APPENDIX K

San Diego Bay
Watershed Management Area
Water Quality Improvement Plan
—
Monitoring and
Assessment Program

Submitted to the

San Diego Regional Water Quality Control Board

by the San Diego Bay Responsible Parties

February 2016

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Acronyms and Abbreviations

Acronym or Abbreviation	Definition
%	percent
<	less than
µg/L	micrograms per liter
303(d)	Clean Water Act Section 303(d) list of impaired waters
AB	(California) Assembly Bill
AB411	California Assembly Bill 411: Beach Safety Act
ABLM	Ambient Bay and Lagoon Monitoring
Airport Authority	San Diego County Regional Airport Authority
Bacteria TMDL	San Diego Regional Water Quality Control Board Resolution Number R9-2010-0001, *Revised TMDL for Indicator Bacteria, Project I – Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek)*
Bight ’08	Southern California Bight Monitoring (2008)
Bight ’13	Southern California Bight Monitoring (2013)
BMI	benthic macroinvertebrate
BMP	best management practice
BOD	biological oxygen demand
CIP	Capital Improvement Project
CLRP	Comprehensive Load Reduction Plan
Copermittee	Operator of a municipal separate storm sewer system in San Diego County that is party to the Municipal Permit.
CRAM	California Rapid Assessment Method
CTR	California Toxics Rule
CWA	Clean Water Act

Acronyms and Abbreviations (continued)

Acronym or Abbreviation	Definition
DEH	San Diego County Department of Environmental Health
FIB	fecal indicator bacteria
Focused Priority Condition	Focused Priority Water Quality Condition
FY	fiscal year
HA	Hydrologic Area
Highest Priority Condition	Highest Priority Water Quality Condition
HMP	Hydromodification Management Plan
HSA	Hydrologic Sub-Area
HU	Hydrologic Unit
IB	Imperial Beach
IBI	Index of Biological Integrity
IC/ID	illicit connection and/or illicit discharge
IDDE	illicit discharge detection and elimination
IGP	Industrial General Permit
ILACSD	I Love a Clean San Diego
JRMP	Jurisdictional Runoff Management Program (2013 Municipal Permit)
LID	Low-Impact Development
MEP	maximum extent practicable
MLS	mass loading station
MS4	municipal separate storm sewer system
MST	microbial source tracking

Acronyms and Abbreviations (continued)

Acronym or Abbreviation	Definition
Municipal Permit	San Diego Regional Water Quality Control Board Order Number R9-2013-0001, *National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region*
NA	not applicable
NAL	non-storm water action level
NPDES	National Pollutant Discharge Elimination System
O&G	oil and grease
OPP	Office of Pesticide Programs
PGA	pollutant-generating activity
pH	measure of hydrogen ion
PWQC	Priority Water Quality Condition
QA/QC	quality assurance and quality control
QAPP	Quality Assurance Project Plan
REC-1	Contact Water Recreation (beneficial use)
Regional Board	San Diego Regional Water Quality Control Board
RHMP	Regional Harbor Monitoring Program
RP	Responsible Party. Responsible Parties include parties subject to the Bacteria TMDL and participating in this Water Quality Improvement Plan Monitoring and Assessment Program, specifically the Copermittees in the San Diego Bay WMA.
SAL	storm water action level
SCCWRP	Southern California Coastal Water Research Project
Sediment Control Plan	State Water Board's Water Quality Control Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality

Acronyms and Abbreviations (continued)

Acronym or Abbreviation	Definition
SHELL	Shellfish Harvesting (beneficial use)
SISP	Shelter Island Shoreline Park
SIYB	Shelter Island Yacht Basin
SMC	Southern California Stormwater Monitoring Coalition
SQO	California Sediment Quality Objective
SR-MLS	Sweetwater River Mass Loading Station
SSID	stressor/source identification
State	State of California
State Board	State Water Resources Control Board
SWAMP	Surface Water Ambient Monitoring Program
TBD	to be determined
TIE	Toxicity identification evaluation
TMDL	total maximum daily load
TRE	Toxicity reduction evaluation
TWAS	temporary watershed assessment station
USEPA	United States Environmental Protection Agency
WER	Water Effect Ratio
WLA	Waste Load Allocation
WMA	Watershed Management Area
WQBEL	water quality-based effluent limits
WQO	water quality objective
WURMP	Watershed Urban Runoff Management Program

K.1 INTRODUCTION

The San Diego Regional Water Quality Control Board (Regional Board) develops and enforces water quality objectives and implements plans to protect the area's waters. On May 8, 2013, the Regional Board adopted a new Municipal Permit[1] to regulate discharges from Municipal Separate Storm Sewer Systems (MS4s) (Regional Board, 2013). The Municipal Permit established a new, watershed-based approach by which the Copermittees plan and implement storm water programs. The new approach requires that jurisdictions' storm water programs address the priority receiving water conditions, focusing efforts toward measureable improvements in receiving water quality. The San Diego Bay watershed Water Quality Improvement Plan describes the priority conditions and goals to improve water quality, and identifies strategies to be implemented to assist in meeting the goals. The Municipal Permit requires that a Water Quality Improvement Plan be developed for the San Diego Bay Watershed Management Area (WMA). Provision D of the Municipal Permit requires that a Monitoring and Assessment Program be developed as part of the Water Quality Improvement Plan to assess impacts of MS4 discharges on receiving water conditions.

This section provides background information on the Monitoring and Assessment Program, including the purpose, the watershed background, the applicable Copermittees, and the anticipated program schedule. Collection and assessment of monitoring data guide future implementation of management actions by Responsible Parties (RPs) (described in Section 1.3) as part of the Water Quality Improvement Plan process. Monitoring during wet and dry weather is conducted to collect observational and analytical data. These data are used to help RPs determine whether receiving water conditions are improving, degrading, or staying the same.

K.1.1 Purpose of the Monitoring and Assessment Program

Monitoring data collection and assessment provide the vehicle to help the RPs determine whether the goals of the Highest Priority Conditions and Focused Priority Conditions are being met or whether the RPs' programs may need to be adapted to achieve the intended outcomes. RPs assess the data, in combination with their management actions, to determine what actions are improving receiving water conditions and where additional actions are necessary to improve conditions. The Municipal Permit supports this outcome-based approach, as implemented and adapted through the Water Quality Improvement Plan process.

The Monitoring and Assessment Program incorporates requirements of Provision D of the Municipal Permit, along with the specific monitoring and assessment requirements for applicable Total Maximum Daily Loads (TMDLs) listed in Attachment E of the Municipal Permit and specific monitoring for focused priority conditions.

[1] *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* (Municipal Permit) (Order Number R9-2013-0001) (Regional Board, 2013).

As stated in Provision D of the Municipal Permit:

> *"The purpose of this provision is for the Copermittees to monitor and assess the impact on the conditions of receiving waters caused by discharges from the Copermittees' MS4s under wet weather and dry weather conditions. The goal of the Monitoring and Assessment Program is to inform the Copermittees 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 RPs in the San Diego Bay WMA have developed an integrated Monitoring and Assessment Program that:

(1) Measures the progress toward addressing the Highest Priority Conditions and Focused Priority Conditions;

(2) Assesses the progress toward achieving the Water Quality Improvement Plans numeric goals and schedules; and

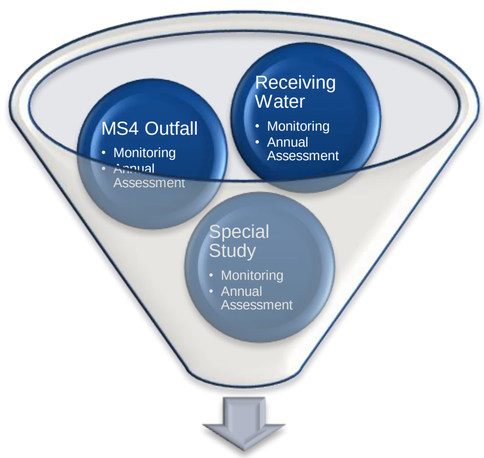
(3) Evaluates each RP's overall efforts to implement the Water Quality Improvement Plan.

The Monitoring and Assessment Program for the San Diego Bay WMA includes three major monitoring components:

(1) Receiving water monitoring, which measures the long-term health of the watershed;

(2) MS4 outfall monitoring, which promotes the elimination of dry weather flows from MS4 outfalls and investigates the improvement of the quality of the flows that exit the MS4 outfalls during rain events; and

(3) Special studies, which are designed to research regional issues and answer questions specific to Highest and Focused Priority Conditions.



Integrated Assessment and Iterative Review Process

Each of these components has elements that are applicable to the Highest and Focused Priority Conditions in the WMA. The Assessment Program includes an annual analysis of the monitoring data and an integrated analysis that combines all previously performed evaluations at the end of the Municipal Permit term. The program also reviews metrics collected through programmatic assessments and strategic implementation.

K.1.2 Watershed Background

The San Diego Bay WMA encompasses a 444-square-mile area (approximately 284,500 acres) that extends eastward from the San Diego Bay for more than 50 miles to the Laguna Mountains. The WMA ranges in elevation from sea level at San Diego Bay to a maximum elevation of approximately 6,000 feet above sea level at the eastern boundary. Most of the WMA land area lies north of the Tijuana River WMA, south of the San Diego River WMA, west of the Anza Borrego WMA, and east of the Pacific Ocean. The Municipal Permit defines the San Diego Bay WMA as containing three hydrologic units (HUs): (1) the Pueblo San Diego (Pueblo) HU 908, (2) the Sweetwater River (Sweetwater) HU 909, and (3) the Otay River (Otay) HU 910.

Previous efforts through the Watershed Urban Runoff Management Program (WURMP) focused on watershed collaboration to identify and address Highest and Focused Priority Conditions in the WMA, and to develop and implement activities that include pollutant load reduction and abatement, educational activities, and public participation.

The Municipal Permit continues the watershed-based approach to water quality management by focusing on providing consistent implementation, improving interagency communication and collaboration, and establishing requirements that focus on attaining water quality improvement goals. The emphasis is on watershed quality outcomes rather than fulfillment of prescriptive activities that were required in the previous permit. This approach assesses the WMA in its entirety, as well as at the subwatershed and jurisdictional level. The outcome-based adaptive management process supports the use of scientific tools to answer management questions that lead to implementation actions in the WMA. The goal of the Water Quality Improvement Plan is to reduce pollutants and other stressors from the RPs' MS4 discharges to support the Clean Water Act's objective to protect, preserve, enhance, and restore the water quality and designated beneficial uses of waters of the state.

Figure K1-1 presents the San Diego Bay WMA, along with Highest and Focused Water Priority Conditions.

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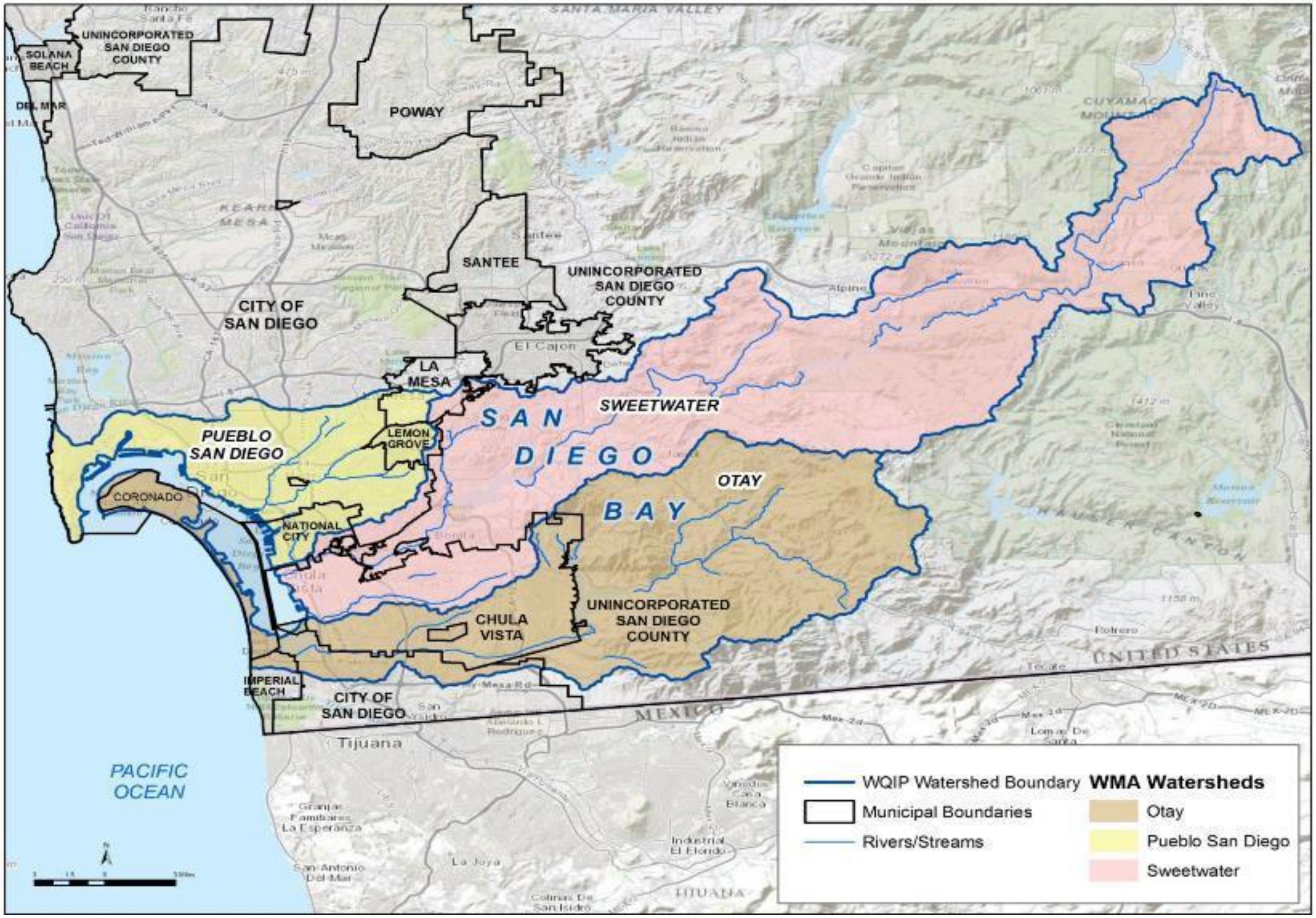

Figure K1-1
San Diego Bay WMA

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K.1.3 Responsible Parties

Water Quality Improvement Plan development and implementation is a collaborative effort by all of the RPs. The RPs in the San Diego Bay WMA include the County of San Diego, the San Diego Unified Port District (Port of San Diego), the San Diego County Regional Airport Authority (Airport Authority), and the Cities of Chula Vista, Coronado, Imperial Beach, La Mesa, Lemon Grove, National City, and San Diego. The Copermittees within the San Diego Bay WMA are collectively referred to throughout this document as RPs.

Table K1-1 provides an overview of the three HUs and the jurisdictions within the watershed.

Table K1-1
San Diego Bay WMA Jurisdictional Breakdown (by Hydrologic Area [HA])

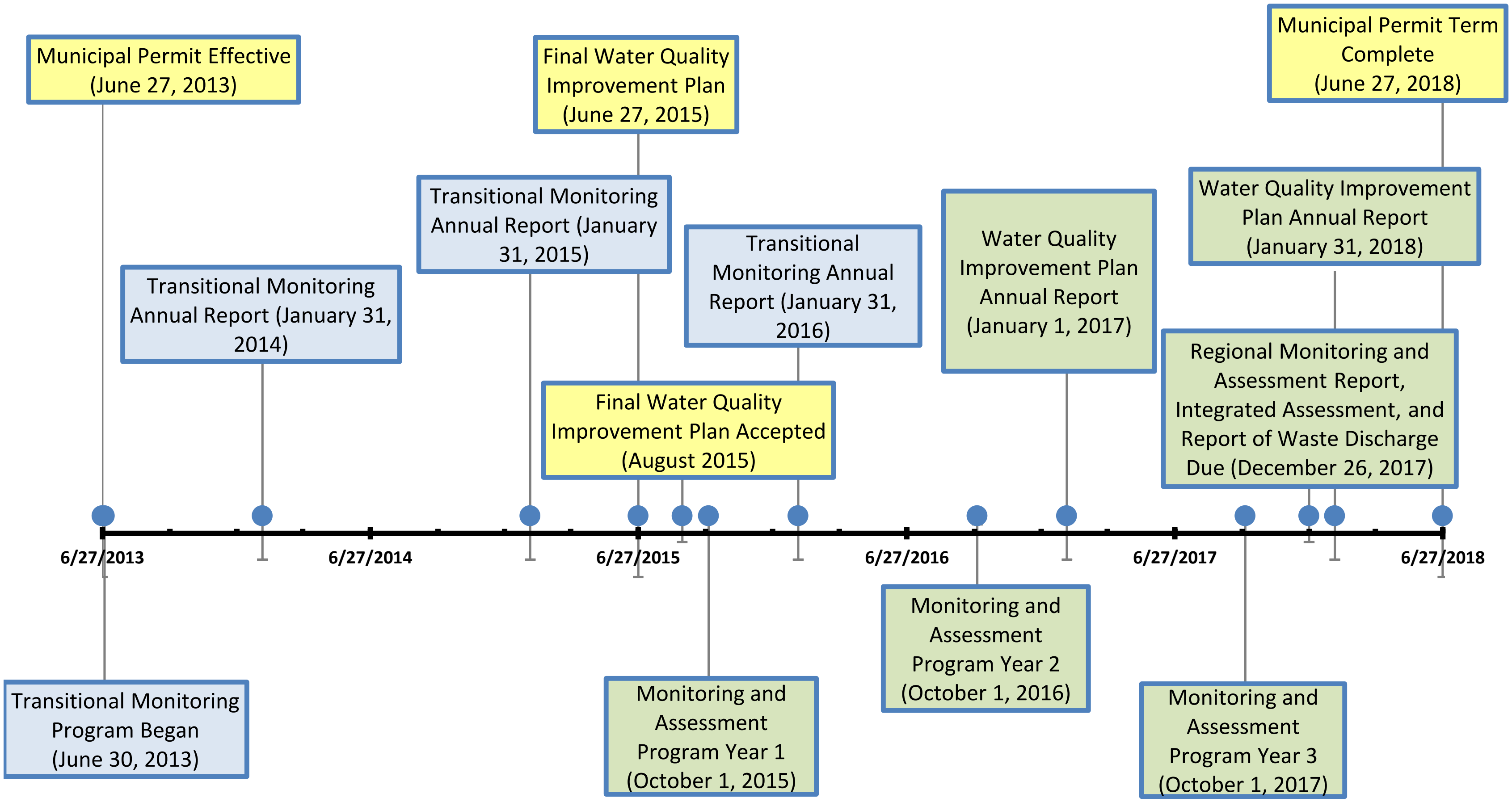
RP	San Diego Bay WMA								
	Pueblo			Sweetwater River			Otay River		
	908.1	908.2	908.3	909.1	909.2	909.3	910.1	910.2	910.3
Airport Authority		✓							
Chula Vista				✓				✓	✓
County		✓		✓	✓	✓		✓	✓
Coronado							✓		
Imperial Beach							✓	✓	
La Mesa		✓		✓					
Lemon Grove		✓		✓					
National City			✓	✓					
Port of San Diego	✓	✓	✓	✓			✓		
San Diego	✓	✓	✓	✓				✓	

K.1.4 Monitoring and Assessment Program Schedule

The Municipal Permit was adopted in June 2013. Since adoption of the Municipal Permit, the RPs have implemented a regional transitional monitoring program. Per the Municipal Permit, the transitional monitoring program remains in place until Regional Board approval of the Final Water Quality Improvement Plan, which includes a 30-day public comment period. When the Final Water Quality Improvement Plan is approved by the Regional Board, RPs implement the Monitoring and Assessment Program jurisdictionally, on a watershed-wide basis, and regionally, as applicable. Approval of the Final Water Quality Improvement Plan is anticipated in summer 2015. The transitional monitoring program is anticipated to continue until the end of the monitoring year (September 30, 2015). The RPs expect to implement the Monitoring and Assessment Program beginning October 1, 2015.

Annual monitoring assessments are to be included as part of the Water Quality Improvement Plan Annual Report. Six months prior to the end of the Municipal Permit term, the RPs are to submit a regional monitoring and assessment report in collaboration with other Copermitees in the San Diego Region. At the same time, the RPs also submit the Report of Waste Discharge, which includes an integrated assessment of both this Monitoring and Assessment Program and RPs respective Jurisdictional Runoff Management Programs (JRMPs).

Figure K1-2 presents the general program timeline for Monitoring and Assessment, including reporting.



Note:
Yellow boxes indicate general permit milestones. Blue boxes indicate transitional monitoring milestones. Green boxes indicate milestones included as part of this Monitoring and Assessment Program.

Figure K1-2
Monitoring and Assessment Program Timeline

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K.2 MONITORING APPROACH

K.2.1 General Information on Types of Monitoring

The San Diego Bay Water Quality Improvement Plan Monitoring Program has three major components:

- General permit-required monitoring (monitoring requirements prescribed in Provision D of the Municipal Permit);
- Highest and Focused Priority Condition monitoring (monitoring intended to inform programs and assess progress toward the goals outlined in the Water Quality Improvement Plan Second Interim Deliverable); and
- Additional monitoring (TMDL monitoring, where the TMDL is not a Highest or Focused Priority Condition, and special studies).

Each program component may include various types of monitoring elements, from visual observations used to identify illicit discharges, to flow-weighted composite sample collection. While monitoring may include water sample collection, it may also include other sampling types such as counting the number of trash pieces on a stream bank, collecting sediment or algae grab samples, or measuring physical changes in channel width and depth.

Table K2-1 presents an overview of planned monitoring activities for the San Diego Bay WMA, including key monitoring elements, sampling types, monitoring locations, and monitoring frequency by program. Figure K2-1 presents an overview of the San Diego Bay WMA's various monitoring programs and station locations, including the Long-Term Receiving Water Monitoring, the MS4 Outfall Monitoring, the Highest and Focused Priority Condition programs, and Additional Monitoring Programs.

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Table K2-1
Water Quality Improvement Plan
Monitoring Overview

Monitoring Programs			Weather (Wet or Dry)	Monitoring Elements	Sample Type(s)	Highest or Focused Priority Condition Addressed or Contributed to by Monitoring Program					Permit Schedule[1]				
						Chollas Creek Bacteria/Metals	Airport Metals	Riparian	Physical Aesthetics	Swimmable Waters	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
General Permit-Required Monitoring															
Receiving Water Monitoring	Long-Term Receiving Water Monitoring	Long-Term Receiving Water	Dry	Chemistry, FIB, toxicity (chronic), visual observations, field measurements	Time-weighted water composite, water grab, visual observations, *in-situ* measurements	✓[7]	–	–	–	–	●	–	–	–	–
			Dry	Trash Assessment	Visual observations, *in-situ* measurements	–	–	–	✓	–	●	–	–	–	–
			Dry	Hydromodification (channel conditions, discharge points, habitat integrity, evidence and estimate of erosion and habitat impacts)	Visual observations, *in-situ* measurements	–	–	–	–	–	●	–	–	–	–
			Dry	Bioassessment (BMI taxonomy, algae taxonomy, physical habitat characteristics)	Per SWAMP protocols	–	–	✓	–	–	●	–	–	–	–
			Wet	General: chemistry, FIB, toxicity (chronic), field measurements	Flow-weighted water composite	✓[7]	–	–	–	–	●	–	–	–	–
			Wet	Trash Assessment	Visual observations, *in-situ* measurements	–	–	–	✓	–	●	–	–	–	–
	Regional Monitoring	Southern California Bight Monitoring (Bight '13)	Dry	Chemistry, toxicity, bioassessment	Sediment grab, per SWAMP protocols	✓	–	✓	✓	✓	●	–	–	–	–
		Stormwater Monitoring Coalition (SMC)	Dry	TBD (year 1 was under SMC bioassessment)	Per SMC Protocols	–	–	✓	✓	–	●	TBD[1]	TBD[1]	TBD[1]	TBD[1]

Notes:

AB411 = Assembly Bill 411; BMI = benthic macroinvertebrate; BOD = biological oxygen demand; CRAM = California Rapid Assessment Method; FIB = fecal indicator bacteria; HMP = Hydromodification Monitoring Program; IBI = Index of Biological Integrity; IC/ID = illicit connection and/or illicit discharge; MST = microbial source tracking; NA = not applicable; O&G = oil and grease; PWQC = Priority Water Quality Condition; RHMP = Regional Harbor Monitoring Program; SMC = Southern California Stormwater Monitoring Coalition; SWAMP = Surface Water Ambient Monitoring Program; TBD = to be determined

● Monitoring has been or will be conducted.
– Monitoring will not be conducted
1. SMC participation will be determined each year.
2. The California Assembly Bill 411 (AB411) program monitoring has been conducted for a number of year during the dry season by the County of San Diego Department of Environmental Health will be tracked and incorporated into bacteria-related receiving water assessments. Monitoring under AB411 is not required under Provision D of the Municipal Permit, but bacteria monitoring is required as part of the Bacteria TMDL (Municipal Permit Attachment E.6). AB411 monitoring may be used to augment RP monitoring and will be reviewed as part of the data assessment.
3. Conducted under the Ambient Bay and Lagoon Monitoring (ABLM) Program, as part of Bight '13.
4. If <125 outfalls, 80% must be monitored twice annually.
5. Airport monitoring for metals will be conducted as part of the Industrial General Permit monitoring. Additional constituents are monitored under that program, but only metals is included here because that is the focused priority condition.
6. Monitoring is paired. Receiving Water and MS4 Outfall will be monitored the same day.
7. Provided via Chollas Creek TMDL monitoring.

Table K2-1 (continued)
Water Quality Improvement Plan Monitoring Overview

Monitoring Programs			Weather (Wet or Dry)	Monitoring Elements	Sample Type(s)	Highest or Focused Priority Condition Addressed or Contributed to by Monitoring Program					Permit Schedule[1]				
						Chollas Creek Bacteria/Metals	Airport Metals	Riparian	Physical Aesthetics	Swimmable Waters	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Receiving Water Monitoring (cont.)	Regional Monitoring (cont)	Hydromodification Monitoring Program (HMP)	Wet	Rain gauge analysis; stream gauge analysis; channel assessments; flow monitoring; and sediment transport monitoring	Visual observations, *in-situ* measurements	–	–	✓	–	–	●	●	●	TBD	TBD
Receiving Water Monitoring (cont.)	Sediment Quality Monitoring	Sediment Quality Monitoring	Dry	Chemistry, toxicity, bioassessment	Sediment grab, visual observations, *in-situ* measurements	–	–	✓	–	–	●[3]	●	●	●	●
Receiving Water Monitoring (cont.)	Sediment Quality Monitoring	Regional Harbor Monitoring Program (RHMP)	Dry	Field parameters, chemistry, toxicity, bioassessment, trash assessment	Water grab, sediment grab, visual observations, *in-situ* measurements	✓	–	–	✓	✓	●	–	–	–	–
MS4 Monitoring	MS4 Outfall	MS4 Field Screening	Dry	Visual: flow condition/estimation, trash, IC/IDs, Station condition descriptions (see Municipal Permit Table D-5)	Visual observations[3]	✓	✓	✓	✓	✓	●	●	●	●	●
MS4 Monitoring	MS4 Outfall	MS4 Outfall	Dry	Chemistry, FIB, toxicity (chronic), visual observations, field measurements	Water grab, visual observations, *in-situ* measurements	✓	✓	✓	✓	✓	●	●	●	●	●
MS4 Monitoring	MS4 Outfall	MS4 Outfall	Wet	Chemistry, FIB, toxicity (chronic), visual observations, field measurements	Time-weighted or flow-weighted water composite, water grab, visual observations, *in-situ* measurements	✓	✓	✓	✓	✓	●	●	●	●	●

Notes:

AB411 = Assembly Bill 411; BMI = benthic macroinvertebrate; BOD = biological oxygen demand; CRAM = California Rapid Assessment Method; FIB = fecal indicator bacteria; HMP = Hydromodification Monitoring Program; IBI = Index of Biological Integrity; IC/ID = illicit connection and/or illicit discharge; MST = microbial source tracking; NA = not applicable; O&G = oil and grease; PWQC = Priority Water Quality Condition; RHMP = Regional Harbor Monitoring Program; SMC = Southern California Stormwater Monitoring Coalition; SWAMP = Surface Water Ambient Monitoring Program; TBD = to be determined

- ● Monitoring has been or will be conducted.
- – Monitoring will not be conducted

1. SMC participation will be determined each year.
2. The California Assembly Bill 411 (AB411) program monitoring has been conducted for a number of year during the dry season by the County of San Diego Department of Environmental Health will be tracked and incorporated into bacteria-related receiving water assessments. Monitoring under AB411 is not required under Provision D of the Municipal Permit, but bacteria monitoring is required as part of the Bacteria TMDL (Municipal Permit Attachment E.6). AB411 monitoring may be used to augment RP monitoring and will be reviewed as part of the data assessment.
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						Chollas Creek Bacteria/Metals	Airport Metals	Riparian	Physical Aesthetics	Swimmable Waters	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Highest and Focused Priority Condition Monitoring															
Highest and Focused Priority Condition Monitoring	Highest Priority	Chollas Creek Metals TMDL	Wet	Metals (copper, lead, and zinc), pesticides, FIB	Flow-weighted water composite	✓	–	–	–	–	●	●	●	●	●
		Chollas Creek Bacteria TMDL (part of the 20 Beaches and Creeks TMDL)	Dry	FIB, visual observations, field measurements (optional)	Water grab, visual observations, *in-situ* measurements	✓	–	–	–	–	●	●	●	●	●
			Wet	FIB, visual observations, field measurements (optional)	Water grab, visual observations, *in-situ* measurements	✓	–	–	–	–	●	●	●	●	●
	Focused Priority	Airport Metals	Dry	Metals (total and dissolved)	Water grab	–	✓	–	–	–	●	●	●	●	●
			Wet	Metals (total and dissolved)	Flow-weighted water composite, water grab	–	✓	–	–	–	●	●	●	●	●
		Riparian Area Monitoring – Paradise Creek	Dry	Plant communities	% Survival of Plantings % Native Cover % Non-Native Weed Cover % Bare Ground			✓			Will begin after completion of creek restoration. Initial monitoring will likely begin in 2017-2018, depending on date restoration is completed.				
			Dry	Bioassessment (CRAM)	Physical Habitat (pHab)	–	–	✓	–	–	–	●	–	–	●
		Physical Aesthetics Monitoring – Sweetwater and Otay[6]	Dry	Trash Assessment	Visual observations, *in-situ* measurements	–	–	–	✓	–	–	–	●	●	●
			Wet (Post-storm)	Trash Assessment	Visual observations, *in-situ* measurements	–	–	–	✓	–	–	–	●	●	●
		Swimmable Waters Monitoring – Beaches (Otay River)[6]	Dry[2]	FIB	Water grab	–	–	–	–	✓	●	●	●	●	●
			Wet	FIB	Water grab	–	–	–	–	✓	–	–	●	●	●

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Additional Monitoring Programs														
Additional TMDL Monitoring	Shelter Island Yacht Basin Dissolved Copper TMDL – Receiving Water Monitoring	See Regional Board Investigative Order No. No. R9-2011-0036.												
	Shelter Island Yacht Basin Dissolved Copper TMDL – MS4 Outfall Monitoring	Dry	Dissolved Copper	Water grab, visual observations, *in-situ* measurements	✓	✓				●	●	●	●	●
		Wet	Dissolved Copper	Time-weighted or flow-weighted water composite, water grab, visual observations, *in-situ* measurements	✓	✓				●	●	●	●	●
	Shelter Island Shoreline Park Bacteria TMDL	Dry	FIB	Water grab	–	–	–	–	✓	●	●	●	●	●
		Wet	FIB	Water grab	–	–	–	–	✓					

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Water Quality Improvement Plan Monitoring Overview

Monitoring Programs			Weather (Wet or Dry)	Monitoring Elements	Sample Type(s)	Highest or Focused Priority Condition Addressed or Contributed to by Monitoring Program					Permit Schedule[1]				
						Chollas Creek Bacteria/Metals	Airport Metals	Riparian	Physical Aesthetics	Swimmable Waters	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Special Study Monitoring and AB411 Monitoring	Regional Special Study	San Diego Regional Reference Streams and Beaches	Dry	Chemistry, FIB, instantaneous flow (streams only), bioassessment	Water grab, per SWAMP protocols	✓	–	✓	–	✓	●	–	–	–	–
			Wet	Chemistry, FIB, field measurements, flow and precipitation (duration of storm), Toxicity	Pollutograph water grabs	✓	–	✓	–	✓	●	●	TBD	–	–
	WMA Special Study	San Diego Bay Debris Study	Dry	Trash Assessment, pHab	Grab, visual observation	✓	–	✓	✓	✓	TBD	TBD	TBD	TBD	TBD
	Focused Priority Special Study	Pueblo-San Diego Hydrologic Unit: Creek Refuse Assessment Program	Dry	Trash Assessment	Grab, visual Observation	✓	–	✓	✓	✓	●	●	●	●	●
	Highest Priority Special Study	Chollas Jurisdictional Boundary Study	Wet	Metals, Pesticides, FIB	Flow-weighted water composites, water grabs	✓	–	–	–	–	●	●	TBD	TBD	TBD
	Beach Water Quality (AB411)[2]	Beach Water Quality (AB411)[2]	Dry	FIB	Water grab	–	–	–	–	✓	●	●	●	●	●
	Focused Priority Special Study	Riparian Area Special Study	Dry Wet	Metals (selenium)	Water grab	–	–	✓	–	–	●	●	TBD	TBD	TBD

Notes:

AB411 = Assembly Bill 411; BMI = benthic macroinvertebrate; BOD = biological oxygen demand; CRAM = California Rapid Assessment Method; FIB = fecal indicator bacteria; HMP = Hydromodification Monitoring Program; IBI = Index of Biological Integrity; IC/ID = illicit connection and/or illicit discharge; MST = microbial source tracking; NA = not applicable; O&G = oil and grease; PWQC = Priority Water Quality Condition; RHMP = Regional Harbor Monitoring Program; SMC = Southern California Stormwater Monitoring Coalition; SWAMP = Surface Water Ambient Monitoring Program; TBD = to be determined

● Monitoring has been or will be conducted.
– Monitoring will not be conducted
1. SMC participation will be determined each year.
2. The California Assembly Bill 411 (AB411) program monitoring has been conducted for a number of year during the dry season by the County of San Diego Department of Environmental Health will be tracked and incorporated into bacteria-related receiving water assessments. Monitoring under AB411 is not required under Provision D of the Municipal Permit, but bacteria monitoring is required as part of the Bacteria TMDL (Municipal Permit Attachment E.6). AB411 monitoring may be used to augment RP monitoring and will be reviewed as part of the data assessment.
3. Conducted under the Ambient Bay and Lagoon Monitoring (ABLM) Program, as part of Bight '13.
4. If <125 outfalls, 80% must be monitored twice annually.
5. Airport monitoring for metals will be conducted as part of the Industrial General Permit monitoring. Additional constituents are monitored under that program, but only metals is included here because that is the focused priority condition.
6. Monitoring is paired. Receiving Water and MS4 Outfall will be monitored the same day.
7. Provided via Chollas Creek TMDL monitoring.

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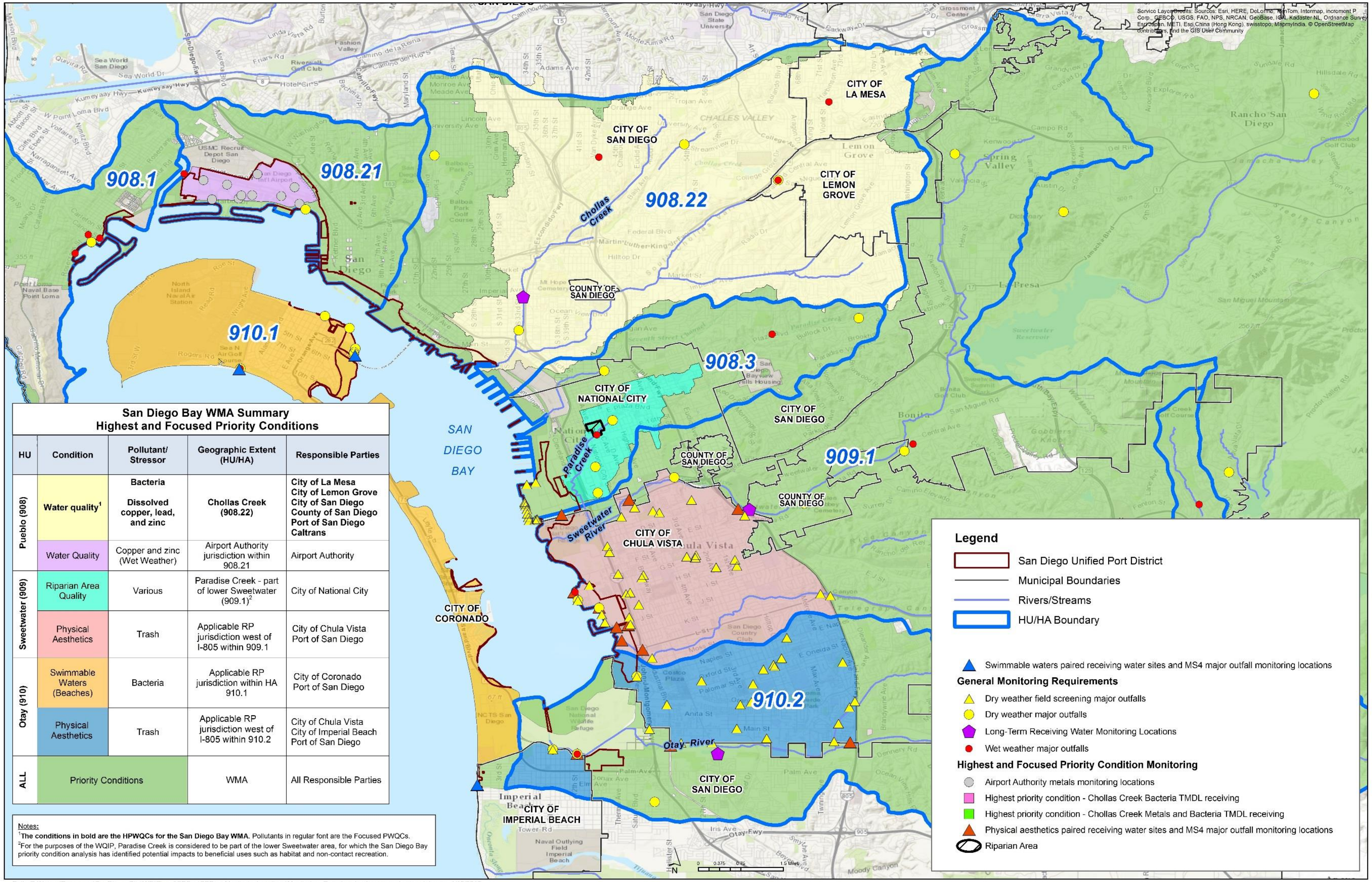

San Diego Bay WMA Summary
Highest and Focused Priority Conditions

HU	Condition	Pollutant/ Stressor	Geographic Extent (HU/HA)	Responsible Parties
Pueblo (908)	**Water quality[1]**	**Bacteria** **Dissolved copper, lead, and zinc**	**Chollas Creek (908.22)**	**City of La Mesa** **City of Lemon Grove** **City of San Diego** **County of San Diego** **Port of San Diego** **Caltrans**
	Water Quality	Copper and zinc (Wet Weather)	Airport Authority jurisdiction within 908.21	Airport Authority
Sweetwater (909)	Riparian Area Quality	Various	Paradise Creek - part of lower Sweetwater (909.1)[2]	City of National City
	Physical Aesthetics	Trash	Applicable RP jurisdiction west of I-805 within 909.1	City of Chula Vista Port of San Diego
Otay (910)	Swimmable Waters (Beaches)	Bacteria	Applicable RP jurisdiction within HA 910.1	City of Coronado Port of San Diego
	Physical Aesthetics	Trash	Applicable RP jurisdiction west of I-805 within 910.2	City of Chula Vista City of Imperial Beach Port of San Diego
ALL	Priority Conditions		WMA	All Responsible Parties

Notes:
[1]**The conditions in bold are the HPWQCs for the San Diego Bay WMA.** Pollutants in regular font are the Focused PWQCs.
[2]For the purposes of the WQIP, Paradise Creek is considered to be part of the lower Sweetwater area, for which the San Diego Bay priority condition analysis has identified potential impacts to beneficial uses such as habitat and non-contact recreation.

Note:
Sediment monitoring sites have not been finalized at this time. See Section 3.1.3 for more details.

Figure K2-1
Comprehensive Map of San Diego Bay WMA Monitoring Program

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K.2.2 General Permit-Required Monitoring

The Municipal Permit includes general monitoring requirements that are not directly related to RPs' selected Highest and Focused Priority Conditions. General Municipal Permit-required monitoring is applicable to all Copermittees, regardless of watershed or effective TMDLs. Where overlap is available, general monitoring requirements may be used to fulfill monitoring elements for Highest and Focused Priority Conditions. Upon completion of the transitional monitoring program, which is being implemented until the Water Quality Improvement Plan is approved by the Regional Board, general monitoring requirements applicable to the San Diego Bay WMA include:

- Long-Term Receiving Water Monitoring;
- Regional Monitoring Program Participation, including:
  - Southern California Stormwater Monitoring Coalition (SMC) Regional Monitoring;
  - Southern California Bight Monitoring (Bight '13); and
  - Hydromodification Regional Monitoring Program;
- Sediment Quality Monitoring; and
- MS4 Outfall Monitoring.

Additional information about each monitoring component is provided in Section K.3.

K.2.3 Highest and Focused Priority Condition Monitoring

Monitoring is designed to answer management questions regarding Highest and Focused Priority Conditions. In addition to general permit-required monitoring, RPs monitor receiving waters and the MS4, where applicable, to provide data for assessment of progress toward the goals selected by RPs. Highest and Focused Priority Conditions include:

- Chollas Creek Metals and Bacteria TMDLs (Highest);
- Airport Metals (Focused);
- Riparian Area (Focused);
- Physical Aesthetics –Trash (Focused); and
- Swimmable Waters – Bacteria (Focused).

Additional information about each monitoring component is provided in Section K.4. and Attachment A1.

K.2.4 Additional Monitoring Program Components: Other TMDLs, Special Studies, and AB411 Monitoring

Additional monitoring programs include TMDL compliance monitoring, per Attachment E of the Municipal Permit, and monitoring selected by RPs to collect data for special studies. Additional monitoring addresses both WMA-specific and regional goals, and includes:

- San Diego Regional Reference Streams and Beaches Studies (Regional);
- San Diego Bay Debris Special Study (WMA);
- Jurisdictional Boundary Special Study for Metals, Pesticides, and Bacteria (WMA);
- Riparian Area Special Study (WMA); and
- San Diego County Beach Water Quality (Assembly Bill [AB]411) Monitoring.

Additional information about each monitoring component is provided in Section 5.

K.3 GENERAL PERMIT-REQUIRED MONITORING

This section provides an overview of general monitoring requirements per Provision D of the Municipal Permit. General permit-required monitoring incorporates receiving water and MS4 monitoring, which are monitoring elements common to all Copermittees under the Municipal Permit and, at the same time, may be watershed and jurisdiction specific. The San Diego Bay WMA RPs are required to implement long-term receiving water monitoring and to participate in certain regional monitoring programs, including, but not limited to, Bight ’13 monitoring. Each Copermittee is also required to monitor MS4 outfalls within its jurisdiction in each WMA. This section includes receiving water monitoring and MS4 monitoring required under the Municipal Permit for the San Diego Bay WMA.

K.3.1 Receiving Water Monitoring

The purpose of the receiving water monitoring program is to characterize trends in the chemical, physical, and biological conditions of a receiving water to determine whether beneficial uses are protected, maintained, or enhanced. This program is designed to meet the requirements set forth in Provision D.1 of the Municipal Permit. Long-term monitoring occurs during both wet and dry conditions for water quality and physical and biological integrity, along with sediment quality monitoring, and is part of the continued participation in a regional monitoring program. The Municipal Permit (Attachment E) also stipulates how TMDL monitoring requirements are to be incorporated into the receiving water monitoring program. Receiving water monitoring comprises several types of data collection activities for the San Diego Bay WMA:

(1) Long-Term Receiving Water Monitoring: includes a broad set of monitoring activities designed to characterize receiving water quality during dry and wet weather over an extended (multi-year) time frame.

(2) Regional Monitoring Participation: includes continuing participation in regional monitoring programs that are applicable to the San Diego Bay WMA, including the Bight ’13 program and SMC Regional Monitoring.

(3) Sediment Quality Monitoring: involves monitoring of sediments from receiving waters, including San Diego Bay, which is named in the state’s Sediment Control Plan for enclosed bays and estuaries.

The monitoring approach for each of these data collection activities is described below.

K.3.1.1 Long-Term Receiving Water Monitoring

Long-term receiving water monitoring tracks the overall health of the receiving water and is designed to answer the following questions:

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

Dry and wet weather receiving water monitoring has been completed during the current Permit term and prior to the current Permit term in the Sweetwater, Otay, and Pueblo hydrologic units (HU). To continue to the long-term data sets and to supply more information that can be used in future reevaluations of priority conditions, monitoring will continue in these three HUs during the next Permit term, as follows:

- Sweetwater HU: at site SR-MLS, per procedures described in Sections K.3.1.1.1 and K.3.1.1.2 and Section A.1.3 of Attachment A1.
- Otay HU: at site OR-TWAS-1, per procedures described in Sections K.3.1.1.1 and K.3.1.1.2 and Section A.1.3 of Attachment A1.
- Pueblo HU: at site-SD8(1) per procedures described in Section K.4.1, Section A1.4 of Attachment A1, and Attachment C.

Figure K3-1 presents the locations of these monitoring stations.

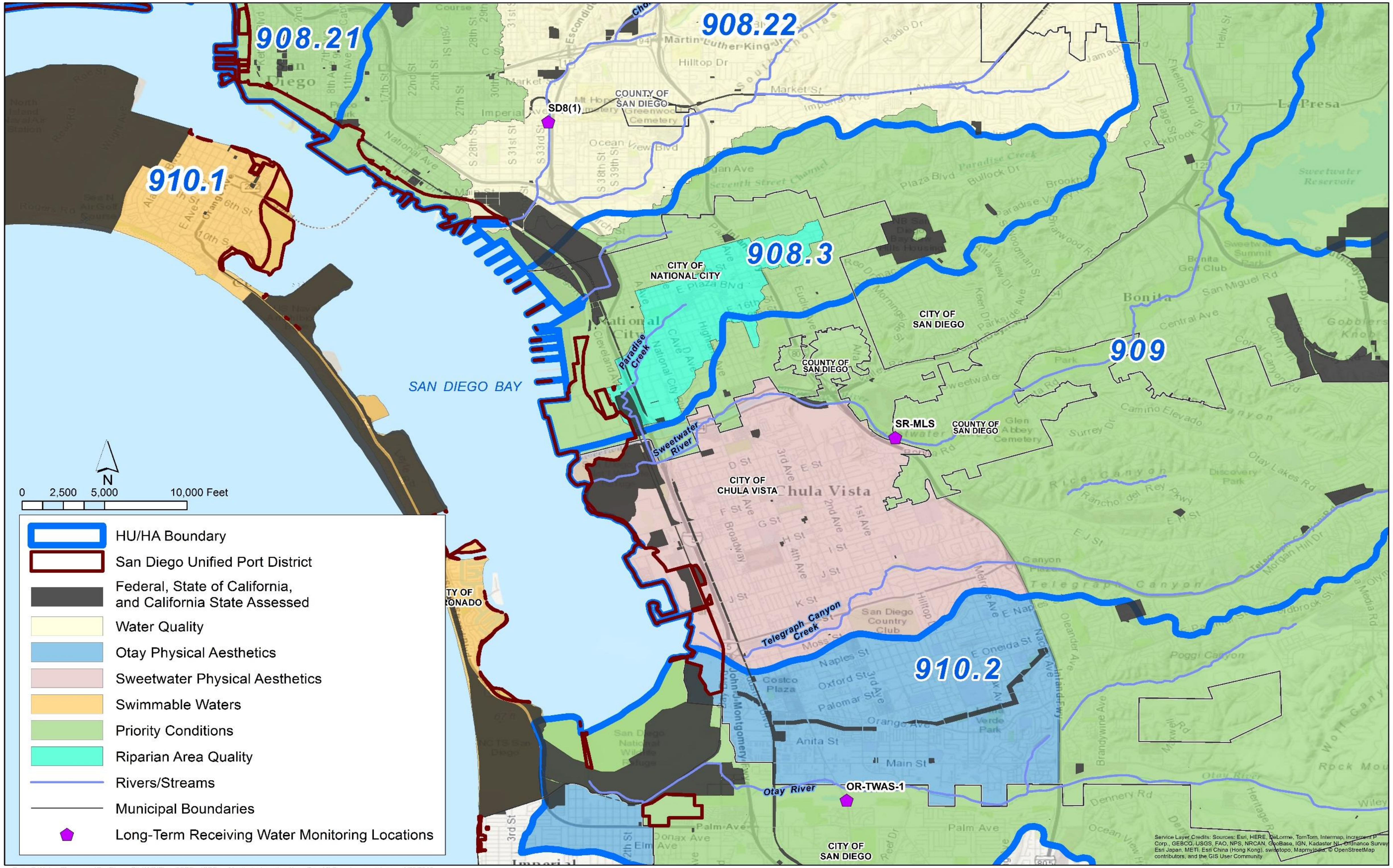

Figure K3-1
Long-Term Receiving Water Monitoring Stations

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K.3.1.1.1 Dry Weather Receiving Water Monitoring (Municipal Permit Provision D.1.c)

Dry weather monitoring per Municipal Permit Provision D.1.c consists of three field events per permit term. The dry weather events are spread throughout one year during the Municipal Permit term to the maximum extent practicable as follows:

- Event 1—During dry season (May 1 through September 30),
- Event 2—During wet season (October 1 through April 30)[2], and
- Event 3—At-large dry weather event.

Dry weather sampling occurs on dry weather days when there is measureable flow at the location. During the wet season, samples are collected after an antecedent dry period of at least 72 hours with less than 0.1 inch of rainfall.

Data collection for each of the three dry weather events includes:

- Field observations (as listed in Municipal Permit Table D-1);
- Field measurements (as listed in Municipal Permit Table D-2);
- Laboratory analytical chemistry (constituents relating to Highest Priority Conditions, Clean Water Act Section 303(d) listings (303(d) list), TMDL Load Reduction Plans, Permit non-storm water action levels [NALs], and constituents listed in Municipal Permit Table D-3); and
- Toxicity testing (chronic testing for three freshwater species for fresh waters and one marine species for salt waters, as listed in Municipal Permit Table D-4).

In addition to water quality monitoring, bioassessment and hydromodification monitoring are also performed at the designated monitoring stations once each during the Municipal Permit term:

- Bioassessment, including benthic macroinvertebrate taxonomy and calculation of Index of Biological Integrity (IBI), algae taxonomy and calculation of IBI, and physical habitat characterization; and
- Hydromodification monitoring, including observations regarding channel characteristics, discharge points, and habitat integrity, photo documentation of erosion or habitat impacts, measurements of erosion, and identification of known or suspected causes of erosion or habitat impacts.

Attachment A details the monitoring methods, including constituent lists and quality assurance practices for long-term receiving water monitoring.

[2] Dry weather sample must be preceded by a ≥72-hour antecedent dry period following a rainfall event of >0.1 inch and must occur after the first wet weather event of the season.

K.3.1.1.2 Wet Weather Receiving Water Monitoring (Municipal Permit Provision D.1.d)

Wet weather monitoring per Municipal Permit Provision D.1.d consists of monitoring three storm events during the wet season (October 1 to April 30). Storms resulting in greater than 0.1 inch of precipitation are targeted for analysis. The storm events during the permit term are spread throughout the wet season to the maximum extent practicable as follows:

- Event 1—First wet weather event of wet season (October 1—April 30);
- Event 2—Event occurring after February 1; and
- Event 3—Additional wet weather event.

Wet weather sampling occurs on wet weather days when there is measureable flow at the location. Samples are to be collected after an antecedent dry period of 72 hours with greater than 0.1 inch of rainfall.

Data collection for each of the three wet weather events includes:

- Field observations, including description of monitoring station, rainfall parameters, field conditions, flow rates, and presence/assessment of trash;
- Field measurements (as listed in Municipal Permit Table D-2)
- Laboratory analytical chemistry (constituents relating to Highest Priority Conditions, 303(d) listings, TMDL Load Reduction Plans, Permit storm water action lists [SALs], and constituents listed in Municipal Permit Table D-3); and
- Toxicity testing (chronic testing for three freshwater species for fresh waters and one marine species for salt waters, as listed in Municipal Permit Table D-4).

During wet weather events, water samples are analyzed for conventional constituents, nutrients, metals, pesticides, bacteria, field parameters, and toxicity, when applicable, and are collected by flow-weighted composite samples. A flow-weighted composite sample consists of a mixture of constant-volume aliquots collected at variable time intervals. The resulting composite represents the average concentration throughout the hydrograph. Chronic toxicity can be collected by a composite sample or a grab sample, as determined by each jurisdiction.

During each wet weather monitoring event, field observations, including presence/absence of trash and station conditions, are recorded consistently with Table D-2 of the Municipal Permit.

For further details on monitoring methods, please refer to Attachment A.

K.3.1.2 Regional Monitoring Participation

Regional monitoring includes several separate studies to evaluate various aspects of receiving water health on a regional scale. The data may be used by RPs to answer the following questions:

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

RPs have and/or will participate in the following regional programs:

- Bight ’13

  The Bight ’13 program is a multi-agency collaborative effort conducted by SCCWRP to assess the ecological condition of the Southern California Bight from a cross-regional perspective. The core program consists of monitoring of sediment chemistry, sediment toxicity, benthic infauna, demersal fish, and epibenthic invertebrates. The goal of the Bight ’13 program is to answer three primary questions:

  – What are the extent and magnitude of direct impact from contaminants?

  – How do the extent and magnitude of the environmental impact vary by habitat?

  – What is the trend in the extent and magnitude of direct impacts from contaminants?

- Regional Harbor Monitoring Program (RHMP)

  The Regional Harbor Monitoring Program (RHMP) was developed by the Port of San Diego, the City of San Diego, the City of Oceanside, and the County of Orange (RHMP Agencies) in response to a July 24, 2003, request by the Regional Board under §13225 of the California Water Code. The RHMP is a comprehensive effort to survey the general water and sediment quality and condition of aquatic life and to determine whether beneficial uses are being protected and attained in Dana Point Harbor, Oceanside Harbor, Mission Bay, and San Diego Bay. The program is composed of a core monitoring program completed every five years and supplemented with focused special studies. The special studies are determined by assessing the chemical, biological, and toxicological results of the core monitoring program. Compliance with the RHMP goals is accomplished in part through participation in the region-wide Bight ’13 monitoring program managed by the Southern California Coastal Water Research Project (SCCWRP).

  Sediment and water quality were monitored in San Diego Bay, Mission Bay, Oceanside Harbor, and Dana Point Harbor. The harbors are partitioned into five strata, composed of freshwater-influenced, shallow, deep, industrial/port, and marina areas. A total of 75 sites were randomly selected among the four harbors, with 15 monitoring stations allotted per stratum. Freshwater-influenced areas in San Diego Bay are located at the mouths of major watersheds, including Sweetwater Channel and Chollas Creek. There were nine freshwater-influenced sites in San Diego Bay during Bight ’13. As described in Section 3.1.3, RHMP sediment monitoring data are used to fulfill part of the Municipal Permit’s sediment monitoring requirements.

- SMC Regional Monitoring

  The Stormwater Monitoring Coalition Stream Survey is a collaborative effort of leading storm water and multiple state, federal, and local regulatory agencies in southern California. In 2009, the SMC began assessing the health of streams in these watersheds by monitoring stream conditions using multiple indicators of ecological health. The initial five-year study documented the condition of perennial wadeable streams in the region and set a baseline for monitoring regional trends.

  The Southern California Stream Survey is designed to generate the data to answer three key management questions:

  (1) What is the condition of streams in southern California?

  (2) What stressors are associated with poor condition?

  (3) Are conditions changing over time?

  In 2015, a new five-year program extended the initial survey to answer key management questions about the impacts of storm water on stream conditions. The objective is to create a comprehensive monitoring design that integrates many elements of the individualized monitoring programs that currently exist within the region. Through re-allocation of Municipal Permit-required monitoring efforts, this survey is intended to provide valuable data about regional conditions in a cost-effective way. This integrated regional monitoring program is designed to be collaborative, so that each individual program can assess its local geography, and then contribute its portion to the whole region to address large-scale management needs and provide answers to the public about the health of southern California’s streams and rivers.

- Hydromodification Regional Monitoring Program

  Copermittees have developed a regional Hydromodification Management Plan (HMP) to address impacts to beneficial uses and stream habitat from increased erosive force caused by an increase in runoff discharge rates and volume from all Priority Development Projects (County of San Diego, 2011). Monitoring consists of channel sediment transport assessments, and continuous flow monitoring of pre-project, post-project, and reference conditions.

K.3.1.3 Sediment Quality Monitoring

Sediment quality monitoring is designed to assess compliance with the sediment quality receiving water limits applicable to enclosed bays and estuaries in accordance with the State Water Board's Water Quality Control Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality (Sediment Control Plan) (State Water Board, 2009). Sediment quality monitoring is performed in compliance with Municipal Permit Provision D.1.e.(2), Sediment Control Plan Section VII.D requires National Pollutant Discharge Elimination System (NPDES) Phase I storm water dischargers to conduct monitoring at least twice per permit term, unless monitoring stations are shown to consistently be unimpacted. Section VII.E provides general guidelines for conducting sediment monitoring, and refers to the specific monitoring parameters and assessments that are required per Sediment Control Plan Section V.

Sediment quality monitoring is performed as part of the Water Quality Improvement Plan in compliance with Municipal Permit Provision D.1.e.(2), which requires preparation of a Sediment Monitoring Plan that satisfies the requirements of the state's Sediment Control Plan, including the following elements:

(1) The elements required under Sections VII.D and VII.E of the Sediment Control Plan,

(2) A Quality Assurance Project Plan (QAPP), and

(3) A schedule for completion of sample collection, analysis, and reporting.

These elements, as well as the details for sediment monitoring methods and protocols, are largely covered in the Sediment Monitoring Plan that was prepared for this purpose by the San Diego Copermittees (Attachment B).

Sediment quality monitoring employs the following general approach to meet the requirements of the Permit:

(1) Conduct initial monitoring within each qualifying water body per the requirements of the state's Sediment Control Plan. These data are used to assess the degree of potential impact at each site using the California Sediment Quality Objective (SQO) multiple-line-of-evidence approach in accordance with the assessment criteria specified in Sediment Control Plan Section V. These scores are derived using multiple metrics from three key lines of evidence: (1) sediment chemistry data, (2) toxicity data, and (3) benthic community data. Sites are then categorized as un-impacted, likely un-impacted, possibly impacted, likely impacted, or clearly impacted.

(2) Confirm and characterize pollutant related impacts for any sites that are considered possibly impacted, likely impacted, or clearly impacted, following an integration of all lines of evidence. In accordance with Sediment Control Plan criteria, the data assessment in this phase is required to determine whether the score(s) indicate potential impacts due to toxic pollutants (e.g., freshwater-related contaminant sources from the MS4), or non-toxic pollutants (e.g., physical habitat, freshwater inundation, legacy contaminants, or other potential factors). This phase is considered the first phase of the level stressor/source identification (SSID) based on existing data. The requirements of this phase are dependent on the site as categorized in the previous phase as follows:

(a) Stations deemed to be possibly, likely, or clearly impacted based on initial monitoring for which the impact or impairment is determined to likely not be caused or contributed to by MS4 discharges are monitored once more in the current Municipal Permit term. Follow-up monitoring is required to verify the findings from the first round of monitoring.

(b) If results from the follow-up monitoring are consistent (possibly impacted), or un-impacted, no additional follow-up is required during the current Municipal Permit term.

(c) If the second round of sampling reclassifies the station as likely or clearly impacted, an additional follow-up investigation may be needed or suspended pending future routine SQO monitoring. In this circumstance, results of the analytical assessments are discussed with the Regional Board staff to determine whether/where any SSID studies should be undertaken, and to identify major elements of the approach for any identified studies. Prior to additional investigation, a site-specific Sediment Assessment Work Plan is prepared that outlines specific steps and methodologies to be taken.

(d) Stations deemed by assessment to be likely or clearly impacted by MS4 discharges require additional follow-up investigation and this is deemed the first phase of SSID. A site-specific Sediment Assessment Work Plan is prepared that outlines specific steps and methodologies to be taken. Per the Sediment Control Plan, SSID comprises three steps: (1) confirmation and characterization of pollutant impacts, (2) pollutant identification, and (3) source identification and management actions.

(3) In the annual Sediment Monitoring Report, describe the planned follow-up monitoring, including any planned SSID studies, and revisions the Sediment Monitoring Plan, accordingly.

During the transitional monitoring phase (2013-2015), the RHMP, in coordination with the Bight ’13 program, may satisfy all or a portion of the requirements of the state's Sediment Control Plan (adopted in 2009) for monitoring of sediments in San Diego Bay.

There were a total of 60 sediment sampling sites monitored in San Diego Bay as part of the RHMP. Of those, nine were designated as freshwater influenced locations; eight of them were in or near the Sweetwater Channel, and one site was near a storm in the Laurel Hawthorn embayment. According to Municipal Permit Provision D.1.e(2), sediment monitoring is required to assess compliance with sediment quality receiving water limits applicable to MS4 discharges to enclosed bays and estuaries. Therefore, of the RHMP sites monitored, the freshwater-influenced sites are considered most applicable to evaluate or be representative of MS4 discharges. Following completion of RHMP data assessment and reporting, the RPs are to determine whether follow-up monitoring is needed for Bight ’13 freshwater-influenced sites or whether additional monitoring locations are needed to improve representation of other areas in San Diego Bay that are influenced by freshwater. For example, the Otay River is a major source of freshwater to south San Diego Bay, but has not been monitored under the regional Bight ’08 or Bight ’13 programs. [3]

The analysis is in progress and is focused on the most recent Bight ’13/RHMP 2013 "freshwater-influenced" monitoring stations within areas from the Chollas Creek and Sweetwater watersheds in San Diego Bay in 2013 through the RHMP. Additional sediment monitoring data are also available for eight locations in or near Chollas Creek or Sweetwater Channel, and one site located near a stormdrain in the Laurel Hawthorne embayment. These data were collected from prior monitoring programs, including the Southern California Bight Monitoring (2008) (Bight ’08)/RHMP efforts in 2008. The RHMP/Bight ’08 data are to be used in conjunction with the Bight ’13/RHMP 2013 data to assess consistency both temporally and spatially for the same “freshwater-influenced” areas, when possible. Discussions with Regional Board staff are to be held to provide the results of the analytical assessments; determine whether SSID studies should be undertaken, and identify major elements of the approach for any identified studies.

The Sediment Monitoring Plan (Attachment B) is considered to be the template from which modifications are made as the assessment and analytical steps described above are completed. Additions include specifications for monitoring stations and methods reflecting the results of the analytical assessments.

Final quality assurance and quality control (QA/QC) and analysis of the data collected for RHMP in 2013 are currently underway, and thus the data results are not currently available for decision-making purposes. A draft RHMP report containing these results is due to be submitted to the RHMP agencies in the summer of 2015. The schedule of implementation shown in the Sediment Monitoring Plan (Attachment B) reflects the pending data and is to be amended upon completion of the analytical assessments described above to include the planned follow-up monitoring.

[3] Additional, more intensive investigative and TMDL-related efforts are ongoing at the mouth of Chollas Creek, one of the major sources of freshwater in San Diego Bay. Additional monitoring of this site through the MS4 Program may be duplicative and thus not warranted depending on the timing of future activities.

K.3.2 MS4 Outfall Monitoring

Section K.3.1 described Municipal Permit requirements for long-term receiving water monitoring. This section describes Municipal Permit requirements for MS4 outfall monitoring. The purpose of the MS4 outfall monitoring program is to evaluate the potential contribution from MS4 discharges to the receiving water quality. This program is designed to meet requirements set forth in Provision D.2 of the Municipal Permit. The MS4 outfall monitoring program has both dry and wet weather monitoring components.

The outfall monitoring program seeks to answer the question:

- Do non-storm water or storm water discharges from the MS4 cause or contribute to receiving water quality problems?

The MS4 Outfall Discharge Monitoring component involves the following types of data collection activities for the San Diego Bay WMA:

- Dry Weather MS4 Outfall Field Screening: involves inspection of major outfalls during dry weather conditions to identify and prioritize persistently flowing outfalls.
- MS4 Outfall Dry Weather Monitoring: monitors up to five persistently flowing outfalls semi-annually by each jurisdiction during dry weather.
- MS4 Outfall Wet Weather Monitoring: monitors one wet weather MS4 outfall discharge monitoring station that is representative of storm water discharges from land uses in the San Diego Bay WMA for each RP annually during the wet season.

The monitoring approach for each of these data collection activities is described below.

Table K3-1 provides the number of major outfalls to be monitored under each component of the MS4 Outfall Monitoring Program by RP. Additional information is available in Attachment A.

Table K3-1
Number of Major MS4 Outfalls per Jurisdiction

Jurisdiction	Number of Outfalls		
	Total Major Outfalls for Dry Weather Field Screening	Dry Weather Monitoring (Persistently Flowing Outfalls)[3]	Wet Weather Monitoring
Airport Authority[4]	0[2]	0(0)	0
Chula Vista	184[1]	5(5)	1
Coronado	7[2]	5(1)	1
Imperial Beach	2[2]	2(2)	1
La Mesa	3[2]	0(0)[5]	1
Lemon Grove	4[2]	1(1)	1
National City	21[2]	5(5)	1
City of San Diego	94[6]	5(5)	1
County of San Diego	57[2]	5(5)	1
Port of San Diego	65[2]	5(2)	1

Notes:

1. For Responsible Parties with fewer than 500 but more than 125 major MS4 outfalls in the watershed, 100% of major outfalls must be screened once per year.
2. For RPs with fewer than 125 major outfalls in the WMA, 80% of total major outfalls presented in the table must be screened twice per year.
3. Parenthesis indicates the number of persistent flowing outfalls monitored under this program. Jurisdictions with less than five persistently flowing outfalls may still monitor five outfalls during dry weather for additional data collection.
4. The Airport Authority has two major outfalls that are tidally influenced and cannot be safely screened or monitored. The nearest safe upstream access points will be screened/monitored as a proxy.
5. No persistently flowing outfalls have been identified within La Mesa's jurisdiction within the San Diego Bay WMA.
6. The City of San Diego has 502 outfalls within the City jurisdiction. The City of San Diego in accordance with D.2.a(2).(a).(iv) is required to screen 500 sites City wide once per year. The City is not required to screen 500 sites within each watershed.

K.3.2.1 Dry Weather MS4 Outfall Field Screening

The purpose of the MS4 Outfall Dry Weather Monitoring Program is to evaluate the potential contribution from MS4 discharges to receiving water quality during dry weather conditions and to effectively eliminate non-storm water discharges. The dry weather MS4 outfall monitoring component has two phases. For the first phase, each RP performs a field screening of a certain number of outfalls, based on the total number of outfalls in its jurisdiction. Using this outfall review, the RPs prioritize the persistently flowing outfalls on the basis of their potential to impact receiving water quality. For the second phase, the highest priority dry weather MS4 outfalls are then monitored, using more in-depth methods than those used in the field screening program.

Dry Weather Field Screening

Field screening consists of visual monitoring of all MS4 outfalls to identify and eliminate sources of persistently flowing non-storm water discharges. Dry weather MS4 outfall discharge field screening is designed to answer the following questions:

- Which non-storm water discharges are transient and which are persistent?
- Which discharges should be investigated as potential illicit connection/illicit discharges?

Each RP continues to perform a field screening of a certain number of outfalls on an annual basis to maintain an up-to-date inventory of persistently flow outfalls and to initiate follow-up IC/ID investigations to identify and possibly mitigate the source(s). The frequency of field screening varies from once to twice per year on a jurisdictional basis and is dependent on the number of major outfalls.

The frequency of field screening is determined on a jurisdictional basis and is dependent on the number of major outfalls. Provision D.2.b(1) of the Municipal Permit outlines three categories as the basis for frequency, as described below:

- For 0-125 major outfalls, 80 percent of major outfalls 2 times per year
- For 125-500 major outfalls, all major outfalls 1 time per year
- For 500+ major outfalls, at least 500 major outfalls 1 time per year

Field screening activities are conducted during dry weather with an antecedent dry period of at least 72 hours with less than 0.1 inch of rainfall. Field observations include flow condition (pooled, ponded, flowing, or no flow), an estimate of flow, characteristics of flow and water, likely source(s), the presence of trash, or evidence or signs of illicit connections or illegal dumping. Follow-up investigations are employed on the basis of jurisdictional illicit connection and/or illicit discharge (IC/ID) programs.

The dry weather outfall screening involves two sets of activities:

- Conduct field inspections, and
- Identify/prioritize persistent non-storm water discharges.

Field Inspections

Based on the jurisdictional inventory of major outfalls, each RP may inspect up to 500 outfalls annually within its jurisdiction, and 80 percent of major outfalls in the San Diego Bay WMA twice a year.

Inspections are performed during dry weather conditions (defined as having an antecedent dry period of at least 72 hours following any storm event producing measurable rainfall greater than 0.1 inch). Visual observations (as listed in Municipal Permit Table D-5) are recorded during inspections.

Identification/Prioritization of Persistent Discharges

Persistent discharges are defined as those with evidence of flow present during three consecutive dry weather inspections.

Persistently flowing discharges are assigned a priority "according to potential threat to receiving water quality" (per Municipal Permit Provision D.4.b.(1)(c)) based on the following criteria:

- Persistent flow (defined as evidence of flow in each of three most recent inspections);
- Representative of discharges to Highest or Focused Priority Condition receiving waters;
- Connectivity/proximity to receiving water;
- Representativeness of urban land uses (commercial, industrial, residential, mixed use); and
- Prior water quality data (especially if NALs are exceeded.

The prioritized list of persistently flowing outfalls is maintained and adjusted as needed on the basis of subsequent inspections and on the results of the dry weather outfall monitoring as described below.

K.3.2.2 MS4 Outfall Dry Weather Monitoring

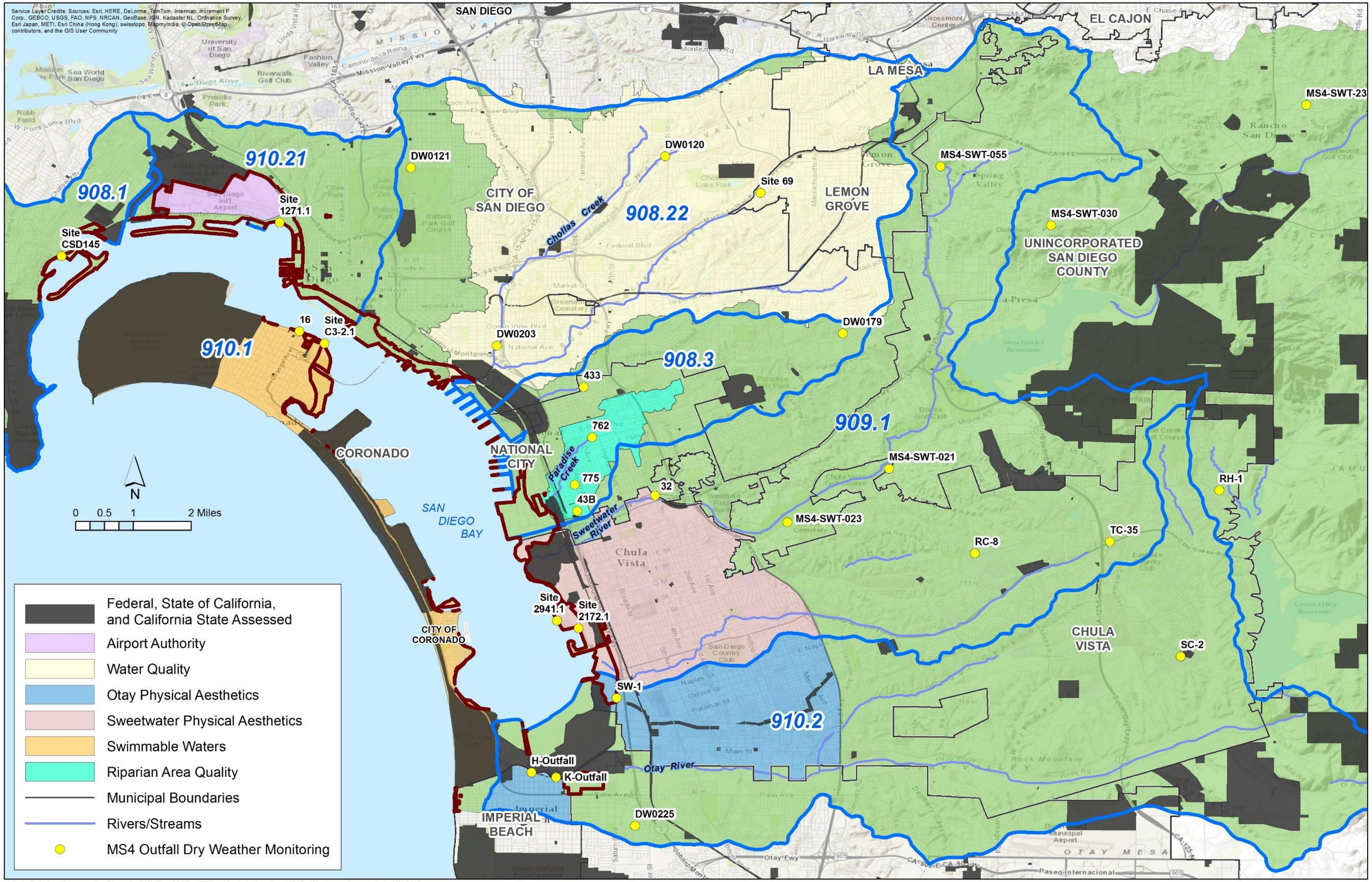
Each jurisdiction ranked its outfalls independently on the basis of its Highest or Focused Priority Conditions, pollutant-generating activities (PGAs), and available resources. RPs considered the following factors to prioritize persistently flowing outfalls:

- Potential to contribute to a Highest or Focused Priority Condition,
- Historical monitoring or inspection data,
- Controllability,
- Surrounding land uses/potential sources, and
- Flow rate.

Up to five major outfalls are selected from the prioritized lists of persistent non-storm water discharges generated by each jurisdiction for major outfalls within the San Diego Bay WMA. Where a jurisdiction identifies fewer than five persistently flowing dry weather stations, all of the persistently flowing stations are monitored. Sites to be monitored during dry weather are mapped in Figure K3-2.

Using this prioritized list, Participating Parties focus resources on abating identified sources to mitigate flow at the highest priority locations. Monitoring is performed semi-annually and consists of the following elements:

- Field observations,
- Field measurements, and
- Laboratory analytical chemistry.



Note:
No outfalls in the City of La Mesa have persistent flow.
Only 2 of the Ports Outfalls are persistent, but five are monitored.

Figure K3-2
MS4 Outfall Dry Weather (Persistent) Monitoring Stations

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K.3.2.3 MS4 Outfall Wet Weather Monitoring

The purpose of this program is to identify pollutants in storm water discharges from the MS4s, guide pollutant source identification efforts, and track progress in achieving the Water Quality Improvement Plan goals. The RPs' locations for the wet weather MS4 outfall discharge monitoring component are chosen to be representative of the residential, commercial, industrial, and mixed-use land uses within the San Diego Bay WMA. These locations are monitored during one storm event annually. The wet weather MS4 outfall discharge monitoring is designed to answer the following questions:

- Do wet weather discharge concentrations at MS4 outfalls meet Municipal Permit action levels?
- What is the relative contribution of MS4 outfalls to priority water quality conditions during wet weather?
- How do representative MS4 outfalls discharge concentrations, loads, and flows change over time?

A total of 10 outfalls are monitored once per year during a storm event with greater than 0.1 inch of rainfall. During each event, observational and hydrologic data are recorded, including duration of the storm, rainfall estimates, and estimated or measured flow rates and volumes. Grab samples are collected to analyze for pH, temperature, specific conductivity, dissolved oxygen, turbidity, hardness, and indicator bacteria. A composite sample must be collected and analyzed for constituents contributing to the Highest or Focused Priority Conditions, 303(d) list impairments, TMDLs, and SALs. When historical data demonstrate or justify that analysis of a constituent is not necessary for a particular waterbody or outfall, then it will be removed from the constituent list.

One monitoring event per year is performed during the wet season (October 1–April 30). The following monitoring elements will be included for each site:

- Field observations,
- Field measurements, and
- Laboratory analytical chemistry.

Wet weather MS4 outfall monitoring stations are selected that are representative of storm water discharges from land uses in the San Diego Bay WMA, including at least one wet weather MS4 outfall discharge monitoring station for each RP within the WMA. Sites to be monitored during wet weather are mapped in Figure K3-3.

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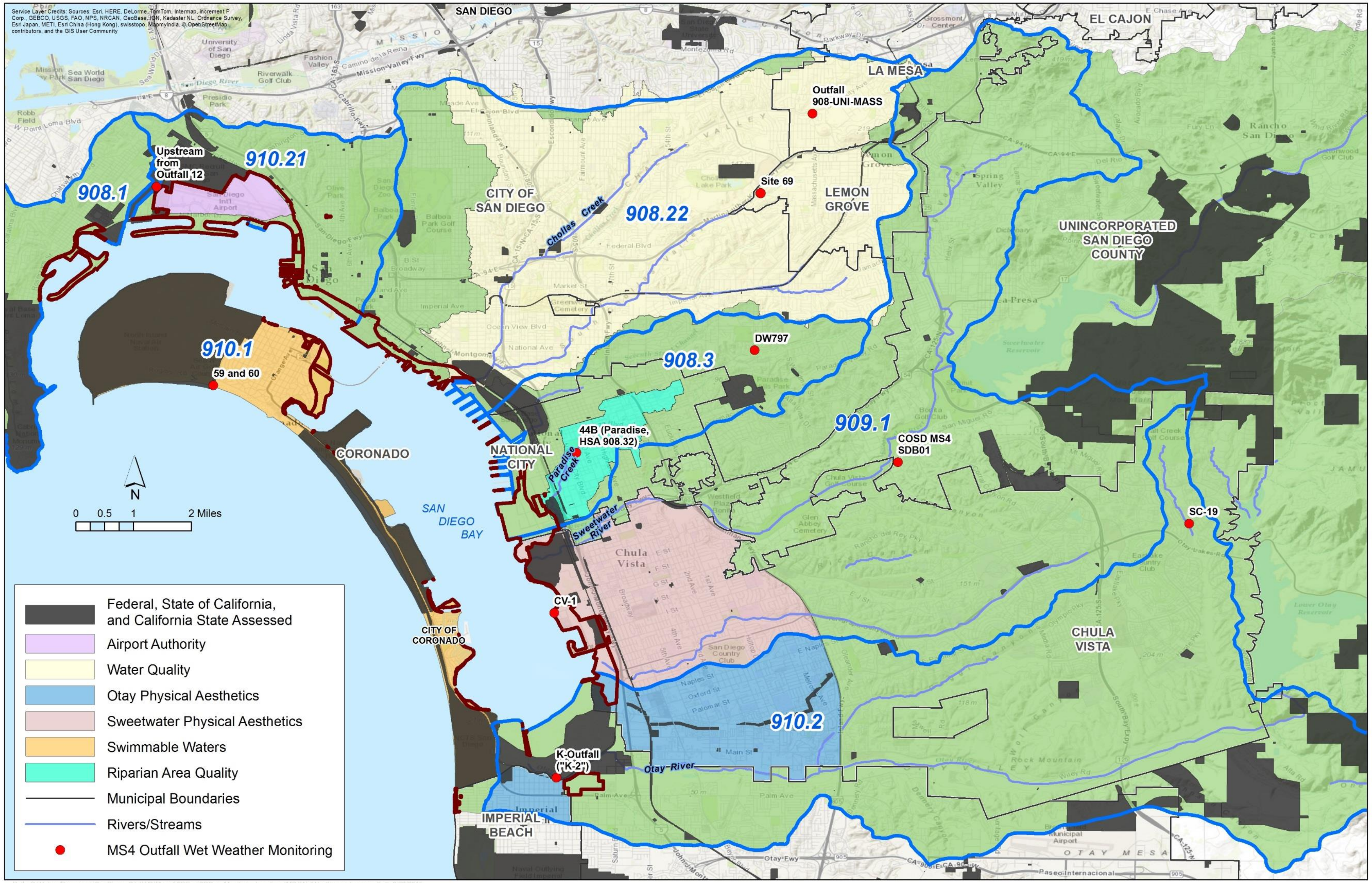

Note:
Outfalls 59 and 60 are co-located in the same headwall.

Figure K3-3
MS4 Outfalls Wet Weather Discharge Monitoring Stations

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K.4 HIGHEST AND FOCUSED PRIORITY CONDITION-SPECIFIC MONITORING

Receiving water monitoring is planned to address Highest and Focused Priority Conditions in the following areas:

- Water quality monitoring for the Highest Priority Condition in accordance with the Chollas Creek TMDLs for metals and bacteria;
- Monitoring for metals at the San Diego International Airport;
- Monitoring to characterize riparian area quality in Paradise Creek, via the California Rapid Assessment Method (CRAM);
- Trash monitoring for physical aesthetics in the Sweetwater and Otay HUs; and
- Bacteria monitoring of swimmable waters in Otay HU.

The monitoring approach for each of these Highest and Focused Priority Conditions is described below.

K.4.1 Chollas Creek Metals and Bacteria TMDLs

The Chollas Creek Metals TMDL is intended to identify and reduce dissolved copper, lead, and zinc in Chollas Creek. The Bacteria TMDL is intended to address levels of indicator bacteria in Chollas Creek. Final TMDL compliance requirements of both TMDLs are intended to be protective of beneficial uses in Chollas Creek. Water quality composite samples are collected for dissolved metals during wet weather at the Chollas Creek mass loading stations (MLSs). Water quality grab samples are collected for indicator bacteria during wet and dry weather at the Chollas Creek MLSs and one tidal location. TMDL receiving water and major outfall monitoring locations are mapped in Figure K4-1. Dry weather monitoring for metals has also been completed in Chollas Creek as part of the Regional Monitoring Program.

K.4.1.1 Chollas Bacteria TMDL Receiving Water Monitoring

Dry weather bacteria monitoring occurs weekly during the dry season (April 1 through September 30) and monthly during the wet season at the Chollas Creek MLSs and one tidal location, provided in Table K4-1. Wet weather monitoring is conducted at the Chollas Creek MLSs and one tidal location during up to three storm events of each wet season.

Additional information is available in the Chollas Creek TMDL Monitoring Plan (Attachment C).

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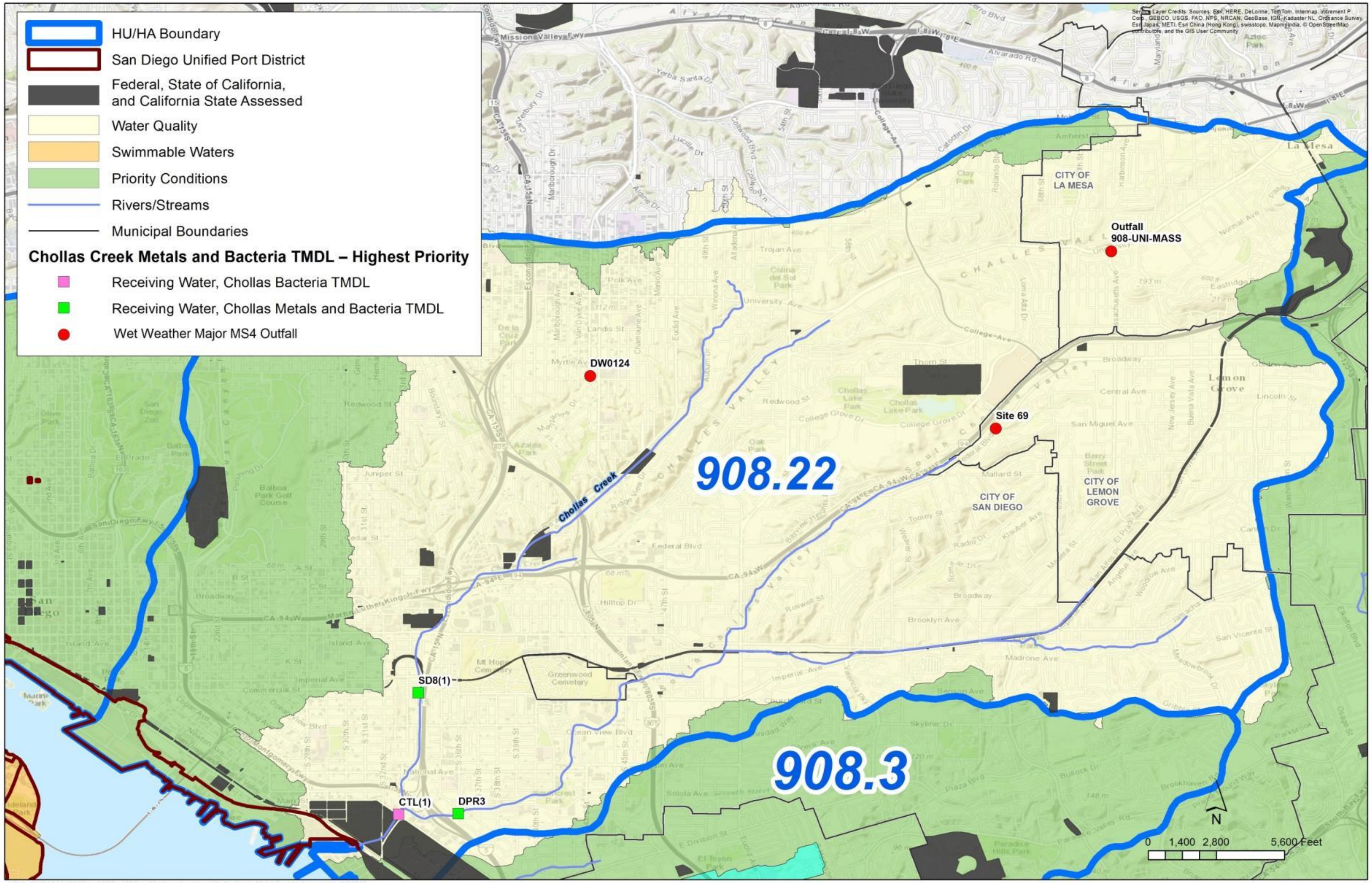

Figure K4-1
Chollas Creek TMDL Monitoring Locations

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Table K4-1
Bacteria TMDL Receiving Water Monitoring Stations

Station Name	Station Type	Waterbody	HU	Latitude	Longitude
SD8(1)	North Chollas Creek MLS	Chollas Creek	Pueblo (908)	32.70493	-117.12132
Z STREET	South Chollas Creek MLS	Chollas Creek	Pueblo (908)	32.692992	-117.109573
CTL(1)	Chollas Tidal	Chollas Creek	Pueblo (908)	32.69120	-117.12354

K.4.1.2 Chollas Metals TMDL Receiving Water Monitoring

Chollas Metals TMDL monitoring is conducted annually during wet weather at the Chollas Creek MLSs. Flow-weighted composite samples are collected for copper, lead, and zinc during three wet weather events each year at the Chollas Creek MLS stations provided in Table K4-2.

Table K4-2
Chollas Creek Metals TMDL Receiving Water Monitoring Stations

Station Name	Station Type	Waterbody	HU	Latitude	Longitude
SD8(1)	North Chollas Creek MLS	Chollas Creek	Pueblo (908)	32.70493	-117.12132
Z STREET	South Chollas Creek MLS	Chollas Creek	Pueblo (908)	32.692992	-117.109573

Additional Information is available in the Chollas Creek TMDL Monitoring Plan (Attachment C). Dry weather monitoring has also been completed at site SD8(1) as part of the Regional Monitoring Program. Site SD8(1) is located just upstream of site SD8(1). Three samples have been collected and analyzed for metals during the current Permit term. See the 2015 Transitional Receiving Water Monitoring Work Plan for details.

K.4.1.3 Outfall Monitoring

The Chollas Creek Bacteria TMDL does not require outfall monitoring at this time. The Chollas Creek Metals TMDL requires outfall monitoring.

Per Municipal Permit Attachment E.4:

> *"The Responsible Copermittees (City of La Mesa, City of Lemon Grove, City of San Diego, County of San Diego, San Diego Unified Port District) must monitor the effluent of the MS4 outfalls discharging to Chollas Creek for dissolved copper, lead, and zinc, and calculate or estimate the monthly and annual…loads, in accordance with the requirements of Provisions D.2, D.4.b.(1), and D.4.b.(2) of this Order.*
>
> *…dry and wet weather discharge concentrations may be calculated based on a flow-weighted average across all major MS4 outfalls along a water body segment or within a jurisdiction if samples are collected within a similar time period."*

Time-weighted composite samples are collected for copper, lead, and zinc during one wet weather event annually at the major outfall stations provided in Table K4-3.

Table K4-3
Chollas Creek Metals TMDL Major Outfall Monitoring Stations

Jurisdiction[1]	Station Name	HA or HSA	Latitude	Longitude
City of La Mesa	Outfall 908-UNI-MASS	908.22	32.754663	-117.043269
City of Lemon Grove	Site 69	908.22	32.7347	-117.05626
City of San Diego	DW0124	908.22	32.740608	-117.101952

Notes:
HA = Hydrologic Area; HSA = Hydrologic Sub-Area; TBD = to be determined
1. The Port and the County of San Diego do not have any major MS4 outfalls in the Chollas Creek HSA.

Additional Information is available in the Chollas Creek TMDL Monitoring Plan (Attachment C).

