The completed COC form will be placed in a sealable plastic envelope that will travel inside the ice chest containing the listed samples. The COC form will be signed by the person transferring custody of the samples. The condition of the samples will be recorded by the receiver. COC records will be included in the final analytical report prepared by the laboratory, and will be considered an integral part of that report.

2.2 Physical and Chemical Analysis

Physical and chemical measurements of water and sediment in the Sediment Monitoring Program were selected to provide data on chemicals of potential concern in bays and estuaries located in San Diego County. All analytical methods used to obtain contaminant concentrations will follow United States Environmental Protection Agency (USEPA), Standard Methods (SM 21st Edition; American Public Health Association [APHA], 2005), or American Society for Testing and Materials (ASTM).

2.2.1 Sediment Samples

The specific physical and chemical analyses, analytical methods, target method detection limits (MDLs) and target reporting limits (RLs) for sediment samples are specified in Table 2-3. Physical analyses of sediment will include grain size and percent solids. Grain size is analyzed to determine the general size classes that make up the sediment (e.g., gravel, sand, silt, and clay). The frequency distribution of the size ranges (reported in mm) of the sediment will be reported in the final data report. Percent solids will also be measured to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis. Chemical analyses of sediment will include ammonia, TOC, nutrients including total nitrogen and total phosphorus, total sulfides, metals, synthetic pyrethroids, chlorinated pesticides, PCBs, and PAHs. In addition, sediment samples at San Diego River Estuary will be analyzed for AVS-SEM to determine the bioavailability of metals to aquatic organisms.

Table 2-3. Chemical and Physical Parameters for Sediment Samples

Parameter	Method	Procedure	Target Method Detection Limit (dry weight)	Target Reporting Limit (dry weight)
Physical / Conventional Tests				
Ammonia	USEPA 350.1 M	ICP/MS	0.04 mg/wet kg	0.5 mg/wet kg
Grain Size	Plumb (1981)	Sieve/Pipette	1.0%	1.0%
Percent Total Solids	USEPA 160.3 M	Gravimetric	0.1%	0.1%
Total Organic Carbon	USEPA 9060A	Combustion IR	0.02%	0.1%
Total Nitrogen	USEPA353.2M/ASTM D1426-93B M	NH3/NO2/NO3/TKN	0.5 mg/kg	1 mg/kg
Total Phosphorus	USEPA 365.3M	Colorimetric	0.02 mg/kg	0.1 mg/kg
Total Sulfides	USEPA 9030M	Distillation	0.2 mg/kg	0.5 mg/kg
Sulfides, Acid Volatile	GEN-AVS	ICP-AES	0.004 µmol/g	0.016 µmol/g
Metals				
Aluminum (Al)	USEPA 6020A	ICP/MS	0.4 mg/kg	2 mg/kg
Antimony (Sb)	USEPA 6020A	ICP/MS	0.02 mg/kg	0.05 mg/kg
Arsenic (As)	USEPA 6020A	ICP/MS	0.2 mg/kg	0.5 mg/kg
Barium (Ba)	USEPA 6020A	ICP/MS	0.02 mg/kg	0.05 mg/kg
Beryllium (Be)	USEPA 6020A	ICP/MS	0.006 mg/kg	0.02 mg/kg
Cadmium (Cd)	USEPA 6020A	ICP/MS	0.008 mg/kg	0.02 mg/kg
Chromium (Cr)	USEPA 6020A	ICP/MS	0.05 mg/kg	0.2 mg/kg
Copper (Cu)	USEPA 6020A	ICP/MS	0.04 mg/kg	0.1 mg/kg
Iron (Fe)	USEPA 6020A	ICP/MS	2.0 mg/kg	4.0 mg/kg
Lead (Pb)	USEPA 6020A	ICP/MS	0.005 mg/kg	0.05 mg/kg
Mercury (Hg)	USEPA 7471B	CVAA	0.002 mg/kg	0.02 mg/kg
Nickel (Ni)	USEPA 6020A	ICP/MS	0.09 mg/kg	0.2 mg/kg
Selenium	USEPA 6020A	ICP/MS	0.5 mg/kg	1.0 mg/kg
Silver	USEPA 6020A	ICP/MS	0.005 mg/kg	0.02 mg/kg
Zinc (Zn)	USEPA 6020A	ICP/MS	0.2 mg/kg	0.5 mg/kg
AVS-SEM				
Antimony (Sb)	USEPA 6010C	ICP-AES	0.0003 µmol/g	0.008 µmol/g
Arsenic (As)	USEPA 6010C	ICP-AES	0.002 µmol/g	0.003 µmol/g
Cadmium (Cd)	USEPA 6010C	ICP-AES	0.0002 µmol/g	0.0004 µmol/g
Chromium (Cr)	USEPA 6010C	ICP-AES	0.0003 µmol/g	0.001 µmol/g
Copper (Cu)	USEPA 6010C	ICP-AES	0.0005 µmol/g	0.0013 µmol/g
Lead (Pb)	USEPA 6010C	ICP-AES	0.0005 µmol/g	0.001 µmol/g
Nickel (Ni)	USEPA 6010C	ICP-AES	0.0003 µmol/g	0.003 µmol/g
Zinc (Zn)	USEPA 6010C	ICP-AES	0.0003 µmol/g	0.0031 µmol/g
Synthetic Pyrethroids				
Allethrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Bifenthrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Cyfluthrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Cypermethrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Danitol (Fenpropathrin)	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Deltamethrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Esfenvalerate	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Fenvalerate	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
L-Cyhalothrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*

Table 2-3. Chemical and Physical Parameters for Sediment Samples

Parameter	Method	Procedure	Target Method Detection Limit (dry weight)	Target Reporting Limit (dry weight)
Permethrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Prallethrin	GC/MS SIM	GC/MS NCI SIM	0.5 µg/kg *	0.5 µg/kg*
Organochlorine Pesticides				
2,4′-DDD	USEPA 8081B	GC/MS/MS	0.063 µg/kg	0.1 µg/kg
2,4′-DDE	USEPA 8081B	GC/MS/MS	0.079 µg/kg	0.1 µg/kg
2,4′-DDT	USEPA 8081B	GC/MS/MS	0.94 µg/kg	0.1 µg/kg
4,4′-DDD	USEPA 8081B	GC/MS/MS	0.035 µg/kg	0.1 µg/kg
4,4′-DDE	USEPA 8081B	GC/MS/MS	0.07 µg/kg	0.1 µg/kg
4,4′-DDT	USEPA 8081B	GC/MS/MS	0.047 µg/kg	0.1 µg/kg
Aldrin	USEPA 8081B	GC/MS/MS	0.079 µg/kg	0.1 µg/kg
BHC-alpha	USEPA 8081B	GC/MS/MS	0.061 µg/kg	0.1 µg/kg
BHC-beta	USEPA 8081B	GC/MS/MS	0.061 µg/kg	0.1 µg/kg
BHC-delta	USEPA 8081B	GC/MS/MS	0.097 µg/kg	0.1 µg/kg
BHC-gamma	USEPA 8081B	GC/MS/MS	0.031 µg/kg	0.1 µg/kg
Chlordane-alpha	USEPA 8081B	GC/MS/MS	0.062 µg/kg	0.1 µg/kg
Chlordane-gamma	USEPA 8081B	GC/MS/MS	0.064 µg/kg	0.1 µg/kg
cis-Nonachlor	USEPA 8081B	GC/MS/MS	0.038 µg/kg	0.1 µg/kg
Dieldrin	USEPA 8081B	GC/MS/MS	0.077 µg/kg	0.1 µg/kg
Endosulfan I	USEPA 8081B	GC/MS/MS	0.088 µg/kg	0.1 µg/kg
Endosulfan II	USEPA 8081B	GC/MS/MS	0.015 µg/kg	0.1 µg/kg
Endosulfan Sulfate	USEPA 8081B	GC/MS/MS	0.061 µg/kg	0.1 µg/kg
Endrin	USEPA 8081B	GC/MS/MS	0.072 µg/kg	0.1 µg/kg
Endrin Aldehyde	USEPA 8081B	GC/MS/MS	0.1 µg/kg	0.1 µg/kg
Endrin Ketone	USEPA 8081B	GC/MS/MS	0.071 µg/kg	0.1 µg/kg
Heptachlor	USEPA 8081B	GC/MS/MS	0.039 µg/kg	0.1 µg/kg
Heptachlor Epoxide	USEPA 8081B	GC/MS/MS	0.073 µg/kg	0.1 µg/kg
Methoxychlor	USEPA 8081B	GC/MS/MS	0.019 µg/kg	0.1 µg/kg
Mirex	USEPA 8081B	GC/MS/MS	0.045 µg/kg	0.1 µg/kg
Oxychlordane	USEPA 8081B	GC/MS/MS	0.1 µg/kg	0.1 µg/kg
Toxaphene	USEPA 8081B	GC/MS/MS	14 µg/kg	50 µg/kg
trans-Nonachlor	USEPA 8081B	GC/MS/MS	0.058 µg/kg	0.1 µg/kg
PCBs				
PCB Congeners	USEPA 8082A	GC/ECD	0.1 µg/kg	0.5 µg/kg
PAHs				
1-Methylnaphthalene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.1 µg/kg
1-Methylphenanthrene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
2,6-Dimethylnaphthalene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
2-Methylnaphthalene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Acenaphthene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Acenaphthylene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Anthracene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Benzo(a)anthracene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Benzo(a)pyrene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Benzo(b)fluoranthene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Benzo(e)pyrene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Benzo(g,h,i)perylene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Benzo(k)fluoranthene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Biphenyl	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Chrysene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Dibenzo(a,h)anthracene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Fluoranthene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Fluorene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg

Table 2-3. Chemical and Physical Parameters for Sediment Samples

Parameter	Method	Procedure	Target Method Detection Limit (dry weight)	Target Reporting Limit (dry weight)
Indeno(1,2,3-cd)pyrene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Naphthalene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Perylene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Phenanthrene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg
Pyrene	USEPA 8270D	GC/MS SIM	0.05 µg/kg	0.5 µg/kg

*Target MDLs and RLs for synthetic pyrethroids provided in wet weight.