K.4.2 Airport Authority Metals Monitoring

Monitoring at the Airport is performed under a monitoring program that was designed to simultaneously comply with both the Industrial general permit and the Municipal Permit. Metals have been and continue to be analyzed as part of the monitoring suite. Prior to July 2015, nine sites were monitored during two storm events each year. However, recent changes to the Industrial General Permit that take effect after July 2015 require that four storm events are to be monitored: two between July and December, and two between January and June. The current sampling site locations are being reevaluated, and final site selection has not yet been completed. The current sampling site locations are presented in Figure K4-2. Additional information is available in Attachment A.

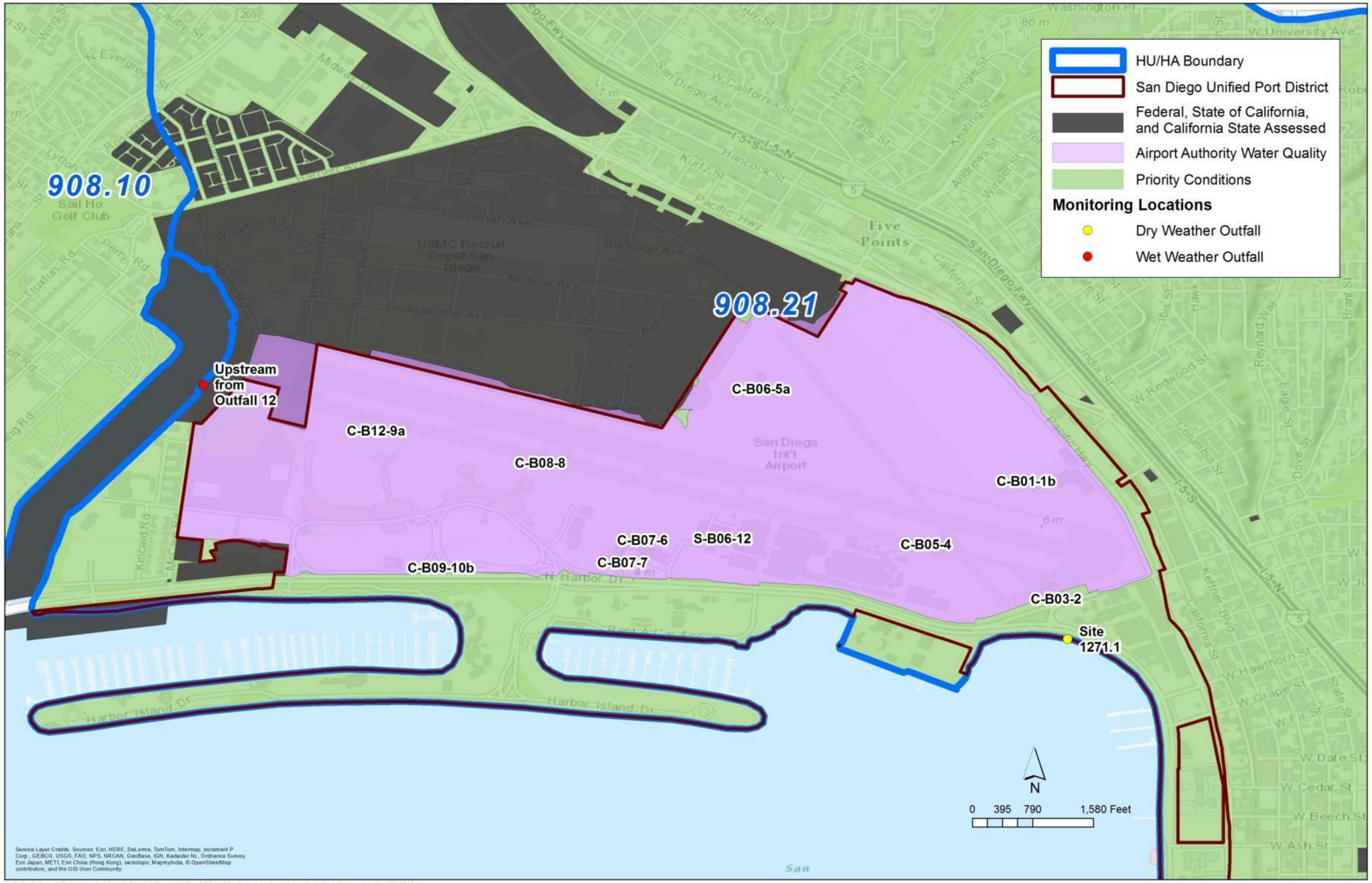

Figure K4-2
Airport Authority Monitoring Locations

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K.4.3 Paradise Creek – Riparian Area Quality

Riparian area monitoring is performed by the City of National City along the reach of Paradise Creek within Kimball Park. Percent survival of plantings, percent minimum native cover, percent non-native weed cover, and percent bare ground will all be monitored in this reach of Paradise Creek for three years after completion of the project, as specified in resource agency permits. The Wetland and Riparian Habitat Restoration, Maintenance, and Monitoring Plan (Attachment G) provides more detail on this monitoring. One additional round of visual monitoring, following the visual monitoring procedure described in Attachment G, per year will also be completed in year four and in year five following restoration. The CRAM will also be used to assess riparian habitat before and after creek restoration in Paradise Creek. A map of the monitoring location is presented in Figure K4-3.

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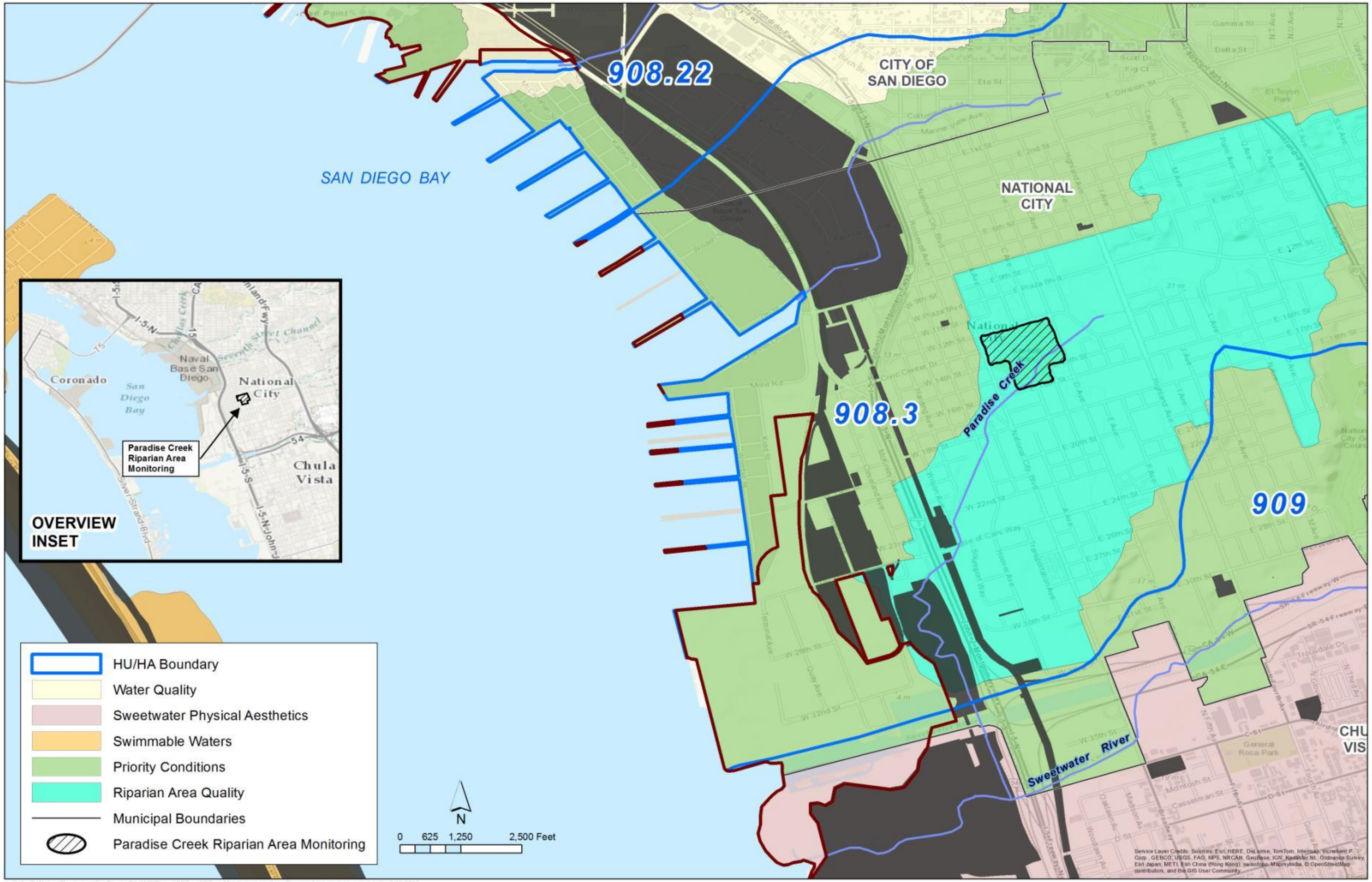

Figure K4-3
Paradise Creek – Riparian Area Monitoring Location

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K.4.4 Physical Aesthetics – Sweetwater and Otay Rivers

Physical aesthetics is a Focused Priority Condition in the Sweetwater and Otay HUs. Because physical aesthetics monitoring and Focused Priority Condition monitoring are similar in nature, Focused Priority Condition monitoring programs for both HUs are covered in this section. Nine sites are monitored for trash in the Sweetwater HU and three sites are monitored for trash in the Otay HU. Monitoring is conducted during two dry weather events (one dry season [May to September], one wet season [October to April]) and one wet weather event [event within three days following a storm event with at least 0.2 inch of precipitation]) annually.

Table K4-4 presents the RP monitoring approach, frequency, and timing of physical aesthetics monitoring for the San Diego Bay WMA. Additional details are available in Attachment A. Figure K4-4 presents the locations of the monitoring sites.

Table K4-4
Physical Aesthetics (Trash) Monitoring

	Wet Weather Monitoring	Dry Weather Monitoring, Dry Season	Dry Weather Monitoring, Wet Season
Monitoring Approach	• Inspect predetermined transect of 2-25 feet (standard area) from major outfall MS4 sites. • Assess major outfall MS4 site when assessing receiving water	• Inspect predetermined transect of 2-25 feet (standard area) away from major outfall MS4 sites. • Assess major outfall MS4 site when assessing receiving water	• Perform MS4 inspections at 12 locations. • Inspect predetermined transect of 2-25 feet (standard area) away from major outfall MS4 sites. • Assess major outfall MS4 site when assessing receiving water
Frequency (Number of Monitoring Events)	• Annually inspect after one wet weather event during wet season	• Annual inspection	• Annual inspection
Timing of monitoring	• Sample within 72 hours of a storm	• During dry season (May 1 – September 30)	• During dry periods, 72 hours or more after storm event

Trash assessments are conducted visually using standardized field sheets. Assessments are included with wet or dry weather receiving water monitoring events for receiving water and major MS4 outfalls. The monitoring locations are receiving waters within 2 to 25 feet of an MS4 outfall. Thus, the site is evaluated as a receiving water/MS4 outfall monitoring location.

Many third-party groups, including San Diego Coastkeeper, I Love a Clean San Diego (ILACSD), and other volunteer agencies, conduct cleanup events and trash assessments in the San Diego Bay WMA. Information collected from these programs, where applicable and collected in accordance with a quality assurance plan, may be used to augment data collected by the RPs.

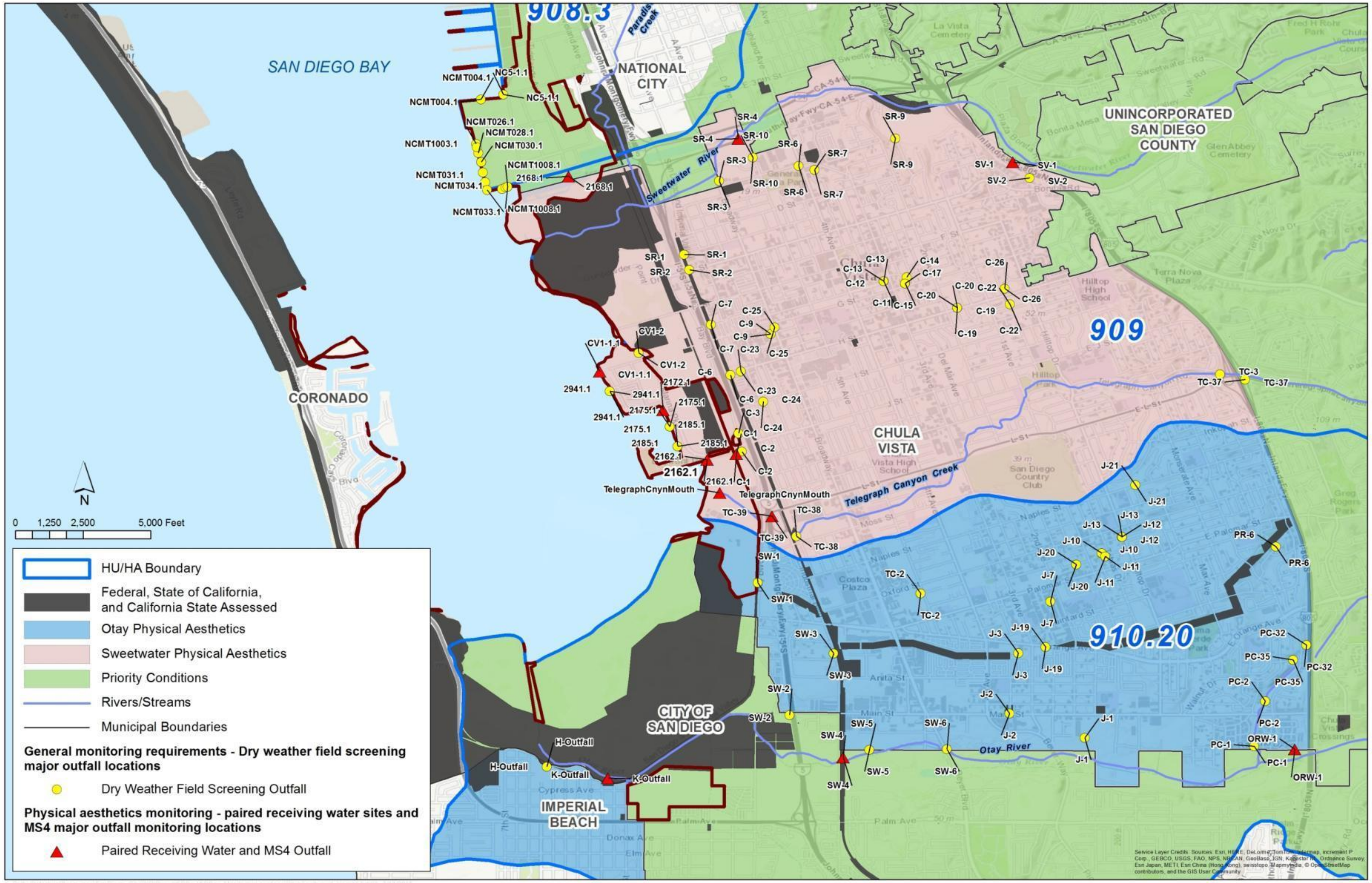

Figure K4-4
Physical Aesthetics – Sweetwater and Otay Monitoring Locations

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K.4.5 Otay Hydrologic Unit – Swimmable Waters

The following sites are monitored in HA 910.1 for bacteria indicators:

- One site is bay side: Tidelands Park (Port), and
- One site is ocean side: North Beach (Coronado).

Table K4-5 presents the RP monitoring approach, frequency, and timing of swimmable waters receiving water monitoring for the San Diego Bay WMA, including data to be collected by the RPs in this HA.

Table K4-5
Swimmable Waters Monitoring Summary

	Receiving Water Wet Weather Monitoring	Receiving Water Dry Season, Dry Weather Monitoring	Receiving Water Wet weather season, Dry Weather Monitoring	MS4 Monitoring
Monitoring Approach	Monitor at Tidelands Park and North Beach sites	• Tidelands Park[1]: Current San Diego County Department of Environmental Health (DEH) sites. (No additional monitoring to be done by RPs at these sites during this period) • North Beach: Past DEH site and City of Coronado's current transitional wet and dry monitoring location and dry weather MS4 major outfall monitoring location	• Expand DEH's dry weather monitoring to occur during the wet weather season. • Monitoring at Tidelands Park and North Beach sites[2] •	• Paired Sampling: Perform MS4 monitoring at all beach sites at same time as monitoring receiving water quality • Sample three wet weather events during wet season at Tidelands Park in conjunction with receiving water, if feasible
Frequency (Number of Monitoring Events)	Annually sample three wet weather events during wet season at Tidelands Park and North Beach sites	• Tidelands Park site: Weekly • North Beach: Past DEH site and City of Coronado's current transitional wet and dry monitoring location and dry weather MS4 major outfall monitoring location	• Monthly at Tidelands Park and North Beach sites[2] (November 1 – March 31)	Inspect MS4 monthly, year round

Table K4-5 (continued)
Swimmable Waters Monitoring Summary

	Receiving Water Wet Weather Monitoring	Receiving Water Dry Season, Dry Weather Monitoring	Receiving Water Wet weather season, Dry Weather Monitoring	MS4 Monitoring
Timing of monitoring	Sample within 72 hours of a storm (consistent with Bacteria I TMDL[4])	During dry weather season (April 1 – October 31)	During dry periods, 72 hours or more after storm event	Take sample at MS4 if there is flow/discharge

Notes:
1. The Pacific shoreline of the Coronado HA 910.1 already has an established monitoring plan to assess the receiving water conditions through the South Bay Ocean Outfall Waste Discharge Requirements in Order R9-2014-0071 for the City of San Diego and Order R9-2014-0009 for the International Boundary and Water Commission. These permits establish a joint receiving water monitoring program for the South Bay Ocean Outfall and include weekly surf zone bacteria monitoring at 3 locations along the Coronado HA 910.1. These locations include S12 Carnation Ave (Camp Surf), S8 Silver Strand State Beach, and S9 Avenida del Sol (Hotel del Coronado). In addition, the County of San Diego Department of Environmental Health performs AB411 beach water quality monitoring throughout the year for public health along the Pacific shoreline of the Coronado HA 910.1. The existing beach water quality monitoring is sufficient to assess swimmable waters along the Pacific shoreline of the Coronado HA 910.1 and the San Diego Bay WMA Copermittees are to utilize these data for the Water Quality Improvement Plan Monitoring and Assessment Annual Report.
2. South Bay Ocean Outfall Sites: Weekly surf zone bacteria monitoring at three locations along the Coronado HSA 910.1. These locations include S12 Carnation Ave (Camp Surf), S8 Silver Strand State Beach, and S9 Avenida del Sol (Hotel del Coronado).

RPs utilize existing monitoring samples conducted under the AB411 program to augment sample collection. The existing beach water quality monitoring data are sufficient and are to be used to assess swimmable waters along the Pacific shoreline of the Coronado HSA 910.1. The San Diego Bay RPs are to utilize the data, as well as additional data collected, at the existing monitoring locations for the annual Water Quality Improvement Plan Monitoring and Assessment Report.

The Pacific Ocean shoreline of the Coronado HA 910.1 already has an established monitoring plan to assess the receiving water conditions through the South Bay Ocean Outfall Waste Discharge Requirements in Order R9-2014-0071 for the City of San Diego and Order R9-2014-0009 for the International Boundary and Water Commission. These permits establish a joint receiving water monitoring program for the South Bay Ocean Outfall and include weekly surf zone bacteria monitoring at three locations along the Coronado HSA 910.1. These locations include S12 Carnation Ave (Camp Surf), S8 Silver Strand State Beach, and S9 Avenida del Sol (Hotel del Coronado). In addition, the County of San Diego Department of Environmental Health (DEH) performs AB411 beach water quality monitoring from April 1 through October 31 for public health along the Pacific

[4]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, 2010. http://www.waterboards.ca.gov/sandiego/water_issues/programs/ tmdls/docs/bacteria/updates_022410/2010-0210_BactiI_Resolution&BPA_FINAL.pdf.

Ocean shoreline of the Coronado HSA 910.1. The existing beach water quality monitoring data are sufficient to assess swimmable waters along the Pacific shoreline of the Coronado HSA 910.1 and the San Diego Bay WMA RPs utilize this data for the annual Water Quality Improvement Plan Monitoring and Assessment report.

Additional details are available in Attachment A. A map of the monitoring locations is presented in Figure K4-5.

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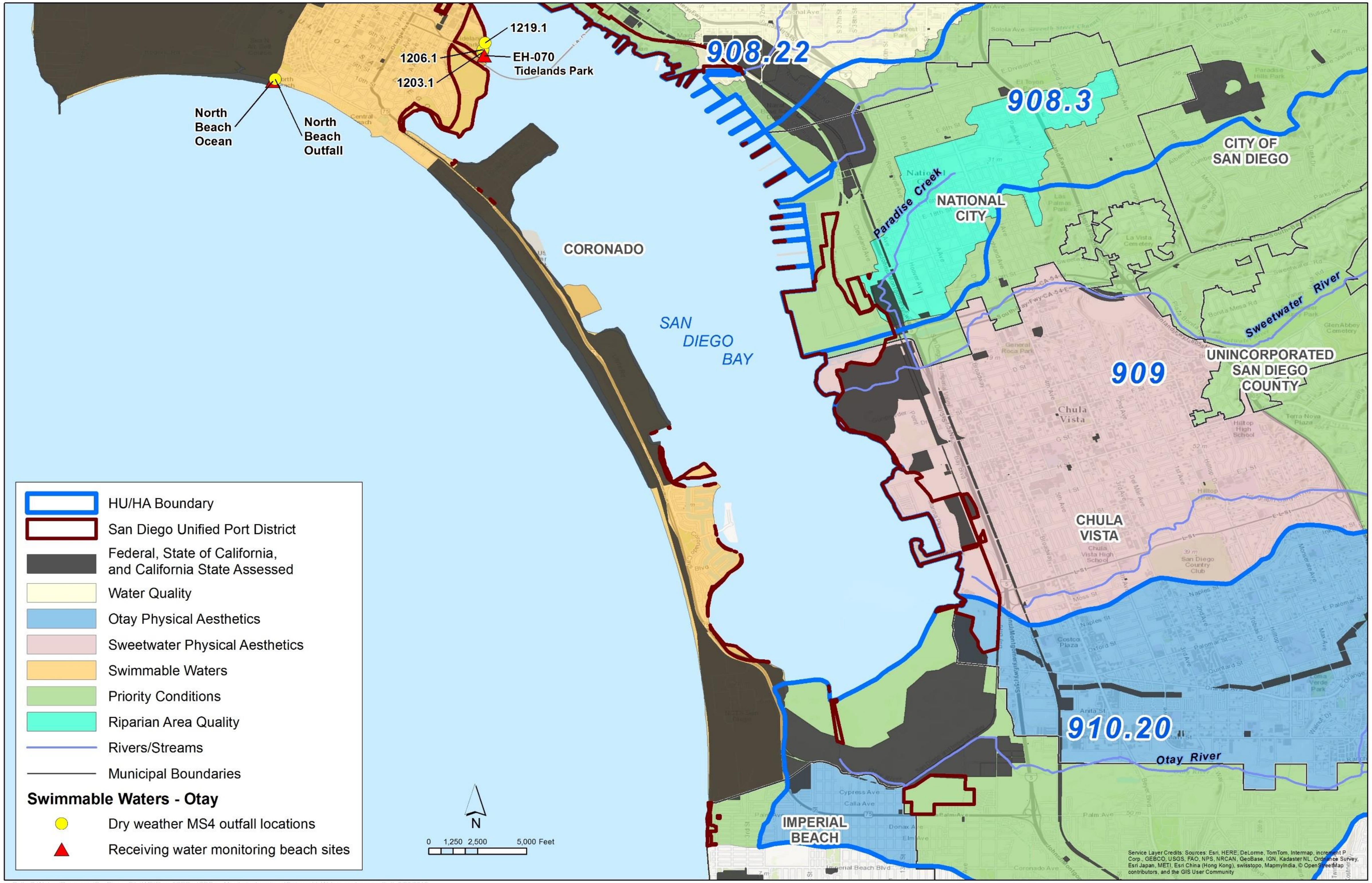

Figure K4-5
Swimmable Waters – Otay Monitoring Locations

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K.5 ADDITIONAL MONITORING PROGRAMS

Additional monitoring programs included in this section are additional TMDL monitoring programs that were not selected as the Highest Priority Condition and Special Studies required under Municipal Permit Provision D.3 and other pertinent monitoring programs.

K.5.1 TMDLs

The purpose of TMDL monitoring programs is to track progress toward achieving compliance with interim and final numeric targets. Compliance monitoring is designed to meet the receiving water monitoring requirements of the TMDL. TMDL provisions, schedules, and monitoring requirements are provided in Attachment E of the Municipal Permit. Compliance monitoring, including wet and dry weather sampling (as applicable), is conducted each year at the compliance monitoring locations located in the San Diego Bay WMA.

The following San Diego Bay WMA TMDL monitoring programs are included in the Water Quality Improvement Plan:

- Highest Priority Conditions (see Section 4.1)
  - Revised Total Maximum Daily Loads for Indicator Bacteria, Project I – Twenty Beaches and Creeks in the San Diego Region (including Chollas Creek). Resolution No. R9-2010-0001 (Chollas Creek Bacteria TMDL);
  - Total Maximum Daily Loads for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay. Resolution No. R9-2007-0043 (Chollas Creek Metals TMDL);
- Additional TMDLs that require monitoring
  - Total Maximum Daily Load for Dissolved Copper in Shelter Island Yacht Basin, San Diego Bay. Resolution No. R9-2005-0019 (Shelter Island Copper TMDL), discussed in Section 5.1.1;
  - Total Maximum Daily Loads for Indicator Bacteria, Baby Beach in Dana Point Harbor and Shelter Island Shoreline Park (SISP) in San Diego Bay. Resolution No. R9-2002-0123 (Shelter Island Shoreline Park Bacteria TMDL or SISP Bacteria TMDL, discussed in Section 5.1.2); and
  - Total Maximum Daily Loads for Diazinon in Chollas Creek Watershed. Resolution No. R9-2002-0123. (Chollas Creek Diazinon TMDL, discussed in Section 5.2.3).

K.5.1.1 Shelter Island Copper TMDL

The Shelter Island Copper TMDL is intended to identify and implement actions to reduce dissolved copper loads discharging into the Shelter Island Yacht Basin. Final TMDL compliance requirements are intended to be protective of beneficial uses in the San Diego Bay and Shelter Island Yacht Basin (SIYB). Figure K5-1 presents the MS4 Outfall monitoring locations.

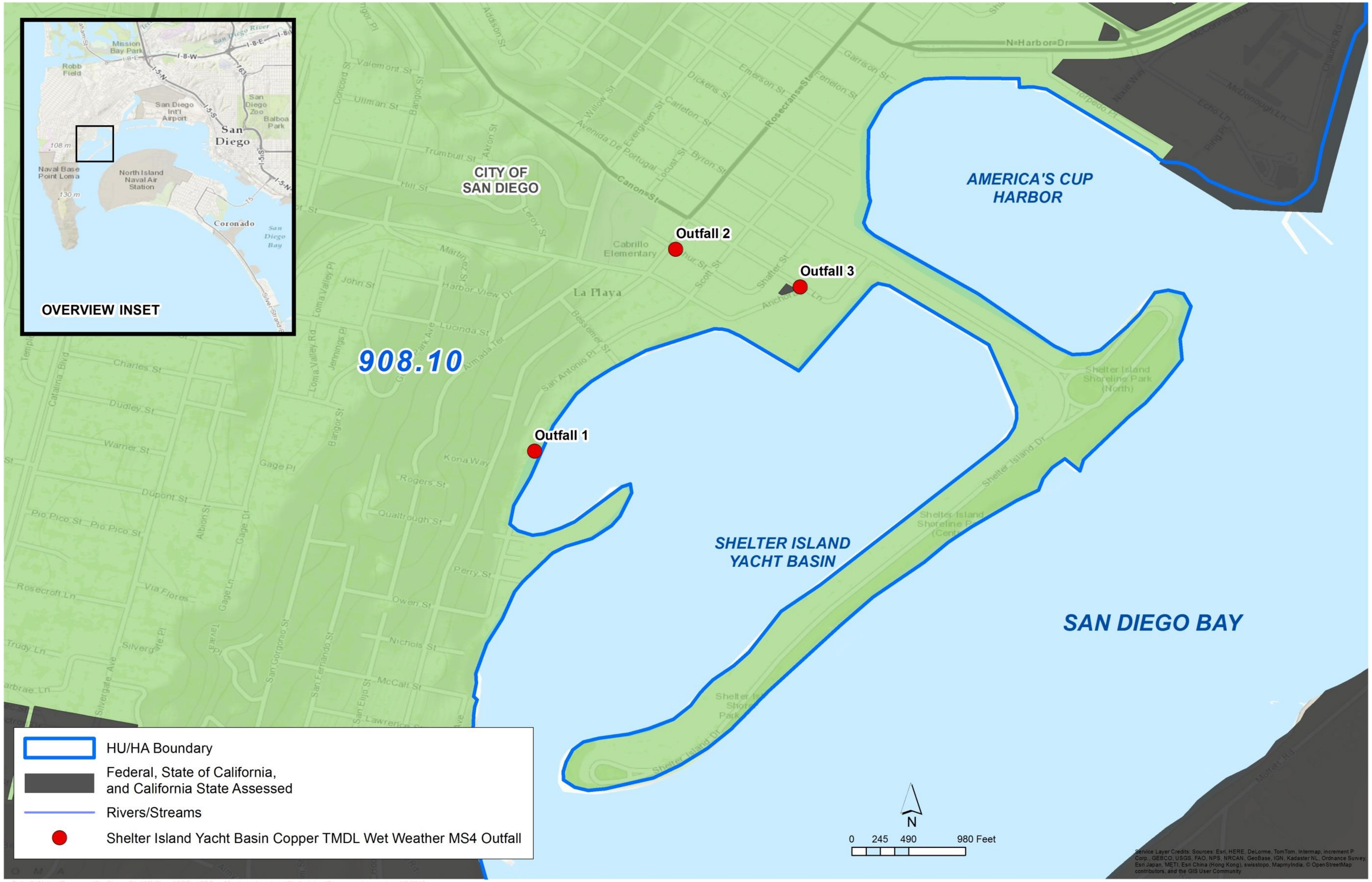

Figure K5-1
Shelter Island Copper TMDL MS4 Monitoring Locations

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K.5.1.1.1 Receiving Water Monitoring

As stated in the "*Total Maximum Daily Load for Dissolved Copper in Shelter Island Yacht Basin, San Diego Technical Report*" (Regional Board, 2005), the primary source of copper loading to the SIYB was determined to be passive leaching from boats in the marinas and yacht clubs, and not from MS4 discharges. Receiving water stations are monitored under Investigative Order No. R9-2011-0036 and submitted to the Regional Board by the Port of San Diego in an annual report separate from the Water Quality Improvement Plan Annual Report.

K.5.1.1.2 Outfall Monitoring

The Shelter Island Copper TMDL is intended to identify and implement actions to reduce dissolved copper loads discharging into the Shelter Island Yacht Basin. The Shelter Island Copper TMDL requires outfall monitoring. Per Municipal Permit Attachment E.2,

> *"The Responsible Copermittee (City of San Diego) must monitor the effluent of its MS4 outfalls for dissolved copper, and calculate or estimate the monthly and annual dissolved copper loads, in accordance with the requirements of Provisions D.2, D.4.b.(1), and D.4.(b)(2)."*

Pollutograph samples are collected for copper during three storm events annually at the outfall stations provided in Table K5-1.

Table K5-1
Shelter Island Copper TMDL Outfall Monitoring Stations

Jurisdiction	Station Name	HA or HSA	Latitude	Longitude
City of San Diego	Outfall 1	908.10	32°42'57.71"N	117°14'7.80"W
City of San Diego	Outfall 2	908.10	32°43'14.89"N	117°13'55.80"W
City of San Diego	Outfall 3	908.10	32°43'11.69"N	117°13'45.22"W

Note:
HA = Hydrologic Area; HSA = Hydrologic Sub-Area

Flow monitoring also is conducted during wet weather at Outfall 2. Time-weighted composite samples are collected from Outfall 2 during three dry weather events. Tidal influence, jurisdictional boundaries, and lack of observed dry weather flows prevent the additional monitoring at Outfalls 1 and 3.

Figure K5-1 maps the monitoring locations. Additional Information is available in the City of San Diego's Shelter Island Yacht Basin Dissolved Copper TMDL Monitoring Plan (Attachment D).

K.5.1.2 Shelter Island Shoreline Park Bacteria TMDL

The SISP Bacteria TMDL is intended to address levels of indicator bacteria at the shoreline of San Diego Bay at SISP. Final TMDL compliance requirements are intended to be protective of beneficial uses at SISP.

Analysis of the results of bacteria monitoring done through the County of San Diego DEH under the AB411 program and by the Port of San Diego is intended to assist with final TMDL compliance requirements. The data assist in making a case for the removal of SISP from the 303(d) list. Through the AB411 program, receiving water monitoring is conducted weekly from April through October each year. Receiving water monitoring is also conducted by the Port of San Diego from November through March during dry weather.

In addition, monthly visual observation monitoring of outfalls within the vicinity of SISP beach is conducted during dry weather by the Port of San Diego. Outfall monitoring is conducted at low tide to identify unauthorized discharges of non-storm water to and from the MS4 that may impact receiving water quality. If non-storm water discharges are observed, samples are collected and analyzed to determine whether concentrations of indicator bacteria are elevated above water quality objectives.

Figure K5-2 maps the monitoring locations. Additional information is available in the SISP Bacteria TMDL Monitoring Plan (Attachment E).

K.5.2 Special Studies and AB411 Monitoring

Special studies, per Municipal Permit Provision D.3, are required in the San Diego Bay WMA and regionally. Special studies are selected to further investigate the Highest and Focused Priority Conditions and to meet requirements of Municipal Permit Provision D.3. The special studies include a regional special study and a special study specific to the San Diego Bay WMA, as well as additional studies applicable to the Focused Priority Conditions. RPs participating in the San Diego Bay WMA special studies are presented in Table K5-2.

Note:
Figure leveraged from SISP Bacteria TMDL Monitoring Plan (Attachment E). Some nearby MS4 drains in the Shelter Island Shoreline Park are visually monitored for flow.

Figure K5-2
Shelter Island Shoreline Park
Monitoring Locations

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Table K5-2
Overview of Special Studies

RP	Special Study				
	San Diego Regional Reference Streams and Beaches (Regional)	San Diego Bay Debris Study (WMA)	Pueblo-San Diego Hydrologic Unit: Creek Refuse Assessment Program (WMA)	Chollas Jurisdictional Boundary Study (WMA)	Riparian Area Special Study (WMA)
City of Chula Vista	✓	✓			✓
City of Coronado	✓	✓			✓
City of Imperial Beach	✓	✓			✓
City of La Mesa	✓	✓		✓	✓
City of Lemon Grove	✓	✓		✓	✓
City of National City	✓	✓			✓
Port of San Diego	✓	✓			✓
Airport Authority	✓	✓			✓
City of San Diego	✓	✓	✓	✓	✓
County of San Diego	✓	✓			✓

Note:
RPs are required to participate in watershed and regional level special studies, per the Municipal Permit.

K.5.2.1 San Diego Regional Reference Streams and Beaches Studies (Regional Scale)

The San Diego Regional Reference Stream Study serves as the regional special study for the San Diego Bay WMA. The study is currently being conducted by the San Diego and Orange County Copermittees and fulfills the regional special study requirement in Municipal Permit Provision D.3.(a). The goal of this project is to collect the data necessary to derive reasonable and accurate numeric targets for bacteria, nutrients, and heavy metals by referencing natural, local conditions. The study develops numeric targets that account for natural sources to establish the concentrations or loads from streams in a minimally disturbed or reference condition. This study provides a scientific basis for evaluating bacteria compliance levels in the Bacteria TMDL. The results of this study are used to support the forthcoming reopener of the recently adopted Bacteria TMDL and to support numeric targets in future TMDLs for bacteria, nutrients, and metals.

The San Diego Regional Stream Reference Study addresses the following questions (Southern California Coastal Water Research Project [SCCWRP], 2013):

- How does the Water Quality Objective (WQO) attainment 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 (temperature, pH, conductivity, dissolved oxygen, total suspended solids concentration)?

A total of six locations have been selected for wet weather monitoring and up to 10 locations were selected for dry weather monitoring. Sites were selected to represent 95 percent undeveloped land uses (reference conditions), two major geologic settings, and the target catchment sizes. Wet weather sampling frequency at the six locations consists of three targeted events throughout the wet season (October 1 through April 31). Dry weather sampling frequency consists of weekly sampling for up to 40 weeks at flowing locations during winter and summer dry weather periods. Dry weather sampling occurs if there has been no measurable rainfall for at least 72 hours.

K.5.2.2 Trash – San Diego Bay Debris Special Study (WMA Scale)

The San Diego Bay Debris Study is a multi-agency project conducted by the SCCWRP that is being leveraged in coordination with several ongoing studies, including the Regional Harbor Monitoring Program, Shallow Water Habitat Bioaccumulation Study, the Bight ’13 Debris Survey, and the Stormwater Monitoring Coalition Regional Watershed Monitoring Program. The study is being supported through in-kind services, project-directed contributions from stakeholders, and participation by local volunteers who all have an interest in better understanding trash issues in San Diego Bay and its contributing watersheds.

The San Diego Bay Debris Study is a comprehensive bay-wide study to help managers understand the current extent and magnitude of plastic-based debris accumulation and takes into account seasonal changes to better understand the plastic debris conditions throughout San Diego Bay and its upland contributing areas. The intent of the San Diego Bay Debris Study is to quantify the abundance and amount of plastic debris in a variety of bay habitats, including:

- Open water areas throughout the bay from the north to south side of the bay;
- Enclosed area such as ports and marinas;
- Intertidal areas, including mudflats, salt marshes, sandy beaches, and the protective rip-rap shoring; and
- Upland areas in the contributing riverine habitats.

The goal of the San Diego Bay Debris Study is to develop a baseline trash assessment of the bay habitats that includes identifying the most abundant type of plastic items, evaluating where the plastic accumulates in greatest quantities, evaluating plastic items that are preferentially transported to the bay during wet weather conditions, and determining whether the plastics that reach the open waters of the bay affect fish communities. Attachment F presents the work plan for the study. The general approach adopted for the San Diego Bay Debris Study follows the question-driven approach of the San Diego Region Framework for Monitoring and Assessment. Standard metrics for quantitative and qualitative assessment of trash were identified as part of the study, the anticipated transport mechanism, and potential original source. Standard field assessment methodologies are also established for consistency.

Members of the San Diego Bay Debris Study Work Group are also actively involved in outreach programs to help disadvantaged communities understand the importance of reducing trash in the environment. Through funding provided by the National Science Foundation, members of the Work Group, along with middle school and high school aged volunteer students, are contributing their time and effort to help collect data for this study.

K.5.2.3 Trash – Pueblo San Diego Hydrologic Unit: Creek Refuse Assessment Program Special Study (WMA Scale)

The City of San Diego is conducting a special study to improve identification of trash sources in the Chollas Creek and Paleta Creek watersheds with the intent of guiding future watershed planning efforts and implementing cost-effective best management practices (BMPs) to reduce trash (San Diego Bay Debris Study Workgroup, 2014). The special study comprises a two-tiered approach to identify sources, locate areas that disproportionately accumulated trash, and assess whether watershed locations are showing reductions in trash over time. The first stage of the special study includes a comprehensive and detailed technical evaluation of the existing storm-drain-based Creek Refuse Assessment Program trash data collected from 2007 to 2013. The second stage of the special study includes a comprehensive assessment of the north and south forks of Chollas Creek to locate areas that disproportionately accumulate trash and identify additional sources.

The goals of the special study are to:

- Identify high-priority sites that accumulate trash disproportionately,
- Prioritize management efforts to target the sources and land uses that generate the most trash, and
- Communicate the successes of the ongoing assessment program and focus management planning on the remaining high-priority areas.

K.5.2.4 Chollas – Jurisdictional Boundary Study (WMA Scale)

The purpose of this special study is to acquire additional data to support TMDL water quality monitoring data in the lower drainages of Chollas Creek for diazinon (per the Chollas Creek Diazinon TMDL), dissolved metals (Chollas Creek Metals TMDL), and Bacteria (Chollas Creek Bacterial TMDL) TMDL compliance programs (State Water Quality Control Board [State Board] Resolution No. R9-2004-0277, Resolution No. R9-2007-004, and Resolution No. R9-2010-0001, respectively). Water quality monitoring is conducted in the north and south forks of Chollas Creek to determine whether a potential pollutant source area can be identified. The data are also used to evaluate and compare the upper drainage area (special study jurisdictional boundaries) with the lower drainage area (compliance MLSs).

As part of the Chollas Creek Comprehensive Load Reduction Plan (CLRP), the Chollas Creek Jurisdictional Boundary Study is an ongoing special study conducted in the two upper-fork drainages of the Chollas Creek HSA near the jurisdictional boundaries of the Cities of San Diego and La Mesa and Cities of San Diego and Lemon Grove. For dissolved metals (copper, lead, and zinc), flow-weighted composite samples and grab samples are collected during two storm events annually. Monitoring is conducted at the downstream jurisdictional boundaries of the City of La Mesa (LM-1) and the City of Lemon Grove (LG-1). Continuous flow data are also collected throughout the wet season. Water quality samples are analyzed for toxicity and dissolved metals, in addition to other constituents, such as diazinon and indicator bacteria. Analytical results are compared with applicable water quality criteria set forth in the approved TMDLs for the Chollas Creek HSA, pesticide criteria of the California Department of Fish and Wildlife and the United States Environmental Protection Agency (USEPA) Office of Pesticide Programs (OPP) Aquatic Life Benchmarks. The Jurisdictional Boundary Study is anticipating completion of data collection during 2014.

K.5.2.5 Riparian Area (WMA Scale)

Paradise Creek is listed on the 2010 Clean Water Act 303(d) list of impaired water bodies with a selenium impairment. The Surface Water Ambient Monitoring Program (SWAMP) data collected in 2005 and 2006 indicated that selenium results exceeded the WQO of 5 micrograms per liter (µg/L) in four of four samples. Beneficial uses of Paradise Creek include warm freshwater habitat, wildlife habitat, and non-contact water recreation. Elevated selenium levels pose a threat to warm freshwater habitat. While no TMDL has been established for Paradise Creek, this water body is of great importance to the City of National City because it runs through the center of the city, directly through Kimball Park at City Hall. Paradise Creek is one of the few urban creeks within the Pueblo San Diego Watershed that has not been completely channelized or undergrounded. Paradise Creek is also a tributary to Paradise Marsh, which is part of the Sweetwater Marsh National Wildlife Refuge.

The objective of Paradise Creek selenium monitoring is to collect additional selenium data in the portion of the creek adjacent to Kimball Park within National City that would support the removal of the selenium 303(d) listing in the future.

The sites selected for monitoring are presented in Table K5-3.

Table K5-3
Paradise Creek Monitoring Locations

Site	Location	Latitude	Longitude
KP-2	Paradise Creek, adjacent to Kimball Park, east of footbridge (approximately 175 feet), within depressed area of channel	32.67036	-117.10223
KP-2.1	Paradise Creek, adjacent to Kimball Park, upstream of Site KP-2	32.67068	-117.10220
KP-2.2	Paradise Creek, adjacent to Kimball Park, upstream of Site KP-2.1	32.66963	-117.10275
KP-3	Paradise Creek, adjacent to Kimball Park, approximately 125 feet west of D Ave parking lot	32.67128	-117.10172
KP-4	Paradise Creek, adjacent to Kimball Park, just downstream of three outlet pipes/culvert (upstream-most point of creek segment)	32.67146	-117.10133

Approximately 50 grab samples were collected by field personnel between January and June 2014, during dry and wet weather, to represent various conditions of the creek. Because four samples collected from Paradise Creek have exceeded the WQO in the past, at least 48 samples must have selenium values below the WQO to remove the Paradise Creek from the 303(d) list, according to the Regional Board's Water Quality Control Policy for Developing California's CWA Section 303(d) list.

K.5.2.6 San Diego County Beach Water Quality (AB411) Monitoring

In 1997, the California State Assembly passed a resolution to amend the state's Health and Safety Code Section 115880, known as Assembly Bill 411 (AB411). AB411 required the testing of the ocean receiving waters adjacent to all public beaches for microbiological contamination, including total coliform, fecal coliform, and *Enterococcus* bacteria. AB411 criteria established a monitoring program whereby receiving waters at public beaches were required to be sampled weekly from April 1 through October 31 within a given calendar year. The purpose of including the AB411 program data in this monitoring and assessment plan is to utilize the data to augment RPs efforts when possible. For example, the AB411 data are directly applicable to the SISP Bacteria TMDL and Swimmable Waters Focused Priority Condition monitoring approach.

San Diego County DEH implements the Beach and Bay Water Quality Monitoring Program to support the statewide program funded by the AB411. The purpose of this monitoring program is to advise the public of potential health risks that could occur with water contact recreation at local beaches. DEH posts a health advisory notice or closes a beach when fecal indicator bacteria (FIB) results are above contact water recreational use (REC-1) water quality standards. There are four AB411 beach monitoring stations in the San Diego Bay WMA.

K.6 ASSESSMENT PROCESS AND APPROACH

The assessment portion of the Monitoring and Assessment Program evaluates the data collected under the monitoring programs described in Sections 3 through 5, as well as the information collected as part of the JRMP. The data collected from these programs are used to assess the progress toward achieving the Water Quality Improvement Plan numeric goals and schedules and to measure the progress toward addressing the Highest and Focused Priority Conditions. Programmatic assessment includes:

- General permit-required assessment (assessment requirements prescribed in Provision D of the Municipal Permit),
- Highest and Focused Priority Condition assessment (analysis intended to inform programs and assess progress toward the goals outlined in the Water Quality Improvement Plan Second Interim Deliverable),
- Additional assessment (assessments toward achieving the Waste Load Allocations (WLAs) outlined in applicable TMDLs, where the TMDL is not a Highest or Focused Priority Condition, and special studies assessments); and
- An integrated assessment (an assessment incorporating data collected from the assessments above, requirements as part of the JRMP program(s) under Provision E of the Municipal Permit, and additional regional assessment requirements required under Provision F of the Municipal Permit).

Figure K6-1 presents an overview of the general approach for assessment of monitoring data.

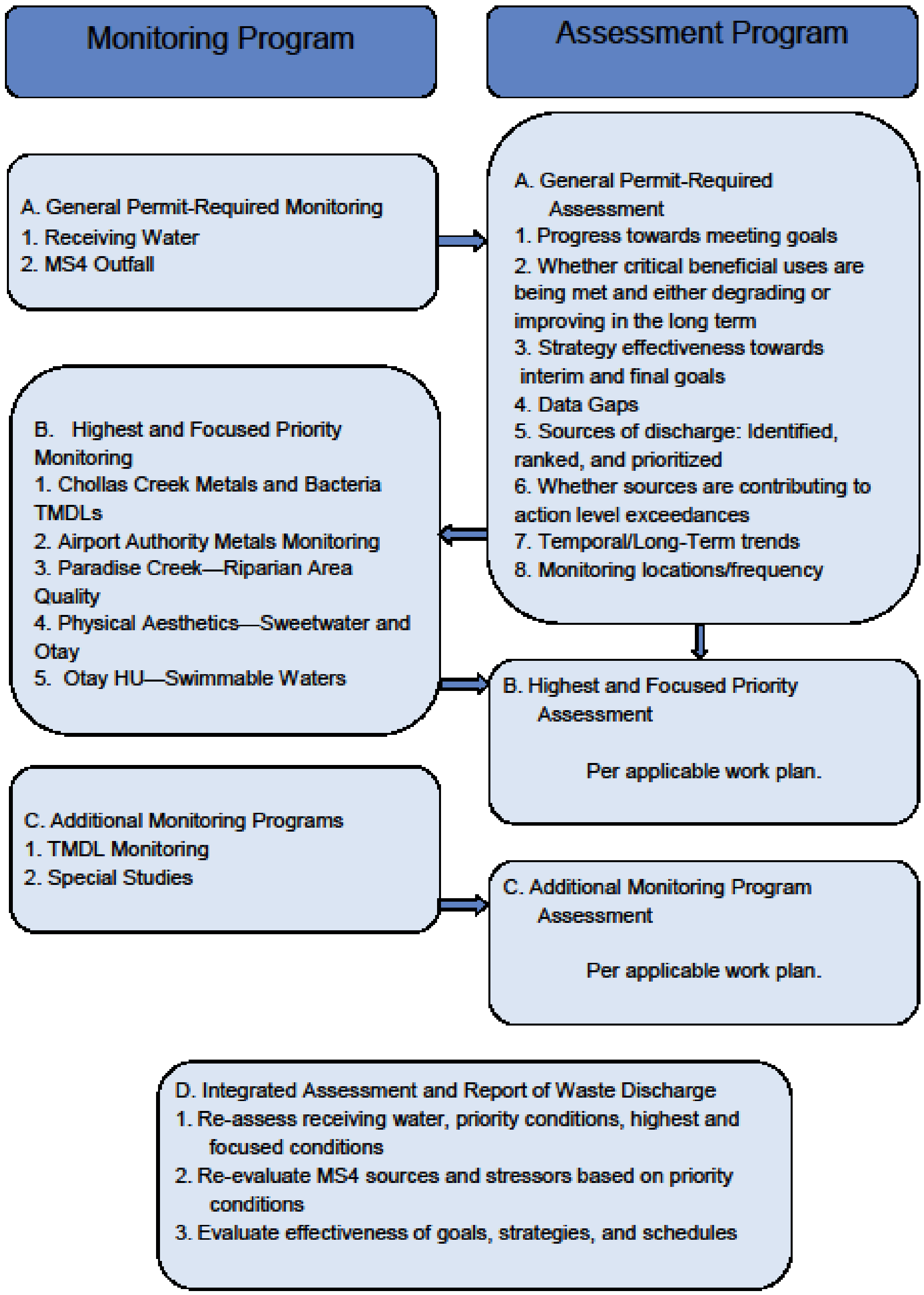

Figure K6-1
Monitoring and Assessment Approach

K.7 GENERAL PERMIT-REQUIRED ASSESSMENT

The Municipal Permit includes general assessment requirements unrelated to RPs' selected Highest and Focused Priority Conditions. General permit-required assessment is applicable to all Copermittees, regardless of watershed or effective TMDLs. General permit-required assessment requirements applicable to the San Diego Bay WMA include:

- Receiving water assessments; and
- MS4 outfall discharge assessments.

K.7.1 Receiving Water Assessment

The receiving water data collected as part of this monitoring and assessment plan are to be assessed in the Report of Waste Discharge. The assessment of receiving waters involves evaluating the physical, chemical, and biological conditions of the receiving waters and sediments. The RPs must assess the status and trends of receiving water quality conditions in coastal waters, enclosed bays, harbors, estuaries, and streams in the San Diego Bay WMA. This includes a review of the following common elements as appropriate for that reporting year, including receiving water monitoring data, Jurisdictional Runoff Management Program data, and other available data.

Prior to completing the assessments, each RP must compile available relevant receiving water and jurisdictional program data, as applicable, in regionally consistent formats to complete the non-storm water discharges reduction assessments including, but not limited to, the following:

Monitoring and Assessment Program Data (Watershed, Regional, and Jurisdictional)

- Wet and dry weather chemical, biological, and physical data collected under Long-term receiving water, regional monitoring, sediment monitoring, and focused priority conditions monitoring programs
- Other available and relevant wet and dry weather data at receiving water locations collected under programs such as TMDL or special studies
- Relevant historical wet and dry weather data at receiving water locations
- Follow-up field investigations of source(s) of flow based on receiving water observations and field screening (IDDE)
- Reports or notifications of illicit discharges, illicit connections, or other sources of non-storm water from hotlines or other sources
- Results of Toxicity Identification Evaluations (TIEs) or Toxicity Reduction Evaluations (TREs), if applicable

Jurisdictional Runoff Mangement Program Data (Jurisdictional)

- Reports or notifications of illicit discharges, illicit connections, or other sources of non-storm water from hotlines or other sources
- Follow-up field investigations of source of flow based on complaints or inspection results
- Review of inventories or land use data
- Construction, commercial, industrial, municipal, and residential inspections
- Outreach programs
- Relevant historical records
- Capital Improvement Projects (CIPs)
- Results of enforcement response, based on Enforcement Response Plans
- Review of inventories or land use data
- Green infrastructure
- Multiuse treatment areas
- Water quality improvement BMPs
- New jurisdictional ordinances

Other Relevant Information

- New regulations or policies
- Basin Plan Amendments
- Publicly available data
- Scientific studies conducted by outside agencies

Once each RP's jurisdictional data are compiled in regional formats, data are to be compiled for the San Diego Bay WMA for a watershed assessment. Table K7-1 presents the minimum elements to be included in the receiving water quality assessment per Provision D.4.a(2), example evaluation process and suggested output for each element.

Table K7-1
Receiving Water Assessment Evaluation Process and Suggested Outputs

Receiving Water Assessments per Provision D.4.a(2)	Example Process of Evaluation	Suggested Output(s)
Assessment 1: Determine whether or not the conditions of the receiving waters are meeting the numeric goals established pursuant to Provision B.3.a D.4.a(2)(a)	1. Compare water quality data from TMDL compliance locations collected from current and past monitoring years to TMDL interim and final numeric goals 2. Compare MLS data to that of previous years	Categorize goals as met, partially met, or currently not met, or alternative categories more specific to the relevant goal(s)
Assessment 2: Identify the most critical beneficial uses that must be protected to promote the overall health of the receiving water D.4.a(2)(b)	1. Use multiple lines of evidence prioritization methodology from applicable Water Quality Improvement Plan section to evaluate current state of receiving water quality conditions using more recent and updated data, including: a. Compare water quality data from receiving water locations collected from current and past monitoring years to water quality benchmarks. b. Consider publicly available data c. Consider current regulatory drivers d. Evaluate MS4 contribution.	Status of and potential changes to Priority Conditions, High Priority Conditions, and Focused Priority Conditions

Table K7-1 (continued)
Receiving Water Assessment Evaluation Process and Suggested Outputs

Receiving Water Assessments per Provision D.4.a(2)	Example Process of Evaluation	Suggested Output(s)
Assessment 3: Evaluate whether or not the critical beneficial uses from Assessment 2 are being protected D.4.a(2)(c)	1. For Priority Water Quality Conditions and High Priority Water Quality Conditions, compare current and historical data to water quality benchmarks and calculate a frequency of exceedances. (completed as part of Assessment 2. Evaluate seasonal or temporal patterns in available water quality and flow data to determine when those critical beneficial uses are supported or impaired.	Categorize Priority Conditions, High Priority Conditions, and Focused Priority Conditions as protected, likely protected, possibly impacted, likely impacted, or clearly impacted, or alternative categories depending on type of beneficial use.
Assessment 4: Identify short-term or long-term improvements or degradation of those critical beneficial uses D.4.a(2)(d)	1. Compare current and historical data to water quality benchmarks. 2. Calculate a frequency of exceedances for each monitoring year.	Statistical analysis of trends and recommended programmatic changes or enhancements
Assessment 5: Identify data gaps in the monitoring data needed to assess the provisions above D.4.a(2)(e)	1. Review assessment methodology and determine additional data needed to improve evaluation and better characterize general health of beneficial uses.	List of potential modifications to the monitoring, Jurisdictional Runoff Management Plan activities, or strategies

Note:
Regional formats, data evaluation processes, and suggested outputs are provided as an example only and are subject to change on the basis of program refinements and lessons learned from implementation of program elements as part of the adaptive management process.

K.7.2 MS4 Outfall Discharge Assessments

The second assessment to be presented in the Water Quality Improvement Plan Annual Report is the review of the MS4 outfall discharge assessments. This includes evaluating the dry weather field screening, wet and dry weather outfall monitoring data, and data collected under the Jurisdictional Runoff Management Program Illicit Discharge Detection and Elimination (IDDE) program. Details of these separate assessments are provided below. RPs assess their MS4 monitoring programs individually and on a watershed-wide basis annually as part of the San Diego Bay WMA Water Quality Improvement Plan Annual Report.

K.7.2.1 Dry Weather Outfall Assessments/Illicit Discharges

In addition to dry weather outfall field screening and monitoring, each RP must assess and report the progress of its IDDE program (required pursuant to Municipal Permit Provision E.2) toward effectively prohibiting non-storm water and illicit discharges into the MS4s within its jurisdiction. Prior to completing the assessments, each jurisdiction must compile available relevant data, as applicable, in a regionally consistent format to complete the non-storm water discharge reduction assessment including, but not limited to, the following:

Monitoring Data:

- Field screening visual observations in per Municipal Permit Provision D.2.a(1)
- Non-storm water monitoring, including water quality, observations, field measurements, and flow estimates perMunicipal Permit Provision D.2.a(2)
- Relevant historical dry weather data
- Reports or notifications of illicit discharges, illicit connections, or other sources of non-storm water from hotlines or other sources
- Follow-up field investigations of source of flow
- Review of MS4 outfall inventories, drainage areas, or changes in land use

JRMP Data:

- Reports or notifications of illicit discharges, illicit connections, or other sources of non-storm water from hotlines or other sources
- Follow-up field investigations of source of flow or pollutants
- Review of MS4 outfall inventories, drainage areas, or changes in land use
- Construction, commercial, industrial, municipal, and residential inspections
- Enforcement response actions, per the applicable Enforcement Response Plans
- Outreach programs
- Relevant historical records
- Localized or regional structural BMPs contributing to discharge reductions, as applicable

Table K7-2 presents the minimum elements to be included in the non-storm water pollutant discharges reduction assessment per Provision D.4.b(1), example evaluation process, and suggested output for each element.

Table K7-2
Dry Weather MS4 Outfall Assessment Evaluation Process and Suggested Outputs

Non-storm Water Assessments per Provision D.4.b(1)	Example Process of Evaluation	Suggested Output(s)
Assessment 1: Progress toward effectively prohibiting non-storm water and illicit discharges into the MS4 within each jurisdiction D.4.b(1)(c)(i)/ D.4.b(1)(b)	1. Categorize flows as dry, persistent, transient, or undetermined based on historic and current field screening data 2. For transient and persistent flows, identify the known and suspected controllable sources, as feasible, and which sources were reduced or eliminated 3. Based on two previous steps, evaluate any modifications to field screening locations or frequency necessary to identify and eliminate sources of persistent flows. Reprioritization of outfalls may occur if one of the following conditions is met: a. Non-storm water discharges have been effectively eliminated for three consecutive monitoring events or b. Source(s)s of the persistent flows have been identified as not an illicit or a source of pollutants or c. Pollutants in the persistent flow do not exceed NALs or d. The threat to water quality has been reduced by the RP	Number of sources reduced and eliminated Updated MS4 outfall inventory to reflect current flow status, outfalls removed or added from field screening program List of programmatic modifications.

Table K7-2 (continued)
Dry Weather MS4 Outfall Assessment Evaluation Process and Suggested Outputs

Non-storm Water Assessments per Provision D.4.b(1)	Example Process of Evaluation	Suggested Output(s)
Assessment 2: Rank and prioritize MS4 outfalls D.4.b(1)(c)(ii)	1. Assess threat to receiving water quality from major MS4 outfalls based on available water quality data. Compare dry weather water quality data to relevant NALs, Highest and Focused Priority Conditions (water quality objectives, 303(d) List or ESAs), and discharge prohibitions, as applicable 2. Identify pollutants from sources or land uses known to exist within the area, drainage basin, or watershed that discharges to the portion of MS4 within its jurisdiction 3. Rank MS4 outfalls according to threat to water quality using the metrics established under the transitional monitoring program	Revised prioritized list of major MS4 outfalls List of modifications to major MS4 outfalls monitored under Provision D.2.b Revised prioritization metrics, as applicable
Assessment 3: Identify known and suspected sources contributing to numeric action limit exceedances at highest-ranked MS4 outfalls D.4.b(1)(c)(iii)	1. Compare dry weather water quality data from major outfalls to relevant NALs (completed in Assessment 2) 2. For those exceeding NALs, use visual observation, inspection data, land use data, complaints, and other reports to identify potential sources in the outfall drainage area.	List of known and suspected sources for each highest-ranked MS4 outfall Summary of NAL exceedances per HU, and applicable follow-up actions List of follow-up actions and whether those actions have resulted in lower pollutant concentrations or identification of confirmed or suspected sources, if data are available Revise internal follow-up procedures, as necessary, to increase effectiveness of follow-up actions as part of adaptive management.

Table K7-2 (continued)
Dry Weather MS4 Outfall Assessment Evaluation Process and Suggested Outputs

Non-storm Water Assessments per Provision D.4.b(1)	Example Process of Evaluation	Suggested Output(s)
Assessment 4: Estimate volumes and loads of non-storm water discharges D.4.b(1)(c)(iv)	1. Compile dry weather water quality and flow data from major MS4 outfalls with persistent flow per jurisdiction. 2. Annual rainfall data representative of the watershed to define wet versus dry days for the monitored year. 3. Calculate or estimate annual non-storm water volume and pollutant loads collectively discharged from each jurisdiction's major MS4 outfalls to receiving waters 4. Estimate the percent contribution from each known source for each MS4 outfall (as identified in Assessment 3). 5. Calculate or estimate annual non-storm water volume and pollutant loads collectively discharged from non-storm water not subject to the RP's legal authority	Total estimated volume or load of non-storm water discharges per jurisdiction and by HU
Assessment 5: Identify data gaps D.4.b(1)(c)(vi)	1. Review assessment methodology and determine additional data needed to improve evaluation and identify and eliminate non-storm water discharges.	List of potential modifications to the monitoring, Jurisdictional Runoff Management Program activities, or strategies

Note:
Regional formats, data evaluation processes, and suggested outputs are provided as an example only and are subject to change based on program refinements and lessons learned from implementation of program elements as part of the adaptive management process.

K.7.2.2 Wet Weather Outfall Assessments/Illicit Discharges

The RPs must assess and report the progress of the water quality improvement strategies implemented as part of the Water Quality Improvement Plan and the Jurisdictional Runoff Management Program toward reducing pollutants in storm water discharges from the MS4s. This is designated as the Wet Weather MS4 Outfall Discharge Monitoring Program.

Table K7-3 presents the minimum elements to be included in storm water pollutant discharges reduction assessment per Municipal Permit Provision D.4.b(2), example process, and suggested outcome for each element.

Prior to completing the assessments, each RP must compile available relevant data, as applicable, in a regionally consistent format to complete the storm water discharge reduction assessments, including, but not limited to, the following:

Monitoring Data:

- Storm water monitoring, including water quality, observations, field measurements, and flow estimates per Municipal Permit Provisions D.2.a(3) and D.2.c
- Land use data
- Reports or notifications of illicit discharges, illicit connections, or other sources of non-storm water from hotlines or other sources
- Follow up field investigations of source of flow
- Annual WMA rainfall data, if not collected

JRMP Data:

- Reports or notifications of illicit discharges, illicit connections, or other sources of non-storm water from hotlines or other sources
- Follow-up field investigations of source of flow
- Review of inventories or land use data
- Construction, commercial, industrial municipal, and residential inspections
- Outreach programs

Table K7-3 presents the minimum elements to be included in the storm water pollutant discharge reduction assessment per Municipal Permit Provision D.4.b(2), example evaluation process, and suggested output for each element.

Table K7-3
Wet Weather MS4 Outfall Assessment Evaluation Process and Suggested Outputs

Storm Water Assessments per Provision D.4.b(2)	Example Process of Evaluation	Suggested Output(s)
Assessment 1: Estimate volumes and loads of storm water discharges D.4.b(2)(b)/ D.4.b(2)(c)(i)	1. Compile wet weather water quality and flow data from monitored outfalls for the monitoring year. 2. Use annual rainfall data representative of the watershed to define wet versus dry days for the monitored year. 3. Calculate or estimate annual non-storm water volume and pollutant loads collectively discharged from each jurisdiction's monitored MS4 outfalls to receiving waters 4. Estimate the percent contribution from each land use type within each hydrologic subarea. 5. Evaluate modifications to wet weather MS4 monitoring locations or frequency necessary to identify pollutants in storm water discharges in the WMA	Total estimated volume or load of non-storm water discharges per jurisdiction and for the San Diego Bay WMA
Assessment 2: Identify known and suspected sources contributing to SAL exceedances at highest-ranked MS4 outfalls D.4.b(2)(c)(ii)	1. Compare wet weather water quality data from major outfalls to relevant SALs 2. For those exceeding SALs, use visual observation, inspection data, land use data, reports to identify potential sources in the outfall drainage area 3. Re-evaluate strategies and update other assumptions under the adaptive management approach	Summary of SAL exceedances per HU, and applicable follow-up actions List of known and suspected wet weather point sources for each highest ranked MS4 outfall, as applicable List of follow-up actions and whether those actions have resulted in lower pollutant concentrations or identification of confirmed or suspected sources, if data are available Revise internal follow-up procedures, as necessary, to increase effectiveness of follow-up actions as part of adaptive management.

Table K7-3 (continued)
Wet Weather MS4 Outfall Assessment Evaluation Process and Suggested Outputs

Storm Water Assessments per Provision D.4.b(2)	Example Process of Evaluation	Suggested Output(s)
Assessment 5: Identify data gaps D.4.b(1)(c)(vi)	1. Review assessment methodology and determine additional data needed to improve evaluation and identify and eliminate non-storm water discharges.	List of potential modifications to the monitoring, Jurisdictional Runoff Management Program activities and response actions, or strategies

K.7.2.3 Report of Waste Discharge Assessment Process

Table K7-4 presents the ROWD Assessment process.

Table K7-4
Report of Waste Discharge Assessment

	ROWD Assessments (once per permit term)	Example Process of Evaluation	Suggested Output(s)
Non-storm water Assessments	Assessment 1: Identification of reductions and progress in achieving reduction in non-storm water and illicit discharges in the WMA D.4.b(1)(c)(v)[a]	1. Compile number of sources non-storm water and illicit discharges reduced and eliminated by all jurisdictions in the WMA over the permit term. 2. Assess progress by comparing to previous permit terms.	Percent (%) increase or decrease in number of sources reduced or abated for the entire WMA this permit term
	Assessment 2: Assess effectiveness of strategies toward reducing or eliminating non-storm water and pollutant loads from the MS4 to receiving waters by Jurisdiction D.4.b(1)(c)(v)[b]	1. Compare data from pre- and post- project or focused area to evaluate potential effects of enhanced Water Quality Improvement Plan strategies, as available 2. If possible, estimate the pollutant load reduction attributable to specific water quality strategies.	Summary of pre-project (baseline) data and post-project data Summary of load reductions per jurisdiction by HU for highest and focused priorities List of strategies that may support pollutant load reductions and those that don't, based on data collected
	Assessment 3: Identify modifications necessary to increase the effectiveness of strategies toward reducing or eliminating non-storm water and pollutant loads from the MS4 to receiving waters by Jurisdiction D.4.b(1)(c)(v)[c]	1. Review assessment methodology and determine additional data needed to improve evaluation and identify and eliminate non-storm water discharges.	List of potential modifications to the Monitoring and Assessment Program, Jurisdictional Runoff Management Program activities, or strategies Recommendations for programmatic adjustments of strategies and schedules

Table K7-4 (continued)
Report of Waste Discharge Assessment

ROWD Assessments (once per permit term)		Example Process of Evaluation	Suggested Output(s)
Storm Water Assessments	Assessment 1: Identify reductions and progress in achieving pollutant load reductions from different land uses in the WMA D.4.b(2)(c)(iii)[a]	1. Compile total estimated volume or load of non-storm water discharges by drainage area, land use, or other relevant assessment metric for the WMA over the permit term 2. Assess progress by comparing pollutant loads by land use over a period of three years to determine short-term trends over the five years of implementation.	% allocation of volume or load based on % of land use per HU and by WMA Trend analysis, if sufficient data points are available, based on % allocation of volume or load
	Assessment 2: Identify modifications necessary to increase the effectiveness of strategies toward reducing or eliminating storm water and pollutant loads from the MS4 to receiving waters in the WMA to the maximum extent practicable (MEP) D.4.b(2)(c)(iii)[b]	1. Compare data from pre-post project or focused area to control area to evaluate potential effects of enhanced Water Quality Improvement Plan strategies. 2. If possible, estimate the pollutant load reduction attributable to specific water quality strategies.	Summary of pre-project (baseline) data and post-project data Summary of load reductions per jurisdiction by HU for highest and focused priorities List of strategies that may support pollutant load reductions and those that don't, based on data collected
	Assessment 3: Identify modifications necessary to increase the effectiveness of strategies toward reducing or eliminating non-storm water and pollutant loads from the MS4 to receiving waters by Jurisdiction D.4.b(2)(c)(iii)[c]	1. Review assessment methodology and determine additional data needed to improve evaluation and identify and eliminate non-storm water discharges.	List of potential modifications to the monitoring, Jurisdictional Runoff Management Program activities, or strategies Recommendations for programmatic adjustments of strategies and schedules

K.8 HIGHEST AND FOCUSED PRIORITY CONDITIONS ASSESSMENT

The assessment of additional receiving water and MS4 outfall monitoring data provides an indication of whether the goals associated with Highest and Focused Priority Conditions are being met. Additional monitoring includes:

- Assessment of water quality (metals and bacteria) in Chollas Creek;
- Evaluation of metals at the San Diego International Airport;
- Characterization of riparian area quality in Paradise Creek, via biological monitoring for percent survival of plantings, percent minimum native cover, percent non-native weed cover, and percent bare ground and CRAM;
- Assessment of physical aesthetics in the Sweetwater HU and Otay HU via trash monitoring; and
- Assessment of swimmable waters in the Otay HU via bacteria monitoring.

Highest and Focused Priority Conditions have individual assessment metrics, depending on the strategies, that are evaluated in the integrated assessment at the end of the permit term. Additional information on the integrated assessment is available in Section K.10.1.

Standard assessment methods as prescribed by the CRAM and Trash Assessment Methodologies are also used to provide a scientifically based assessment of the quantitative and qualitative data collected. The assessment of the CRAM data includes a review of the riparian buffer zone, local hydrology, physical structure, and biotic structure. The evaluation of the physical aesthetics is based on visual trash assessment data, and includes characterization of trash-generating areas based on land use, source identification and prioritization based on the amount and type of trash, identification of persistent pathways where trash enters creeks, and recommendations for management efforts targeted to reduce trash. The assessment of swimmable waters in the Otay HU includes the comparison of bacteria data with the appropriate water quality objectives and the beach score card metrics that are to be developed.

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K.9 ADDITIONAL PROGRAM ASSESSMENT

K.9.1 TMDL Assessment

TMDL monitoring data for the five TMDLs in the San Diego Bay WMA continue to be evaluated under separate TMDL annual reports because different RPs are involved with different TMDLs. Each TMDL has its own specific assessment requirements that are detailed in the appropriate monitoring plan or Quality Assurance Project Plan.

The annual reporting schedule for the TMDLs is to be modified as needed to allow for the incorporation of the TMDL annual reports into the Water Quality Improvement Plan Annual Report. A summary of the TMDLs is to be incorporated into the main body of the Water Quality Improvement Plan Annual Report. The results of the TMDL monitoring for the Highest Priority Conditions in Chollas Creek are used where appropriate to assess the progress toward achievement of goals and to determine whether the critical beneficial uses are being protected. Over time, the data collected as part of the five TMDL monitoring programs are analyzed to determine whether the strategies established by the Water Quality Improvement Plan are contributing to the achievement of goals. This analysis requires a number of years of data to see the impact of the Water Quality Improvement Plan strategies.

K.9.2 Special Studies Assessments

As part of the Water Quality Improvement Plan Annual Report, the San Diego Bay WMA RPs evaluate the results and findings from the special studies described in their respective attachments. They use the resulting data to (1) assess their relevance to the RPs' 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 Water Quality Improvement Plan.

The San Diego Bay WMA special studies attempt to answer questions concerning the natural reference concentration of bacteria and other pollutants in the region, analyze area trash levels and jurisdictional loads in relation to the highest priority and perform stream bioassessment using the CRAM method, and evaluate selenium concentrations in the San Diego Bay WMA. The special studies help guide the implementation of the strategies for the Highest and Focused Priority Conditions. Each special study has its own assessment methods and metrics.

Future special studies related to BMP effectiveness that are implemented by the RPs in the San Diego Bay WMA are included in this assessment. RPs may select to report the results of BMP effectiveness studies that are being performed in other WMAs if they relate to the Highest or Focused Priority Conditions and if results are expected to be transferrable to strategies planned for the San Diego Bay WMA.

K.9.2.1 San Diego Regional Reference Streams and Beaches Studies

The Regional Reference Stream and Beach Studies are currently ongoing. The assessment of the study data helps to determine concentration or loads from minimally disturbed or reference conditions. The information provides the basis for reasonable numeric targets that are appropriate for the San Diego region. When the results from this study are finalized and published, they are to be incorporated into the Annual Water Quality Improvement Plan Annual Report as well as the Report of Waste Discharge. The reference area information provides a foundation for the analysis of regional beneficial use attainment.

K.9.2.2 Trash – San Diego Bay Debris Special Study

The goal of the San Diego Bay Debris Study is to develop a baseline trash assessment of the bay habitats that includes identifying the most abundant type of plastic items, evaluating where the plastic accumulates in greatest quantities, evaluating plastic items that are preferentially transported to the bay during wet weather conditions, and determining whether the plastics that reach the open waters of the bay affect fish communities. By measuring the types of debris that are present during dry weather and preferentially transported to the bay during wet weather, the San Diego Bay Debris Study provides the opportunity to better target management decisions on the most important types of plastics.

The analysis of the overall plastic debris quantities is an important component for establishing a benchmark of the most abundant types of plastic and being able to measure changes in the plastics quantities over time. The plastics data that are to be collected for the San Diego Bay Debris Study include a substantially expanded list of items beyond the data collected during previous SMC and Bight ’08 regional monitoring programs to capture a greater level of detail about the most prevalent types of plastic items.

The intent of the San Diego Bay Debris Study is to quantify the abundance and amount of plastic debris in a variety of bay habitats, including:

- Open water areas throughout the bay from the north to south side of the bay;
- Enclosed area such as ports and marinas;
- Intertidal areas, including mudflats, salt marshes, sandy beaches, and the protective rip-rap shoring; and
- Upland areas in the contributing riverine habitats.

The primary data analyses that are to be performed to answer the study questions include the following:

(1) How do the quantities and types of debris in different habitats vary during dry and wet season?

  (a) What are the quantities and types of debris found in San Diego Bay habitats?

  (b) What are the quantities and types of debris found in watersheds flowing to San Diego Bay?

  (c) How do the quantities and types of trash in different San Diego Bay habitats vary by summer and winter dry season?

  (d) What are the quantities and types of trash in San Diego Bay following the first storms of the wet season?

(2) What types of riverine debris do wet weather flows transport to the bay?

(3) What species caught in the bay has ingested plastic pieces?

The general approach adopted for the San Diego Bay Debris Study follows the question-driven approach of the San Diego Region Framework for Monitoring and Assessment.

K.9.2.3 Trash – Pueblo San Diego HU: Creek Refuse Assessment Program Special Study

The analyses of the Pueblo San Diego Hydrologic Unit data provide an opportunity to improve the characterization of site conditions, assess land use contributions, better describe important trash sources, and evaluate the general extent to which sites are showing trash decreases over time. The results are also intended to prioritize the trash conditions to help identify the important sources and pathways of the most abundant types of trash among the land use categories that have the largest amount of trash.

The assessment approach for the trash data included six components as follows:

(1) Evaluating volumes of various types of trash (food packaging, household items, etc.) to identify the most abundant types of trash;

(2) Evaluating the overall extent of site conditions and determining the trash volumes in each condition rating category;

(3) Calculating mean trash volumes and mapping the geographic distribution of the sites to identify locations that accumulate large amounts of trash;

(4) Evaluating the overall trash volumes among various land use and demographic categories to determine association between land scale attributes and sites containing large amounts of trash;

(5) Characterizing additional sources and pathways for trash; and

(6) Evaluating which sites have trash (presence/absence) to determine the proportion of the overall number of sites that may need further management.

K.9.2.4 Chollas – Jurisdictional Boundary Study for Metals and Bacteria

The Chollas Jurisdictional Boundary Study has been ongoing since 2012. The study is designed to characterize the upper drainage areas (special study sites) in relation to the lower drainage areas (which comprise the Chollas Metals and Bacteria TMDL compliance sites). Results from the two drainage areas are to be compared with the California Toxics Rule (CTR) objectives for dissolved metals through application of both default and site-specific Water Effect Ratios (WERs). The study is designed to fill data gaps regarding priority water problems and potential pollutant sources in the Chollas Creek HSA. Further analysis under the Water Quality Improvement Plan monitoring program allows refinement of previous findings and helps to identify and prioritize problem drainage areas.

K.9.2.5 Riparian Area

The Paradise Creek Selenium Special Study is ongoing. The assessment of the study data helps to determine whether removal of selenium in Paradise Creek from the 303(d) list is appropriate. The selenium 303(d) listing is associated with an impairment to warm freshwater habitat beneficial use. The information collected in the special study will provide the required data set for a delisting analysis for selenium. When the results from this study are finalized and published, they will be incorporated into the Water Quality Improvement Plan Annual Report and the Report of Waste Discharge.

K.9.3 Data Gaps

During the development of the Priority Conditions, Sources, and Potential Strategies of the Water Quality Improvement Plan, the RPs identified data gaps in either receiving water or MS4 data related to the priority water quality conditions in the San Diego Bay WMA. This Monitoring and Assessment Program begins to address a number of these data gaps, as described in Table K9-1 below. As part of the iterative process, the priorities of the various water quality will be re-evaluated as the data gaps are filled, and may be elevated or demoted as the data indicate.

Table K9-1
Data Gaps Addressed by MAP

HA/HSA	Water Body	Pollutant Category	Data Gap Identified	Monitoring Program Components Addressing the Data Gap(s)
Pueblo HU				
San Diego Mesa 908.2	Chollas Creek	Lead	MS4 data and source not identified in 303(d)-listing	Chollas Creek Highest Priority Condition Monitoring (Section K.4.1) and MS4 Outfall Monitoring (Section K.3.2).
		Trash	MS4 data	Pueblo San Diego Hydrologic Unit: Creek Refuse Assessment Program Special Study (K.5.2.3) and MS4 Outfall Monitoring (Section K.3.2).
	Mouth of Chollas Creek	PAHs	MS4 data and source not identified in 303(d)-listing	Chollas Creek Highest Priority Condition Monitoring (Section K.4.1) and MS4 Outfall Monitoring (Section K.3.2).
		PCBs		
		Chlordane		
Sweetwater HU				
Lower Sweetwater 909.1	Lower Sweetwater River (below Sweetwater Reservoir)	Bacteria	Receiving Water data	Long-Term Receiving Water Monitoring (Section K.3.1) and MS4 Outfall Monitoring (Section K.3.2).
		TDS	MS4 data	
Lower Sweetwater 909.1 (continued)	Lower Sweetwater River (below Sweetwater Reservoir) (continued)	Trash	Receiving Water and MS4 data	Long-Term Receiving Water Monitoring (Section K.3.1), MS4 Outfall Monitoring (Section K.3.2), and Physical Aesthetics Focused Priority Monitoring (Section K.4.4).
Otay HU				
Coronado 910.1	Pacific Ocean Shoreline at Carnation Ave and Camp Surf Jetty	Bacteria	Receiving Water data	Swimmable Waters Focused Priority Monitoring (Section 4.5) and AB411 monitoring program
	Pacific Ocean Shoreline at Tidelands Park	Bacteria	Receiving Water data	

Note:
PAH = polycyclic aromatic hydrocarbon; PCB =polychlorinated biphenyl; TDS = total dissolved solids

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K.10 INTEGRATED ASSESSMENT

The RPs integrate the data collected as part of the Monitoring and Assessment Program, along with information collected during the implementation of the JRMP. The integrated assessment evaluates the main components of the Water Quality Improvement Plan and follows the assessment process outlined in the Municipal Permit. The priority water quality conditions are re-evaluated using the receiving water and MS4 outfall discharge assessments on the basis of the methodology presented in Attachment A. The compliance pathways that comprise the goals and schedules in the Water Quality Improvement Plan are reviewed on the basis of the results of the receiving water and MS4 outfall discharge assessments, along with data collected as part of the JRMP. This evaluation highlights the progress in achieving the compliance goals. Finally, both water quality monitoring data and maintenance and observational data related to BMP effectiveness are used to assess the strategies implemented by the RPs. Table K10-1 summarizes the assessment program components.

Table K10-1
Integrated Assessment Components

Water Quality Improvement Plan Components	Municipal Permit Assessment Methodology	Evaluation Assessment
Highest and Focused Priority Conditions	<u>Re-assess receiving water, priority, and Highest and Focused Priority Conditions.</u> (1) Re-evaluate the receiving water conditions per methodology and any new methodology provided in Attachment A. (2) Re-evaluate the impacts of MS4 discharges on receiving waters per methodology provided in Attachment A. (3) Identify beneficial uses in receiving waters that must be protected per Receiving Water Assessment. <u>Re-evaluate MS4 sources and stressors based on potentially new Priority and Highest Priority Conditions.</u> (4) Re-evaluate the identification of MS4 sources and/or stressors performed in Section 3.	• Receiving Water Assessments • MS4 Outfall Discharge Assessments
Goals and Schedules (Compliance Pathways)	<u>Evaluate effectiveness of goals.</u> (1) Evaluate the progress toward achieving interim and final numeric goals for protecting impacted beneficial uses in receiving waters.	• Receiving Water Assessments • MS4 Outfall Discharge Assessments • JRMP Assessments

Table K10-1 (continued)
Integrated Assessment Components

Water Quality Improvement Plan Components	Municipal Permit Assessment Methodology	Evaluation Assessment
Strategies	Evaluate effectiveness of strategies and actions. (1) Identify the non-storm water and storm water pollutant loads from the MS4 outfalls based on the MS4 Outfall Discharge Assessment. (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. (4) Evaluate the progress of the strategies toward achieving interim and final numeric goals for protecting beneficial uses in receiving waters.	• MS4 Outfall Discharge Assessments • Special Studies Assessments for BMP Effectiveness • JRMP Assessments

Strategies developed within the Water Quality Improvement Plan are incorporated into individual RP programs through implementation of their respective JRMPs. Each RP is implementing programs that are focused on addressing the Highest and Focused Priority Conditions within the San Diego Bay WMA. While implementation of these programs has been ongoing in many cases, refinements to the programs provide additional focus on the particular water quality issues identified in the Water Quality Improvement Plan. Over time, RPs utilize various assessment methods to determine which program refinements are effective and which are not. In some cases, the program effectiveness assessment results may provide useful information leading to adaption of elements of the Water Quality Improvement Plan. Where new information is applicable, it may be used to modify goals, strategies, schedules, and the Monitoring and Assessment Program.

The Municipal Permit also contains specific assessments to be performed during preparation of the Report of Waste Discharge. The assessments are longer term in nature, occurring only once during the Municipal Permit cycle. Because the updates to the Water Quality Improvement Plan are required to undergo a full public participation process per Municipal Permit Provision F.2.c, including reconvening the Consultation Panel, modifications will proactively consider input from the public and the Regional Board. Adaptation of Water Quality Improvement Plan elements also considers new regulations or policies as appropriate. In the Report of Waste Discharge preparation, all elements of the Water Quality Improvement Plan are eligible for modifications through the required adaptive management processes. Elements to be evaluated include the water quality conditions (i.e., priorities), goals and accompanying schedules, strategies and accompanying schedules, and the Monitoring and Assessment Program. Of particular interest for the integrated assessment to be performed during this Municipal Permit cycle is a review of the performance-based goals. These goals are to be reviewed during the development the Report of Waste Discharge.

The process for selecting the Highest and Focused Priority Conditions is documented in the Section 2 of the Water Quality Improvement Plan. Given the relatively short duration of the remainder of this Municipal Permit term after expected approval of the Water Quality Improvement Plan, the priority water quality conditions selected during the development of the Water Quality Improvement Plan remain for the duration of the current permit term. They are modified only on the basis of new information assessed as part of the Report of Waste Discharge. Data collected during the Municipal Permit term are used to update the analysis of the priority water quality conditions on the basis of the methodology described in Attachment A and implemented in Section 2.

RPs will evaluate the progress toward achieving the interim and final numeric goals as part of the preparation of the Report of Waste Discharge. The Water Quality Improvement Plan interim goals identified for the current permit term are provided in Tables K10-2 through K10-6, along with the related assessment metric for each.

Table K10-2
Assessment of Goals for Chollas Creek, Current Permit Term

Jurisdiction	Numeric Goal	Unit of Measure	Assessment Period and Fiscal Year Current Permit Term	Assessment Method
PERFORMANCE MEASURES – WET AND DRY WEATHER				
	Performance Metrics		FY18	
City of La Mesa	Design, Construct, and Maintain Low-Impact Development (LID) Retrofits	Linear Feet	Approximately 4,540 linear feet of bioretention areas will replace impervious asphalt along University Avenue between La Mesa Boulevard and Harbison Avenue.	Calculate the exact number of linear of feet of bioretention areas installed.
City of San Diego	Develop green infrastructure policy, attain City Council approval, and construct green infrastructure BMPs to improve water quality during wet and dry weather	Acres Baseline: 0 acres treated in 2002, the year used as baseline in the Bacteria TMDL	44.6 acres of drainage area treated through construction of 6 green infrastructure BMPs	Verify number of acres of drainage area treated from completed green infrastructure BMPs using information from final design drawings.
PERFORMANCE MEASURES – WET WEATHER				
	Performance Metrics		FY18	
City of Lemon Grove	Reduction in Bacteria	Restaurant Used Cooking Oil Bins Stored in Covered Areas Protected from Run-On	75 percent (%)[1]	Percent of Restaurant Used Cooking Oil Bins Stored in Covered Areas Protected from Run-On as based on the baseline to be developed during the FY16 Annual Report

Table K10-2 (continued)
Assessment of Goals for Chollas Creek, Current Permit Term

Jurisdiction	Numeric Goal	Unit of Measure	Assessment Period and Fiscal Year Current Permit Term	Assessment Method
City of Lemon Grove (continued)	**OR**			
	Municipal Facility Retrofits for Reduction of Bacteria and Metals	Redirect parking lot runoff to pervious area	2 municipal facilities retrofitted (drainage area/facility TBD during site selection in FY16)	Number of facilities retrofitted and the calculated drainage area for those facilities
		Redirect Roof Downspouts to Pervious Area	2 municipal facilities retrofitted (drainage area/facility TBD during site selection in FY16)	
PERFORMANCE MEASURES – DRY WEATHER				
	Performance Metrics		FY18	
City of Lemon Grove	Non-Storm Water Flow Reduction Programs	Install smart irrigation systems at municipal facilities	8 Cal-Sense smart irrigation systems installed	Number of Cal-Sense smart systems installed
City of San Diego	Implement runoff reduction programs including targeted education and outreach, enhanced inspections, rebates[2], and increased enforcement	Volume Reduction Baseline: Historical dry weather monitoring data will be used to establish a baseline in the first Water Quality Improvement Plan Annual Report	10% reduction in prohibited[3] dry weather flow from baseline measured at persistently flowing outfalls in the WMA	Percent reduction in the amount of dry weather flow measured from City of San Diego dry weather monitoring locations

Notes:
1. These data have not been directly recorded in past inspection programs. The City's current BMP requirements state that bins must be kept clean but do not always require coverage. Based on discussion with inspection staff, it is estimated that about 20-30% of used oil cooking bins are stored in covered areas protected from run-on.
2. City of San Diego rebates include grass replacement, rainwater harvesting, downspout disconnect, and micro-irrigation.
3. Does not include allowable discharges as defined in Provision A and Provision E.2.a of the MS4 Permit.

% = percent; FY = fiscal year; TBD = to be determined

Table K10-3
Assessment of Goals for Water Quality (Copper and Zinc) Within Airport Authority Jurisdiction (908.21), Current Permit Term

Jurisdiction	Numeric Goal	Unit of Measure	Assessment Period and Fiscal Year	Assessment Method
			Current Permit Term FY17 or FY16 as Noted	
Airport Authority	**MS4 Discharges** Jurisdiction-wide % of Samples With Concentrations Exceeding Industrial General Permit (IGP) NALs	% of Samples	Dissolved Copper = 70% (FY17)	Comparison of sample results to the IGP NALs and calculation of percent exceedance
			Dissolved Zinc = 65% (FY17)	
	OR			
	MS4 Discharges Sub-basins 1, 3, and 5 (in total) Area Treated with Street Sweeping	Acres/ Week	34 Acres/Week (Current Frequency) (FY16)	Confirmation of implementation of street sweeping frequency.

Table K10-4
Assessment of Goals for Riparian Area Habitat in Paradise Creek (909.1), Current Permit Term

Jurisdiction	Numeric Goal	Unit of Measure	Assessment Period and Fiscal Year Current Permit Term FY17 or FY16 as Noted	Assessment Method
City of National City	**Receiving Water** Removal of 303(d) Selenium Listing	303(d) Listed Segment	Complete Selenium Water Quality Monitoring (FY16) Collect and analyze 48 samples for selenium, with zero exceedances of the water quality objective[1]	Summary of the completed monitoring program, including sampling locations, number of samples taken, and summary of results.
	Restore Native Riparian Vegetation and Wetlands	Remove Concrete Bottom from Paradise Creek	1,000 Linear Feet (FY17)	Total number of linear feet of concrete bottom removed.
		Wetland Restoration	6,000 Square Feet (FY17)	Total square feet of wetland restored.
		Total native plant restoration, including wetlands	35,000 Square Feet (FY17)	Total square feet of native plan replacement.
		Provide Treatment for Tributary Urbanized Areas	130 Treated Acres (FY17)	Total acres of treated area.

Note:
1. These numbers are designed such that the when analyzed together with the historical data upon which the current 303(d) listing is based, the entire data set (current study data plus historical data) meets the delisting criteria in the State listing policy (State Board, 2004).