2.2.2 Water Samples

The specific analyses, analytical methods, and target reporting limits for water samples are specified in Table 2-4. Water quality measurements will be taken in the field using YSI 6600 Multiparameter Water Quality Sondes as described in Section 2.1.4. Parameters will include DO, pH, salinity, and temperature. Laboratory chemical and physical analysis of water samples will include TSS, total nitrogen, total phosphorus, chlorophyll-a, and DOC.

Table 2-4. Chemical and Physical Parameters for Water Samples

Parameter	Method/Instrument	Units	Target Reporting Limit
Field Measurements			
Dissolved oxygen	YSI 6600	mg/L	0.2
pH	YSI 6600	pH units	1-14
Salinity	YSI 6600	ppt	1-75
Temperature	YSI 6600	°C	0-100
Physical / Conventional Laboratory Tests			
Chlorophyll-a	SM 10200 H	mg/m^3	10
Dissolved Organic Carbon	SM 5310 B	mg/L	0.1
Total Nitrogen	USEPA 353.2/USEPA 351.2	mg/L	0.1
Total Phosphorus	USEPA 365.3	mg/L	0.01
Total Suspended Solids	SM 2540 D	mg/L	5

2.2.3 Quality Assurance/Quality Control

The quality assurance (QA) objectives for chemical analysis conducted by the participating analytical laboratories are detailed in their Laboratory QA Manual(s). These objectives for accuracy and precision involve all aspects of the testing process, including the following:

- Methods and Standard Operating Procedures (SOPs)
- Calibration methods and frequency
- Data analysis, validation, and reporting
- Internal quality control (QC)
- Preventive maintenance
- Procedures to ensure data accuracy and completeness

Results of all laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology will be identified, and the corresponding data will be appropriately qualified in the final report.

All QA/QC records for the various testing programs will be kept on file for review by regulatory agency personnel.

2.3 Toxicity Testing

To evaluate the benthic condition of San Diego County's bays and lagoons, sediment toxicity testing will be conducted in accordance with the American Society for Testing and Materials (ASTM) and USEPA methods. The project plan is for analysis of three sediment samples per lagoon/estuary[1]. In addition, appropriate laboratory control samples will be run with each of the selected test species. Toxicity testing for this project will consist of a 10-day solid phase (SP) test using *Eohaustorius estuarius* and a 48-hour sediment-water interface (SWI) test using *Mytilus galloprovincialis*. The toxicity tests proposed for this project are summarized in Table 2-5. In addition, if significant toxicity is observed in the SP or SWI test, a toxicity identification evaluation (TIE) may be conducted as part of stressor identification studies described in Section 2.3.3.

Table 2-5. Toxicity Testing Proposed to Evaluate the Benthic Condition of San Diego County Bays and Lagoons

Test Type	Type of Organism	Taxon	Project Sediments	Control	Reference Toxicant	Ammonia Reference Toxicant
Solid Phase	Amphipod	*Eohaustorius estuarius*	X	Control Sediment	X	X
Sediment-Water Interface	Mussel	*Mytilus galloprovincialis*	X	Control Water	X	X

2.3.1 Solid Phase Testing

SP bioassays will be performed to estimate the potential toxicity of the collected sediments to benthic organisms. Ten-day SP tests using the marine amphipod *E. estuarius* will be conducted in accordance with procedures outlined in *Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (USEPA, 1994) and the ASTM method E1367-03 (ASTM, 2006). Test conditions are summarized in Table 2-6. On the day before test initiation, 2-cm aliquots of sample sediment will be placed in each of five replicate glass jars followed by approximately 800 mL of prepared seawater. Five replicate controls will be used to determine the health of the amphipods; this will be done by exposing the amphipods to clean sediment following the same protocols used for the test sediments. The test chambers will be left overnight to allow establishment of equilibrium between the sediment and overlying water. On day zero of the test, 20 amphipods will be randomly placed in each of the test chambers. Amphipods that do not bury in the sediment within an hour will be removed and replaced. Samples will be monitored daily for obvious mortality, sublethal effects, and abnormal

[1] Three replicate sediment samples will be collected per sampling site.

behavior. Water quality parameters, including DO, temperature, salinity, and pH, will be monitored daily. Overlying and interstitial ammonia will also be measured at test initiation and test termination. At the end of the test, organisms will be removed from the test chambers by sieving the sediment through a 0.5-mm mesh screen, and the numbers of live and dead amphipods in each test chamber will be recorded. Percent survival will be calculated for control and test sediments. Tests will be considered to be acceptable if there is more than 90% mean control survival.

Two 96-hour reference toxicity tests (cadmium chloride and ammonium chloride) will be conducted concurrently with each batch of sediment tests to establish the sensitivity of the test organisms used in the evaluation of the sediments and to evaluate the potential influence of ammonia toxicity on the test organisms. The cadmium reference toxicant test will be performed using the reference substance cadmium chloride ($CdCl_2$) with target concentrations of 1.25, 2.5, 5.0, 10.0, and 20.0 milligrams (mg) $CdCl_2$/L. Ten organisms will be added to each of four replicates for each concentration. The concentration of $CdCl_2$ that cause 50% mortality of the organisms (i.e., the median lethal concentration, or LC_{50}) will be calculated from the data. The LC_{50} values will then be compared to historical laboratory data for the test species with cadmium chloride. The ammonia reference toxicant test will be performed using the reference substance ammonium chloride (NH_4) with target concentrations of 20.0, 40.0, 80.0, 160.0, and 320.0 mg NH_4/L. Ten test organisms will be added to each of four replicates for each concentration. Subsamples will be obtained at test initiation to measure the actual ammonia concentrations and to calculate un-ionized ammonia concentrations. The LC_{50} values for total ammonia and un-ionized ammonia will be calculated from the data. The results of these reference toxicant tests will be used in combination with the control mortality to assess the health of the test organisms.

Table 2-6. Conditions for the 10-Day Solid Phase Bioassay with *E. estuarius*

Test Conditions 10-Day SP Bioassay		
Test Species		***E. estuarius***
Test Procedures		USEPA (1994); ASTM 1367-03 (2006)
Age/Size Class		Mature, 3-5 mm
Test Type/Duration		Static - Acute SP/10 days
Sample Storage Conditions		4°C, dark, minimal head space
Control Water Source		Scripps Pier seawater, 20 µm filtered, UV sterilized
Recommended Water Quality Parameters	Temperature	15 ± 2°C
	Salinity	20 ± 2 ppt
	Dissolved Oxygen	> 60% saturation (6.0 mg/L)
	pH	Monitor for pH drift
	Pore Water Total Ammonia	< 60 mg/L
	Pore Water Un-ionized Ammonia	< 0.8 mg/L
Photoperiod		Continuous light
Test Chamber		1 L glass jars

Table 2-6. Conditions for the 10-Day Solid Phase Bioassay with *E. estuarius*

Test Conditions	10-Day SP Bioassay
Replicates/Sample	5
No. of Organisms/Replicate	20
Exposure Volume	2 cm sediment, 800 mL water
Aeration	Constant gentle aeration
Feeding	None
Water Renewal	None

2.3.2 Sediment-Water Interface Testing

SWI bioassays will be performed to estimate the potential chronic toxicity of contaminants fluxed from sediments to overlying water. Forty-eight-hour bivalve *M. galloprovincialis* SWI bioassays will be conducted in accordance with procedures outlined in *Short-term Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (USEPA 1995) and Anderson et al. (1996). Test conditions are summarized in Table 2-7. The day before test initiation, 5 cm aliquots of sample sediment will be placed in each of the five replicate glass chambers followed by approximately 300 mL of prepared seawater. Five replicate controls will be used to verify that the test system does not cause toxicity; this will be done by exposing the bivalve larvae to test chambers with screen tubes but no sediment. The test chambers will be left overnight to allow establishment of equilibrium between the sediment and overlying water. On day zero of the test, polycarbonate screen tubes will be lowered into each chamber so that larvae settled inside the screen tube will be in close proximity to the sediment surface. Approximately 250 bivalve larvae will be placed inside the screen tube in each of the test chambers. Water quality parameters, including DO, temperature, salinity, and pH, will be monitored daily. Overlying and interstitial ammonia will also be measured at test initiation and test termination. At the end of the test, organisms will be retrieved from the test chambers by removing the screen tubes and gently rinsing the larvae into glass shell vials with clean filtered seawater. The vials will be preserved with formalin to be analyzed by microscope. After microscope counts are performed, the percent normal-alive embryo development will be calculated for the control and test sediments. Tests will be considered to be acceptable if there is greater than 70% mean control normal-alive embryo development.

Two 48-hour reference toxicity tests (copper chloride and ammonium chloride) will be conducted concurrently with each batch of SWI tests to establish the sensitivity of the test organisms used in the evaluation of the sediments and to evaluate the potential influence of ammonia toxicity on the test organisms. The copper reference toxicant test will be performed using the reference substance copper chloride ($CuCl_2$) with target concentrations of 2.5, 5.0, 10.0, 20.0, and 40.0 micrograms (µg) $CuCl_2$/L. Approximately 250 larvae will be added to each of five replicates of these concentrations. The LC_{50} value will be calculated from the data and will then be compared to historical laboratory data for the test species with copper chloride. The ammonia reference toxicant test will be performed using the reference substance ammonium chloride with target concentrations of 1.0, 2.0, 4.0, 8.0, and 16 mg NH_4/L. Approximately 250 larvae will be added to each of five replicates of these concentrations. Subsamples will be obtained at test initiation to measure the actual ammonia concentrations and to calculate un-ionized ammonia concentrations. The LC_{50} value for survival and the concentration causing a 50% reduction in normality (i.e., median effective concentration or EC_{50}) for total ammonia and un-ionized ammonia will be calculated from the data. The results of these reference toxicant tests will be used in combination with the percent control normal-alive embryo development to assess the health of the test organisms.