Table K10-5
Assessment of Goals for Physical Aesthetics in Lower Sweetwater HA (909.1) and Otay River HA (910.2), Current Permit Term

Jurisdiction	Numeric Goal	Unit of Measure	Assessment Period and Fiscal Year	Assessment Method
			Current Permit Term FY18	
City of Chula Vista and Port of San Diego (909.1) City of Chula Vista, City of Imperial Beach, and Port of San Diego (910.2)	**MS4 Discharges** % Optimal[1] Trash Assessment Scores	MS4 Outfalls Assessed for Trash	65%	Comparison to the baseline determined in the first Annual Report that includes the RPs' cumulative number of site visits of major MS4 outfalls in the Focused Priority Condition area for dry weather and MS4 outfall monitoring during FY12 through FY14
	OR			
	MS4 Discharges % Jurisdictional High Volume Trash Drainage Area Treated for Trash[2]	Feasible Drainage Area for BMP retrofit	10%	An assessment is needed to incorporate review of all available trash and source assessment data, drainage areas, and potential locations in high-volume trash-generating areas to feasibly implement structural control BMPs to identify or verify high-volume trash areas and % area feasible to retrofit with trash BMPs

Notes:
1. Historically, an optimal score was given to sites meeting the following requirements: "On first glance, no trash visible. Little or no trash (<10 pieces) evident when evaluated area is closely examined for litter and debris." This definition may change in the future and will be noted in Water Quality Improvement Plan updates.
2. These values are based on best available information and current jurisdictional knowledge. A feasibility study is required to determine where BMP retrofits can be implemented.

Table K10-6
Assessment of Goals for Swimmable Waters (Beaches) in the Coronado HA (910.1), Current Permit Term

Jurisdiction	Numeric Goal	Unit of Measure	Assessment Period and Fiscal Year Current Permit Term FY18	Assessment Method
City of Coronado and Port of San Diego	**Receiving Water** Removal of 303(d) Indicator Bacteria Listings for Recreation Water Contact (REC-1 Beneficial Use)	% of Samples Exceeding WQOs Tidelands Park	Baseline = 15% Below 15% for dry weather monitoring 33% for wet weather monitoring	Comparison to the baseline identified in the San Diego Bay Water Quality Improvement Plan.
	OR			
	Water Quality Report Card – Achieve grade and inform the public	% Water Quality Report Card Grade Achieved (Dry Weather)[7]	Baseline = 80% - Grade A 85% - Grade A	Comparison to the baseline grade average identified by Heal the Bay.
		% Water Quality Report Card Grade Achieved (Wet Weather)	Baseline = 58% - Grade A 67% - Grade A	Comparison to the baseline grade average identified by Heal the Bay.

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Attachment A Monitoring Methods

ATTACHMENT A1. LONG-TERM RECEIVING WATER MONITORING PROGRAM – MONITORING PLAN

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ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviation	Definition
>	less than
<	greater than
AFDM	ash-free dry mass
APHA	American Public Health Association
AWWA	American Water Works Association
BMI	benthic macroinvertebrate
BOD	biochemical oxygen demand
BSA	bovine serum albumin
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
CEDEN	California Environmental Data Exchange Network
COC	chain of custody
cm^2	square centimeter
CRAM	California Rapid Assessment Method
CSBP	California Stream Bioassessment
EDD	electronic data deliverable
EDTA	ethylenediaminetetraacetic acid
ELAP	Environmental Laboratory Accreditation Program
GIS	geographic information system
GPS	Global Positioning System
HU	hydrologic unit
IBI	Index of Biological Integrity
ID	identification
mL	milliliter
MLS	Mass Loading Station
mm	millimeter
MS4	municipal separate storm sewer system
MS4 Permit	San Diego Regional Water Quality Control Board Order Number R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region

Acronyms and Abbreviations (continued)

Acronym or Abbreviation	Definition
NPDES	National Pollutant Discharge Elimination System
PBO	piperonyl butoxide
pH	hydrogen ion concentration
PVC	polyvinyl chloride
O/E	observed to expected
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RWQCB	Regional Water Quality Control Board
SAFIT	Southwest Association of Freshwater Invertebrate Taxonomists
SCCWRP	Southern California's Coastal Water Research Project
SDCRC	San Diego County Regional Copermittees
SR-MLS	Sweetwater River Mass Loading Station
SDWQCB	San Diego Regional Water Quality Control Board
SMC	Stormwater Monitoring Coalition
SOP	standard operating procedure
SPE	solid phase extraction
STS	sodium thiosulfate
SWAMP	Surface Water Ambient Monitoring Program
TIE	toxicity identification evaluation
TMDL	total maximum daily load
TSS	total suspended solids
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
WEF	Water Environment Federation
WMA	Watershed Management Area

A.1 INTRODUCTION

The purpose of this Monitoring Plan is to describe the long-term receiving water monitoring, as required by the San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001, *National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges From the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region*, hereafter referred to as the MS4 Permit. The goal of the San Diego Bay Watershed Management Area (WMA) Receiving Water Monitoring Program is to characterize current conditions and assess progress in the receiving waters, and effectiveness of water quality improvement strategies implemented as part of the San Diego Bay WMA Water Quality Improvement Plan.

A.1.1 Program Overview

The Receiving Water Monitoring Plan includes the following monitoring to satisfy the requirements of Provision D of the MS4 Permit:

- Long-term dry and wet weather receiving water monitoring in accordance with the MS4 Permit (Provisions D.1.a, b, c, and d)[1]
- Rapid stream bioassessment in accordance with the MS4 Permit (Provision D.1.c.(5)), which includes Regional monitoring participation in the Stormwater Monitoring Coalition (SMC) Regional Monitoring Program and Southern California Bight Regional Monitoring Program (Provision D.1.e.(1))
- Dry weather hydromodification monitoring in accordance with the MS4 Permit (Provision D.1.c.(6))
- Toxicity identification evaluation (TIE)/toxicity reduction evaluation (TRE), if appropriate

The MS4 Permit identifies the Responsible Parties (RPs) for the San Diego Bay WMA. The RPs will collaborate to support the monitoring and reporting activities described in this plan are:

- Airport Authority
- City of Chula Vista
- County of San Diego
- City of Coronado

[1] The receiving water station in the Pueblo HU will be monitored according to Chollas Creek TMDL Compliance. See Section A.1.4 and Appendix C (Chollas Creek TMDL Compliance) for details.

- City of Imperial Beach
- City of La Mesa
- City of Lemon Grove
- City of National City
- Port of San Diego
- City of San Diego
- Caltrans[2]

A.1.2 Monitoring Locations

The San Diego Bay WMA RPs have completed receiving water monitoring at stations in the Sweetwater, Otay, and Pueblo hydrologic units (HU) during the current Permit term and prior to the current Permit term. To continue to the long-term data sets and to supply more information that can be used in future reevaluations of priority conditions, monitoring will continue in these three HUs during the next Permit term, as summarized in Table A1-1. Monitoring procedures applicable to the sites in the Sweetwater and Otay HUs are described in Monitoring and Assessment Plan Attachment A, and procedures applicable to the sites in the Pueblo HU are described in The Chollas Creek TMDL Monitoring Plan Attachment C. Further description of the Pueblo HU monitoring stations is provided in Section A.1.4.

A map of the locations is presented in Figure A1-1.

Table A1-1
List of Receiving Water Monitoring Locations

Station Name	Waterbody	HU	Latitude	Longitude	Description of Applicable Monitoring Procedures
SR-MLS	Sweetwater River	Sweetwater (909)	32.650720	-117.063592	Attachment A1, Section A.1.3
OR-TWAS-1	Otay River	Otay (910)	32.588464	-117.071683	Attachment A1, Section A.1.3
SD8(1)	Chollas Creek	Pueblo (908)	32.70493	-117.12132	Attachment A1, Section A.1.4; Attachment C

[2] The California Department of Transportation (Caltrans) is not listed in the Municipal Permit as a Copermittee, but is participating voluntarily in the development of the Water Quality Improvement Plan as a Chollas Creek TMDL Responsible Party. Caltrans' participation is limited to an 864-acre area within the Chollas Creek Hydrologic Sub-Area (HSA) in the Pueblo HU.

Figure A1-1
Receiving Water Long-Term Monitoring Stations

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A.1.3 Monitoring Methods: Sweetwater HU (909) and Otay (910) HU

This section describes monitoring methods and procedures used to implement the long-term receiving water monitoring program. Long-term receiving water monitoring will be conducted at for the Sweetwater and Otay HU sites as indicated in Table A1-1 within the San Diego Bay WMA, in accordance with the MS4 Permit (Provisions D.1.b, c, and d). Further information and details of the long-term monitoring in Pueblo HU, as indicated in Table A1-1, is provided in Section A.1.4. Seasonal mobilization and demobilization activities will include the following:

- Equipment will be installed and maintained to perform flow monitoring and sampling.
- Flow monitoring data will be collected throughout the monitoring season to estimate the annual watershed loads.
- Monitoring equipment will be removed upon completion of the required monitoring).
- Because safety and quality are integral parts of data collection, team safety meetings and quality reviews will be conducted to ensure that safe and reliable business practices are used during the implementation of this program.

A.1.3.1 Water Quality Sampling

This section discusses the sampling procedures and analytical methods for water quality sampling. All sampling and analyses conducted for long-term receiving water monitoring locations will be in accordance with applicable SWAMP regulations and guidance. Attachment A5 provides a complete list of constituents, methods, sample volumes, holding times, and target reporting limits for the San Diego Bay WMA Receiving Water Monitoring Program.

A.1.3.1.1 Dry Weather

Each station will be monitored during three dry weather events: once during September prior to the start of the wet season, once during the wet season, and once in May or June after the end of the wet season. Dry weather monitoring will be conducted on days with less than 0.1 inches of rainfall in any 24 hour period and 72 hours of antecedent dry conditions.

In the event that dry weather flow is not observed at a station during the September monitoring event prior to the start of the wet season, the first dry weather sampling event will occur during non-storm events (e.g., at least 72 hours after a storm event) if dry weather flow is observed during the wet season.

A.1.3.1.2 Wet Weather

Each long-term station will be monitored during three wet weather events: during the first viable rainfall event of the wet season on or after October 1, during one event at least 30 days after the first monitored rainfall event, and during one rainfall event on or after February 1.

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 percent chance of rainfall within a 24 hour period. Each storm of at least 0.1 inch of rainfall must be separated by a minimum of 72 hours, and the forecast storm volume within ± 50 percent 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/).

A.1.3.1.3 Flow Monitoring

Flow rates will be monitored using American Sigma (or comparable) flowmeters with an ultrasonic sensor, bubbler, or submerged pressure transducer as the primary measuring device. The primary sensor will continuously measure stage (i.e., stream height) and relay that information to the flowmeter. The flowmeter will continually calculate flow rates by inserting the stage information into the preprogrammed discharge equation. Using this system, the flowmeter will be able to actuate the sampler to achieve a flow-weighted composite sample. Sampling and flow equipment will be monitored remotely, and data will be transferred to a permanent data system by cellular modem or manual download.

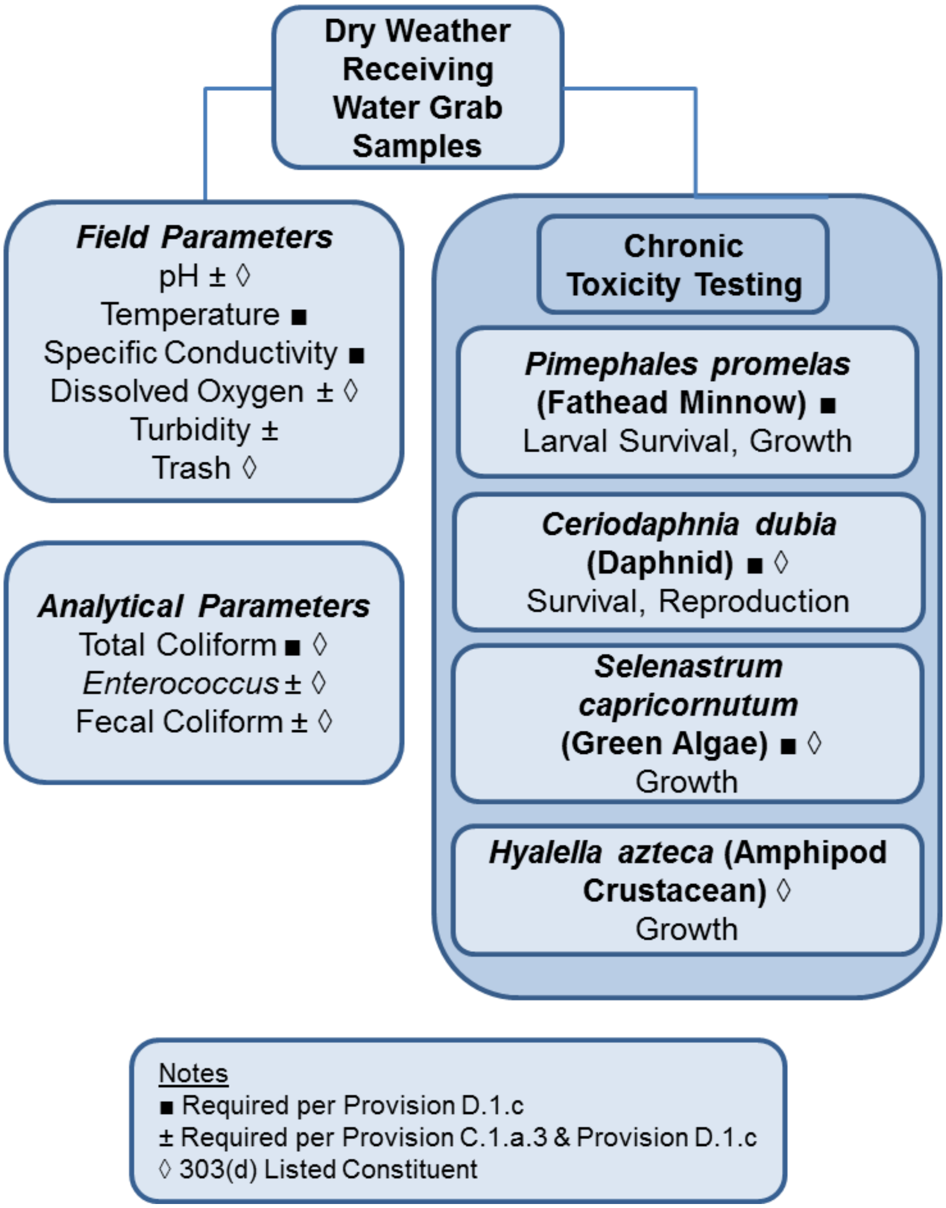
Equipment installed and used for monitoring during dry weather will remain in place during the course of the monitoring year. The monitoring year is October 1 through September 30. Continual flow data will be downloaded remotely from each station once every two weeks to verify equipment functionality and to reduce data gaps, increase accuracy, and identify maintenance and calibration needs. Flow data will be entered into the data management system. Equipment will be maintained throughout this period to verify that it is in proper working order. Additional flow monitoring details, including methods used for stream rating and channel surveys, are provided in Attachment A.

A.1.3.1.4 Grab Samples

Grab samples will be collected for those constituents that are not amenable to composite sampling. Per the Permit, the constituents to be collected as grab samples are indicated in Figure A1-2 and Figure A1-3 and include:

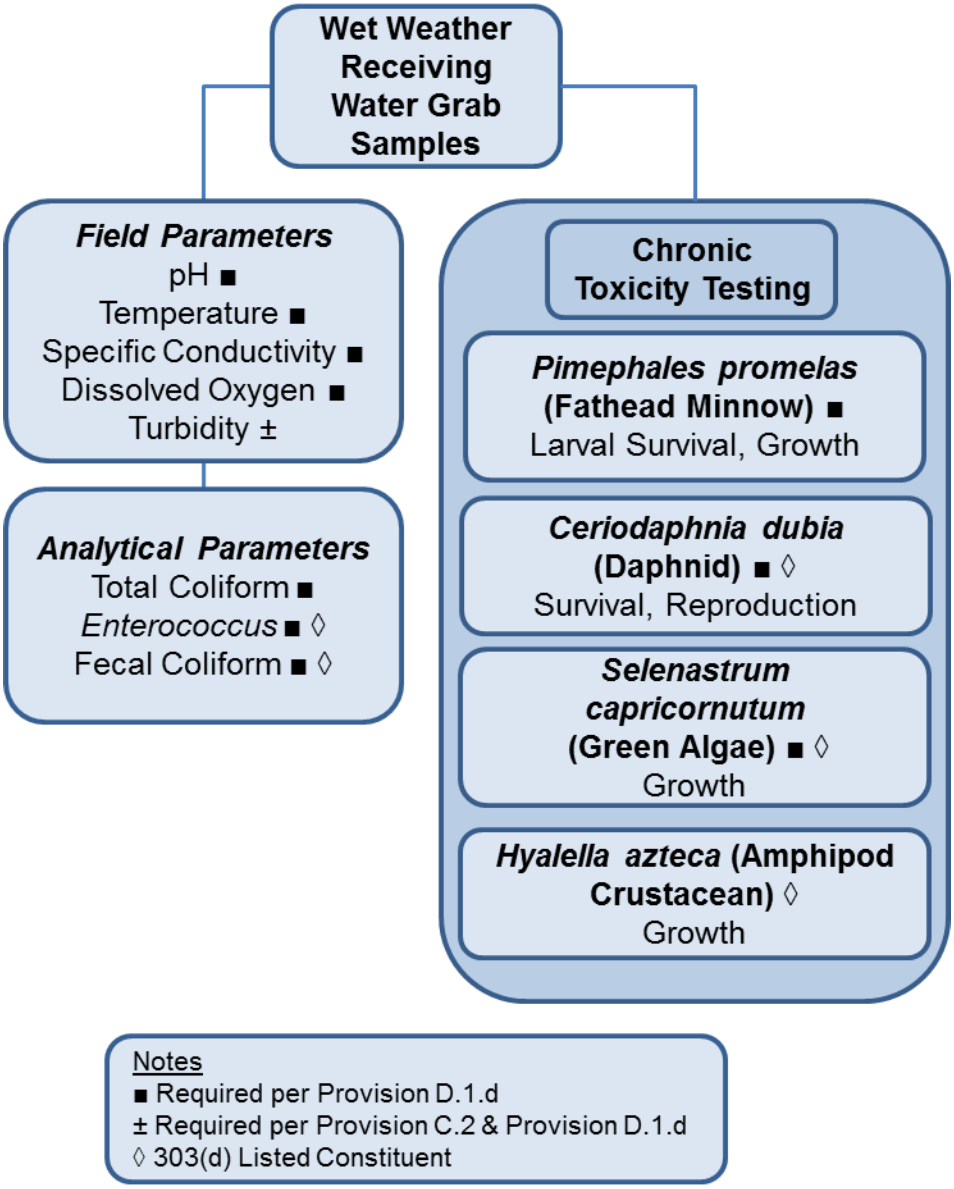
- Temperature
- Hydrogen ion concentration (pH)
- Specific conductance
- Dissolved oxygen
- Turbidity
- Total coliform
- Fecal coliform

- *Enterococcus*



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A1-2
Dry Weather Receiving Water Monitoring Grab Samples



Note: *This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.*

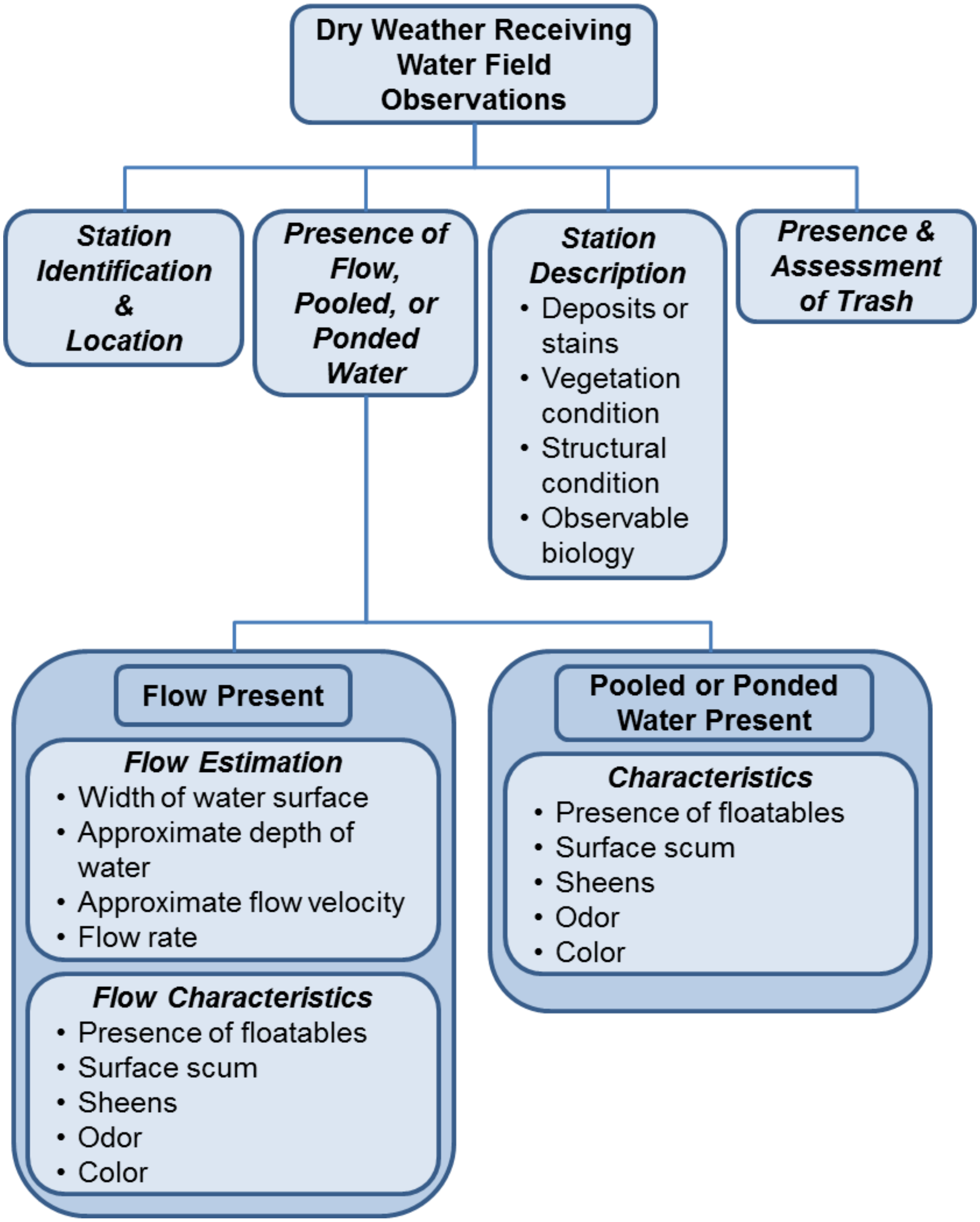
Figure A1-3
Wet Weather Receiving Water Monitoring Grab Samples

Samples will be collected from the horizontal and vertical center of the channel, if possible, per SWAMP requirements, and will be kept clear of uncharacteristic floating debris.

Microbiology samples will be collected using sterile techniques. Nitrile or latex-type gloves will be worn during sample handling. During the sample event, a 100-milliliter (mL) sterile bacteria bottle will be used to collect the sample directly from the receiving water. Care will be employed to not allow contact with area structures or bottom sediments. The container will be opened only for the time needed to collect the sample and will be closed immediately following sample collection. If it is suspected that the container was compromised at any time, the sample container will be discarded, and a new sample will be collected using a new sample bottle. The sample must be filled only to the 100-mL mark on the sample bottle (not over-topped or under-filled).

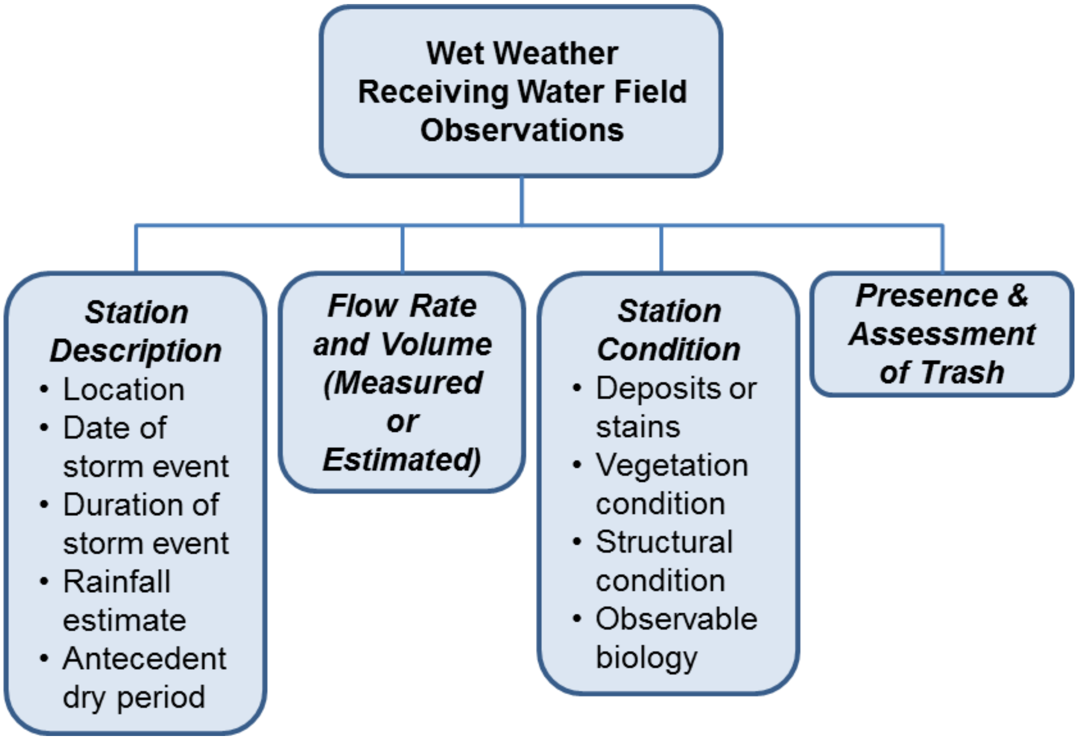
Field measurements will be performed for pH, specific conductance, temperature, dissolved oxygen, and turbidity using an YSI 6920 series water quality probe or similar device. Calibration of the instruments will be conducted prior to each sampling event in accordance with the manufacturer's specifications and checked following each sampling event. Calibration records will be kept on file.

A field observation data sheet will be completed for each sample collected to be representative of station conditions. Field observations include trash assessments, which will be performed at each station in accordance with the *Monitoring Workplan for the Assessment of Trash in San Diego County* (San Diego County Regional Copermittees [SDCRC], 2007a). Narrative field observation requirements are outlined in Figure A1-4 and Figure A1-5.



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A1-4
Dry Weather Receiving Water Field Observations



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

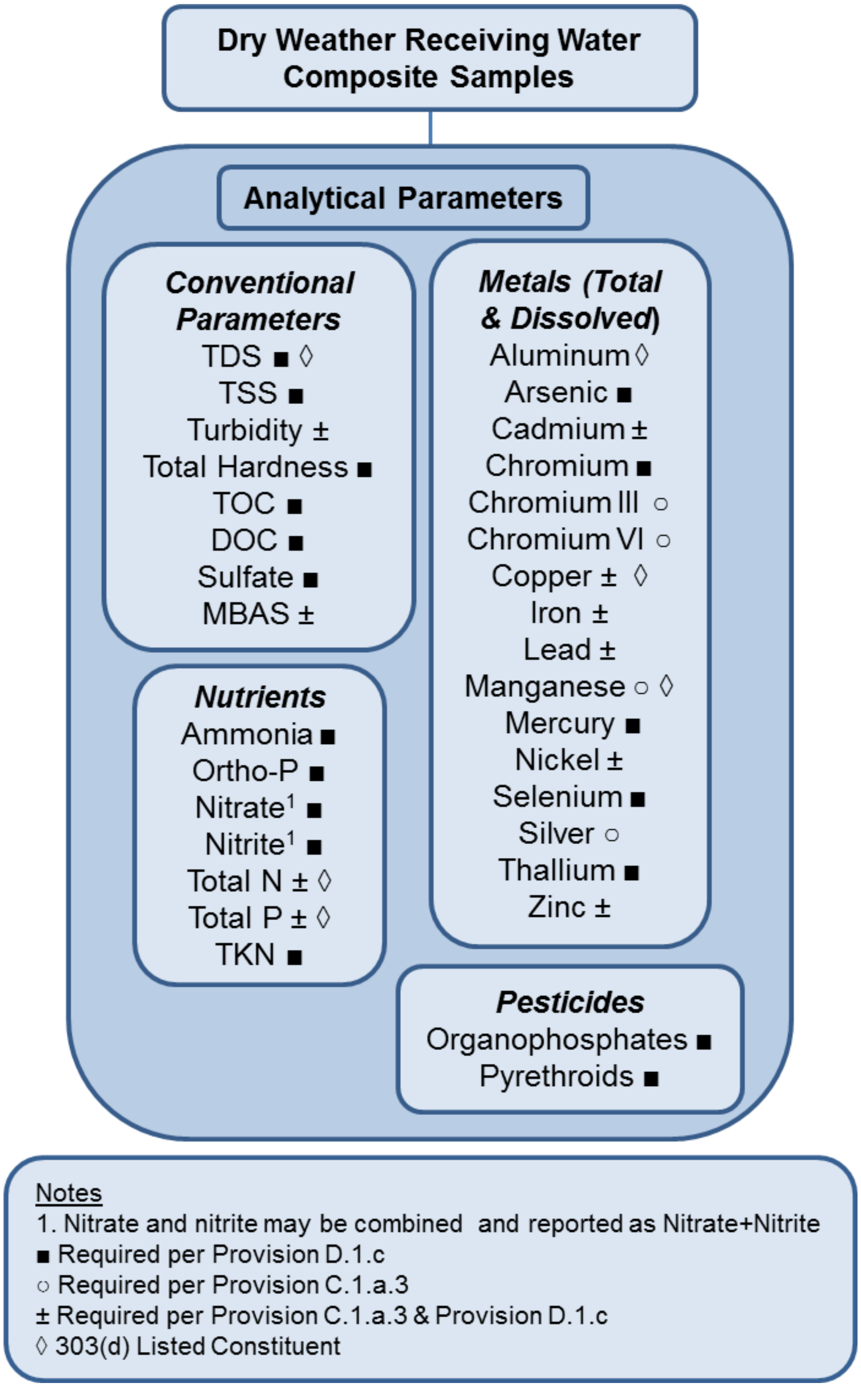
Figure A1-5
Wet Weather Receiving Water Field Observations

A.1.3.2 Composite Samples

A single flow-weighted composite sample will be collected at each station during the dry weather and wet weather monitoring events. During the monitoring event, sample aliquots will be collected in proportion to the rate of flow (i.e., flow-weighted) using automated equipment and Teflon-lined tubing. Dry weather flow-weighted composite samples will be collected over a typical 24-hour period. Wet weather flow-weighted composite samples will be collected by taking sample aliquots across the hydrograph of the storm event. Based on the anticipated size of the storm, a flow-proportioned pacing will be programmed into the automated sampling equipment. The first sample aliquot will be taken when the selected pacing triggers the sampler, and each subsequent aliquot of equal volume will be collected every time the pre-selected flow volume (flow-proportional pacing) discharges past the monitoring location. Some variation may occur depending on actual storm intensity and duration.

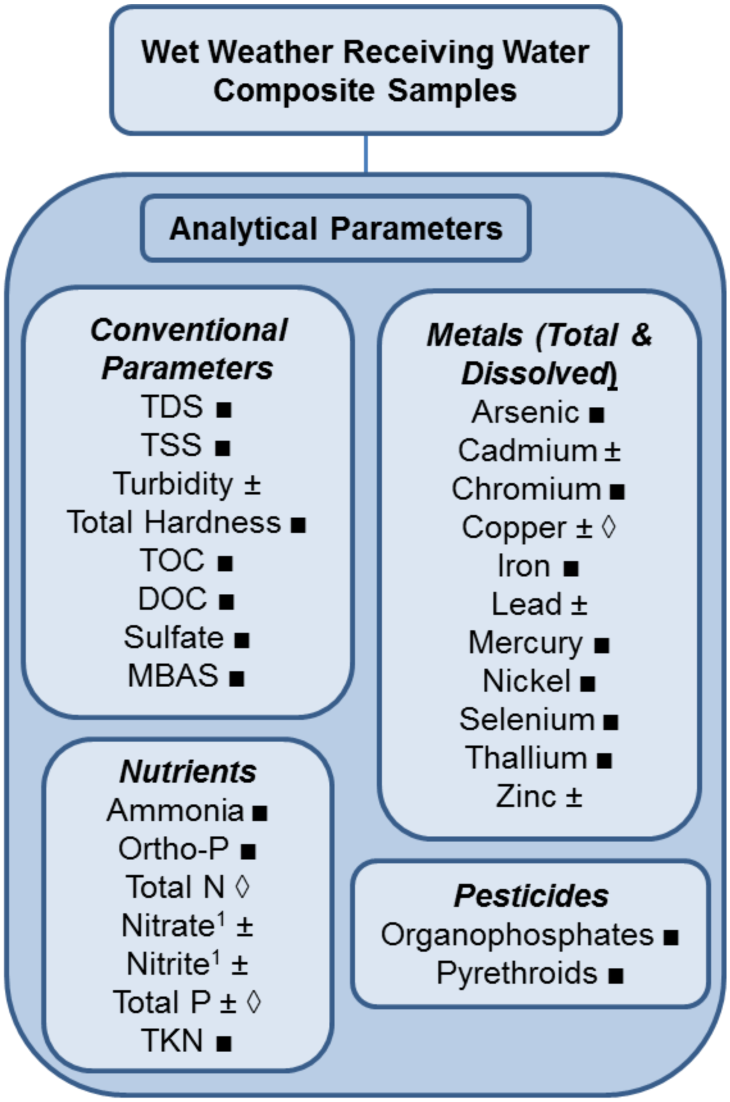
Flow-weighted water samples will be collected in pre-cleaned 20-liter (L) borosilicate graduated glass bottles. Sample bottles will be properly labeled with sample identification (ID), date, and time; sealed with a pre-cleaned rubber stopper; and preserved on ice for transport to the laboratory or consultant for sample compositing. Approximately 19 L of sample water will be contained in a "full" bottle. If flow rate sampling adjustments are made during a sampling event, the volume of sample to be used in sample compositing from the various bottles will differ for a given monitoring location to ensure that the final composite sample is properly flow-weighted. To ensure that a representative sample is used, samples should be mixed prior to pouring out liquid. A 100-L compositing container will be used to composite samples with multiple bottles. The graduated 19-L sample bottle will be used to measure sample volume that will be composited. The mixing will be done between transfers of liquid. Samples will be mixed continuously using a pre-cleaned glass stir bar as they are poured into the large pre-cleaned containers. After the determined amount from each bottle has been added to the compositing container from a specific station, subsampling may begin. Subsamples for chemical analyses will be poured into appropriate sample bottles.

The flow-weighted composite samples will be analyzed for the constituents not identified for grab sampling. Figure A1-6 and Figure A1-7 outlines the constituent requirements for composite samples. The list of constituents for the San Diego Bay WMA for dry weather and wet weather is provided in Attachment A5.



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.
Aluminum will be analyzed for Sweetwater HU only.

Figure A1-6
Dry Weather Receiving Water Monitoring Composite Samples



<u>Notes</u>
1. For Provision C.2, nitrate and nitrite are to be combined and reported as nitrate+nitrite (total)
■ Required per Provision D.1.d
± Required per Provision C.2 & Provision D.1.d
◊ 303(d) Listed Constituent

Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.
Total N will be analyzed for Sweetwater HU only.

Figure A1-7
Wet Weather Receiving Water Monitoring Composite Samples

A.1.3.3 Sample Analysis

Samples will be analyzed for the bacteria, chemistry, toxicity, and general field parameters provided in Attachment A5. Attachment A5 includes the methods and target reporting limits for each constituent. Chemical, toxicity, and bacterial analysis of samples will be performed by a laboratory certified for the appropriate fields of testing by the California Environmental Laboratory Accreditation Program (ELAP). The laboratory(s) will also be a participant in the SMC Intercalibration Program.

General physical and chemical constituents will be analyzed by accredited laboratories, with the exception of field-measured constituents (i.e., pH, specific conductance, temperature, turbidity, and dissolved oxygen). Field measurements will be collected by field staff during sampling activities using an YSI 6920 series water quality probe or similar type device.

A.1.3.4 Quality Assurance/Quality Control

Quality assurance (QA) and quality control (QC) for sampling processes will include proper collection of the samples to minimize the possibility of contamination. Samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample bottles. Field staff will wear powder-free nitrile or similar gloves during sample collection.

QC samples will be collected to ensure that valid data are collected. Depending on the parameter, QC samples will consist of blanks and duplicate samples to remain compliant with (SWAMP) protocols. QC requirements will be reviewed and discussed with the appropriate staff to verify the proper working order of equipment, refresh monitoring personnel in monitoring techniques, and determine whether the data quality objectives are being met.

The QA objectives for analyses conducted by the participating analytical laboratories are detailed in their Laboratory QA Manuals. The objectives for accuracy and precision involve all aspects of the testing process, including the following:

- Methods and standard operating procedures (SOPs)
- Calibration methods and frequency
- Data analysis, validation, and reporting
- Internal QC
- Preventive maintenance
- Procedures to ensure data accuracy and completeness

The results of the laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology will be identified, and the corresponding data will be appropriately qualified in the final report. The QA/QC records for the various testing programs will be kept on file for review by regulatory agency personnel for five years.

A.1.3.4.1 Training and Certification

All field personnel will have current and relevant experience in all aspects of standard field monitoring, including use of relevant field equipment such as field instruments and monitoring equipment. Field personnel will be trained and will have experience in the sample collection and handling/storage, and chain-of-custody procedures. Proper field sampling and sample-handling techniques will be reviewed prior to sampling, and only those staff with proficiency will be permitted to conduct the field work. Training will be documented in the health and safety plan for each member of the field team.

All personnel are responsible for complying with the QA/QC requirements that pertain to their organizational/technical functions. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of his or her particular function and a general knowledge of laboratory operations, test methods, QA/QC procedures, and records management.

A.1.3.4.2 Chain-of-Custody Procedures

Samples will be considered to be in custody if they are (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal such that the sample could not be reached without breaking the seal. The principal documents used to identify samples and to document possession will be chain-of-custody (COC) records, field logbooks, and field tracking forms. COC procedures will be used for samples throughout the collection, transport, and analytical process.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or group of samples. Each person who will have custody of the samples will sign the form and ensure that the samples will not be left unattended unless properly secured. Documentation of sample handling and custody includes the following:

- Sample identifier
- Sample collection date and time
- Any special notations on sample characteristics or analysis
- Initials of the person collecting the sample
- Date the sample was sent to the analytical laboratory
- Shipping company and waybill information

Completed COC forms will be placed in a plastic envelope and kept inside the cooler containing the samples. Once delivered to the analytical laboratory, the COC form will be signed by the person receiving the samples. The condition of the samples will be noted and recorded by the receiver. COC records will be included in the final reports prepared by the analytical laboratories and are considered an integral part of the report.

A.1.3.4.3 Field Quality Control

For conventional water quality analyses except field measurements performed on grab samples, field blanks and field duplicates will be analyzed in accordance with SWAMP guidelines.

For toxicity testing, only field duplicates will be collected. The use of controls and reference toxicant testing are QA/QC measures that have been put in place to identify changes in test organism sensitivity due to stress or other factors.

A.1.3.4.4 Equipment Calibration

All instruments used for field and laboratory analyses will be calibrated in accordance with the manufacturer's specifications. Calibration of the flow monitoring and sampling equipment will be conducted immediately prior to deployment or use and will be field verified during each data download or sampling event. The calibrations will be conducted in accordance with the manufacturer's specifications.

Field measurements for pH, specific conductance, dissolved oxygen, turbidity, and temperature will be made using an YSI 6920 series water quality probe or similar probe in accordance with the manufacturer's specifications. The YSI 6920 series water quality probe will be calibrated with calibration solutions, and it will be verified that the expiration date has not been exceeded.

A.1.3.4.5 Equipment Decontamination and Cleaning

QA/QC for sampling processes begins with proper collection of the samples to minimize the possibility of contamination. All water samples will be collected in laboratory-certified, contaminant-free bottles. Appropriate sample containers and field measurement and sampling gear will be transported to the sampling location in clean storage containers. Field measurements will be taken and recorded using the appropriate equipment. If sampling poles are used for collecting water samples, they will be decontaminated between sampling locations.

A.1.3.5 Toxicity Identification Evaluations

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

TIEs, if necessary, will be conducted in compliance with Provisions D.1.c.(4)(f) and D.1.d.(4) of the MS4 Permit and used to determine the causative agent(s) of toxicity. The Copermittees have budgeted for three Phase I TIEs in the event that assessment under Provision D.4.a.(2) indicates the need for a TIE. TIEs will be conducted in accordance with the guidelines for characterizing chronically toxic effluents (USEPA, 1991; USEPA, 1992; USEPA, 1993a; USEPA, 1993b).

Phase I TIE testing involves manipulating the sample(s) using the methods in Table A1-2.

Treatment blanks will be created for each TIE treatment to determine the effects of the manipulation on laboratory dilution water. The results of these blanks will be used to determine whether any changes in toxicity of the control (dilution water) are impacted by the chemical or physical manipulation of the sample. A baseline test, run concurrently with the TIE treatments, will be performed to assess the toxicity of the unmanipulated sample(s). Baseline tests are intended to confirm the presence of toxicity in the sample and to benchmark the toxicity for comparison to toxicity in TIE treatments.

Table A1-2
Phase I TIE Manipulations

Physical and Chemical Manipulation (Test) on Water Samples	Purpose of Test
Filtration	Detects filterable compounds (e.g., total suspended solids [TSS] related)
Aeration	Detects volatile, oxidizable, sublatable, or spargeable compounds
Ethylenediaminetetraacetic acid (EDTA) addition	Detects cationic metals (e.g., cadmium)
Sodium thiosulfate (STS) addition	Detects oxidative compounds (e.g., chlorine)
Solid phase extraction (SPE) over C18 column, followed by methanol elution	Detects non-polar organics and some surfactants
Piperonyl butoxide (PBO) addition	Detects organophosphate pesticides and pyrethroids
Carboxyl esterase addition	Detects pyrethroids
Bovine serum albumin (BSA) addition	Protein BSA is used as a control for the carboxyl esterase
Temperature reduction	Increases toxicity of pyrethroid pesticides
pH reduction	Detects pH-dependent toxicants (e.g., ammonia or sulfides)

A.1.3.6 Dry Weather Hydromodification Monitoring

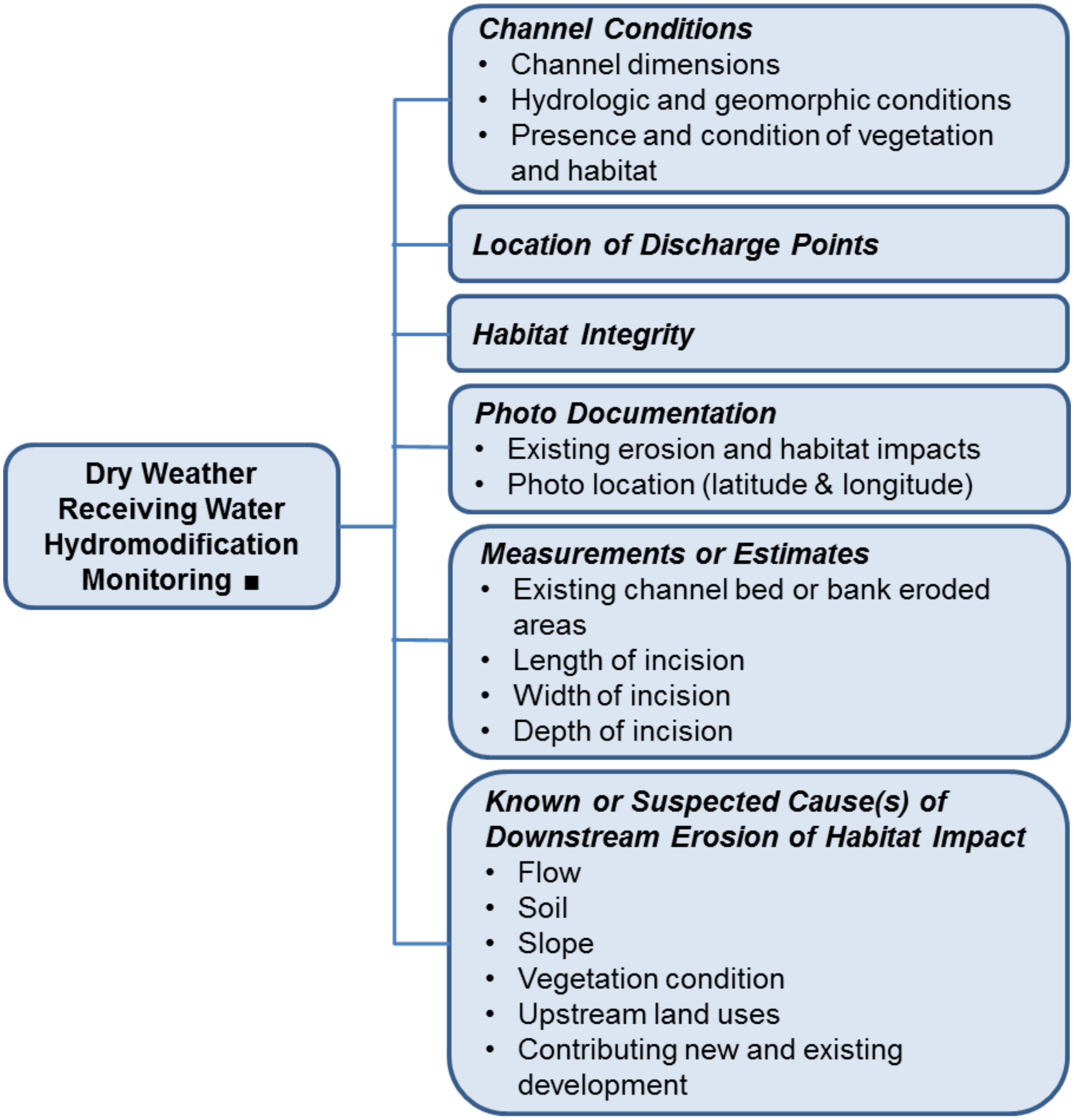
This section describes the sampling and data collection methods for the dry weather receiving water hydromodification monitoring requirements as outlined in Provision D.1.c.(6) of the MS4 Permit.

In addition to the hydromodification monitoring conducted as part of the Copermittees' Hydromodification Management Plans, hydromodification monitoring is required at least once during the MS4 Permit term. The Copermittees must collect the following hydromodification monitoring observations and measurements within an appropriate domain of analysis during at least one dry weather monitoring event for each monitoring location:

- Channel conditions, including: Channel dimensions, hydrologic and geomorphic conditions, and presence and condition of vegetation and habitat
- Location of discharge points
- Habitat integrity
- Photo documentation of existing erosion and habitat impacts, with location (i.e., latitude and longitude coordinates) where photos were taken
- Measurement or estimate of dimensions of any existing channel bed or bank eroded areas, including length, width, and depth of any incisions
- Known or suspected cause(s) of existing downstream erosion or habitat impact, including flow, soil, slope, and vegetation conditions, as well as upstream land uses and contributing new and existing development

The monitoring will coincide with the spring receiving water dry weather monitoring event in May or June and the dry weather receiving water bioassessment monitoring. The domain of analysis at each monitoring location for dry weather hydromodification monitoring will be within the same reach of the channel as that used for dry weather bioassessment monitoring.

Figure A1-8 provides an outline of the hydromodification monitoring requirements and the methods for each assessment category. Detailed methods for each assessment category are described in the following sections.



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A1-8
Dry Weather Receiving Water Hydromodification Monitoring

A.1.3.6.1 Channel Dimensions

Channel surveys will be conducted at each monitoring location to gather basic hydraulic measurements of the receiving water channels. Channel surveys will be conducted using a standard line of site survey. Channel depth, height and slope will be calculated by visual estimations. Channel thalweg surveys will be conducted for the reach upstream and downstream of the cross-section. The average channel slope will be calculated from the survey data.

A.1.3.6.2 Hydrologic and Geomorphic Conditions

The geomorphic assessment will be conducted to characterize the susceptibility of the channel and gather basic hydraulic measurements of the receiving water channels. The geomorphic assessment comprises the channel survey and the Southern California Coastal Water Research Project (SCCWRP) channel assessment tool. The SCCWRP Field Manual (Bledsoe et al., 2010) will be used to assess the vertical and lateral susceptibility of the receiving water channels. The domain of analysis for each monitoring location is derived from the desk and field components of the screening tool and will be within reach of the channel used for dry weather bioassessment monitoring. A suite of field measurements will also be made to characterize the channel bed and banks, and overall stability state. Sediment samples will be collected to characterize bed materials. Fixed-interval pebble counts will be performed for each reach where the channel bed is composed of gravel or coarser material (Bunte and Abt, 2001), and channel beds composed of fine material will be noted as sand or cohesive materials (bed gradations are not required for channels with D50 less than (<) 2 millimeters [mm]).

A.1.3.6.3 Presence and Condition of Vegetation and Habitat Integrity

The presence and condition of vegetation and habitat integrity will be determined from the data collected during dry weather bioassessment monitoring. For dry weather bioassessment monitoring, the sampling will follow the protocols previously outlined in Section 2.5. Physical habitat quality assessments of the monitoring locations using the California Rapid Assessment Method (CRAM) will provide a numerical summary score of the physical conditions for each monitoring location. This method involves assessing the quality of the in-stream habitat features as well as the buffer zones (250 meters perpendicular to flow from each bank and 500 meters upstream and downstream of the monitoring reach), hydrologic source quality, and biotic structure quality. For each monitoring reach sampled, the physical habitat of the stream and its adjacent banks will be assessed to provide a record of the overall physical condition of the reach. Parameters such as substrate complexity, channel alteration and human influence, frequency of riffles, and width and quality of riparian zones will provide a more comprehensive understanding of the condition of the stream. Additionally, specific characteristics of the sampled riffles will be measured, including substrate size classes, stream depth, gradient, sinuosity, and flow volume. A final CRAM score will be calculated that can range from 25 to 100 points, with higher scores indicating higher quality conditions. CRAM ratings of good, fair, and poor are defined by the score (i.e., for the CRAM score range of 25-100, <50=low, 50-75=moderate, and >75=high).

A.1.3.6.4 Photo Documentation

A channel survey will be conducted and photographs will be used to document the conditions in the receiving water channels, including any existing erosion and habitat impacts. Photographs will be taken using a digital camera with a built-in Global Positioning System (GPS). Photo documentation will be conducted using the general procedures outlined in San Diego Water Board Stream Photo Documentation Procedures for 401 Water Quality Certifications Standard Operating Procedure.

The following information will be recorded for each photograph:

- Project name
- General location
- Photographer and team members
- Photo number
- Date
- Time

At a minimum, photographs will be taken of the following:

- Long view up or down the stream (from stream level) showing changes in the stream bank and vegetation
- Long view and medium view of streambed changes (e.g., thalweg, gravel, meanders)
- Long views from a bridge or other elevated position
- Medium and close views of structures and plantings
- Medium views of bars and banks, with a person (preferably holding a stadia rod) in view for scale
- Close views of streambed with a ruler or other common object in the view for scale

A.1.3.6.5 Dimensions of Bed or Bank Eroded Areas

Measurements or estimates of dimensions of any bed or bank eroded areas, including length, width, and depth of any incisions, will be conducted during the channel survey. Bed or bank eroded areas will be documented with photographs as described in the channel survey section above.

A.1.3.6.6 Location of Discharge Points/Known or Suspected Causes of Erosion or Habitat Impact

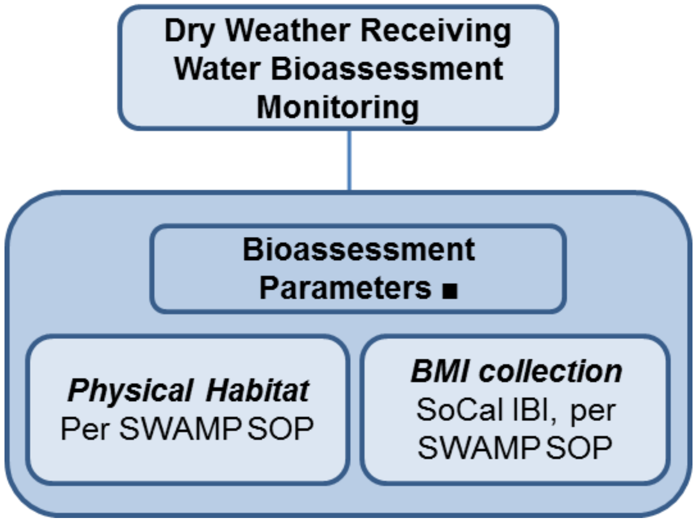
Known or suspected cause(s) of existing downstream erosion or habitat impact, including flow, soil, slope, and vegetation conditions, as well as upstream land uses and contributing new and existing development, will be assessed during a GIS desktop exercise and the SCCWRP channel assessment tool.

A.1.3.7 Dry Weather Receiving Water Bioassessment Monitoring

Dry weather receiving water bioassessment monitoring will be conducted in accordance with the MS4 Permit (Provisions D.1.a.(1), D.1.a.(3)(a), D.1.c.(5), and D.1.e.(1)(a)). Dry weather receiving water bioassessment monitoring will include bioassessment at each long-term receiving water monitoring location and participation in the SMC Regional Monitoring Program. Bioassessment surveys will be conducted during the spring/summer dry season bioassessment index period, typically from May through July. Benthic macroinvertebrates (BMIs) and physical habitat data will be collected following the *SWAMP Bioassessment Procedures: Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California* (Ode, 2007) using the reach-wide benthos method. Benthic algae (i.e., periphyton) monitoring will be conducted in accordance with the *SWAMP Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California* (Fetscher et al., 2009). Samples will be collected and processed for ash-free dry mass (AFDM), chlorophyll-a analysis, and periphyton taxonomy. Reach-wide algal cover will be quantified as part of the SWAMP physical habitat assessment. Physical habitat quality of the monitoring locations will be quantified using CRAM for estuarine wetlands (Collins et al., 2013).

The SWAMP sampling protocol includes the collection of stream BMI and also assesses the physical quality and condition of the streambed and banks in detail. (Note: A physical habitat index based on the SWAMP procedure has not been developed at the time of this report). CRAM assessments incorporate broader buffer zone and land use attributes than do SWAMP assessments, and also provide a numerical quality score for each monitoring location. BMIs reside in streams for periods ranging from a month to several years, and have varying sensitivities to the multiple stressors associated with urban runoff. Using species-specific tolerance values and community species composition, numerical biometric indices are calculated, allowing for comparison of relative habitat health among streams in a region. By assessing the invertebrate community structure of a stream, a cumulative measure of stream habitat health and ecological response is obtained.

The data include a taxonomic listing of all BMIs identified in the surveys, and calculation of the biological metrics listed in the California Stream Bioassessment Procedure (CSBP). Additionally, calculation of two indices that rate the overall BMI community quality will be performed. These include the Index of Biotic Integrity (IBI) (Ode et al., 2005) and the observed to expected (O/E) ratio of taxa (Hawkins, Western Center for Monitoring and Assessment, 2010). Figure A1-9 provides an outline of the bioassessment monitoring requirements.



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A1-9
Dry Weather Receiving Water Bioassessment Monitoring

A.1.3.7.1 2015 SMC Regional Monitoring Program

The 2015 SMC Regional Monitoring Program is currently being developed. The SMC Bioassessment Technical Workgroup is working to determine which components of the 2009-2013 SMC Regional Monitoring Program were effective tools for achieving the program's goals and what monitoring elements may be suspended or added for future assessments. Beginning in 2015, SMC will confirm the monitoring locations under this program.

A.1.3.7.2 Monitoring Reach Delineation

Using SWAMP methodology, every monitoring reach is 150 meters in length and will be sampled from downstream to upstream. If a portion of a reach is inaccessible, the reach length may be reduced to as little as 100 meters. The bioassessment reaches are placed as closely as possible to the water quality and flow monitoring locations.

A.1.3.7.3 Macroinvertebrate Sample Collection

BMI samples will be collected at evenly spaced 15-meter transects for a total of 11 transects in the 150-meter reach. The samples will be collected in an alternating margin-center-margin pattern. Collections will be made using a 1-foot-wide, 0.5-millimeter (mm)-mesh, D-frame kick-net. A 1-square-foot area upstream of the net will be sampled by disrupting the substrate and scrubbing the cobble and boulders, so that the organisms will be dislodged and swept into the net by the current. The duration of the sampling generally ranges from 1 to 3 minutes, depending on the substrate complexity. Every monitoring location will be sampled from downstream to upstream. The samples will be combined into a single composite sample for the reach, transferred to 1-quart jars, preserved with 95 percent ethanol, and returned to the laboratory for processing. Photographs will be taken of every monitoring location.

A.1.3.7.4 Multihabitat Periphyton Sample Collection

Periphyton (benthic algae) will be collected using the reach-wide procedure and within the same transects used for BMI collection, but offset 1 meter upstream to avoid disturbed substrate. Depending on the substrate type and the stream habitat, one of three sampling devices will be used to collect the substrate sample: a 12.6-square centimeter (cm^2) rubber delimiter, a 4-centimeter (cm) diameter polyvinyl chloride (PVC) delimiter, or a syringe scrubber.

After all transects are sampled, the subsamples will be composited. The macroalgae will be gathered and separated from the composited liquid. A subsample of the macroalgae will be taken for the soft-bodied taxonomic identification sample. The composite liquid volume will be recorded, and the remaining macroalgae will be finely cut up and thoroughly mixed with the composite liquid. The homogenized sample will be used for the diatom taxonomic identification sample, as well as the two filtered biomass samples. The diatom and soft-bodied algae samples will be fixed accordingly before being delivered to the laboratory for taxonomic identification. Taxonomic identification will be performed by a qualified taxonomist. The remaining homogenized portion of the composite will be filtered in the field, and the filters will be placed on ice and/or frozen until delivery to the chemistry laboratory for chlorophyll-a and ash-free dry mass analysis.

A separate soft-bodied algae sample will be collected for qualitative taxonomic identification. The qualitative sample consists of a composite of all soft-bodied algae found within the reach. The sample will be left unpreserved and put on ice or refrigerated until delivery to the laboratory for taxonomic identification. Qualitative taxonomic identifications will be performed by a qualified taxonomist for the receiving water and SMC monitoring locations.

A.1.3.7.5 Physical Habitat Quality Assessment

For each monitoring reach sampled, the physical habitat of the stream and its adjacent banks will be assessed to provide a record of the overall physical condition of the reach. Parameters such as substrate complexity, channel alteration and human influence, frequency of riffles, and width and quality of riparian zones will provide a more comprehensive understanding of the condition of the stream. Additionally, specific characteristics of the sampled riffles will be measured, including substrate size classes, stream depth, gradient, sinuosity, and flow volume.

CRAM assessments of each monitoring location also will be performed. This method assesses the quality of the in-stream habitat features as well as the buffer zones (250 meters perpendicular to flow from each bank and 500 meters upstream and downstream of the monitoring reach), hydrologic source quality, and biotic structure quality. A final CRAM score will be calculated that can range from 25 to 100 points, with the higher scores indicating higher quality conditions.

Water quality measurements will be taken at each of the monitoring locations using a YSI Model 6920 (or comparable) data sonde. Measurements will include water temperature, specific conductance, pH, and dissolved oxygen. Samples will be collected for laboratory analysis following the protocols outlined in the SMC Regional Monitoring Program Workplan. Stream flow velocity will be measured with a Marsh-McBirney Model 2000 (or comparable) portable flowmeter, or will be visually estimated when the water is too shallow for the flowmeter.

A.1.3.7.6 Laboratory Processing and Analysis

Laboratory processing of BMI samples will follow the SWAMP Bioassessment Procedures: *Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrates in California* (Woodward et al., 2012). At the laboratory, samples are poured over a No. 35 standard testing sieve (0.5-mm stainless-steel mesh), and the ethanol is retained for reuse. The sample is gently rinsed with fresh water, and large debris such as wood, leaves, or rocks are removed. The sample is transferred to a tray marked with grids approximately 50 cm^2 in size. One grid is randomly selected, and the sample material contained within that grid is removed and processed. In cases where the test organisms appear extremely abundant, a fraction of the grid may be removed.

The material from the grid is examined under a stereomicroscope, and all the invertebrates are removed, sorted into major taxonomic groups, and placed in vials containing 70 percent ethanol. If there are less than 600 test organisms in the grid, another grid is selected and processed. This process is repeated until 600 organisms are removed from the sample, or until the entire sample is sorted. Organisms from a grid in excess of 600 are also removed, counted, and recorded as “remaining test organisms,” so that estimated total organism abundance and density for the sample can be calculated. Terrestrial organisms, vertebrates, water-column associated organisms (e.g., copepods), and nematodes are not removed from the samples. Processed material from the sample is placed in a separate jar and labeled “sorted,” and the unprocessed material is returned to the original sample container and archived. Sorted material is retained for QA purposes. All organisms are identified to Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) standard taxonomic effort Level II (SAFIT, 2006).

A.1.3.7.7 Quality Assurance/Quality Control

QA/QC procedures for the Bioassessment Monitoring and SMC Program will be consistent with those outlined in Section 2.2.4. In addition, QA of the benthic infauna sample sorting will be performed on all of the samples to ensure at least a 90 percent removal rate of organisms. Organisms removed during sorting QA also will be identified. Taxonomic QA will be performed on 10 percent of the samples.

A.1.4 Monitoring Methods: Pueblo HU

This section describes monitoring methods and procedures used to perform total maximum daily load (TMDL) water quality monitoring at the long-term receiving water location during the wet and dry weather season in Chollas Creek. Long-term receiving water monitoring will be conducted for the Pueblo HU at the site as indicated in Table A1-3 within the San Diego Bay WMA, in accordance with the MS4 Permit (Provisions D.1.b, c, and d). Seasonal mobilization and demobilization activities will include the following:

- Equipment will be installed and maintained to perform flow monitoring and sampling, as well as extended flow monitoring.
- Flow monitoring data will be collected throughout the monitoring season to estimate the annual watershed loads.
- Monitoring equipment will be removed upon completion of the required monitoring.
- Because safety and quality are integral parts of data collection, team safety meetings and quality reviews will be conducted to increase safe and reliable business practices are used during the implementation of this program.

A.1.4.1 Monitoring Location

The Chollas Creek receiving water station is located upstream of the tidally influenced reach of Chollas Creek. The SD8(1) mass loading station is located in a trapezoidal concrete channel on North Chollas Creek. Historically, SD8(1) mass loading station has been monitored as a receiving water station through the Copermittees' Regional Monitoring Program. Sampling has also been conducted at SD8(1) to support the Diazinon TMDL, the Dissolved Metals TMDL, and the Bacteria TMDL, as described in the sections below. Water quality sampling during the wet and dry weather seasons has occurred at the Chollas MLS station during the current permit term and will continue during the next permit cycle. The monitoring site coordinates are provided in Table A1-3.

Table A1-3
Pueblo HU Receiving Water Monitoring Location

Site ID	Site Name	Latitude	Longitude
SD8(1)	North Chollas Creek MLS	32.70493	-117.12132

A.1.4.2 Water Quality Sampling

Water quality sampling and analyses conducted for the receiving water monitoring location will be in accordance with applicable SWAMP regulations and guidance. Table A1-4 and A1-5, as well as Attachment C, provide a complete list of constituents, methods, sample volumes, holding times, and target reporting limits for the TMDL compliance monitoring.

A.1.4.2.1 Wet Weather

The Chollas Creek receiving water station will be monitored at SD8(1) for water quality and flow during three storm events: the first two qualifying storm events after October 1 and the first qualifying storm event after February 1.

Qualifying storm events for the purposes of this project are defined as storms forecast to produce at least 0.10 inches of rainfall within a 24 hour period with at least a 72 hour antecedent dry weather period (<0.10" of rainfall in a 24 hour period). The weather forecast, forecast discussion, and quantitative precipitation forecast produced by the National Weather Service (NWS) are publically available at: http://www.wrh.noaa.gov/sgx/ will be used to determine if a storm event should be mobilized for. Antecedent rainfall conditions will be determined by review of data available from publically available NWS rain gauge data and on site rain gauge data.

A.1.4.2.1.1 Sample Analysis

Water quality samples collected at the Chollas Creek receiving water monitoring site will be analyzed for general chemistry, metals, synthetic organics, and toxicity during wet weather events. *In-situ* field measurements and flow will be collected during wet weather events. Flow will also be monitored throughout the wet weather season (October 1-April 30). All analytes to be monitored during the wet weather season are presented in Table A1-4. A comprehensive list of analytical methods and target RLs for is presented in Attachment A5.

Chemical, toxicity, and bacterial analysis of samples will be performed by a laboratory certified for the appropriate fields of testing by the California Environmental Laboratory Accreditation Program (ELAP). General physical and chemical constituents will be analyzed by accredited laboratories, with the exception of field-measured constituents (i.e., pH, specific conductance, temperature, turbidity, and dissolved oxygen). Field measurements will be collected by field staff during sampling activities using an YSI 6920 series water quality probe or similar type device.

Water quality samples will be collected using a Hach SD900 automated peristaltic pump that is paced by the American Sigma 950 flow meter to collect composite samples proportional to the flow of the creek. Additional information regarding methodology and QAQC for sample collection and field observations is further described in Attachment C.

Table A1-4
List of Constituents

Analyte	Method	MDL	RL	Units
General Chemistry				
Chloride	EPA 300.0	0.10	0.50	mg/L
Sulfate	EPA 300.0	0.10	0.50	mg/L
Total Calcium	EPA 200.7	0.016	0.10	mg/L
Total Magnesium	EPA 200.7	0.012	0.10	mg/L
Dissolved Organic Carbon	SM 5310C	0.013	0.30	mg/L
Total Organic Carbon	SM 5310C	0.0090	0.30	mg/L
Total and Dissolved Metals				
Copper, Dissolved	EPA 200.8	0.022	0.50	µg/L
Copper, Total	EPA 200.8	0.022	0.50	µg/L
Lead, Dissolved	EPA 200.8	0.017	0.20	µg/L
Lead, Total	EPA 200.8	0.017	0.20	µg/L
Zinc, Dissolved	EPA 200.8	0.30	5.0	µg/L
Zinc, Total	EPA 200.8	0.30	5.0	µg/L
Organics				
Organophosphorus Pesticides	EPA 625 modified low level	varies[(a)]	varies[(a)]	µg/L
Organochlorine Pesticides/PCBs	EPA 608 low-level	varies[(a)]	varies[(a)]	ng/L
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 8270C-SIM	varies[(a)]	varies[(a)]	µg/L
PCB Congener	GCMS SIM	5.0 ng/L	10 ng/L	ng/L
Toxicity				
Ceriodaphnia dubia 96-hour acute static-renewal test	EPA/821/R-02/012, Oct-02	NA	NA	TU_a
Ceriodaphnia dubia 7-day chronic static-renewal test	EPA/821/R-02/012, Oct-02	NA	NA	TU_c
Field Parameters				
Dissolved Oxygen	Field Meter	NA	NA[(d)]	mg/L

Table A1-4
List of Constituents (continued)

Analyte	Method	MDL	RL	Units
Flow	TBD	NA	NA[(b)]	cfs
pH	Field Meter	NA	NA[(b)]	pH units
Specific Conductivity	Field Meter	NA	2 µS/cm[(b)]	µS/cm
Temperature	Field Meter	NA	NA[(b)]	°C
Turbidity	Field Meter	NA	5 NTU[(b)]	NTU

Notes:
(a) See Attachment C, Appendix A for MDL and RL.
(b) Recommended SWAMP reporting limit
MDL Method Detection Limit
RL Reporting Limit
SM Standard Method
EPA United States Environmental Protection Agency
NA Not Applicable
TU Toxicity Units, a = acute, c = chronic
GCMS Gas Chromatography Mass Spectrometer
SIM Selective Ion Monitoring
µg/L micrograms/liter
µS/cm Micro Semens/centimeter
mg/L milligrams/liter
cfs cubic feet per second
°C Celsius degrees
NTU Nephelometric Turbidity Units

A.1.4.2.1.2 Flow Monitoring

Flow rates will be monitored using American Sigma (or comparable) flowmeters with an ultrasonic sensor, bubbler, or submerged pressure transducer as the primary measuring device.

The flow meter will measure and log flow levels, rainfall and sample history. One-minute average flow and rainfall data will be recorded in the flow meters during monitored storm events. The flow meters convert 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

Equipment will be maintained throughout this period to ensure that it is in proper working order. Additional flow monitoring details, including methods used for stream rating and channel surveys, are provided in Attachment C.

A.1.4.2.2 Dry Weather Bacteria TMDL Sampling

Dry weather monitoring will be conducted monthly during the wet season and weekly during the dry season at the compliance monitoring location SD8(1). Dry weather sampling will occur on dry weather days when there is measureable flow at the location. Samples are to be collected after an antecedent dry period of 72 hours with less than 0.1 inches of rainfall. During each dry weather monitoring event, field observations will be recorded and a grab water sample will be collected at the compliance monitoring location(s). Methodology for field observations and sample collection is described in the QAPP (Attachment C, Appendix E). Table A1-5 provides the general scope of the Compliance Monitoring Program for dry weather Bacteria TMDL sampling.

Table A1-5
Scope of Bacteria TMDL Compliance Monitoring

Number of Monitoring Locations	Dry Weather Monitoring 10/01/13 to 03/31/14		Dry Weather Monitoring 06/24/13 to 9/30/13 and 04/1/14-9/30/14	
	Grab Samples Per Site Per Event	Event Frequency	Grab Samples Per Site Per Event	Event Frequency
1	1	monthly	1	Weekly (minimum 5 events per month)

A.1.4.2.2.1 Sample Analysis

Grab samples will be representative of the environmental conditions of each location, therefore, the grab samples will be collected from the horizontal center of the stream to the maximum extent practicable. For intermittent streams, sampling will be suspended once the stream is too low to sample. Samples collected during dry weather monitoring will be analyzed for Fecal Indicator Bacteria (FIB) in accordance with SWAMP requirements. Table A1-6 presents the constituents, reporting limits, and analytical methods.

Table A1-6
Compliance Analyses for Bacteria TMDL

Parameter	Project Reporting Limit[(a)] (per 100mL)	Analytical Method
Enterococcus	10 CFU	TBD
Fecal Coliform	20 MPN	TBD
Total Coliform	20 MPN	TBD

Notes:
CFU = Colony Forming Units
TBD = To be determined by the RAs.
(a) The reporting limits are consistent with the existing AB411 program to facilitate overlap with that program. However, reporting limits may be lower depending on the laboratory used to conduct the analysis.

A.1.4.2.2.2 Flow Monitoring

Flow rates will be monitored using American Sigma (or comparable) flowmeters with an ultrasonic sensor, bubbler, or submerged pressure transducer as the primary measuring device. The primary sensor will continuously measure stage (i.e., stream height) and relay that information to the flowmeter. The flowmeter will continually calculate flow rates by inserting the stage information into the preprogrammed discharge equation. Using this system, the flowmeter will be able to actuate the sampler to achieve a flow-weighted composite sample. Sampling and flow equipment will be monitored remotely, and data will be transferred to a permanent data system by cellular modem or manual download.

The flow meter will measure and log flow levels, rainfall and sample history. During dry weather flow and non-monitored storm events, flow will be recorded every 15 minutes. The flow meters convert instantaneous flow into total runoff volume. Data containing hydrological information is electronically stored in the flow meter. 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.

Equipment installed and used for monitoring during dry weather will remain in place during the course of the monitoring year. The monitoring year is October 1 through September 30. Continual flow data will be downloaded remotely from each station once every two weeks to verify equipment functionality and to reduce data gaps, ensure accuracy, and identify maintenance and calibration needs. Flow data will be entered into the data management system. Equipment will be maintained throughout this period to ensure that it is in proper working order. Additional flow monitoring details, including methods used for stream rating and channel surveys, are provided in Attachment C.

A.1.5 Data Management, Assessment, and Reporting

The Monitoring and Assessment Annual Report, which will be submitted to the RWQCB on January 31 annually, will include descriptions of monitoring conducted during the applicable monitoring year.

A.1.5.1 Data Management

Field Data Records and Analytical Data Reports will be sent to and kept by the Program Manager or specified contracted agency. Data will be submitted in a standardized

California Environmental Data Exchange Network (CEDEN)-compatible format to the County of San Diego for their records.

The agency selected to conduct field efforts will review all Field Data Log Sheets for completeness, maintain the original hardcopies, and scan electronic copies (*.pdf) for storage in the project file. The field crew will retain the original Field Data Log Sheets. Summaries of sampling events will be emailed to the County of San Diego on a basis deemed appropriate by the County of San Diego.

The laboratories will provide data in electronic format (*.pdf copies of lab reports and an electronic data deliverable [EDD]). Formal analytical results will be submitted to contracted agency and/or the County of San Diego in *.pdf format and as an EDD within three weeks of submittal of samples. The contracted agency will review all lab reports and EDDs for accuracy and completeness. If necessary, the contracted agency will convert the submitted EDDs into a CEDEN-compatible format. Laboratories will retain original COC forms. The laboratories will also retain copies of the preliminary and final data reports.

In addition to providing formal results within three weeks of submittal of samples, the laboratories will report the results of indicator bacteria analyses via call or email upon completion or as soon as practical, especially if initial results indicate an exceedance of water quality objectives.

A.1.5.2 Assessment and Reporting

The assessment of receiving waters involves evaluating the physical, chemical, and biological conditions of the receiving waters and sediments. The RPs must assess the status and trends of receiving water quality conditions in coastal waters, enclosed bays, harbors, estuaries, and streams in the San Diego Bay WMA. This assessment includes evaluation of both dry weather and wet weather conditions. The receiving water assessment to be presented in the Water Quality Improvement Plan Annual Report will:

- Assess whether or not the conditions of the receiving waters are meeting the numeric goals established in Water Quality Improvement Plan
- Identify the most critical beneficial uses that must be protected to ensure the overall health of the receiving water
- Evaluate whether or not those critical beneficial uses are being protected
- Identify short-term and/or long-term improvements or degradation of those critical beneficial uses
- Consider whether or not the strategies established in the Water Quality Improvement Plan contribute toward progress in achieving the interim and final numeric goals of the Water Quality Improvement Plan
- Identify data gaps in the monitoring data needed to assess the provisions above

Attachment A
Stream Rating and Channel Survey Details

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Stream Ratings

The flow rate at each of the monitoring locations will be determined by stream stage (water level) sensors that are typically secured to the bottom of the channel. To quantify flow rates on the basis of stream stage, a relationship between flow and stage will be derived using the standardized stream rating protocols developed by the U.S. Geological Survey (USGS) (Rantz, 1982; Oberg et al., 2005). Instantaneous flow measurements will be taken at various stages at each of the monitoring locations. The measurements will be combined to produce and calibrate the rating curve for each monitoring location.

To estimate flow in streams, the following elements are needed to develop the rating curves:

- An up to date survey of the stream channel cross-section and longitudinal slope
- Level measurements based on a fixed point
- Measurements of velocity at several stages throughout the rating curve, including low flow, mid flow, and peak flow conditions

Channel Surveys

To make an instantaneous flow measurement, first, an appropriate reach of stream must be located which is hydraulically connected to the flow sensor location. Straight sections of stream with consistent gradients that are away from channel bends or structures which have laminar flow are considered ideal.

A tape measure is stretched across the stream, perpendicular to flow and secured on both banks of the stream. The tape is positioned so that it is suspended approximately 1 foot above the surface of the water. The distance on the tape directly above the waterline (i.e., where the water meets the bank) is recorded as the initial point. The first measurement is made at the first point where there is adequate water depth (i.e., generally 0.2 foot). At this point, three measurements are made, including water depth, velocity, and distance from the bank (the initial point). Subsequent depth, velocity, and distance measurements are made incrementally across the entire width of the channel. Flow across the channel is determined by integrating the velocity measurements over the cross-sectional surface area of the stream channel. The result is an instantaneous flow.

Channel slope is determined by channel thalweg surveys which are conducted for the reach upstream and downstream of the cross-section. The average channel slope is calculated from the survey data.

Instantaneous Flow Measurement

To measure instantaneous flows during low flow and base flow conditions, two velocity measurement instruments are typically used—a Marsh-McBirney Model 2000 Portable Flowmeter connected by a cable to an electromagnetic open channel velocity sensor and the SonTek (YSI) FlowTracker Acoustic Doppler Velocimeter.

A Stream Pro Acoustic Doppler Current Profiler (ADCP) is used to measure mid- and high-stage flow conditions. (Oberg et al., 2005). The instrument is pulled across the stream either by walking across a bridge or attaching the unit to a tagline. Data are collected in real time and transmitted by a wireless data link to a PC. Data can be viewed in real time and are typically post-processed following the field event in the office.

During each instantaneous flow measurement, it is critical that the stage at the monitoring station is recorded at the same time so that a relationship between stage and discharge can be developed.

RATING CURVE DEVELOPMENT

A rating curve is then developed using the Chézy–Manning Equation which is calibrated with the data from the field measurements. Each rating curve is adjusted by the roughness coefficient. Rating curves are extended to high stream stages not measured using site-specific survey information and the Chézy–Manning formula (Linsley et al., 1982). The Chézy–Manning formula is an empirical formula for open channel flow, or flow driven by gravity, as follows:

$$Q = (1.486/n) A R^{2/3} S^{1/2}$$

where:

- Q = flow
- n = Manning Roughness coefficient
- A = cross-sectional area
- R = hydraulic radius
- S = hydraulic slope

The hydraulic radius is derived as follows:

$$R = A/P$$

where:

- A = cross-sectional area of flow (ft2)
- P = wetted perimeter (ft)

The Chézy–Manning formula was developed for conditions of uniform flow in which the water surface profile and energy gradient are parallel to the streambed and the area, hydraulic radius, and depth remain constant throughout the reach. Field surveys of the channel geometry of each station will be conducted to compute the channel characteristics for each station.

As Southern California has predominantly sandy bottom braided stream channels that shift continually, routine updated channel surveys, instantaneous flow measurements, and rating curve calibrations are critical to flow estimation.

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Attachment B
Toxicity Identification Evaluation/Toxicity Reduction Evaluation Implementation Work Plan

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Toxicity Identification Evaluation / Toxicity Reduction Evaluation Implementation Draft Work Plan

Prepared for:

San Diego County Regional Copermittees

Prepared by:

Weston Solutions, Inc.
5817 Dryden Place, Suite 101
Carlsbad, California 92008

January 16, 2015

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LIST OF ACRONYMS

2007 Permit	RWQCB Order No. R9-2007-0001
2013 Permit	RWQCB Order No. R9-2013-0001
BMP	best management practice
BSA	bovine serum albumin
CLRP	Comprehensive Load Reduction Plan
Copermittees	San Diego Regional Copermittees
EDTA	ethylenediaminetetraacetic acid
IWC	instream waste concentration
JRMP	Jurisdictional Runoff Management Plan
LC_{50}	median lethal concentration
LID	low impact development
MAP	Monitoring and Assessment Plan
MEP	maximum extent practicable
MS4	multiple separate storm sewer system
NOEC	no observed effect concentration
NPDES	National Pollutant Discharge Elimination System
PBO	piperonyl butoxide
QA/QC	quality assurance/quality control
RWQCB	Regional Water Quality Control Board
SMC	Stormwater Monitoring Coalition
SPE	solid phase extraction
STS	sodium thiosulfate
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TIE	toxicity identification evaluation
TMDL	Total Maximum Daily Load
TRE	toxicity reduction evaluation
TST	Test of Significant Toxicity
USEPA	United States Environmental Protection Agency
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan
WURMP	Watershed Urban Runoff Management Program

UNITS OF MEASURE

ppt	parts per thousand
%	percent
$<$	less than
$>$	greater than

1.0 INTRODUCTION

In May of 2013, San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001 (2013 Permit) was adopted. Provision B of the 2013 Permit requires Copermittees in each Watershed Management Area (WMA) to develop a Water Quality Improvement Plan (WQIP) which, per Provision B.4, incorporates a Monitoring and Assessment Program (MAP). Also, per Provision D.1.c.(4)(f), *"If chronic toxicity is detected in receiving waters, the Copermittees must discuss the need for conducting a TIE/TRE in the assessments required under Provision D.4.a.(2), and develop a plan for implementing the TIE/TRE to be incorporated in the Water Quality Improvement Plan.*"

A toxicity identification evaluation (TIE) is defined by the 2013 Permit as "*A set of procedures for identifying the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.*" A toxicity reduction evaluation (TRE) is defined as "*A study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices and best management practices. A TIE may be required as part of the TRE, if appropriate.*"

This Work Plan outlines the process used to identify chronic toxicity in receiving waters, as well as guidance to prioritize the need to implement a TIE/TRE based on the magnitude and persistence of chronic toxicity. The Work Plan refers to the appropriate references for detailed sampling and analytical/toxicity test methods specific to the TIE/TRE treatment process. An example of a potential TRE decision process for receiving water samples (Stormwater Monitoring Coalition (SMC) Model Monitoring Technical Committee, 2004) is presented in Figure A-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).

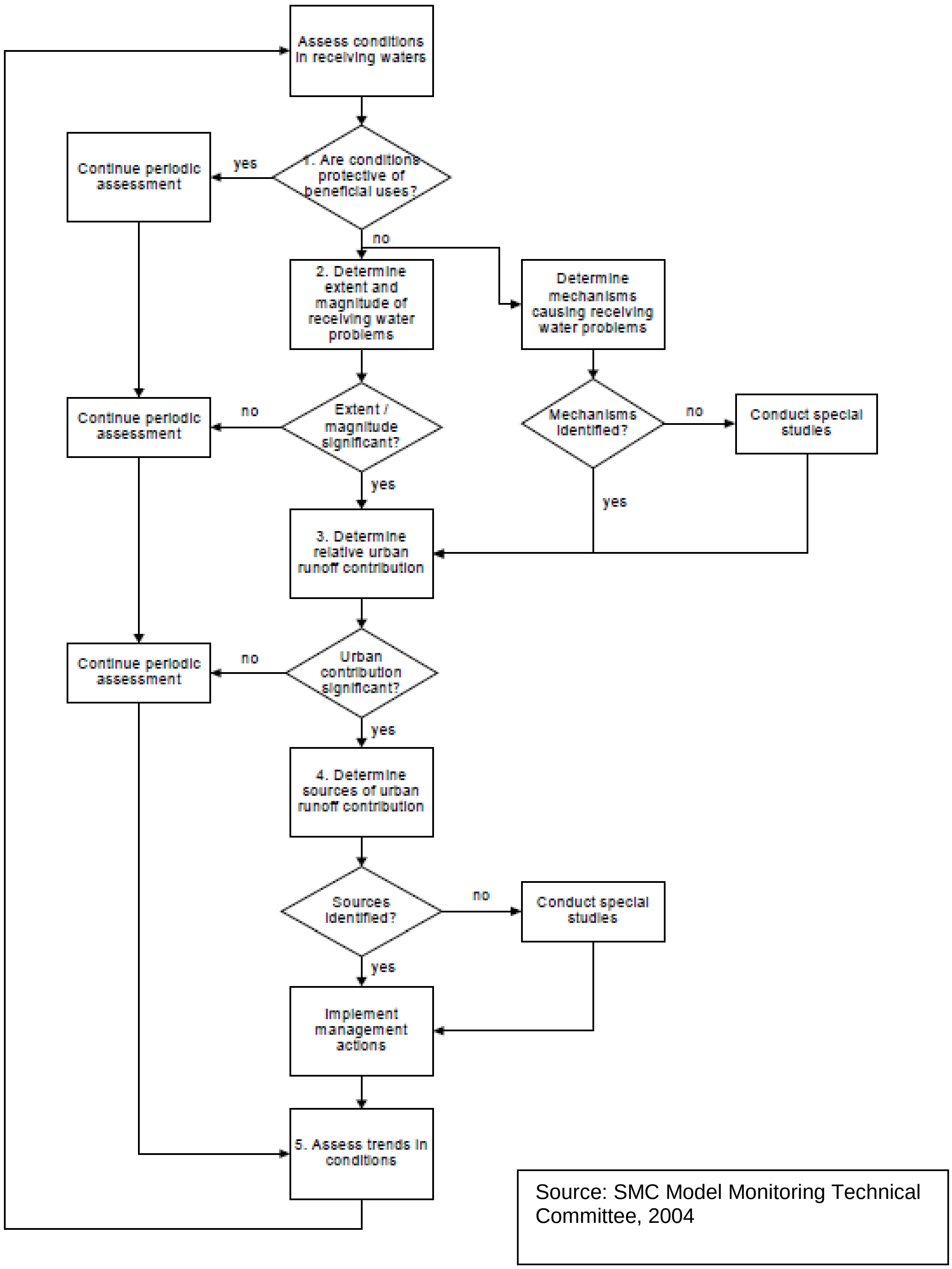

Figure A-1. Example Receiving Water Monitoring and TIE/TRE Decision Framework

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 A-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 A-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 ≥ 1 ppt			
Strongylocentrotus purpuratus	Chronic development	Pass/Fail	EPA-600-R-95-136

3.0 TIE/TRE PROCESS

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.

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 approaych 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 A-2**.

Table A-2. 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 A-2** 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).

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 A-2**.

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 A-2. 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.

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 A-3**.

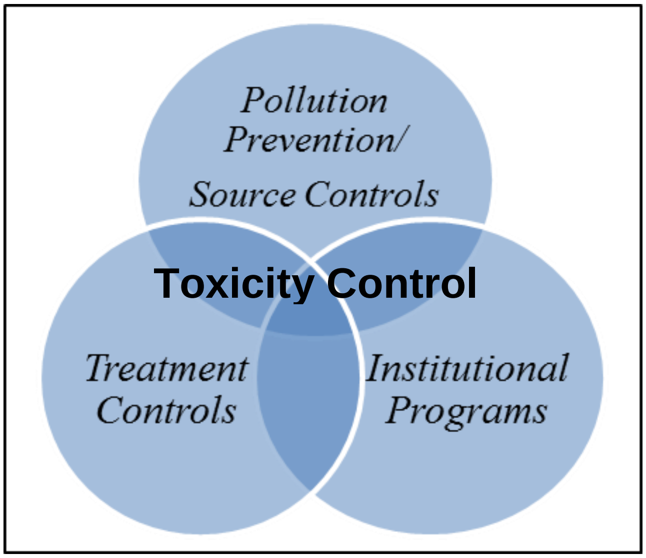

Figure A-3. Components of Toxicity Control Evaluation

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 0).

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.

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.

TIE/TRE Limitations

There are inherent limitations associated with the TIE/TRE process summarized in this Work Plan, including the difficulty of characterizing intermittent toxicity (USEPA, 1993c) and/or toxicity resulting from multiple toxicants (USEPA, 2001). In addition, existing TRE guidance was developed primarily for point source discharges from wastewater treatment plants whereas receiving waters potentially capture pollutants from many sources and contain contaminants at more variable concentrations than those from a wastewater treatment facility, especially during a storm event.

4.0 REFERENCES

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ATTACHMENT A2. MS4 OUTFALL MONITORING PROGRAM – MONITORING PLAN

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ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviation	Definition
%	percent
<	less than
303(d) list	Clean Water Act Section 303(d) List of Impaired Waterbodies
Bacteria TMDL	A Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) To Incorporate Revised Total Maximum Daily Loads for Indicator Bacteria Project I—Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek) (RWQCB, February 10, 2010)
CMP	corrugated metal pipe
CP	concrete pipe
CWA	Clean Water Act
ELAP	California Environmental Laboratory Accreditation Program
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
JRMP	Jurisdictional Runoff Management Program
MS4	Municipal Separate Storm Sewer System
MS4 Permit	San Diego Regional Water Quality Control Board Order Number R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region
NAL	non-storm water action level
NPDES	National Pollutant Discharge Elimination System
PID	photoionization detector
QA	quality assurance
RCC	reinforced concrete channel
RCP	reinforced concrete pipe
RWQCB	Regional Water Quality Control Board, San Diego Region

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Acronym or Abbreviation	Definition
SAL	storm water action level
SWAMP	Surface Water Ambient Monitoring Program
TBD	to be determined
TKN	total Kjeldahl nitrogen
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WMA	Watershed Management Area
WQBEL	Water Quality Based Effluent Limit
Water Quality Improvement Plan	Water Quality Improvement Plan
WQO	Water Quality Objective
WURMP	Watershed Urban Runoff Management Program

A.2 INTRODUCTION

In May 2013, the San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirement for Discharges From The Municipal Separate Storm Sewer Systems (MS4s) Draining The Watersheds Within the San Diego Region (MS4 Permit; RWQCB, 2013) was adopted, replacing RWQCB Order No. R9-2007-0001 (RWQCB, 2007), and became effective June 27, 2013. The MS4 Permit prescribes monitoring programs for the MS4 outfalls during wet and dry weather for the duration of the Permit cycle.

A.2.1 Program Overview

In the San Diego Bay Watershed Management Area (WMA), the Responsible Parties (RPs) are named under the MS4 Permit:

- Airport Authority
- City of Chula Vista
- County of San Diego
- City of Coronado
- City of Imperial Beach
- City of La Mesa
- City of Lemon Grove
- City of National City
- Port of San Diego
- City of San Diego
- Caltrans[1]

The Copermittees are required to perform MS4 outfall monitoring in accordance with Provision D of the MS4 Permit. Permit-required MS4 outfall monitoring is composed of two major components:

- Dry Weather MS4 Outfall Discharge Monitoring (Provision D.2.b; RWQCB, 2013)
- Wet Weather MS4 Outfall Discharge Monitoring (Provision D.2.c; RWQCB, 2013)

[1] The California Department of Transportation (Caltrans) is not listed in the Municipal Permit as a Copermittee, but is participating voluntarily in the development of the Water Quality Improvement Plan as a Chollas Creek TMDL Responsible Party. Caltrans' participation is limited to an 864-acre area within the Chollas Creek Hydrologic Sub-Area (HSA) in the Pueblo HU.

The purpose of this monitoring plan is to describe the monitoring and assessment requirements and procedures for the San Diego Bay WMA MS4 Outfall Discharge Monitoring Program required by the MS4 Permit.