Table 2-7. Conditions for the 48-Hour Sediment-Water Interface Bioassay with *M. galloprovincialis*

Test Conditions 48-Hour SWI Bioassay		
Test Species		***M. galloprovincialis***
Test Procedures		USEPA (1995), Anderson et al. (1996)
Age/Size Class		< 4 hour old larvae
Test Type/Duration		Static - Acute SWI/48 hours
Sample Storage Conditions		4°C, dark, minimal head space
Control Water Source		Scripps Pier seawater, ≤ 1μm filtered, UV sterilized
Recommended Water Quality Parameters	Temperature	15 ± 2°C
	Salinity	32 ± 2 ppt
	Dissolved Oxygen	> 4.0 mg/L
	pH	Monitor for pH drift
Photoperiod		16 hours light: 8 hours dark
Test Chamber		Polycarbonate core tube 7.3 cm ID and 16 cm high, or similar
Replicates/Sample		5
No. of Organisms/Replicate		Approximately 250 larvae
Exposure Volume		5 cm sediment, 300 mL water
Aeration		Constant gentle aeration
Feeding		None
Water Renewal		None

2.3.3 Stressor Identification Studies

Biological testing is a useful tool for determining the presence of toxicity from sediment contamination; however, it does not indicate the cause of toxicity. The current SQO guidelines recommend assessing the multiple lines of evidence and conducting stressor identification investigations for sites identified as clearly impacted or likely impacted. Segments or reaches identified as possibly impacted are recommended for confirmation sampling prior to initiating stressor identification studies. However, by reviewing the available data sets, deductive reasoning can be used to narrow the focus of future actions.

The stressor identification investigations use a variety of tools that can be used to determine if the reason for the narrative objective not being met is due to generic stressors other than toxic pollutants, such as physical alterations or other pollutant related stressors. According to the SQO guidelines "If there is compelling evidence that the SQO exceedances contributing to a receiving water limit exceedance are not due to toxic pollutants, then the assessment area shall be designated as having achieved the receiving water limit." To determine if a site is impacted from toxic pollutants, one or more of the following tools may be applied:

- Evaluate the spatial extent of the area of concern in relation to anthropogenic sources
- Evaluate the body burden of the pollutants accumulated in the animals used for exposure testing
- Evaluate the chemical constituent results to mechanistic benchmarks
- Compare chemistry and biology data to determine if correlations exist
- Alternative biological assessment such as bioaccumulation experiments, pore water toxicity, or pore water chemistry analyses may be conducted.
- Phase I TIEs may also be conducted and are often useful for determining the causative agent or class of compounds causing toxicity.

Stressor identification investigations may be conducted using one or more of the following; statistical, biological, or chemical investigation data. Following a review of the investigation data, conclusions will be made based on the data available and/or recommendations will be developed for future studies to further characterize or identify the condition causing the narrative impairment.

2.4 Benthic Infauna Analysis

The benthic infaunal samples will be transported from the field to the laboratory and stored in a formalin solution for a minimum of 6 days. The samples will then be transferred from formalin to 70% ethanol for laboratory processing. The organisms will initially be sorted using a dissecting microscope into five major phyletic groups: polychaetes, crustaceans, molluscs, echinoderms, and miscellaneous minor phyla. While sorting, technicians will keep a count for quality control purposes, as described in the following paragraph. After initial sorting, samples will be distributed to qualified taxonomists who will identify each organism to species or to the lowest possible taxon. WESTON's taxonomists will utilize the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) Edition 9 for nomenclature and orthography.

A QA/QC procedure will be performed on each of the sorted samples to ensure a 95% sorting efficiency. A 10% aliquot of a sample will be re-sorted by a senior technician trained in the QA/QC procedure. The number of organisms found in the aliquot will be divided by 10% and added to the total number found in the sample. The original total will be divided by the new total to calculate the percent sorting efficiency. When the sorting efficiency of the sample is below 95%, the remainder of the sample (90%) will be re-sorted.

2.5 Data Review, Management and Analysis

2.5.1 Data Review

All data will be reviewed and verified by participating team laboratories to determine whether all data quality objectives have been met, and that appropriate corrective actions have been taken, when necessary.

2.5.2 Data Management

All laboratories will supply analytical results in both hard copy and electronic formats. Laboratories will have the responsibility of ensuring that both forms are accurate. After completion of the data review by participating team laboratories, hard copy results will be placed in the project file at WESTON and the results in electronic format will be imported into WESTON's database system.