A.2.2 Dry Weather MS4 Outfall Discharge Monitoring

This section details the dry weather MS4 outfall monitoring required to comply with the MS4 Permit. Each Copermittee is required to perform dry weather MS4 outfall prioritization and monitoring to aid in the identification of non-storm water and illicit discharges within its respective jurisdictions as required by Provision D.2.b of the MS4 Permit.

A.2.2.1 MS4 Outfall Inventory

The Copermittees have identified the known major MS4 outfalls that discharge directly to receiving waters within their respective jurisdictions within the San Diego Bay WMA. The identified major MS4 outfalls have been geo-located on respective Geographic Information System (GIS) jurisdictional map of the San Diego Bay WMA as required by Provision D.2.a.(1) of the MS4 Permit. Each Copermittee will individually maintain, confirm, and update its respective maps during annual field screening (Povision D.2.a.(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 Copermittee
- Known locations of inlets that discharge and/or collect runoff into the Copermittee's MS4
- Known locations of connections with other MS4s not owned or operated by the Copermittee
- Known locations of MS4 outfalls and private outfalls that discharge runoff collected from areas within the Copermittee's jurisdiction
- Segments of receiving waters within the Copermittee's jurisdiction that receive and convey runoff discharged from the Copermittee's MS4 outfalls
- Locations of the MS4 outfalls within each Copermittee's respective jurisdiction
    - 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

- 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

- Locations of the selected non-storm water persistent flow MS4 outfall discharge monitoring stations within each Copermittee's respective jurisdiction.

Because of their size, geo-located MS4 outfall maps are not included in this monitoring plan. Table A2-1 presents the number of identified major outfalls in the San Diego Bay WMA by Copermittee.

Table A2-1
Number of Identified Major MS4 Outfalls by Copermittee

Jurisdiction	Number of Outfalls		
	Total Major Outfalls for Dry Weather Field Screening	Dry Weather Monitoring (Persistently Flowing Outfalls)[3]	Wet Weather Monitoring
Airport Authority[4]	0[2]	0(0)	0
Chula Vista	184[1]	5(5)	1
Coronado	7[2]	5(1)	1
Imperial Beach	2[2]	2(2)	1
La Mesa	3[2]	0(0)[5]	1
Lemon Grove	4[2]	1(1)	1
National City	21[2]	5(5)	1
City of San Diego	94[6]	5(5)	1
County of San Diego	57[2]	5(5)	1
Port of San Diego	65[2]	5(2)	1

Notes:

1. For Responsible Parties with fewer than 500 but more than 125 major MS4 outfalls in the watershed, 100% of major outfalls must be screened once per year.
2. For RPs with fewer than 125 major outfalls in the WMA, 80% of total major outfalls presented in the table must be screened twice per year.
3. Parenthesis indicates the number of persistent flowing outfalls monitored under this program. Jurisdictions with less than five persistently flowing outfalls may still monitor five outfalls during dry weather for additional data collection.
4. The Airport Authority has two major outfalls that are tidally influenced and cannot be safely screened or monitored. The nearest safe upstream access points will be screened/monitored as a proxy.
5. No persistently flowing outfalls have been identified within La Mesa's jurisdiction within the San Diego Bay WMA.
6. The City of San Diego has 502 outfalls within the City jurisdiction. The City of San Diego in accordance with D.2.a(2).(a).(iv) is required to screen 500 sites City wide once per year. The City is not required to screen 500 sites within each watershed.

A.2.2.2 Field Screening

Each Copermittee is required to conduct field screening to determine which non-storm water MS4 outfall discharges are transient flows and which have persistent flows, and to prioritize the non-storm water MS4 discharges that will be investigated and eliminated in accordance with the Illicit Discharge Detection and Elimination (IDDE) program.

A.2.2.2.1 Monitoring Locations and 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 Copermittee's inventory. The requirements are as follows:

- For Copermittees with fewer than 125 known major MS4 outfalls that discharge to receiving waters within a given WMA, at least 80 percent of the outfalls are required be visually inspected two times per year during non-storm water conditions. The following Copermittees in the San Diego Bay WMA fall into this category:
    - Airport Authority
    - County of San Diego
    - City of Coronado
    - City of Imperial Beach
    - City of La Mesa
    - City of Lemon Grove
    - City of National City
    - Port of San Diego
    - City of San Diego[2]
- For Copermittees 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. The following Copermittees in the San Diego Bay WMA fall into this category:
    - City of Chula Vista

[2] The City of San Diego has 502 outfalls within the City jurisdiction. The City of San Diego in accordance with D.2.a(2).(a).(iv) is required to screen 500 sites City-wide once per year. The City is not required to screen 500 sites within each watershed.

- For Copermittees 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. Copermittees 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 non-storm water action levels (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 (303(d) list);
    - Flow rate
- For a Copermittee 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. Copermittees 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
    - 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 A2-2 details the frequency at which Copermittees will inspect major outfalls within the San Diego Bay WMA.

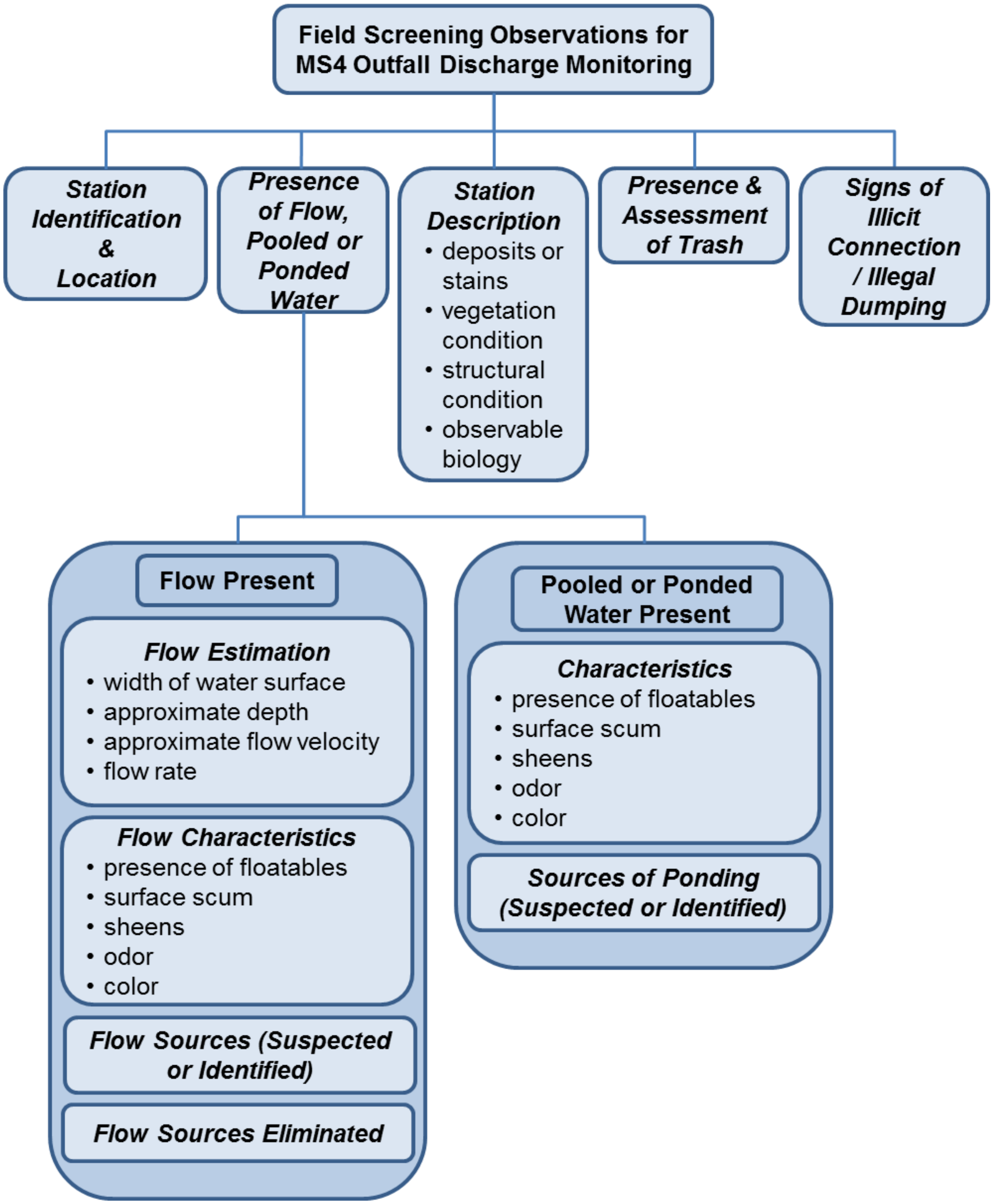
Table A2-2
MS4 Outfall Screening Frequency

Number of Major Outfalls	Major Outfalls Required to be Screened	Frequency of Screening
0-125	80%	2 per year
125-500	100%	1 per year
500+	≥500	1 per year

A.2.2.2.2 Visual Observations

Per the MS4 Permit, during a field screening visual observation inspection, each MS4 outfall selected for screening will be inspected following at least 72 hours of dry weather after any storm event producing greater than 0.10 inch of rainfall within a 24-hour period. Figure A2-1 details the visual observations that will be recorded during each field screening visual observation inspection, per the requirements of Provision D.2.a.(2) of the MS4 Permit.

Flow estimation will be performed as described in Attachment A.



Note: *This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.*

Figure A2-1
Dry Weather MS4 Outfall Field Screening

A.2.2.3 Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring

Each Copermittee is required to perform non-storm water persistent flow MS4 outfall discharge monitoring to determine whether persistent non-storm water discharges may be impacting receiving water quality.

A.2.2.3.1 Outfall Prioritization

Copermittees must each identify a minimum of the 5 highest priority major MS4 outfalls with non-storm water persistent flows that they will monitor within their respective jurisdictions in the San Diego Bay WMA, in accordance with MS4 Permit Provision D.2.b.(2)(b) (RWQCB, 2013). If a Copermittee has less than 5 major outfalls within the WMA, the Copermittee will monitor all its major MS4 outfalls with persistent flow. The Copermittees selected dry weather MS4 outfall discharge monitoring stations from the inventories developed pursuant to Provision D.2.b.(2)(a) for the San Diego Bay WMA as follows:

- *Based upon the dry weather MS4 outfall discharge field screening monitoring records developed pursuant to Provision D.2.a.(2)(c), each Copermittee must identify and prioritize the MS4 outfalls with persistent flows based on the highest priority water quality conditions identified in the Water Quality Improvement Plan and any additional criteria developed by the Copermittee, which may include historical data and data from sources other than what the Copermittee collects.*

A.2.2.3.2 Monitoring Locations and Frequency

The major MS4 outfalls with non-storm water persistent flows selected by each Copermittee are presented in Table A2-3 and mapped in Figure A2-2.

Each selected major outfall will be monitored least semi-annually. A Copermittee may substitute a next-highest priority major outfall for a selected major outfall in the event that one of the following criteria becomes applicable, until no qualifying major MS4 outfalls remain within the Copermittee's jurisdiction in the San Diego Bay WMA:

- 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.
- The source 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 NALs.
- The source of the persistent flows has been identified as a non-storm water discharge authorized by a separate NPDES permit.

In the event of a substitution, each Copermittee will document the reprioritization of its highest priority persistent flow MS4 outfalls in the Water Quality Improvement Plan Annual Report.

Table A2-3
Selected Major MS4 Outfalls for Non-Storm Water Persistent Flow Monitoring

Jurisdiction	Dry Weather Outfall Monitoring Stations	HA or HSA	Latitude	Longitude
City of Chula Vista	RC-8 RH-1 SC-2 SW-1 TC-35	909.12 910.32 910.20 910.20 909.11	32.64437 32.66018 32.61855 32.60811 32.64729	-117.00262 -116.94133 -116.95102 -117.09231 -116.968793
City of Coronado	Outfall No. 16	910.1	32.70003	-117.17182
City of Imperial Beach	H-outfall K-outfall	910.1 910.1	32.589468 32.588304	-117.113711 -117.107516
City of La Mesa[1]	None. No persistently flowing outfalls.	N/A	N/A	N/A
City of Lemon Grove	Site 69	908.22	32.7347	-117.05626
City of National City	32 43B 433 762 775	909.12 908.32 908.31 908.32 908.32	32.65887 32.65496 32.686076 32.67344 32.66158	-117.08274 -117.10223 -117.100612 -117.09848 -117.10284
Port of San Diego[2]	Site 2172.1 Site CSD145 Site 1271.1 Site C3-2.1 Site 2941.1	919.12 908.1 908.21 910.1 909.12	32.625611 32.718884 32.727256 32.69697 32.627538	-117.101921 -117.231408 -117.176754 -117.165551 -117.107337
Airport Authority	None. Both outfalls are tidal.	N/A	N/A	N/A
City of San Diego	DW0120 DW0203 DW0179 DW0121 DW0225	908.22 908.22 908.32 908.22 910.20	32.74385 32.69642 32.6995067 32.74102 32.576139	-117.0802 -117.122397 -117.0357083 -117.1439 -117.087742
County of San Diego	MS4-SWT-021 MS4-SWT-023 MS4-SWT-030 MS4-SWT-055 MS4-SWT-235	909.12 909.12 909.21 909.12 909.22	32.66561 32.65221 32.72662 32.74139 32.75674	-117.02409 -117.04956 -116.9835 -117.01119 -116.91961

Note: HA = Hydrologic Area; HSA = Hydrologic Sub-Area; TBD = to be determined
1. No persistently flowing outfalls have been identified within La Mesa's jurisdiction within the WMA.
2. Only 2 of the Ports Outfalls are persistent, but five are monitored.

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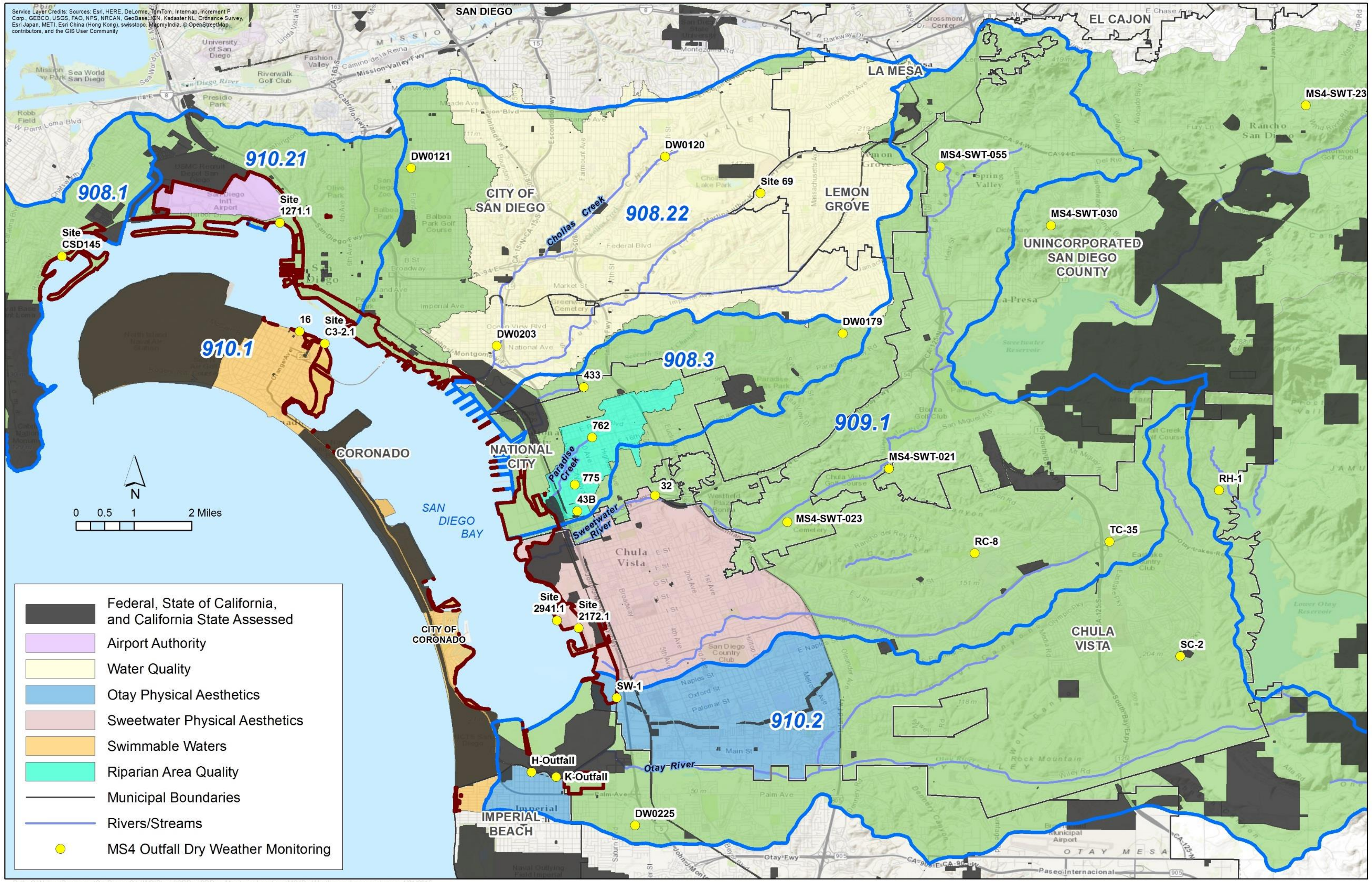

Note:
No outfalls in the City of La Mesa have persistent flow.
Only 2 of the Ports Outfalls are persistent, but five are monitored.

Figure A2-2
Selected Major MS4 Outfalls for Non-Storm Water Monitoring

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A.2.2.3.3 Field Observations

During the monitoring events, field observations will be recorded at each of the selected major outfall persistent flow monitoring sites. Flow estimation will be performed as described in Attachment A.

A.2.2.3.4 Field Monitoring

During the monitoring events, *in-situ* measurements for field monitoring parameters will be collected at each of the selected major outfall persistent flow monitoring sites. Field monitoring parameters include:

- pH
- Temperature
- Specific conductivity
- Dissolved oxygen
- Turbidity

Field monitoring will be documented on a field observation form. Analytical methods and detection limits for field monitoring parameters are provided in Section A.2.2.3.5.2.

A.2.2.3.5 Analytical Monitoring

A.2.2.3.5.1 Sample Collection

During the monitoring events, provided sufficient measurable flow is present, samples will be collected for analysis by an analytical laboratory. Grab samples will be collected according to the procedures described in Attachment B, and will follow Surface Water Ambient Monitoring Program (SWAMP) protocols. Quality assurance and quality control procedures are outlined in Attachment C.

A.2.2.3.5.2 Laboratory Analysis

The required analyses are based upon the following five groupings of constituents:

(1) Constituents contributing to the highest priority water quality conditions identified in the San Diego Bay WMA Water Quality Improvement Plan

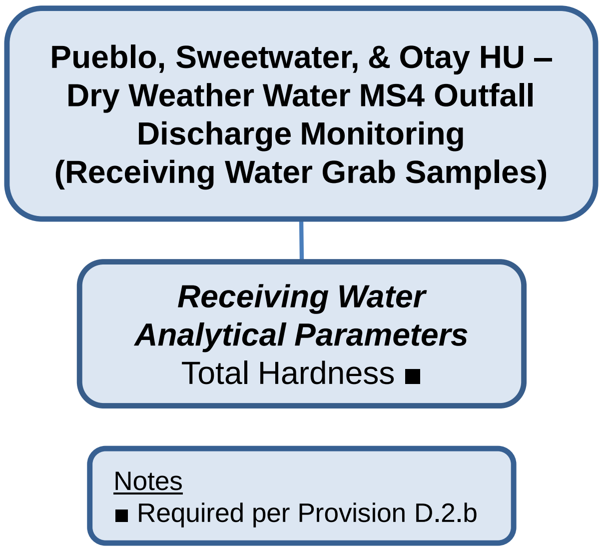
(2) Constituents listed as a cause for impairment of receiving waters in the San Diego Bay WMA as listed on the 303(d) list

(3) Constituents for implementation plans or load reduction plans (e.g., Bacteria Load Reduction Plans, Comprehensive Load Reduction Plans) developed for the San Diego Bay WMA where the Copermittees are listed RPs to a Total Maximum Daily Load (TMDL)

(4) Applicable NAL constituents listed in Provision C.1 of the MS4 Permit

(5) Constituents listed in Table D-7 of the MS4 Permit

Figures A2-3 to A2-7 detail the analyses required for selected MS4 outfall non-storm water persistent flow monitoring. Attachment A5 details the analytes required for MS4 outfall for persistent flow monitoring including analytical methods and detection limits. Analytes that are field measured are not required to be analyzed by a laboratory. Chemical and bacterial analysis of samples will be performed by a laboratory certified for the appropriate fields of testing by the California Environmental Laboratory Accreditation Program (ELAP). The laboratory should also be a participant of the Stormwater Monitoring Coalition's Intercalibration Program. Quality assurance and quality control procedures for laboratory analysis are outlined in Attachment C.



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A2-3
Pueblo, Sweetwater, & Otay HU – Dry Weather MS4 Outfall Discharge Monitoring Receiving Water Grab Samples

Pueblo HU – Mesa HA (908.2)
Dry Weather MS4 Outfall Discharge
Monitoring Constituents
(Grab Samples)

Analytical Parameters

Conventional Parameters
TDS ■
TSS ■
Turbidity[1] ±
Total Hardness ■
MBAS ○
Trash ◊

Metals (Total & Dissolved)[2]
Cadmium ±
Chromium III ○
Chromium VI ○
Copper ± ◊
Iron ○
Lead ± ◊
Manganese ○
Nickel ○
Silver ○
Zinc ± ◊

Organics
Chlordane ◊
Diazinon ◊
PAHs ◊
PCBs ◊

Nutrients
Ammonia ■
Ortho-P ■
Nitrate[3] ■
Nitrite[3] ■
TKN ■
Total N ○ ◊
Total P ± ◊

Bacteria
Total Coliform ± ◊
Enterococcus ± ◊
Fecal Coliform ± ◊

Field Parameters
pH ±
Temperature ■
Specific Conductivity ■
Dissolved Oxygen ±
Turbidity[1] ±

Notes
1. To be assessed in laboratory only if field meter fails.
2. Although Mercury is 303(d)-listed in the Mesa HA, the source is identified as a Major Industrial Point Source/Industrial Wastewater and not storm water or urban runoff from the MS4
3. Nitrate and nitrite may be combined and reported as Nitrate+Nitrite
■ Required per Provision D (Tables D-2 and D-7)
○ Required per Provision C.1.a
± Required per Provision C.1.a & Provision D (Tables D-2 and D-7)
◊ 303(d) Listed Constituent

Note: *This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.*

Figure A2-4
Pueblo HU Dry Weather MS4 Outfall Discharge Monitoring Constituents (Mesa HA)

Pueblo HU -
Point Loma and National City HAs (908.1 & 908.3)
Dry Weather MS4 Outfall Discharge Monitoring
Constituents (Grab Samples)

Analytical Parameters

Conventional Parameters
TDS ■
TSS ■
Turbidity[1] ±
Total Hardness ■
MBAS ○

Metals (Total & Dissolved)
Cadmium ±
Chromium III ○
Chromium VI ○
Copper ± ◊
Iron ○
Lead ± ◊
Manganese ○
Nickel ○
Silver ○
Zinc ±

Nutrients
Ammonia ■
Ortho-P ■
Nitrate[2] ■
Nitrite[2] ■
TKN ■
Total N ○
Total P ±

Bacteria
Total Coliform ± ◊
Enterococcus ± ◊
Fecal Coliform ± ◊

Field Parameters
pH ±
Temperature ■
Specific Conductivity ■
Dissolved Oxygen ±
Turbidity[1] ±

Notes
1. To be assessed in laboratory only if field meter fails.
2. Nitrate and nitrite may be combined and reported as Nitrate+Nitrite
■ Required per Provision D (Tables D-2 and D-7)
○ Required per Provision C.1.a
± Required per Provision C.1.a & Provision D (Tables D-2 and D-7)
◊ 303(d) Listed Constituent

Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A2-5
Pueblo HU Dry Weather MS4 Outfall Discharge Monitoring Constituents (Point Loma and National City HAs)

**Sweetwater HU –
Dry Weather MS4 Outfall
Discharge Monitoring
Constituents (Grab Samples)**

Analytical Parameters

Conventional Parameters
TDS ■ ◊
TSS ■
Turbidity[1] ±
Total Hardness ■
MBAS ○

Metals (Total & Dissolved)[2]
Cadmium ±
Chromium III ○
Chromium VI ○
Copper ± ◊
Iron ○
Lead ±
Manganese ○ ◊
Nickel ○
Selenium ◊
Silver ○
Zinc ±

Nutrients
Ammonia ■
Ortho-P ■
Nitrate[3] ■
Nitrite[3] ■
TKN ■
Total N ○ ◊
Total P ± ◊

Bacteria
Total Coliform ± ◊
Enterococcus ± ◊
Fecal Coliform ± ◊

Field Parameters
pH ± ◊
Temperature ■
Specific Conductivity ■
Dissolved Oxygen ± ◊
Turbidity[1] ±

Notes
1. To be assessed in laboratory only if field meter fails.
2. Although Aluminium is 303(d)-listed in the Sweetwater HU, the Loveland Reservoir is located in the upstream reaches of the watershed where most drainage to the reservoir comes from the Cleveland National Forest, and the source has not been identified as storm water or urban runoff from the MS4
3. Nitrate and nitrite may be combined and reported as Nitrate+Nitrite

■ Required per Provision D (Tables D-2 and D-7)
○ Required per Provision C.1.a
± Required per Provision C.1.a & Provision D (Tables D-2 and D-7)
◊ 303(d) Listed Constituent

Note: *This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.*

Figure A2-6
Sweetwater HU Dry Weather MS4 Outfall Discharge Monitoring Constituents

Otay HU –
Dry Weather MS4 Outfall Discharge
Monitoring Constituents
(Grab Samples)

Analytical Parameters[1]

Conventional Parameters
TDS ■
TSS ■
Turbidity[2] ±
Total Hardness ■
MBAS ○
Color ◊

Metals (Total & Dissolved)
Cadmium ±
Chromium III ○
Chromium VI ○
Copper ± ◊
Iron ○ ◊
Lead ±
Manganese ○ ◊
Nickel ○
Silver ○
Zinc ±

Nutrients
Ammonia ■ ◊
Ortho-P ■
Nitrate[3] ■
Nitrite[3] ■
TKN ■
Total N ○ ◊
Total P ±

Bacteria
Total Coliform ± ◊
Enterococcus ± ◊
Fecal Coliform ± ◊

Field Parameters
pH ± ◊
Temperature ■
Specific Conductivity ■
Dissolved Oxygen ±
Turbidity[2] ±

Notes
1. Although PCBs are 303(d)-listed in the Otay HU at the IB pier, no persistent flow outfalls drain directly to the Pacific Ocean, and the source has not been identified as storm water or urban runoff from the MS4
2. To be assessed in laboratory only if field meter fails.
3. Nitrate and nitrite may be combined and reported as Nitrate+Nitrite

■ Required per Provision D (Tables D-2 and D-7)
○ Required per Provision C.1.a
± Required per Provision C.1.a & Provision D (Tables D-2 and D-7)
◊ 303(d) Listed Constituent

Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A2-7
Otay HU Dry Weather MS4 Outfall Discharge Monitoring Constituents

A.2.3 Wet Weather MS4 Outfall Discharge Monitoring

This section details the wet weather MS4 outfall monitoring required to comply with the MS4 Permit. Each Copermittee is required to perform wet weather MS4 outfall monitoring to identify pollutants in storm water discharges from the MS4s, guide pollutant source identification efforts, and determine compliance with the Water Quality Based Effluent Limits (WQBELs) associated with the Bacteria TMDL within its respective jurisdiction as required by Provision D.2.c of the MS4 Permit.

A.2.3.1 Storm Water MS4 Outfall Discharge Monitoring

Each Copermittee 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, to guide pollutant source identification efforts, and to determine compliance with the WQBELs associated with the applicable TMDLs within its respective jurisdiction as required by Provision D.2.c of the MS4 Permit.

A.2.3.1.1 Outfall Prioritization

The Copermittees selected wet weather MS4 outfall discharge monitoring stations from the inventories developed pursuant to Provision D.2.a.(3).(a).(1) of the MS4 Permit for the San Diego Bay WMA as follows:

- At least five 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 Watershed Management Area
- At least one wet weather MS4 outfall discharge monitoring station for each Copermittee within the Watershed Management Area

The Copermittees may adjust the wet weather MS4 outfall discharge monitoring locations in the San Diego Bay WMA, as needed, to identify pollutants in storm water discharges from MS4s, to guide pollutant source identification efforts, and to determine compliance with the WQBELs associated with applicable TMDLs in accordance with the highest priority water quality conditions identified in the San Diego Bay WMA Water Quality Improvement Plan.

A.2.3.1.2 Monitoring Locations and Frequency

The monitoring locations for wet weather MS4 outfall monitoring are provided in Table A2-4 and are mapped in Figure A2-8.

Table A2-4
Wet Weather MS4 Outfall Monitoring Locations

Jurisdiction	Wet Weather Outfall Stations	HA or HSA	Latitude	Longitude
City of Chula Vista	SC-19	910.20	32.651985	-116.948903
City of Coronado	Outfall No. 59 & 60	910.10	32.68661	-117.193424
City of Imperial Beach	K-outfall ("K-2")	910.20	32.58832	-117.10747
City of La Mesa	Outfall 908-UNI-MASS	908.22	32.754663	-117.043269
City of Lemon Grove	Site 69	908.22	32.7347	-117.05626
City of National City	44B (Paradise, HSA 908.32)	908.32	32.66974	-117.10247
Port of San Diego	CV-1	909.12	32.629627	-117.108012
Airport Authority	Upstream from Outfall 12	908.21	32.73635	-117.207699
City of San Diego	DW797	908.32	32.69541	-117.05776
County of San Diego	COSD MS4 SDB01	909.12	32.667388	-117.021871

Notes:

HA = Hydrologic Area; HSA = Hydrologic Sub-Area

Per the requirements of the MS4 Permit, each Copermittee will monitor its wet weather MS4 outfall discharge monitoring station(s) in the San Diego Bay WMA once annually.

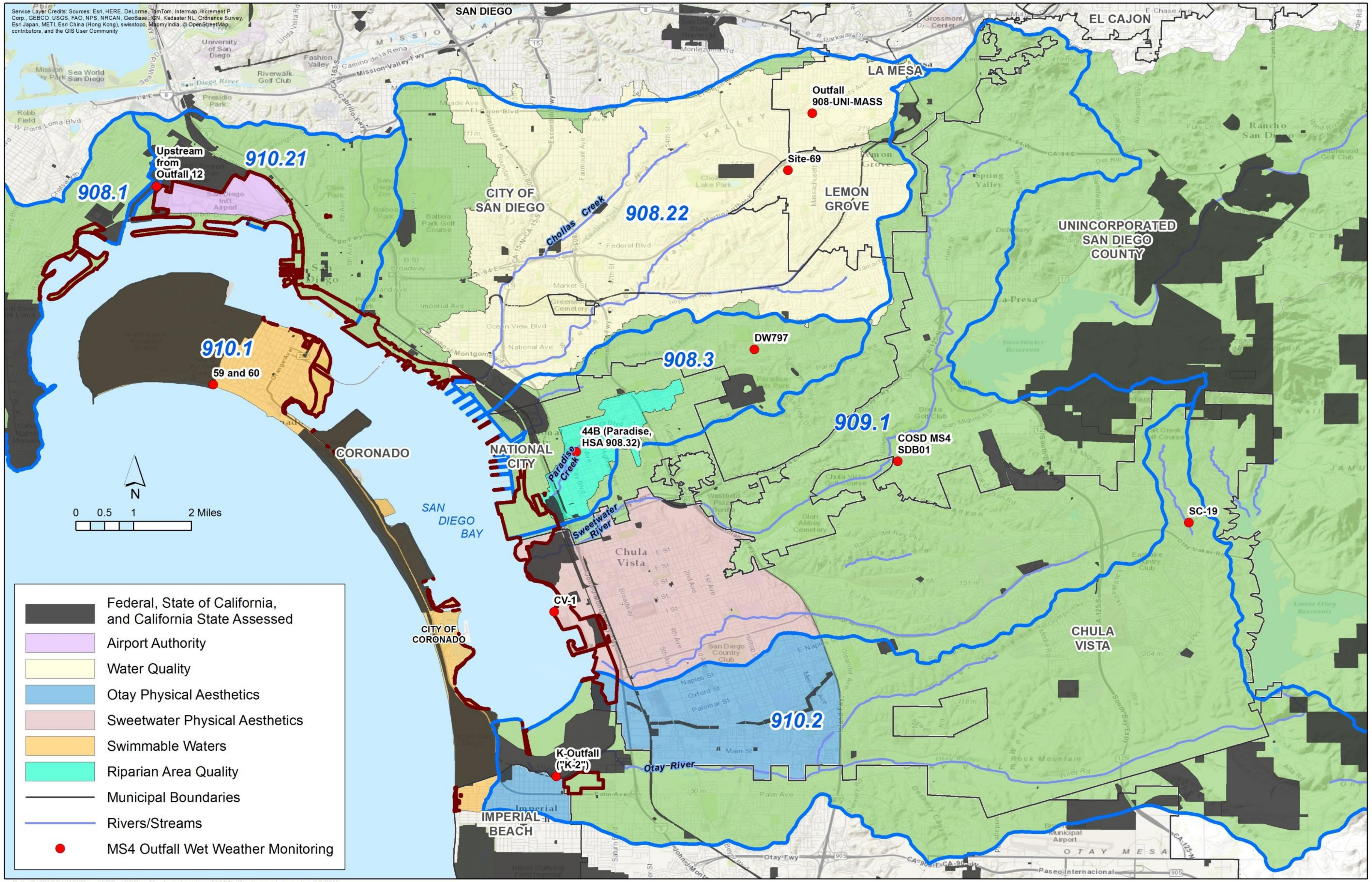


Figure A2-8
Selected MS4 Outfalls Wet Weather Discharge Monitoring

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A.2.3.1.2.1 Wet Weather Events

For each wet weather monitoring event, the following narrative descriptions and observations will be recorded at each wet weather MS4 outfall discharge monitoring station:

- Station location
- Date and duration of the storm event(s) sampled
- Rainfall estimates of the storm event
- Duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event

Storm events will be considered viable for mobilization if they are predicted to produce at least 0.1 inch of rainfall in the drainage area and at least a 70 percent chance of rainfall. The mobilization criteria must be met at least 24 hours prior to the anticipated onset of rainfall. For the purposes of the criteria, storm forecasts will be obtained from the National Weather Service website (http://www.wrh.noaa.gov/sgx/).

A.2.3.1.3 Field Observations

During the wet weather monitoring event, narrative descriptions and field observations will be recorded at each wet weather MS4 outfall discharge monitoring station. Narrative descriptions and observations include the location, date, and duration of the storm event(s) sampled, rainfall estimates for the storm event(s), and the duration between the sampled storm event and the end of the previous measurable (greater than 0.1 inch of rainfall) storm event.

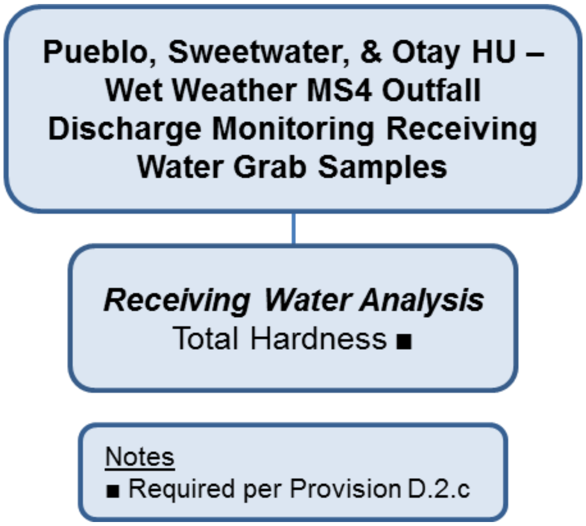
Flow estimation or measurement will be performed as described in Attachment A, using data from nearby United States Geological Survey (USGS) gauging stations, or flow rates may be measured or estimated in accordance with the United States Environmental Protection Agency (USEPA) Storm Water Sampling Guidance Document (EPA-833-B-92-001), Section 3.2.1, or other method proposed by the Copermittees that is acceptable to the RWQCB.

A.2.3.1.4 Field Monitoring

During each wet weather monitoring event, *in-situ* measurements for field monitoring parameters will be collected at each of the selected outfall sites. Field monitoring parameters include:

- pH
- Temperature
- Specific conductivity
- Dissolved oxygen
- Turbidity

Field grab parameters for receiving waters under this program are detailed in Figure A2-9. Additional parameters are presented in Figures A2-10, A2-11, and A2-12. Analytical methods and detection limits for field monitoring parameters are provided in Attachment A5.



Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A2-9
Pueblo, Sweetwater, & Otay HU – Wet Weather MS4 Outfall Discharge Monitoring Receiving Water Grab Samples

A.2.3.1.5 Analytical Monitoring

A.2.3.1.5.1 Sample Collection

Samples will be collected as follows:

- Grab samples will be collected for the analytes not amenable to composite sampling. These analytes are noted in Attachment A5. Samples will be collected in accordance with the protocol provided in Attachment A.
- Composite samples will be collected for all other analytes. To ensure the most consistent sample collection method for all sites, the Copermittees will collect a single time-weighted composite at each site.
  - When unattended automated sampling is feasible, time-weighted composites will be collected over the length of the storm event or in the first 24-hour period, whichever is shorter, composed of discrete samples, which may be collected through the use of automated equipment set at the time intervals listed in Attachment B.

- When unattended automated sampling is not feasible (i.e., security or safety issues), a composite sample will be collected using a minimum of four grab samples, collected during the first 24 hours of the storm water discharge, or for the entire storm water discharge if the storm event is less than 24 hours at the time intervals listed in Attachment B based on the anticipated size of the storm. Some variation may occur depending on the actual storm intensity and duration. After the storm event, the discrete samples will be composited into one time-weighted composite for chemistry analysis.

Figures A2-10, A2-11, and A2-12 detail the analyses required for selected wet weather MS4 outfall monitoring. Attachment A5 details the analytes required for MS4 outfall for persistent flow monitoring including analytical methods and detection limits. All samples will be collected in accordance with SWAMP protocols. An example COC form is included in Attachment C. Quality assurance and quality control procedures are outlined in Attachment C.

Pueblo HU – Wet Weather MS4 Outfall Discharge Monitoring Constituents

Composite Samples (Analytical Parameters)

Conventional Parameters
TDS ■
Turbidity[1] ○ ◊
Total Hardness ■
Trash[2] ◊

Metals (Total & Dissolved)
Cadmium ±
Copper ± ◊
Iron[2] ◊
Lead ± ◊
Manganese[2] ◊
Mercury[2] ◊
Zinc ± ◊

Nutrients
Ammonia ■
Nitrate[3] ±
Nitrite[3] ±
TKN ■
Total N ■ ◊
Total P ± ◊

Organics[2]
Chlordane ◊
Diazinon ◊
PAHs ◊
PCBs ◊

Grab Samples

Field Parameters
pH ■
Temperature ■
Specific Conductivity ■
Dissolved Oxygen ■
Turbidity[1] ± ◊

Analytical Parameters
Total Coliform ■ ◊
Enterococcus ■ ◊
Fecal Coliform ■ ◊

Notes
1. To be assessed in laboratory only if field meter fails.
2. Monitored in Mesa HA (908.2) only.
3. Nitrate and nitrite may be combined and reported as Nitrate+Nitrite
■ Required per Provision D.2.c
± Required per Provision C.2.a & Provision D.2.c
◊ 303(d) Listed Constituent

Note: This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.

Figure A2-10
Pueblo HU Wet Weather MS4 Outfall Discharge Monitoring Constituents

Sweetwater HU – Wet Weather MS4 Outfall Discharge Monitoring Constituents

Composite Samples (Analytical Parameters)

Conventional Parameters
TDS ◊
Turbidity[1] ○ ◊
Total Hardness ■
Color ◊
Trash ± ◊

Metals (Total & Dissolved)
Cadmium ±
Copper ± ◊
Lead ±
Manganese ◊
Selenium ◊
Zinc ±

Nutrients
Ammonia ■
Nitrate[2] ■
Nitrite[2] ■
TKN ■
Total N ◊
Total P ± ◊

Grab Samples

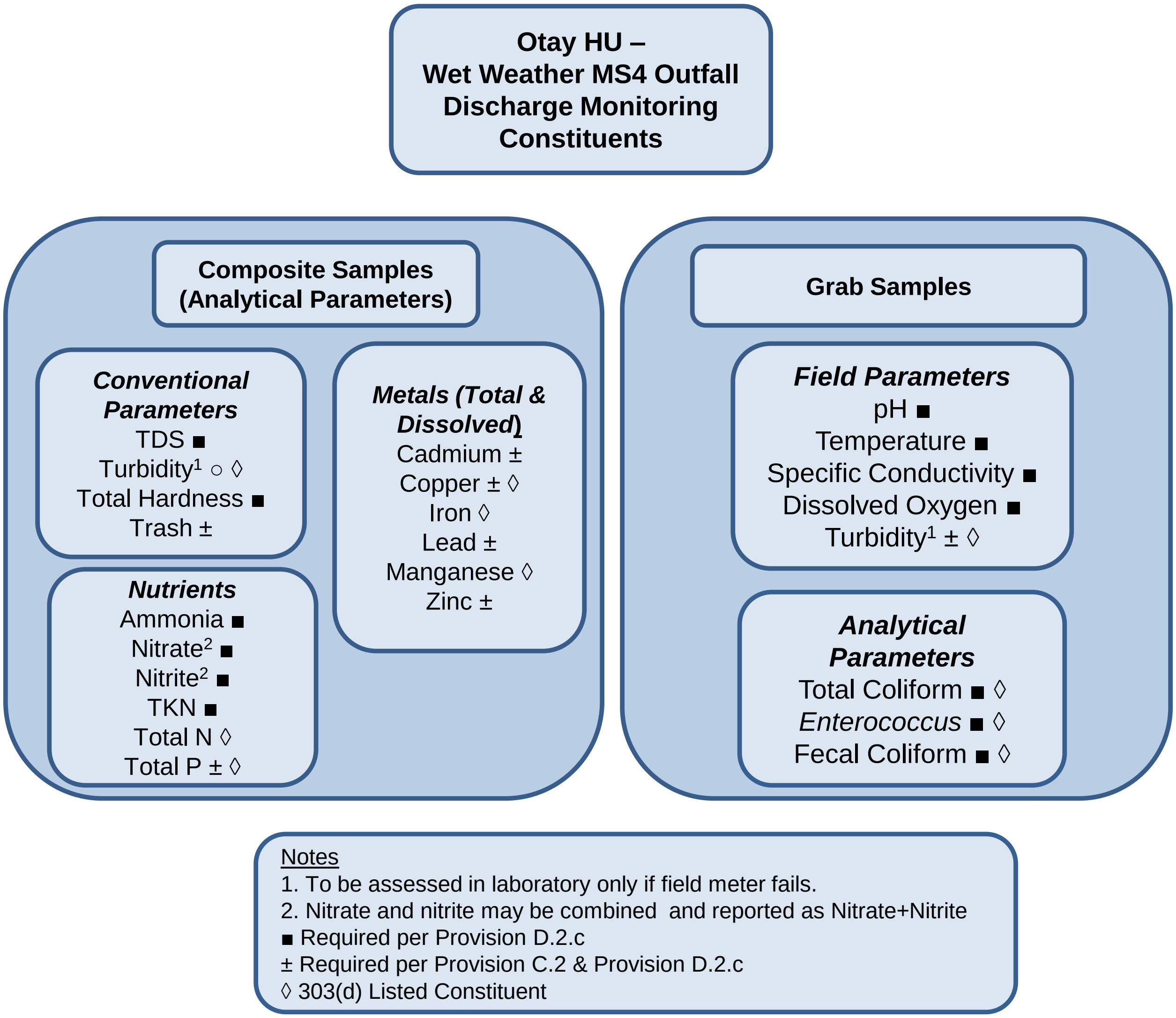
Field Parameters
pH ■
Temperature ■
Specific Conductivity ■
Dissolved Oxygen ■
Turbidity[1] ± ◊

Analytical Parameters
Total Coliform ■ ◊
Enterococcus ■ ◊
Fecal Coliform ■ ◊

Notes
1. To be assessed in laboratory only if field meter fails.
2. Nitrate and nitrite may be combined and reported as Nitrate+Nitrite
■ Required per Provision D.2.c
± Required per Provision C.2 & Provision D.2.c
◊ 303(d) Listed Constituent

Note: *This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.*

Figure A2-11
Sweetwater HU Wet Weather MS4 Outfall Discharge Monitoring Constituents



Note: *This figure describes detailed monitoring procedures and analytical methods that are illustrative and may be revised on the basis of site-specific environmental conditions and equivalent alternate analytical methods.*

Figure A2-12
Otay HU Wet Weather MS4 Outfall Discharge Monitoring Constituents

A.2.3.1.5.2 Laboratory Analysis

The required analyses are based upon the following four groupings of constituents:

(1) Constituents contributing to the highest priority water quality conditions identified in the San Diego Bay WMA Water Quality Improvement Plan

(2) Constituents listed as a cause for impairment of receiving waters in the San Diego Bay WMA as listed on the 303(d) list

(3) Constituents for implementation plans or load reduction plans (e.g., Bacteria Load Reduction Plans, Comprehensive Load Reduction Plans) developed for the San Diego Bay WMA where the Copermittees are listed as RPs under a TMDL

(4) Applicable storm water action level (SAL) constituents listed in Provision C.2 of the MS4 Permit.

Attachment A5 details the analyses required for wet weather MS4 outfall monitoring, including analytical methods and detection limits. Analytes that are field measured are not required to be analyzed by a laboratory. Chemical and bacterial analysis of samples will be performed by a laboratory certified for the appropriate fields of testing by the California Environmental Laboratory Accreditation Program (ELAP). The laboratory should also be a participant of the Stormwater Monitoring Coalition's Intercalibration Program. Additionally, only one analysis of a collected sample is required. Quality assurance and quality control procedures for laboratory analysis are outlined in Attachment C.

A.2.4 MS4 Outfall Assessment and Monitoring

Each Copermittee must evaluate the data collected pursuant to Provisions D.2.b and D.2.c. Annual reporting assessments are presented in Section D.4.1. Report of Waste Discharge (ROWD) Assessments are presented in Section 4.2.4 of the Water Quality Improvement Plan.

A.2.4.1 Annual Report

The MS4 outfall discharge assessments include evaluating both the dry weather monitoring data associated with the IDDE program collected as part of the Jurisdictional Runoff Management Program (JRMP) and the dry and wet weather monitoring data collected by the Copermittees. Details of the two separate assessments are provided below. Each Copermittee will assess its MS4 monitoring programs and compile results as part of the San Diego Bay WMA Water Quality Improvement Plan Annual Report.

A.2.4.1.1 Dry Weather MS4 Outfall Assessments

Each Copermittee must assess and report the progress of its IDDE program (required pursuant to MS4 Permit Provision E.2) toward effectively prohibiting non-storm water and illicit discharges into the MS4s within its jurisdiction. Additionally, each RP will assess its dry weather MS4 monitoring programs individually and compile results in a regionally agreed upon format annually into a watershed assessment in the San Diego Bay WMA Water Quality Improvement Plan Annual Report. Assessments are presented below and summarized in Table A2-5.

Table A2-5
Annual Dry Weather MS4 Outfall Assessments

Assessment	Components	Reporting
Identify known and suspected controllable sources	Identify known and suspected controllable sources (e.g., facilities, areas, land uses, pollutant generating activities) of transient and persistent flows	Provide annually in Water Quality Improvement Plan Annual Report
Identify sources that have been reduced or eliminated	Identify sources of transient and persistent flows that have been reduced or eliminated	
Identify necessary modifications to monitoring locations and frequencies	Identify necessary modifications to monitoring locations and frequencies necessary to identify and eliminate sources of persistent flows	
Rank and prioritize non-storm water discharges	Rank persistently flowing outfalls according to potential threat to receiving water quality	
	Produce/update prioritized list of outfalls	
Identify sources contributing to NAL exceedances	Identify known and suspected sources that may cause or contribute to exceedances	
Estimate volumes and loads of non-storm water discharges	Analyze data collected as part of the MS4 Permit-required dry weather outfall monitoring	
	Use a model or other method to calculate and estimate collective persistent non-storm water discharge volumes and pollutant loads. Specific calculations/estimates include: 1) Annual non-storm water volumes and loads discharged from the Copermittee's major MS4 outfalls to receiving waters within its jurisdiction, with an estimate of the percent contribution from each known source for each MS4 outfall 2) Annual identification and quantification (by volume and pollutant load) of sources of discharged non-storm water not subject to the Copermittee's legal authority	

Table A2-5 (continued)
Annual Dry Weather MS4 Outfall Assessments

Assessment	Components	Reporting
Evaluate progress in achieving non-storm water volume and load reductions	Identify reductions and progress in achieving reductions	Prove minimum once during Permit cycle in Water Quality Improvement Plan Annual Report
	Assess the effectiveness of Water Quality Improvement Plan improvement strategies, with estimates of volume and load reductions attributed to specific strategies when possible	
	Identify modifications necessary to increase the effectiveness of Water Quality Improvement Plan strategies	
Identify data gaps	Identify data gaps in the monitoring data necessary to fulfill assessment requirements	Provide annually in Water Quality Improvement Plan Annual Report

- Identify sources of non-storm water discharges.
  - Identify the known and suspected controllable sources (e.g., facilities, areas, land uses, and pollutant generating activities) of transient and persistent flows within the Copermittee's jurisdiction in the San Diego Bay WMA.
  - Identify sources of transient and persistent flows within the Copermittee's jurisdiction in the San Diego Bay WMA that have been reduced or eliminated.
  - Identify modifications of the field screening monitoring locations and frequencies for the MS4 outfalls in Copermittee's inventory necessary to identify and eliminate sources of persistent flow non-storm water discharges (Provision D.2.b).
  - The JRMP Annual Report will be used to guide this assessment in the Water Quality Improvement Plan Annual Report. Known and suspected sources will be identified during the implementation of JRMP activities. These activities include the facility inspections that complement the IDDE program and information gathered by the storm water hotline or other public complaints. The JRMP Annual Report now consists of a one-page form that summarizes the JRMP activities in Attachment D of the MS4 Permit, along with supporting information. Section IV of the JRMP Annual Report Form summarizes the findings of the IDDE Program. The back-up that will be provided along with the form may include the following information to help identify sources:
    - Identify the subwatershed of the source or complaint
    - Identify the potential receiving water of the source or complaint

    - Identify the potential pollutant or pollutant category that could be contributed by the source or complaint

- Rank and prioritize non-storm water discharges.
    - Based on the data collected and applicable numeric action levels described in San Diego Bay WMA Water Quality Improvement Plan, the Copermittees must rank the persistently flowing major outfalls in their jurisdictions according to the potential threat to receiving water quality and produce a prioritized list of major MS4 outfalls. The Water Quality Improvement Plan will be updated annually on the basis of these findings and with the goal of implementing (in the order of the ranked priority list) targeted programmatic actions and source investigations to eliminate persistent non-storm water discharges and/or pollutant loads. The list will be reprioritized according to one or more of the following criteria (Provision D.2.b.(2)(b)(ii)):
        - The non-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 level) and the persistent flow can be reprioritized to a lower priority.
        - The constituents in the persistent flow non-storm water discharge do not exceed NALs (Provision C.1).
        - 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 Copermittee, 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 Copermittee 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 Water Quality Improvement Plan Annual Report. When a Copermittee removes a persistent flow MS4 outfall monitoring station, it will be replaced with the next highest prioritized major MS4 outfall designated by that jurisdiction in the San Diego Bay WMA. If there are no remaining qualifying major MS4 outfalls within its jurisdiction, the number of major MS4 outfalls monitored will be reduced.

- Identify sources contributing to NAL exceedances.
  - For the highest priority major MS4 outfalls with persistent flows that exceed NALs (Provision C1.), each RP must identify the known and suspected sources within its jurisdiction in the San Diego Bay WMA that may cause or contribute to the numeric action limit exceedances and report them annually.
- Estimate volumes and loads of non-storm water discharges.
  - Annually, the RPs must (1) analyze the data collected as part of the Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring Program from the highest priority major MS4 outfalls collected in regionally agreed-upon formats, and (2) use a model or another method to calculate or estimate and report 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. These calculations or estimates must 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 Copermittee’s major MS4 outfalls to receiving waters within the Copermittee’s jurisdiction
    - The annual volumes and pollutant loads for sources of non-storm water not subject to the Copermittee’s legal authority that are discharged from the Copermittee’s major MS4 outfalls to downstream receiving waters
- Evaluate progress in achieving non-storm water volume and load reductions
  - Based on evaluation of the data collected under the dry weather MS4 outfall monitoring program and annual assessments performed, the following assessments must be performed a minimum of once per Permit cycle:
    - Identify reductions and progress in achieving reductions in non-storm water and illicit discharges to the Copermittee’s MS4 system.
    - Evaluate the effectiveness of the water quality improvement strategies being implemented toward reducing or eliminating non-storm water and pollutant loads discharging from the Copermittee’s MS4 to receiving waters, with an estimate of the volume and/or pollutant load reductions attributable to specific strategies, if possible.
    - Identify modifications necessary to increase the effectiveness of the Water Quality Improvement Plan strategies being implemented toward reducing or eliminating non-storm water and pollutant loads discharging from the MS4 to receiving waters.

- Identify data gaps
  - Identify gaps in the monitoring data necessary to fulfill annual dry weather MS4 outfall assessment and reporting requirements on an annual basis.

Table A2-6 presents NAL criteria from Municipal Permit provision C.1 and which discharges the NAL criteria are applicable to.

Table A2-6
Non-Storm Water Action Levels

<table>
<tr><th>Type of Receiving Water that MS4 Discharges to</th><th>Parameter</th><th>Units</th><th>AMAL</th><th>MDAL</th><th>Instantaneous Maximum</th><th>Municipal Permit Table Reference</th></tr>
<tr><td rowspan="3">Ocean Surf Zone(s)</td><td>Total Coliform</td><td rowspan="3">MPN/100mL</td><td>1,000</td><td rowspan="3">N/A</td><td>10,000 or 1,000 (if the fecal coliform to total coliform ratio exceeds 0.1)</td><td rowspan="3">Table C-1</td></tr>
<tr><td>Fecal Coliform</td><td>200 during any 30-day period</td><td>400</td></tr>
<tr><td>Enterococci</td><td>35</td><td>104 (for saltwater designated beaches)</td></tr>
<tr><td rowspan="4">Bays, Harbors, and Lagoons/Estuaries[1]</td><td>Turbidity</td><td>NTU</td><td>75</td><td>N/A</td><td>225</td><td rowspan="4">Table C-2</td></tr>
<tr><td>pH</td><td>Units</td><td colspan="3">Within the range of 6.0 to 9.0</td></tr>
<tr><td>Fecal Coliform</td><td rowspan="2">MPN/100mL</td><td>200 (with at least 5 samples within a 30-day period)</td><td>N/A</td><td>If more than 10% of samples exceed 400 within a 30 day period</td></tr>
<tr><td>Enterococci</td><td>35</td><td>N/A</td><td>104 (for saltwater designated beaches)</td></tr>
</table>

Table A2-6 (continued)
Non-Storm Water Action Levels

Type of Receiving Water that MS4 Discharges to	Parameter	Units	AMAL	MDAL	Instantaneous Maximum	Municipal Permit Table Reference
Bays, Harbors, and Lagoons/Estuaries[1] (continued)	**Cadmium[2]**	µg/L	**Freshwater – CTR Saltwater - 8**	**Freshwater – CTR Saltwater - 16**	N/A	Tables C-2 and C-3
	Copper		Freshwater – CTR Saltwater – 2.9	Freshwater – CTR Saltwater – 5.8		
	Chromium III[2]		**Freshwater – CTR Saltwater – N/A**	**Freshwater – CTR Saltwater - N/A**		
	Chromium VI		Freshwater – 8.1 Saltwater - 41	Freshwater – 16 Saltwater - 83		
	Lead		Freshwater – CTR Saltwater – 2.9	Freshwater – CTR Saltwater - 14		
	Nickel[2]		**Freshwater – CTR Saltwater – 6.8**	**Freshwater – CTR Saltwater - 14**		

Table A2-6 (continued)
Non-Storm Water Action Levels

<table>
<tr><th>Type of Receiving Water that MS4 Discharges to</th><th>Parameter</th><th>Units</th><th>AMAL</th><th>MDAL</th><th>Instantaneous Maximum</th><th>Municipal Permit Table Reference</th></tr>
<tr><td rowspan="2">Bays, Harbors, and Lagoons/Estuaries[1] (continued)</td><td>Silver</td><td rowspan="2">µg/L</td><td>Freshwater – CTR
Saltwater – 1.1</td><td>Freshwater – CTR
Saltwater – 2.2</td><td rowspan="2">N/A</td><td rowspan="2">Tables C-2 and C-3</td></tr>
<tr><td>Zinc</td><td>Freshwater – CTR
Saltwater - 47</td><td>Freshwater – CTR
Saltwater - 95</td></tr>
<tr><td rowspan="10">Inland Surface Waters</td><td>Dissolved Oxygen</td><td>mg/L</td><td colspan="3">Not less than 5.0 in waters with the WARM beneficial use and not less than 6.0 in waters with a COLD beneficial use</td><td rowspan="10">Table C-4</td></tr>
<tr><td>Turbidity</td><td>NTU</td><td>N/A</td><td>20</td><td>20</td></tr>
<tr><td>pH</td><td>Units</td><td colspan="3">Within the range of 6.5 to 8.5</td></tr>
<tr><td>Fecal Coliform</td><td rowspan="2">MPN/100mL</td><td>200 (with at least 5 samples within a 30-day period)</td><td>N/A</td><td>If more than 10% of samples exceed 400 within a 30 day period</td></tr>
<tr><td>Enterococci</td><td>33</td><td>N/A</td><td>61 (for freshwater designated beaches)</td></tr>
<tr><td>Total Nitrogen</td><td rowspan="5">mg/L</td><td rowspan="5">N/A</td><td>1.0</td><td>1.0</td></tr>
<tr><td>Total Phosphorus</td><td>0.1</td><td>0.1</td></tr>
<tr><td>MBAS</td><td>0.5</td><td>0.5</td></tr>
<tr><td>Iron</td><td>0.3</td><td>0.3</td></tr>
<tr><td>Manganese</td><td>0.05</td><td>0.05</td></tr>
</table>

Table A2-6 (continued)
Non-Storm Water Action Levels

Type of Receiving Water that MS4 Discharges to	Parameter	Units	AMAL	MDAL	Instantaneous Maximum	Municipal Permit Table Reference
Inland Surface Waters (continued)	**Cadmium**[2]	µg/L	**Freshwater – CTR**	**Freshwater – CTR**	N/A	Tables C-3 and C-4
	Copper		Freshwater – CTR	Freshwater – CTR		
	Chromium III[2]		**Freshwater – CTR**	**Freshwater – CTR**		
	Chromium VI		Freshwater – 8.1	Freshwater – 16		
	Lead		Freshwater – CTR	Freshwater – CTR		
	Nickel[2]		**Freshwater – CTR**	**Freshwater – CTR**		
	Silver		Freshwater – CTR	Freshwater – CTR		
	Zinc		Freshwater – CTR	Freshwater – CTR		

Notes: AMAL – Average Monthly Action Level; MDAL – Maximum Daily Action Level; CTR – California Toxics Rule; mg/L – milligrams per liter; µg/L – micrograms per liter; NTU – Nephelometric Turbidity Units; MPN/100mL – most probable number per 100 milliliters

NALs shaded green, if exceeded, must be compared to the receiving water hardness-based Calfiornia Toxics Rule (CTR) criteria from 40 CFR 131.38(b)(2). Some NALs are automatically set at the CTR criteria, as indicated by "CTR" in the applicable AMAL or MDAL columns. Exceedance of an NAL where the CTR criteria is applied to a discharge does not constitute a water quality objective exceedance in the downstream receiving water.

1. Applicable NAL standards for freshwater and saltwater are location dependent. The majority of receiving waters in this category in San Diego Bay are likely to be considered brackish or marine where saltwater criteria will apply. However, some estuary locations in the San Diego Bay watershed that are elevated or become separated from tidal influence may be inundated predominantly with freshwater and be classified as such. As a result, both freshwater and saltwater NALs have been included for this category.
2. NAL objectives calculated from the CTR for parameters that are **bolded** must not be higher than the Maximum Contaminant Levels (MCLs) under the California Code of Regulations, Title 22, Division 4, Chapter 15, Article 4, Section 64431. MCLs are secondary drinking water standards that are being applied to MS4 Discharges per Table C-3 of the Municipal Permit; however, exceedance of the MCLs in MS4 discharges does not constitute a water quality exceedance in the downstream receiving water. It is simply the highest allowable NAL standard for these constituents. NALs must not exceed the numeric MCLs for the following constituents: Cadmium (5 µg/L), Chromium III (which is not included in Section 64431, so the total chromium standard of 50 µg/L will be applied), and Nickel (100 µg/L)

The CTR contains sample-specific water quality objectives applicable to dissolved metals in which a calculation is required to determine MDAL/CMC and AMAL/Criteria Continuous Concentrations (CCC) for freshwater criteria. However, Provision C of the municipal permit applies the CTR criteria to total metals, except for Chromium III and Chromium VI, which are listed in their dissolved form. To calculate CTR criteria, receiving water hardness must be available either from sample analytical results or from reliable third party data. The calculations are based on the hardness of the receiving water because hardness can affect how toxic metals are in the water. The placeholder number for receiving water hardness in the CTR is 100 mg/L. However, in the San Diego Bay WMA hardness values are likely to be higher, which is why grab samples in the receiving water are collected. In general, as the hardness increases, the water quality objective increases because the metals are less toxic in the water. Metals concentrations in the receiving water are generally expected to be lower than those in the outfall. It is appropriate to use the receiving water hardness instead of the hardness from the outfall sample because, typically, when an outfall discharges into a receiving water, any metals concentrations from the outfall may be subject to mixing and dilution in the receiving water.

The other site-specific requirement for the CTR calculation is the Water Effect Ratio (WER). There currently is no site-specific WER present for any water body in the San Diego Bay WMA, though a draft WER has been derived for copper and zinc in the Chollas Creek watershed and is currently under review by the State Board and EPA for approval. The placeholder WER of 1 is used for the standard calculation, as is consistent with the CTR, when a site-specific WER has not been established. The CTR criteria have the same number of significant figures as the hardness concentration. Additional information is available at 40 C.F.R. § 131.38. The calculations are as follows:

$$\text{MDAL (CMC)} = \text{WER} \times (\text{Acute Conversion Factor}) \times (\exp\{m_A[\ln(\text{hardness})]+b_A\})$$

$$\text{AMAL (CCC)} = \text{WER} \times (\text{Chronic Conversion Factor}) \times (\exp\{m_C[\ln(\text{hardness})]+b_C\})$$

Specific dissolved metal conversion requirements under the CTR are presented in Table A2-7.

**Table A2-7:
CTR Conversion Requirements**

Constituent	m_A	b_A	m_C	b_C	Conversion Factor for Acute (CMC)	Conversion Factor for Chronic (CCC)
Antimony	-	-			NA[1]	NA[1]
Arsenic	-	-			1.000	1.000
Beryllium	-	-			NA[1]	NA[1]
Cadmium	1.128	-3.6867	0.7852	-2.715	= 1.136672-[(ln {hardness})(0.041838)]	= 1.101672-[(ln {hardness})(0.041838)]
Chromium (III)	0.8190	3.688	0.8190	1.561	0.316	0.860
Chromium (VI)	-	-			0.982	0.962
Copper	0.9422	-1.700	0.8545	-1.702	0.960	0.960
Lead	1.273	-1.460	1.273	-4.705	= 1.46203-[(ln {hardness})(0.145712)]	= 1.46203-[(ln {hardness})(0.145712)]
Mercury	-	-			NA	NA
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Selenium	-	-			NA	NA
Silver	1.72	-6.52	NA	NA	0.85	NA[1]
Thallium	-	-			NA[1]	NA[1]
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

[1] Aquatic life criterion has not yet been published by the USEPA.

A.2.4.1.2 Wet Weather Outfall Assessments and Illicit Discharges

The Copermittees must assess and report the progress of the water quality improvement strategies implemented as part of the Water Quality Improvement Plan 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 contain the elements provided below and summarized in Table A2-8.

The elements for assessment of this program include the following:

- Estimate volumes and loads of storm water discharges.
    - As part of the Water Quality Improvement Plan Annual Report, the Copermittees must annually analyze the monitoring data collected as part of the Wet Weather MS4 Outfall Discharge Monitoring Program. This includes calculating or estimating the following for each monitoring year:
        - The average storm water runoff coefficient for each land use type within the San Diego Bay WMA.
        - For storm events with measurable rainfall greater than 0.1 inch, the volume of storm water and pollutant loads discharged from the monitored MS4 outfalls to receiving waters within the San Diego Bay WMA.
        - The total flow volume and pollutant loadings discharged from each Copermittee's jurisdiction within the San Diego Bay WMA over the course of the wet season, extrapolated from the data produced from the monitored MS4 outfalls.
        - For storm events with measurable rainfall greater than 0.1 inch, the percent contribution of storm water volumes and pollutant loads discharged from the 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.
        - Supporting information for calculations required for this assessment is provided in Attachment D.
- Evaluate Water Quality Improvement Plan analysis.
    - The Copermittees will evaluate the Water Quality Improvement Plan analysis on the basis of the wet weather MS4 outfall monitoring data collected and the applicable storm water numeric action levels (Provision C.2). This evaluation will include analyzing and comparing the monitoring data used to develop the Water Quality Improvement Plan, particularly the strategies, on an annual basis. Additionally, the Copermittees will evaluate whether those analyses should be updated as a component of the adaptive management described in the Water Quality Improvement Plan.

Table A2-8
Annual Wet Weather MS4 Outfall Assessments

Assessment	Component	Reporting
Estimate loads and volumes	Calculate or estimate the average storm water runoff coefficient for each land use type	Provide annually in Water Quality Improvement Plan Annual Report
	Calculate or estimate the volume of storm water and pollutant loads discharged from each monitored MS4 outfall for each qualifying storm event	
	Calculate or estimate the total volume and pollutant load discharged from the Copermittee's jurisdiction over the course of the wet season	
	Calculate or estimate the percent contribution of storm water volumes and pollutant loads discharged from each land use type within each hydrologic subarea with a major MS4 outfall or each major MS4 outfall for each qualifying storm event	
Evaluate Water Quality Improvement Plan analysis	Using data and applicable SALs, analyze and company to the analyses and assumptions used to develop the Water Quality Improvement Plan	
	Evaluate whether analyses and assumptions should be updated as a component of the adaptive management efforts	
Evaluate progress in achieving storm water pollutant reductions	Identify reductions and progress in achieving reductions from different land uses and/or drainage areas	Provide minimum once during Permit cycle in Water Quality Improvement Plan Annual Report
	Assess the effectiveness of Water Quality Improvement Plan improvement strategies, with estimates of volume and load reductions attributed to specific strategies when possible.	
	Identify modifications necessary to increase the effectiveness of Water Quality Improvement Plan strategies	
Identify data gaps	Identify data gaps in the monitoring data necessary to fulfill assessment requirements	Provide annually in Water Quality Improvement Plan Annual Report

- Evaluate progress in achieving storm water pollutant reductions.
  - Based on evaluation of the data collected under the wet weather MS4 outfall monitoring program and annual assessments performed, the following assessments must be performed a minimum of once per Permit cycle:
    - Identify reductions and progress in achieving reductions in storm water discharges to the Copermittee's MS4 system from different land uses and/or drainage areas
    - Evaluate the effectiveness of the water quality improvement strategies being implemented toward reducing pollutants in storm water discharging from the Copermittee's MS4 to receiving waters, with an estimate of the pollutant load reductions attributable to specific strategies, if possible
    - Identify modifications necessary to increase the effectiveness of the Water Quality Improvement Plan strategies being implemented toward reducing pollutants discharging from the MS4 to receiving waters.
- Identify data gaps
  - Identify gaps in the monitoring data necessary to fulfill annual wet weather MS4 outfall assessment and reporting requirements on an annual basis.

A.2.4.2 Data Management and Reporting

Data sharing templates have been developed to support reporting under previous Permit cycles. Copermittees will leverage existing data sharing templates in order to facilitate compilation of WMA-wide datasets for assessment and reporting purposes. Data compiled should be CEDEN-compatible and contain the following categories of information:

- General site description
- Visual observations
- Field measurements
- Laboratory data

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Attachment A
Flow Monitoring and Equipment Calibration Procedures

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Flow Monitoring and Equipment Calibration Procedures

This attachment describes the methodologies and equipment that are proposed to be used to complete flow monitoring and field measurements for the MS4 Outfall Monitoring Program, as well as the installation and maintenance procedures.

Flow estimation and water quality sampling are dynamic processes which may require modification based on current site and channel conditions. Thus, the methodologies presented are subject to modification or substitution in order to meet the requirements of this monitoring program.

Flow Monitoring

Dry Weather MS4 Outfall Flow Monitoring

Field-Based 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 National Pollutant Discharge Elimination System (NPDES) Storm Water Sampling Guidance Document (EPA-833-B-92-001; United States Environmental Protection Agency (USEPA), 1992). These methodologies include, but are not limited to the “float method” and the “bucket and stopwatch method”.

Equipment-Based Flow Estimation

Copermittees may choose to perform optional equipment-based flow monitoring of non-storm water persistent flows. Equipment-based flow estimation procedures are described in Section B.1.2.1.

Wet Weather MS4 Outfall Flow Monitoring

During wet weather MS4 outfall monitoring, the flow rates and volumes will be measured or estimated from the MS4 outfalls. Flow rates will be measured or estimated in accordance with the NPDES Storm Water Sampling Guidance Document Section 3.2.1 (USEPA, 1992), or by another method proposed by the Copermittees that is acceptable to the San Diego RWQCB. Flow monitoring may need to be adapted specifically for tidally influenced sites.

Equipment-Based Flow Estimation

Flow hydrograph and volume estimations will be captured utilizing estimated flow rates in accordance with the Section 3.2.1 of the USEPA document NPDES Storm Water Sampling Guidance Document (USEPA, 1992).

Measurement devices, sensor types, and equipment program settings will be selected on a site specific basis using best professional judgment. Due to flood control concerns typically associated with MS4 outfalls during storm events especially, a primary measurement device such as a weir or flume is unlikely to be selected. Thus, a lower profile secondary flow measurement device, such as an area-velocity senor or bubbler pressure transducer, is recommended for flow estimation from MS4 Outfalls.

Flow will be monitored at each site to determine the volume of runoff. Flow may be estimated with a Sigma 920 Flow Meter (or similar type device) with an area velocity sensor and pressure transducer (Figure A-1). An area velocity sensor measures water level and velocity. Flow will be calculated based on the cross sectional area of the pipe, level of water, slope, and velocity. Flow may also be estimated using a HOBO level logger (or similar type device) (Figure A-2). The HOBO level logger is a pressure transducer only, and the flow will be estimated based on the area of the pipe, level of water, and slope.

Field teams will mount equipment securely using best professional judgment. Sampler tubing and wiring will be routed through conduits that will be placed between the monitoring locations and the sampling equipment or enclosures. Above-ground instruments will be protected within a site equipment enclosure. Depending on site configuration, enclosures may be semi-permanent (installed before monitoring begins and removed only when the monitoring program ends) or temporary. Exposed conduit, intakes, and sensors will be securely fastened using stainless steel brackets, screws, and anchors (Figure A-3).

Figure A-1
Sigma 910 Flowmeter and Area/Velocity Pressure Sensor

Figure A-2
HOBO Level Logger

Figure A-3
Example of Sensor Installation

The flow meter may be connected to an automated sampler through a 4-20 milliampere (mA) range output. In this configuration, the flow meter provides a method to control or pace the sampler, and store sampling data and other auxiliary data. The flow meter may measure and log estimated flow, rainfall, and sample history.

At each site, the pipe diameter and slope will be measured and recorded. Level and flow measurements will be logged at minimum 5-minute intervals for the duration of the monitoring event when using continuous logging devices. Data downloads will occur after the monitoring event is complete. Due to the velocities and potential for debris to be carried by storm flows, it is possible that the flow sensor may be damaged during storm flows. Damage to a flow sensor may result in a data gap of actual recorded flows. In this event, flows from the respective drainage area will be modeled for any data gaps based on the drainage area and impervious cover.

Data Downloads and Storage

All recorded flow data downloaded to a field computer will be immediately copied to a main office data server. The server will be backed up daily in accordance with standard server practices. Data will also be copied to project folders for QA review and approval prior to moving to the project file.

Equipment Calibration

Field Meter Calibration

Calibration of all field meters will be conducted immediately prior to deployment or use. Water quality probes will be calibrated with specified calibration solutions, and it will be verified that the solution expiration date has not been exceeded. All calibrations will be conducted in accordance with the manufacturer’s specifications.

Flow Equipment Calibration

Calibration of flow equipment will be conducted immediately prior to deployment or use using the procedures described in the corresponding operations and maintenance manual.

All level logging equipment will be calibrated on-site and field verified for accuracy with a level measurement tape.

Autosampler Calibration

Calibration of autosampling equipment will be conducted immediately prior to deployment or use using the procedures described in the corresponding operations and maintenance manual.

All autosampling equipment will be calibrated on-site and field verified for aliquot collection accuracy using a graduated flask or beaker.

Attachment B
Sample Collection Procedures

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Sample Collection Procedures

This attachment describes the sampling procedures for the MS4 Outfall Monitoring Program.

Dry Weather MS4 Outfall Sample Collection

For dry weather monitoring events, the Copermittees will collect and analyze grab samples from each dry weather MS4 outfall discharge monitoring station to satisfy the requirements of the MS4 Permit. Analytes that are field measured are not required to be analyzed by a laboratory.

Wet Weather MS4 Outfall Sample Collection

For wet weather monitoring events, the Copermittees will collect and analyze samples from each wet weather MS4 outfall discharge monitoring station to satisfy the following requirements in accordance with the MS4 Permit:

- Analytes that are field measured are not required to be analyzed by a laboratory;
- The Copermittees must implement consistent sample collection methods for regional comparability of data, unless site-specific conditions indicate the need for alternate methods;
- Grab samples may be collected for pH, temperature, specific conductivity, dissolved oxygen, turbidity, and indicator bacteria;
- For all other constituents, composite samples must be collected for a duration adequate to be representative of changes in pollutant concentrations and runoff flows using one of the following techniques:
    - Time-weighted composites collected over the length of the storm event or the first 24 hour period whichever is shorter, composed of discrete samples, which may be collected through the use of automated equipment, or
    - Flow-weighted composites collected over the length of the storm event or a typical 24 hour period, whichever is shorter, which may be collected through the use of automated equipment, or
    - If automated compositing is not feasible, a composite sample may be collected using a minimum of 4 grab samples, collected during the first 24 hours of the storm water discharge, or for the entire storm water discharge if the storm event is less than 24 hours; and
- Only one analysis of the composite of aliquots is required

To ensure the most consistent sample collection method for all sites, the Copermittees will collect a single time-weighted composite at each site. When unattended automated sampling is feasible, time-weighted composites will be collected over the length of the storm event or in the first 24-hour period, whichever is shorter, composed of discrete samples, which may be collected through the use of automated equipment set at the time intervals listed in Table B-1 based on the anticipated size of the storm.

Table B-1
Automated Sample Pacing for Time-Weighted Composites Per Storm Duration

Storm Duration (Hours)	Sample Aliquot Interval (Minutes)	Sample Volume (mL)	Total Sample Aliquots	Total Volume (mL)
2	10	800	12	9,600
4	10	800	24	19,200
6	10	400	36	14,400
8	10	400	48	19,200
12	10	400	72	28,800
16	20	400	48	19,200
20	20	400	60	24,000
24	20	400	72	28,800

mL = milliliter

When unattended automated sampling is not feasible (i.e., security or safety issues), a composite sample will be collected using a minimum of four grab samples, collected during the first 24 hours of the stormwater discharge, or for the entire stormwater discharge if the storm event is less than 24 hours at the time intervals listed in Table B-2 based on the anticipated size of the storm. Some variation may occur depending on the actual storm intensity and duration. After the storm event, the discrete samples will be composited into one time-weighted composite for chemistry analysis.

Table B-2
Grab Sample Pacing for Time-Weighted Composites Per Storm Duration

Storm Duration (Hours)	Sample Aliquot Interval (Minutes)	Sample Volume (mL)	Total Sample Aliquots	Total Volume (mL)
2	20	2,000	6	12,000
4	20	2,000	12	24,000
6	40	2,000	9	18,000
8	40	2,000	12	24,000
12	60	2,000	12	24,000
16	60	2,000	16	32,000
20	120	2,000	10	20,000
24	120	2,000	12	24,000

Automated samples for chemistry will be collected with a Sigma 900MAX autosampler (or similar type device). Teflon-lined tubing will be installed and secured at each monitoring location prior to the wet weather event. The autosampler will be deployed by the field team upon arrival at each site. Samples will be pumped with the autosampler into a clean glass bottle. The sample bottle will be appropriately labeled with the sample identifier (ID), date, and time, and will be preserved on ice for transport to the laboratory. After compositing, samples will be subsampled into the appropriate bottles for analysis. Grab samples will be collected using either the Sigma 900MAX autosampler or a sample bottle connected to a sample pole that will be used to collect the sample directly from the outfall location. Nitrile or latex gloves will be worn during sample handling.

Bacteria samples and field measurements will not be taken from the composite sample; therefore, a grab sample will be collected for bacteria and field measurements during elevated flows. The grab sample will be collected after the second hour of stormwater runoff and before the sixth hour of stormwater runoff. If the stormwater runoff is less than 2 hours, the grab sample will be collected as close to the peak of flow as possible.

Bacteria samples will be collected using sterile techniques. Nitrile or latex type gloves will be worn during sample handling. During the sampling event, a 100-milliliter (mL) sterile bacteria bottle will be secured to a sample pole that will be used to collect the sample directly from the outfall location. Care will be employed to not allow contact with area structures or the bottom sediments. The container will be opened only for the needed time to collect the sample and will then be closed immediately following sample collection. If it is suspected that the container was compromised at any times, the sample container will be discarded, and a new sample will be collected with a new sample bottle. The sample bottle must be filled only to the 100-mL mark on the bottle (not over topped or under filled).

Field parameters will include hydrogen ion concentration (pH), conductivity, temperature, dissolved oxygen (DO), and turbidity. Samples will be collected and the measurements will be made using a YSI Inc. 6600 series water quality probe or similar type device. Calibration of the instruments will be conducted in accordance with Attachment B.

A field observation data sheet will be completed for each sample collected to be representative of site conditions during each sample collection. Chain-of-custody (COC) documentation (Section E.3) will be completed, and samples will be delivered to the respective laboratory to allow for all applicable analyte holding times.

Chain-of-Custody Procedures

Chain-of-custody (COC) procedures will be used for all samples throughout the collection, transport, and analytical process. A copy of a COC form is included in Attachment C. Samples will be considered to be in custody if they are: 1) in the custodian’s possession or view, 2) retained in a secured place (under lock) with restricted access, or 3) placed in a container and secured with an official seal so that the sample cannot be reached without breaking the seal. The principal documents used to identify samples and to document possession will be COC records, field logbooks, and field tracking forms.

The COC procedures will be initiated during sample collection. A COC record will be provided with each sample or group of samples. Each person who had custody of the samples will sign the form and ensure that the samples were not left unattended unless properly secured. Documentation of sample handling and custody will include the following:

- Sample identifier.
- Sample collection date and time.
- Any special notations on sample characteristics or analysis.
- Initials of the person collecting the sample.
- Date the sample was sent to the analytical laboratory.
- Shipping company and waybill information.

Completed COC forms will be placed into a plastic envelope and kept inside the cooler containing the samples. Upon delivery to the analytical laboratory, the COC form will be signed by the person receiving the samples. COC records will be included in the final reports prepared by the analytical laboratories and will be considered an integral part of the laboratory report.

Health and Safety

Field sampling events have the potential for dangerous situations to arise. Field personnel need to be aware of safety hazards and take appropriate precautions. A health and safety tailgate meeting will be held prior to any on-site activity. During this meeting, site-specific hazards will be discussed and addressed appropriately. There are several health and safety issues that pertain to the proposed sampling and equipment installation within any areas.

Traffic Hazards and Traffic Control

Because this study is being conducted in residential areas, traffic control procedures must be employed. All traffic rules and regulations and all traffic control signs and devices should be obeyed. Field personnel should allow for extra time when planning travel routes. Vehicle traffic is a major concern during field monitoring activities. Traffic presents hazards when site workers are working close to roadways and the potential exists to be hit by oncoming traffic, and when driving to, from, and on the site. Driving during rain events also presents hazards as slick roadway conditions exist. It is recommended that safe speeds and distances be maintained to avoid rain-related accidents.

Whenever possible, field personnel should park as far off the road as possible to avoid interfering with any traffic flow and should comply with the following guidelines when working:

- Turn on the vehicle's flashing yellow warning light and hazard lights.
- Put out safety cones to mark off the work area.

- Place yellow barricade around open manhole to clearly mark the area.
- Avoid steep slopes and stream banks.
- Always use a flashlight in the dark.
- Always wear bright orange and reflective safety vests to be more visible.

Confined Space

Several monitoring locations for this project are located in the underground MS4 system. To install, maintain, and uninstall monitoring equipment within the MS4, confined space entry will need to be performed. Confined spaces are defined as any space with only one entry and exit point; therefore, an MS4 is considered a confined space. To perform confined space entry, project personnel must have confined space entry, attendant, and supervisor training, and must have their certificate card. Entering confined spaces presents many health and safety hazards if not performed properly. These hazards include asphyxiation, falls, burns, drowning, engulfment, toxic exposure, and electrocution. A confined space represents the potential for unusually high concentrations of contaminants, explosive atmospheres, limited visibility, physical injury, and restricted movement.

A five-gas meter will be used to monitor the atmosphere within the MS4 prior to any personnel entering the system. If the MS4 is unsafe for entry, field personnel may attempt to ventilate the space. If the MS4 is still determined to be unsafe for entry, then no personnel will enter the MS4. Once the MS4 has been determined to be safe for entry, the personnel may enter. A harness and retrieval system are used for personnel entering the system. When field personnel are in the MS4, continued air monitoring will occur to ensure that the atmosphere remains non-hazardous. Should air monitoring determine at any time that the air is becoming hazardous, field staff will immediately evacuate the confined space.

Weather Hazards

Installation and maintenance activities will be conducted during dry weather periods only. Though the San Diego region is generally mild during the fall season, the most likely safety issue related to weather is excessive heat. Extreme heat can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials. Standard precautions should be taken to mitigate heat exhaustion during field monitoring events.

Storm event monitoring will occur during wet weather. Wet weather conditions increase slipping and tripping hazards, braking distances of vehicles, and the potential for slippage or handling difficulties of field equipment. Rain fills holes and obscures trip-and-fall hazards. Tools and personnel can slip on wet surfaces. Rain and wet weather conditions may decrease visibility and increase the potential for driving accidents. Rain and high humidity may also limit the effectiveness of certain direct-reading instruments (e.g., photoionization detectors (PIDs)).

Attachment C
Quality Assurance/Quality Control Procedures

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QUALITY ASSURANCE / QUALITY CONTROL

Field Quality Assurance/Quality Control

Quality assurance (QA) and quality control (QC) for sampling processes will include proper collection of the samples to minimize the possibility of contamination. All samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample bottles. Field staff will wear powder-free nitrile gloves or a similar type of gloves at all times during sample collection.

Target measurement objectives for field quality control samples are provided in Table C-1

Table C-1
Field Quality Control Samples

Sample Type	Measurement Objective			Frequency of Analysis
	Field Duplicate	Field Blank	Equipment Blank	
Conventionals	RPD<25%[a]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Indicator Bacteria	RPD<25%[c]	Negative Response	Negative Response	Per batch of samples submitted to the laboratory[b]
Metals	RPD<25%[a]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Nutrients	RPD<25%[a]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Solid Parameters	RPD<25%[a]	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]
Organics	Per method	<RL for target analyte	<RL for target analyte	Per batch of samples submitted to the laboratory[b]

Notes:
RL = reporting limit.
RPD = relative percent difference.
a. NA if native concentration of either sample<RL.
b. For equipment blanks, the frequency is 10% of the cleaned material. Equipment blanks are only analyzed for TOC and total metals per Section F.1.5
c. Field duplicates are not a current SWAMP requirement for indicator bacteria. However, the collection and analysis of a field duplicate is recommended.

Training

All sampling personnel will be trained according to field sampling standard operating procedures (SOPs). Additionally, the field staff will be made aware of the significance of the project's detection limits and the requirement to avoid contamination of samples at all times.

Field Blank

A field blank will be collected and analyzed to assess contamination from field-related conditions to ensure that positive bias of the sample has not been introduced, and to remain in compliance with the Surface Water Ambient Monitoring Program (SWAMP) protocols. One field blank will accompany each batch of samples submitted to the analytical laboratory.

Field Duplicate

A duplicate sample may be collected and analyzed to assess the variability in sampling and to remain in compliance with the SWAMP protocols. One field duplicate will accompany each batch of samples submitted to the analytical laboratory.

Temperature Blank

A temperature blank will be used to ensure that sample holding temperatures were maintained from sample collection through delivery to the laboratory.

Equipment Blank

The selected analytical laboratory Teflon-lined tubing, silicone pump tubing, silicone bottle stoppers, and stainless steel sample intake strainers. The following blank samples will be created for analysis:

- One blank sample representative of the cleaned silicone and Teflon-lined tubing. Blank water will be passed through at least 10% of cleaned tubing and be representative of both silicone and Teflon-lined tubing.
- One blank representing the bottles and stoppers. Blank water will be passed into/over at least 10% of cleaned bottles and stoppers.

The analytical laboratory will analyze the equipment blanks for total organic carbon and total metals at a minimum. The analytical laboratories will analyze blank water from the cleaned sampling equipment at the same detection level proposed for sample analysis; this will verify that the sampling equipment in contact with sample water is clean and is not a likely source of contamination.

If a blank sample produces an analyte detection above the RL, the equipment will be cleaned and blanked again. Cleaned and blanked sampling equipment will not be deployed for sampling until an acceptable blank analysis has occurred unless directed by the Copermittees.

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 C-2.

Field supplies will be stored at the sampling team's offices; laboratory supplies will be stored at the laboratory. Inspection and testing requirements for laboratory supplies are covered in the laboratory's QA/QC procedures.

Table C-2
Inspection/Acceptance Testing Requirements for Consumables and Supplies

Project-Related Supplies/ Consumables	Inspection/ Testing Specifications/ Source	Acceptance Criteria	Frequency	Responsible Party
Pre-cleaned sample bottles	Closed bottle	Lids screwed on bottles	100%	Sampling Team
Silicone tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Laboratory/Sampling Team
Teflon tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Laboratory/Sampling Team
Gloves	New box	New box	As needed	Sampling Team

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 C-3. The frequency of the laboratory QA/QC samples will a minimum of once per batch per analyte unless otherwise adjusted by Copermittees.

Table C-3
Laboratory Quality Control Samples by Constituent Class

Laboratory Quality Control	Conventionals	Indicator Bacteria	Inorganic Analytes	Nutrients	Solid Parameters	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	–	–	–	–	–	✓

Data Quality Objectives

Data quality objectives (DQOs) are quantitative and qualitative statements that define project objectives and specify the acceptable ranges of field sampling and laboratory performance. DQOs include accuracy, precision, and completeness.

Accuracy describes how close the measurement is to its true value. Accuracy is the measurement of a sample of known concentration and comparing the known value against the measured value. The accuracy of chemical measurements will be checked by performing tests on a standard prior to and/or during sample analysis. A standard is a known concentration of a certain solution. Standards can be purchased from chemical or scientific supply companies. Standards might also be prepared by a professional partner (e.g., a commercial or research laboratory). The concentrations of the standards should be within the mid-range of the equipment. Recovery measurements are determined by spiking a replicate sample in the laboratory with a known concentration of the analyte. Accuracy of the project data will be determined by comparing results from MS/MSDs, LCSs, field blanks, and equipment blanks to the accuracy objectives to be developed by Copermittees.

Precision describes how well repeated measurements agree. The evaluation of precision described here applies to repeated measurements and samples collected in the field (field duplicates) or the laboratory (laboratory replicates and MS/MSDs). Precision measurements will be determined by comparing results from field duplicates, laboratory replicates and MSD to the precision objectives specified in Appendix F. Relative Percent Differences (RPDs) will be calculated to determine the precision between duplicate samples. This calculation is presented in Equation 1. Precision objectives will be developed by the Copermittees.

$$RPD = \frac{abs\left[x_1 - x_2\right]}{0.5 * \left(x_1 + x_2\right)} \qquad \text{Equation 1}$$

where:

abs is the absolute value.

x1 is measurement 1.

x2 is measurement 2.

Completeness is the fraction of planned data that must be collected to fulfill the statistical criteria of the project. There are no statistical criteria that require a certain percentage of data. However, the anticipated target is 90%. This accounts for adverse weather conditions, safety concerns, and equipment problems. The project team determined completeness by comparing the number of measurements planned to be collected with the number of measurements actually collected that are deemed valid. An invalid measurement would be one that does not meet the sampling method requirements. Completeness will be measured as a percentage of the number of samples collected that meet the respective DQOs compared to the anticipated number of samples. This calculation is presented in Equation 2.

$$Completeness = \frac{Actual\ number\ of\ samples\ collected}{Project\ required\ total\ samples\ to\ be\ collected} * 100 \qquad \text{Equation 2}$$

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.

Corrective Action

Corrective action will be taken when an analysis is deemed suspect. Reasons a sample may be considered suspect consist of exceedances of the RPD ranges, spike recoveries, and blanks. The corrective action may vary from analysis to analysis, but typically will involve the following:

Check of procedures:

- Review of documents and calculations to identify possible errors.
- Error correction.
- Re-analysis of the sample extract, if available, to see if results can be improved.
- Reprocessing and re-analysis of additional sample material, if it is available.

Malfunctions that occur during data collection and laboratory analyses will be the responsibility of the field crew or laboratory conducting the work, respectively. In the case of field instruments, problems will be addressed through instrument cleaning, repair, or replacement of parts or the instrument, as warranted. Field crews should carry basic spare parts and consumables with them, and have access to spare parts. The laboratories have procedures in place to follow when failures occur, and have identified individuals responsible for corrective action and developed appropriate documentation as needed.

Attachment D
Volume and Load Estimate Calculations

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Calculation of Runoff Volumes and Load Estimations for Assessment and Reporting

The methods to complete the Wet Weather MS4 outfall discharge monitoring assessment, as described in the Transitional Wet Weather MS4 Outfall Monitoring Work Plan prepared by Weston Solutions, are detailed in this section (Weston, 2014)

The assessment methods were formulated with the purpose of providing a means to calculate various parameters required by Section II.D.4.b.(2)(b) of the MS4 Permit based on the MS4 wet weather monitoring data collected during the 2013-2014 and 2014-2015 wet seasons. Section II.D.4.b.(2)(b) of the MS4 Permit states:

(b) Based on the transitional wet weather MS4 outfall discharge monitoring required pursuant to Provision D.2.a.(3) the Copermittees must assess and report the following:

- (i) The Copermittees must analyze the monitoring data collected pursuant to Provision D.2.a.(3), and utilize a watershed model or other method, to calculate or estimate the following for each monitoring year:
  - [a] The average storm water runoff coefficient for each land use type within the Watershed Management Area;
  - [b] The volume of storm water and pollutant loads discharged from each of the Copermittee's monitored MS4 outfalls in its jurisdiction to receiving waters within the Watershed Management Area for each storm event with measurable rainfall greater than 0.1 inch;
  - [c] The total flow volume and pollutant loadings discharged from the Copermittee's jurisdiction within the Watershed Management Area over the course of the wet season, extrapolated from the data produced from the monitored MS4 outfalls; and
  - [d] The percent contribution of storm water volumes and pollutant loads discharged from each land use type within each hydrologic subarea with a major MS4 outfall to receiving waters or within each major MS4 outfall to receiving waters in the Copermittee's jurisdiction within the Watershed Management Area for each storm event with measurable rainfall greater than 0.1 inch.
- (ii) Identify modifications to the wet weather MS4 outfall discharge monitoring locations and frequencies necessary to identify pollutants in storm water discharges from the MS4s in the Watershed Management Area pursuant to Provision D.2.c.(1) (RWQCB, 2013).

Land Use Categorization

Geographic information system (GIS) mapping software, in combination with data from the San Diego Geographic Information Source (SanGIS), will be used to determine the quantities of the various land use types within each monitored outfall drainage area. The SanGIS land use dataset has numerous land use classifications, and the assessment included categorizing the SanGIS land use classifications into several assessment land use categories. The correlations between SanGIS land use data and the assessment land use classes are shown in Table D-1. Table D-2 shows the assessment land use classes along with the San Diego Hydrology Manual (Hydrology Manual) land use types runoff coefficient (Runoff "C") values.

SanGIS land uses will be grouped into a minimum of four assessment categories listed by the MS4 Permit (e.g., Commercial, Industrial, Residential, and Mixed Land Use). The Commercial land use category will incorporate all "commercial" and most of the "public facility," "parking lot," and "commercial recreation" SanGIS classifications. The Industrial land use category will incorporate "industrial," "airport," "communications and utilities," and "terminal" SanGIS classifications. The Residential land use category will incorporate Rural Residential (1 to 4 dwelling units per acre (DU/A)), Single-Family Residential (4.3 to 20 DU/A), and Multi-Family Residential (>20 DU/A). The Multi-Family Residential land use categorization will incorporate high density housing types, such as barracks, dormitories, monasteries, and other group quarters. The Mixed Land Use classification will incorporate the SanGIS classes 9700 (mixed use). These additional land uses will include a combination of roads, parking areas, various types of impervious surfaces (tennis courts, buildings, sidewalks/paved areas), and less than 90% open space (maintained fields and undeveloped lands).

SanGIS land uses classes that are not easily grouped into one of the four main land use categories will be identified as "other" and will undergo further assessment. Two additional land use categories, Open Space and Agriculture, will be used to address less developed regions in San Diego County. In accordance with the Hydrology Manual (County of San Diego, 2003), these land uses will undergo a separate analysis based on the soil type and associated pervious Runoff "C" value.

The Open Space land use category will include open space, vacant and undeveloped land, parks and recreation, and most of the remaining military SanGIS land uses. Given that areas classified as water, bay, lagoon, lake, reservoir, and large pond would likely turn into a sink for runoff storage, water-related land use classifications (9200, 9201, and 9202) will be excluded from this analysis.

Traditionally, Transportation land uses were considered a unique land use classification. The Hydrology Manual does not include unique Runoff "Cs" for roads, freeways, right of ways, and other Transportation land uses. These SanGIS classes will be grouped into a Transportation land use category and assigned a Runoff "C" based on the approximate percentage of impervious cover and associated Runoff "C" listed in the Hydrology Manual.

Table D-1
Assessment Land Use Categories Developed from SanGIS Land Use Classes

Assessment Land Use Category	SanGIS Land Use Classification	
Agriculture	7204	Golf Course
	8001	Orchard or Vineyard
	8002	Intensive Agriculture
	8003	Field Crops
Commercial	1401	Jail/Prison
	1501	Hotel/Motel (Low-Rise)
	1502	Hotel/Motel (High-Rise)
	1503	Resort
	4111	Rail Station/Transit Center
	4114	Parking Lot - Surface
	4115	Parking Lot - Structure
	4116	Park and Ride Lot
	5001	Wholesale Trade
	5002	Regional Shopping Center
	5003	Community Shopping Center
	5004	Neighborhood Shopping Center
	5005	Specialty Commercial
	5006	Automobile Dealership
	5007	Arterial Commercial
	5008	Service Station
	5009	Other Retail Trade and Strip Commercial
	6001	Office (High-Rise)
	6002	Office (Low-Rise)
	6003	Government Office/Civic Center
	6101	Cemetery
	6102	Religious Facility
	6103	Library
	6104	Post Office
	6105	Fire/Police Station
	6108	Mission
	6109	Other Public Services
	6501	UCSD/VA Hospital/Balboa Hospital

Table D-1. (Continued)
Assessment Land Use Categories Developed from SanGIS Land Use Classes

Assessment Land Use Category	SanGIS Land Use Classification	
Commercial (continued)	6502	Hospital - General
	6509	Other Health Care
	6807	School District Office
	7201	Tourist Attraction
	7202	Stadium/Arena
	7203	Racetrack
	7205	Golf Course Clubhouse
	7206	Convention Center
	7207	Marina
	7209	Casino
	9501	Residential Under Construction
	9502	Commercial Under Construction
	9504	Office Under Construction
	7208	Olympic Training Center
	7210	Other Recreation - High
	7607	Residential Recreation
Educational	6801	SDSU/CSU San Marcos/UCSD
	6802	Other University or College
	6803	Junior College
	6804	Senior High School
	6805	Junior High School or Middle School
	6806	Elementary School
	6809	Other School
	9505	School Under Construction

Table D-1. (Continued)
Assessment Land Use Categories Developed from SanGIS Land Use Classes

Assessment Land Use Category	SanGIS Land Use Classification	
Industrial	2001	Heavy Industry
	2101	Industrial Park
	2103	Light Industry - General
	2104	Warehousing
	2105	Public Storage
	2201	Extractive Industry
	2301	Junkyard/Dump/Landfill
	4101	Commercial Airport
	4102	Military Airport
	4103	General Aviation Airport
	4104	Airstrip
	4113	Communications and Utilities
	4120	Marine Terminal
	9503	Industrial Under Construction
Transportation	4112	Freeway
	9507	Freeway Under Construction
	4117	Railroad Right of Way
	4118	Road Right of Way
	4119	Other Transportation
	9506	Road Under Construction
Mixed Use	9700	Mixed Use
Residential: Multi-Family	1200	Multi-Family Residential
	1280	Single Room Occupancy Units (SRO's)
	1290	Multi-Family Residential Without Units
	1300	Mobile Home Park
	1402	Dormitory
	1403	Military Barracks
	1404	Monastery
	1409	Other Group Quarters Facility
Residential: Rural	1000	Spaced Rural Residential

Table D-1. (Continued)
Assessment Land Use Categories Developed from SanGIS Land Use Classes

Assessment Land Use Category	SanGIS Land Use Classification	
Residential: Single-Family	1100	Single Family Residential
	1110	Single Family Detached
	1110	Single Family Detached
	1120	Single Family Multiple-Units
	1190	Single Family Residential Without Units
Open Space	6701	Military Use
	6702	Military Training
	6703	Weapons Facility
	7211	Other Recreation - Low
	7601	Park - Active
	7603	Open Space Park or Preserve
	7604	Beach - Active
	7605	Beach - Passive
	7606	Landscape Open Space
	7609	Undevelopable Natural Area
	9101	Vacant and Undeveloped Land
Water	9200	Water
	9201	Bay or Lagoon
	9202	Lake/Reservoir/Large Pond
Source: SanGIS, 2014		

Table D-2
Assessment Land Use Hydrology Manual Runoff "C" Values

Land Use Type	Hydrology Manual Runoff "C"
Agriculture-A	0.2
Agriculture-B	0.25
Agriculture-C	0.3
Agriculture-D	0.35
Commercial	0.82
Educational	0.58
Industrial	0.87
Mixed Use	0.66
Multi-Family Residential	0.6
Open Space-A	0.2
Open Space-B	0.25
Open Space-C	0.3
Open Space-D	0.35
Rural-Residential	0.41
Single-Family Residential	0.49
Transportation	0.71

Source: County of San Diego, 2003

Stormwater Runoff Coefficient Calculations

Measured flow values will be used in combination with the hydrological features associated with the drainage areas of the monitored outfalls to calculate the average stormwater Runoff "C" for each land use type within the WMA. First, for each monitored outfall, the actual event Runoff "C" will be calculated based on outfall drainage area, rainfall, and measured flow. Next, the Hydrology Manual land use Runoff "C" values and overall outfall drainage area Hydrology Manual Runoff "C" value will be calculated based on the individual land use areas within each monitored outfall drainage area. For each monitored outfall, a correction factor will be calculated based on the comparison between the actual Runoff "C" value and the overall Hydrology Manual Runoff "C" value. The associated correction factor will be applied to the individual land use Runoff "C" values for each outfall. Finally, the WMA individual land use Runoff "C" values will be determined based on the area-weighted average of the monitored outfalls' individual land use Runoff "C" values. The steps in this process are discussed in more detail in the following paragraphs

The actual Runoff “C” for each outfall will be calculated based on the measured stormwater runoff, rainfall, and overall size of the drainage area. Flow equipment will be installed in each monitored outfall, except in rare cases where it is not feasible, in order to estimate the volume of stormwater runoff for the monitored event. Rainfall data for each event will be obtained from the County of San Diego Automatic Local Evaluation in Real Time (ALERT) System rain gauge database for the gauge nearest to the monitored outfall. The delineation of each monitored outfall drainage area will be performed by the responsible Copermittee. The actual Runoff “C” for each outfall will be calculated using the following formula:

$$Runoff\ "C"_{Outfall\,Actual} = \left(\frac{Monitored\ StormWater\ Runoff\ Volume}{Area \times Rainfall}\right)_{Outfall} (UC)$$

Volume in cubic feet (ft3)
Area in acres
Rainfall in inches (in)

$$UC = Unit\ Conversion = \left(\frac{1\ ft}{12\,in}\right)\left(\frac{43{,}560\ ft^2}{1\ acre}\right)$$

The Hydrology Manual Runoff “C” for each monitored outfall will be selected based on the guidance found in Section 3 (Rational Method) of the Hydrology Manual. The area-weighted Hydrology Manual Runoff “C” for each monitored outfall will be calculated using the following formula:

$$Runoff\ "C"_{Outfall\,HM\ Calculated} = \frac{\sum\left(Area_{Outfall\,LU} \times HM\ Runoff\ "C"_{LU}\right)}{\sum Area_{Outfall\,LU}}$$

Where: LU = land use type
HM = Hydrology Manual

A Runoff “C” correction factor will be calculated for each monitored outfall using the following formula:

$$CF_{Outfall\,Runoff"C"} = \frac{Runoff\ "C"_{Outfall\,Actual}}{Runoff\ "C"_{Outfall\,HM\ Calculated}}$$

Where: CF = correction factor

For each monitored outfall, the calculated correction factor will be applied to the Hydrology Manual land use Runoff “C” values within the applicable drainage area as follows:

$$Runoff\ "C"_{Outfall\,LU} = CF_{Outfall\,Runoff"C"} \times Runoff\ "C"_{HM\ LU}$$

The land use type Runoff "C" calculation results for the monitored outfalls within the WMA will be compiled as follows to determine the WMA Runoff "C" value for each land use type:

$$Runoff\ "C"_{WMALU} = \frac{\sum(Runoff\ "C" \times Area)_{OutfallLU}}{\sum Area_{OutfallLU}}$$

Monitored Outfalls Annual Runoff Volumes and Pollutant Loads Calculations

The annual stormwater runoff volumes and pollutant loads discharged from monitored MS4 outfalls for storm events greater than 0.1 inch of measurable rainfall will be calculated using the actual Runoff "C" values, drainage area sizes, ALERT rain gauge data, and chemistry results obtained from the collection of stormwater samples during the 2013-2014 and 2014-2015 wet seasons. The actual Runoff "C" value and drainage area size for each monitored outfall will be determined as described in Section 5.2. Annual rainfall will be obtained from the ALERT rain gauge database for the gauge nearest to each monitored outfall. The rain gauge data will be analyzed, and rainfall values will be identified and excluded from the annual stormwater volume calculations when precipitation totals do not exceed 0.1 inch over a 24-hour period. The annual volume discharge from each monitored outfall will be calculated as follows:

$$StormWaterVolume_{Outfall} = \left(Runoff\ "C"_{OutfallActual} \times Area_{Outfall}\right)\left(\sum Rainfall_{Event}\right)(UC)$$

Where:

$$UC = Unit\ Conversion = \left(\frac{1\ ft}{12\ in}\right)\left(\frac{43{,}560\ ft^2}{1\ acre}\right)$$

The pollutant loads discharged from each monitored MS4 outfall will be calculated based on the calculated annual volume and the chemistry results specific to each outfall as follows:

$$Pollutant\ Load_{Outfall} = \left(Storm\ Water Volume \times Pollutant\ Concentration\right)_{Outfall}(UC))$$

Where:

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{1000\ mg}\right)\left(\frac{1\ lbs}{453.592\ _g}\right),\ for\ \frac{mg}{L}\ concentration\ units;$$

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{10^6\ \mu g}\right)\left(\frac{1\ lbs}{453.592\ _g}\right),\ for\ \frac{\mu g}{L}\ concentration\ units; or$$

Watershed Management Area Jurisdictional Annual Runoff Volumes and Pollutant Loads Calculations

The total flow volume and pollutant loads discharged from each Copermittee's jurisdiction within the WMA over the course of the wet season will be calculated based on the data produced from monitoring MS4 outfalls during the 2013-2014 and 2014-2015 wet seasons. The WMA Runoff "C" values, calculated as described in Section 5.2, will be used in combination with land use data and ALERT rain gauge data to calculate the total flow volume for each jurisdiction. The annual volumes will be applied to pollutant event mean concentrations (EMCs) in order to estimate the annual pollutant loads conveyed by the MS4 in each Copermittee's jurisdiction. The EMC for each applicable pollutant will be determined by compiling the results from the outfalls monitored in the WMA. More details on the flow volume and pollutant load calculations are provided in the paragraphs that follow.

The total flow volume conveyed by each Copermittee's MS4 will be calculated using the land use data, WMA land use type Runoff "C" values (see Section 5.2), and ALERT rain gauge data. GIS mapping software will be used to determine the quantities of the various land use types for each Copermittee by comparing the WMA boundary with the Copermittees' boundaries. The areas associated with hydrologic subareas (HSAs) without a major outfall will be included in the total area to calculate the assessment required by Section II.D.4.b.(2)(b)(i)[c]; however, an HSA without a major outfall will not be included in the assessment required by Section II.D.4.b.(2)(b)(i)[d].

Properties owned by state or federal agencies and indian reservations will also be excluded from the total jurisdictional WMA area. An ALERT rain gauge located within the WMA will be selected for the volume calculations. In the event that data from more than one ALERT gauge are available for the WMA, the ALERT gauge that has the most representative data related to the monitored outfalls will be selected (i.e., the station closest to the majority of monitored outfalls was selected to perform outfall-specific calculations for more of the outfalls and was also selected for WMA calculations). The ALERT data will be analyzed, and rainfall values will be identified and excluded from the calculations when precipitation totals do not exceed 0.1 inch of rainfall over a 24-hour period. The following formulas will be used to calculate the annual flow volume from each land use type and total flow volume within each Copermittee's jurisdiction in the WMA during the wet season:

$$Storm\ Water\ Volume_{WMAJurisdLU} = \left(Runoff\ "C"_{WMALU}\right)\left(Area_{WMALU}\right)\left(\sum Rainfall_{Event}\right)(UC)$$

Where:

$$UC = \left(\frac{1\ ft}{12\ in}\right)\left(\frac{43{,}560\ ft^2}{1\ acre}\right)$$

$$StormWaterVolume_{WMAJurisd,} = \sum StormWaterVolume_{WMAJurisdLU}$$

The chemistry results obtained from analyzing samples collected at the monitored outfalls during the 2013-2014 and 2014-2015 wet seasons will be evaluated in order to estimate the WMA EMC values for the measured constituents for each general land use type assessed. This evaluation includes estimating each monitored outfall drainage area's EMC values for the measured constituents for each general land use type assessed. The monitored outfalls will be selected, where practical, to have a single primary land use type in order to facilitate the correlation between land use type and pollutant loading; however, due to the general mixed composition of urban development, the drainage areas of the monitored outfalls may typically consist of a combination of land use types (e.g., primarily single-family residential with some commercial, open space, transportation.).

The correlation of measured pollutant concentrations to EMC values for various land use types, therefore, will incorporate the use of published, typical EMC values so that the measured chemistry results will be proportioned to the different land use types within each drainage area. The methods to proportion the measured chemistry results will be similar to the methods to determine the land use type Runoff "C" values (Section 5.2). The measured chemistry results will be the actual EMC values for each monitored outfall drainage area. Typical EMC values will be selected from the literature for each land use type for the measured constituents. Typical overall or comingled EMC values will be calculated for each monitored outfall based on the weighted average of the outfall land use type Runoff "C" values and drainage area land use type areas. The actual EMC values (comingled chemistry results) of the monitored outfall will then be compared to the calculated, typical outfall EMC values in order to determine correction factors for each constituent. For each constituent, the correction factor will then be applied to the typical land use type EMC values for the associated monitored outfall drainage area. The WMA EMC values for the various land use types will be calculated based on corrected land use type EMCs of the monitored outfalls within the WMA, which are weighted by the product of the land use type Runoff "C" values and land use type areas. The following formulas will be used to complete these calculations:

$$EMC_{OutfallActual} = Sampling\ \ Chemisty\ Result_{Outfall}$$

The overall or comingled outfall typical EMC for each measured constituent will be calculated using the following formula:

$$EMC_{OutfallCalculated} = \frac{\sum\left(Area_{OutfallLU} \times Runoff\ "\ C"_{OutfallLU} \times Typical\ EMC_{LU}\right)}{\sum\left(Area_{OutfallLU} \times Runoff\ "\ C"_{OutfallLU}\right)}$$

An EMC correction factor will be calculated for each constituent for each monitored outfall using the following formula:

$$CF_{OutfallEMC} = \frac{EMC_{OutfallActual}}{EMC_{OutfallCalculated}}$$

For each monitored outfall for each constituent, the calculated EMC correction will be applied to the land use type typical EMC value as follows:

$$EMC_{OutfallLU} = CF_{OutfallEMC} \times Typical\ EMC_{LU}$$

The calculation results for the monitored outfalls within the WMA will be compiled to determine the EMC value for each constituent of each land use type assessed within the WMA.

$$EMC_{WMALU} = \frac{\sum(Runoff\ "C" \times Area \times EMC)_{OutfallLU}}{\sum(Area \times Runoff\ "C")_{OutfallLU}}$$

The total WMA pollutant load for each constituent within each jurisdiction will be calculated utilizing the follow the formula:

$$Pollutant\ Load_{WMA\,Jurisd,} = \sum\left(Storm\,Water\,Volume_{WMA\,Jurisd\,LU} \times EMC_{WMALU} \times UC\right)$$

Where:

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{1000\ mg}\right)\left(\frac{1\ lbs}{453.592\ _g}\right),\ for\ \frac{mg}{L}\ concentration\ units;$$

$$UC = \left(\frac{28.317\ L}{1\ ft^3}\right)\left(\frac{1\ g}{10^6\ \mu g}\right)\left(\frac{1\ lbs}{453.592\ _g}\right),\ for\ \frac{\mu g}{L}\ concentration\ units; or$$

$$UC = \left(10\,\frac{100\ mL}{L}\right)\left(\frac{28.317\ L}{1\ ft^3}\right),\ for\ \frac{MPN}{100\ mL}\ EMC\ units;$$

ATTACHMENT A3. FOCUSED PRIORITY MONITORING PROGRAM – MONITORING PLAN

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ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviation	Definition
BMI	benthic macroinvertebrate
CRAM	California Rapid Assessment Method
HA	Hydrologic Area
IBI	Index of Biological Integrity
ID	identification
MS4	municipal separate storm sewer system
Municipal Permit	San Diego Regional Water Quality Control Board Order Number R9-2013-0001, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region
NPDES	National Pollutant Discharge Elimination System
RP	Responsible Party
SOP	standard operating procedure
SWAMP	Surface Water Ambient Monitoring Program
TMDL	total maximum daily load
WMA	Watershed Management Area

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A.3 FOCUSED PRIORITY MONITORING

Focused priority monitoring will be implemented as part of the Water Quality Improvement Plan pursuant to San Diego Regional Water Quality Control Board (Regional Board) Order No. R9-2013-0001, *National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges From the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region*, hereafter referred to as the Municipal Permit. The goal of the San Diego Bay WMA Focused Priority Monitoring Program is to characterize current conditions and assess progress in the receiving waters, and effectiveness of water quality improvement strategies, if applicable to the Focused Priority Conditions implemented as part of the San Diego Bay WMA Water Quality Improvement Plan.

Focused Priority Monitoring includes the following monitoring to satisfy the requirements of Provision B.4 of the Municipal Permit:

- Riparian Area Monitoring – Paradise Creek
  - City of National City
- Physical Aesthetics Monitoring (Trash) – Sweetwater Hydrologic Area (HA) 909.1 and Otay HA 910.2
  - City of Chula Vista, City of Imperial Beach, and the Port of San Diego
- Swimmable Waters Monitoring – Otay HA 910.1
  - City of Coronado, City of Imperial Beach, and Port of San Diego

Other Highest and Focused Priority Conditions have existing monitoring plans and are discussed in MAP Attachment A.5.

A.3.1 Riparian Area Monitoring – Paradise Creek

The goal of riparian area monitoring at Paradise Creek is to assess changes in habitat in the restored portion of Paradise Creek. Specific monitoring details are provided below.

A.3.1.1 Assessment Locations

Sampling will be conducted in the City of National City along the reach of Paradise Creek within Kimball Park. Figure A3-1 presents the location of the assessment area.

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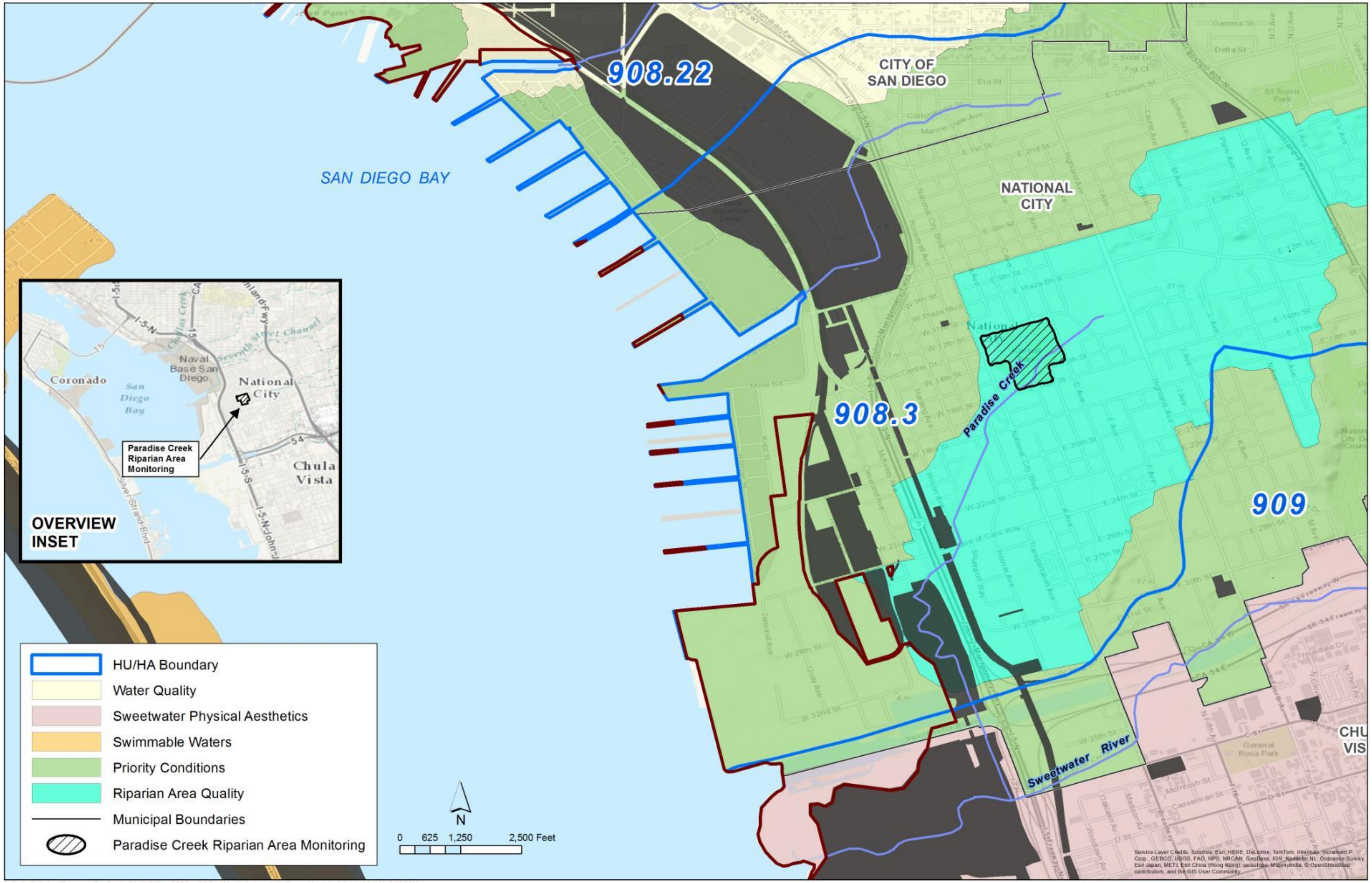

Figure A3-1
Location of Riparian Area Monitoring

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A.3.1.2 Number of Sampling Events

Percent survival of plantings, percent minimum native cover, percent non-native weed cover, and percent bare ground will all be monitored in this reach of Paradise Creek for three years after completion of the project, as specified in resource agency permits. Monitoring will be completed quarterly during the first year following completion of the restoration project and then twice per year during the second and third years following restoration completion. At least one CRAM assessment will be completed before the project and after creek restoration. The post-restoration monitoring may fall outside the Municipal Permit term, depending on when the restoration project is completed and vegetation has been sufficiently established to complete an assessment.

A.3.1.3 Assessment Method

Biological monitoring for percent survival of plantings, percent minimum native cover, percent non-native weed cover, and percent bare ground by a qualified biologist. The Wetland and Riparian Habitat Restoration, Maintenance, and Monitoring Plan (Attachment G) provides more detail on the approach. Habitat assessment will be conducted according to the California Rapid assessment Method (CRAM) for estuarine wetlands.[1]

A.3.2 Physical Aesthetics Monitoring – Sweetwater HA 909.1 and Otay HA 910.2

The goal of physical aesthetics monitoring in Sweetwater 909.1 HA and Otay 910.2 HA is to assess and identify receiving waters impacted by trash from the MS4. Specific monitoring details are provided below.

A.3.2.1 Monitoring Approach

Table A3-1 presents a summary of monitoring to be conducted for Physical Aesthetics in the Sweetwater and Otay HAs.

Table A3-1
Physical Aesthetics (Trash) Monitoring – Sweetwater and Otay Rivers

	Wet Weather Monitoring	Dry Season, Dry Weather Monitoring	Wet Weather Season, Dry Weather Monitoring
Monitoring Approach	• Inspect predetermined transect of 2-25 feet (standard area) from major outfall MS4 sites. • Assess major outfall MS4 site when assessing receiving water	• Inspect predetermined transect of 2-25 feet (standard area) away from major outfall MS4 sites • Assess major outfall MS4 site when assessing receiving water	• Perform MS4 inspections at 12 locations • Inspect predetermined transect of 2-25 feet (standard area) away from major outfall MS4 sites • Assess major outfall MS4

[1] Collins, J.N., E.D. Stein, M. Sutula, R. Clark, A.E. Fetscher, L. Grenier, C. Grosso and A. Wiskind. 2007. *California Rapid Assessment Method (CRAM) for Wetlands and Riparian Areas.* Version 5.0. Available from http://www.cramwetlands.org.

			site when assessing receiving water
Frequency (Number of Monitoring Events)	• Annually inspect after one wet weather event during wet season at 12 locations	• Annual inspection at 12 locations	• Annual inspection at 12 locations
Timing of monitoring	• Sample within 72 hours of a storm	• During dry weather season (May 1 – September 30)	• During dry periods, 72 hours or more after storm event

A.3.2.2 Paired Receiving Water and Outfall Monitoring

There are 12 receiving water sites that will be monitored concurrently with MS4 major outfall monitoring locations in the Focused Priority Condition area. The 12 paired receiving water sites and MS4 major outfall monitoring locations are presented in Table A3-2 and Figure A3-2.

Table A3-2
Paired Receiving Water and MS4 Outfall Stations in Focused Priority Area

Jurisdiction	Site	Location	Hydrologic Subarea	Latitude	Longitude
City of Chula Vista	C-1	West side of Bay Blvd., south of J St., south side of channel, under road, access from gate east side of Bay Blvd.	909.12	32.62116	-117.09449
	ORW-1	South of Rancho Dr., SW corner of Shadow Pines condos, in canyon	910.20	32.59125	-117.03790
	SR-4	South bank of Sweetwater River, between Broadway and Highland	909.12	32.65311	-117.09430
	SV-1	North of I-805, south side of river, south of Plaza Bonita Mall	909.12	32.65076	-117.06646
	SW-4	South of Main St., east side of trolley tracks, across from Otay Valley Regional Park, access from bridge at Hanson Aggregates	910.20	32.59043	-117.08368
	TC-39	West of property at SW corner of L St. and Industrial Blvd., inlet at end of brow ditch between property and I-5	909.11	32.61487	-117.09086
Port of San Diego	2168.1	Outfall off of Pepper Park along Sweetwater Channel	909.12	32.649309005	-117.111502361
	TelegraphCnyn Mouth	Mouth of Telegraph Canyon	909.11	32.617238	-117.096168
	CV1-1.1	North end of Bayside Park in Chula Vista	909.12	32.6295319965	-117.108343322
	2172.1	North end of Chula Vista Marina Basin	909.12	32.6256107322	-117.101921013
	2162.1	South end of Chula Vista Bayfront	909.11	32.6205856513	-117.097457173
City of Imperial Beach	K-Outfall	Southeast side of the south bay	910.20	32.588304	-117.107516

A.3.2.3 Assessment Methods

Trash assessments will be conducted according to methods presented in the MS4 Outfall – Dry Weather Monitoring Program. In addition, the monitoring approach and the methodology will be similar to the following elements of the San Diego Bay Debris Study Work Plan Plan[2]:

- Characterize habitat conditions (e.g., concrete, riprap, homeless encampment nearby, etc.)
- Record habitat aesthetic rating (optimal to poor)
- Evidence of littering and illegal dumping (yes or no type of answer)
- Assess types of trash present (general categories)

A.3.2.4 MS4 Outfall Monitoring Program Requirements

Sweetwater River (909.1 HA) monitoring locations under this program are within the jurisdiction of the City of Chula Vista and the Port of San Diego. Otay River (910.2 HA) monitoring locations under this program are within the jurisdiction of the City of Chula Vista, the Port of San Diego, and the City of Imperial Beach. There are nine monitoring locations in Sweetwater River (909.1 HA) and three monitoring locations in Otay River (910.2 HA). The 12 paired receiving water sites and MS4 major outfall monitoring locations are presented in Figure A3-2. In addition to the focused monitoring approach identified for the 12 paired locations, the RPs will also continue to assess trash as part of the MS4 Outfall Monitoring Program requirements at other major outfall locations in the Focused Priority Condition area, as presented in Table A3-3 and Figure A3-2.

[2]San Diego Bay Debris Study Workgroup. 2014. *San Diego Bay Debris Special Study Work Plan.*

Table A3-3
MS4 Outfall Dry Weather Field Screening Stations Inventory in Focused Priority Area

Jurisdiction[1]	Site	Hydrologic Subarea	Latitude	Longitude
City of Chula Vista	C-2	909.12	32.62139	-117.09394
	C-3	909.12	32.62325	-117.09426
	C-6	909.12	32.62918	-117.09507
	C-7	909.12	32.63428	-117.09706
	C-9	909.12	32.63331	-117.09102
	C-11	909.12	32.63869	-117.07956
	C-12	909.12	32.63869	-117.07956
	C-13	909.12	32.63869	-117.07956
	C-14	909.12	32.63906	-117.07722
	C-15	909.12	32.63843	-117.07739
	C-16	909.12	32.63843	-117.07739
	C-17	909.12	32.63843	-117.07739
	C-18	909.12	32.63599	-117.07208
	C-19	909.12	32.63599	-117.07208
	C-20	909.12	32.63599	-117.07208
	C-22	909.12	32.63633	-117.06676
	C-23	909.12	32.62953	-117.09403
	C-24	909.12	32.62646	-117.09178
	C-25	909.12	32.634	-117.0906
	C-26	909.12	32.63792	-117.06728
	J-1	910.20	32.59239	-117.05917
	J-2	910.20	32.59487	-117.06681
	J-3	910.20	32.60097	-117.0659
	J-7	910.20	32.60622	-117.06266
	J-10	910.20	32.61112	-117.05745

1. For Responsible Agencies with fewer than 500 but more than 125 major MS4 outfalls in the WMA (Chula Vista), 100% of major outfalls must be screened once per year. For Copermittees with fewer than 125 major outfalls in the WMA (Port of San Diego and Imperial Beach), 80% of total major outfalls presented in the table must be screened twice per year.

Table A3-3 (continued)
MS4 Outfall Dry Weather Field Screening Stations Inventory in Focused Priority Area

Jurisdiction[1]	Site	Hydrologic Subarea	Latitude	Longitude
City of Chula Vista (continued)	J-11	910.20	32.61077	-117.0571
	J-12	910.20	32.61277	-117.0554
	J-13	910.20	32.61275	-117.05539
	J-19	910.20	32.60159	-117.06313
	J-20	910.20	32.60995	-117.06001
	J-21	910.20	32.61802	-117.05405
	ORC-1	910.20	32.60580	-116.97481
	PC-1	910.20	32.59154	-117.04199
	PC-2	910.20	32.59611	-117.04087
	PC-32	910.20	32.6018	-117.03669
	PC-35	910.20	32.60028	-117.03806
	PR-6	910.20	32.61177	-117.03979
	SR-1	909.12	32.64136	-117.0998
	SR-2	909.12	32.63984	-117.09928
	SR-3	909.12	32.64884	-117.09623
	SR-6	909.12	32.65036	-117.08819
	SR-7	909.12	32.64995	-117.08656
	SR-9	909.12	32.65315	-117.07837
	SR-10	909.12	32.65122	-117.09283
	SV-2	909.12	32.64914	-117.06477
	SW-1	910.20	32.60811	-117.09231
	SW-2	910.20	32.5947	-117.0891
	SW-3	910.20	32.60094	-117.08464
	SW-5	910.20	32.59119	-117.081
	SW-6	910.20	32.59124	-117.07315
	TC-2	910.20	32.60702	-117.0758

1. For Responsible Agencies with fewer than 500 but more than 125 major MS4 outfalls in the WMA (Chula Vista), 100% of major outfalls must be screened once per year. For Copermittees with fewer than 125 major outfalls in the WMA (Port of San Diego and Imperial Beach), 80% of total major outfalls presented in the table must be screened twice per year.

Table A3-3 (continued)
MS4 Outfall Dry Weather Field Screening Stations Inventory in Focused Priority Area

Jurisdiction[1]	Site	Hydrologic Subarea	Latitude	Longitude
City of Chula Vista (continued)	TC-3	909.11	32.62923	-117.04544
	TC-37	909.11	32.6287	-117.04292
	TC-38	909.11	32.61283	-117.0884
Port of San Diego	2185.1	909.12	32.62192051	-117.1004408
	2941.1	909.12	32.62753771	-117.1073369
	2175.1	909.12	32.62392325	-117.1012412
	NCMT030.1	909.12	32.65074241	-117.1203395
	NCMT1008.1	909.12	32.64823422	-117.1176928
	NCMT031.1	909.12	32.64968508	-117.120188
	NCMT032.1	909.12	32.64871894	-117.1199524
	NCMT033.1	909.12	32.64790477	-117.1197531
	NCMT034.1	909.12	32.64801773	-117.1182581
	NCMT035.1	909.12	32.64819461	-117.1178862
	NCMT026.1	909.12	32.65258795	-117.1208761
	NCMT028.1	909.12	32.65166124	-117.1206465
	NCMT1003.1	909.12	32.65224671	-117.120821
	NCMT004.1	909.12	32.65708543	-117.120383
	NC5-1.1	909.12	32.65758987	-117.118102
	CV1-2	909.12	32.63139829	-117.1043923
City of Imperial Beach	H-Outfall	910.20	32.589468	-117.113711

1. For Responsible Agencies with fewer than 500 but more than 125 major MS4 outfalls in the WMA (Chula Vista), 100% of major outfalls must be screened once per year. For Copermittees with fewer than 125 major outfalls in the WMA (Port of San Diego and Imperial Beach), 80% of total major outfalls presented in the table must be screened twice per year.

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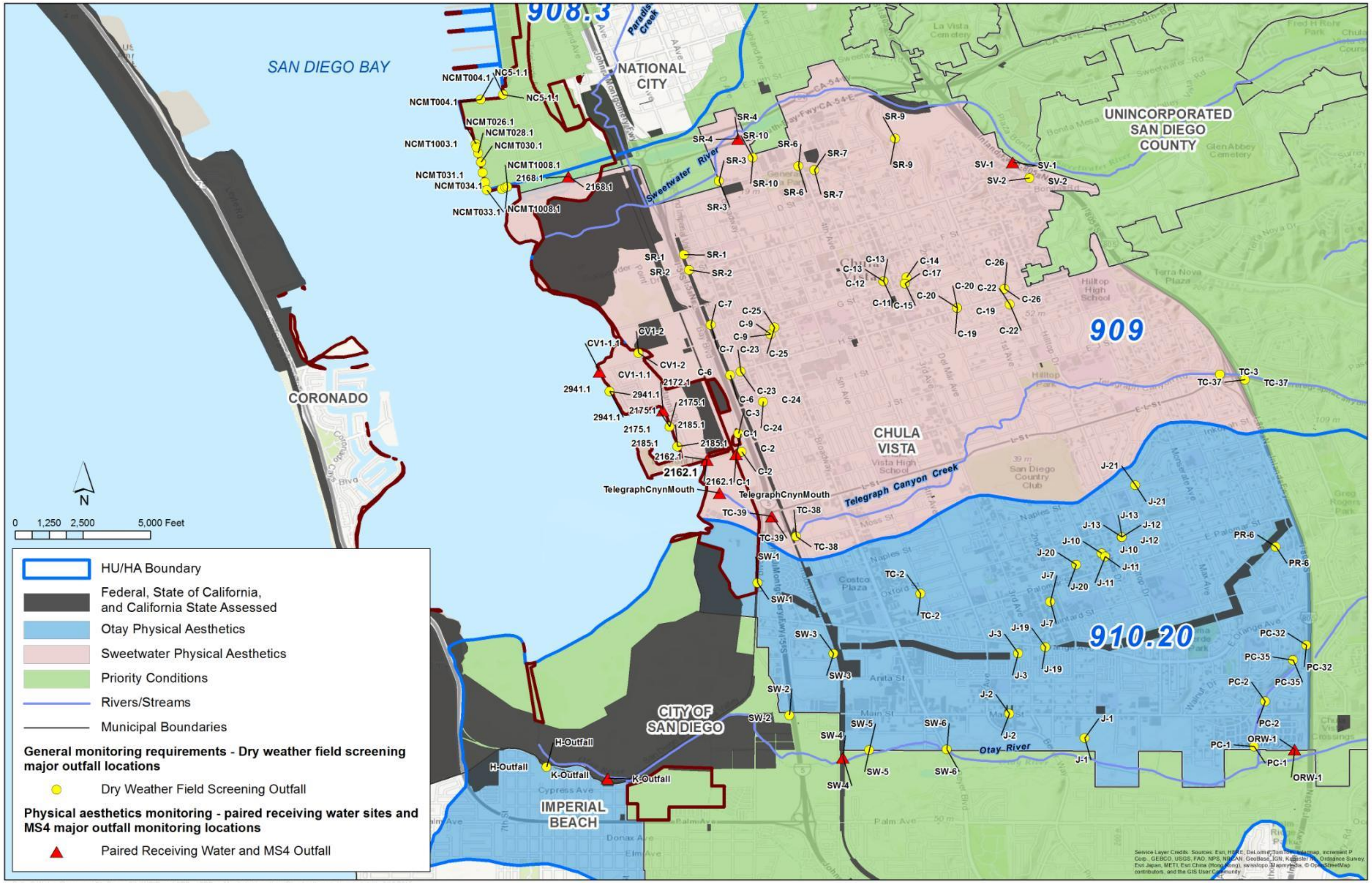

Figure A3-2
Location of Physical Aesthetics Monitoring

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A.3.3 Otay HA 910.1 – Swimmable Waters Monitoring

The goal of swimmable waters monitoring in the Coronado HA (910.1) is to assess the status of beaches in this HA by assessing for Indicator Bacteria and determine whether MS4 discharges may potentially be a source. Specific monitoring details are provided below.

A.3.3.1 Monitoring Approach

Samples will be collected and analyzed for Indicator Bacteria according to Department of Environmental Health (DEH) protocols for receiving waters.[3] MS4 Outfalls will be sampled according to Section A.2 of this Attachment. Table A3-4 presents a summary of sample collection.

[3] http://www.cdph.ca.gov/healthinfo/environhealth/water/Documents/Beaches/RecommendedMethodsforAB411.pdf; http://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/Beach&Bay/bb_beach_water_quality_info.pdf

Table A3-4
Swimmable Waters Monitoring

	Receiving Water Wet Weather Monitoring	Receiving Water Dry Season, Dry Weather Monitoring	Receiving Water Wet weather season, Dry weather monitoring	MS4 Monitoring
Monitoring Approach	Monitor at Tidelands Park and North Beach	• Tidelands Park* : Current San Diego County Department of Environmental Health (DEH) sites. (No additional monitoring to be done by RPs at these sites during this period) • North Beach*: Past DEH site and City of Coronado's current transitional wet and dry monitoring location and dry weather MS4 major outfall monitoring location	• Expand DEH's dry weather monitoring to occur during the wet weather season. • Monitoring at Tidelands Park and North Beach sites[1] •	• Perform MS4 monitoring at all beach sites at same time as monitoring receiving water quality • Sample three wet weather events during wet season at Tidelands Park in conjunction with receiving water, if feasible
Frequency (Number of Monitoring Events)	Annually sample three wet weather events during wet season at Tidelands Park and North Beach	• Tidelands Park: Weekly • North Beach: Past DEH site and City of Coronado's current transitional wet and dry monitoring location and dry weather MS4 major outfall monitoring location	• Monthly at Tidelands Park and North Beach sites* (October 1 – April 31)	Inspect MS4 monthly, year round
Timing of monitoring	Sample within 72 hours of a storm (consistent with Bacteria I TMDL[4])	During dry weather season (May 1 – September 30)	During dry periods, 72 hours or more after storm event	Take sample at MS4 if there is flow/discharge

Notes:
* South Bay Ocean Outfall Sites: Weekly surf zone bacteria monitoring at three locations along the Coronado HSA 910.1. These locations include S12 Carnation Ave (Camp Surf), S8 Silver Strand State Beach, and S9 Avenida del Sol (Hotel del Coronado).

The Pacific shoreline of the Coronado HA 910.1 already has an established monitoring plan to assess the receiving water conditions through the South Bay Ocean Outfall Waste Discharge Requirements in Order R9-2014-0071 for the City of San Diego and Order R9-2014-0009 for the International Boundary and Water Commission. These permits establish a joint receiving water monitoring program for the South Bay Ocean Outfall and include weekly surf zone bacteria monitoring at 3 locations along the Coronado HA 910.1. These locations include S12 Carnation Ave (Camp Surf), S8 Silver Strand State Beach, and S9 Avenida del Sol (Hotel del Coronado). In addition, the

[4]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, 2010. http://www.waterboards.ca.gov/sandiego/water_issues/programs/ tmdls/docs/bacteria/updates_022410/2010-0210_BactiI_Resolution&BPA_FINAL.pdf.

County of San Diego Department of Environmental Health performs AB411 beach water quality monitoring throughout the year for public health along the Pacific shoreline of the Coronado HA 910.1. The existing beach water quality monitoring is sufficient to assess swimmable waters along the Pacific shoreline of the Coronado HA 910.1 and the San Diego Bay WMA Copermittees are to utilize these data for the Water Quality Improvement Plan Monitoring and Assessment Annual Report.

A.3.3.2 Sampling Locations

Swimmable waters monitoring has three receiving water monitoring locations that are associated with MS4 outfall locations: one at Tidelands Park in the San Diego Bay, and one location in the Pacific Ocean at North Beach in Coronado. Table A3-5 presents the MS4 Outfalls monitoring locations. Figure A3-3 presents the general areas to be monitored as part of the swimmable waters monitoring.

Table A3-5
Swimmable Waters MS4 Outfall Monitoring Locations

Monitoring Area	Site ID	HSA	Latitude	Longitude	Description
North Beach	North Beach Outfall	910.1	32.68665	-117.1934	Major Outfall
	North Beach Ocean	**910.1**	**32.6864**	**-117.1937**	**Receiving Water Beach Site (outfall location varies with the tide)**
Tidelands Park	1203.1	910.1	32.690395	-117.164465	Tidelands Park outfall -closest to beach
	1206.1	910.1	32.690791	-117.164368	Tidelands Park outfall -second outfall from beach
	1219.1	910.1	32.691713	-117.164085	Tidelands Park outfall -third outfall from beach
	EH-070*	**910.1**	**32.68993**	**-117.16419**	**Receiving Water Beach Site (Tideland's Park Beach)**

Notes:
Stations in **boldface** indicate receiving water beach sites where receiving water monitoring and MS4 outfall inspections will be conducted simultaneously.
*Monitoring location is also a DEH AB 411 monitoring site.

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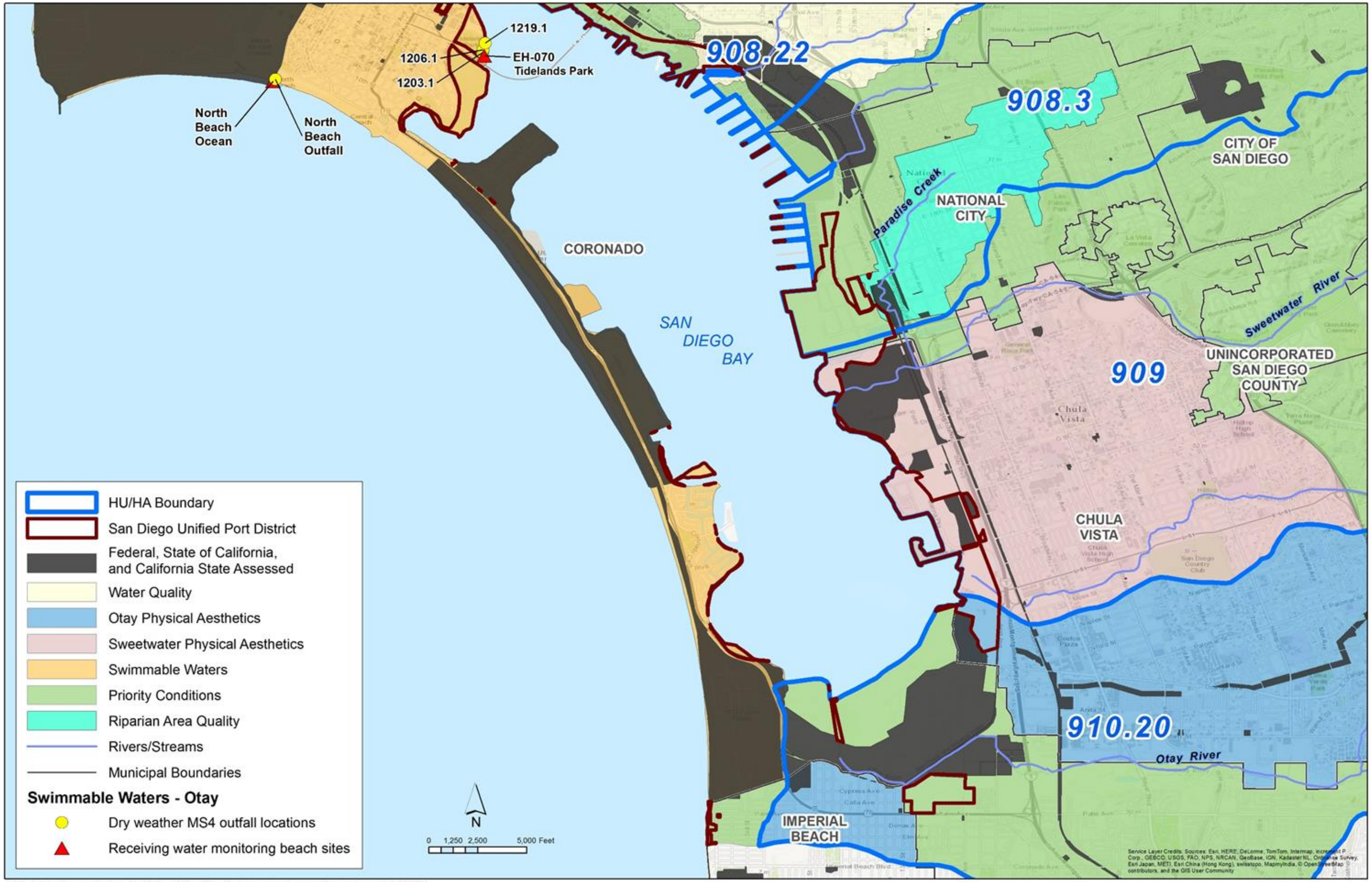

Figure A3-3
Locations for Swimmable Waters Monitoring

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A.3.4 References

California Department of Public Health. 2000. Recommended Methods for the Analysis of Recreational Marine Water to Comply with AB 411. Accessed January 6, 2015. http://www.cdph.ca.gov/healthinfo/environhealth/water/Documents/Beaches/RecommendedMethodsforAB411.pdf

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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, 2010. http://www.waterboards.ca.gov/sandiego/water_issues/programs/tmdls/docs/bacteria/updates_022410/2010-0210_Bactil_Resolution&BPA_FINAL.pdf.

San Diego Bay Debris Study Workgroup. 2014. *San Diego Bay Debris Special Study Work Plan.*

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ATTACHMENT A4. MONITORING PLANS FOR EXISTING PROGRAMS

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A.4 EXISITING MONITORING PLAN REFERENCES

The following MAP components will be conducted under existing monitoring plans, as listed:

- Airport Authority Metals Monitoring
  - Reference: Wet Weather Monitoring Programs
- Bacteria TMDL Monitoring (Chollas Creek)
  - Reference: Chollas Creek TMDL Monitoring Plan (Appendix K, Attachment C)
- Bight' 13
  - Reference: Southern California Bight Regional Monitoring Plan

    http://www.sccwrp.org/Documents/BightDocuments/Bight13Documents/Bight13PlanningDocuments.aspx
- Chollas Creek Metals and Bacteria TMDLs
  - Reference: Chollas Watershed Comprehensive Load Reduction Plan

    http://www.sandiego.gov/stormwater/plansreports/
  - Reference: Chollas Watershed Comprehensive Load Reduction Plan – Phase II

    http://www.sandiego.gov/stormwater/plansreports/
- Chollas – Jurisdictional Boundary Study for Metals
  - Reference: Chollas Watershed Comprehensive Load Reduction Plan

    http://www.sandiego.gov/stormwater/plansreports/
  - Reference: Chollas Watershed Comprehensive Load Reduction Plan – Phase II

    http://www.sandiego.gov/stormwater/plansreports/
- Hydromodification Regional Monitoring Program
  - Reference: Hydromodification Management Plan

    http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=182&Itemid=188

- Riparian Area
  - Reference: City of National City Paradise Creek Selenium Monitoring Plan (Attached as Appendix A.4-A)
  - Reference: City of National City Paradise Creek Selenium Monitoring QAPP (Attached as Appendix A.4-B)
  - California Rapid Assessment Method Monitoring Plan (in progress).
- San Diego County Beach Water Quality (AB411) Monitoring
  - Reference: Beach Water Quality (AB411) Monitoring Guidance

    http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=141&Itemid=142
- San Diego Regional Reference Streams and Beaches Studies
  - Reference: San Diego Reference Stream Survey Workplan

    http://www.sccwrp.org/Documents/ResearchPlan.aspx
- Sediment Quality Monitoring
  - Reference: Draft Sediment Monitoring Plan (Appendix K, Attachment B)
- Shelter Island Copper TMDL
  - Reference: Shelter Island Yacht Basin TMDL Monitoring Plan (Appendix K, Attachment D)
- Shelter Island Shoreline Park Bacteria TMDL
  - Reference: Shoreline Park Bacteriological Monitoring Plan (Appendix K, Attachment E)
- SMC Regional Monitoring
  - Reference: Storm Water Monitoring Coalition Regional Monitoring Plan

    http://www.waterboards.ca.gov/sandiego/water_issues/programs/swamp/regional.shtml
- Trash – Pueblo San Diego Hydrologic Unit: Creek Refuse Assessment Program Special Study
  - Reference: Pueblo San Diego Hydrologic Unit: Creek Refuse Assessment Program Special Study Standard Operating Procedure (Attached as Appendix A.4-C)
- Trash – San Diego Debris Special Study
  - Reference: San Diego Debris Special Study Work Plan (Appendix K, Attachment F)

APPENDIX A.4-A. CITY OF NATIONAL CITY PARADISE CREEK SELENIUM MONITORING PLAN

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APPENDIX A.4-B. CITY OF NATIONAL CITY PARADISE CREEK SELENIUM QUALITY ASSURANCE PROJECT PLAN

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APPENDIX A.4-C: PUEBLO SAN DIEGO HYDROLOGIC UNIT: CREEK REFUSE ASSESSMENT PROGRAM SPECIAL STUDY STANDARD OPERATING PROCEDURE

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ATTACHMENT A5. ANALYTE LIST

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Analyte	Volume Required	Analytical Method	Target Reporting Limit[1]	Units	Max Holding Time
Conventional Parameters					
Dissolved Oxygen	In field	Meter	0.01	mg/L	NA
Dissolved Organic Carbon	250 mL	SM 5310 C	0.6	mg/L	28D
Color	500 mL	SM 2120B	3	Color Units	48H
pH	In field	Meter	0.01	pH	NA
Specific Conductivity	In field	Meter	2.5	µS/cm	NA
MBAS	100 mL	SM5540C	0.05	mg/L	7D
Sulfates	250 mL	USEPA 300.0	1.0	mg/L	28D
TDS	500 mL	SM 2540C	10	mg/L	7D
Temperature	In field	Meter	0.1	◦C	NA
Total Hardness	Calculation from Calcium and Manganese	SM 2340B	1	mg/L	6M
Total Organic Carbon	250 mL	SM 5310 C	0.6	mg/L	28D
Trash	In field	Visual Observation	NA	Count	NA
TSS	1000 mL	SM 2540D	0.5	mg/L	7D
Turbidity	In field or lab: 250 mL	Meter	0.5	NTU	NA or 48H

This table describes detailed monitoring and analytical methods that are illustrative and may be revised based on site-specific environmental conditions and equivalent alternate analytical methods.

NA = Not applicable; mL = milliliter; L = liter; D = day; H = hour; M = month

Sediment Toxicity and Benthic Community Effects are listed as a cause for impairment of receiving waters in the San Diego Bay WMA on the 303(d) list, however are not applicable to MS4 Outfalls.

1. SWAMP Target Reporting Limits are recommended and not required. At a minimum, monitoring programs will meet requirements set forth in the State Implementation Plan (SIP).
2. Nitrite and nitrate may be combined and reported as nitrite+nitrate.

Analyte	Volume Required	Analytical Method	Target Reporting Limit[1]	Units	Max Holding Time
Indicator Bacteria					
Enterococcus	100 mL	SM 9230C	1	Colonies/100mL	8H
Fecal Coliform	100 mL	SM 9221E	2	MPN/100mL	8H
Total Coliform	100 mL	SM 9221B	2	MPN/100mL	8H
Inorganic Analytes					
Aluminum (Dissolved)	250 mL	USEPA 200.8	0.3	µg/L	6M
Aluminum (Total)	250 mL	USEPA 200.8	0.3	µg/L	6M
Arsenic (Dissolved)	250 mL	USEPA 200.8	0.3	µg/L	6M
Arsenic (Total)	250 mL	USEPA 200.8	0.3	µg/L	6M
Cadmium (Dissolved)	250 mL	USEPA 200.8	0.01	µg/L	6M
Cadmium (Total)	250 mL	USEPA 200.8	0.01	µg/L	6M
Chromium (Dissolved)	250 mL	USEPA 200.8	0.1	µg/L	6M
Chromium (Total)	250 mL	USEPA 200.8	0.1	µg/L	6M
Chromium III	NA	Calculated from Chromium and Chromium VI	NA	NA	NA

This table describes detailed monitoring and analytical methods that are illustrative and may be revised based on site-specific environmental conditions and equivalent alternate analytical methods.

NA = Not applicable; mL = milliliter; L = liter; D = day; H = hour; M = month

Sediment Toxicity and Benthic Community Effects are listed as a cause for impairment of receiving waters in the San Diego Bay WMA on the 303(d) list, however are not applicable to MS4 Outfalls.

1. SWAMP Target Reporting Limits are recommended and not required. At a minimum, monitoring programs will meet requirements set forth in the State Implementation Plan (SIP).
2. Nitrite and nitrate may be combined and reported as nitrite+nitrate.

Analyte	Volume Required	Analytical Method	Target Reporting Limit[1]	Units	Max Holding Time
Chromium VI	250 mL	USEPA 218.6	0.1	µg/L	28D
Copper (Dissolved)	250 mL	USEPA 200.8	0.01	µg/L	6M
Copper (Total)	250 mL	USEPA 200.8	0.01	µg/L	6M
Iron (Dissolved)	250 mL	USEPA 200.7	0.02	mg/L	6M
Iron (Total)	250 mL	USEPA 200.7	0.02	mg/L	6M
Lead (Dissolved)	250 mL	USEPA 200.8	0.01	µg/L	6M
Lead (Total)	250 mL	USEPA 200.8	0.0002	µg/L	6M
Mercury (Dissolved)	250 mL	USEPA 200.8	0.0002	µg/L	6M
Mercury (Total)	250 mL	USEPA 200.8	0.0002	µg/L	6M
Manganese (Dissolved)	250 mL	USEPA 200.8	0.01	µg/L	6M
Manganese (Total)	250 mL	USEPA 200.8	0.01	µg/L	6M
Nickel (Dissolved)	250 mL	USEPA 200.8	0.02	µg/L	6M
Nickel (Total)	250 mL	USEPA 200.8	0.02	µg/L	6M
Selenium (Dissolved)	250 mL	USEPA 200.8	0.3	µg/L	6M
Selenium (Total)	250 mL	USEPA 200.8	0.3	µg/L	6M
Silver (Dissolved)	250 mL	USEPA 200.8	0.02	µg/L	6M

This table describes detailed monitoring and analytical methods that are illustrative and may be revised based on site-specific environmental conditions and equivalent alternate analytical methods.

NA = Not applicable; mL = milliliter; L = liter; D = day; H = hour; M = month

Sediment Toxicity and Benthic Community Effects are listed as a cause for impairment of receiving waters in the San Diego Bay WMA on the 303(d) list, however are not applicable to MS4 Outfalls.

1. SWAMP Target Reporting Limits are recommended and not required. At a minimum, monitoring programs will meet requirements set forth in the State Implementation Plan (SIP).
2. Nitrite and nitrate may be combined and reported as nitrite+nitrate.

Analyte	Volume Required	Analytical Method	Target Reporting Limit[1]	Units	Max Holding Time
Silver (Total)	250 mL	USEPA 200.8	0.02	µg/L	6M
Thallium (Dissolved)	250 mL	USEPA 200.8	1	µg/L	6M
Thallium (Total)	250 mL	USEPA 200.8	1	µg/L	6M
Zinc (Dissolved)	250 mL	USEPA 200.8	0.1	µg/L	6M
Zinc (Total)	250 mL	USEPA 200.8	0.1	µg/L	6M
Nutrients					
Ammonia	250 mL	USEPA 350.1	0.1	mg/L	28D
Nitrate[2]	250 mL	USEPA 353.2	0.01	mg/L	48H
Nitrite[2]	250 mL	USEPA 353.2	0.01	mg/L	48H
Orthophosphate	250 mL	USEPA 365.1	0.01	mg/L	48H
Total Kjeldahl Nitrogen (TKN)	250 mL	USEPA 351.2	0.5	mg/L	28D
Total Nitrogen	Calculation	Calculated from TKN, Nitrate, and Nitrite	NA	NA	NA
Phosphorus (Dissolved)	250 mL	USEPA 365.1	0.01	mg/L	28D
Phosphorus (Total)	250 mL	USEPA 365.1	0.01	mg/L	28D
Organics					

This table describes detailed monitoring and analytical methods that are illustrative and may be revised based on site-specific environmental conditions and equivalent alternate analytical methods.

NA = Not applicable; mL = milliliter; L = liter; D = day; H = hour; M = month

Sediment Toxicity and Benthic Community Effects are listed as a cause for impairment of receiving waters in the San Diego Bay WMA on the 303(d) list, however are not applicable to MS4 Outfalls.

1. SWAMP Target Reporting Limits are recommended and not required. At a minimum, monitoring programs will meet requirements set forth in the State Implementation Plan (SIP).
2. Nitrite and nitrate may be combined and reported as nitrite+nitrate.

Analyte	Volume Required	Analytical Method	Target Reporting Limit[1]	Units	Max Holding Time
Chlordane	1000ml	EPA 608	0.002	µg/L	7D
Diazinon	1000 mL	EPA 625	0.05	µg/L	7D
PAHs	1000 mL	EPA 8270C	10	µg/L	7D
PCBs	1000 mL	GCMS SIM/ EPA 608	0.002	µg/L	7D/7D
Synthetic Organic Compounds					
Organophosphate Pesticides	2 L	USEPA 625M	0.05	µg/L	7/40D
Synthetic Pyrethroid Pesticides	2 L	GC/MS NCI-SIM	2-10	ng/L	7/40D
Toxicity					
Growth with *Hyalella azteca*	15 L	EPA-821-R-02-013	NA	Pass/Fail	36H
Larval Survival and Growth with *Pimephales promelas*	15 L	EPA-821-R-02-013	NA	Pass/Fail	36H
Survival and Reproduction with *Ceriodaphnia dubia*	4 L	EPA-821-R-02-013	NA	Pass/Fail	36H
Growth with *Selenastrum capricornutum*	4 L	EPA-821-R-02-013	NA	Pass/Fail	36H

This table describes detailed monitoring and analytical methods that are illustrative and may be revised based on site-specific environmental conditions and equivalent alternate analytical methods.

NA = Not applicable; mL = milliliter; L = liter; D = day; H = hour; M = month

Sediment Toxicity and Benthic Community Effects are listed as a cause for impairment of receiving waters in the San Diego Bay WMA on the 303(d) list, however are not applicable to MS4 Outfalls.

1. SWAMP Target Reporting Limits are recommended and not required. At a minimum, monitoring programs will meet requirements set forth in the State Implementation Plan (SIP).
2. Nitrite and nitrate may be combined and reported as nitrite+nitrate.

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Attachment B

Sediment Monitoring Plan

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San Diego County Municipal Copermittees
Sediment Monitoring Plan-Draft

Prepared For:

County of San Diego Municipal Copermittees

September 2, 2014

San Diego County Municipal Copermittees Sediment Monitoring Plan-Draft

Prepared For:

County of San Diego Municipal Copermittees

Prepared By:

Weston Solutions, Inc.
5817 Dryden Place, Suite 101
Carlsbad, California 92008

September 2, 2014

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
AVS:SEM	acid-volatile sulfides and simultaneously extracted metals
Bight	Southern California Bight Regional Monitoring Program
BRI	Benthic Response Index
CA EPA	California Environmental Protection Agency
CA LRM	California Logistic Regression Model
CEDEN	California Environmental Data Exchange Network
COC	chain-of-custody
Copermittees	San Diego Regional Copermittees
CSI	Chemical Score Index
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DGPS	Differential Global Positioning System
DO	dissolved oxygen
DTCS	Department of Toxic Substances Control
EC_{50}	median effective concentration
IBI	Index of Biotic Integrity
ID	inner diameter
LC_{50}	median lethal concentration
LOE	line of evidence
$MgSO_4$	magnesium sulfate
MLOE	multiple lines of evidence
MS4	Municipal Separate Storm Sewer System
MW	molecular weight
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
pH	hydrogen ion concentration
P_{MAX}	maximum probability model
QA	quality assurance
QA/QC	quality assurance/quality control
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
QC	quality control
RBI	Relative Benthic Index
RIVPACS	River Invertebrate Prediction and Classification System
RL	Reporting Limit
RWQCB	Regional Water Quality Control Board
SCAMIT	Southern California Association of Marine Invertebrate Taxonomists
SDRWQCB	San Diego Regional Water Quality Control Board
SOPs	Standard Operating Procedures
SPME	solid phase microextraction
SQOs	Sediment Quality Objectives
SWAMP	Surface Water Ambient Monitoring Program

SWRCB	State Water Resources Control Board
TIE	toxicity identification evaluation
TMDL	Total Maximum Daily Load
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
WQIP	Water Quality Improvement Plan

UNITS OF MEASURE

cm	centimeter
°C	degrees Celsius
ft	feet or foot
L	liter
m^2	square meters
µg/kg	microgram per kilogram
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
mm	millimeter
ppt	parts per thousand
%	percent

1.0 INTRODUCTION

The San Diego County Regional Copermittees (Copermittees) are required to conduct sediment quality monitoring in accordance with the requirements of the San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001 (Permit), effective June 27, 2013. The Copermittees are required, either individually, in association with multiple Copermittees, or through participation in a water body monitoring coalition to perform sediment quality monitoring to assess compliance with the sediment quality receiving water limits applicable to MS4 discharges to enclosed bays and estuaries. Provision D.1.e.(2) of the Permit requires the Copermittees to develop a Sediment Monitoring Plan for incorporation into the Water Quality Improvement Plan (WQIP) which satisfies the requirements of the *Water Quality Control Plan for Enclosed Bays and Estuaries of California – Part I Sediment Quality* (Sediment Control Plan; State Water Quality Control Board [SWRCB] and California Environmental Protection Agency [CA EPA], 2009; see Appendix A).

Provision D.1.e.(1)(b) of the Permit also requires the Copermittees to participate in the Southern California Bight Regional Monitoring Program (Bight). The Bight Program can be used to simultaneously fulfill all or part of the sediment quality monitoring requirement (Provision D.1.e(2)) as long as the Bight Program utilizes the Sediment Control Plan to assess the health of San Diego County lagoons. Depending on the outcome of the sediment quality objectives (SQOs) assessments at Bight stations located in San Diego County lagoons, follow-up monitoring may be necessary to meet all of the Permit requirements.

The following Sediment Monitoring Plan describes the sediment quality sample collection and analysis activities that will be implemented by the Copermittees during the Permit term. As required by the Permit, this Sediment Monitoring Plan includes the elements listed in Sections VII.D and VII.E of the Sediment Control Plan (Receiving Water Limits Monitoring Frequency and Sediment Monitoring, respectively), a Sediment Monitoring Quality Assurance Project Plan (QAPP) (Appendix B), and a schedule for completion of monitoring and submission of the Sediment Monitoring Report. Once the sediment quality monitoring is complete, the Copermittees will incorporate a Sediment Monitoring Report into the WQIP Annual Report.

1.1 Background

In 2003, the SWRCB initiated a program to develop SQOs for enclosed bays and estuaries. The primary objective is to protect benthic communities and aquatic life from exposure to contaminants in sediment that have been directly discharged into the water body or indirectly discharged into waters draining into the water body. The SQOs, which are outlined in the Sediment Control Plan, are based on a multiple lines of evidence (MLOE) approach in which the lines of evidence (LOE) are sediment toxicity, sediment chemistry, and benthic community condition, as described in the Sediment Control Plan (see Appendix A) and in Section 3.2. The MLOE approach evaluates the severity of biological effects and the potential for chemically mediated effects to provide a final station level assessment. The Sediment Control Plan was approved by the SWRCB and the Office of Administrative Law on September 16, 2008, and on January 5, 2009, respectively, and was subsequently approved by the United States Environmental Protection Agency (USEPA) on August 25, 2009.

1.2 Monitoring Objective

The primary objective of the sediment monitoring program is to assess compliance with the sediment quality receiving water limits applicable to MS4 discharges to enclosed bays and estuaries of San Diego County. Sediment toxicity, chemistry, and benthic community condition will be assessed using SQOs as described in the Sediment Control Plan (Appendix A). The goals of the SQOs are to determine whether pollutants in sediments are present in quantities that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful.

The goal of the Sediment Monitoring Plan is to provide the key elements that are required to successfully conduct field sediment sampling, processing, testing, and analysis of the results. Analyses of chemistry, toxicity, and benthic community condition require that samples be collected, preserved, processed, and analyzed using proper field and laboratory equipment, methods, and techniques. Additionally, representative station locations ensure the proper characterization of benthic conditions. The Sediment Monitoring Plan and Sediment Monitoring QAPP (Appendix B) describe the collection and analysis of surface sediment samples necessary to provide representative assessments of in situ conditions for the enclosed bays and estuaries of San Diego County.

2.0 MATERIALS AND METHODS

The materials and methods described in this section are designed to meet the requirements of the Sediment Control Plan, Sections VII.D and VII.E, as required by Permit Provision D.1.e.(2)(a). The methodology is outlined in Section V of the Sediment Control Plan. If sediment quality monitoring is conducted as part of the Bight Program, the work plans and associated QA/QC documents pertaining to the Bight Program should be followed.

Quality assurance methods and procedures needed to maintain consistency in sample collection, processing, and analysis to produce scientifically defensible data are provided in the Sediment Monitoring Quality Assurance Project Plan (QAPP) (Appendix B). The QAPP provides acceptability criteria for the collection and analysis of duplicate field samples, field or equipment rinse blanks, laboratory methods, and laboratory spikes. The QAPP should be used as a reference to ensure proper methods are used consistently throughout the monitoring program.

2.1 Field Collection Program

2.1.1 Station Selection

The Sediment Control Plan applies to subtidal surficial sediments located seaward of the intertidal zone in enclosed bays and estuaries. It does not apply to ocean waters, inland surface waters, sediments consisting of less than 5 percent (%) fines or substrates composed of gravel, cobble, or consolidated rock, or to sediment classified as a pollutant due to physical processes such as burial or sedimentation. SQOs have been fully developed for only two of California's six enclosed bay habitats: euhaline (salinity = 25 to 32 parts per thousand [ppt]) bays and coastal lagoons south of Point Conception and polyhaline (18 to 25 ppt) central San Francisco Bay. In addition, the benthic species assemblage used to calculate the benthic LOE for southern California marine bays is Habitat C (Bay et al., 2014), and one of the criteria for Habitat C is a salinity greater than 27 ppt. In order to select a sampling station applicable to the SQQ assessment using Habitat C for the benthic LOE, it is recommended to verify that a proposed sampling station is both subtidal and has salinity greater than 27 ppt. Salinity measurements should be taken at a spring high and low tide to get an estimate of the salinity range for a proposed station. If feasible, it is recommended that salinity should be monitored throughout an entire spring tidal cycle to ensure it meets the salinity criteria prior to sampling. This monitoring can be accomplished by deploying a continuous monitoring device such as an YSI water quality data sonde. Water depth should also be measured when visiting the station at a spring low tide or deploying a continuous monitoring device over a spring tidal cycle to ensure the station is subtidal.

The Sediment Control Plan does not give guidance as to how many stations should be sampled in each lagoon. The number of sampling stations will vary within each San Diego County lagoon based on the spatial extent of the area likely to be impacted. If the Bight Program is utilized to fulfill the Sediment Quality Monitoring requirement of the Permit, then the number of stations within each San Diego County lagoon will be dictated by the Bight Program. For example, in the 2008 Bight Program, five stations were analyzed per lagoon; however, in the 2013 Bight Program the number of stations per lagoon varied from one to three stations. If a stressor identification study becomes necessary following the original SQO assessment of a lagoon (see Section 4.0), then the number of stations will be based on what suspected pollutants are driving the impacted scores (e.g. algae, physical factors, or chemical factors) and to have enough samples to statistically support meaningful findings.

2.1.2 Permitting

Scientific collecting permits from the California Department of Fish and Wildlife will need to be obtained in order to collect benthic infaunal samples containing invertebrate specimens. At a minimum, it can take up to three weeks to obtain the permit; however, at times it can take several months to receive a scientific collecting permit so applications should be submitted well in advance of the desired sampling dates. A minimum of 24 hours (business day only) prior to collecting benthic infaunal samples in the field, a copy of the Notification of Intent to Collect for Scientific Purposes form should be faxed or emailed to the Marine Region (Monterey, CA) office of the CDFW. Additionally, written authorization may be required from state agencies or private landowners in order to gain access to water bodies that are surrounded by private land, have locked fences or gates, contain threatened or endangered species, or require the use of a private boat launch. Nesting seasons of threatened and endangered bird species may prevent sampling from being conducted or may restrict access around nesting areas during certain times of year, typically mid to late summer months.

2.1.3 Monitoring Season and Frequency

Section VII.E.6 of the Sediment Control Plan requires that samples for SQO programs be collected between June and September. Physical environments and benthic community composition and abundance within enclosed bays and estuaries are generally stable and most similar from year to year during this time (Bay et al., 2014).

According to Section VII.D of the Sediment Control Plan, sediment monitoring associated with Phase I stormwater discharges and major discharges will be conducted at least twice during the Permit cycle except at stations that have consistently been classified as unimpacted or likely unimpacted using the MLOE approach described in Section 3.2. At the unimpacted or likely unimpacted stations, monitoring may be reduced to a frequency of once during the Permit cycle.

2.1.4 Sampling Vessels

Vessels used to collect sediment samples will be both stable and maneuverable and will have a sufficiently shallow draft to navigate into shallow waters (e.g. large inflatable boat). The vessels will be equipped with a side or rear davit from which to deploy and retrieve surface sampling equipment, and will be able to accommodate a minimum of two persons in addition to all appropriate sampling and safety equipment.

2.1.5 Navigation

All station locations will be pre-plotted prior to sampling activities. Stations will be identified using a Differential Global Positioning System (DGPS). The system uses U.S. Coast Guard differential correction data, and is accurate within 10 feet (ft). All final station locations will be recorded in the field using positions from the DGPS.

2.1.6 Sediment Sampling and Handling

Benthic sediments will be collected as surface grabs using an appropriate sampler, such as a stainless steel Van Veen grab sampler. The size of the grab sampler to be used for sediment programs in Southern California should be 0.1 square meter (m^2) across the top of the sampler. An appropriate sampler for the collection of benthic sediments will have the following characteristics:

- Constructed of a material that does not introduce contaminants.
- Causes minimal surface sediment disturbance.
- Does not leak or mix during sample retrieval.
- Has a design that enables safe/easy sample verification that samples meet all applicable sampling criteria (e.g., collects sediments to at least 5 centimeters (cm) below the sediment surface, has access doors allowing visual inspection and removal of undisturbed surface sediment).

A sample will be determined to be acceptable if the surface of the grab is even, there is minimal surface disturbance, and there is a penetration depth of at least 5 cm. Rejected grabs will be discarded, and the station will be re-sampled. Upon retrieval, if the grab is acceptable, the overlying water will be carefully drained, and the sediment will be processed depending on analysis and use. Sediment grabs will be collected for the following analyses: benthic infauna, chemistry, grain size, and toxicity. Station location and grab event data should be written on preformatted field data sheets (hard copies or via computer). At a minimum, field data should include station identification, station location, date, time of sample collection, depth of water, depth of penetration of grab in sediment (e.g. 5 cm), sediment composition, sediment odor and color, and sample type (e.g. sediment chemistry).

In the event that a pre-plotted sample station is found to be unsuitable for collecting sediment, because of factors such as inaccessibility, the salinity does not meet the SQO criteria, disturbance to wildlife, or safety considerations, the station may be abandoned and an alternate station may be selected. Reasons for abandonment should be recorded on field data sheets.

The entire contents of a grab sample will be collected for benthic community analyses. Samples collected for benthic infaunal analysis will be rinsed through a 1.0-millimeter (mm) mesh screen. The material retained on the screen will be transferred to a labeled glass or plastic sample container. A 7% magnesium sulfate ($MgSO_4$) seawater solution will be added to the sample container to 85-90% of its volume to relax the collected specimens. The sample container will be inverted several times to distribute the relaxant solution. After 30 minutes, add enough sodium borate buffered formaldehyde to top off the sample container and gently invert the container several times to ensure the sample is mixed. This will make a 10% formalin solution.

Sediment samples for toxicity testing and chemistry will be collected from the top 5 cm of a grab sample using a pre-cleaned stainless steel scoop. Sediment within 1 cm of the sides of the grab will be avoided to prevent interaction of any contaminants and the steel sampling device. According to the Sediment Control Plan, the preferred method of collection for sediment-water interface toxicity tests (see Section 2.2.2.2) is to collect intact cores directly from the sediment sampler by pressing polycarbonate core tubes (7.3-cm inner diameter [ID] and 16 cm in length) into the top 5 cm of sediment. However, homogenizing sediment for sediment-water interface testing is also acceptable according to the Sediment Control Plan. This method is more practical to implement in the field and is consistent with previous sediment quality objective methodology (e.g., Bight protocols and previous lagoon monitoring implemented by the Copermittees). Minimum sample volumes and types of sample containers to be used in the sediment collection is provided in the Sediment Monitoring QAPP (see Appendix B)

All sampling equipment will be cleaned prior to sampling. Between sampling stations, the grab sampler will be rinsed with station water. Stainless steel scoops will be rinsed with seawater and rinsed with de-ionized water between stations. All sediment samples will be logged on a chain-of-custody (COC) form (see Section 2.1.7). Sediment chemistry and toxicity samples will be placed in a cooler on ice until delivered or shipped to the appropriate laboratories. Prior to shipping, sample containers will be placed in sealable plastic bags and securely packed inside the cooler with ice. The original signed COC forms will remain with the samples during shipment. Sediment samples will be shipped or delivered to the analytical laboratory within appropriate holding times (refer to Sediment Monitoring QAPP in Appendix B).

2.1.7 Documentation of Chain-of-Custody

This section describes the program requirements for sample handling and COC procedures. Samples are considered to be in custody if they are: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession are COC records, field log books, and field tracking forms. COC procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or sample group. Each person who has custody of the samples will sign the form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sample identification.
- Sample collection date and time.
- Any special notations on sample characteristics.
- Initials of the person collecting the sample.
- Date the sample was sent to the laboratory.
- Shipping company and waybill information.

The completed COC form will be placed in a sealable plastic envelope that will travel inside the ice chest containing the listed samples. The COC form will be signed by the person transferring custody of the samples. The condition of the samples will be recorded by the receiver. COC records will be included in the final analytical report prepared by the laboratory and will be considered an integral part of the report.

2.2 Laboratory Testing

All samples will be tested in accordance with USEPA or American Society for Testing and Materials (ASTM) protocols. If appropriate protocols do not exist, the Copermittees should use other methods approved by the SWRCB or San Diego RWQCB. Analytical laboratories will be certified by the California Department of Health Services in accordance with Water Code 13176. Additional information pertaining to laboratory testing is presented in the Sediment Monitoring QAPP (see Appendix B).

2.2.1 Physical and Chemical Analysis

Physical and chemical measurements of sediment were selected to comply with the Sediment Control Plan and to provide data on chemicals of potential concern in bays and estuaries located in San Diego County. The physical and chemical analyses of sediments will include, at a minimum, the constituents outlined in Table **Error! No text of specified style in document.**-1. Reporting limits (RLs) must be equal to or less than those listed in Table Error**! No text of specified style in document.**-1 in order to generate the chemistry LOE outlined in Section 2.3.3.1. Concentrations associated with the RLs in Table **Error! No text of specified style in document.**-1 are expressed in dry-weight. Physical analyses of sediment will include grain size and percent solids. Grain size will be analyzed to determine the general size classes that make up the sediment (e.g., gravel, sand, silt, and clay), whereas percent solids will be measured to convert chemical concentrations from a wet-weight to a dry-weight basis. Chemical analyses of sediment will include total organic carbon (TOC), and the select trace metals, chlorinated pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) shown in Table **Error! No text of specified style in document.**-1.

Table Error! No text of specified style in document.**-1. Chemical and Physical Parameters for Sediment Samples**

Parameter	Reporting Limit
Physical/Conventional Tests	
Grain Size	1.00 %
Percent Solids	0.10 %
Total Organic Carbon (TOC)	0.01 %
Metals	
Cadmium (Cd)	0.09 mg/kg
Copper (Cu)	52.8 mg/kg
Lead (Pb)	25.0 mg/kg
Mercury (Hg)	0.09 mg/kg
Zinc (Zn)	60.0 mg/kg
Organochlorine Pesticides	
2,4′-DDD	0.50 µg/kg
2,4′-DDE	0.50 µg/kg
2,4′-DDT	0.50 µg/kg
4,4′-DDD	0.50 µg/kg
4,4′-DDE	0.50 µg/kg
4,4′-DDT	0.50 µg/kg

Table 2-1. Chemical and Physical Parameters for Sediment Samples (continued)

Parameter	Reporting Limit
Chlordane-alpha	0.50 µg/kg
Chlordane-gamma	0.54 µg/kg
Dieldrin	2.5 µg/kg
trans-Nonachlor	4.6 µg/kg
PCB Congeners	
2,4'-Dichlorobiphenyl	3.0 µg/kg
2,2',5-Trichlorobiphenyl	3.0 µg/kg
2,4,4'-Trichlorobiphenyl	3.0 µg/kg
2,2',3,5'-Tetrachlorobiphenyl	3.0 µg/kg
2,2',5,5'-Tetrachlorobiphenyl	3.0 µg/kg
2,3',4,4'-Tetrachlorobiphenyl	3.0 µg/kg
2,2',4,5,5'-Pentachlorobiphenyl	3.0 µg/kg
2,3,3',4,4'-Pentachlorobiphenyl	3.0 µg/kg
2,3',4,4',5-Pentachlorobiphenyl	3.0 µg/kg
2,2',3,3',4,4'-Hexachlorobiphenyl	3.0 µg/kg
2,2',3,4,4',5'-Hexachlorobiphenyl	3.0 µg/kg
2,2',4,4',5,5'-Hexachlorobiphenyl	3.0 µg/kg
2,2',3,3',4,4',5-Heptachlorobiphenyl	3.0 µg/kg
2,2',3,4,4',5,5'-Heptachlorobiphenyl	3.0 µg/kg
2,2',3,4',5,5',6-Heptachlorobiphenyl	3.0 µg/kg
2,2',3,3',4,4',5,6-Octachlorobiphenyl	3.0 µg/kg
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	3.0 µg/kg
Decachlorobiphenyl	3.0 µg/kg
PAHs (low molecular weight)	
Acenaphthene	20.0 µg/kg
Anthracene	20.0 µg/kg
Phenanthrene	20.0 µg/kg
Biphenyl	20.0 µg/kg
Naphthalene	20.0 µg/kg
2,6-Dimethylnaphthalene	20.0 µg/kg
Fluorene	20.0 µg/kg
1-Methylnaphthalene	20.0 µg/kg
2-Methylnaphthalene	20.0 µg/kg
1-Methylphenanthrene	20.0 µg/kg
PAHs (high molecular weight)	
Benzo(a)anthracene	80.0 µg/kg
Benzo(a)pyrene	80.0 µg/kg
Benzo(e)pyrene	80.0 µg/kg
Chrysene	80.0 µg/kg
Dibenzo(a,h)anthracene	80.0 µg/kg
Fluoranthene	80.0 µg/kg
Perylene	80.0 µg/kg
Pyrene	80.0 µg/kg

DDD Dichlorodiphenyldichloroethane
DDE dichlorodiphenyldichloroethylene
DDT dichlorodiphenyltrichloroethane
mg/kg milligrams per kilogram
µg/kg micrograms per kilogram

2.2.2 Toxicity Testing

To evaluate the benthic condition of San Diego County's bays and lagoons, sediment toxicity testing will be conducted in accordance with ASTM and USEPA methods. Toxicity testing involves a short-term survival test, a sublethal endpoint test, and an assessment of sediment toxicity. For each test type, more than one specific test is acceptable. The appropriate species tested for a sample will depend on the characteristics of the sample such as grain size, salinity, and suspected toxic constituents, if any. When historical data are available for a sample location, it is recommended that the same species be used in order to make comparisons and to conduct trend analysis. In addition, when testing is conducted as part of a regional monitoring program such as the Bight program, the species selection will be dictated by the program.

If significant toxicity is observed in the solid phase or sediment-water interface test, a toxicity identification evaluation (TIE) may be conducted as part of stressor identification studies described in Section 4.0.

2.2.2.1 Short-Term Survival Testing

SQO analysis requires that at least one short-term survival test be conducted. There are three acceptable short-term survival tests, each of which is a 10-day test exposing amphipods to whole sediment. The three acceptable test organisms are *Eohaustorius estuarius*, *Leptocheirus plumulosus*, and *Rhepoxynius abronius*. The *E. estuarius* short-term survival test has been the 10-day test method used in previous San Diego County lagoon monitoring programs where the SQO analytical tool was used to assess lagoon health. These amphipod bioassays will be conducted in accordance with procedures outlined in *Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (USEPA, 1994) and ASTM method E1367-03 (ASTM, 2006). Test conditions are summarized in Table Error**! No text of specified style in document.**-2.

A water-only reference toxicity test should be conducted concurrently with the whole sediment amphipod test to assess the relative sensitivity of test organisms used in the evaluation of project sediments. Amphipod reference toxicant tests are typically conducted using cadmium. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing.

Table Error! No text of specified style in document.**-2. Summary of Conditions for 10-Day Whole Sediment Amphipod Bioassay**

Test Conditions 10-Day Whole Sediment Bioassay				
Test Species		***E. estuarius***	***L. plumulosus***	***R. abronius***
Test Procedures		USEPA (1994); ASTM E1367-03 (2006)		
Test Type/Duration		Static - Acute Whole Sediment/10 days		
Sample Storage Conditions		4 °C, dark, minimal head space		
Age/Size Class		3-5 mm	2-4 mm; immature	3-5 mm
Grain Size Tolerance		0.6-100% sand	0-100% sand	10-100% sand
Recommended Water Quality Parameters	Temperature	15 ± 1 °C	25 ± 1 °C	15 ± 1 °C
	Salinity	20 ± 2 ppt	20 ± 2 ppt	28 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation		
	Total Ammonia	< 60 mg/L	< 60 mg/L	< 30 mg/L
Test Chamber		1 L glass		
Exposure Volume		2 cm sediment, 800 mL seawater		
Replicates/Sample		5		
No. of Organisms/Replicate		20		
Photoperiod		Continuous light		
Feeding		None		
Water Renewal		None		
Aeration		Constant gentle aeration		
Acceptability Criteria		Mean control survival ≥ 90%; ≥80% survival in each replicate		

mg/L milligram per liter

2.2.2.2 Sublethal Testing

The second type of testing required for SQO analysis is a sublethal test. Either a 48-hour development test exposing embryos of the bivalve *Mytilus galloprovincialis* to the sediment-water interface may be conducted or a 28-day survival and growth test exposing the polychaete worm *Neanthes arenaceodentata* to whole sediment. Test condition summaries for the bivalve and polychaete tests are presented in Table Error**! No text of specified style in document.**-3 and Table Error**! No text of specified style in document.**-4, respectively. The *M. galloprovincialis* sediment-water interface test has been the sublethal test method used in previous San Diego County lagoon monitoring programs where the SQO analytical tool was used to assess lagoon health.

Mytilus galloprovincialis Sediment-Water Interface Development Sublethal Test

Sediment-water interface bioassays are performed to estimate the potential toxicity of contaminants fluxing from test sediments into the overlying water. The sediments will be tested in a 48-hour sediment-water interface test using the bivalve *M. galloprovincialis* in accordance with procedures outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (USEPA, 1995) and Assessment of Sediment Toxicity at the Sediment-Water Interface (Anderson et al., 1996). Sediment-water interface bioassays will be tested on intact cores collected in the field or on homogenized sediment samples as described in Section 2.1.6.

A water-only reference toxicity test should be conducted concurrently with the sediment-water interface bivalve test to assess the relative sensitivity of test organisms used in the evaluation of the project sediments. Bivalve reference toxicant tests are typically conducted using copper. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing.