2.5.3 Data Analysis

Data analysis will consist of tabulation and comparison with regulatory guidelines. Chemistry data for sediment will be compared to relevant Sediment Quality Guidelines. Toxicity results will be compared to appropriate laboratory controls. Sediment toxicity, chemistry, and benthic community condition will be assessed using California's SQOs as described in the *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (SWRCB and Cal EPA, 2009).

2.5.3.1 Sediment Quality Guidelines

Results of chemical analyses of sediments will be compared to effects range-low (ER-L) and effects range-median (ER-M) values developed by Long et al. (1995). The effects range values (ER-L and ER-M) are helpful in assessing the potential significance of elevated sediment-associated contaminants of concern, in conjunction with biological analyses. Briefly, these values were developed from a large data set where results of both benthic organism effects (e.g., toxicity tests, benthic assessments) and chemical concentrations were available for individual samples. To derive these guidelines, the chemical values for paired data demonstrating benthic impairment were sorted in according to ascending chemical concentration. The 10^{th} percentile of this rank order distribution was identified as the ER-L and the 50^{th} percentile as the ER-M. While these values are useful for identifying elevated sediment-associated contaminants, they should not be used to infer causality because of the inherent variability and uncertainty of the approach. For certain pesticide compounds (i.e., chlordane and dieldrin) the ER-L and ER-M levels are so low as to make it largely impractical to detect them in typical estuarine sediments using routine analytical procedures. Accordingly, having non-detect results that are greater than the ER-L, ER-M, or MDLs would not require re-analysis.

2.5.3.2 Application of California Sediment Quality Objectives

Sediment quality from bays and lagoons in San Diego County will be assessed using California's SQOs. The goals of the SQOs are to determine if pollutants in sediments are present in quantities that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful to humans.

The SQOs are based on a MLOE approach in which sediment toxicity, sediment chemistry, and benthic community condition are the LOE. The MLOE approach evaluates the severity of biological effects and the potential for chemically-mediated effects to provide a final station level assessment. The specific methods associated with each LOE are described below.

Sediment Toxicity

Sediment toxicity will be assessed using two tests: a 10-day *E. estuarius* survival test and a sublethal test using the mussel *M. galloprovincialis*. Sediment toxicity test results from each station will be statistically compared to control test results, normalized to the control survival, and categorized as nontoxic, low, moderate, or high toxicity. The average of the test responses is calculated to determine the final toxicity LOE category (Table 2-8 and Table 2-9). If the average falls midway in between the two categories it is rounded up to the higher of the two.

Table 2-8. Sediment Toxicity Categorization Values for *E. estuarius*

% Survival of *E. estuarius* in Project Sediment		Category
If Significantly Different than Control Survival	If Not Significantly Different from Control	
90 – 100	82 – 100	**Nontoxic**
82 – 89[1]	59 – 81[1]	**Low Toxicity**
59 – 81[1]		**Moderate Toxicity**
< 59[1]	< 59[1]	**High Toxicity**

[1] These values are a percentage of the control

Table 2-9. Sediment Toxicity Categorization Values for *M. galloprovincialis*

% Normal of *M. galloprovincialis* in Project Sediment		Category
If Significantly Different than Control Survival	If Not Significantly Different from Control	
80 – 100	77 – 79	**Nontoxic**
77 – 79[1]	42 – 76[1]	**Low Toxicity**
42 – 76[1]		**Moderate Toxicity**
< 42[1]	< 42[1]	**High Toxicity**

[1] These values are a percentage of the control

Sediment Chemistry

Concentrations of chemicals detected in sediments will be compared to the California Logistic Regression Model (CA LRM) and the Chemical Score Index (CSI). The CA LRM is a maximum probability model (P_{MAX}) that uses logistic regression to predict the probability of sediment toxicity. The CSI is a predictive index that relates sediment chemical concentration to benthic community disturbance. Sediment chemistry results according to CA LRM and CSI are categorized as having minimal, low, moderate, and high exposure to pollutants (Table 2-10). The final sediment LOE category is the average of the two chemistry exposure categories. If the average falls midway in between the two categories it is rounded up to the higher of the two. For example if the CA LRM is low exposure and the CSI is moderate exposure, then the final sediment LOE category is moderate exposure.

Table 2-10. Sediment Chemistry Guideline Categorization

Sediment Chemistry Guideline		Category
CA LRM	CSI	
<0.33	<1.69	**Minimal Exposure**
0.33 - 0.49	1.69 - 2.33	**Low Exposure**
0.50 - 0.66	2.34 - 2.99	**Moderate Exposure**
>0.66	>2.99	**High Exposure**

Benthic Community Condition

Benthic community condition will be assessed using a combination of four benthic indices: the Benthic Response Index (BRI), Relative Benthic Index (RBI), Index of Biotic Integrity (IBI), and a predictive model based on the River Invertebrate Prediction and Classification System (RIVPACS). The four indices will be calculated following the January 21, 2008 guidance provided by the Southern California Coastal Water Research Project (SCCWRP) entitled *Determining Benthic Invertebrate Community Condition in Embayments* for southern California marine bays. Each benthic index result is categorized according to four levels of disturbance, including reference, low, moderate, and high disturbance.