Table Error! No text of specified style in document.**-3. Test Conditions for the 48-Hour *M. galloprovincialis* Sediment-Water Interface Bioassay**

Test Conditions 10-Day Whole Sediment Bioassay		
Test Species		***M. galloprovincialis***
Test Procedures		USEPA (1995), Anderson et al. (1996)
Test Type/Duration		Static - Acute sediment-water interface/48 hours
Sample Storage Conditions		4 °C, dark, minimal head space
Age/Size Class		< 4 hour old larvae
Recommended Water Quality Parameters	Temperature	15 ± 1 °C
	Salinity	32 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation
	Total Ammonia	< 4 mg/L
Test Chamber		Polycarbonate core tube 7.3-cm inner diameter, 16 cm high
Exposure Volume		5 cm sediment, 300 mL water
Replicates/Sample		4
No. of Organisms/Replicate		Approximately 250 larvae
Photoperiod		16 hours light: 8 hours dark
Feeding		None
Water Renewal		None
Aeration		Constant gentle aeration
Acceptability Criteria		Mean control normal-alive $\geq$ 80%

Neanthes arenaceodentata Whole Sediment Survival and Growth Sublethal Test

The *N. arenaceodentata* test will be conducted in accordance with ASTM method E1562 (ASTM, 2002) with modifications described in Farrar and Bridges (2011) that have been found to contribute manageability and precision to the ASTM procedure. A water-only reference toxicity test should be conducted concurrently with the whole sediment polychaete test to assess the relative sensitivity of test organisms used in the evaluation of the project sediments. Polychaete reference toxicant tests are typically conducted using cadmium. However, using ammonia as the reference toxicant is preferable because the sensitivity of the test organisms to ammonia (often a confounding factor in sediment testing) can be evaluated along with the relative sensitivity of the batch of organisms used in testing.

Table Error! No text of specified style in document.**-4. Test Conditions for the 28-Day Whole Sediment *N. arenaceodentata* Bioassay**

Test Conditions 10-Day Whole Sediment Bioassay		
Test Species		***N. arenaceodentata***
Test Procedures		ASTM E1562 (2002), Farrar and Bridges (2011)
Test Type/Duration		Static - Acute Whole Sediment/28 days
Sample Storage Conditions		4 °C, dark, minimal head space
Age/Size Class		≤ 7 days post-emergence
Grain Size Tolerance		5-100% sand
Recommended Water Quality Parameters	Temperature	20 ± 1 °C
	Salinity	30 ± 2 ppt
	Dissolved Oxygen	Maintaining 90% saturation
	Total Ammonia	< 20 mg/L
Test Chamber		300 mL glass
Exposure Volume		2 cm sediment, 125 mL seawater
Replicates/Sample		10
No. of Organisms/Replicate		1
Photoperiod		12 hours light: 12 hours dark
Feeding		Twice per week
Water Renewal		Weekly
Aeration		Constant gentle aeration
Acceptability Criteria		Mean control survival ≥ 80%; positive growth in controls

2.2.3 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 48 hours and no longer than 5 days. The samples will then be transferred from formalin to 70% ethanol for laboratory processing. The organisms will initially be sorted using a dissecting microscope into five major phyletic groups: polychaetes, crustaceans, molluscs, echinoderms, and miscellaneous minor phyla. While sorting, technicians will keep a count for quality control purposes, as described in the following paragraph. After initial sorting, samples will be distributed to qualified taxonomists who will identify each organism to species or to the lowest possible taxon. Taxonomists will use the most recent version of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) taxonomic listing for nomenclature and orthography.

A QA/QC procedure will be performed on each of the sorted samples to ensure a 95% sorting efficiency. A 10% aliquot of a sample will be re-sorted by a senior technician trained in the QA/QC procedure. The number of organisms found in the aliquot will be divided by 10% and added to the total number found in the sample. The original total will be divided by the new total to calculate the percent sorting efficiency. When the sorting efficiency of the sample is below 95%, the remainder of the sample (90%) will be re-sorted.

2.2.3.1 Quality Assurance/Quality Control

All quality assurance/quality control (QA/QC) samples must be conducted in accordance with the Quality Assurance Management Plan (QAMP) for the State of California's Surface Water Ambient Monitoring Program (SWAMP). The data quality objectives for all analyses conducted by the participating analytical laboratories will be detailed in the Sediment Monitoring QAPP (see Appendix B). The results of the laboratory quality control (QC) analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology or the Sediment Monitoring QAPP will be identified, and the corresponding data will be appropriately qualified in the final report. All QA/QC records for the various testing programs will be kept on file for review by regulatory agency personnel.

3.0 DATA REVIEW, MANAGEMENT, AND ANALYSIS

3.1 Data Review and Management

All quality assurance/quality control (QA/QC) data must be conducted in accordance with the Quality Assurance Management Plan (QAMP) for the State of California's SWAMP and the data quality objectives as outlined in the Sediment Monitoring QAPP (see Appendix B). Data will be reviewed to determine that appropriate corrective actions have been taken, when necessary. The laboratories will supply analytical results in both hard copy and electronic formats. Laboratories will have the responsibility of ensuring that both formats are accurate. Monitoring data and analytical results will be uploaded into California Environmental Data Exchange Network (CEDEN).

3.2 Data Analysis

Sediment toxicity, chemistry, and benthic community condition will be assessed using California's SQOs as described in the Sediment Control Plan (Appendix A). The goals of the SQOs are to determine whether pollutants in sediments are present in quantities that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful to humans. SQOs have been fully developed for only one of Southern California's enclosed bay habitats: euhaline (salinity = 25 to 32 ppt) bays and coastal lagoons south of Point Conception. In addition, the benthic species assemblage used to calculate the benthic LOE for southern California marine bays is Habitat C (Bay et al., 2014), and one of the criteria for Habitat C is a salinity greater than 27 ppt. The data analysis methods described below should be limited to those subtidal areas of the coastal lagoons/estuaries where the for the SQO salinity criteria can be met.

The SQOs are based on a MLOE approach in which sediment toxicity, sediment chemistry, and benthic community condition are the LOE. The MLOE approach evaluates the severity of biological effects and the potential for chemically mediated effects to provide a final station level assessment. Brief descriptions of the specific methods associated with each LOE are described below. Detailed calculations and descriptions of each LOE are provided in the Sediment Control Plan (SWRCB and CA EPA, 2009) (see Appendix A).

3.2.1 Sediment Toxicity

Sediment toxicity will be assessed using two tests: a short-term survival test using one of three species of marine amphipods (*E. estuarius*, *L. plumulosus*, or *R. abronius*) and a sublethal test using either *N. arenaceodentata* (a species of polychaete worm) or *M. galloprovincialis* (a species of marine bivalve). Sediment toxicity test results from each station will be statistically compared to control test results; normalized to the control survival; and categorized as nontoxic, low, moderate, or high toxicity according to Table Error**! No text of specified style in document.**-5. The average of the two test response categories (nontoxic, low toxicity, moderate toxicity, and high toxicity) will be calculated to determine the final toxicity LOE category. If the average falls midway between the two categories, it will be rounded up to the higher of the two. For example, if the test response category for the short-term survival test is low toxicity, and the test response category for the sublethal test is moderate toxicity, the final category for sediment toxicity would be moderate toxicity.

Table Error! No text of specified style in document.**-5. Sediment Toxicity Categorization Values**

Test Type	Endpoint	Statistical Significance	Nontoxic[1]	Low Toxicity[2]	Moderate Toxicity[2]	High Toxicity[2]
Short-Term Survival Tests	*E. estuarius* Survival	Significant	90 to 100	82 to 89	59 to 81	<59
		Not significant	82 to 100	59 to 81	-	<59
	L. plumulosus Survival	Significant	90 to 100	78 to 89	56 to 77	<56
		Not significant	78 to 100	56 to 77	-	<56
	R. abronius Survival	Significant	90 to 100	83 to 89	70 to 82	<70
		Not significant	83 to 100	70 to 82	-	<70
Sublethal Tests	*N. arenaceodentata* Growth	Significant	90 to 100[2]	68 to 90	46 to 67	<46
		Not significant	68 to 100	46 to 67	-	<46
	M. galloprovincialis Normal-Alive	Significant	80 to 100	77 to 79	42 to 76	<42
		Not significant	77 to 79	72 to 76	-	<42

[1] Expressed as percent.
[2] Expressed as percent of control.

3.2.2 Sediment Chemistry

Sediment chemistry will be assessed using the analyte list presented in Table Error**! No text of specified style in document.-**1. Concentrations of chemicals detected in sediments will be compared to the California Logistic Regression Model (CA LRM) and the Chemical Score Index (CSI). The CA LRM is a maximum probability model (P_{max}) that uses logistic regression to predict the probability of sediment toxicity. The CSI is calculated independently of the CA LRM and is a predictive index that relates sediment chemical concentration to benthic community disturbance. Sediment chemistry results according to CA LRM and CSI are categorized as having minimal, low, moderate, and high exposure to pollutants (Table **Error! No text of specified style in document.**-6). The final sediment LOE category is the average of the two chemistry exposure categories. If the average falls midway between the two categories, it is rounded up to the higher of the two. For example, if the CA LRM is low exposure and the CSI is moderate exposure, then the final sediment LOE category is moderate exposure.

Table Error! No text of specified style in document.**-6. Sediment Chemistry Guideline Categorization**

Sediment Chemistry Guideline		Sediment LOE Category
CA LRM	**CSI**	
<0.33	<1.69	**Minimal Exposure**
0.33 - 0.49	1.69 - 2.33	**Low Exposure**
0.50 - 0.66	2.34 - 2.99	**Moderate Exposure**
>0.66	>2.99	**High Exposure**

3.2.3 Benthic Community Condition

Benthic community condition will be assessed using a combination of four benthic indices: the Benthic Response Index (BRI; abundance-weighted average pollution tolerance of sample organisms), the Relative Benthic Index (RBI; the weighted sum of community parameters and abundance of indicator species), the Index of Biotic Integrity (IBI; a measure that identifies benthic community characteristics outside of reference ranges), and a predictive model based on the River Invertebrate Prediction and Classification System (RIVPACS; a comparison of assemblages in a sample to expected species composition). The four indices will be calculated following the January 21, 2008, guidance provided by Southern California Coastal Water Research Project (SCCWRP) entitled *Determining Benthic Invertebrate Community Condition in Embayments* for Southern California marine bays. Each benthic index result is categorized according to four levels of disturbance, including reference, low, moderate, and high disturbance.

- Reference: Equivalent to a least affected or unaffected station.
- Low Disturbance: Some indication of stress is present, but is within measurement error of unaffected condition.
- Moderate Disturbance: Clear evidence of physical, chemical, natural, or anthropogenic stress.
- High Disturbance: High magnitude of stress.

Specific categorization values, which are tailored to southern California marine bays, are assigned for each index (Table Error**! No text of specified style in document.**-7), and are based on the specific taxa found within a given sample. To determine the benthic community condition, the four indices will be integrated into a single category. The median of the four benthic index response categories are computed to determine the benthic condition. If the median falls between two categories, the value is rounded to the next higher category to provide the most conservative estimate of benthic community condition.

Table Error! No text of specified style in document.**-7. Benthic Index Categorization Values for Southern California Marine Bays**

Benthic Community Guideline				Index
BRI	**IBI**	**RBI**	**RIVPACS**	
<39.96	0	>0.27	>0.90 to <1.10	**Reference**
39.96 - 49.14	1	0.17 - 0.27	0.75 - 0.90 or 1.10 - 1.25	**Low Disturbance**
49.15 - 73.26	2	0.09 - 0.16	0.33 - 0.74 or >1.25	**Moderate Disturbance**
>73.26	3 or 4	<0.09	<0.33	**High Disturbance**

3.2.4 Integration of Multiple Lines of Evidence

The station level assessment that indicates whether the aquatic life SQO at a station has been met will be determined by the combination of the three LOE categories to assess the severity of biological effects and the potential for chemically mediated effects. The severity of biological effects will be determined by combining the toxicity and benthic community condition LOEs (Table **Error! No text of specified style in document.**-8). The potential for chemically mediated effects will be determined by combining the toxicity and chemistry LOEs (Table **Error! No text of specified style in document.**-9).

Table Error! No text of specified style in document.**-8. Determination of Severity of Biological Effects**

Combination of Toxicity LOE and Benthic Condition LOE		Toxicity LOE			
		Non-toxic	Low Toxicity	Moderate Toxicity	High Toxicity
Benthic Community Condition LOE	Reference	Unaffected	Unaffected	Unaffected	Low Effect
	Low Disturbance	Unaffected	Low Effect	Low Effect	Low Effect
	Moderate Disturbance	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect
	High Disturbance	Moderate Effect	High Effect	High Effect	High Effect

Table Error! No text of specified style in document.**-9. Determination of Potential for Chemically Mediated Effects**

Combination of Toxicity LOE and Sediment Chemistry LOE		Toxicity LOE			
		Non-toxic	Low Toxicity	Moderate Toxicity	High Toxicity
Sediment Chemistry LOE	Minimal Exposure	Minimum Potential	Minimum Potential	Low Potential	Moderate Potential
	Low Exposure	Minimum Potential	Low Potential	Moderate Potential	Moderate Potential
	Moderate Exposure	Low Potential	Moderate Potential	Moderate Potential	Moderate Potential
	High Exposure	Moderate Potential	Moderate Potential	High Potential	High Potential

Based on the determinations of the severity of biological effects and the potential for chemically mediated effects, a station level assessment (Table **Error! No text of specified style in document.**-10) will be made that categorizes the station as one of the following:

- Unimpacted: Confident that sediment contamination is not causing significant adverse impacts to aquatic life living in station sediments.
- Likely unimpacted: Sediment contamination at the station is not expected to cause adverse impacts to aquatic life, but some disagreement among the LOE reduces the certainty that the station is unimpacted.
- Possibly impacted: Sediment contamination at the station may be causing adverse impacts to aquatic life, but the impacts are either small or uncertain due to disagreement among the LOE.
- Likely impacted: Evidence for a contaminant-related impact to aquatic life at the station is persuasive, even if there is some disagreement among the LOE.
- Clearly impacted: Sediment contamination at the station is causing clear and severe adverse impacts to aquatic life.

- Inconclusive: Disagreement among the LOE suggests that either the data are suspect or additional information is needed before a determination can be made.

Table Error! No text of specified style in document.**-10. Determination of Final Station Assessment**

Combination of Severity of Biological Effects and Potential for Chemically-Mediated Effects		Severity of Biological Effects			
		Unaffected	**Low Effect**	**Moderate Effect**	**High Effect**
Potential for Chemically-Mediated Effects	**Minimal Potential**	Unimpacted	Likely Unimpacted	Likely Unimpacted	Inconclusive
	Low Potential	Unimpacted	Likely Unimpacted	Possibly Impacted	Possibly Impacted
	Moderate Potential	Likely Unimpacted	Possibly Impacted or Inconclusive[1]	Likely Impacted	Likely Impacted
	High Potential	Inconclusive	Likely Impacted	Clearly Impacted	Clearly Impacted

[1] When chemistry classification is minimal exposure, benthic response is reference, and toxicity is high.

All 64 possible combinations are presented in Attachment B of the Sediment Control Plan.

If a station is consistently classified as Unimpacted or Likely Unimpacted according to the SQO assessments, then the protective condition has been achieved. In cases where segments contain stations categorized as Possibly Impacted but not Clearly Impacted or Likely Impacted, confirmation monitoring will be conducted prior to requiring stressor identification studies. If a follow-up assessment result is Unimpacted or Likely Unimpacted, the protective condition has been achieved at that location. If the final station assessment result is Possibly Impacted, Likely Impacted or Clearly Impacted, the station is considered degraded and the Copermittees may need to conduct a stressor identification study. Stations categorized as Inconclusive should not be used to evaluate whether the protective condition at a station has been met. Additional information should be gathered at stations classified as Inconclusive in order to understand why the LOE results show a level of disagreement.

If stations are categorized as Possibly Impacted within a monitored segment, reach, or water body that also contain stations that are not categorized as Clearly or Likely Impacted, then confirmation monitoring should be conducted in order to confirm the level of impact at these stations prior to initiating a stressor identification study. As stated in the *Sediment Quality Assessment Technical Support Manual* (Bay et al., 2014), "the *Possibly Impacted* station assessment is the least certain of all categorizations, and therefore requires the most caution during interpretation. Stations may be classified as *Possibly Impacted* due to low levels of effect for each LOE, indicating a low magnitude of impacts. Alternatively, a *Possibly Impacted* classification may be the result of a large disagreement between LOEs, potentially due to confounding factors or noncontaminant stressors." Following the confirmation monitoring, if the station assessment is categorized as Possibly Impacted, Likely Impacted, or Clearly Impacted then the Copermittees may need to conduct a stressor identification study. If additional monitoring or specialized studies at Possibly Impacted stations indicate that factors other than toxic pollutants in sediments are causing observed negative responses then it may be possible to designate the station as meeting the protective condition.

4.0 STRESSOR IDENTIFICATION

The highest priority for stressor identification will be assigned to those water body segments with the highest percentage of Clearly Impacted or Likely Impacted stations. In cases where segments contain sediments categorized as Possibly Impacted but not Clearly Impacted or Likely Impacted, confirmation monitoring will be conducted prior to requiring stressor identification studies. By reviewing the available data sets, deductive reasoning can be used to narrow the focus of future actions. Based on the outcome of the additional data analysis, steps forward for stressor identification should be coordinated with the San Diego RWQCB. If a stressor identification study is required, the Copermittees should develop a clearly defined work plan prior to beginning work. No formal guidance is given in the Sediment Control Plan on how to conduct a stressor identification study; however, the Sediment Control Plan does give some general guidance on types of stressor identification studies that can be implemented. These studies include confirmation and characterization of pollutant-related impacts, pollutant identification, and source identification and management actions. These types of studies are summarized in the following sections.

4.1.1 Pollutant Confirmation and Characterization

When the analyses described in Section 3.2 indicate that pollutants are a likely cause of an SQO exceedance at a station, a variety of tools can be used to determine whether the reason for the narrative objective not being met is due to generic stressors other than toxic pollutants, such as physical alterations or other pollutant-related stressors. Physical disturbances, such as decreased salinity, dredging impacts, and grain size, are confounding factors that may produce conditions mimicking the effects of pollutants. In these cases, the benthic community LOE will indicate degradation, but the toxicity and chemistry LOEs may not. Pollutant-related stressors, such as ammonia, TOC, nutrients, and pathogens, may also be confounding factors. In these cases, the benthic community LOE will indicate degradation, toxicity may be indicated, and chemical concentrations will be low. To determine whether a station is impacted from toxic pollutants, one or more of the following tools may be included in the stressor identification analysis as part of the confirmation:

- Evaluate the spatial extent of the area of concern in relation to anthropogenic sources.
- Evaluate the body burden of the pollutants accumulated in the animals used for exposure testing.
- Evaluate the chemical constituent results in relation to the mechanistic benchmarks.
- Compare chemistry and biology LOE to determine whether correlations exist.
- Alternative biological assessment, such as bioaccumulation experiments, pore water toxicity, or pore water chemistry analyses, may be conducted.
- Phase I TIEs, which are often useful in determining the causative agent or class of compounds causing toxicity may be conducted.

According to the SQO guidelines, "If there is compelling evidence that the SQO exceedances contributing to a receiving water limit exceedance are not due to toxic pollutants, then the assessment area shall be designated as having achieved the receiving water limit."

4.1.2 Pollutant Identification

Pollutant identification investigations may be conducted using one or more of the following types of data: statistical, biological, or chemical investigation data. These investigations should be station-specific and should be based on:

- Correlations between individual chemicals and biological endpoints.
- Gradient analysis of chemical concentrations and the biological responses in comparison to distance from a chemical hotspot.
- Additional TIE procedures.
- Sediment pore water investigations into the bioavailability of pollutants (e.g., acid-volatile sulfides and simultaneously extracted metals [AVS:SEM] analysis, solid phase microextraction [SPME], and/or laboratory desorption studies.
- Verification studies such as spiking or in situ toxicity and bioaccumulation studies.

In cases where stressor identification studies conducted on stations categorized as Possibly Impacted are inconclusive, the Copermittees may iplement a one-time augmentation to the study or suspend stressor identification studies in favor of additional routine SQO monitoring.

4.1.3 Pollutant Source Identification and Management

Stressor identification studies should include determinations of whether sources are ongoing or legacy and determinations of the number and nature of ongoing sources. If a single or multiple dischargers are responsible for stressor pollutant discharges, the discharger(s) may need to address the SQO exceedance and to reduce the pollutant loading.

According to Section VII.H of the Sediment Control Plan, the San Diego RWQCB may develop station-specific sediment management guidelines to estimate the level of the stressor pollutant in order to meet the SQOs. Guideline development should be initiated only following identification of the stressor, and should have an overall goal of establishing a relationship between the organism's exposure and the biological effect. Upon establishing this relationship, a pollutant-specific guideline may be designated that corresponds with minimum biological effects. Approaches that can be used to establish relationships between exposure and biological effect include the following: correspondence with sediment chemistry, correspondence with bioavailable pollutant concentration, correspondence with tissue residue, and literature review. Additionally, the Sediment Control Plan states that the chemistry LOE, "including the threshold values (e.g. CSI and CALRM) shall not be used for setting cleanup levels or numeric values for technical TMDLs."

5.0 REPORTING

Provision D.1.e.(2)(c) of the Permit requires incorporation of Sediment Monitoring Report into the WQIP Annual Report. The Sediment Monitoring Report will contain an evaluation, interpretation, and tabulation of monitoring data, including an assessment of whether receiving water limits outlined in the Permit were attained; a sample location map; and a statement of certification that monitoring data and results have been uploaded into CEDEN.

Based on the conclusions of the Sediment Monitoring Report, a human health risk assessment may be necessary based on the Sediment Monitoring Report conclusions in order to determine whether human health objectives have been obtained at each sample location. Provision A.2.a.(3)(b)(ii) states that "pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health." The potential risk assessments must consider any relevant information, such as guidelines set forth in the CA EPA's Office of Environmental Health Hazard Assessment (OEHHA) fish consumption policies, CA EPA's Department of Toxic Substances Control (DTSC) risk assessment, and the USEPA human health risk assessment policies.

Since the WQIPs are still in development and there will be not WQIP Annual Reports in 2015, the Copermittees will include the Sediment Monitoring Report with the Transitional Monitoring and Assessment Report due to the San Diego RWQCB on January 31, 2015. The Sediment Monitoring Report will include the results from the 2013 Bight Program and any follow-up monitoring collected in 2014 to satisfy Provisions D.1.e.(1)(b) and D.1.e.(2) of the Permit. Additional sediment quality monitoring or stressor identification studies conducted after 2014 will be included in the WQIP Annual Reports.

6.0 SCHEDULE

The schedule for completing the sediment quality monitoring requirements of the Permit and for submitting the Sediment Monitoring Report is shown in Table Error**! No text of specified style in document.**-11:

Table Error! No text of specified style in document.**-11. Sediment Monitoring Plan Schedule**

Activity/Deliverable	Dates(s)
San Diego RWQCB Order No. R9-2013-0001	Adopted May 8, 2013 and effective June 27, 2013
Southern California Bight Regional Monitoring Program	August-September 2013
Draft Sediment Monitoring Plan	September 2014
Draft Sediment Monitoring QAPP	September 2014
Final Sediment Monitoring Plan	November 2014
Final Sediment Monitoring QAPP	November 2014
Follow-up confirmation monitoring	TBD
Final Sediment Monitoring Plan incorporated into WQIPs	December 2014
Draft Sediment Monitoring Report	Summer 2015
Final Sediment Monitoring Report incorporated into appropriate WQIP Annual Report	December 2015
Potential Stressor ID Studies	TBD
Potential Human health risk assessment	TBD

7.0 REFERENCES

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Appendix A

Water Quality Control Plan for Enclosed Bays and Estuaries - Part 1 Sediment Quality

Appendix B

Sediment Monitoring Plan QAPP

ATTACHMENT C. CHOLLAS CREEK TMDL MONITORING PLAN

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DRAFT
CHOLLAS CREEK
DIAZINON AND DISSOLVED METALS TMDL
AND BACTERIA TMDL
2014-2015 MONITORING PLAN

Submitted to:
City of San Diego

Submitted by:
AMEC Environment & Infrastructure, Inc.
San Diego, California

May 2014

AMEC Project No. 5025141073

IMPORTANT NOTICE

This report was prepared exclusively for the City of San Diego by AMEC, Inc. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
303(d) List	Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments
AMEC	AMEC Environment and Infrastructure, Inc.
ASAP	as soon as possible
AVB	area velocity bubbler
Bacteria TMDL	*A Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) to Incorporate Revised Total Maximum Daily Loads for Indicator Bacteria Project I-Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek)*
Basin Plan	Water Quality Control Plan for the San Diego Basin
BMP	best management practice
BPA	Basin Plan Amendment
Caltrans	California Department of Transportation
CD	compact disk
CFU	Colony-forming Units
Chambers	Chambers Group, Inc.
City	City of San Diego
CLRP	Comprehensive Load Reduction Plan
cm	centimeters
COC	chain of custody
CTL(1)	Chollas Creek Tidal Compliance Monitoring Location
CTR	California Toxics Rule
CWA	Clean Water Act
Diazinon TMDL	Investigation Order No. R9-2004-00277, California Department of Transportation and San Diego Municipal Separate Storm Sewer system Copermittees Responsible for the Discharge of Diazinon into the Chollas Creek HSA, San Diego, California
Dissolved Metals TMDL	Resolution No. R9-2007-0043, A Resolution Adopting an Amendment to the Water Quality Control Plan for the San Diego Basin (9) to Incorporate Total Maximum Daily Loads for Dissolved Copper, Lead and Zinc in Chollas Creek, Tributary to San Diego Bay (approved under State Water Resources Control Board Resolution No. 2008-0054)
DPR3	South Chollas Creek Mass Loading Station
DQO	data quality objective
e	exponential
EDD	Electronic data deliverable
e.g.	*exempli gratia* (for example)
EPA	United States Environmental Protection Agency
FIB	Fecal Indicator Bacteria
ft	feet
GCMS	gas chromatography mass spectrometer
GIS	Geographic Information Systems
HCl	hydrochloric acid
HNO_3	nitric acid
H_2SO_4	sulfuric acid
HVF	head versus flow

Acronyms and Abbreviations (Cont.)

ID	identification
JHA	job hazards analysis
L	liter
LA	Load Allocation
LCS	laboratory control sample
LWA	Larry Walker and Associates
ln	natural logarithm
mA	milliampere
MDL	method detection limit
mg	milligrams
mL	milliliters
MLS	mass loading station
MOU	Memorandum of Understanding
MPN	Most Probable Number
mS	milli Siemens
MS	matrix spike
MS4	Municipal Separate Storm Sewer System
MSD	matrix spike duplicate
NA	not applicable
Nautilus	Nautilus Environmental
ng	nanograms
No.	number
NTU	Nephelometric Turbidity Units
NWS	National Weather Service
O&M	operations and maintenance
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
*.pdf	Portable Document Format
pH	potential Hydrogen
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
REC-1	Water contact recreation
RL	reporting limit
RPD	relative percent difference
SCCWRP	Southern California Coastal Water Research Project
SD8(1)	North Chollas Creek Mass Loading Station
SDRWQCB	San Diego Regional Water Quality Control Board
SIM	selective ion monitoring
SM	Standard Method
SOP	Standard Operating Procedure
SRM	Standard Reference Material

Acronyms and Abbreviations (Cont.)

State Board	State Water Resources Control Board
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TBD	To Be Determined
Tetra Tech	Tetra Tech, Inc.
TIE	toxicity identification evaluation
TMDL	total maximum daily load
TU	toxicity units
µS	micro Siemens
µS/cm	micro Siemens per centimeter
µg	micrograms
USEPA	United States Environmental Protection Agency
VDC	volts direct current
Weck	Weck Laboratories, Inc.
WLA	Waste Load Allocation
WQO	water quality objective
WURMP	HSA Urban Runoff Management Plan

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1.0 PROJECT DESCRIPTION

1.1 Purpose

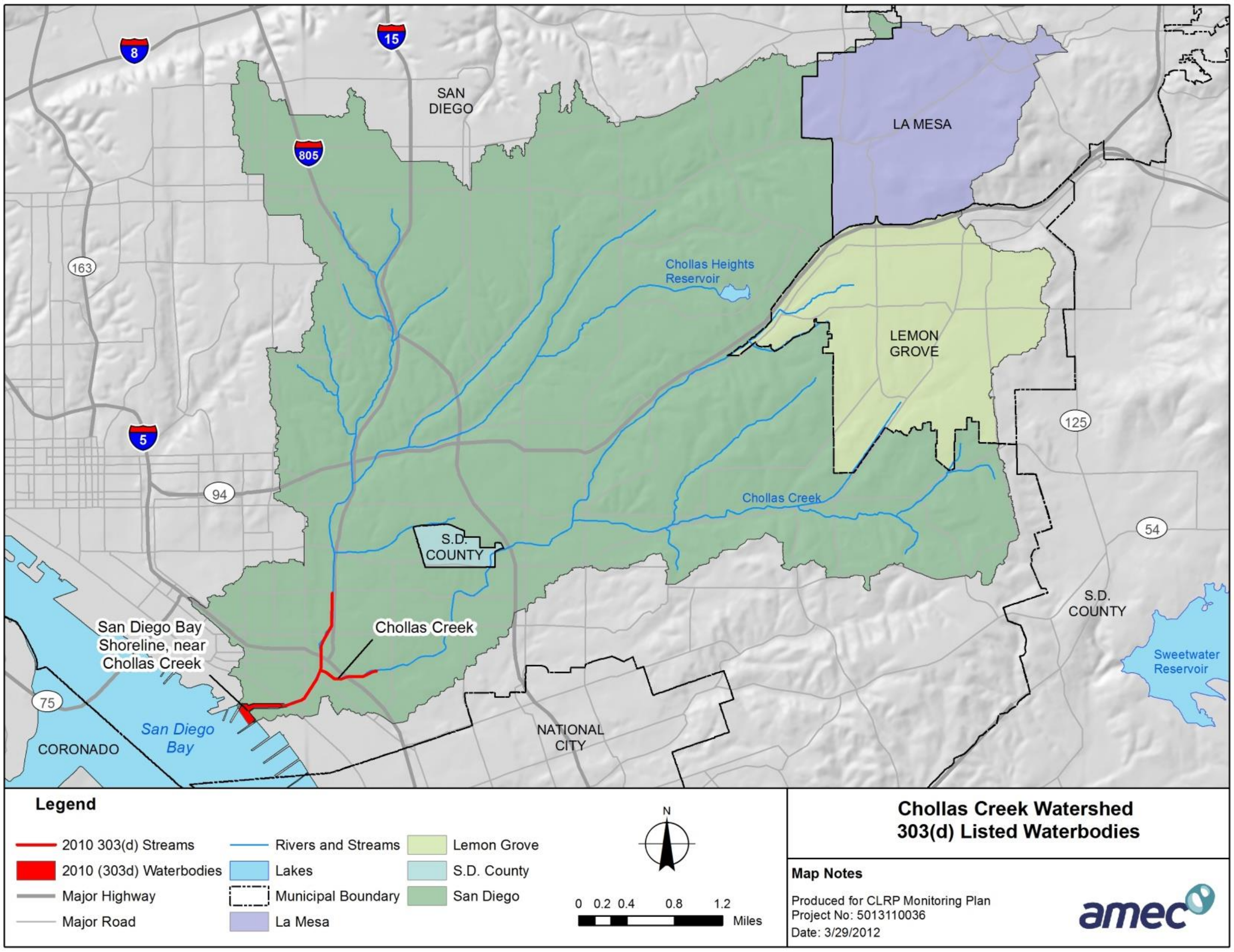
The purpose of this monitoring plan is to perform total maximum daily load (TMDL) water quality monitoring during the 2014-2015 wet weather season in Chollas Creek. This monitoring plan has included provisions to aid in attaining the TMDL monitoring requirements of the recently adopted *National Pollutant 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, herein referred to as the MS4 Permit (SDRWQCB, 2013). Monitoring will generate data to support the Chollas Creek Contaminate Load Reduction Plan (CLRP).

1.2 Chollas Creek Hydrologic Subarea

The Chollas Creek hydrologic subarea (HSA) encompasses approximately 18,000 acres of mainly urbanized land located southeast of downtown San Diego, in the San Diego Mesa Hydrologic Area, and within the larger Pueblo San Diego Hydrologic Unit. Land use in the Chollas Creek HSA is predominantly composed of residential (48 percent) road (20 percent), and open space (9 percent) land uses. The remaining HSA land uses consist of office/institutional (6 percent), freeway (5 percent), commercial (4 percent), industrial (3 percent), and other miscellaneous land uses.

The creek includes two main tributaries, the north fork and the south fork. The drainage area of the northern fork (i.e., 8,794 acres) of the HSA is larger than that of the southern fork (i.e., 7,575 acres). The headwaters of the north fork originate approximately 1.5 miles west of the jurisdictional boundary of the City of La Mesa. From this point, the north fork flows in a southwesterly direction for approximately 3 miles before it is joined by several smaller tributaries, which feed into the main stem of the creek. The creek then flows in a southerly direction for approximately 1.5 miles before discharging into San Diego Bay. The south fork of Chollas Creek flows in a west–southwesterly direction from its headwaters in the City of Lemon Grove and is the product of two smaller creek branches. The north and south fork of Chollas Creek merge approximately 0.8 miles east of the creek's mouth at San Diego Bay, in a tidally influenced section of the creek. Figure 1-1 presents the Chollas Creek HSA.

Figure 1-1. Chollas Creek Hydrologic Subarea



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1.3 TMDL Background

The San Diego Regional Water Quality Control Board (SDRWQCB) has issued the following resolutions and investigative orders in the Chollas Creek Hydrologic Subarea (HSA):

- Investigation Order No. R9-2004-00277, California Department of Transportation (Caltrans) and San Diego Municipal Separate Storm Sewer System (MS4) Copermittees Responsible for the Discharge of Diazinon into the Chollas Creek Watershed, San Diego, California, herein referred to as the Diazinon Total Maximum Daily Load (TMDL).
- Resolution No. R9-2007-0043, A Resolution Adopting an Amendment to the Water Quality Control Plan for the San Diego Basin (9) to Incorporate TMDLs for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay (approved under State Water Resources Control Board Resolution No. 2008-0054), herein referred as the Dissolved Metals TMDL.
- Resolution No. R9-2010-0001, A *Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) to Incorporate Revised TMDLs for Indicator Bacteria Project I-Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek),* herein referred to as the Bacteria TMDL.

Sediments in San Diego Bay near the mouth of Chollas Creek are on the 303(d) list for benthic community effects and sediment toxicity (SWRCB, 2010). These issues are being addressed through the development of TMDLs for polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and chlordane, and are not addressed in this monitoring plan. Table 1-1 presents the water bodies in the Chollas Creek HSA that have been placed on the 2010 State Board's Section 303(d) List. Beneficial uses within the Chollas Creek HSA, as designated by the State Water Resources Control Board's (State Board) San Diego Region Basin Plan (Basin Plan) for surface waters, are provided in Table 1-2.

Table 1-1. TMDL Pollutants and Other 303(d) Listed Constituents

Water body	TMDL Pollutants[(a) (b) (c)]	Other 303(d) Listed Constituents[(d)]
Chollas Creek	Indicator bacteria, dissolved copper, dissolved lead, dissolved zinc, diazinon	Total nitrogen and trash
San Diego Bay Shoreline, near Chollas Creek (Mouth of Chollas Creek)	-	Benthic community effects and sediment toxicity[(c)]

Note:
(a) Source: California RWQCB, San Diego Region. Resolution No. R9-2010-0001.
(b) Source: California RWQCB, San Diego Region. Resolution No. R9-2007-0043.
(c) Source: California RWQCB, San Diego Region. Resolution No. R9-2004-00277.
(d) Source: USEPA, 2010; Integrated Report (CWA, 303(d) List / 305(b) Report).

Table 1-2. Beneficial Uses Listed in Basin Plan

Inland Surface Water	Hydrologic Unit Basin Number	Municipal and Domestic Supply (MUN)	Contact Recreation (REC1)	Non-Contact Recreation (REC2)	Warm Freshwater Habitat (WARM)	Wildlife Habitat (WILD)
Chollas Creek	908.22	+	○	●	●	●

Notes:
Source: Basin Plan = Water Quality Control Plan for the San Diego Basin (9) (San Diego RWQCB, 2007).
● Beneficial use
○ Potential beneficial use
+ Indicates that the water body has been exempted by the Regional Board from the municipal use designation under the terms and conditions of State Board Resolution No. 88-63, *Sources of Drinking Water Policy*.

Chollas Creek was placed on the Clean Water Act Section 303(d) list in 1996 for toxicity, cadmium, copper, lead, and zinc due to exceedances of the Water Quality Control Plan for the San Diego Region (Basin Plan) water quality objectives (WQOs) and California Toxics Rule (CTR) water quality criteria (SDRWQCB, 2007b; USEPA, 2000). Results from toxicity identification evaluations (TIEs) indicated that the insecticide diazinon in part caused toxicity in Chollas Creek during storm events. As a result, a TMDL for diazinon was developed and was adopted in 2002 for toxicity in urban storm water flows under Resolution No. R9-2002-0123 (SDRWQCB, 2002). Based on further review of storm water data cadmium was delisted in 2006. The copper, lead, and zinc 303(d) listings were addressed through The Chollas Creek Dissolved Metals TMDL which was adopted in 2007 under Resolution No. R9-2007-0043 (SDRWQCB, 2007a). The monitoring requirements and management program for diazinon and dissolved metals in Chollas Creek are outlined in Investigation Order No. R9-2004-0277(SDRWQCB, 2004). The water quality criteria which will be used to determine compliance with the diazinon and dissolved metals TMDLs in Chollas Creek are provided in Table 1-3.

Table 1-3. Water Quality Criteria for Dissolved Metals in Chollas Creek

Metal	Numeric Target for Acute Conditions: Criteria Maximum Concentration	Numeric Target for Chronic Conditions: Criteria Continuous Concentration
Diazinon	0.072 µg/L	0.045 µg/L
Copper	(1) * (0.96) * {e^ [0.9422 * ln (hardness) - 1.700]}	(1) * (0.96) * {e^[0.8545 * ln (hardness) - 1.702]}
Lead	(1) * {1.46203 – [0.145712 * ln (hardness)]} * {e^ [1.273 * ln (hardness) - 1.460]}	(1) * {1.46203 – [0.145712 * ln (hardness)]} * {e^[1.273 * ln (hardness) - 4.705]}
Zinc	(1) * (0.978) * {e^ [0.8473 * ln (hardness) + 0.884]}	(1) * (0.986) * {e^[0.8473 * ln (hardness) + 0.884]}

Notes:
Hardness expressed in mg/L.
Calculated concentrations should have two significant figures.

The Bacteria TMDL is based on the 2002 303(d) List which indicated that the greatest cause of water body impairments in the San Diego Region was due to elevated bacteria levels. Per the Bacteria TMDL, impaired waters were given a priority number of 1, 2, or 3 with 1 being the highest priority. The prioritized list identifies segments or areas where bacterial water quality improvements are most likely to occur first (Priority 1), and segments or areas where bacterial water quality improvements are most likely to require more time to accomplish (Priority 3). Priority 1 waters also include water bodies likely to be removed from the CWA Section 303(d) List. Chollas Creek is listed as Priority 3. The ultimate goal of the Bacteria TMDL analysis is to achieve the necessary pollutant load reductions to restore and protect designated beneficial uses, particularly water contact recreation (REC-1).

The Bacteria TMDL defines the numeric targets and WLAs for the RAs. Data collected will be utilized to evaluate progress and attainment of TMDL targets and WLAs. Tables 1-4 and 1-5 provide the numeric targets, WLAs, and LAs for the Chollas Creek HSA per the Bacteria TMDL.

Table 1-4. Numeric Targets for Bacteria TMDL

Parameter	Dry Weather[(a)]		Wet Weather[(b)]	
	WQO (MPN/100mL) [(c)]	Allowable Exceedance[(c)]	WQO (MPN/100mL) [(d)]	Allowable Exceedance[(e)]
Enterococcus	33	0%	61	22%
Fecal Coliform	200	0%	400	22%

Notes:
mL = mililiters
MPN = Most Probable Number

- Source (including footnotes): California RWQCB, San Diego Region. Resolution No. R9-2010-0001.
- Dry weather days defined as days with less than 0.2 inch of rainfall observed on each of the previous 3 days.
- Wet weather days defined as days with rainfall events of 0.2 inches or greater and the following 72 hours.
- Dry weather numeric objectives based on the 30-day geometric mean (or equivalent) water quality objectives in Water Quality Control Plan for the San Diego Basin (1994). Compliance with the dry weather TMDLs in the receiving water is based on the frequency that the dry weather days in any given year exceed the dry weather numeric objective.
- Wet weather numeric objectives based on the single sample maximum (or equivalent) water quality objectives in the Water Quality Control Plan for the San Diego Basin (1994). Compliance with the wet weather TMDLs in the receiving water is based on the frequency that the wet weather days in any given year exceed the wet weather numeric objective, but 30-day geometric mean must also be met.
- The wet weather allowable exceedance frequency is set at 22%. In the calculation of the wet weather TMDLs, the San Diego Regional Board chose to apply the 22 percent allowable exceedance frequency as determined for Leo Carillo Beach in Los Angeles County. At the time the wet weather HSA model was developed, the 22 percent exceedance frequency from Los Angeles County was the only reference beach exceedance frequency available. The 22 percent allowable exceedance frequency used to calculate the wet weather TMDLs is justified because the San Diego Region HSAs' exceedance frequencies will likely be close to the value calculated for Leo Carillo Beach, and is consistent with the exceedance frequency that was applied by the Los Angeles Regional Board.

Table 1-5. Indicator Bacteria TMDL for Chollas Creek

Pollutant	TMDLs, WLAs & LAs for Controllable Sources (Billion MPN/Year)				
	Total HSA TMDL[(a)]	MS4 WLA[(b)]	Caltrans WLA[(c)]	Agriculture LA[(d)]	Open LA[(e)]
Dry Weather					
Enterococcus	66	66	0	0	0
Fecal Coliform	398	398	0	0	0
Total Coliform	1,991	1,991	0	0	0
Wet Weather					
Enterococcus	1,152,645	802,918	2,062	0	347,665
Fecal Coliform	520,440	252,479	892	0	267,070
Total Coliform	13,247,626	9,880,784	46,652	0	3,321,191

Notes:

Source: California RWQCB, San Diego Region. Resolution No. R9-2010-0001.

- TMDLs, WLAs, and LAs calculated based on numeric targets and percent allowable exceedance frequency. Meeting the numeric targets in the discharge and/or RW indicate the TMDLs, WLAs, and/or LAs have been met.
- MS4 WLA = Point source WLA for discharges from Municipal MS4 land uses.
- Caltrans WLA = Point source WLA for discharges from Caltrans land uses, assumed to be equal to the Caltrans Existing Load.
- Agriculture LA = Non-point source LA for discharges from Agriculture land uses, assumed to be equal to the Agriculture Existing Load.
- Open Space LA = Point source WLA for discharges from Open Space land uses, assumed to be equal to the Open Space Existing Load.

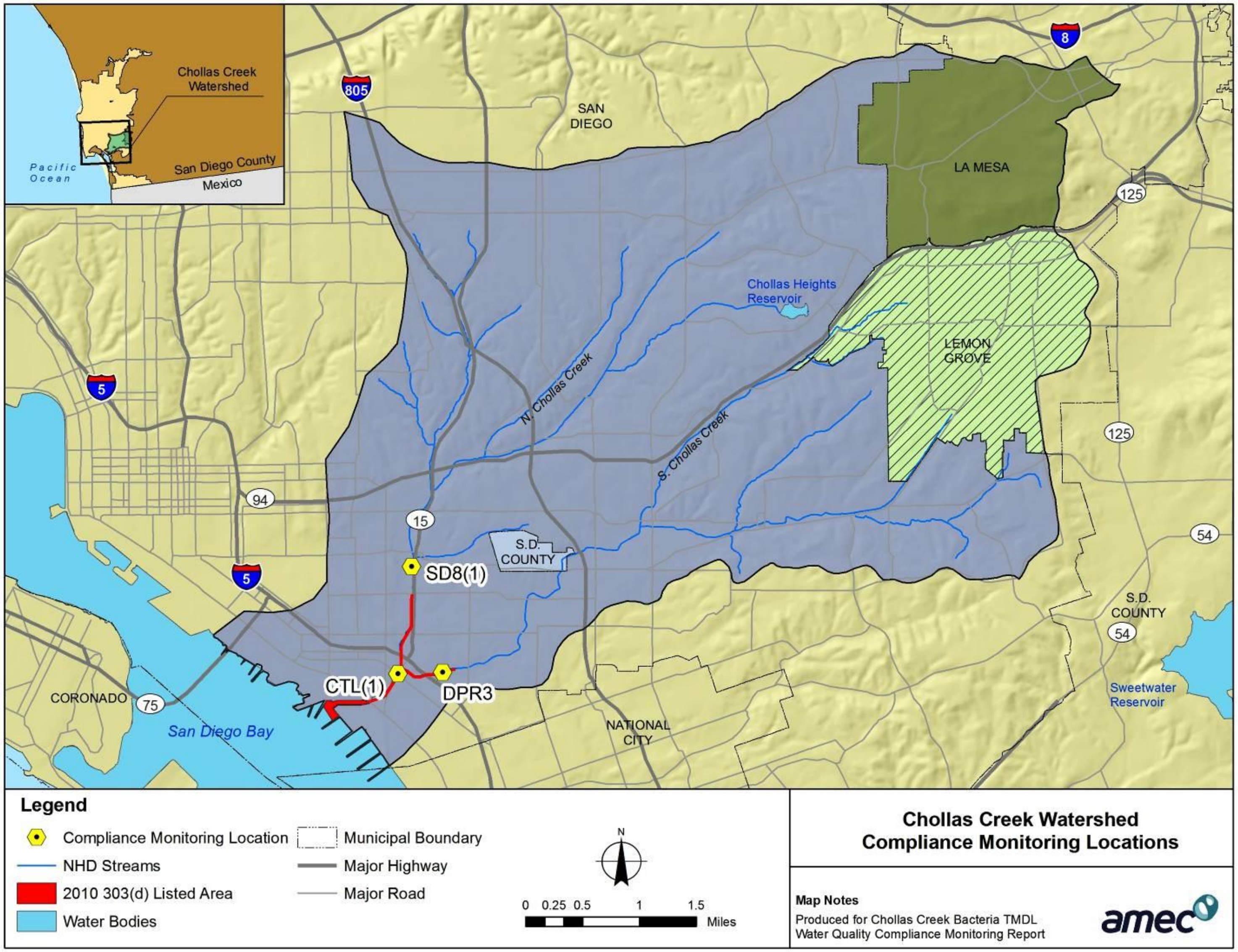
Attainment of the TMDLs in the receiving water is based on the frequency that the dry or wet weather days in any given year exceed the respective numeric objective. For dry weather, the TMDL numeric target is based on the geometric mean water quality objective and a 0 percent allowable exceedance frequency as presented in Table 1-4. The “existing” dry weather exceedance frequencies for impaired water bodies will be calculated using the available historical data from the years 1996 to 2002 per the Bacteria TMDL. For wet weather, the TMDL numeric target is based on the single-sample maximum and an allowable exceedance frequency of 22 percent as well as the geometric mean as presented in Table 1-4. The Bacteria TMDL provides a modeled estimate of the “existing” wet weather exceedance frequency for Chollas Creek HSA. RAs will compare the “existing” exceedance frequencies for dry and wet weather to the mandated frequency reductions in order to evaluate progress toward attaining the TMDL.

1.4 Monitoring Programs

This monitoring plan includes two primary scopes of work as detailed below. The monitoring locations are provided in Figure 1-2.

- Diazinon and Dissolved Metals Compliance Monitoring is presented in Section 2. Monitoring will be conducted at DPR3 and SD8(1)
- Bacteria Compliance Monitoring is presented in Section 3. Monitoring will be conducted at DPR3, SD8(1), and CTL (1).

Figure 1-2. Chollas Creek Monitoring Locations



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1.5 Project Organization

The approved Chollas Creek TMDLs identify Responsible Agencies (RAs). The RAs are collaborating on the implementation of the monitoring programs. The RAs, excluding owners and operators of small MS4s, are:

- City of San Diego (Lead Agency)
- City of La Mesa
- City of Lemon Grove
- San Diego County
- San Diego Unified Port District
- Caltrans
- United States Navy (Diazinon and Dissolved Metals TMDL only)

The City of San Diego (City) is the municipal government agency overseeing this project.

- Ruth Kolb is the Program Manager with the City of San Diego Storm Water Division.
- Andre Sonksen is the City of San Diego Project Manager. The Chollas Creek TMDL organization structure is provided in Figure 1-3.

AMEC Environment & Infrastructure, Inc. (AMEC) is the consultant hired by the City of San Diego to perform work for the Chollas Creek Monitoring Program.

- Tommy Wells is the Project Manager for AMEC and will be responsible for project coordination, scheduling, budget management, and oversight of project plans and deliverable development.
- Roshan Christoph is the AMEC Assistant Project Manager and will provide technical oversight and leadership of the Bacteria TMDL sampling and reporting.
- Claire Johnson is the AMEC Sampling Manager and Laboratory Coordinator. She will be responsible for implementing the monitoring activities.
- John Brandt is the AMEC Quality Assurance Officer and will be responsible for the project quality assurance and quality control procedures implemented during sampling, laboratory analysis, data management, and data analysis.
- Jesse Davis is the AMEC Health and Safety Officer and will be responsible for implementation of the project Health and Safety Plan and practices.
- William Szafranski will be responsible for developing and maintaining a database of project data.
- Darcy Ebentier is the AMEC Reporting Manager.

Weck Laboratories, Inc. (Weck) will be responsible for the analysis of the water quality samples with the exception of toxicology analyses.

- Hai Van Nguyen is the Weck Laboratory Project Manager and will be responsible for the proper analysis of samples in accordance with the methods and quality assurance requirements outlined in this monitoring plan.

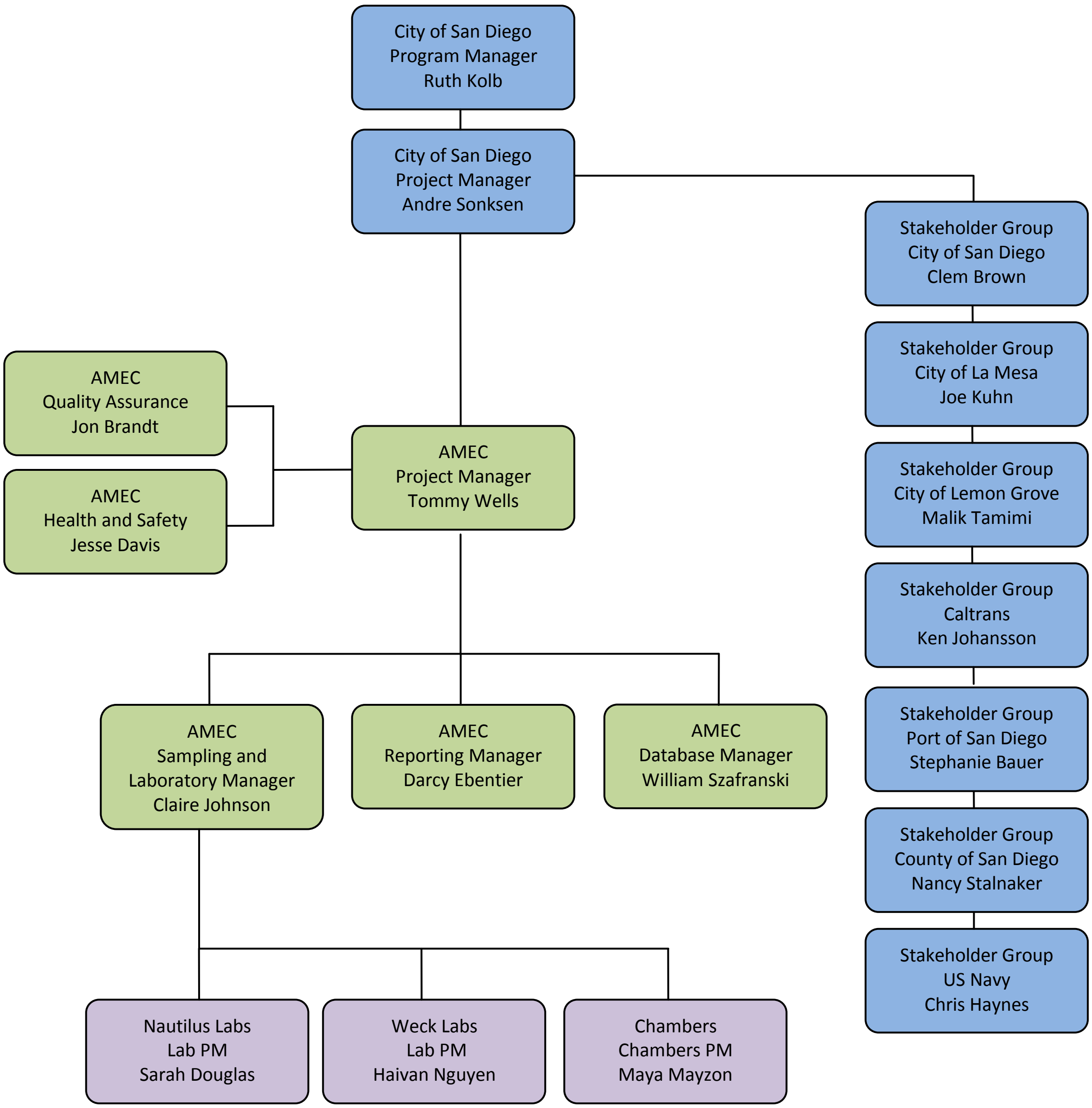
Nautilus Environmental (Nautilus) is responsible for toxicology analyses of program water samples.

- Sarah Douglas is the Nautilus Environmental Project Manager and will be responsible for the proper analysis of samples in accordance with the methods and quality assurance requirements outlined in this monitoring plan.

Chambers Group, Inc. (Chambers) will be responsible for providing field support during equipment installation and removal, maintenance, and storm event monitoring.

- Maya Mazon is the Chambers Project Manager and will be responsible for coordination of field support staff.

Figure 1-3. Organizational Chart



2.0 DIAZINON AND DISSOLVED METALS TMDL COMPLIANCE MONITORING

2.1 Analytes

Water quality samples collected at the Chollas TMDL MLSs monitoring sites will be analyzed for general chemistry, metals, synthetic organics, and toxicity during wet weather events. Additionally, *in-situ* field measurements will be collected during wet weather events. *In-situ* field measurements are presented in Table 2-1. Analytical constituents, methods, method detection limits (MDLs), and target reporting limits (RLs) are provided in Table 2-2. A comprehensive list of MDLs and RLs for organics is presented in Appendix A.

Wet weather water quality samples will be collected as flow-weighted composites, i*n-situ* field measurements will be recorded once during the monitored storm events.

Table 2-1. Field Measurements

Constituent	Method	Range	Units
Conductivity	Field Meter	0 to 200,000	microSiemens per centimeter (µS/cm)
pH	Field Meter	0 to 14	pH units
Temperature	Field Meter	-5 to +75 °C	Degrees Celsius (°C)

Table 2-2. List of Constituents

Analyte	Method	MDL	RL	Units
General Chemistry				
Chloride	EPA 300.0	0.10	0.50	milligrams per liter (mg/L)
Sulfate	EPA 300.0	0.10	0.50	mg/L
Total Calcium	EPA 200.7	0.016	0.10	mg/L
Total Magnesium	EPA 200.7	0.012	0.10	mg/L
Dissolved Organic Carbon	SM 5310C	0.013	0.30	mg/L
Total Organic Carbon	SM 5310C	0.0090	0.30	mg/L
Total and Dissolved Metals				
Copper, Dissolved	EPA 200.8	0.022	0.50	micrograms per liter (µg/L)
Copper, Total	EPA 200.8	0.022	0.50	µg/L
Lead, Dissolved	EPA 200.8	0.017	0.20	µg/L
Lead, Total	EPA 200.8	0.017	0.20	µg/L
Zinc, Dissolved	EPA 200.8	0.30	5.0	µg/L
Zinc, Total	EPA 200.8	0.30	5.0	µg/L
Organics				
Organophosphorus Pesticides	EPA 625 modified low level	varies[(a)]	varies[(a)]	µg/L
Organochlorine Pesticides/PCBs	EPA 608 low-level	varies[(a)]	varies[(a)]	nanograms per liter (ng/L)
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 8270C-SIM	varies[(a)]	varies[(a)]	µg/L
PCB Congener	GCMS SIM	5.0 ng/L	10 ng/L	ng/L
Toxicity				
Ceriodaphnia dubia 96-hour acute static-renewal test	EPA/821/R-02/012, Oct-02	NA	NA	TU_a
Ceriodaphnia dubia 7-day chronic static-renewal test	EPA/821/R-02/012, Oct-02	NA	NA	TU_c

Notes:

(a)	See Appendix A for MDL and RL.
MDL	Method Detection Limit
RL	Reporting Limit
SM	Standard Method
EPA	United States Environmental Protection Agency
NA	Not Applicable
TU	Toxicity Units, a = acute, c = chronic
GCMS	Gas Chromatography Mass Spectrometer
SIM	Selective Ion Monitoring

2.1.1 Holding Times, Sample Times, and Preservation Requirements

Sample containers and preservation methods have been confirmed with the laboratories and are presented in Table 2-3.

Chains-of-Custody (COCs) will be pre-printed along with the bottle labels. The COCs will contain at a minimum the same data as the sample labels. The COCs 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.

Transport of the samples will be coordinated with the laboratories by the Sampling Manager. The COCs will be reviewed by personnel at the receiving laboratory to verify that stated samples are accounted for, preservation requirements have been met, analysis requirements are clearly detailed, and the holding times are remaining.

Table 2-3. Sample Volumes, Containers, Preservations, and Holding Times

Analyte	Container	Sample Volume	Preservation	Holding Time
General Chemistry				
Chloride	19-Liter (L) glass bottle	300 milliliters (mL)	<4°C; store in the dark	28 days
Sulfate		300 mL	<4°C; store in the dark	28 days
Total Hardness as Calcium and Magnesium		300 mL	<4°C; store in the dark; Acidify with HNO_3 to pH<2	6 months
Total Organic Carbon		40 mL	<4°C; store in the dark; pH < 2 with HCl or H_2SO_4	28 days
Dissolved Organic Carbon		40 mL	<4°C; store in the dark	28 days
Total and Dissolved Metals				
Copper	19-L glass bottle	360 mL	<4°C; store in the dark; Acidify to pH<2 with pre-tested HNO_3 ASAP	48 hours to filter and preserve/ 6 months to analyze
Lead				
Zinc				
Synthetic Organics				
Organochlorine Pesticides/PCBs	19-L glass bottle	1 L[(a)]	Cool to ≤4°C in the dark; pH 5-9.	7 Days Extraction/ 40 Days Analysis
Organophosphorus Pesticides		1 L[(a)]	Cool to ≤4°C in the dark; pH 5-9.	7 Days Extraction/ 40 Days Analysis
Polynuclear Aromatic Hydrocarbons		1 L[(a)]	Cool to 4°C in the dark.	7 Days Extraction/ 40 Days Analysis
PCB Congeners		1 L[(a)]	Cool to 4°C in the dark.	7 Days Extraction/ 40 Days Analysis
Toxicity				
Ceriodaphnia dubia 96-hour acute static-renewal test	19-L glass bottle	2.5 L	<4°C in the dark	48 hours
Ceriodaphnia dubia 7-day chronic static-renewal test		2.5 L	<4°C in the dark	48 hours

Notes:
a. Additional sample volume may be required for QC samples.

2.1.2 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
- Site ID Number
- Bottle __ of __ (for multi-bottle samples)
- Collected by __
- Analysis

Field samples will be labeled as described below. These samples will be labeled, recorded on the COC form, and then transported to the analytical laboratory.

Each water sample collected will receive a unique alphanumeric code (Sample ID Number) for tracking. This code will be standardized for water quality samples and will contain information as it relates to the site, event, and type of sample. The required sample identification numbers, applicable to water quality samples, are listed below. Example identification numbers are shown in Table 2-4:

- Monitoring Year
  - 2014 = 2014-2015 Wet weather season
- Event Number
  - W1 = Wet Weather Event 1
  - W2 = Wet Weather Event 2
  - W3 = Wet Weather Event 3
- Site ID
  - Alphanumeric unique ID
- Sample Code
  - C = Composite sample
- Sample Type
  - 01 = Primary sample

Table 2-4. Example Sample Identification Numbers

Sample ID	Description			
	Sample Type	Site ID	Event	Sample Type
2014-W1-SD8(1)-C-01	Composite Sample	SD8(1)	2014-2015 Season Wet Weather Event 1	Primary Sample

2.1.3 Laboratory Data Package Deliverables

Laboratories will aim to provide a three-week turnaround on the deliverable package per event. The deliverable package will include a hard copy and electronic data files. The hard copy will include standard narratives identifying analytical inconsistencies, Quality Assurance / Quality Control (QA/QC) exceedances, and corrective actions. The electronic data files will be submitted in a Surface Water Ambient Monitoring Program (SWAMP) compatible format (SWRCB, 2008) and will contain the same information found in the hard copy reports submitted by the laboratory. Individual data sets may be submitted to the consultant as either Microsoft Excel workbook files or as Microsoft Access database files.

2.1.4 Laboratory Selection

Weck Laboratories, Inc., located in the City of Industry, California, will be providing laboratory services for this project, including analytical testing for water quality constituents except toxicology samples.

Weck Laboratories Inc.
14859 East Clark Avenue
City of Industry, California 91745
Office: (626) 336-2139
Fax: (626) 336-2634

Nautilus Environmental, located in San Diego, California, will be providing toxicology laboratory services for this project.

Nautilus Environmental
4340 Vandever Avenue
San Diego, California 92120
Office: (858) 587-7333
Fax: (858) 587-6769

2.2 Monitoring

Chollas TMDL Compliance MLSs will be monitored for water quality and flow during three storm events. Monitoring will be conducted at the north fork of Chollas Creek (SD8(1)) and at the south fork of Chollas Creek (DPR3). Additionally, flow will be monitored during the wet weather season at the Compliance MLSs. Flow monitoring will be conducted at both locations from October 1, 2013, through April 30, 2014.

The sites will be monitored for the parameters listed in Table 2-1 and Table 2-2. The first two qualifying storm events after October 1, 2013 and the first qualifying storm event after February 1, 2014, will be mobilized for.

Qualifying storm events for the purposes of this project are defined as storms forecast to produce at least 0.10 inches of rainfall within a 24 hour period with at least a 72 hour antecedent dry weather period (<0.10" of rainfall in a 24 hour period). The weather forecast, forecast discussion, and quantitative precipitation forecast produced by the National Weather Service (NWS) and publically available at: http://www.wrh.noaa.gov/sgx/ will be used to determine if a storm event should be mobilized for. Antecedent rainfall conditions will be determined by review of data available from publically available NWS rain gauge data and on site rain gauge data.

2.2.1 Monitoring Locations

The Chollas TMDL MLSs are located upstream of the tidally influenced sections of Chollas Creek. The North Chollas Creek site is located in a trapezoidal concrete channel east of the intersection of 33rd Street and Durant Street. The South Chollas Creek site is located north of the intersection of Beta Street and Birch Street, in a natural bottom channel with concrete lined walls and a small concrete-lined bottom section. The monitoring site coordinates are provided in Table 2-5

Table 2-5. Chollas TMDL Mass Loading Stations

Site Name	Site ID	Latitude	Longitude
North Chollas Creek	SD8(1)	32.70493	-117.12132
South Chollas Creek	DPR3	32.69130	-117.11682

2.2.1.1 SD8(1) Mass Loading Station

The SD8(1) mass loading station is located in a trapezoidal concrete channel on North Chollas Creek. Flow will be measured at the station using an American Sigma 950 Area Velocity Bubbler (AVB) flow meter. A low profile velocity sensor and stainless steel bubbler pressure transducer will be used to measure stage and velocity in the channel.

Flow will be calculated in the flow meter using a head versus flow (HVF) table. The HVF table was developed based on a survey of channel dimensions and slope and the calculations produced using the Manning's Equation for open channel flow. The HVF table will be adjusted to produce more accurate flow estimations based on recorded channel velocities and physical gauging of the stream during low flow and high flow conditions, as available. This monitoring location is depicted in Figure 3-1.

Figure 2-1. SD8(1) Mass Loading Station

2.2.1.2 DPR3 Mass Loading Station

The DPR3[1] mass loading station is located in a relatively short section of trapezoidal concrete channel. Approximately 10 feet (ft) upstream and 10 ft downstream of the monitoring site the channel bottom is natural with concrete sides. Several large wooden posts are present embedded in the concrete near the monitoring location and reach approximately the height of the channel. These posts are remnants of a footbridge that was removed during the 2012-2013 wet weather season.

Flow will be measured at the station using an American Sigma 950 AVB flow meter. A low profile velocity sensor and stainless steel bubbler pressure transducer will be used to measure stage and velocity in the channel.

Flow will be calculated in the flow meter using a HVF[2] table. The HVF table was developed based on a survey of channel dimensions and slope and the calculations produced using the Manning's Equation for open channel flow. The HVF table will be adjusted to produce more

[1] The South Chollas Creek MLS was relocated prior to the 2011-2012 wet season downstream of the historical monitoring location. At the previous monitoring site, DPR2, located at 38th Street and Alpha Street (32.69204, -117.11233), heavy vegetation and sediment had accumulated over several years consequently reducing the accuracy of flow data obtained at this location. The current monitoring site, DPR3, has been used for numerous studies, including a 1999 Caltrans District 11 Water Quality Study (Caltrans 1999), the 2005-2007 SCCWRP Chollas Creek TMDL program (SCCWRP 2007), and the 2009-2010 City of San Diego Storm Drain Characterization Study (Tetra Tech 2010). The change of the site location was approved by the San Diego Regional Water Quality Control Board (SDRWQCB) in a letter sent to the City of San Diego on September 19, 2011.

[2] A HVF table developed by Caltrans in 1999 was used to calculate flows prior to the 2013-2014 wet weather season. However, review of aerial imagery indicated that channel conditions have likely changed significantly since this table was initially developed. Thus, an updated HVF table was created.

accurate flow estimations based on recorded channel velocities and physical gauging of the stream during low flow and high flow conditions, as available.

Figure 2-2. DPR3 Mass Loading Station

2.2.2 Water Quality Monitoring

AMEC will perform water quality monitoring at the Chollas MLSs for three storm events during the 2014-2015 wet weather monitoring period, in accordance with SDRWQCB Order No. R9-2004-0277.

Storm water monitoring will include the collection of flow-weighted composite samples to be analyzed for chemistry and toxicity parameters, as listed in Table 2-2. *In-situ* field measurements will be taken once during each storm event for pH, temperature, and conductivity. Flow monitoring will be conducted at each monitoring site to capture the event hydrograph. Rain gauges will be installed at MLS SD8(1) and MLS DPR3. In accordance with SDRWQCB Order No. R9-2004-0277, monitoring and analyses must follow the SWAMP Quality Assurance (QA) guidelines, which are presented in Section 2.5.

Water quality samples will be collected using a Hach SD900 automated peristaltic pump that is paced by the American Sigma 950 flow meter to collect samples proportional to the flow of the creek. Additional information regarding automated flow-weighted sampling equipment is presented in Section 5.

To be compatible with SWAMP, equipment blanks will be performed on 19L bottles, Teflon tubing, peristaltic tubing, and sample intake strainers. Composite sampling is not amenable to field duplicate or field blank samples. Duplicate measurement of *in-situ* parameters will be performed. As the laboratories perform sample compositing, a laboratory split duplicate sample analysis will be performed at a frequency of five percent of the total sample count. Quality control methods are describes in more detail in Section 2.5.

2.2.3 Extended Flow Monitoring

In addition to storm event monitoring, flow will be measured continuously at the two MLSs. Flow data will be logged at one-minute intervals during monitored storm events and at 15-minute intervals during non-storm events. Data will be manually downloaded and reviewed on an approximately bi-weekly basis. Additional information regarding flow monitoring equipment is presented in Section 2.3.

2.3 Field Equipment Installation, Operation, and Maintenance

2.3.1 Extended Flow Monitoring and Water Quality Monitoring Equipment

This section will describe the type of equipment that is proposed to be used to complete the Chollas Creek Monitoring Program, as well as the installation and maintenance procedures. Flow and storm water monitoring are dynamic processes which may require modification based on current site and channel conditions. Thus, the methodologies presented are subject to modification or change in order to meet the objectives of this monitoring program.

2.3.1.1 Automated Composite Sampling and Flow Monitoring Equipment

The storm water sampling equipment is designed to measure flow and collect composite samples of storm water runoff in a flow-proportioned manner. The selected equipment has been found to be appropriate to meet the project objectives and has been successfully utilized in other regional water quality monitoring studies. The equipment is automated and can be accessed remotely via telemetry if properly equipped. The use of telemetry is not proposed during the 2014-2015 wet weather season due to manufacturer upgrades currently being conducted to the telemetry system which have not been determined to be presently reliable by AMEC. However, if AMEC identifies a telemetry system that appears reliable, telemetry may be implemented during the 2014-2015 wet weather season. These features allow reductions in operating effort and increase the reliability and quality of the storm water monitoring data.

The following equipment components will be installed at the two Chollas TMDL MLSs. Equipment components will be installed prior to the beginning of the 2014-2015 wet weather season (October 1, 2014). Installed equipment will include the following:

- American Sigma 950 AVB data-logging flow meter(s).
- Hach SD900 automated composite sampler(s).
- American Sigma tipping bucket rain gauge.
- 12-VDC rechargeable gel cell power supply.
- Security Enclosure

The specific configuration at each site will be dependent on site location and access. An overview of the main flow monitoring components and other monitoring equipment is presented below.

2.3.1.2 Data-Logging Flow Meter

American Sigma 950 AVB flow meters log and calculate flow based on measured parameters. Water stage and velocity are measured with a stainless steel bubbler pressure transducer and low profile velocity sensor installed in the conveyance. A pressure transducer translates the proportional relationship of the hydrostatic pressure on a pressure plate compare to an atmospheric vent to estimate water level. Water velocity is measured using Doppler technology, which rates the velocity of particles in the water. The water must have sufficient suspended solids in order for a velocity reading to be obtained. The flow meter allows for several methods of flow estimations. This project will utilize HVF tables at the TMDL compliance sites and the area-velocity method at the Special Study sites. The flow meter allows for programming of either the HVF table or the geometry of the conveyance and, based on input from the bubbler and velocity sensors, the flow meter calculates instantaneous flow estimates. The flow meters also have inputs for a rain gauge and sampler communication.

2.3.1.3 Flow Meter Logging and Sampler Control

The data logging feature of the American Sigma 950 AVB flow meter is a required component of any flow-weighted sampling station. The American Sigma 950 AVB 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 flow levels, rainfall and sample history. One-minute average flow and rainfall data will be recorded in the flow meters during monitored storm events. During dry weather flow and non-monitored storm events, flow will be recorded every 15 minutes. The flow meters convert 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.

2.3.1.4 Automated Sampler and Associated Sampling Equipment

The Hach SD900 automated sampling system consists of an intake strainer, Teflon-lined intake tubing, flexible silicon pump tubing, a peristaltic pump, sample bottle(s), a distributor arm, and a controller. The samplers will be programmed to collect flow-weighted composite samples throughout a monitoring event.

The intake tubing and intake strainers will be securely fastened at the desired sampling point in the runoff flow stream. The intake tubing will be housed in protective conduit and then attached to the flexible silicon pump tubing at the sampler. The flexible silicon pump tubing will run through the sampler's peristaltic pump into the composite sample bottle(s).

A sample aliquot will be collected after a programmed volume of flow, referred to as the "pacing," has passed the flow monitoring point for flow-weighted sampling sites. The pacing is selected, based on forecast rainfall totals and estimated runoff volumes, so that an appropriate number of aliquots will be collected to provide sufficient sample volume. The automated sampler will be programmed to collect 500-milliliter (mL) sample aliquots in a 19-L borosilicate glass bottle. The composite sample will be analyzed for the constituents listed in Table 2-2.

2.3.1.5 Rain Gauges

An American Sigma tipping bucket rain gauge will be used to measure rainfall at each of the four monitoring sites. The rain gauge measures 0.01 inches of rain each time the tipping bucket fills and closes a switch. The data logger/controller counts each switch closure to calculate rainfall totals.

2.3.1.6 Power

The Hach SD900 automated samplers and American Sigma 950 AVB flow meters will be powered by a 12-VDC rechargeable gel cell power source.

2.3.1.7 Equipment Security Housing

Monitoring equipment will be mounted within fiberglass or metal enclosures that will be bolted to concrete or wooden monitoring foundations and locked to secure the monitoring equipment.

2.3.2 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. 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.

2.3.3 Maintenance and Calibration of Monitoring Equipment

Maintenance and calibration of monitoring equipment will be performed during installation and prior to wet weather 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.

2.4 Preparation and Logistics

2.4.1 Weather Tracking

Weather will be tracked for the duration of the 2014-2015 wet weather season from October 1, 2014, to April 30, 2015. The weather forecast, forecast discussion, and quantitative precipitation forecast produced by the National Weather Service (NWS) and publically available at: http://www.wrh.noaa.gov/sgx/ will be used to determine if a storm event should be mobilized for. Antecedent rainfall conditions will be determined by review of data available from publically available NWS rain gauge data and on site rain gauge data.

2.4.2 Storm Selection Criteria

The Chollas MLSs will be monitored for the first two storm events that meet the sampling criteria and produce sufficient flow at the monitoring locations after October 1, 2014. The third event will be the first storm event after February 1, 2015, that meets the sampling criteria and produce sufficient flow at the monitoring locations.

The sampling criteria are:

- Rainfall of a least one-tenth (0.1) of an inch in the drainage area within a 24 hour period.
- An antecedent dry period of at least 72 hours prior to the sampled event (<0.10" in 24 hours).
- A storm event within plus or minus 50 percent of the average or median storm volume and duration for the region.

Communication with the City's project manager will be made within 48 hours of the intent to monitor a storm via either phone or email. Storm event monitoring will be conducted from the onset of rainfall until stream flow returns to within approximately 10 percent of base flow or a maximum of 24 hours from the first sample aliquot time.

2.4.3 Mobilization and Staffing

Monitoring for both the flow and water quality of storm water runoff requires considerable planning prior to actual rainfall occurring. Obtaining representative samples and complete storm 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-storm mobilization team will be made up of two field individuals. A Staffing Plan, which designates personnel and equipment required for each facet of storm monitoring, will be completed for each potential monitoring event.

The Staffing Plan will 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 27 and 28, 2014.
- Christmas: December 24 and 25, 2014.
- New Year's: December 31, 2014, and January 1, 2015.

2.4.3.1 Personnel

Storm water monitoring tasks require a variety of skills and positions. The required personnel include:

- Project Manager.
- Sampling Manager.
- Field Technicians.

- ***Project Manager*** **–** During storm 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 determine the appropriate "Volume to Sample" values (volume of runoff to flow past the station prior to each sample aliquot being taken) for composite sampling, as well as to make informed decisions regarding the storm status. 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 storm water sample collection and Health and Safety issues. Field technicians may also be used as couriers.

2.4.3.2 Equipment Mobilization

Equipment needed for storm water sampling includes: sampling equipment and containers, safety equipment, personal rain gear, storm kits, and vehicles equipped with mobile communication and safety equipment (See Table 2-6). The necessary equipment should be loaded into the appropriate vehicles early in the storm preparation sequence. During the wet weather season, field crews will utilize the safety equipment, personal rain gear, and other site maintenance equipment listed below.

Table 2-6. 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 hazards analysis (JHA) and Tailgate Safety Meeting Forms) Paper towels Spare chains of custody Sample control paperwork Extra-fine indelible markers 19-L borosilicate glass bottles Grab 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 B - *Health and Safety Plan*)

2.4.3.3 Communication Channels

Communication channels must be established for personnel to contact each other before and during the event. Cellular telephone communication links to field teams are essential for efficient storm water 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 AMEC field team, and work numbers for primary laboratory contacts and City of San Diego personnel to aid in communication.

2.4.4 Station Preparation

Prior to a storm event, stations must 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 storm events includes pre-icing the composite sample bottles. Performing general equipment inspections to confirm that the sites are operational will also be included in station preparation.

2.4.4.1 Determination of Sampler Pacing Value

Water quality monitoring requires that the proper "Volume to Sample" or “Pacing” value be entered into the flow meter when collecting a flow-weighted composite sample. This is the flow volume corresponding to the automated sampler trigger for each composite sample aliquot. The amount of expected rainfall, how the station performed during previous storms, and how much runoff is anticipated at the station for each storm event are to be taken into consideration in determining the “Volume to Sample” for each event.

Once the proper “Pacing” is determined for the flow-weighted composites, it must be entered into the monitoring station flow meter at the onset of rainfall. It is important that this value is accurate. If the value is too high, the system will not collect enough volume of water to be analyzed; if the value is too low, the sample bottle capacity will be exceeded, and if the bottles are not changed in time the percent storm capture will drop. This project requires a minimum volume of six liters of sample to meet analytical chemistry needs, and three liters of sample to meet toxicity needs designated for the composite samples.

2.4.4.2 Prepare Sampler

A complete 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 must verify that the automated sampler has been reset and that it has been programmed to collect samples based on flow pulses from the flow meter. The sampler should be programmed to “run continuously.”

2.4.4.3 Iced Sample Bottle

The composite sample bottles will be iced after the decision has been made to monitor the storm. From the time that the first sample aliquot is delivered to the composite sample bottle, sufficient ice must be maintained around the bottle(s) to maintain a sample temperature of four degrees Celsius or less.

2.4.4.4 General Site Inspection

The general functionality of the surrounding site will be inspected. It should be verified that no debris is located in the water sampling areas, and the areas should be inspected for trash to prevent clogging of equipment.

The equipment will be physically inspected to make certain that there are no obvious problems, such as damaged cables or a kinked hose. Intake strainers and flow sensors are to be visually inspected when access allows and cleared of debris if necessary.

2.4.4.5 Documentation

During each monitored storm event records of the event should be recorded accurately in the field data sheet. A blank field data sheet is provided in Appendix C.

The following general information should be entered during each monitored storm event:

- Alphanumeric Site ID
- Date
- Time
- Monitoring program
- Field team
- Field measurements
- Weather conditions
- Runoff characteristics
- Equipment condition
- Sample aliquots in each bottle
- Grab sample collection times
- Miscellaneous comments

Additional data will be recorded on the field data sheet at the end of a storm event. The following data will be collected at stations:

- **Total Flow Volume (liters)** – Total volume of water that passed the station during the storm at sites where flow meters are installed
- **Composite Sample Aliquot Count –** Total aliquots attempted, the number of aliquots missed, and the total number of successful aliquots
- **Total Rain (inches)** – Total accumulated rainfall in inches since the start of the storm, measured each time the rain bucket tips
- **Sample Volume (liters) –** Total volume of sample collected during the storm

This data will be logged by the flow meter; however, if downloaded data is lost, the data recorded on the field log will act as a back-up.

2.4.4.6 Training

Field personnel will be properly trained in the use of the monitoring equipment and clean sample handling techniques (Appendix D) along with appropriate health and safety protocols (Appendix B). Specifically, the following elements will be included in the training of field personnel:

- Review of Health and Safety Plan
- Field equipment training

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 the 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.

2.5 Quality Assurance / Quality Control

2.5.1 Field Quality Assurance/Quality Control

This section addresses Quality Assurance/Quality Control (QA/QC) activities associated with field sampling. The field QA/QC samples are used to evaluate potential contamination and sampling errors applicable to automated composite sampling and grab sampling introduced prior to submittal of the samples to the analytical laboratory.

The main types of field QA/QC samples that will be utilized are as follows. Sample types, measurement objectives, and frequencies are summarized in Table 2-7.

- **Equipment Blanks** – Equipment blanks provide verification that the sampling containers, sampling equipment, and tubing are clean[3] prior to sampling. A representative number of bottles or sections of tubing from each lot will be submitted to the laboratory. The laboratory will use reagent-grade, analyte-free deionized water to fill the bottles or rinse through the tubing and then analyze the water. Blank analysis results will be evaluated by checking against the reporting limit for that analyte. Results obtained should be less than the reporting limit for each analyte. If results are above the reporting limits then the entire lot must be cleaned and re-analyzed.
- **Field Duplicates** – A field duplicate may be produced during grab sampling or post storm composite sampling. However, no grab samples are being collected for this project and post storm compositing of samples is being performed by the laboratories. Thus, no field duplicates will be collected for this project. Field duplicate measurements of in-situ measurements will be conducted at a rate of greater than or equal to five percent.

[3] Present at concentrations below the laboratory MDL for analytes selected for analysis.

- **Laboratory Duplicates** – Laboratory duplicates evaluate sampling error introduced by sub sampling. The laboratory is responsible for compositing samples and sub sampling. The laboratory will select one sample during the wet season at the direction of AMEC to create a laboratory duplicate for analysis. A laboratory duplicate will not be performed for toxicity analysis.

Table 2-7. Quality Control Samples

Constituent Category	Measurement Quality Objective		Frequency of Analysis[b]
	Laboratory Duplicate	Equipment Blank	
Conventionals	RPD<25%[a]	<RL for target analyte	5% of total project sample count
Metals	RPD<25%[a]	<RL for target analyte	5% of total project sample count
Organics	RPD<25%[a]	<RL for target analyte	5% of total project sample count
Toxicity	NA	NA	NA

Notes:
NA: Not applicable.
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.

2.5.2 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) as follows. The quality control checks performed on each constituent are presented in Table 2-8. The frequency of the laboratory QA/QC samples is presented in Table 2-9, and the laboratory quality control objectives are presented in Table 2-10.

- **Laboratory Replicate/Split** – A sample is split by the laboratory into two portions and each portion is analyzed. Once analyzed, the results are evaluated by calculating the relative percent difference (RPD) between the two sets of results. This serves as a measure of the reproducibility, or precision, of the sample analysis. Typically, replicate results should fall within an accepted RPD range, depending upon the analysis.
- **Method Blanks** – A method blank is an analysis of a known clean sample matrix that has been subjected to the same complete analytical procedure as the field sample to determine if potential contamination has been introduced during processing. Blank analysis results are evaluated by checking against reporting limits for that analyte. Results obtained should be less than the reporting limit for each analyte.
- **Matrix Spike and Matrix Spike Duplicates (MS/MSDs)** – Matrix spikes and matrix spike duplicates involve adding a known amount of the analyte(s) of interest to one of the actual samples being analyzed. One sample is split into three separate portions. One portion is analyzed to determine the concentration of the analyte in question in an un-spiked state. The other two portions are spiked with a known concentration of the analytes of interest. The recovery of the spike, after accounting for the concentration of the analyte in the original sample, is a measure of the accuracy of the analysis. An additional precision measure is made by calculating the RPD of the duplicate spike recoveries. Both the RPD values and spike recoveries are compared against accepted and known method dependent acceptance limits. Results outside these limits are subject to corrective action.
- **Laboratory Control Sample (LCS)** – The laboratory control sample procedure involves spiking known amounts of the analyte of interest into a known, clean, sample matrix to assess the possible matrix effects on spike recoveries. High or low recoveries of the analytes in the matrix spikes may be caused by interferences in the sample. Laboratory control samples assess these possible matrix effects since the LCS is known to be free from interferences.

Table 2-8. Laboratory Quality Control Samples by Constituent

Analyte	Laboratory Replicate	Method Blank	MS/MSD	LCS
General Chemistry				
Chloride	—	✓	✓	✓
Sulfate	—	✓	✓	✓
Total Calcium	—	✓	✓	✓
Total Magnesium	—	✓	✓	✓
Dissolved Organic Carbon	—	✓	✓	✓
Total Organic Carbon	—	✓	✓	✓
Total and Dissolved Metals				
Copper, Total	—	✓	✓	✓
Copper, Dissolved	—	✓	✓	✓
Lead, Dissolved	—	✓	✓	✓
Lead, Total	—	✓	✓	✓
Zinc, Dissolved	—	✓	✓	✓
Zinc, Total	—	✓	✓	✓
Organics				
Organophosphorus Pesticides	—	✓	✓	✓
Organochlorine Pesticides/PCBs	—	✓	✓	✓
Polynuclear Aromatic Hydrocarbons (PAHs)	—	✓	✓	✓
PCB Congeners	—	✓	✓	✓
Toxicity				
Ceriodaphnia dubia 96-hour acute static-renewal test	✓	✓	—	—
Ceriodaphnia dubia 7-day chronic static-renewal test	✓	✓	—	—

Table 2-9. Laboratory Quality Control Sample Frequency

QA/QC Sample Type	Minimum Sampling Frequency
	General Chemistry
Laboratory Replicate/Split	One per batch or per 20 samples (5% collected throughout the duration of the project)
Method Blank	One per batch or per 20 samples (5% collected throughout the duration of the project)
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per batch or per 20 samples (5% collected throughout the duration of the project)
Laboratory Control Sample (LCS)	One per batch or per 20 samples (5% collected throughout the duration of the project)

Table 2-10. Laboratory Quality Control Sample Objectives

QC Sample Type	General Chemistry	Metals	Synthetic Organics
Laboratory Blank	<RL for target analyte	<RL for target analyte	<RL for target analytes
Laboratory Duplicate	NA	NA	NA
Reference Material	80-120% recovery	75-125% recovery	70-130% recovery if certified; otherwise, 50-150% recovery
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	80-120% recovery; RPD<25%	75-125% recovery; RPD<25%	50-150% recovery, or based on 3x the standard deviation of laboratory's actual method recoveries; RPD<25%

Notes:
NA: Not applicable.
[a] NA if native concentration of either sample <RL.

2.5.3 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 Tables 2-11 and 2-12, respectively. 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 standard used to determine accuracy by Weck is called a Standard Reference Material (SRM), which is a sample with a matrix similar to the sample being tested that contains analytes of interest at known or certified concentrations. The concentrations of the standards will be unknown to the analyst until after measurements are determined. The concentrations of the standards should also 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. Laboratory Control Samples (LCSs) can be used when SRMs are not available. Accuracy of the project data will be determined by comparing results from MS/MSDs, SRMs, field blanks, method blanks, and equipment blanks to the accuracy objectives specified in Table 2-7 for field control samples and Table 2-10 for laboratory control samples.

Table 2-11. *In-Situ* Field Measurement Data Quality Objectives

Parameter	Accuracy	Resolution	Completeness
Conductivity	±1% Full Scale + 1 digit	0.01 µS/cm	90%
pH	±0.01 units	0.01 unit	90%
Temperature	±0.51°C	0.1 °C	90%

Table 2-12. Laboratory Quality Control Data Quality Objectives

Constituent Category	Accuracy	Precision	Representativeness		Completeness
			Lab	Field	
General Chemistry	80-120%	RPD<25%[a]	Laboratory sample replicates per 20 samples or analytical batch (whichever is more frequent).	NA	90%
Metals	75-125% recovery	RPD<25%[a]	Laboratory sample replicates per 20 samples or analytical batch (whichever is more frequent).	NA	90%
Synthetic Organic Compounds	Laboratory control standards: 70-130% recovery if certified, otherwise 50-150% recovery; Matrix spikes: 50-150% recovery, or based on 3x the standard deviation of laboratory's actual method recoveries.	RPD<25%[a]	Laboratory duplicate per method.	NA	90%
Toxicity Testing	Laboratory Control Water and Sediment Control must meet test acceptability criteria	Per method requirements	NA	NA	90%

Notes:
NA: Not applicable.
a. NA if native concentration of either sample is less than the RL.

Precision describes how well repeated measurements agree. The evaluation of precision described here relates to repeated measurements/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 matrix spike duplicates to the precision objectives specified in Table 2-7 for field control samples and Table 2-10 for laboratory control samples. Relative Percent Differences (RPDs) will be calculated to determine the precision between duplicate samples. This calculation is shown below:

$$RPD = \frac{abs[x_1 - x_2]}{0.5 * (x_1 + x_2)} * 100$$

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, it is expected that 90 percent of measurements will be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems. The project team will determine completeness by comparing the number of measurements planned to be collected with the number of measurements actually collected that were also deemed valid. An invalid measurement would be one that does not meet the sampling method requirements and the DQOs. Completeness will be measured as a percentage of the number of samples collected that meet the respective DQOs compared to the anticipated total number of samples. This calculation is shown below:

$$Completeness = \frac{Actual\,number\,of\,samples\,collected}{Project\,required\,total\,samples\,to\,be\,collected} * 100$$

2.5.3.1 Accuracy, Precision, and Completeness

The *in-situ* field measurement DQOs are presented in Table 2-11. Analytical method numerical DQOs for constituent reporting limits, accuracy, precision, and completeness are summarized in Table 2-12.

2.5.3.2 Composite Sample Representativeness

A flow-weighted composite sample consists of a mixture of constant volume aliquots collected at variable time intervals during a storm event. For example, at higher flow rates (i.e., larger cumulative volume), the aliquot times are more closely spaced. The resulting composite is representative of the average concentration throughout the storm hydrograph.

The representativeness of any composite sample is dependent upon many factors, but is most heavily dependent upon: 1) the spacing of samples collected relative to the hydrograph, and 2) the number of samples collected during the storm event. This is true whether the samples are analyzed individually or composited. To collect a representative flow-weighted composite sample an automated sampler is utilized in conjunction with a flow meter. Immediately following sample collection composite sample representativeness will be evaluated by comparing the first sample aliquot times to the flow start times and confirming that sample aliquots are collected throughout the storm event. Composite samples with excessive missed aliquots generally are not analyzed. The decision to analyze samples with questionable representativeness will be made in consultation with the City of San Diego.

2.5.3.3 Instrument/Equipment Calibration and Frequency

Laboratory equipment is calibrated based on manufacturer recommendations and accepted laboratory protocols. Laboratories maintain calibration practices as part of their method SOPs maintained by their Laboratory Directors and QA officers, and can be provided upon request.

Calibration for flow meters and automated samplers will be conducted prior to installation and, thereafter, per the calibration frequencies discussed in Table 2-13.

- The American Sigma 950 AVB flow meter will be calibrated using the procedures described in the American Sigma 950 AVB O&M Manual (Hach Catalog No. 3314). For flow meter calibration, the recorded water level will be checked by operation of the flow meter while the pressure transducer is submersed in water of a known level. Level adjustments will be made to the flow meter. Results that deviate significantly from the known level and do not maintain an adjusted offset will be documented and will require the equipment to be replaced or repaired. Velocity is calibrated at the factory only; therefore, if a velocity sensor is reporting erroneous velocity measurements it will be replaced.

- The Hach SD900 automated sampler will be calibrated using the procedures described in the SD900 O&M Manual (Hach Catalog No. DOC026.53.00742). For automated sampler calibration, the aliquot volume will be calibrated using a graduated flask or beaker.

- Rain gauges are not adjustable and cannot be calibrated. If a rain gauge fails to record simulated rainfall, the instrument will be repaired or replaced.

Calibration of the Oakton Con10 series pH/conductivity/temperature handheld meter will be performed during storm event mobilization or as needed according to manufactures recommendations.

Calibration measurements will be recorded and a calibration log will be maintained.

Table 2-13. Calibration of Field Sampling Equipment and Monitoring Instruments

Equipment	Calibration Description	Responsible Person	Frequency	SOP Reference
American Sigma 950 AVB Flow Meter (level only)	Water level check against known levels	AMEC Technical Staff	Semi-annually	American Sigma 950 AVB O&M Manual 3314
Hach SD900 Automated Sampler	Aliquot calibration	AMEC Technical Staff	Semi-annually	Hach SD900 Sampler O&M Manual DOC026.53.00742
American Sigma Rain Gauge	NA	AMEC Technical Staff	Semi-annually	NA
Oakton Con10 Series Water Quality Meter	Calibration using standard solutions	AMEC Technical Staff	Prior to each event	Manufacturer O&M Manual

2.5.3.4 Inspection/Acceptance of Supplies and Consumables

Glassware, sample bottles, and collection equipment will be inspected prior to use. Some sampling containers and caps will be obtained from Weck and Nautilus. The Sampling Manager will be in charge of ordering sampling containers. Ordered supplies will be examined for damage as they are received per Table 2-14.

The Sampling Manager will order field supplies prior to the start of the wet weather season and as needed through the year. Field supplies will be stored at AMEC and laboratory supplies will be stored at the laboratories conducting the work. Inspection and testing requirements for laboratory supplies are covered in the laboratory's QA/QC procedures.

Table 2-14. Consumable Supplies Requirements

Project-Related Supplies/ Consumables	Inspection/ Testing Specifications/ Source	Acceptance Criteria	Frequency	Responsible Individual
Pre-Cleaned Sample Bottles	Closed bottle	Lids screwed on bottles	100%	AMEC
Composite Sample Bottles	Laboratory cleaned and blanked	Pass blanking analysis	Clean blanked bottles each monitoring event	Weck/AMEC
Silicone Tubing	Laboratory cleaned and blanked	Pass blanking analysis	New blanked tubing each season	Weck/AMEC
Teflon Tubing	Laboratory cleaned and blanked	Pass blanking analysis	New blanked tubing each season	Weck/AMEC
Gloves	New box	New box	As needed	AMEC

2.5.3.5 Corrective Action

Corrective action will be taken when an analysis is deemed suspect for some reason. The reasons include exceedances of the RPD ranges, spike recoveries, and blanks. The corrective action varies somewhat from analysis to analysis, but typically involves the following:

- Check of procedures.
- Review of documents and calculations to identify any possible errors.
- Error correction.
- Re-analysis of the sample extract, if available, to see if results can be improved.
- Complete reprocessing and re-analysis of additional sample material, if it is available.

Any failures (e.g., instrument failures) 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 entire instrument, as warranted. Field crews will carry basic spare parts and consumables with them, and will have access to spare parts to be stored at the AMEC office. Records of repairs or replacements of field instruments will be maintained at AMEC. The laboratories have procedures in place to follow when failures occur, and will identify individuals responsible for corrective action and develop appropriate documentation.

2.6 Data Management and Reporting Procedures

2.6.1 Data Management

The responsibility for hydrologic data management and laboratory data management will be led by the Project Manager. The laboratory will be requested to provide data in both hard copy and electronic formats.

The Reporting and Laboratory Coordinator will be responsible for tracking the analytical process to make sure that laboratories are meeting the required turnaround times and are providing a complete deliverable package. The Reporting and Laboratory Coordinator will receive the original hard copy from the laboratory, verify completeness, and log the date of receipt. The hard copy originals then will be transferred to the Project Manager and filed with other original project documentation in order to maintain complete project records.

The electronic submittals will conform to reporting protocols that are compatible with the Surface Water Ambient Monitoring Program (SWRCB, 2008). A relational database will be developed by the Database Coordinator and used for data. Laboratory data will be maintained and managed with Microsoft Excel and/or Microsoft Access by the Database Coordinator. Data from the monitoring site flow meters/data loggers will also be stored in the same database system and linked to the laboratory database. The data logger files will include rainfall, sampling history, and discharge (velocity, stage, and instantaneous flow) data.

2.6.2 Compliance Monitoring Report

AMEC will provide the City of San Diego with an end of year Compliance Monitoring Report, which will be included in the WURMP Annual Report as an appendix. An executive summary, formatted as a “drop in” to the WURMP Annual Report text will also be prepared.

The data collected under the Chollas Creek TMDL Compliance Monitoring Program will be compiled and analyzed, with the findings presented in a Draft Compliance Monitoring Report. This report will comply with the January 31, 2016, deliverable requirements specified in Order No. R9-2004-0277. The draft report will be completed as soon as possible after the last storm event to provide sufficient time for the workgroups to review and provide comments and to produce the final report before the fiscal year end.

The report will summarize the sample collection methods and events, present the findings of the analytical results, and provide spatial loading information from both forks of Chollas Creek. It will assess TMDL compliance, discuss chemistry and toxicity bioassay results, identify constituent concentrations above water quality criteria, and present trend information of TMDL analytes. Any deviations from protocols listed in the Monitoring Plan and the implications of those deviations on the interpretation of the data will be included in the report. Raw data will be provided as an appendix on CDs.

A Draft Compliance Monitoring Report will be provided (up to seven hardcopies with CDs). The files will also be provided electronically for review and comments. A comment template will be provided for the jurisdictions to complete.

Comments on the 2014-2015 Draft Compliance Monitoring Report will be compiled and tabulated in a response to comments letter for inclusion in the final report. The report will be finalized per the discharger group’s recommendations. The Final Compliance Monitoring Report will be produced to meet the June 30, 2015, fiscal year end. Seven hard copies with CDs of electronic files will be provided.

3.0 BACTERIA TMDL COMPLIANCE MONITORING

This section describes the purpose, scope, and type of sampling conducted for each monitoring program including Compliance Monitoring, Optional Monitoring, and Follow-Up Monitoring. Additional details of the sampling and analytical methodology and data quality objectives are described in the Bacteria TMDL QAPP, provided as Appendix E.

3.1 Bacteria Compliance Monitoring

Compliance monitoring is designed to meet the receiving water monitoring requirements of the Bacteria TMDL. Compliance monitoring, including wet and dry weather sampling, will be conducted each year at the compliance monitoring locations. The data generated will be used to address the following questions:

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

Per the Bacteria TMDL, receiving water monitoring will be conducted with the existing Regional MS4 Mass Loading Station (MLS) Monitoring Program. Therefore, the scope of compliance monitoring accounts for the frequency and type of sampling activities of the existing programs in order to facilitate overlap of monitoring efforts and resources. Table 3-1 provides the general scope of Compliance Monitoring Program.

Table 3-1. Scope of Compliance Monitoring

Number of Monitoring Locations	Wet Weather Monitoring		Dry Weather Monitoring 10/01/13 to 03/31/14		Dry Weather Monitoring 06/24/13 to 9/30/13 and 04/1/14-9/30/14	
	Grab Samples Per Site Per Event	Event Frequency	Grab Samples Per Site Per Event	Event Frequency	Grab Samples Per Site Per Event	Event Frequency
3	1	3 storms	1	monthly	1	Weekly (minimum 5 events per month)

3.1.1 Compliance Monitoring Locations

The Bacteria TMDL identifies the lower 1.2 miles of Chollas Creek as the targeted segment in the TMDL. Three monitoring locations were selected based on the compliance requirements set forth in Resolution No. R9-2010-0001. The resolution requires receiving water compliance monitoring to occur at or near the mouth of the creek, such as the MLS or Mass Emission Station, and one or more locations upstream of the mouth, such as the Chollas Creek HSA Assessment Station. The two MLSs in the Chollas Creek HSA, SD8(1) and DPR3, were selected for compliance monitoring. A third compliance monitoring location approximately 100 yards south of the confluence of the north and south forks of Chollas Creek was also selected to fulfill the TMDL compliance monitoring requirements, since it is more reflective of the loading from the entire HSA. Table 2.2 provides the location name and coordinates for the compliance monitoring locations.

Table 3-2. Compliance Monitoring Location

Site ID	Site Name	Site Type	Latitude	Longitude
CTL(1)	Chollas Tidal	Creek	32.69120	-117.12354
SD8(1)[a]	North Chollas Creek MLS	Creek	32.70493	-117.12132
DPR3[a]	South Chollas Creek MLS	Creek	32.69130	-117.11682

Notes:
CTL = Chollas Tidal Compliance Monitoring Location
SD8(1) = North Chollas Creek Mass Loading Station
DPR3 = South Chollas Creek Mass Loading Station
[a] Monitoring location also selected to fulfill monitoring requirements of the Diazinon and Dissolved Metals TMDL.

3.1.2 Constituents

Fecal indicator bacteria (FIB) are the target constituents for Chollas Creek, as indicated by the TMDL. Grab samples will be representative of the environmental conditions of each location, therefore, the grab samples will be collected from the horizontal center of the stream to the maximum extent practicable. For intermittent streams, sampling will be suspended once the stream is too low to sample. Samples collected during wet and dry weather monitoring will be analyzed for FIB in accordance with Surface Water Ambient Monitoring Program (SWAMP) requirements provided in the QAPP (Appendix A). Table 3-3 presents the constituents, reporting limits, and analytical methods. In accordance with the new MS4 Permit, total coliform is not a required analyte for creeks and will not be analyzed.

Table 3-3. Compliance Analyses for Bacteria TMDL

Parameter	Project Reporting Limit[a] (per 100mL)	Analytical Method
Enterococcus	10 CFU	TBD
Fecal Coliform	20 MPN	TBD

Notes:
CFU = Colony Forming Units
TBD = To be determined by the RAs.
[a] The reporting limits are consistent with the existing AB411 program to facilitate overlap with that program. However, reporting limits may be lower depending on the laboratory used to conduct the analysis.

3.1.3 Dry Weather Monitoring

Dry weather monitoring will be conducted monthly during the wet season and weekly during the dry season at the compliance monitoring locations listed in Table 3-2. Dry weather sampling will occur on dry weather days when there is measureable flow at the location. Samples are to be collected after an antecedent dry period of 72 hours with less than 0.1 inches of rainfall. During each dry weather monitoring event, field observations will be recorded and a grab water sample will be collected at the compliance monitoring location(s). Methodology for field observations and sample collection is described in the QAPP (Appendix E).

3.1.4 Wet Weather Monitoring

Wet weather monitoring will be conducted at the compliance monitoring location(s) during three storm events each wet season (October 1 to April 30). Per the MS4 Permit Appendix E.6, a minimum of one storm is required to be monitored. Storms resulting in greater than 0.2 inches of precipitation will be targeted for analysis. One grab sample will be collected per storm within 24 hours of the end of precipitation. The storm events will be spread throughout the wet season to the maximum extent practicable as follows:

- Storm Event 1 (October to November)
- Storm Event 2 (December to January)
- Storm Event 3 (February to April)

During each wet-weather monitoring event, field observations will be recorded and a grab water sample will be collected at the compliance monitoring locations. Grab samples will be collected using the same sample technique as during a dry weather monitoring event, taking additional safety precautions as needed. Methodology for field observations and sample collection is described in the QAPP (Appendix E).

3.1.5 Future Considerations

The Bacteria TMDL monitoring will be coordinated with the Diazinon and Dissolved Metals TMDLs monitoring to the maximum extent possible, however there are two differences in storm monitoring requirements that support the need for autonomous or semi-autonomous monitoring programs: (1) The definition of a wet weather event, and (2) the distribution of events throughout the wet weather season.

1. The Diazinon and Dissolved Metals TMDLs state that storm events are captured per the USEPA's mobilization criteria defined as 0.10 inch storm event. This differs from the Bacteria TMDL which requires a storm event greater than 0.20 of an inch. The difference in mobilization criteria between the TMDLs may require separate monitoring programs, as storm events less than 0.2 inches are common in the Chollas Creek HSA.

2. The Diazinon and Dissolved Metals TMDLs require monitoring of the first two storm events after October 1 and the first storm event after February 1, whereas the Bacteria TMDL compliance monitoring will target three storm events throughout the entire wet season (early, mid, and late season). This difference makes it unlikely that sampling will be coordinated for all three events.

3.2 Optional Monitoring

Optional monitoring is not mandatory to meet TMDL monitoring requirements and may be suspended if directed. Optional monitoring is presented in this Monitoring Plan so that the procedures are available should the RAs decide to conduct the monitoring. The Chollas Creek HSA RAs will determine when any optional monitoring elements will be implemented. The Chollas Creek HSA RAs will determine each year whether the optional monitoring will be initiated, modified, or eliminated (although optional monitoring may be revised more frequently if approved by the RAs). Modifications to optional monitoring elements will be documented in the Annual CLRP Monitoring Summary. The decision to initiate, modify, or eliminate optional monitoring will be communicated to the SDRWQCB Project Manager to clearly inform the SDRWQCB whether the monitoring is to occur.

The field measurements in Table 3-4 are considered optional for Chollas Creek. Flow may be monitored during sampling events or throughout the year at the compliance monitoring locations. Flow monitoring is considered optional since it is not clearly specified by the TMDL, however, flow information is required to calculate the WLA.

Table 3-4. Optional Field Parameters

Field Parameter	Recommended SWAMP Reporting Limit	Method
Dissolved Oxygen	NA	Field Meter
Flow	NA	TBD
pH	NA	Field Meter
Specific Conductivity	2 μS/cm	Field Meter
Temperature	NA	Field Meter
Turbidity	5 NTU	Field Meter

Notes:
pH = potential Hydrogen
μS/cm = micro Siemens per centimeter
NTU = Nephelometric Turbidity Units

3.3 Follow-Up Monitoring

Per the TMDL, if exceedances of the numeric targets are observed in the monitoring data, additional monitoring locations and/or other source identification methods must be implemented to identify the sources causing the exceedances. Additionally, the locations and/or other source identification methods must also be used to demonstrate that the bacteria loads have been addressed. The RAs have designed the Follow-up Monitoring Program to be implemented prior to the end of the compliance period in order to facilitate compliance with the interim reduction milestones. The Follow-up Monitoring Program should address both expected exceedances and sources limiting the attainment of the milestone. Implementation of follow-up monitoring, if necessary, is scheduled to begin after the first milestone requiring 50 percent reduction of dry or wet weather exceedances.

The Follow-up Monitoring Program will utilize an adaptive monitoring approach to determine the sources contributing to exceedances in the receiving water. Each year, the program will evaluate compliance data to determine if follow-up monitoring is needed and the monitoring approach would be modified to address the pattern of exceedances. The data generated will be used to address the following questions:

- What are the potential sources/areas causing exceedances in the receiving water?
- Are MS4 discharges contributing to WQO exceedances in the receiving water?
- What is the magnitude and duration of the exceedance condition?

3.3.1 Initiation of Follow-up Monitoring

Follow-up monitoring will be implemented based on exceedances of receiving water numeric targets and allowable frequencies recorded each year at the compliance monitoring locations. Follow-up monitoring is designed to address persistent exceedances and to assess the frequency of exceedances over relatively long-term periods. Compliance dates will be consistent with dates presented in the CLRP. Under the Compliance Monitoring Program, FIB results will be compared to TMDL numeric targets and mandated frequency reductions, as described in Section 1.

Follow-up monitoring will occur when:

- Allowable exceedance frequency of dry weather data has not been reduced by at least 50 percent by year seven (2018).
- Allowable exceedance frequency of wet weather data has not been reduced by at least 50 percent by year ten (2021).
- After the 100 percent reduction milestones for both wet and dry weather (i.e., the respective final compliance dates), the initiation criteria will be updated to reflect the most applicable ‘trigger’ based on the available data and possible revisions to the TMDL.

3.3.2 Follow-up Monitoring Approach

The approach implemented for the Follow-up Monitoring Program will be adaptive based on the type of exceedance (wet or dry weather), the frequency of exceedances, and HSA specific data following the first interim milestone. Four types of follow-up monitoring options were identified in the Copermittee Compliance Framework (Larry Walker and Associates [LWA], 2011) and are summarized below. These options are designed to assist with source identification and TMDL compliance and more than one type of monitoring may be implemented per monitoring year.

- Upstream Monitoring: Upstream monitoring may be implemented in HSAs with clear jurisdictional boundaries, hydrologic breaks, or to isolate non-point source inputs along the receiving water. This option will characterize sources throughout the extent of the receiving water and will require additional monitoring to further isolate and identify sources. This option may provide useful data for HSAs where pollutant sources are largely unknown. Follow-up monitoring locations would be located in the receiving water, upstream of the compliance monitoring location.
- Representative Land Use Monitoring: Representative land use monitoring may be implemented in HSAs where homogenous land uses are present and discharge to the MS4. It may provide useful data for distinguishing between non-MS4 land uses and MS4 land uses that may be contributing to receiving water objective exceedances. This data may also be used to further calibrate and validate the HSA model and facilitate selection of management measures and/or BMPs. Follow-up monitoring locations would be selected to be representative of the major land use types present in the HSA.
- Localized Outfall Monitoring: Localized outfall monitoring may be implemented at monitoring stations adjacent to the receiving water in which objective exceedances were detected. It may provide useful data for identification of MS4 discharges to the receiving water in the direct vicinity of the objective exceedance. Monitoring may be employed in HSAs or HSAs that have a limited number of outfalls and may assist in determining whether the MS4 is causing or contributing to particular receiving water exceedances. If WQO exceedances are recorded at the follow-up monitoring locations then additional actions must be taken to bring the location into compliance. This may lead to additional monitoring in the immediate area or an evaluation of management measures and/or BMPs.
- Source Identification Monitoring: Microbial source testing may be added to any of the monitoring options described in the previous sections including both compliance monitoring and follow-up monitoring locations. This will assist in identification of pollutant sources that contribute to exceedances that may or may not be the result of MS4 discharges. Specifically, if no human sources are identified then it is possible to report that controllable sources are not causing the exceedances of WQOs at the monitoring location. This may lead to a potential special study to further identify sources of human fecal bacteria or natural sources.

Follow-up monitoring locations will be identified after compliance year six and will be updated each year after that, to reflect the most recent compliance data set. Therefore, monitoring locations are not provided in this Monitoring Plan. Aerial imagery, Geographic Information Systems (GIS), and field surveys may be utilized to assist with determination of appropriate sampling locations.

Follow-up monitoring will be unique to each location and monitoring condition, therefore the monitoring approach for each specific case will be determined at that time.

A summary of follow-up monitoring will be provided in the Annual CLRP Monitoring Program Summary. The summary will include the monitoring approach, monitoring locations, sampling protocols, summary of results, and planned actions.

3.4 Data Management and Reporting Procedures

This section describes the management of field and analytical data and reporting procedures for the Chollas Creek CLRP Monitoring Program.

3.4.1 Data Management

Field Data Records and Analytical Data Reports will be sent to and kept by the designated Lead Agency Project Manager. Data will be submitted in a standardized SWAMP-compatible format. The Lead Agency will compile the monitoring data and provide an annual CLRP Monitoring Summary to RWQCB.

The Sampling Agency will review all Field Data Log Sheets for completeness, maintain the original hardcopies, and scan electronic copies (personal data form [*.pdf]) for storage in the project file. Copies of Field Data Log Sheets and photographs for each event will be submitted to the Lead Agency on a quarterly basis. The field crew will retain the original Field Data Log Sheets.

The laboratories will provide data in electronic format: both *.pdf copies of lab reports and a SWAMP-compatible Electronic Data Deliverable (EDD). Analytical results will be submitted to the Sampling or Lead Agency in *.pdf format and as a SWAMP compatible EDD within three weeks of submittal of samples. A SWAMP-compatible template will generate data files that can be uploaded to the SWAMP regional database. The Sampling or Lead Agency will review all lab reports and EDDs for accuracy, completeness, and compatibility with SWAMP. The contract laboratory shall retain original Chain-of-Custody forms. The contract laboratory will retain copies of the preliminary and final data reports.

3.4.2 Reporting Procedures

The Sampling Agency will provide quarterly sampling summaries to the Lead Agency as a status of monitoring activities. The update will include a brief summary of activities completed in the previous quarter and the field observations recorded. The Lead Agency will provide quarterly updates to the other participating RAs during regularly scheduled HSA Workgroup meetings.

The Lead Agency will generate an Annual CLRP Monitoring Summary, which will be included in the WURMP Annual Report as an appendix. The Annual CLRP Monitoring Summary will describe the sample collection methods, sampling events, and present key findings of the analytical results. As part of the first year’s assessment, the “existing” dry weather exceedance frequency will be calculated based on the 1996 to 2002 data set which will be used to evaluate progress toward attaining the TMDL. Any deviations from protocols listed in the Monitoring Plan and/or QAPP and the implications of those deviations on the interpretation of the data will be included in the report.

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APPENDIX A

DIAZINON AND DISSOLVED METALS ANALYTICAL SUITE

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Table A-1: Full Analytical Suite

Analyte	Method	MDL	RL	Units
Conventionals				
Chloride	EPA 300.0	0.10	0.50	mg/L
Sulfate	EPA 300.0	0.10	0.50	mg/L
Calcium	EPA 200.7	0.016	0.10	mg/L
Magnesium	EAP 200.7	0.012	0.10	mg/L
TOC	SM 5310C	0.009	0.3	mg/L
DOC	SM 5310C	0.013	0.3	mg/L
Metals				
Copper, Dissolved	EPA 200.8	0.022	0.50	µg/L
Copper, Total	EPA 200.8	0.022	0.50	µg/L
Lead, Dissolved	EPA 200.8	0.017	0.20	µg/L
Lead, Total	EPA 200.8	0.017	0.20	µg/L
Zinc, Dissolved	EPA 200.8	0.30	5.0	µg/L
Zinc, Total	EPA 200.8	0.30	5.0	µg/L
Organochlorine Pesticides/PCBs				
2,4'-DDD	EPA 608 low level	5.0	5.0	ng/L
2,4'-DDE	EPA 608 low level	5.0	5.0	ng/L
2,4'-DDT	EPA 608 low level	5.0	5.0	ng/L
4,4'-DDD	EPA 608 low level	3.0	5.0	ng/L
4,4'-DDE	EPA 608 low level	2.5	5.0	ng/L
4,4'-DDT	EPA 608 low level	3.1	5.0	ng/L
Aldrin	EPA 608 low level	1.5	5.0	ng/L
alpha-BHC	EPA 608 low level	1.8	5.0	ng/L
alpha-chlordane	EPA 608 low level	5.0	5.0	ng/L
Aroclor 1016	EPA 608 low level	50	100	ng/L
Aroclor 1221	EPA 608 low level	60	100	ng/L
Aroclor 1232	EPA 608 low level	100	100	ng/L
Aroclor 1242	EPA 608 low level	70	100	ng/L
Aroclor 1248	EPA 608 low level	60	100	ng/L

Analyte	Method	MDL	RL	Units
Aroclor 1254	EPA 608 low level	40	100	ng/L
Aroclor 1260	EPA 608 low level	40	100	ng/L
beta-BHC	EPA 608 low level	3.1	5.0	ng/L
Chlordane (tech)	EPA 608 low level	50	100	ng/L
cis-Nonachlor	EPA 608 low level	5.0	5.0	ng/L
delta-BHC	EPA 608 low level	2.5	5.0	ng/L
Dieldrin	EPA 608 low level	2.1	5.0	ng/L
Endosulfan I	EPA 608 low level	1.7	5.0	ng/L
Endosulfan II	EPA 608 low level	1.9	5.0	ng/L
Endosulfan sulfate	EPA 608 low level	5.0	5.0	ng/L
Endrin	EPA 608 low level	2.8	5.0	ng/L
Endrin aldehyde	EPA 608 low level	3.0	5.0	ng/L
gamma-BHC (Lindane)	EPA 608 low level	2.1	5.0	ng/L
gamma-Chlordane	EPA 608 low level	5.0	5.0	ng/L
Heptachlor	EPA 608 low level	1.7	5.0	ng/L
Heptachlor epoxide	EPA 608 low level	1.9	5.0	ng/L
Methoxychlor	EPA 608 low level	5.0	5.0	ng/L
Mirex	EPA 608 low level	5.0	5.0	ng/L
Oxychlordane	EPA 608 low level	5.0	5.0	ng/L
Toxaphene	EPA 608 low level	120.0	500.0	ng/L
trans-nonachlor	EPA 608 low level	5.0	5.0	ng/L
Decachlorobiphenyl (Surrogate)	EPA 608 low level			% Recovery
Tetrachloro-meta-xylene (Surrogate)	EPA 608 low level			% Recovery
Organophosphorus Pesticides				

Analyte	Method	MDL	RL	Units
Azinphos methyl (Guthion)	EPA 625 low level	0.0055	0.010	µg/L
Bolstar	EPA 625 low level	0.0046	0.010	µg/L
Chlorpyrifos	EPA 625 low level	0.0069	0.010	µg/L
Coumaphos	EPA 625 low level	0.0051	0.010	µg/L
Demeton-o	EPA 625 low level	0.010	0.010	µg/L
Demeton-s	EPA 625 low level	0.010	0.010	µg/L
Diazinon	EPA 625 low level	0.0052	0.010	µg/L
Dichlorvos	EPA 625 low level	0.0029	0.010	µg/L
Dimethoate	EPA 625 low level	0.0062	0.010	µg/L
Disulfoton	EPA 625 low level	0.010	0.010	µg/L
Ethoprop	EPA 625 low level	0.0067	0.010	µg/L
Ethyl parathion	EPA 625 low level	0.0054	0.010	µg/L
Fensulfothion	EPA 625 low level	0.0029	0.010	µg/L
Fenthion	EPA 625 low level	0.0038	0.010	µg/L
Malathion	EPA 625 low level	0.0076	0.010	µg/L
Merphos	EPA 625 low level	0.0058	0.010	µg/L
Methyl parathion	EPA 625 low level	0.0063	0.010	µg/L
Mevinphos	EPA 625 low level	0.0042	0.010	µg/L
Naled	EPA 625 low level	0.0076	0.010	µg/L
Phorate	EPA 625 low level	0.0030	0.010	µg/L
Ronnel	EPA 625 low level	0.0041	0.010	µg/L
Stirophos	EPA 625 low level	0.0031	0.010	µg/L
Tokuthion (Prothiofos)	EPA 625 low level	0.0078	0.010	µg/L
Trichloronate	EPA 625 low	0.0067	0.010	µg/L

Analyte	Method	MDL	RL	Units
	level			
1,3-Dimethyl-2-nitrobenzene (Surrogate)	EPA 625 low level	NA	NA	% Recovery
Triphenyl phosphate (Surrogate)	EPA 625 low level	NA	NA	% Recovery
Polynuclear Aromatic Hydrocarbons				
1-Methylnaphthalene	EPA 8270C-SIM	0.020	0.10	µg/L
1-Methylphenanthrene *	EPA 8270C-SIM	0.020	0.10	µg/L
2,6-Dimethylnaphthalene *	EPA 8270C-SIM	0.020	0.10	µg/L
2-Methylnaphthalene	EPA 8270C-SIM	0.020	0.10	µg/L
Acenaphthene	EPA 8270C-SIM	0.020	0.10	µg/L
Acenaphthylene	EPA 8270C-SIM	0.020	0.10	µg/L
Anthracene	EPA 8270C-SIM	0.020	0.10	µg/L
Benzo (a) anthracene	EPA 8270C-SIM	0.020	0.10	µg/L
Benzo (a) pyrene	EPA 8270C-SIM	0.020	0.10	µg/L
Benzo (b) fluoranthene	EPA 8270C-SIM	0.020	0.10	µg/L
Benzo (e) pyrene *	EPA 8270C-SIM	0.020	0.10	µg/L
Benzo (g,h,i) perylene	EPA 8270C-SIM	0.020	0.10	µg/L
Benzo (k) fluoranthene	EPA 8270C-SIM	0.020	0.10	µg/L
Biphenyl *	EPA 8270C-SIM	0.020	0.10	µg/L
Chrysene	EPA 8270C-SIM	0.020	0.10	µg/L
Dibenzo (a,h) anthracene	EPA 8270C-SIM	0.020	0.10	µg/L
Fluoranthene	EPA 8270C-SIM	0.020	0.10	µg/L
Fluorene	EPA 8270C-SIM	0.020	0.10	µg/L
Indeno (1,2,3-cd) pyrene	EPA 8270C-SIM	0.020	0.10	µg/L
Naphthalene	EPA 8270C-SIM	0.020	0.10	µg/L
Perylene *	EPA 8270C-SIM	0.020	0.10	µg/L
Phenanthrene	EPA 8270C-SIM	0.020	0.10	µg/L
Pyrene	EPA 8270C-SIM	0.020	0.10	µg/L
2-Fluorobiphenyl (Surrogate)	EPA 8270C-SIM	NA	NA	% Recovery
Nitrobenzene-d5 (Surrogate)	EPA 8270C-SIM	NA	NA	% Recovery
Terphenyl-dl4 (Surrogate)	EPA 8270C-SIM	NA	NA	% Recovery
PCB Congeners				
PCB 101	GCMS SIM	5.0	10	ng/L
PCB 105	GCMS SIM	5.0	10	ng/L
PCB 110	GCMS SIM	5.0	10	ng/L
PCB 114	GCMS SIM	5.0	10	ng/L
PCB 118	GCMS SIM	5.0	10	ng/L
PCB 119	GCMS SIM	5.0	10	ng/L
PCB 123	GCMS SIM	5.0	10	ng/L
PCB 126	GCMS SIM	5.0	10	ng/L

Analyte	Method	MDL	RL	Units
PCB 128	GCMS SIM	5.0	10	ng/L
PCB 132	GCMS SIM	5.0	10	ng/L
PCB 138	GCMS SIM	5.0	10	ng/L
PCB 141	GCMS SIM	5.0	10	ng/L
PCB 149	GCMS SIM	5.0	10	ng/L
PCB 151	GCMS SIM	5.0	10	ng/L
PCB 153	GCMS SIM	5.0	10	ng/L
PCB 156	GCMS SIM	5.0	10	ng/L
PCB 157	GCMS SIM	5.0	10	ng/L
PCB 158	GCMS SIM	5.0	10	ng/L
PCB 167	GCMS SIM	5.0	10	ng/L
PCB 168	GCMS SIM	5.0	10	ng/L
PCB 169	GCMS SIM	5.0	10	ng/L
PCB 170	GCMS SIM	5.0	10	ng/L
PCB 174	GCMS SIM	5.0	10	ng/L
PCB 177	GCMS SIM	5.0	10	ng/L
PCB 18	GCMS SIM	5.0	10	ng/L
PCB 180	GCMS SIM	5.0	10	ng/L
PCB 183	GCMS SIM	5.0	10	ng/L
PCB 187	GCMS SIM	5.0	10	ng/L
PCB 189	GCMS SIM	5.0	10	ng/L
PCB 194	GCMS SIM	5.0	10	ng/L
PCB 195	GCMS SIM	5.0	10	ng/L
PCB 200	GCMS SIM	5.0	10	ng/L
PCB 201	GCMS SIM	5.0	10	ng/L
PCB 203	GCMS SIM	5.0	10	ng/L
PCB 206	GCMS SIM	5.0	10	ng/L
PCB 209	GCMS SIM	5.0	10	ng/L
PCB 28	GCMS SIM	5.0	10	ng/L
PCB 3	GCMS SIM	5.0	10	ng/L
PCB 31	GCMS SIM	5.0	10	ng/L
PCB 33	GCMS SIM	5.0	10	ng/L
PCB 37	GCMS SIM	5.0	10	ng/L
PCB 44	GCMS SIM	5.0	10	ng/L
PCB 49	GCMS SIM	5.0	10	ng/L
PCB 52	GCMS SIM	5.0	10	ng/L
PCB 56	GCMS SIM	5.0	10	ng/L
PCB 60	GCMS SIM	5.0	10	ng/L
PCB 66	GCMS SIM	5.0	10	ng/L
PCB 70	GCMS SIM	5.0	10	ng/L
PCB 74	GCMS SIM	5.0	10	ng/L
PCB 77	GCMS SIM	5.0	10	ng/L

Analyte	**Method**	**MDL**	**RL**	**Units**
PCB 8	GCMS SIM	5.0	10	ng/L
PCB 81	GCMS SIM	5.0	10	ng/L
PCB 87	GCMS SIM	5.0	10	ng/L
PCB 95	GCMS SIM	5.0	10	ng/L
PCB 97	GCMS SIM	5.0	10	ng/L
PCB 99	GCMS SIM	5.0	10	ng/L
1,3-Dimethyl-2-nitrobenzene (Surrogate)	GCMS SIM	NA	NA	% Recovery
Toxicity				
Ceriodaphnia dubia 96-hour acute static-renewal test	EPA/821/R-02/012, Oct-02	NA	NA	TU_a
Ceriodaphnia dubia 7-day chronic static-renewal test	EPA/821/R-02/012, Oct-02	NA	NA	TU_c

NA: Not applicable

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APPENDIX B

HEALTH AND SAFETY PLAN (HASP)

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Chollas Creek

Diazinon and Dissolved Metals TMDL Project

Health and Safety Plan (HASP)

May 2014

Reviewed and Approved: ______________________________
Jesse Davis
Health and Safety Officer

Reviewed and Approved: ______________________________
Tommy Wells
Project Manager

Reviewed and Approved: ______________________________
Claire Johnson
Field Sampling Manager

9177 Sky Park Court
San Diego, CA 92123

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ACRONYMS AND ABBREVIATIONS

AMEC	AMEC Environment & Infrastructure, Inc.
ANSI	American National Standard Institute
DPR3	Mass Loading Station Compliance Site at south fork of Chollas Creek
HASP	Health and Safety Plan
HSO	Health and Safety Officer
IDLH	Immediate Danger to Life and Health
ISEA	International Safety Equipment Association
LG-1	Lemon Grove Special Studies Monitoring Site
LM-1	La Mesa Special Studies Monitoring Site
MLS	Mass Loading Station
MSDS	Material Safety Data Sheet
PEL	Permissible Exposure Limit
PPE	personal protective equipment
PPM	parts per million
SD8(1)	Mass Loading Station Compliance Site at north fork of Chollas Creek
STEL	Short Term Exposure Limit
TMDL	Total Maximum Daily Load
TWA	Time Weighted Average

1.0 INTRODUCTION

This Health and Safety Plan (HASP) is intended to address the health and safety concerns that relate to the field work associated with the Chollas Creek Dissolved Metals TMDL Project. Field team members and the subcontractor's field teams must be familiar with the contents of this document and site-specific safety concerns.

The project Health and Safety Officer (HSO) will be responsible for assuring that all members of the field team are familiar with the requirements of the HASP and have received appropriate training for their specific roles. The Field Monitoring Officer will be responsible for enforcing site-specific health and safety protocols. Site-specific health and safety protocols include emergency response/contingency plans. The project manager and individual employees have authority to suspend work, if necessary, due to health and safety concerns.

1.1 Field Activities

Field activities associated with the Chollas Creek Dissolved Metals TMDL Project will be performed by AMEC Environment & Infrastructure, Inc. (AMEC) employees. Such Activities will include siting, equipment installation and maintenance, travel, and removal and replacement of sample bottles.

1.1.1 Siting of Monitoring Locations

The siting and review of monitoring locations for this project will include physical exertion (walking) in extreme weather conditions (heat) for short periods of time. There will also be physical obstacles encountered such as stream banks, channels, bridges, and low-clearance areas.

1.1.2 Equipment Installation and Maintenance

Installation and maintenance may include working with power tools in wet or damp environments and the operation of heavy equipment. Confined space entry will not be necessary for the Chollas Creek Dissolved Metals TMDL Project.

1.1.3 Travel

Travel to and from the selected monitoring sites will occur for siting, installation and maintenance activities, and storm event monitoring. Although travel during the storm events will be minimized by use of automated equipment, some access is typically necessary during storm events and often at night to document observations, replace composite sample containers, and repair any malfunctioning equipment. Efforts will be made to locate equipment in safe work zones, far from high-traffic and high-use areas.

1.1.4 Removal and Replacement of Sample Containers

Composite sample containers will need to be removed and replaced immediately after each storm event and, perhaps, during storm events.

1.2 Traffic Safety

Working near roadways presents inherent risks, dominated by the possibility of errant vehicles. The motoring public is largely made up of conscientious drivers operating well-maintained equipment. However, some percentage of vehicles on the road at any given time may be marginally under control due to driving factors like distractions, fatigue, confusion, or inadequate training, as well as mechanical factors like vehicle age and condition. Any or all of these factors may contribute to a vehicle leaving the traveled lanes and entering the work site.

Traffic load, posted speed limits, and proximity to travel lanes all have a direct relation to the probability of worker exposure to errant vehicles. Work site selection can reduce the exposure potential relating to these factors. In all cases, the Field Team Leader will make the final evaluation of the appropriateness of performing work with the conditions present at a site.

Field Teams will use signs, cones, and flashing amber lights when necessary to inform motorists of activities that may impact roadway travel conditions. To avoid shoulder closures, attempts will be made to pull vehicles off the road and perform work as far away from the edge of pavement as possible.

Field members will work in teams and utilize high visibility reflectorized (Class 2 ANSI/ISEA minimum) vests or clothing. Steel-toed boots and hard hats will be recommended if overhead hazards and/or if heavy equipment is used when working along roadsides.

Exiting and entering the highway or roadway to/from the shoulder when approaching and leaving sampling sites will be performed in a manner consistent with the roadway conditions present. The use of flashing amber lights as well as turn signals will be required. Drivers will evaluate run-off/run-on distances with respect to traffic load and traffic speed before attempting to exit to the shoulder. The Field Team Leader will consider the possibility of significant changes in road conditions taking place within the duration of planned work at the sampling site.

When working on or near the shoulder, physical barriers should be employed whenever possible to protect workers from errant vehicles. Physical barriers include barrier vehicles, guardrails, fences, and other man-made or natural objects capable of slowing, stopping, or diverting an errant vehicle. Barrier vehicles are to be unoccupied, positioned upstream of the work zone, and parked so as not to roll into the work area or active travel lanes if struck by an errant vehicle. Workers not protected by a physical barrier should employ the use of a lookout whose sole responsibility is to watch traffic for signs of potential trouble and notify endangered workers to make use of a pre-planned escape route. The lookout must have an effective means of communicating with workers given the noise and visual condition present. Workers will conduct their work facing the traffic whenever feasible.

1.3 General Safety

In addition to traffic hazards, field teams may face a variety of potential dangers while maintaining the facilities, installing equipment, and performing environmental monitoring. Some these dangers include:

- Slippery conditions
- Lightning
- Fast moving water
- Unstable earth
- Poor visibility, especially at night
- Lifting heavy objects
- Transients
- Muggers and other criminals
- Power tools and heavy equipment
- Elevated places
- Sharp edges and broken glass
- Overhead dangers
- Dogs and other biological hazards
- Electrical hazards posed by equipment malfunctions

Always be aware of these dangers and all other hazards. Here are some tips that will help increase your safety and the safety of others while working in the field:

- Stay away from the edges of a fast moving body of water. These edges are usually slippery and unstable during rainy conditions.
- If sampling is required at the edge of a fast moving body of water, use a lifeline and a personal flotation device. Have on hand a grabbing device when possible.
- Never work alone at night, and avoid working alone during the day. Two people are required during each site visit.

- Avoid leaving materials, tools, and equipment lying around where someone can trip over them.
- Maximize lighting at all times, especially at night.
- Always keep a charged cellular phone or other means of communication nearby.
- Do not use your back to lift heavy objects. Get help.
- Never use drugs or alcohol while working.
- Always wear an orange reflective vest, appropriate shoes and a hard hat when overhead dangers exist.
- Do not use power tools and heavy equipment unless trained in the proper use and care of the specific power tools.
- Always wear eye protection when working with tools or chemicals.
- Wear rain gear.
- Never leave open holes unattended or not barricaded.
- Do not sample during lightning storm.
- Clean up the work area before leaving.
- Always carry drinking water with you.
- Be aware of the nearest toilet and hand washing facilities.

Workers will complete the following personal hygiene procedures:

- Toilet and hand washing facilities will be located on site or an alternate sanitary facility and their specific location identified prior to beginning work activities.
- Where employees are engaging in the application of paints, coatings, or in other operations involving substances which may be harmful to the employees, cleansing facilities shall be provided in proximity of the worksite and shall be so equipped as to enable employees to remove such substances. Depending upon the problem, these facilities may be in the form of ordinary soap and water or in the form of special compounds designed specifically for removal of the harmful material from skin surfaces.
- Personal protective equipment shall be kept clean and in good repair. Safety devices, including protective clothing worn by the employee, shall not be interchanged among the employees until properly cleaned.
- All equipment leaving the site will be free of gross hazardous and non hazardous waste (i.e. mud and/or soil).

1.4 Confined Space Entry

There are no known instances where a permitted confined space entry will be necessary during the course of site selection or monitoring of the Chollas Creek Dissolved Metals TMDL Project. Additionally, there are no known instances where a non-permitted confined space entry will be necessary. However, if an instance does arise that requires a non-permitted confined space entry the Project Manager, the Site Health and Safety Officer, and the Health and Safety Director must be notified and this HASP amended.

OSHA requires that all employees required to enter a permitted/non-permitted confined space be instructed in the nature of the hazards involved, the necessary precautions to be taken, and the use of protective and emergency equipment required for the job.

AMEC considers all confined spaces as permit-required confined spaces until otherwise re-classified as a non-permit required confined space by a competent person. Prior to entering a confined space, each employee is required to be trained to AMEC's Permit Required Confined Space Entry Procedure ESH 2.9.8 (Rev 1) and the attached re-classification certificate must be completed.

2.0 SITE SPECIFIC SAFETY CONCERNS

This section provides information on unique hazards and necessary precautions for the types of sites that will be monitored during this study. Appropriate emergency response numbers and routes to the nearest medical emergency facilities can be found at the end of this appendix. Field personnel will be responsible for adhering to the requirements of this plan for installation, maintenance, and storm monitoring. If additional measures are necessary due to unforeseen or temporary changes to the work environment, the on-site team leader will make the final judgment for any safety procedure changes.

2.1 Errant Vehicles

There is a moderate exposure hazard from errant vehicles while accessing most sites. While personnel are stopped on the shoulder of the highway or roadway, they should keep well back from the highway or roadway lanes and face the approaching traffic. A lookout person is required if two or more workers are engaged in exposed activity within 30 feet of the travel lane. Exposed activities will occur before, during, and after storm events

2.2 Chemical Hazards

Chemical hazards may collect within pipes and/or collection channels. Chemicals can be corrosive and will burn exposed flesh, and/or they can cause severe illness if they are absorbed through the skin or ingested. Exercise caution when encountering a suspected liquid hazard. Use a pH meter or pH test paper to test for corrosives, but always assume that a hazardous chemical is present and wear personal protective clothing. Chemical hazards other than those discussed above could be hazardous chemicals that have precipitated or accumulated on the sides of the pipes and channels. Table 2.1 lists potential chemicals that may be on site along with each chemical's Permissible Exposure Limit (PEL), Immediately Dangerous to Life and Health (IDHL), odor thresholds, and routes of entry. Personnel will use proper personal protective equipment (PPE) to guard against chemical hazards.

Table 2-1: Toxic Gases

Name	Source/Use	IDLH[a] Ceiling PPM	STEL[b] PPM/ Exposure Time	TWA[c] 8 Hr PEL[d] PPM	Odor Threshold
Acetone	Solvent	2,500	1,000/15	750	100
Carbon Dioxide	Comb./Sludge	40,000	30,000/15	5,000	-
Carbon Monoxide	Comb. Exhaust	1,200	-	25	-
Chlorine		10	1/15	0.5	
Gasoline	Fuel	-	500/15	300	0.005-10
Hydrogen Sulfide	Sewer/Sludge Coal Gas/Petrol.	100	15/15	10	Impairs smell
Nitrogen Oxides		20	1/15	-	-
Ozone	Electric Arcing	5	0.3/15	0.1	0.015

Notes:
[a] *IDLH (Immediately Dangerous to Life and Health)*
[b] *STEL (Short Term Exposure Limit)*
[c] TWA (Time Weighted Average)
[d] PEL (Permissible Exposure Limit)

2.3 Physical Hazards

Always be alert and use adequate protection to safeguard against the physical hazards associated with working at these sites. The most common hazard encountered is falling or tripping. The following are some other common hazards:

- Falling objects
- Sharp objects
- "Flash" flooding
- High water
- Electrical shock
- Grinding
- Chipping
- Moving vehicles and heavy equipment operation
- Mechanical energy

2.3.1 Biological Hazards

Beware of poison ivy, poison oak, and other plants that cause allergic reactions. Use protection against bacteria and other microbiota that could be present in the water and sediment. Be aware that mosquitoes are a common vector for human diseases. In addition, field crews should be aware of poisonous snakes and spiders (i.e. rattle snakes and Black Widow spiders), which may be present near monitoring activities and/or fields and channel bottoms in the vicinity.

2.3.2 Heat Stress

Heat stress is a major hazard, especially for workers wearing protective clothing. The same protective materials that shield the body from chemical exposure also limit the dissipation of body heat and moisture. In its early stages, heat stress can cause rashes, cramps, discomfort, and drowsiness, resulting in impaired functional ability that threatens the safety of both the individual and coworkers. Continued heat stress can lead to heat stroke and death. Avoiding overprotection, careful training and frequent monitoring of personnel who wear protective clothing, judicious scheduling of work and rest periods, and frequent replacement of fluids can protect against this hazard.

Heat stress is a possibility on this project. Breaks in a shaded area will be taken if any worker exhibits or believes necessary to mitigate the symptoms of heat stress such as excessive sweating, muscle spasms, thirst, dizziness, rapid/weak pulse, flushed skin, loss of consciousness, or convulsions. The breaks will last until symptoms are relieved and/or the pulse of the worker is less than 110 beats per minute. As a preventive measure, workers will be instructed to drink fluids to keep hydrated. For severe heat stress, workers will be examined by a health-care professional as soon as possible.

Additionally, during periods of hot weather or other potential heat stress conditions the following safe work practices must apply:

- Be on the alert to signs and symptoms of heat illness during periods of abnormally high heat.
- Know the symptoms of heat illness to watch for which includes excessive sweating, headache, poor concentration, muscle pain, headache, cramping, dizziness, irritability, loss of coordination, vomiting, blurry vision, confusion, and lack of sweating, fainting, or seizures.
- Drink plenty of water throughout the day. Employees working in the heat need to drink four 8-ounce glasses of water per hour, including at the start of the shift to replace the water lost to sweat.
- Dress for conditions. Wear lightweight, light-colored loose clothing. Wear a wide brimmed hat if possible.
- Wear sunscreen and sunglasses.
- Use cool compresses to stay cool.
- Take scheduled rest periods and spend them in the shade.
- Tell your supervisor immediately if you feel you may be getting sick from the heat.
- Know the locations of your closest drinking water supplies.

- Keep track of your coworkers. You all need to look out for each other.
- Know how to contact emergency services in the event of heat illness and how to effectively report the work location to 911.

2.3.3 Cold Exposure

Storms can bring unusual cold weather to the area. Cold injury (frostbite and hypothermia) and impaired ability to work are dangers at low temperatures and wet conditions. To guard against this hazard, wear appropriate clothing, have warm shelter readily available, carefully schedule work and rest periods, and monitor workers' physical conditions.

2.3.4 Worker Safety

Only personnel trained in the use of the proper safety equipment will be allowed to complete the required tasks.

2.4 Personal Protective Equipment

Personal protective equipment recommended includes hard hats, safety vests, work boots, gloves, and sturdy clothing. This equipment will not only help protect against numerous potential hazards but will also allow others to identify you as belonging to the work site. Additionally, Nitrile, latex, or other plastic-based personal protective equipment will be used by any personnel who is likely to come in contact with storm water runoff as the contents of the water are unknown and potentially dangerous.

The safety officer will select the PPE ensemble based on the potential hazards. The appropriate PPE are listed in Table 2-2. Each worker will be responsible for maintaining his or her own PPE.

2.4.1 Special Circumstances

Extreme caution will be used when maintaining pole-mounted equipment. Qualified individuals will perform this task with proper equipment due to the danger of potential falls.

Table 2-2: Standard PPE for Non-Hazardous Work Zones

Activity	Head/Face/Ear	Foot	Hands	Respirator	Clothing
General Site labor	Hard hat (Class B or E) Safety glasses Hearing protection	Steel toed boots w/ puncture resistant insoles.	Leather/Nitrile gloves as needed	None[a]	Shirt w/sleeves. Long pants. High vis-reflectorized vest
Supervision of work	Hard hat (Class B or E) Safety glasses Hearing protection	Steel toed boots w/ puncture resistant insoles.	Leather/Nitrile gloves as needed	None[a]	Shirt w/sleeves. Long pants. High vis-reflectorized vest
Site Visitors	Hard hat (Class B or E) Safety glasses Hearing protection[b]	Steel toed boots w/ puncture resistant insoles.	None	None[a]	Shirt w/sleeves. Long pants. High vis-reflectorized vest

Notes:
(a) Voluntary use of respirators is authorized for nuisance dusts and exposures known to be below PEL levels. For nuisance dust use disposable N, R or P95 or better (dispose of N or r types daily and P type weekly). For odors use half mask with OV or OV/P95 or better (change at start of week).
(b) Hearing protection with adequate noise reduction rating (if consistently exposed to greater than 85 decibels steady-state or 140 decibels impulse). Workers should use clean hands to insert earplugs. Ample supplies of disposable earplugs will be available onsite.

2.5 Traffic Safety

A rotating amber light is required when accessing many of the monitoring locations. A shoulder or lane closure will be considered for all work near the shoulder or in a traffic lane that is expected to last more than 30 minutes. Traffic control requirements described in the encroachment permit for selected shoulder/lane closures shall be followed.

2.6 Installation Safety

The following precautions will be taken while installing the Chollas Creek Dissolved Metals TMDL Project:

- Use plenty of light during the evening hours and use reflective ANSI/ISEA class II or III vests (23 CFR Part 634) if working near the highway or roadway. Night time work also requires on site personnel to wear white coveralls or appropriate ANSI/ISEA approved retroreflective pants.
- Always wear protective gloves, a reflective vest, as described above, and a hard hat when overhead dangers exist.
- Wear boots and foul weather gear during rainy weather.

- Do not eat or smoke while on the job site.
- Use proper lifting techniques and get assistance when moving coolers and large sample composite containers or other equipment.

2.7 Emergency Procedures

2.7.1 Medical Emergencies

Even with full safety awareness and compliance by field teams, medical emergencies can and do occur. To handle minor injuries, field teams will have a basic first aid kit on-site at all times. Table 2-3 is a list of site-specific emergency contacts. Driving directions to the hospital nearest each site are presented in Tables 2-4 through 2-7, along with corresponding maps showing driving routes Figures 2-1 through 2-4.

Table 2-3: Emergency Contacts

Site	Name	Phone	Comments
All	San Diego Police Dept	911	From Cell Phone

Document all information related to the accident or incident that resulted in injury or damage and report it to the Consultant Safety Manager.

Table 2-4: Driving Directions to Hospital from DPR3

Site	Directions/Hospital	Name/Address	Hospital Route Map Figure No.
DPR3	Head Southwest on Birch St. Turn Right on S. 40th St. Turn Left onto Division St. Turn Right at S. Euclid Ave. Turn Left at E. 7th Ave	Paradise Valley Hospital 2400 E 4th St National City, CA 91950 (619) 470-4321	Figure 2-1

Figure 2-1: Hospital Map from DPR3

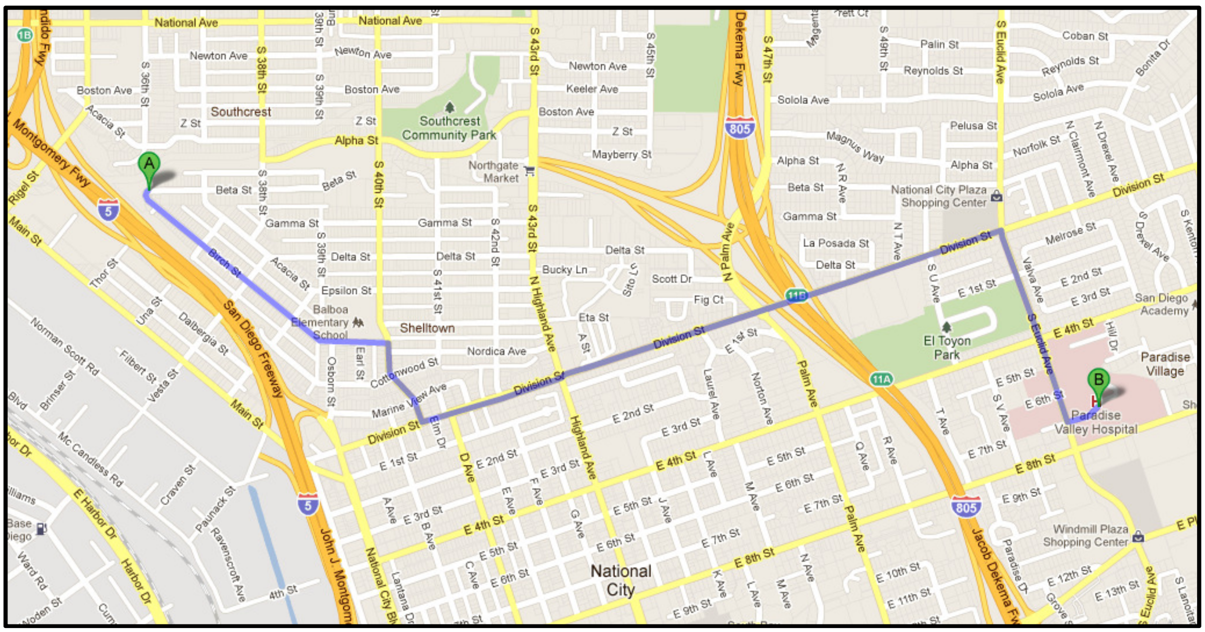


Table 2-5: Driving Directions to Hospital from SD8(1)

Site	Directions/Hospital	Name/Address	Hospital Route Map Figure No.
SD8(1)	Head West on Durant St. Left on S. 33rd St. Left onto Ocean View Blvd. Turn Right at S. 47th St. Left onto Logan Ave. Right on S. Euclid Ave.	Paradise Valley Hospital 2400 E 4th St National City, CA 91950 (619) 470-4321	Figure 2-2

Figure 2-2: Hospital Map from SD8(1)

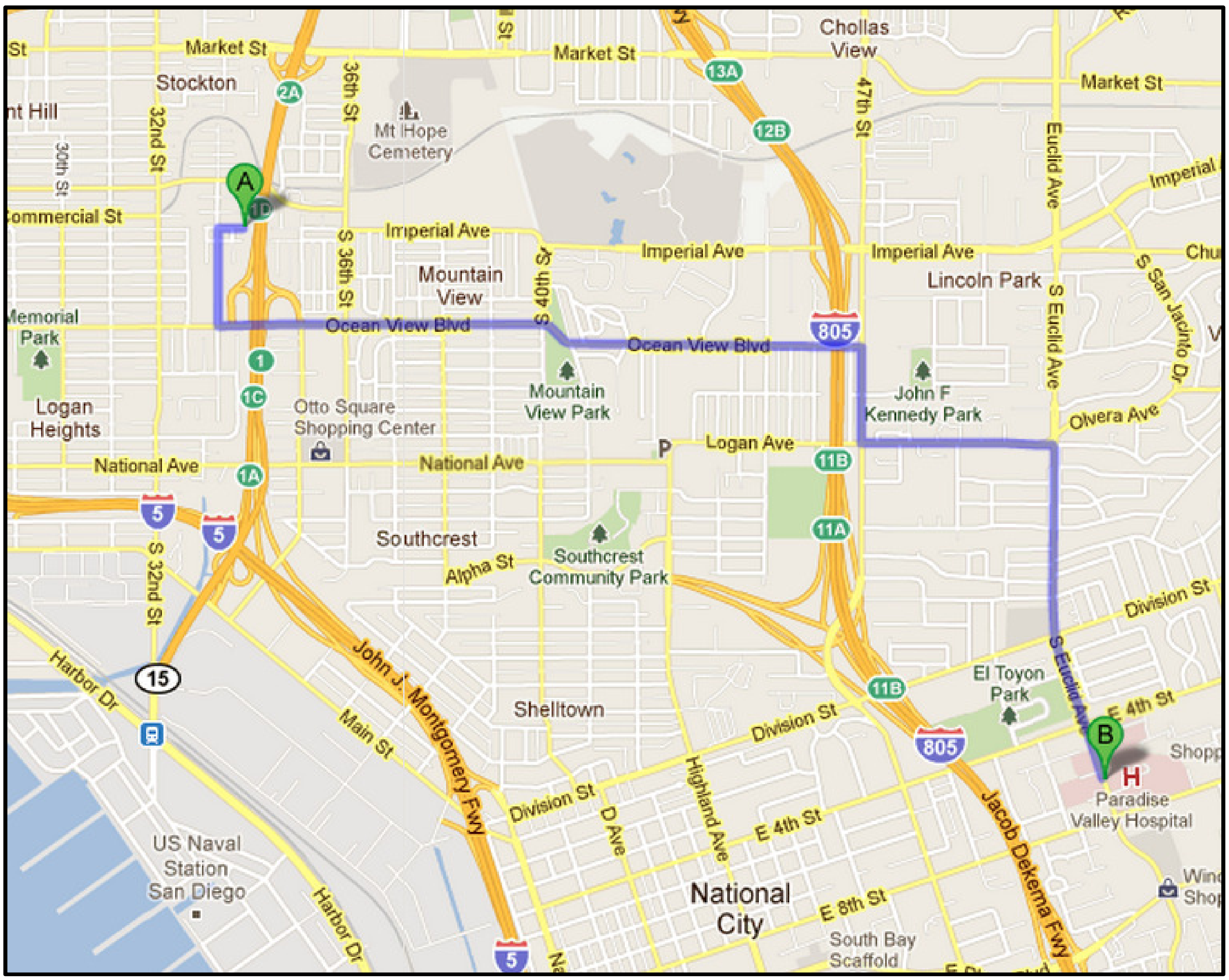


Table 2-6: Driving Directions to Hospital from LM-1

Site	Directions/Hospital	Name/Address	Hospital Route Map Figure No.
LM-1	Head East on Boulevard Dr. Left on Lois St. Continue onto 70th St. Left onto El Cajon Blvd. Right onto Montezuma Rd. Right onto Reservoir Dr.	Alvarado Hospital 6655 Alvarado Rd. San Diego, CA 92120 (619) 287-3270	Figure 2-3

Figure 2-3: Hospital Map from LM-1

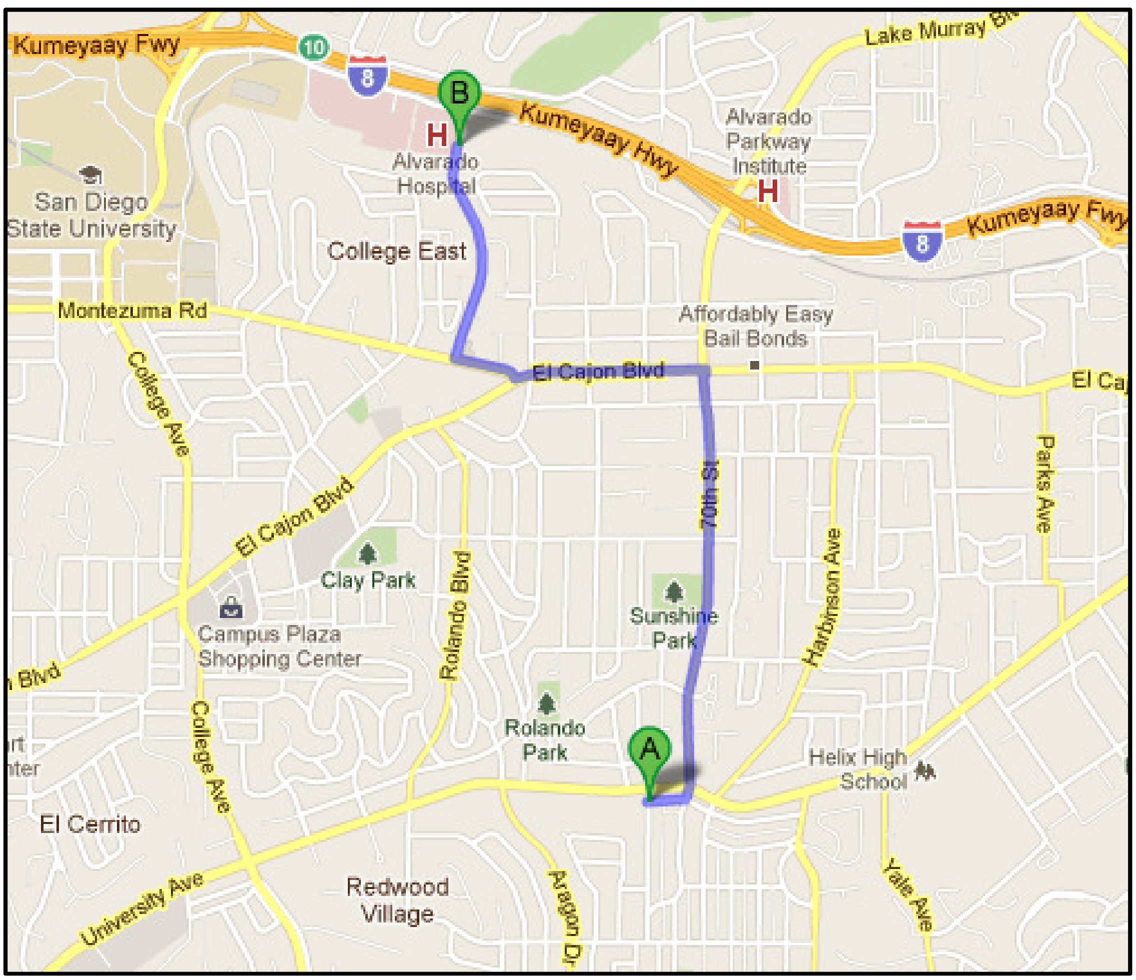
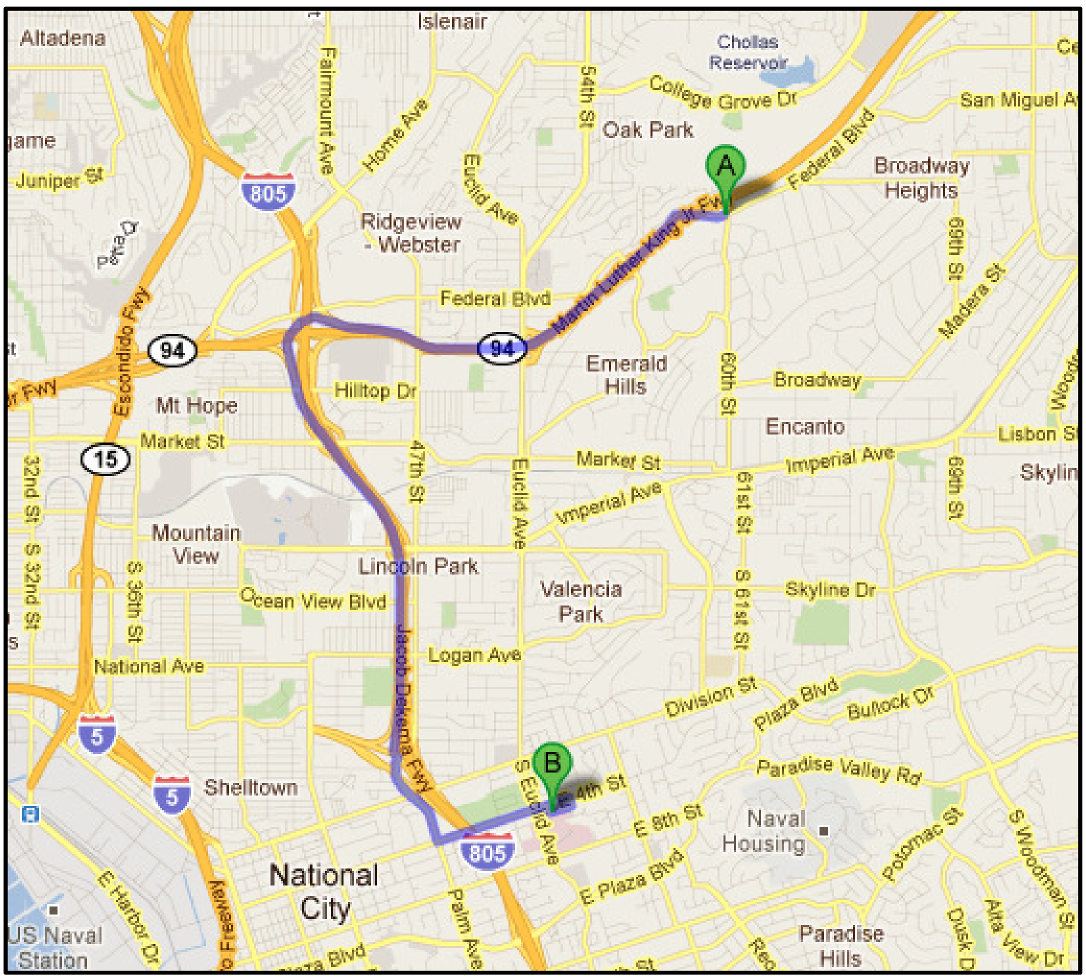


Table 2-7: Driving Directions to Hospital from LG-1

Site	Directions/Hospital	Name/Address	Hospital Route Map Figure No.
LG-1	Head West on Federal Blvd. Merge onto the 94W Freeway Merge onto 805 South Take Exit 11A for Palm Ave. Right onto S. 47th St./N. Palm Ave. Left onto E. 4th St.	Paradise Valley Hospital 2400 E 4th St National City, CA 91950 (619) 470-4321	Figure 2-4

Figure 2-4: Hospital Map from LG-1



2.8 Hazardous Spills

Hazardous substances may be used for various purposes at and around the site. When working with hazardous substances, leaks and spills are always a concern. With the close proximity of the site to the roadway, the probability also exists of potential hazardous spills originating from traveling vehicles.

A spill may present a number of hazards. The specific hazards depend on the substance(s) involved. Among the possibilities are:

- Fire
- Explosion
- Contamination of individuals who come in contact with the spilled substance
- Hazardous substances entering the water supply

Spill response procedures are designed to minimize the risk of any of these things occurring as a result of a spill or, at the very least, reducing the degree of hazard. The primary concern of spill contamination is to stop or retard the spill before it becomes serious.

Field teams working with potentially hazardous materials will be trained in the use of proper personal protective equipment, the safe usage or handling of the substances, and contingency plans for spills and leaks. In the event of a hazardous material spill, follow the procedures listed in Section 1.3 of this HASP. The hazards posed by a spill of a particular substance are detailed on the Material Safety Data Sheet (MSDS) for that substance. In the event of a hazardous material spill originating from an external source such as an accident on the roadway, follow the procedures listed in Section 1.3 of this HASP.

2.9 Tailgate Safety Training

The HSO or another designated Safety Officer will conduct tailgate safety training sessions regularly. These meetings will be held on-site prior to work operations. New personnel working on site will be required to attend a tailgate meeting prior to work operations. The purpose of the safety-training meeting is to ensure that field team members understand and will abide by all safety and potential emergency response measures that may be necessary for the well being of the field team.

The following items will be discussed at each safety meeting:

- Traffic safety
- Safe entering and exiting of the highway or roadway
- Use of personal protective clothing and equipment
- Potential chemical and physical hazards and how to deal with them
- Nearest hospital information
- Emergency response procedures
- Any other site-specific safety issues

Field team members must sign the tailgate safety training meeting form in acknowledgment of understanding all issues discussed. An example of a tailgate meeting form is included as Figure 2-5.

Figure 2-5: Tailgate Safety Meeting Form

Project No.: _________________________ Client: _____________________________

Site: ___________________________ Location: ___________________________

Safety Topics Discussed
1. Protective clothing and equipment: - PPE – Use the PPE that has been provided to prevent injury, exposure to the cold and wet weather conditions, and exposure to storm water runoff containing diluted levels of chemical contaminates. Typical PPE may consist of a hard hat, rain gear, rubber rain boots, nitrile gloves, pants, long sleeved shirts, and layered clothing. Use and wear a PFD if working over water, on piers or quay walls. - Equipment and tool use - Use proper equipment for the task in the prescribed manner to prevent injury.
2. Chemical hazards: - Dermal/eye contact with water contaminants - Do not overfill containers. Fill bottles only to the neck or as otherwise instructed by the site manager. - Food, drinks, or cigarettes will not be consumed while observing or sampling. Prior to handling food, drinks, or cigarettes, personnel will wash hands and face.
3. Physical hazards: - Lifting - Use proper equipment and lifting and motion technique. Do not twist back, stay balanced and use your legs. - Vehicle Hazards - Be aware of vehicle operations in your area. Make eye contact with vehicle operators on approaching equipment. - Driving - Drive vehicle in accordance with company policy. Drive in right lane, use 3-second rule or extended distance from vehicle in front of you. Drive speed limit or slower depending on road conditions and visibility. - Working over water - Exercise care and alertness when working around water. Use the buddy system and wear a PFD if working over water, on piers or quay walls.
4. Vehicle Hazards: - Wear seat belt while vehicle is in motion. - Do not exceed the posted speed limit. - Reduce speed in adverse weather conditions. - Always drive with headlights on. - Drive vehicle in accordance with AMEC policy. Drive in the right lane and maintain an extended distance (3-second rule) from the vehicle in front of you. - Drive defensively and follow traffic regulations. - Do not make sudden lane changes, weave through traffic, or cut off other drivers. **- Do not use handheld or hands-free cell phones while driving.** - Stop at intersections and give the right-of-way to other vehicles and pedestrians. - Check tires for proper inflation.

5. Traffic Hazards: - Be aware of vehicles in your area. Make eye contact with approaching vehicle operators. - In dry weather, a reflective vest should be worn for maximum visibility in high-traffic areas. - Use traffic cones around the work zone in high-traffic areas. - At least two persons must be present to perform any work in high-traffic areas. One of these persons must monitor approaching traffic for any potential hazards. - Watch out for moving vehicles and equipment and equipment.
6. Environmental and biohazards: - Dangerous animals and insect bites and stings – Be aware of your surroundings and watch for dangerous animals and insects such as spiders and snakes. Wear appropriate clothing such as pants, long sleeved shirts, and steel toe boots. - Watch for Poison Oak.
7. Equipment hazards: - Pinch Points – Use proper equipment in the prescribed manner in conjunction with proper lifting techniques to avoid pinch points. - Wear leather or canvas gloves - to protect the hands when performing manual labor, such as moving manhole covers
8. Decontamination procedures: - If an exposure or eye contact occurs, respond with appropriate first aid and immediately notify the supervisor.
9. Other: - The supervisor will review any other significant safety matters specific to sampling and observation activities at this base.
10. Review of emergency procedures: In case of emergency, **immediately dial 911**.

Project Safety Log			Attendees	
Date	Site Activity	Topic Discussed	Printed Name	Signature

Meeting Conducted by:

Name ____________________ Title ____________________

Signature ____________________ Date ____________________

Project Safety Log			Attendees	
Date	**Site Activity**	**Topic Discussed**	**Printed Name**	**Signature**

Meeting Conducted by:

Name ______________________ Title ______________________

Signature ______________________ Date ______________________

APPENDIX C

FIELD FORM AND CHAIN OF CUSTODY

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Field Data Log Sheet

Site ID ____ **Field Crew** ____ **Date** ____

Site-Specific Event Wet Weather 1 Wet Weather 2 Wet Weather 3 Data Downloa **Time** ____

ATMOSPHERIC CONDITIONS

Weather Sunny Partly Cloudy Overcast Fog Raining

Last Rain > 72 Hours < 72 Hours **Rainfall** None < 0.1" > 0.1"

RUNOFF CHARACTERISTICS

Odor None Musty Rotten Eggs Chemical Sewage Other________________

Color None Yellow Brown White Gray Other________________

Clarity Clear Slightly Cloudy Opaque Other________________

Floatables None Trash Bubbles/Foam Sheen Other________________

Deposits None Sediment/Gravel Fine Particles Stains Oily Deposits Other_________

Vegetation None Limited Normal Excessive Other________________

Water Flow Flowing Ponded Moist Dry

CURRENT CONDITIONS

Upon Arrival: Flowmeter Running? Y N **Sampler Running?** Y N **Tubing Connected?** Y N

Level (in) ____ **Velocity (fps)** ____ **Flow (cfs)** ____

Total Flow (cf) ____ **Total Rainfall (in)** ____ **# of Missed Samples** ____

Flow Meter Battery Voltage ____ **# of Successful Samples** ____

Sampler Battery Voltage ____ **Approx. Sample Volume (L)** ____

Upon Departure: Flowmeter Running? Y N **Sampler Running?** Y N **Tubing Connected?** Y N

FIELD MEASUREMENTS

Temp(℃) ____ **pH** ____ **Sp Conductivity @ 25°C (µS/cm)** ____

SAMPLE COLLECTION

Sample Type	Date	Time	Bottle ID	Sample ID
Chemistry				
Toxicity				

POST STORM DATA

Total Flow Volume (cf)	Total Rainfall (in)	Sample Aliquot Count	Total Sample Volume

BOTTLE CHANGE / LAST SAMPLE

Bottle Change: Chemistry	Bottle Change: Toxicity	Last Sample: Chemistry	Last Sample: Toxicity
Date	Date	Date	Date
Time	Time	Time	Time
Aliquot	Aliquot	Aliquot	Aliquot
Volume	Volume	Volume	Volume
Bottle ID	Bottle ID	Bottle ID	Bottle ID

NOTES/COMMENTS

Analysis Request and Chain of Custody

City of San Diego

Chollas TMDL Compliance Monitoring 2013-2014

Project Number: 5025-13-1035

PO Number:C013101246

From:

AMEC Environment & Infrastructure
Attn: Tommy Wells
9177 Sky Park Court
San Diego, CA 92123
Phone: (858) 278-3600 Fax: (858) 278-5300

To:

Weck Laboratories, Inc.
14859 East Clark Avenue
City of Industry, CA 91745
Phone: (626) 336-2139
Fax: (626) 336-2634

SampleID	Date	Time	Analyses	Bottle Size	Preservative	Bottle Count
2013-W____-DPR3-C-01	____________	____________	Chloride, Sulfate, Total Hardness as CaCO3, Mg, Ca, Total and Dissolved Copper, Total and Dissolved Lead, Total and Dissolved Zinc, Organophosphorus Pesticides, Organochlorine Pesticides/PCBs, PAHs, PCB Congeners, TOC, DOC	19L	6 °C	________ ________ Etched Bottle ID
2013-W____-SD8(1)-C-01	____________	____________	Chloride, Sulfate, Total Hardness as CaCO3, Mg, Ca, Total and Dissolved Copper, Total and Dissolved Lead, Total and Dissolved Zinc, Organophosphorus Pesticides, Organochlorine Pesticides/PCBs, PAHs, PCB Congeners, TOC, DOC	19L	6 °C	________ ________ Etched Bottle ID

Relinquished By:

Print:________________________ Date:_____________

Sign:________________________ Time:_____________

Received By:

Print:________________________ Date:_____________

Sign:________________________ Time:_____________

Relinquished By:

Print:________________________ Date:_____________

Sign:________________________ Time:_____________

Received By:

Print:________________________ Date:_____________

Sign:________________________ Time:_____________

Notes/Comments:

Sampler's Initials: __________

Page: ___ of ___

Analysis Request and Chain of Custody

City of San Diego

Chollas TMDL Compliance Monitoring 2013-2014

Project Number: 5025-13-1035

PO Number: C013101247

From:

AMEC Environment & Infrastructure
Attn: Tommy Wells
9177 Sky Park Court
San Diego, CA 92123
Phone: (858) 278-3600 Fax: (858) 278-5300

To:

Nautilus Environmental
4340 Vandever Ave
San Diego, CA 92120
Phone: (858) 587-7333
Fax: (858) 587-6769

SampleID	Date	Time	Analyses	Bottle Size	Preservative	Bottle Count
2013-W____-SD8(1)-C-01	________	________	Ceriodaphnia dubia 96-hour acute static-renewal test, Ceriodaphnia dubia 7-day chronic static-renewal test	19L	6 °C	______ Etched Bottle ID
2013-W____-DPR3-C-01	________	________	Ceriodaphnia dubia 96-hour acute static-renewal test, Ceriodaphnia dubia 7-day chronic static-renewal test	19L	6 °C	______ Etched Bottle ID

Relinquished By: Print:_______________ Date:_________ Sign:_______________ Time:_________	***Received By:*** Print:_______________ Date:_________ Sign:_______________ Time:_________	***Notes/Comments:***
Relinquished By: Print:_______________ Date:_________ Sign:_______________ Time:_________	***Received By:*** Print:_______________ Date:_________ Sign:_______________ Time:_________	Sampler's Initials: ___________ Page: ___ of ___

APPENDIX D

CLEAN SAMPLING PROTOCOLS

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FLOW MONITORING AND SAMPLING STANDARD OPERATING PROCEDURE

FIELD FLOW MONITORING AND SAMPLING TECHNIQUES

The following text describes clean sampling techniques that should be used when low-level analytical detection limits are to be employed for sampling.

The following topics are discussed below:

- Clean Sample and Equipment Handling
- Composite Bottle Changing
- Bottle and Equipment Cleaning

CLEAN SAMPLE AND EQUIPMENT HANDLING

During all sampling operations, extreme care must be taken to minimize exposure of the sample and sample collection equipment to human, atmospheric, and other sources of contamination. This section provides clean sample and equipment handling procedures to be used when samples are collected for-level analysis.

Clean sampling techniques typically require a two person sampling team. Upon arrival at the sampling site, one member of the sampling team is designated as “dirty hands”; the second member is designated as “clean hands”. All operations involving contact with the sample bottle, sample bottle lid, sample suction tubing, and the transfer of the sample from the sample collection device (if the sample is not directly collected in the bottle) to the sample bottle are handled by “clean hands” wearing clean powder-free nitrile gloves. “Dirty hands” (also wearing clean powder-free nitrile gloves) is responsible for preparation of the sampler (except the sample container itself), operation of any machinery, and for all other activities that do not involve handling items that have direct contact with the sample. “Clean hands” will change into clean gloves as frequently as required to ensure that the gloved hands contacting the sample container, container lid, and laboratory cleaned sampling equipment have not contacted any source of potential contamination.

Although the duties of “clean hands” and “dirty hands” would appear to be a logical separation of responsibilities, in fact, the completion of the entire protocol may require a good deal of coordination and practice. For example, “dirty hands” must open the box or ice chest containing the sample bottle and unzip the outer bag; “clean hands” must reach into the outer bag, open the inner bag, remove the bottle, collect the sample, replace the bottle lid, put the bottle back into the inner bag, and zip the inner bag. “Dirty hands” must close the outer bag and place the double-bagged sample in an ice-filled ice chest.

COMPOSITE BOTTLE CHANGING

If an automated monitoring station is used for the collection of composite stormwater samples and a composite bottle change is required, composite bottle changing is conducted using the following steps:

1. The automated sampling equipment is placed in pause mode prior to the initiation of a composite bottle change. This action is accomplished in the field or by remote monitoring personnel if the monitoring station is equipped with telemetry.
2. Composite bottle changing requires two field crew members- “clean hands” and “dirty hands”. Both team members wear clean, powder-free nitrile gloves. “Clean hands” only touches suction tubing and Teflon composite bottle lids. Keep extra gloves within easy reach.
3. Prior to putting on clean gloves, the clean empty sample bottle is placed near the automated sampling unit, and the sampler is opened.
4. Wearing clean powder-free nitrile gloves, “dirty hands” removes the lid clamps from both the full sample bottle and the clean sample bottle.
5. “Clean hands” removes the end of the pump tubing from the composite bottle and “dirty hands” places a clean ziplock bag over the end of the tubing securing it with a rubber band. The inside of the bag should never be touched by sampling personnel.
6. “Clean hands” switches the bottle lids, putting the solid lid on the full bottle and the perforated id on the clean empty bottle.
7. “Dirty hands” installs the lid clamps on both bottles, removes the full bottle from the sampler, replacing it with the clean empty bottle.
8. “Clean hands” holds the tubing while “dirty hands” removes the ziplock bag from the end of the pump tubing, being careful not to touch the tubing.
9. “Clean hands” inserts the tubing through the lid of the clean bottle.
10. The sampler is closed and sampling equipment is placed in sample mode. Remote operation personnel are notified as soon as the bottle change is complete.
11. The sampling team fills out the appropriate information on the label of the full sample bottle.
12. The full bottle is surrounded with fresh ice or frozen refreezable ice packets, and secured inside the vehicle for transport.

BOTTLE AND EQUIPMENT CLEANING

When use of the preceding clean techniques is called for, additional effort should also be made in the area of bottle and equipment cleaning. Consult also EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*, and relevant individual 1600 series methods for further information.

Automated Sampling Equipment

Key components required for successful automated sample collection include an automated sampler, tubing with strainer, and sample bottle(s).

Automated Sampler

Automated samplers are comprised of a peristaltic pump, pump control electronics, a sample distribution system, a power supply, and a housing that contains the composite bottle(s). A peristaltic pump creates suction by compressing a flexible tube with a rotating roller, drawing a sample that is then pushed out of the pump. The pump operates best when placed close to the source; this reduces the suction head or lift (experience has shown that the reliability of peristaltic pumps drawing a consistent sample volume is greatly reduced as the static suction head increases). According to manufacturer's specifications, vertical lift must be no greater than 26 feet. When sampling with an automated sampler, static head height refers to the vertical distance from the surface of the flow stream to the automated sampler pump inlet. Automated samplers may be configured for single or multiple bottle composite collection. Samplers configured to fill multiple sample bottles have a sample distribution mechanism. Tubing from the discharge port of the intake pump is connected to a rotating distributor arm that dispenses the samples into several sample bottles. If flow-weighted sampling is planned, the automated sampler must be capable of accepting a signal from a flow meter that is used to trigger collection of a sample aliquot. Cables can be purchased that connect each type of flow meter to an automated sampler. Automated samplers are equipped with internal memory circuits, and typically a small LCD data screen. The memory holds the user-programmed values for the sample aliquot volume, sample bottle configuration, and number of samples per bottle. The memory also retains information describing the status of the sampling program and the time at which each triggering signal was received from the flow meter. Messages can be displayed on the data screen for the user regarding any sample collection failures.

Samplers are powered by 12-volt (V) DC batteries, AC power, or solar-powered batteries. Two types of 12-V DC batteries are available: nickel-cadmium and lead-acid. Most automated sampler manufacturers offer AC power packs for use where line power is available. Use of AC power decreases routine maintenance requirements, as battery changes are not necessary. The preferred configuration includes AC power with an in-line battery backup. However, back-up batteries typically will not provide adequate power for refrigerated units.

Sampler Intake Strainer, Intake Tubing and Flexible Pump Tubing

The intake strainer is attached to the intake tubing and mounted to the bottom of a pipe or channel. Intake strainers prevent rocks and debris from clogging or damaging the intake tubing or pump. Sizes vary, but smaller intake strainers are generally better for use under low flow conditions. Sample intake strainers are typically made of stainless steel, or a combination of stainless steel and Teflon. For trace metals analyses, all intake strainer parts must be Teflon, or coated with Teflon or Teflon-like material. Specific intake and pump tubing requirements are listed below:

- Intake tubing: Teflon
  - — Maximum vertical lift = 26 feet
  - — Maximum length = 99 feet
- Pump tubing: Silicon or other medical grade flexible tubing

Limit to length needed to feed through peristaltic pump, connect to Teflon intake tubing and sample bottle Teflon tubing is used for the sample intake tubing because of its inert properties. This tubing is connected from the intake strainer to the pump tubing, and may range from 3 to 99 feet in length. EPA protocols permit the use of the minimum amount of flexible pump tubing needed to carry the sample water through a peristaltic pump. Silicone tubing is normally used for this purpose.

Sample Bottle(s)

Automated samplers may be configured to have a variety of sample bottles, from one to a dozen or more sample bottles. If a sampler holds a single bottle, all of the sample aliquots are pumped into this bottle, resulting in one large composite sample. Use of a single composite bottle has the advantage of providing for the estimation of the event mean concentrations (EMCs) directly from analysis of the constituents in the one bottle. However, it does not allow for isolation of specific samples or groups of samples from specific periods of the runoff hydrograph, and provides less visual indication of sampler malfunction (if this should occur). A multiple bottle configuration, however, provides these latter capabilities.

It is important to keep extra bottles (for either the single or multiple bottle configurations) available in case bottles are contaminated or damaged, or in the event that bottles need to be changed to accommodate a larger-than-expected storm. If a storm delivers more precipitation than expected, sample bottles will fill prior to the end of the storm, prompting sample bottle replacement.

AUTOMATED SAMPLER INSTALLATION

The automated sample collection equipment should be installed and maintained according to manufacturer specifications. See Section 5 regarding selection of automated equipment.

Installation The automated sampler should be installed inside the protective enclosure in such a way that all controls, display windows and cable connections are easily accessed. All wiring should be secured, in a well organized fashion to the inside of the enclosure to prevent accidental disconnection or damage. The sampler must be oriented in a way that will allow the sample intake tubing to enter the sampler without sharp bends or kinking, and to allow easy access for tubing replacement. At the sampler peristaltic pump, where the sample intake tubing is connected to the pump tubing, no metallic fittings or clamps should be used. Using “clean techniques”, the Teflon intake tubing should be inserted (at least a half inch) into the flexible pump tubing and fastened using a non-metallic clamp or cable tie. At no time during this procedure should the ends of the tubing be allowed to touch any object that is not known to be clean. The flexible pump tubing should then be fed through the peristaltic pump and into the area of the sampler where the sample bottle(s) are housed. Adequate space must be available in the equipment enclosure to easily remove and replace sample bottles from the automated sampler. Proper placement of the sampler intake assures the collection of representative samples. The intake strainer should be placed in the main flow. The vertical position of the intake strainer in the flow is important. Placement at the bottom may result in excess heavy solids and no floating material, while placement at the top may result in excess floating material and no heavy solids. The constituents of interest must be considered when positioning the intake strainer. Placement of the intake strainer is usually at the channel invert, but may be mounted slightly above the invert on one side of the channel wall if high solids loadings are expected. This will reduce the amount of solids that may enter the intake strainer, and help prevent blockages. However, with the intake strainer offset above the channel invert, low flows may not adequately submerge the strainer, thus preventing sample collection. Maintenance using laboratory provided blank water, the automated sampler should be calibrated according to manufacturer specifications to collect the desired sample aliquot. At a minimum, the calibration should be checked prior to each stormwater monitoring season.

After each stormwater monitoring event, the sample bottle(s) should be checked to verify that the programmed sample volume was delivered to the sample bottle(s). If the programmed sample volume was not delivered accurately to the sample bottle(s), the automated sampler should be recalibrated prior to the next monitoring event.