- Reference: Equivalent to a least affected or unaffected site
- Low Disturbance: Some indication of stress is present, but is within measurement error of unaffected condition
- Moderate Disturbance: Clear evidence of physical, chemical, natural, or anthropogenic stress
- High Disturbance: High magnitude of stress

Specific categorization values, which are specifically tailored to southern California marine bays, are assigned for each index (Table 2-11). The final step to determine the benthic community condition is to integrate the four indices into a single category. In doing so, the median of the four benthic index response categories are computed to determine the benthic condition. If the median fell between two categories, the value is rounded to the next higher category to provide the most conservative estimate of benthic community condition.

Table 2-11. Benthic Index Categorization Values for Southern California Marine Bays

Benthic Community Guideline				Index
BRI	IBI	RBI	RIVPACS	
< 39.96	0	> 0.27	> 0.90 to < 1.10	**Reference**
39.96 to 49.14	1	0.17 to 0.27	0.75 to 0.90 or 1.10 to 1.25	**Low Disturbance**
49.15 to 73.26	2	0.09 to 0.16	0.33 to 0.74 or > 1.25	**Moderate Disturbance**
> 73.26	3 or 4	< 0.09	< 0.33	**High Disturbance**

Station Level Assessment

The final station level assessment will be determined by the combination of the three LOE categories as presented in Attachment B of the *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (SWRCB and Cal EPA, 2009). Attachment B presents every possible LOE combination which corresponds to one of six possible station level assessments as follows:

- unimpacted
- likely unimpacted
- possibly impacted
- likely impacted
- clearly impacted
- inconclusive

2.5.3.3 Statistical Analysis

The data used in the statistical analysis will include macrobenthic measures such as abundances of all taxonomic groups, total abundance, and total number of taxa. Environmental variables include the sediment contaminant concentrations, water column nutrients, physical factors such as sediment grain size, TOC, temperature, DO, salinity, and amphipod and mussel toxicity. The analysis methods detailed below may be modified if data do not pass normality testing, or if the results of the methods below are inconclusive.

Data will be tested for normality, and transformed as necessary prior to statistical analysis. Percent data (organic content, grain size, and amphipod and mussel survivorship) will likely be arcsin square root transformed. Comparisons of environmental variables and macrofaunal metrics between sites will be conducted with a Tukey honestly significant difference (HSD) test for multiple comparisons for normally distributed data and Kraskal Wallace for non-parametric data. Statistical analyses will be performed using the PRIMER 5.0 (Plymouth Routines in Multivariate Ecological Research) SAS 9.1 (SAS Institute) software packages.

Non-metric multidimensional scales (MDS) ordinations and hierarchical agglomerative cluster analysis will be conducted to describe the benthic community composition at each site. Ordinations are based on Bray-Curtis similarities (Bray and Curtis, 1957). Differences in benthic community composition within and between sites will be tested using an analysis of similarities (ANOSIM) randomization test, based on rank similarities of samples (Clark, 1993). The similarity percentages (SIMPER; Clark, 1993) routine will be used to identify the taxa or benthic metric that made the greatest contribution to defining differences among sites identified in the ANOSIM tests (Clark and Warwick, 1994).

2.6 Reporting

2.6.1 Draft and Final Reports

After all results are received, statistical analyses completed, and all evaluations made, the monitoring program results will be included in the Annual Monitoring Report. At a minimum, the following will be included in the final report:

- Summary of all field activities, including a description of any deviations from the SAP
- Descriptions of each sample and all original field logs
- Locations of sediment and water sampling stations, reported in latitude and longitude (DD) World Geodetic System 1984 (WGS 84)
- Plan view of the project showing the actual sampling locations
- QA/QC results and comparison of possible data quality impacts, as described in Section 2.6.2
- Data Results and interpretation using the sediment quality objectives.
- Recommendations for future stressor identification studies if warranted.

2.6.2 Quality Assurance/Quality Control and Laboratory Data Report

Analytical laboratories will provide a QA/QC narrative that describes the results of the standard QA/QC protocols that accompany analysis of field samples. All hard copies of results will be maintained in the project files. In addition, back-up copies of results generated by each laboratory will be maintained at their respective facilities. At a minimum, the laboratory reports will contain results of the laboratory analysis, QA/QC results, methodology, and a case narrative of COC details.

2.7 Schedule

Sampling and Reporting will occur as specified in Table 2-12 below.

Table 2-12. Schedule of Activities

Lagoon or Estuary	Permit Year	ABLM Sampling	Reporting
Agua Hedionda Lagoon	2014	July 2014	Copermittees Annual Monitoring Report Draft – November 2014 Final - January 2015
Batiquitos Lagoon			
San Dieguito Lagoon			
San Diego River Estuary			

3.0 REFERENCES

Anderson, B.S., Hunt, J.W., Hester, M., Phillips, B.M., 1996. Assessment of sediment toxicity at the sediment-water interface. In: G.K. Ostrander (ed.) Techniques in Aquatic Toxicology. Lewis Publishers, Ann Arbor, MI.

APHA (American Public Health Association), AWWA (American Water Works Association), and WEF (Water Environment Federation). 2005. *Standard Methods for the Examination of Water and Wastewater, 21st Edition.*

American Society for Testing and Materials (ASTM). 2006. E1367-03 Standard Guide for Conducting 10-Day Static Sediment Toxicity Tests With Marine and Estuarine Amphipods. *Annual Book of Standards, Water and Environmental Technology, Vol. 11.05,* West Conshohocken, PA.

Bray, J.R., and J.T. Curtis. 1957. An ordination of the upland forest communities of Southern Wisconsin. *Ecological Monographs*. 27:325-349.

Clark, K.R., and R.M. Warwick. 1994. Changes in marine communities: An approach to statistical analysis and interpretation. Plymouth, UK: Plymouth Marine Laboratory.

Clark KR. 1993. Non-parametric multivariate analyses of changes in community structure. *Australian Journal of Ecology*. 18:117-143.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management*, 19:81-97.

Plumb, R.H., Jr. 1981. *Procedure for Handling and Chemical Analysis of Sediment and Water Samples*. Technical Report EPA/CE-81-1. U.S. Army Waterways Experimental Station, Vicksburg, MS.

Southern California Association of Marine Invertebrate Taxonomists (SCAMIT). 2014. A Taxonomic Listing Macro- and Megainvertebrates from Infaunal and Epibenthic Monitoring Programs in the Southern California Bight. Edition 9. July.

State Water Resources Control Board (SWRCB) and California Environmental Protection Agency (Cal EPA). 2009. *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*. August 25, 2009.

United States Environmental Protection Agency (USEPA). 1994. Methods for Assessing Toxicity of Sediment-Associated Contaminants With Estuarine and Marine Amphipods. EPA/600/R-94/025. EPA Office of Research and Development, Narragansett, Rhode Island. June.

United States Environmental Protection Agency (USEPA). 1995. Short-term Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms. EPA/600/R-95/136. EPA Office of Research and Development. Narragansett, RI.

APPENDIX A
Field Sediment Sampling Log

VAN VEEN TRACKING SHEET

Please Record All Drops (GOOD and BAD)

DATE	STATION	(Enter all Drops) GRAB NUMBER	TIME	WATER DEPTH (m)	Penetration Depth (cm)	Grade good(G) fair(F) poor(P)	Sample Type Infauna(I), Tox (T), and/or Chem(C)	Volume (L)	Color	Odor	Latitude	Longitude	Comments

APPENDIX B
Chain-of-Custody Form

☐ 5817 Dryden Place, Ste 101 • Carlsbad, CA 92008 • (760) 795-6900, FAX 931-1580
☐ 1340 Treat Blvd, Ste 210 • Walnut Creek, CA 94597 • (925) 948-2600, FAX 948-2601

CHAIN OF CUSTODY

35009

DATE______________ PAGE_____ OF_____

PROJECT NAME / SURVEY / PROJECT NUMBER

PROJECT MANAGER / CONTACT

CLIENT

ADDRESS

PHONE / FAX / EMAIL

SITE ID (Location)	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE / VOLUME	TOTAL NUMBER OF CONTAINER	ANALYSIS/TEST REQUESTED								PRESERVED HOW	FOR WESTON USE ONLY: SAMPLE TEMP. (°C) UPON RECEIPT	WESTON LAB ID

Sample Matrix Codes: FW=fresh water GW=ground water SLT=salt water SW=storm water WW=waste water SED=sediment A=air BIO=biologic SS=soil T=tissue O=other (specify) ____________

Container Code: G=glass P=plastic B=bags ☐ O=other ____________

Shipped By: ☐ Courier ☐ UPS ☐ FedEx ☐ USPS ☐ Client drop off ☐ Other ____________

Turnaround Time: ☐ 2-day ☐ 5-day ☐ 7-day ☐ 10-day ☐ 14-day ☐ Standard ☐ Other ____________

Reporting Requirements: ☐ PDF ☐ EDD ☐ Hard Copy ☐ Email ☐ Other ____________

SAMPLED BY: PRINT SIGNATURE

COMMENTS / SPECIAL INSTRUCTIONS

RELINQUISHED BY				RECEIVED BY			
Print Name	Signature	Firm	Date/Time	Print Name	Signature	Firm	Date/Time
1.							
2.							
3.							
4.							
5.							
6.							

WHITE – return to originator • YELLOW – lab • PINK – retained by originator