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Attachment D

Shelter Island Yacht Basin TMDL Monitoring Plan

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FINAL
SHELTER ISLAND DISSOLVED COPPER TMDL 2014-2015 MONITORING PLAN

Submitted to:
City of San Diego

Submitted by:
AMEC Environment and Infrastructure, Inc.
San Diego, California

November 2014

AMEC Project No. 5025-14-1083

IMPORTANT NOTICE

This monitoring plan was prepared exclusively for the City of San Diego by AMEC, Inc. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
ac	acres
AMEC	AMEC Environment and Infrastructure, Inc.
ASAP	as soon as possible
ASBS	Area of Special Biological Significance
AVB	area velocity bubbler
Basin Plan	Water Quality Control Plan for the San Diego Basin
CD	compact disk
cfs	cubic feet per second
Chambers	Chambers Group, Inc.
City	City of San Diego
cm	centimetres
COC	chain of custody
DQO	data quality objective
e.g.	example given
GIS	geographic information system
HEC-HMS	Hydrologic Engineering Center - Hydrologic Modeling System
HVF	head versus flow
kg	kilograms
L	litre
LCS	laboratory control sample
Ln	Lane
No.	number
MDL	method detection limit
mg	milligrams
MOS	margin of safety
MS	matrix spike
mS	milli Siemens
MSD	matrix spike duplicate
MS4	municipal separate storm sewer system
NA	not applicable
ND	non detect
NWS	National Weather Service
O&M	operations and maintenance
POSD	Unified Port District of San Diego
QA	quality assurance
QC	quality control
RL	reporting limit
RPD	relative percent difference
SDRWQCB	San Diego Regional Water Quality Control Board
SIYB	Shelter Island Yacht Basin
SOP	Standard Operating Procedure
St.	Street
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TMDL	total maximum daily load

µS	micro Siemens
µg	micrograms
USEPA	United States Environmental Protection Agency
VDC	volts direct current
Weck	Weck Laboratories, Inc.
Weston	Weston Solutions, Inc.
WLA	waste load allocation
yr	year

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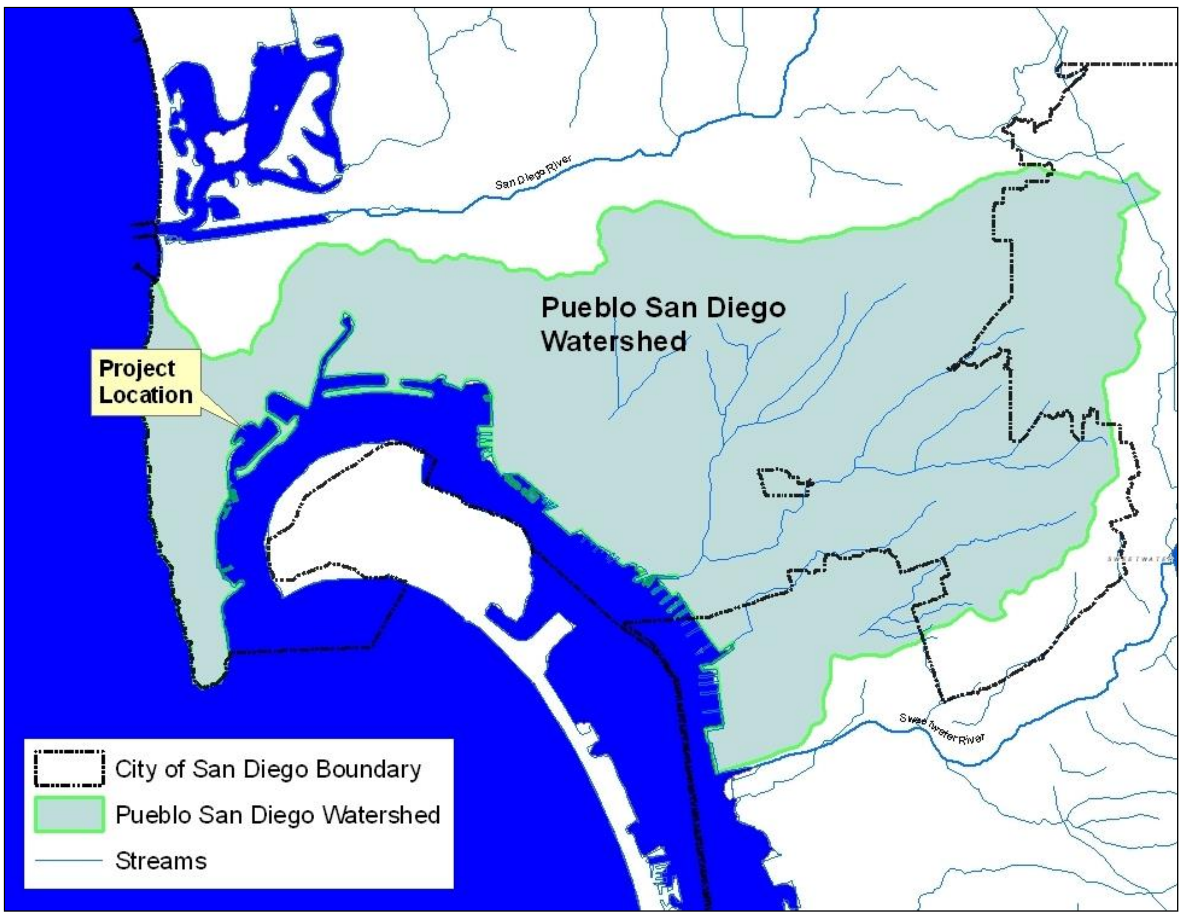
1.0 INTRODUCTION

Shelter Island Yacht Basin (SIYB) is a semi-enclosed recreational yacht basin located in the north-western end of San Diego Bay in San Diego, California. The SIYB drainage area is contained within the Point Loma Hydrologic Area (908.10), which is within the Pueblo San Diego Hydrologic Unit (Figure 1-1). The Pueblo San Diego Hydrologic Unit is one of three sub-watersheds within the San Diego Bay Watershed. The SIYB drainage area is approximately 673 acres and consists of three sub-drainage areas that discharge via municipal separate storm sewer system (MS4) outfalls into the SIYB.

A total maximum daily load (TMDL) for dissolved copper was established for the SIYB and was added as an amendment to the San Diego Regional Water Quality Control Board (SDRWQCB) Water Quality Control Plan for the San Diego Basin (Basin Plan) on February 9, 2005 (SDRWQCB, 2005b).

Figure 1-1. Project Location



1.1 Background and Objectives

The SIYB is part of San Diego Bay. Thus, the same beneficial uses detailed in the Basin Plan that apply to San Diego Bay are applicable to the SIYB. Table 1-1 details the beneficial uses for San Diego Bay stated in the Basin Plan.

Table 1-1. San Diego Bay Beneficial Uses

Designation[1]	Description[1]
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.*
Navigation (NAV)	*Includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.*
Contact Water Recreation (REC1)	*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 (REC2)	*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.*
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.*
Preservation of Biological Habitats of Special Significance (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.*
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).*
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.*
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.*
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)	*Includes uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.*
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.*
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.*

The most sensitive beneficial uses are those designated for protection of marine aquatic life and aquatic dependent wildlife. These beneficial uses are considered threatened or impaired due to elevated levels of dissolved copper in the water column (SDRWQCB, 2005b).

In 1996, the SIYB was placed on the Clean Water Act, Section 303(d) list of impaired waters due to the elevated levels of dissolved copper in the water column. To address this impairment the SDRWQCB issued a resolution on February 9, 2005 adopting an amendment to the Basin Plan to incorporate a TMDL for dissolved copper specific to the SIYB (SDRWQCB Resolution No. R9-2005-0019). The TMDL states that the loading capacity for dissolved copper discharges into the SIYB is 1.6 kilograms per day or 567 kilograms per year (kg/yr).

[1] California Regional Water Quality Control Board, 2011. Water Quality Control Plan for the San Diego Basin. September 8, 1994, revised April 4, 2011.

This allowable load is composed of a Waste Load Allocation (WLA) that has been distributed among the known potential sources of dissolved copper into the SIYB. Approximately 98 percent (%) of the total copper loading to SIYB was determined to originate from copper-based antifouling paints applied to the hulls of recreational vessels moored in the SIYB marinas. Of this total, 93% was determined to be attributable to copper entering the water column through passive leaching of copper from antifouling paints. The remaining 5% was attributed to antifouling paints sourced from underwater hull cleaning operations in the SIYB. Four additional sources of copper were identified: urban runoff, direct atmospheric deposition, marine sediment, and background levels (SDRWQCB, 2005b). The SIYB is under the jurisdiction of the Unified Port of San Diego (POSD) and is stated in the TMDL as the primary source of dissolved copper loading to the SIYB.

The City of San Diego (City) is also named as a discharger under the TMDL and is responsible for the urban runoff contribution to the SIYB from its MS4; however, the contribution from the City's MS4, as reported in previous monitoring years, has historically been relatively minor. The TMDL provides a source analysis, which assigned a WLA for urban runoff from the MS4 of 30 kg/yr, which represents 1% of the current estimated dissolved copper load to SIYB of 2,163 kg/yr (Table 1-2). Based on the historical monitoring results, urban runoff from the City's MS4 is below the City's WLA and was not assigned a load reduction in the TMDL.

Table 1-2 presents a detailed breakdown of the TMDL and WLA.

Table 1-2. TMDL and WLA Summary

Source	Current Load (kg/yr of Copper)	Percent Contribution (% Copper)	WLA (kg/yr of Copper)	Percent Reduction From Current Source Load (%)	Percent Reduction from Total Loading to SIYB (%)
Passive Leaching	2,000	93	375	81	75
Hull Cleaning	100	5	72	28	1
Urban Runoff **(City of San Diego)**	30	1	30	0	0
Background	30	1	30	0	0
Direct Atmospheric Deposition	3	<1	3	0	0
Sediment	0	0	0	0	0
Current Mass Load	2,163	100	NA	NA	0
MOS	NA	NA	57	NA	0
TMDL	NA	NA	567	NA	0
Total Load Reduction					**76**

Notes:

kg/yr = kilograms per year
MOS = Margin of Safety
NA = Not Applicable
TMDL = Total Maximum Daily Load
SIYB = Shelter Island Yacht Basin
WLA = Waste Load Allocation

Source: SDRWQCB, Total Maximum Daily Load for Dissolved Copper In Shelter Island Yacht Basin, San Diego Bay Technical Report (SDRWQCB, 2005c).

The primary objectives of this study are to address two main questions:

1. What is the estimated annual dissolved copper load from the City's MS4 into the SIYB and how does it compare to the TMDL urban runoff WLA of 30 kg/yr?

2. Is there evidence of a trend in the historical dataset?

These two questions can be further broken down as follows:

- What are the dry weather and wet weather estimated pollutant loadings of dissolved copper from the City's MS4 into the SIYB?
- Does the estimated annual dissolved copper load from the City's MS4 exceed the TMDL WLA for urban runoff?
- How does the 2014-2015 monitoring season estimated annual dissolved copper load from the City's MS4 compare to historical results?

1.2 Previous Studies

The monitored drainage area that discharges into the SIYB under the City's jurisdiction consists of three sub-drainage areas, each of which have separate outfalls (Outfall 1, Outfall 2, and Outfall 3). Monitoring and sampling of the City's MS4 that connects to these three outfalls began in February 2008.

During a preliminary site investigation conducted in 2007, it was determined that flow monitoring and sampling was only feasible at Outfall 2. Outfall 2 represents the largest of the three drainage areas (Weston Solutions, Inc. [Weston], 2009). Monitoring of Outfall 1 and Outfall 3 was determined to be infeasible due to tidal influences. Flows for Outfall 1 and Outfall 3 were estimated through modeling and the results are documented in the 2011 Monitoring Report (Weston, 2011c).

A total of 10 wet weather monitoring events and seven dry weather monitoring events were conducted by Weston from 2008 to 2011 to assess dissolved copper loading from the City's MS4 to the SIYB (Weston, 2011c). Beginning in July 2011, AMEC Environment & Infrastructure, Inc. (AMEC) was contracted by the City to continue monitoring and sampling of the City's MS4 that discharges into the SIYB. In an effort to gather additional information to further characterize and estimate the dissolved copper load from the City's MS4 into SIYB, AMEC also began wet weather monitoring at a location upstream from Outfall 3[2] during the 2011-2012 monitoring season. Table 1-3 presents a summary of monitoring events conducted to date.

Table 1-3. Summary of Monitoring Events Conducted to Date

Event Type	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Wet Weather	1	3	3	3	3	3
Dry Weather	0	1	3	3	3	3

This Monitoring Plan presents information, protocols, and procedures relative to the monitoring and sampling of the selected sites by AMEC for the 2014-2015 season.

1.3 Project Organization

The City is the municipal government agency overseeing this project. Ruth Kolb is the Program Manager with the City storm water department. Andre Sonksen is the City Project Manager. The Shelter Island TMDL organization structure is provided in Figure 1-2.

AMEC is the consultant hired by the City to perform work for the Shelter Island Monitoring Program. Tommy Wells is the Project Manager for AMEC and will be responsible for project coordination, scheduling, budget management, and oversight of project plans and deliverable development. Claire Johnson is the AMEC Sampling Manager and Laboratory Coordinator. She will be responsible for developing the monitoring approach and for preparing and implementing the monitoring activities. John Brandt is the AMEC Quality Assurance Officer and will be responsible for the project quality assurance and quality control procedures implemented during sampling, laboratory analysis, data management, and data analysis. Jesse Davis is the AMEC Health and Safety Officer and will be responsible for implementation of the project Health and Safety Plan and practices. William Szafranski will be responsible for developing and maintaining a database of project data and Darcy Ebentier is the AMEC Reporting Manager.

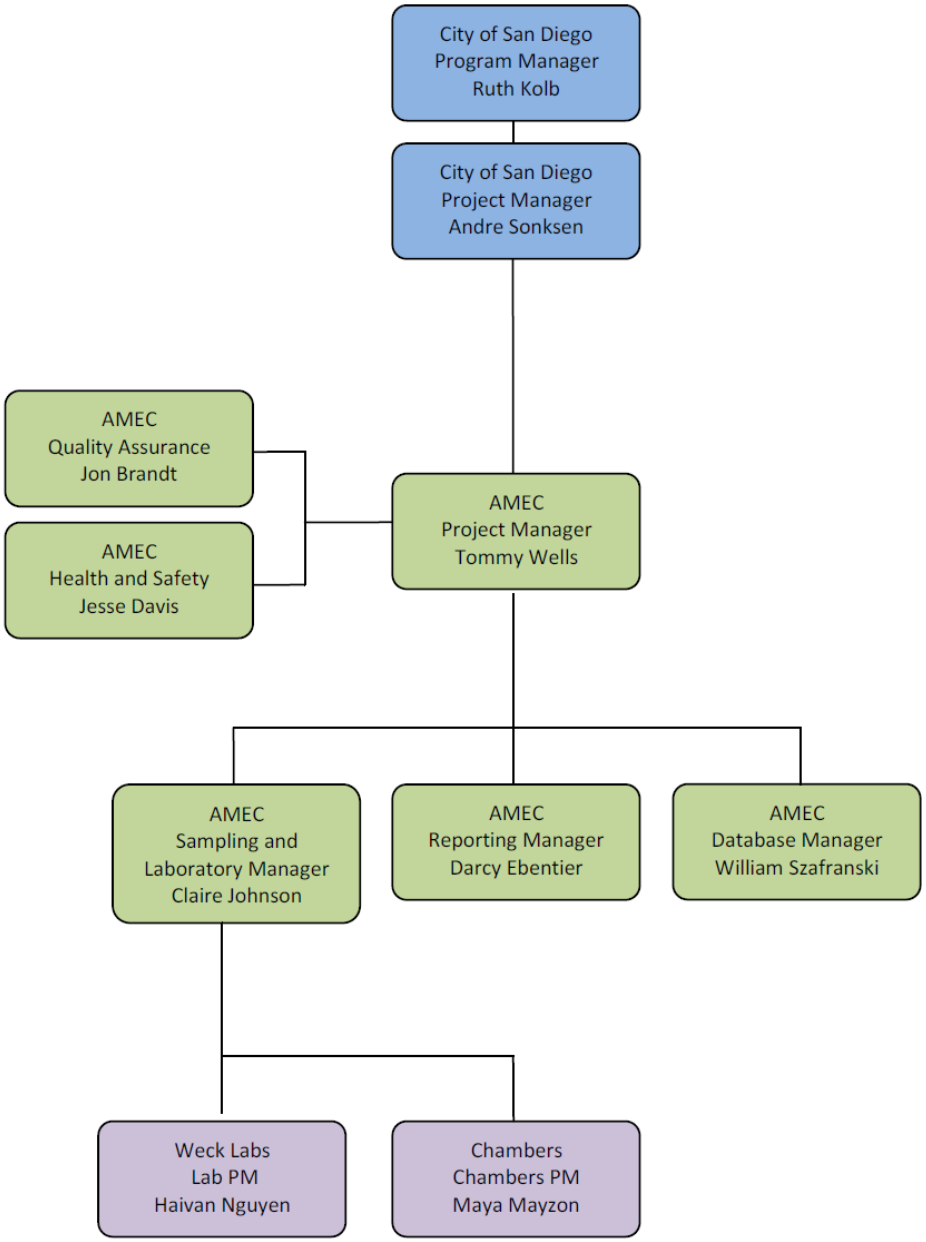
Weck Laboratories, Inc. (Weck) will be responsible for the analysis of the water quality samples. Haivan Nguyen is the Weck Laboratory Project Manager and will be responsible for the proper

[2] Flow monitoring was conducted during the 2011-2012 monitoring season. However, tidal influence limited its effectiveness and it was discontinued. During the 2012-2013 monitoring season samples were collected at Outfall 3 based on the flows and rainfall observed at the Outfall 2 monitoring location. Modeling was utilized to estimate the flows for Outfall 3.

analysis of samples in accordance with the methods and quality assurance requirements outlined in this monitoring plan.

Chambers Group, Inc. (Chambers) will be responsible for providing field support during equipment installation and removal, maintenance, and storm event monitoring. Maya Mazon is the Chambers Project Manager and will be responsible for coordination of field support staff.

Figure 1-2. Organizational Chart



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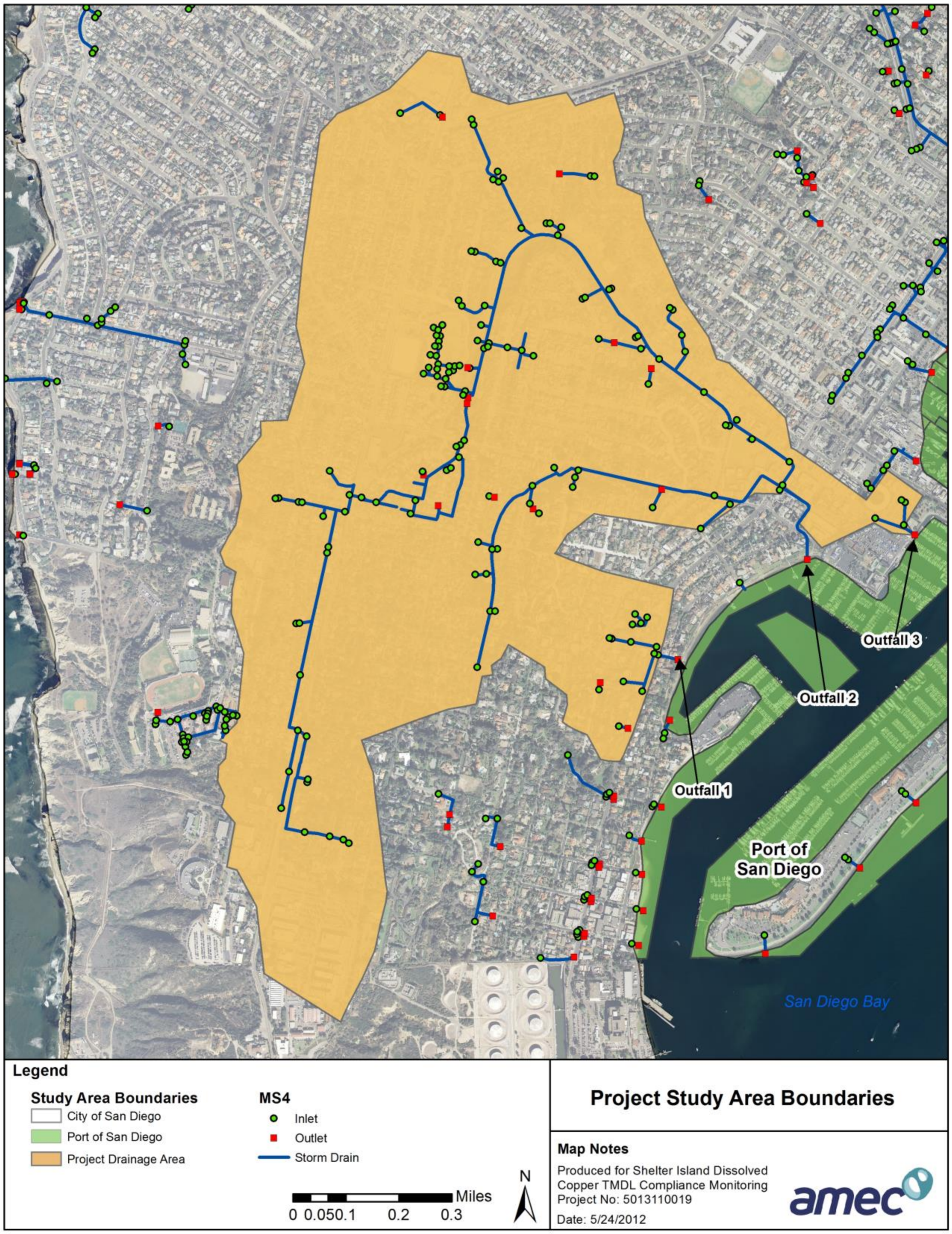
2.0 MONITORING APPROACH

The questions outlined in Section 1.1 will be addressed by estimating wet weather and dry weather flows (monitoring and modeling) and analyzing copper concentrations in runoff samples. The estimated annual dissolved copper load will be calculated based on study results and will be compared to the TMDL load allocation.

2.1 Study Area

The study area for this project consists of the drainage area that discharges into SIYB through the MS4 within the City's boundary and does not encompass the tidelands, which are under the jurisdiction of POSD. The boundaries of the City of San Diego and POSD in the vicinity of the project study area are presented in Figure 2-1. The drainage area that discharges into the SIYB from the City's jurisdiction is approximately 673 acres. It consists of three sub-drainage areas, each with a separate primary outfall (Outfall 1, Outfall 2, and Outfall 3).

Figure 2-1. Project Study Area Boundaries



2.2 Monitoring Site Locations

Prior to the beginning of the 2011-2012 monitoring season, Outfall 2 had been annually monitored and sampled as part of this monitoring program. For Outfall 1 and Outfall 3, dissolved copper load was calculated using modeled flow estimations and dissolved copper concentration data from Outfall 2 (Weston, 2011c).

In August 2011, AMEC conducted a site reconnaissance to re-evaluate the previous monitoring locations. Based on the re-evaluation:

- Outfall 1 – monitoring and sampling activities would likely require encroachment onto POSD land and/or California Department of Transportation (Caltrans) right-of-way; therefore, monitoring was not considered feasible.
- Outfall 2 – the monitoring location remained the same (i.e., Upshur Street at Rosecrans Street).
- Outfall 3 – the outfall is located on private property; however, an inlet upstream at the intersection of Anchorage Lane and Canon Street was observed not to be tidally influenced during low tide (i.e., below three to four feet (ft) tide level) (AMEC, 2011a). However, during the 2011-2012 monitoring season, it was determined that this location was frequently tidally influenced and was not considered a reliably feasible monitoring location.

The locations of these outfalls and monitoring sites are shown in Figure 2-2 and summarized in Table 2-1.

Figure 2-2: Outfalls and Monitoring Locations

Table 2-1: Summary of Outfalls and Monitoring Locations

Site ID/Name	Location	Description	Drainage Area (ac.)	Photo
Outfall 1	32°42'57.71"N 117°14'7.80"W	A 24-inch concrete pipe with a concrete head wall discharging to SIYB.	44.7[a]	
Outfall 2	32°43'8.08"N 117°13'53.11"W	A 66-inch concrete pipe discharging to SIYB.	613[a]	
Outfall 2 Flow Monitoring and Sampling Location	32°43'14.89"N 117°13'55.80"W (Intersection of Rosecrans St. and Upshur St.)	An underground vault with three inlet pipes and one 66-inch outlet pipe.	613[a]	
Outfall 3	32°43'9.88"N 117°13'40.64"W	A 24-inch concrete pipe discharging to SIYB.	15.0[a]	Not Available (on private property)
Outfall 3 Sampling Location	32°43'11.69"N 117°13'45.22"W (Intersection of Anchorage Ln. and Canon St.	A rectangular vault with a 24-inch inlet pipe and outlet pipe.	10.2[b]	

(a) Estimated based on previous Weston reports and available GIS information.
(b) Estimated based on GIS data.

2.3 Monitoring Equipment

This section describes the type of equipment that is proposed to be used to complete the Shelter Island Monitoring Program, as well as the installation and maintenance procedures. Flow and water quality water monitoring are dynamic processes that may require modification based on current site and channel conditions. Thus, the methodologies presented are subject to modification or change in order to meet the objectives of this monitoring program.

2.3.1 Selected Equipment

The water quality sampling equipment selected is designed to measure flow and collect water quality samples of runoff. The selected equipment has been found to be appropriate to meet the project objectives and has been successfully utilized in other regional water quality monitoring studies. The equipment is automated and can be accessed remotely via telemetry if properly equipped[3]. These features allow reductions in operating effort and increase the reliability and quality of the storm water monitoring data. Table 2-2 summarizes monitoring equipment selected for deployment during the 2014-2015 monitoring season.

Table 2-2. Monitoring Equipment

Equipment	Description
American Sigma 950 AVB Flow Meter	American Sigma 950 AVB flow meters log and calculate flow based on measured parameters. Water stage and velocity are measured with a stainless steel bubbler pressure transducer and low profile velocity sensor installed in the conveyance. A pressure transducer translates the proportional relationship of the hydrostatic pressure on a pressure plate compare to an atmospheric vent to estimate water level. Water velocity is measured using Doppler technology, which rates the velocity of particles in the water. The water must have sufficient suspended solids in order for a velocity reading to be obtained.
Hach SD900 Automated Sampler	The Hach SD900 automated sampling system consists of an intake strainer, Teflon-lined intake tubing, flexible silicon pump tubing, a peristaltic pump, sample bottle(s), a distributor arm, and a controller.
American Sigma Tipping Bucket Rain Gauge	The rain gauge measures 0.01 inches of rain each time the tipping bucket fills and closes a switch. The data logger/controller counts each switch closure to calculate rainfall totals.
12-VDC Rechargeable Gel Cell Power Supply	The Hach SD900 automated samplers and American Sigma 950 AVB flow meters will be powered by a 12-VDC rechargeable gel cell power source.

2.3.2 Installation, Calibration, and Maintenance 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 location. Exposed conduit, intakes, and sensors will be securely

[3] The use of telemetry is not proposed during the 2013-2014 monitoring season due to manufacturer upgrades currently being conducted to the telemetry system which have been determined to not currently be reliable by AMEC.

fastened using stainless steel brackets, screws, and anchors. Once the study is completed, monitoring equipment will be removed. Maintenance and calibration of monitoring equipment will be performed during installation and prior to monitoring events if necessary. 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.

2.3.3 Site Specific Equipment

Outfall 1

No flow or water quality sampling will be undertaken for Outfall 1. Thus, no equipment will be utilized.

Outfall 2

The monitoring location for Outfall 2 is approximately two blocks upstream of the outfall in an underground vault with an access manhole on Upshur Street. There are three pipes entering (inlet) the vault and one 66 inch pipe exiting (outlet) the vault. Rainfall (during the three monitored wet weather events only) and flow (continuously for the season) will be measured using a Sigma 950 area-velocity bubbler (AVB) flow meter with a low profile velocity sensor and bubbler pressure transducer installed downstream in the outlet pipe. A Sigma SD900 automatic sampler will be used to manually collect water quality grab samples with the intake strainer collocated with the flow sensors in the outlet pipe.

Based on historical observations, AVB flow meter/sensor combinations are less accurate in low-level/low-flow conditions (i.e., when water level is less than one inch), where a primary device such as a weir or flume is typically more accurate. However, due to limitations at the site, long-term installation of a weir or flume is not considered feasible.

In order to collect more accurate flow data in low-flow conditions using the flow meter/sensor combination a flow calibration monitoring was conducted during September and October of 2011. During the calibration period, two separate sets of flow monitoring equipment were installed to measure dry weather flow in the effluent pipe: one was a Sigma 950 AVB flow meter with an AVB sensor; the other was a Sigma 950 AVB flow meter with the bubbler line in combination with a 90^{o} V-notch weir installed in the pipe upstream from the AVB sensor. The two flow meters were deployed simultaneously to record water level and flow during the calibration period. The recorded flow data from the flow meter and weir combination was used to develop a head-versus-flow (HVF) table, which will be applied to low-flow data (when the level is $\leq$ 1.2 inches) measured by the AVB flow meter/sensor combination. Table 2-3 presents the developed HVF table.

Table 2-3. Head versus Flow Table for Outfall 2

Level (inches)	Estimated Flow (cfs)
0.73[a]	0.030
0.80	0.036
0.90	0.047
1.00	0.083
1.10	0.103
1.20[b]	0.122

(a): Level less than 0.73 inches were not recorded during the calibration period.
(b): Flow for levels greater than 1.2 inches are calculated via area and velocity.
cfs = cubic feet per second.

Outfall 3

The monitoring location for Outfall 3 is an inlet at the intersection of Anchorage Lane and Canon Street. It is approximately 400 feet upstream from Outfall 3. The inlet is approximately three feet deep with no upstream inlet pipes and a single 24 inch downstream outlet pipe. Due to the tidally influenced conditions (especially during storm surge conditions) encountered during the 2011-2012 monitoring season no equipment will be installed within the downstream pipe during the 2014-2015 monitoring season. Water quality samples will be collected directly from the road surface immediately prior to storm water runoff entering the catch basin.

3.0 MONITORING AND MODELING METHODOLOGY

3.1 Monitoring Preparation

3.1.1 Training

Field personnel will be trained in the use of the monitoring equipment and clean sampling techniques (Appendix D) along with appropriate health and safety protocols (Appendix B).

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.

3.1.2 Personnel

Water quality monitoring tasks require a variety of skills and positions. The required 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.

3.1.3 Monitoring Event Preparation Activities

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 27 and 28, 2014.
- Christmas: December 24 and 25, 2014.
- New Year's: December 31, 2014, and January 1, 2015.

3.1.4 Station Preparation

Prior to a monitoring event, stations must 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 complete 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 must verify that the automated sampler has been reset and that it has been programmed to allow collection of samples manually.

The general functionality of the surrounding site will be inspected. It should be verified that no debris is located in the water sampling areas, and the areas should be inspected for trash to prevent clogging of equipment.

The equipment will be physically inspected to make certain that there are no obvious problems, such as damaged cables or a kinked hose. Intake strainers and flow sensors are to be visually inspected when access allows and cleared of debris if necessary.

3.1.5 Equipment Mobilization

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 (See Table 6-1). 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 below.

Table 3-1.
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 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 B - *Health and Safety Plan*)

3.1.6 Communication Channels

Communication channels must 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 AMEC field team, and work numbers for primary laboratory contacts and City personnel to aid in communication.

3.1.7 Documentation

During each monitored event, records of the event should be recorded accurately on a field data sheet. A blank project specific field data sheet is provided in Appendix C.

The following general information should be entered during each monitored storm event:

- Alphanumeric Site ID
- Date
- Time
- Monitoring Program
- Field Team
- Field Measurements
- Weather Conditions
- Runoff Characteristics
- Equipment Condition
- Grab Sample Collection Times
- Miscellaneous Comments

3.1.8 Iced Coolers

Once a sample is collected it should be sealed and placed directly into a cooler with wet ice sufficient to maintain a sample temperature of four degrees Celsius or less.

3.1.9 Post Storm Activities

After each successful water quality monitoring event, flow and rainfall data will be downloaded from the flow meter. Water quality samples will be transported on ice under chain-of-custody (COC) to Weck in the City of Industry, California for analysis.

3.2 Wet Weather Monitoring

Weather will be tracked during the 2014-2015 wet weather season from October 1, 2014, to April 30, 2015. The weather forecast, forecast discussion, and quantitative precipitation forecast produced by the National Weather Service (NWS) and publicly available at: http://www.wrh.noaa.gov/sgx/ will be used to determine if a storm event should be mobilized for. Antecedent rainfall conditions will be determined by review of NWS publicly available rain gauge data.

The sampling criteria are:

- Rainfall of a least one-tenth (0.1) of an inch in the drainage area within a 24 hour period.
- An antecedent dry period of at least 72 hours prior to the sampled event.
- A storm event within plus or minus 50% of the average or median storm volume and duration for the region.

Communication with the City's project manager will be made within 48 hours of the intent to monitor a storm via either phone or email. Storm event monitoring will be conducted from the onset of rainfall until stream flow returns to within approximately 10% of base flow or a maximum of 24 hours from the first sample collection time.

3.2.1 Monitoring Locations

Wet weather monitoring will be conducted at Outfall 2 and Outfall 3 monitoring locations for three storm events during the 2014-2015 monitoring season. Outfall 1 will not be monitored due to the jurisdictional boundaries described previously.

3.2.2 Determination of Pollutograph Sample Collection

Pollutograph sampling requires interpretation of rainfall forecasts prior to a storm event to determine when samples should be collected. Ideally, at least eight samples will be collected from Outfall 2 and Outfall 3 during storm event monitoring. Further interpretation by the Project Manager of satellite, radar, and rain gauge data during storm events is generally required to guide field teams on when samples should be collected. Peak flows are typically targeted for sampling. This is a dynamic process that will occur as the storm event is unfolding.

3.2.3 Water Quality Sampling

Due to the Outfall 2 sampling point being located in a confined space, a Sigma SD900 automated sampler will be used to manually collect water quality grab samples during monitored storm events. Samples should be collected to target peak flows and also to provide a representative sample of water quality for a range of flow conditions. A field crew will visit the site during the course of monitored storm events to oversee the sampling equipment.

As previously discussed, the Outfall 3 monitoring location is tidally influenced during high tides; therefore, pollutograph sampling will be conducted by manually collecting samples directly from the road surface immediately prior to storm water runoff entering the catch basin. Samples will be collected based on rainfall intensity, flow data from Outfall 2, and observed road surface runoff volume.

3.3 Dry Weather Monitoring

Three dry weather sampling events will be conducted at the Outfall 2 monitoring location during the 2014-2015 monitoring season.

- Pollutograph sampling will not be conducted during dry weather monitoring event. Historical flow data has shown little variation in dry weather flows and concentrations over a 24-hour period. Thus, automated time-weighted composite sampling will be used to collect dry weather samples over a 24-hour period during each dry weather monitoring event.
- The composite sample at Outfall 2 will be collected using an automated sampler, which will be connected to the sampler intake tubing pre-installed in the 66 inch pipe.
- A composite sample aliquot will be collected once every two hours during a dry weather monitoring event.

Dry weather sampling will not be conducted for Outfall 1 or Outfall 3 due to historic and current lack of observed dry weather flows, as well as the previously described jurisdictional boundaries at Outfall 1.

3.4 Long Term Flow Monitoring

Continuous flow monitoring at 15-minute intervals will be conducted from October 1, 2014 to April 30, 2015 at the Outfall 2 monitoring location. A Sigma 950 AVB flow meter, bubbler, and low profile velocity sensor will be used to determine and record velocity and water level, which will be subsequently used to calculate flow.

Prior to each monitored storm event at the Outfall 2 monitoring location, the flow meter will be programmed to record water level, velocity, flow, and rainfall data at one minute intervals. Following completion of storm monitoring events, the flow meter will be programmed to collect data at 15-minute intervals.

Flow monitoring will not be conducted at Outfall 1 or Outfall 3 due to jurisdictional boundaries and tidal influence, respectively.

3.5 Flow Modeling

HEC-HMS modeling will be used to estimate wet weather runoff for Outfall 1 and Outfall 3 since monitoring of flows for these outfalls is considered infeasible.

A HEC-HMS model was developed for each of the three outfalls by Weston in 2010. The models were modified by AMEC in 2012 based on the following:

- AMEC's review of historical data and reports.
- Updated geographic information system (GIS) information.
- Model calibration results using the recorded flow data during the three monitored storm events for Outfall 2 and Outfall 3[4].

The modified model parameters were area and percent imperviousness for each respective sub-drainage according to available information. Figures 3-1 through 3-3 show the schematics of the modified model setups that will likely be used for the 2014-2015 monitoring season. The calibrated models will be used to estimate flows for the following scenarios from October 1, 2014 to April 30, 2015:

- Storm events for Outfall 1.
- Storm events for Outfall 3.
- Data gaps due to non-monitored periods or equipment malfunctions for Outfall 2.

[4] Flow data obtained at Outfall 3 during the 2011-2012 monitoring season during non tidally influenced periods.

Figure 3-1. HEC-HMS Model Schematic for Outfall 1 Drainage

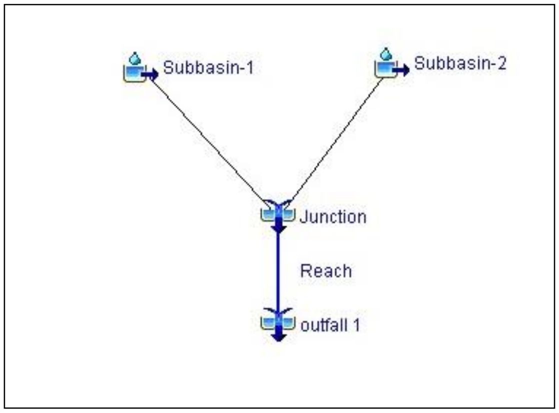


Figure 3-2. HEC-HMS Model Schematic for Outfall 2 Drainage

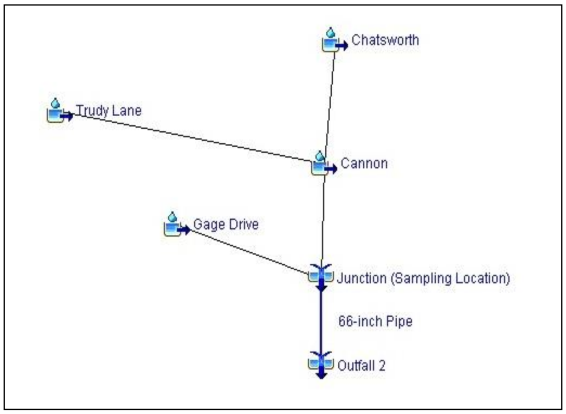
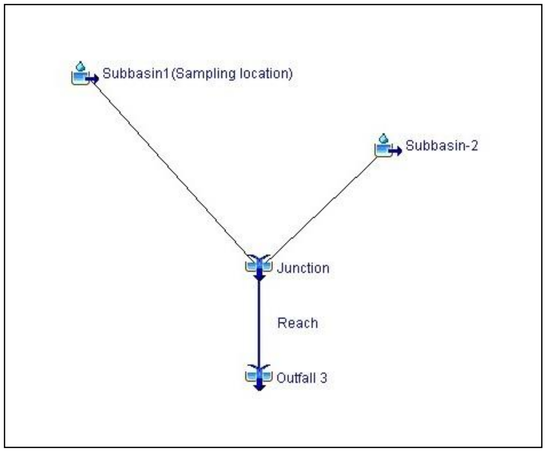


Figure 3-3. HEC-HMS Model Schematic for Outfall 3 Drainage



4.0 SAMPLE ANALYSIS

Water quality samples collected at the Shelter Island monitoring sites will be analyzed for total and dissolved copper and total hardness. Additionally, *in-situ* field measurements will be collected for pH, conductivity, and temperature.

4.1 Holding Times, Sample Times, and Preservation Requirements

Sample containers and preservation methods have been confirmed with the laboratories and are presented in Table 4-1.

Table 4-1.
Holding Times, Sample Volumes, Containers, and Preservations Recommendations

Analyte	Container	Sample Volume	Preservation	Holding Time
General Chemistry				
Total Hardness	1-L poly bottle	1 L	<4°C	6 months
Total and Dissolved Metals				
Copper	1-L poly bottle	1 L	<4°C; store in the dark; Acidify to pH<2 with pre-tested HNO_3 ASAP	48 hours to filter and preserve/ 6 months to analyze

Notes:
[a] Additional sample volume may be required for QC samples.

COCs will be pre-printed along with the bottle labels. The COCs will contain at a minimum the same data as the sample labels. The COCs 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.

Transport of the samples will be coordinated with the laboratories by the Sampling Manager. The COCs will be reviewed by personnel at the receiving laboratory to verify that stated samples are accounted for, preservation requirements have been met, analysis requirements are clearly detailed, and the holding time remaining.

Analytical constituents, methods, method detection limits (MDLs), and target reporting limits (RLs) are provided in Table 4-2. If samples are non-detect for total copper and dissolved copper by United States Environmental Protection Agency (USEPA) 200.8, then the more sensitive method USEPA 1640[5] will be used. *In-situ* field measurements are presented in Table 4-3.

[5] USEPA 1640 typically requires use of clean hands sampling protocol which is not proposed as the sample collection technique for this project. This sampling protocol requires the use of specially prepared double bagged bottles and two people to perform the sampling. Auto samplers, which are utilized for this project, are typically not considered viable for the clean hands sampling technique. Thus, if results are ND using USEPA 200.8, results obtained by analyzing with USEPA 1640 will be qualified.

Table 4-2: Analytical Constituents and Methods for Dry Weather Water Sampling

Analyte	Method	Minimum Detection Limit	Reporting Limit	Units
Total hardness	USEPA 200.7	0.016	0.10	mg/L
Total and dissolved copper (Cu)	USEPA 200.8	0.022	0.50	µg/L
Total and dissolved copper (Cu)	USEPA 1640	0.0038	0.010	µg/L

Table 4-3. Field Measurements

Constituent	Method	Range	Units
Conductivity	Field Meter	0 to 200 miliSiemens per centimeter (mS/cm)	microSiemens per centimeter (µS/cm)
pH	Field Meter	0 to 14	pH units
Temperature	Field Meter	-5 to +75 °C	Degrees Celsius (°C)

4.2 Sample Labelling

Water quality sample bottles will be pre-labeled, to the extent possible, before each monitoring event. Pre-labelling 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 labelled with the following information:

- Project Name
- Monitoring Program
- Event Number
- Date and Time
- Site ID Number
- Bottle __ of __ (for multi-bottle samples)
- Collected by
- Analysis

Field samples will be labelled as described below. These samples will be labeled, recorded on the COC form, and then transported to the analytical laboratory.

Each water sample collected will receive a unique alphanumeric code (Sample ID Number) for tracking. This code will be standardized for water quality samples and will contain information as it relates to the site, event, and type of sample. The required sample identification numbers, applicable to water quality samples, are listed below.

An example Sample ID is shown in Table 4-4:

- Monitoring Year
  - 2014 = 2014-2015 Monitoring Season
- Event Number
  - W1 = Wet Weather Event 1
  - W2 = Wet Weather Event 2
  - W3 = Wet Weather Event 3
  - D1 = Dry Weather Event 1
  - D2 = Dry Weather Event 2
  - D3 = Dry Weather Event 3
- Site ID
  - OF001
  - OF002
  - OF003
- Sample Code
  - C = Composite sample
  - G = Grab sample (pollutograph)
- Sample Type
  - 01 = Primary sample
  - D = Duplicate Sample
  - FB = Field Blank

Table 4-4. Example Sample Identification Numbers

Sample ID	Description			
	Sample Type	Site ID	Event	Sample Type
2014-W1-OF002-G-01	Grab Sample	Outfall 2	2014-2015 Wet Weather Event 1	Primary Sample

4.3 Laboratory Data Package Deliverables

The laboratory will aim to provide a three-week turnaround on the deliverable package per event. The deliverable package will include a hard copy and electronic data files. The hard copy will include standard narratives identifying analytical inconsistencies, Quality Assurance / Quality Control (QA/QC) exceedances, and corrective actions. The electronic data files will be submitted in a Surface Water Ambient Monitoring Program (SWAMP) compatible format (SWRCB, 2008) and will contain the same information found in the hard copy reports submitted by the laboratory. Individual data sets may be submitted to the consultant as either Microsoft Excel workbook files or as Microsoft Access database files.

4.4 Laboratory Selection

Weck Laboratories, Inc., located in the City of Industry, California, will be providing laboratory services for this project.

Weck Laboratories Inc.
14859 East Clark Avenue
City of Industry, California 91745
Office: (626) 336-2139
Fax: (626) 336-2634

5.0 QUALITY CONTROL/DATA QUALITY OBJECTIVES

5.1 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.

The field QA/QC samples that will be utilized are field blanks and field duplicates. Sample types, measurement objectives, and frequencies are summarized in Table 5-1.

Table 5-1.
Field Quality Control Samples

Analyte Category	Measurement Quality Objective		Frequency of Analysis[a]
	Field Duplicate	Field Blank	
Metals	RPD<30%[b]	<RL for target analyte	$\geq$ 5%

Notes:
RL = reporting limit.
RPD = relative percent difference.
(a) No field duplicate or field blank will be collected for dry weather monitoring events as samples will be collected via time-weighted composite sampling.
(b) Relative percent difference (RPD) is not available if native concentration of either sample is less than reporting limit (RL).

5.2 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 QA for this program consisted of the following:

- Employing analytical chemists trained in the procedures to be followed.
- Adherence to documented procedures, United States Environmental Protection Agency approved methods, and written Standard Operating Procedures (SOPs).
- Calibration of analytical instruments.
- Use of QC samples, internal standards and surrogates.
- Documentation of sample tracking and analysis.

Internal laboratory QC checks will consist of the use of laboratory replicates, method blanks, matrix spikes/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCSs). The QC check performed on each constituent is presented in Table 5-2. The frequency of the laboratory QA/QC samples is presented in Table 5-3 and the laboratory QC objectives are presented in Table 5-4.

**Table 5-2.
Laboratory Quality Control Samples by Constituent**

Analyte	Laboratory Replicate	Method Blank	MS/MSD	LCS
General Chemistry				
Total Hardness	—	✓	✓	✓
Total and Dissolved Metals				
Copper, Total	—	✓	✓	✓
Copper, Dissolved	—	✓	✓	✓

Notes:
LCS = laboratory control sample.
MS = matrix spike.
MSD = matrix spike duplicate.

**Table 5-3.
Laboratory Quality Control Sample Frequency**

QA/QC Sample Type	Minimum Sampling Frequency
	General Chemistry
Method Blank	One per batch or per 20 samples
MS/MSD	One per batch or per 20 samples
LCS	One per batch or per 20 samples
Laboratory Duplicate	One per batch or per 20 samples

Notes:
LCS = laboratory control sample.
MS = matrix spike.
MSD = matrix spike duplicate.
QA/QC = quality assurance/quality control.

**Table 5-4.
Laboratory Quality Control Sample Objectives**

QC Sample Type	General Chemistry	Metals
Method Blank	<RL for target analyte	<RL for target analyte
Laboratory Duplicate	NA	NA
LCS	70-130% recovery	70-130% recovery
MS/MSD	70-130% recovery; RPD<30%[a]	70-130% recovery; RPD<30%[a]

Notes:
LCS = laboratory control sample.
MS = matrix spike.
MSD = matrix spike duplicate.
NA = not applicable.
QC = quality control.
RL = reporting limit.
RPD = relative percent difference.
(a) Relative percent difference (RPD) is not available if native concentration of either sample is less than RL

5.3 Data Quality Objectives

Data quality objectives (DQOs) are quantitative and qualitative statements that define project objectives and specify the acceptable ranges of field sampling and laboratory performance. DQOs for this project consisted of 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 Table 5-1 for field QC samples and Table 5-4 for laboratory QC samples.

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 Table 5-1 for field control samples and Table 5-4 for laboratory QC samples. Relative Percent Differences (RPDs) will be calculated to determine the precision between duplicate samples. This calculation is presented in Equation 1.

Equation 1.

$$RPD = \frac{abs[x_1 - x_2]}{0.5 * (x_1 + x_2)}$$

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.

Equation 2.

$$Completeness = \frac{\text{Actual number of samples collected}}{\text{Project required total samples to be collected}} * 100$$

5.3.1 Accuracy, Precision, and Completeness

Analytical method DQOs for accuracy, precision and completeness are summarized in Table 5-5.

Table 5-5.
Laboratory Quality Control Data Quality Objectives

Constituent Category	Accuracy	Precision	Completeness
General Chemistry	70-130%	RPD<30%[(a)]	90%
Metals	70-130% recovery	RPD<30%[(a)]	90%

Notes:
RPD = relative percent difference.
(a) Relative percent difference (RPD) is not available if native concentration of either sample is less than the reporting limit (RL).

5.3.2 Composite Sample Representativeness

Time-weighted composite sampling will be utilized to collect dry weather samples. Historical monitoring data has shown little variation in dry weather flows and concentrations over a 24-hour period. During each of the three dry weather monitoring events at the Outfall 2 monitoring site conducted during the 2014-2015 monitoring season, composite sample aliquots will be collected once every two hours. This frequency will be utilized in an effort to adequately represent dissolved copper concentrations during the 24-hour period.

5.3.3 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.

The Sigma 950 AVB 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 bubbler will be submersed in water of a known level. 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 Sigma SD900 sampler will be calibrated using the procedures described in the Sigma SD900 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.

Rain gauges are not adjustable and cannot be calibrated. If a rain gauge fails to record simulated rainfall, the instrument will be repaired or replaced.

Calibration of flow meters and automated samplers will be conducted prior to installation, and per the calibration frequencies discussed in Table 5-6.

Table 5-6.
Calibration of Field Sampling Equipment and Monitoring Instruments

Equipment	Calibration Description	Responsible Person	Frequency	SOP Reference
Sigma 950 AVB flow meter (level only)	Water level check against known levels	AMEC technical staff	Semi-annually	Sigma 950 O&M Manual 3314
Sigma SD900 automated sampler	Aliquot calibration	AMEC technical staff	Semi-annually	Sigma SD900 Sampler O&M Manual DOC026.53.00742
American Sigma rain gauge	NA	AMEC technical staff	Semi-annually	NA

Notes:
AVB = area-velocity bubbler.
NA = Not Applicable.
O&M = operations and maintenance.
SOP = standard operating procedure.

5.3.4 Inspection/Acceptance of Supplies and Consumables

Sample bottles (provided by Weck) and collection equipment will be inspected prior to their use. Procured supplies will be examined for damage prior to use per Table 5-7.

Field supplies will be stored at AMEC offices; laboratory supplies will be stored at Weck. Inspection and testing requirements for laboratory supplies are covered in the laboratory's QA/QC procedures.

Table 5-7.
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%	AMEC
Composite sample bottles	Laboratory cleaned	Pass blanking analysis	Clean bottles each monitoring event	Weck/AMEC
Silicone tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Weck/AMEC
Teflon tubing	Laboratory cleaned	Pass blanking analysis	New tubing each season	Weck/AMEC
Gloves	New box (Grainger)	New box	As needed	AMEC

5.3.5 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 stored at AMEC. 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.

6.0 DATA MANAGEMENT AND DATA REPORTING PROCEDURES

6.1 Data Management

The responsibility for hydrologic data management and laboratory data management will be led by the Project Manager. The laboratory will be requested to provide data in both hard copy and electronic formats.

The Reporting and Laboratory Coordinator will be responsible for tracking the analytical process to make sure that laboratories are meeting the required turnaround times and are providing a complete deliverable package. The Reporting and Laboratory Coordinator will receive the original hard copy from the laboratory, verify completeness, and log the date of receipt. The hard copy originals then will be transferred to the Project Manager and filed with other original project documentation in order to maintain complete project records.

The electronic submittals will conform to reporting protocols that are compatible with the Surface Water Ambient Monitoring Program (SWRCB, 2009). A relational database will be developed by the Database Coordinator and used for data management and analysis. Laboratory data will be maintained and managed with Microsoft Excel and/or Microsoft Access by the Database Coordinator. Data from the monitoring site flow meters/data loggers will also be stored in the same database system and linked to the laboratory database. The data logger files will include rainfall and discharge (velocity, stage, and instantaneous flow) data.

6.2 Monitoring Report

The data collected under the Shelter Island Monitoring Program will be compiled and analyzed, with the findings presented in a draft Monitoring Report. The draft report will be completed once flows have been monitored through April 30, 2015 at Outfall 2 to provide annual estimated loading estimates within the draft monitoring report for review and to provide comments.

The report will summarize the sample collection methods and events, present the findings of the analytical results, and provide estimated loading information from the three outfalls. Any deviations from protocols listed in the Monitoring Plan and the implications of those deviations on the interpretation of the data will be included in the report. Raw data will be provided as an appendix on CDs.

Comments on the 2014-2015 Draft Monitoring Report will be compiled and tabulated in a response to comments letter for inclusion in the final report. The report will be finalized per the recommendations during the 2015-2016 monitoring season.

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7.0 REFERENCES

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APPENDIX A
WECK LABORATORY'S
QUALITY ASSURANCE PROGRAM MANUAL

APPENDIX B
HEALTH AND SAFETY PLAN

APPENDIX C
FIELD DATA SHEET

APPENDIX D
CLEAN SAMPLING TECHNIQUE

ATTACHMENT E. SHELTER ISLAND SHORELINE PARK BACTERIOLOGICAL MONITORING

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Shelter Island Shoreline Park Bacteriological Monitoring

Final Work Plan

The Port of San Diego
3165 Pacific Highway
San Diego, CA 92101

November 2012

Shelter Island Shoreline Park Bacteriological Monitoring

Final Work Plan

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November 6, 2012

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LIST OF ACRONYMS

AB411	Assembly Bill 411
Basin Plan	Water Quality Control Plan for the San Diego Basin (9)
DEH	San Diego County Department of Environmental Health
COC	chain of custody
CSDM	Coastal Storm Drain Monitoring
HA	Hydrologic Area
HSA	Hydrologic Sub-Area
HU	Hydrologic Unit
NWS	National Weather Service
PID	photoionization detector
Port	Port of San Diego
QA Manual	Quality Assurance Program Manual
QA/QC	quality assurance/quality control
QPF	quantitative precipitation forecast
RWQCB	Regional Water Quality Control Board
SISP	Shelter Island Shoreline Park
SWRCB	State Water Resources Control Board
TMDL	total maximum daily load
WQO	water quality objective

1.0 INTRODUCTION

In 1997, the California State Assembly passed a resolution to amend the state's Health and Safety Code Section 115880. The amendment, known as Assembly Bill 411 (AB411), required the testing of the ocean receiving waters adjacent to all public beaches for microbiological contamination, including total coliform, fecal coliform, and *Enterococcus* bacteria. AB411 criteria established a monitoring program whereby receiving waters at public beaches were required to be sampled weekly from April 1 through October 31 within a given calendar year. The law also required the California State Department of Health Services to adopt regulations establishing minimum standards for the sanitation of public beaches.

In order to meet the requirements of the AB411 regulations, the San Diego County Department of Environmental Health (DEH) has monitored water quality at several sites along the coastline of San Diego Bay since 1999. In addition, the San Diego Unified Port District (Port) has monitored ocean receiving waters at several sites in San Diego Bay as part of the Coastal Storm Drain Monitoring (CSDM) Program. One of these sites (Site EH-200) is located in Shelter Island Shoreline Park (SISP) – a mile-long park and promenade that spans the bayside length of Shelter Island in San Diego Bay (Figure 1). Compliance Monitoring Site EH-200 represents a 0.4 mile long section of the Park that has been identified since 2002 as a water quality limited segment due to exceedances of water quality objectives (WQOs) for three indicator bacteria: total coliform, fecal coliform, and *Enterococcus*. The site has been placed on the State Water Resources Control Board (SWRCB) Section 303(d) List of Water Quality Limited Segments in accordance with the Clean Water Act. A summary of the 303(d) listing for SISP is presented in Table 1. Shelter Island Shoreline Park and the EH-200 compliance monitoring site are shown on Figure 1.

Table 1. Summary of 303(d) Listings for Shelter Island Shoreline Park

Waterbody Name	HA[1]	HSA[2]	HSA Number	Pollutant
Shelter Island Shoreline Park	Point Loma 908.1	Lindbergh	908.11	Total Coliform
				Fecal Coliform
				Enterococcus

[1] HA = Hydrologic Area
[2] HSA = Hydrologic Sub-Area

SISP is located in San Diego Bay within San Diego County. Historically, concentrations of indicator bacteria (total coliform, fecal coliform, and *Enterococcus*) have exceeded REC-1 WQOs as defined in the AB411 criteria and the San Diego Regional Water Quality Control Board's (RWQCB) Water Quality Control Plan for the San Diego Basin (9) (Basin Plan) (RWQCB, 1994). In the Basin Plan, the REC-1 Beneficial Use definition includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible (*e.g.*, swimming, wading, water-skiing, surfing, fishing and SCUBA diving).

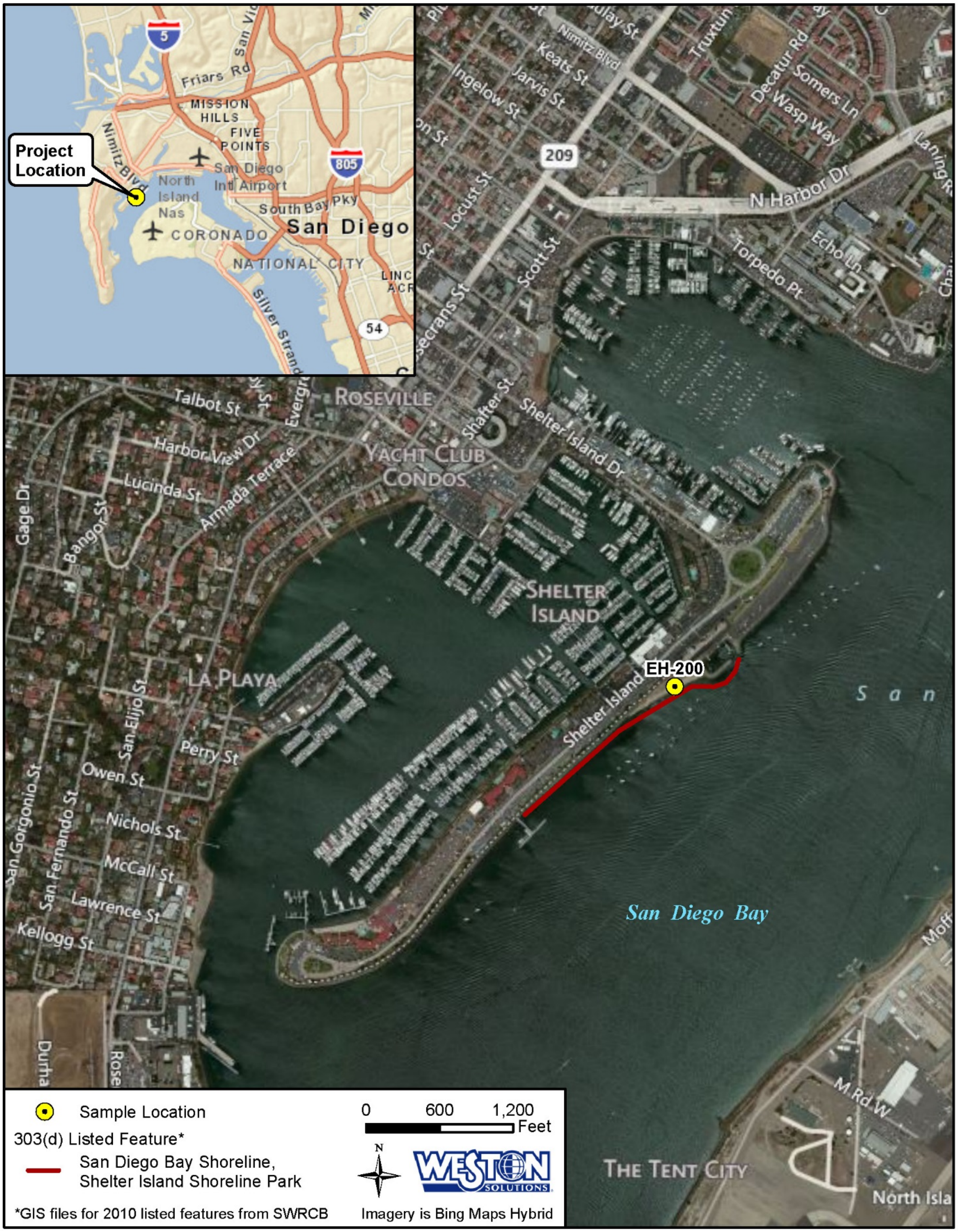

Figure 1. Map of Shelter Island Shoreline Park and EH-200 Monitoring Site in San Diego Bay

In 2000, DEH reported that beach closure and/or health risk advisory signs were posted at SISP for 24 days. Based on this information, SISP was placed on the 2002 Section 303(d) List by the SWRCB as impaired for the REC-1 beneficial use for all three indicator bacteria. In June, 2008, a Total Maximum Daily Load (TMDL) for indicator bacteria was produced for SISP and approved by the United States Environmental Protection Agency (RWQCB, 2008).

The TMDL was based on analytical data made available from the Port and DEH from samples collected at SISP between March, 1999 and February, 2004. Since that time, the Port and the City of San Diego have made significant improvements to SISP to reduce indicator bacteria levels at Site EH-200. Monitoring data collected at Site EH-200 have shown a significant reduction in bacterial levels since 2004 and the site is currently being considered for removal from the 303(d) List (de-listing) for all three indicator bacteria.

According to the Implementation Plan of the TMDL, submittal of a request for de-listing of Site EH-200 for indicator bacteria is the final step in the Compliance Schedule, which is to be completed in 2012. The stated goal of the Implementation Plan is:

> "to ensure that WQOs for indicator bacteria for the shoreline segments of SISP are attained and maintained throughout the waterbody and in all seasons of the year. WQOs are considered "attained" when the waterbody can be removed from the Clean Water Action Section 303(d) List of Water Quality Limited Segments. WQOs are considered "maintained" when, upon subsequent listing cycles, the waterbody has not returned to an impaired condition and been put back on the List."

The purpose of this Work Plan is to describe the procedures and protocols for verifying that WQOs for indicator bacteria are maintained at SISP (as defined above), through a consistent, on-going monitoring program.

1.1 Project Objectives

This Work Plan has been designed to answer the following Key Questions:

1. **What are the concentrations of indicator bacteria in the ocean receiving waters at SISP Site EH-200 during dry and wet weather conditions over time?**

2. **Are the WQOs for indicator bacteria being maintained over time at SISP Site EH-200, in accordance with the TMDL?**

To answer these questions, water quality will be monitored at Site EH-200 during both dry and wet weather conditions as part of a routine monitoring program for SISP.

1.2 Monitoring Site Location

The SISP monitoring location is in the Point Loma Hydrologic Area (HA) (908.1), which is within the Pueblo San Diego Hydrologic Unit (HU). The Pueblo San Diego HU is approximately 70 square miles, covering 44,368 acres, and does not have a major stream system (RWQCB, 1994). Site coordinates and location description are provided in Table 2. Photographs of the EH-200 monitoring site are presented in Figure 2 and a map of the site showing area storm drains and approximate sub-basin boundaries is provided in Figure 3.

Table 2. Shelter Island Shoreline Park Site EH-200 Coordinates and Site Description

Site ID	Coordinates		Site Description
	Latitude	Longitude	
EH-200	32.714668	-117.224461	Site EH-200 is located on Shelter Island in San Diego Bay within Shelter Island Shoreline Park (SISP), a mile-long park and promenade that spans the bayside length of Shelter Island. Compliance Monitoring Site EH-200 is located on the sandy beach adjacent to the boat ramp at SISP and represents a 0.4 mile long section of the Park.

Figure 2. Photographs of Shelter Island Shoreline Park Monitoring Location

Figure 3. Shelter Island Shoreline Park in San Diego Bay Showing the EH-200 Compliance Monitoring Site and Approximate Sub-drainage Boundaries

2.0 SAMPLING AND ANALYSIS PROCEDURES

2.1 Dry Weather Monitoring

2.1.1 Sample Collection

Field scientists wearing clean, disposable gloves will collect bacterial grab samples in sterile, plastic, 100-mL containers. Sampling containers will be kept in clear Ziploc™ bags until use. The bag will be opened, and the sampling container will be opened with the lid held face-down to prevent any airborne contamination. Samples will be collected directly from the ocean in ankle to knee-deep water at Site EH-200 during an incoming wave. The bottle will be submerged open-end down approximately 6 inches below the water's surface. The bottle will then be turned face-up and allowed to fill. As sampling containers contain trace amounts of sodium thiosulfate (a chlorine neutralizer), the bottle should be filled once and drained to the desired volume. The bottle will then be closed and placed back in the Ziploc™ bag, and the bag will be sealed. Samples will be stored on ice in a covered cooler in the field and during pick-up and delivery to the laboratory. All samples will be labeled and transported according to the Sample Handling and Tracking procedures discussed in Section 3.0. Laboratory analysis will begin as quickly as possible and always within the maximum holding time of six hours.

Samples will be transported on ice under chain of custody (COC) from collection in the field and will be delivered to the appropriate certified analytical laboratory for further processing. The Quality Assurance Program Manual (QA Manual) for chemistry analyses (Appendix A) outlines the practices used by the laboratory to ensure reliable, high-quality results for the bacteriological analyses.

A field data log (Appendix B) will be filled out by the field team over the course of each dry weather sampling event. The field data log includes empirical observations regarding the site and its current conditions (*e.g.*, meteorological conditions, odor, color, turbidity, floating materials, and trash).

2.1.2 Sample Frequency

Dry weather monitoring will be conducted at Site EH-200 during two distinct Dry Weather Monitoring Seasons: Summer Dry Weather and Winter Dry Weather. The Summer Dry Weather monitoring will be conducted between April 1 and October 31 of a given calendar year as part of the AB411 Monitoring Program. During this period, a single sample will be collected by DEH staff one time per week during the daylight hours between 7:00 a.m. and 4:00 p.m.

Winter Dry Weather monitoring may be conducted by the Port between November 1 and March 31 of a given calendar year. During this timeframe, samples may be collected from Site EH-200 approximately once every month, depending on storm frequency during the winter months. If needed, Winter Dry Weather samples will be collected at least 72 hours after a storm event using the sample collection techniques discussed above.

2.2 Wet Weather Monitoring

The Port will conduct three wet weather monitoring events per storm season to verify that WQOs for indicator bacteria are being maintained at SISP. Criteria for wet weather events include a minimum of 72 hours of antecedent dry weather and a minimum of 0.10 inch of rain forecasted within the runoff area. Staff will monitor the National Weather Service (NWS) website (http://www.wrh.noaa.gov/sgx/) for forecasted storms. The posted forecasts, discussions, and quantitative precipitation forecast (QPF) are used to determine if a storm meets the criteria for a potential wet weather event. If the QPF predicts measurable rain greater than 0.10 inch at the coast the day prior to a rain event or within 48 hours of a weekend event, storm event staffing will be notified to be on call and ready to perform monitoring. Staff will also use infrared satellite imagery, live streaming NEXRAD radar, and pressure gradient maps to verify the QPF.

2.2.1 Sample Collection

Wet weather samples will be collected for bacterial analyses in the same manner as that described for dry weather (see Section 2.1.1). A single grab will be collected near the peak of the storm in the ocean receiving waters for a total of three storms per storm season. (Note: Due to the small size of the watershed, runoff response time is short at SISP.)

All samples will be labeled and transported according to the Sample Handling and Tracking procedures discussion in Section 3.0. Laboratory analysis will begin as quickly as possible and always within the maximum holding time of six hours. As with Dry Weather Monitoring, a field data log (Appendix B) will be filled out by the field team over the course of each wet weather sampling event. The field data log includes empirical observations regarding the site and its current conditions (*e.g.,* meteorological conditions, odor, color, turbidity, floating materials, and trash).

Samples will be transported on ice under COC from collection in the field and will be delivered to the appropriate certified analytical laboratory for further processing. The QA Manual for chemistry analyses (Appendix A) outlines the practices used by the laboratory to ensure reliable, high-quality results for the bacteriological analyses.

2.2.2 Sample Frequency

The Port will conduct three wet weather monitoring events per storm season, between October 1 and April 30 for a given storm season.

For official rainfall statistics, staff will use NWS information from the San Diego Lindbergh Field. In the event of an equipment malfunction, other rain gauges in close proximity to the SISP site which may be used for official rainfall statistics are presented in Table 3. Data may be obtained from the Weather Underground website: <http://www.wunderground.com>.

Table 3. Rain Gauges in Close Proximity to the Shelter Island Shoreline Park Site EH-200

Weather Underground Site ID	Coordinates		Site Description
	Latitude	Longitude	
KNZY	32.70	-117.21	NORTH ISLAND GAUGE (ELEVATION: 23-ft) North of SISP, at the San Diego Naval Supply Center.
MAS414	32.67	-117.17	CORONADO GAUGE (ELEVATION: 13-ft) East of SISP, on North Island at State Highway 75.
KCASANDI129	32.69	-117.17	C AVENUE GAUGE (ELEVATION: 39-ft) East of SISP, at Tidelands Park.

2.2.3 Quality Control

Quality assurance and quality control for sampling processes begin with proper collection of the samples in order to minimize the possibility of contamination. All water samples are first collected in laboratory-certified, contaminant-free bottles. For bacterial sampling, sterile bacteria-free containers, containing sodium thiosulfate (which neutralizes chlorine) will be used.

Field blanks will be collected at a rate of one sample per sampling event. Field blanks are check samples that monitor contamination originating from the collection, transport or storage of environmental samples. A field blank is analyte-free water that is poured into the sample collection device and sub-sampled for analyses to verify that field cleansing procedures are adequate and sample handling and transportation does not introduce any analytes of interest. Field blanks will be collected and analyzed for total coliforms, fecal coliforms, and enterococci.

2.3 Sample Analysis

All dry and wet weather samples will be analyzed for total coliforms, fecal coliforms, and enterococci. Table 4 outlines the methods, minimum detection limits, and reporting limits of each analysis.

Table 4. Analytical Methods for Quantifying Indicator Bacteria Concentrations

Analyte	Method	Minimum Detection Limit	Reporting Limit	Units
Total coliform	SM9221B	<2	<20	MPN/100 mL
Fecal coliform	SM 9221E	<2	<20	MPN/100 mL
Enterococcus	SM 9230B or Enterolert	<2 or <1	<20 or <10	MPN/100 mL

3.0 SAMPLE HANDLING AND TRACKING

3.1 Sample Identification

Each sample will receive a unique alphanumeric code (sample I.D. number) for tracking. This code will be standard for all samples and contain information as to the station, sample interval number, and sequential monitoring event number. Samples will be kept properly chilled and transferred to the analytical laboratory within holding times to achieve the highest quality data possible. To ensure proper tracking and handling of the samples, documentation will accompany the samples from the initial pickup to the final extractions and analysis. This documentation will be in the form of Chain of Custody Forms (Appendix C). These forms, or equivalent, will be used to track and handle samples. All samples collected will be labeled with the following information:

3.2 Chain of Custody Procedures

Samples will be considered in custody if they are (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal such that the sample can not be reached without breaking the seal. A COC record (Appendix C) and field logs (Appendix B) are the principal documents used to track samples and to document possession. COC procedures will be used for all samples throughout the collection, transport, and analytical process.

COC procedures will be initiated during sample collection. A COC record will accompany each sample or group of samples. Each person who has custody of the samples will sign the form and ensure that samples are not left unattended unless properly secured. Documentation of sample handling and custody includes the following:

- Sample identifier.
- Sample collection date and time.
- Any special notations on sample characteristics or analysis.
- Initials of the person collecting the sample.
- Date the sample was sent to and received by the analytical laboratory.
- Shipping company and waybill information (if used).
- Constituents to be tested, preservatives, and temperature requirements.

Completed COC forms will be placed in a waterproof envelope and kept with the samples. Once delivered to the analytical laboratory, the COC form will be signed by the sample recipient. The condition of the samples (*i.e.*, confirming all samples are accounted for and properly labeled, the temperature of the samples, and integrity of the sample bottles) will be noted and recorded by the receiver. COC records will be included in the final analytical reports prepared by the laboratories and are considered an integral part of the analytical report.

4.0 DATA ANALYSIS AND REPORTING

All field and laboratory data collected will be subjected to quality assurance/quality control (QA/QC) protocols to assure the data's accuracy and validity. Once the data have been verified, wet and dry weather bacterial concentrations will be compared to the appropriate WQO (Table 5) to determine the extent to which the objective for each indicator bacteria is being maintained at SISP.

Table 5. Water Quality Objectives for Indicator Bacteria

	30-Day Limit[1]	Single Sample Limit
Total Coliform	1,000 MPN[2]/ 100 mL	1,000 MPN/ 100 mL if Fecal > 10% of Total, or 10,000 MPN/100 mL[3]
Fecal Coliform	200 MPN/ 100 mL	400 MPN/ 100 mL
Enterococcus	35 MPN/ 100 mL	104 MPN/ 100 mL

1 = 30 day limit is based on the geometric mean of at least five weekly samples
2 = MPN is Most Probable Number
3 = Total coliform single sample limit of 10,000 MPN decreases to 1,000 when the fecal coliform value is greater than 10% of total coliform value

The results will be summarized based on dry and wet weather exceedance frequencies and presented to the RWQCB for review. A summary report will be submitted to the RWQCB every two years, in accordance with the Compliance Schedule in the TMDL Implementation Plan (RWQCB, 2008), as a periodic demonstration that wasteload allocations and WQOs are being met at SISP.

5.0 HEALTH AND SAFETY

Wet weather sampling events can pose some potentially dangerous situations that field personnel need to be aware of and take precautions against. A health and safety tailgate meeting is required prior to any on-site activity. During this meeting, site-specific hazards should be taken into account, discussed, and addressed appropriately. There are various health and safety issues of particular interest to this sampling location.

5.1.1 Inclement Weather

Extremes of heat, cold, and humidity as well as rain, snow, and ice can adversely affect monitoring instrumentation response and reliability, respiratory protection performance, and chemical protective clothing materials. Rain and wet weather conditions also increase slipping and tripping hazards, braking distances of vehicles, and the potential for slippage or handling difficulties of field equipment. Rain fills holes and obscures trip and fall hazards. Tools and personnel can slip on wet surfaces. Rain and wet weather conditions may decrease visibility, increasing potential for driving accidents, and may limit the effectiveness of certain direct-reading instruments (*e.g.*, photoionization detectors (PIDs)).

Winter storms will bring in colder than normal temperatures to the area. Field crews will be working long hours in wet and cold conditions. Field personnel should wear extra layers of clothing under rain gear since to prepare for a variety of temperature changes.

5.1.2 Traffic Hazards and Traffic Control

There is potential for field crews to be driving in the rain and/or at night, so extra precaution should be taken while driving. All traffic rules and regulations and all traffic control signs and devices should be obeyed. Field personnel should allow for extra time when planning travel routes. Vehicle traffic is a major concern in storm water monitoring. Traffic presents hazards in the following two ways: 1) when field personnel are close to roadways, the potential exists to be hit by oncoming traffic and 2) driving to, from, and on the site poses a potential accident hazard.

There is a public parking lot at the SISP site and direct access to the site. Whenever possible, field personnel should park close to the site, in well-lit a designated parking space. Field personnel should abide by the following guidelines while working in traffic:

- Traffic awareness of other drivers and pedestrians.
- Turn on the vehicle’s flashing yellow warning light and hazard lights.
- Put out safety cones to mark off the work area, and wear a reflective safety vest.
- Avoid steep slopes and stream banks.
- Always use a flashlight in the dark.
- Always wear bright rain gear during storms to be more visible.

5.1.3 Fatigue

Field staff may work long hours during the course of the monitoring event. If field personnel are too tired to safely continue working, a replacement will be provided.

These are just some basic, common hazards encountered during storm water sampling and are not intended to be a complete list for any and all sites or conditions. A complete Health and Safety Plan may need to be developed specifically for this project and will be reviewed and implemented by all field staff prior to project implementation.

6.0 REFERENCES

RWQCB, 1994. California Regional Water Quality Control Board San Diego Region. Water Quality Control Plan for the San Diego Basin (9). September 8, 1994 (with amendments effective on or before April 4, 2011).

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Appendix A

Analytical Laboratory's Quality Assurance Program Manual

Appendix B

Field Log

Appendix C

Chain-of-Custody Form

ATTACHMENT F. SAN DIEGO DEBRIS SPECIAL STUDY WORK PLAN

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San Diego Bay Debris Special Study
Work Plan

Prepared by:
San Diego Bay Debris Study Workgroup

Prepared for:
Surface Water Ambient Monitoring Program of the State Water Resources Control Board
and
Southern California Bight 2013 Regional Marine Monitoring Survey
Bight ’13 Debris Planning Committee

October 2014

SWAMP
Surface Water Ambient Monitoring Program

Unified Port of San Diego

SAN DIEGO COASTKEEPER

Ocean Discovery Institute
Young Lives Transformed Through Science

Sea Grant California

Water Boards

CITY OF CHULA VISTA

IMPERIAL BEACH
classic southern california

THE CITY OF SAN DIEGO • STATE OF CALIFORNIA
SEMPER VIGILANS

NAVFAC
Naval Facilities Engineering Command

SURFRIDER FOUNDATION
SAN DIEGO COUNTY CHAPTER

SCCWRP
Established 1969

WiLDCOAST
COSTASALVAjE

SAN DIEGO
PORT TENANTS ASSOCIATION

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ACRONYMS AND ABBREVIATIONS

AMRI	Algalita Marine Research Institute
Bay Debris Study	San Diego Bay Debris Study
Bight Program	Southern California Bight Regional Monitoring Program
C-CAP	Coastal Change Analysis Program
CEDEN	California Environmental Data Exchange Network
CIA	Bight Contaminant Impacts Assessment Group
cm	centimeter
COC	Chain of Custody
GPS	Global Positioning System
m	meter
mm	millimeter
MS4	Municipal Separate Storm Sewer System
NAVFAC	United States Naval Facilities Engineering Command
NHD Plus	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Administration
RHMP	Regional Harbor Monitoring Program
RTA	rapid trash assessment
RWQCB	Regional Water Quality Control Boards
SCCWRP	Southern California Coastal Water Research Project
SDTP	Standard Data Transfer Protocol
SMC	Stormwater Monitoring Coalition
SOP	Standard Operating Procedure
SWAMP	Surface Water Ambient Monitoring Program
SWHB	San Diego Bay Shallow Water Habitat Bioaccumulation Study
QA/QC	Quality Assurance/Quality Control

1.0 INTRODUCTION

1.1 San Diego Bay Debris Special Study

In Southern California, and particularly the San Diego County coastline, the coastal wetlands and bays are an important intermediary waterbody between the upland watersheds and the downstream marine environment. As a primary linkage between rivers and the marine environment, coastal embayments may be a key sink of land-based debris and the types of land-based debris that are the most influential on conditions in the bay and eventually the marine environment are not well understood. Because of the extended residence time and exposure to the environment, coastal wetlands and bays can have the potential to increase the retention of debris and facilitate the breakdown of materials into smaller and potentially more detrimental pieces of plastic that can have diverse impacts on wildlife including bird and fish communities (Andrady, 2011). At the focus of this study, San Diego Bay, shown in Figure 1-1, is a large coastal embayment that rests between the upland watersheds in the greater San Diego area and the coastal waters off of southern California.

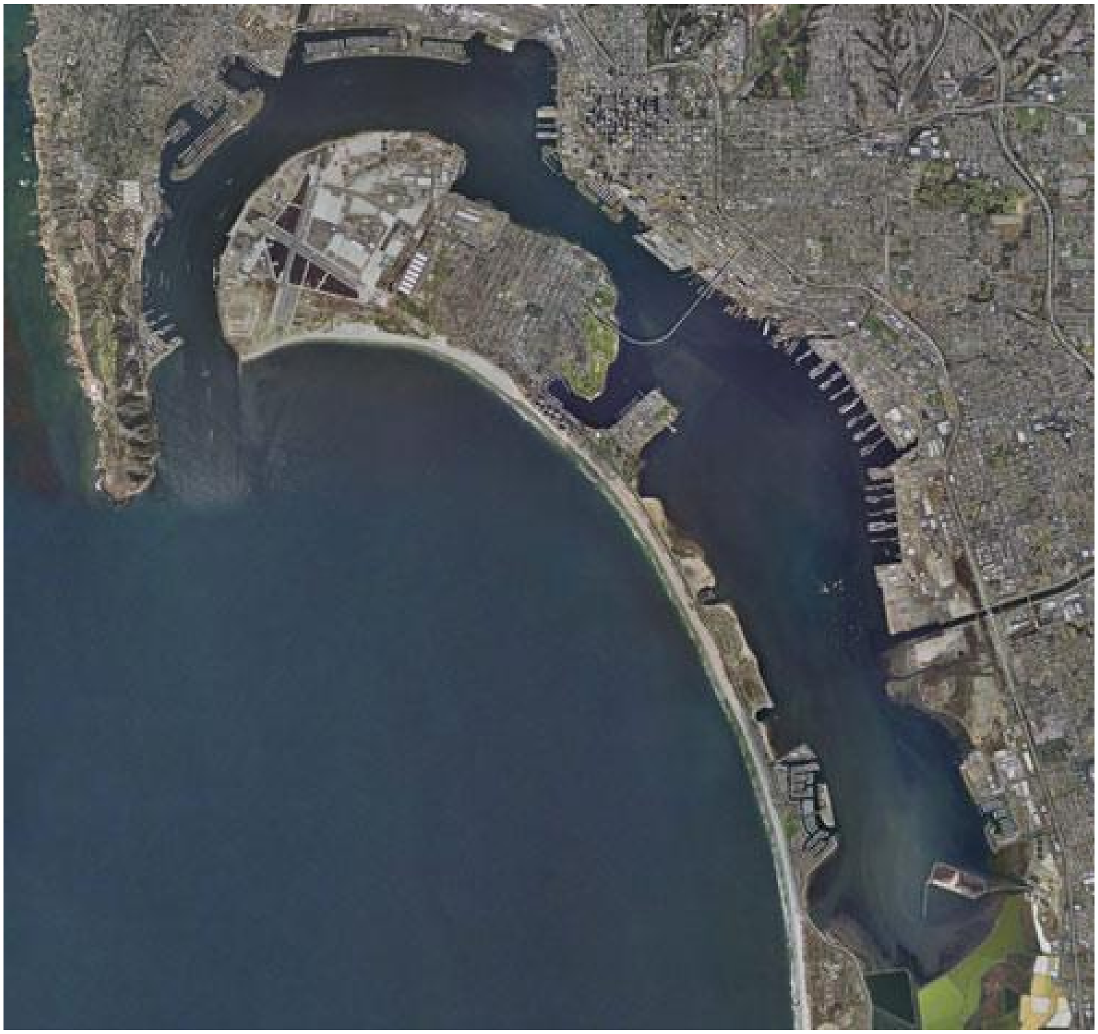

Figure 1-1. San Diego Bay

To better understand the distribution of debris amongst various bay habitats, the San Diego Bay Debris Study (Bay Debris Study) is being developed as a special study to understand the types and quantities of debris in a coastal embayment. Because plastics generally represent the largest proportion of land-based debris, the Bay Debris Study focuses only on plastic based items. The terms debris, plastic debris, and plastics may be used interchangeably in this Work Plan and intended to be synonymous to the Bay Debris Study's focus on plastics.

1.2 Geographic Setting

The San Diego Bay Watershed, shown in Figure 1-2, encompasses a 415 square mile area that extends more than 50 miles to the east - all the way to the Laguna Mountains. The watershed land area lies north of the border with Mexico and south of Mission Bay just to the north of San Diego Bay. The watershed is comprised of three smaller watersheds: Pueblo San Diego, Sweetwater, and Otay. The major water courses feeding San Diego Bay include the Sweetwater River, Otay River, Chollas Creek, Paleta Creek, Paradise Creek, and Switzer Creek.

The San Diego Bay watershed transects all or portions of seven cities including San Diego, National City, Chula Vista, Imperial Beach, Coronado, Lemon Grove, and La Mesa along with unincorporated areas of the County of San Diego, the San Diego County Regional Airport Authority, and the Port of San Diego. Nearly half of the population of San Diego County lives and works in the San Diego Bay Watershed. Most of these people live and work in close proximity to San Diego Bay itself.

San Diego Bay, which is 12 miles (19 km) long and 1 to 3 miles (1.6 to 4.8 km) wide, is the third largest of three large, protected natural bays on California's entire 840 miles (1,350 km) long coastline after San Francisco Bay and Humboldt Bay.

San Diego Bay hosts a wide range of uses including a commercial shipping port, naval base docks and shipyards, a large number of marinas for privately held boats, and numerous docks for the sport and commercial fishing fleets. The southern area of San Diego Bay is held in reserve for the San Diego Bay National Wildlife Refuge and the South Bay Naval Biological Study area. Portions of the south bay are also home to an active salt work.

The bay itself consists of a variety of different ecological habitat types including mudflats, salt marshes, sandy beaches, salt flats, freshwater and river mouth habitats, and open water areas. Portions of the bay are also protected by a series of man-made protective barriers built out of large granitic type of rocks, commonly referred to as rip-rap.

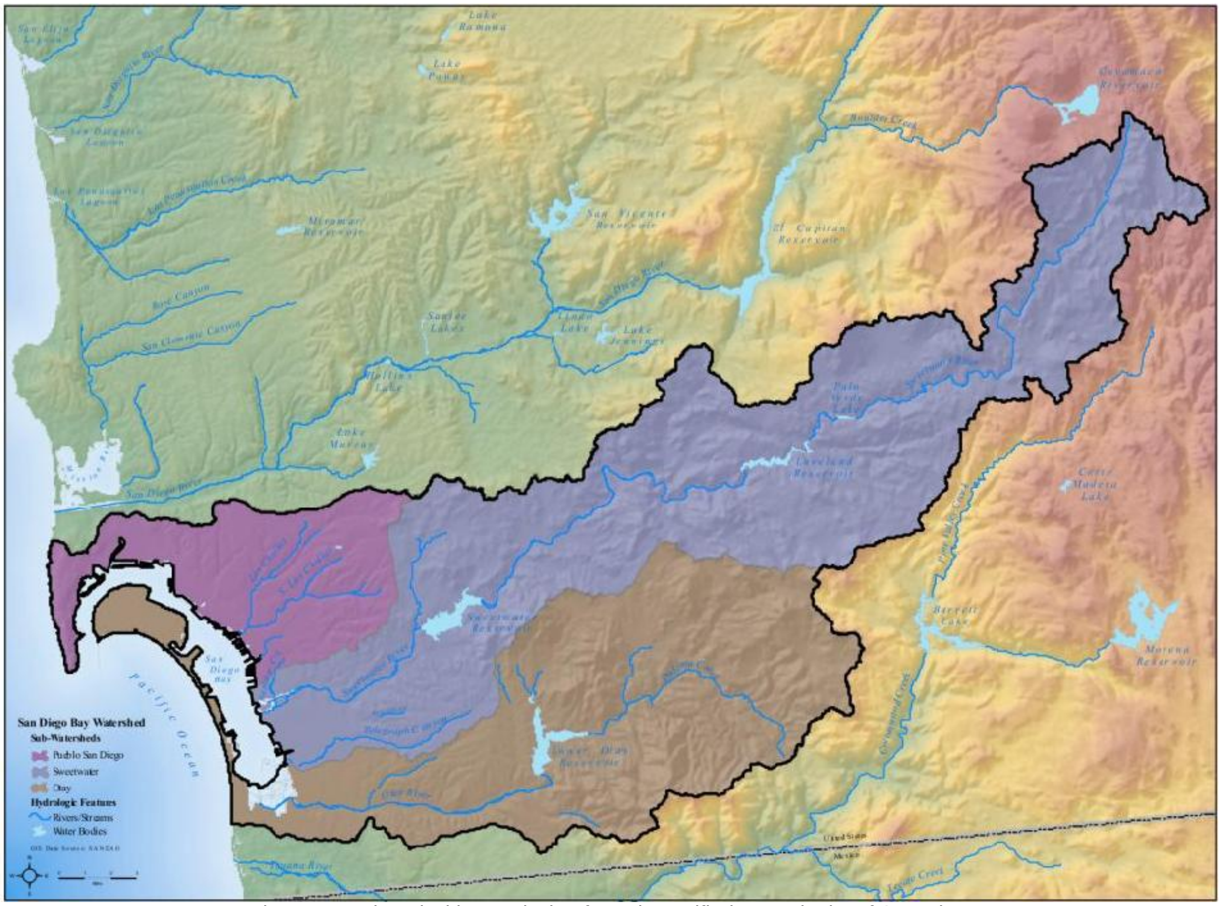

Figure reproduced with permission from the Unified Port District of San Diego.

Figure 1-2. San Diego Bay and the contributing watersheds

1.3 Overall Goals of the San Diego Bay Debris Study

The goal of the Bay Debris Study is to develop a baseline debris assessment of the bay habitats that includes identifying the most abundant type of plastic items, evaluating where the plastic accumulates in greatest quantities, evaluating plastic items that are preferentially transported to the bay during wet weather conditions, and whether the plastics that reach the open waters of the bay affect fish communities. The general approach adopted for the Bay Debris Study follows the question-driven approach of the San Diego Region Framework for Monitoring and Assessment (Busse and Posthumus, 2012).

This study provides one of the first opportunities to generate results that can be used for management decisions to target efforts towards controlling trash, specifically plastic based items. As one of the first comprehensive debris assessments of San Diego Bay and the contributing watershed, shown in Figure 1-2, the Bay Debris Study is intended to help managers understand the types of plastics that may be the most prevalent in the various habitats. Similarly, measuring the types of debris that are present during dry weather and preferentially transported to the bay during wet weather, or plastics found most often ingested by fish provides the opportunity to better target management decisions at the most important types of plastics.

The San Diego Bay Debris Study also provides an example of a coastal embayment debris study that might help managers to deal with debris in coastal estuaries in general.

2.0 BACKGROUND

2.1 Marine Debris

Marine debris has become one of the most recognized pollution problems in the world's oceans and watersheds today (Lippiatt et al. 2013). About 80 percent of debris found in marine environments is generated from land-based sources (Sheavly, 2010) suggesting that the reduction of watershed based debris sources is an important management action for reducing marine debris. Of the debris found in watersheds, studies generally show that about 60 percent of the debris is composed of plastic based items which are the primary and generally most abundant type of material found in marine debris (Thompson et al., 2009). Debris in the environment also represents a substantial financial burden to cities and public agencies responsible for managing debris. It is estimated that the West Coast cities of the United States spend on average $500 million per year to remove trash from streets and neighborhoods in an effort to prevent it from reaching coastal water bodies (Stickel et al., 2012). The perpetual clean up that is required to prevent debris from entering the environment and the ongoing costs to the public suggests that debris represents an environmental issue of high priority for land and public agency managers.

Debris can cause adverse impacts on aquatic and terrestrial wildlife, can affect human health and reduce the aesthetics of freshwater and coastal environments. Debris that enters the environment has the potential to become ingested by animals such as fish and birds or create entanglement problems for sea life (Boergner et al., 2010; Ryan, 1989; Azzarello et al., 1987). Persistent plastic pieces which form the predominate type of marine debris found in the ocean and type of material ingested by animals, can also function as a transport mechanism for persistent organic pollutants such as flame retardants, chlorinated organic compounds such as DDT, and chemicals created as by-products of petroleum combustion and industrial processes (Rios, 2007; Rios, 2010; Teuten et al., 2009; Engler 2012).

2.2 Bight '13 Debris Study

The Southern California Bight Regional Monitoring Program (Bight Program) is a large scale multi-stakeholder monitoring program consisting of more than 60 organizations focused on assessing emerging or priority environmental concerns across the coastal area of the Southern California Bight. The Bight Program surveys which are conducted once every five years between Point Conception and the US-Mexico Border focus on assessing issues of common concern amongst the stakeholders.

The Bight surveys provide a mechanism to develop standardized methods, quality assurance protocols, and data transfer standards agreeable to all participants. This process ensures that all data collected during the survey can be integrated and provides the foundation for enhanced coordination among southern California's monitoring programs. The surveys have also provided a forum for multi-party agreement about ways to analyze and interpret monitoring data.

A key advantage of the Bight Program is the opportunity to leverage ongoing programs and studies to expand the sampling efforts for the Bight surveys. The San Diego Bay Regional Harbor Monitoring Program (RHMP) and Shallow Water Habitat Bioaccumulation Study (SWHB) are examples of two studies focused on specific water quality issues, but through the cooperative interaction with the Bight Program, integrated a Bight survey approach into their own program and as a result have contributed information towards an understanding a debris issues in San Diego Bay.

"Core" components of Bight surveys include offshore water quality, coastal ecology, focusing on sediment quality, and shoreline microbiology. Previous Bight Program studies (1994, 1998, 2003, and 2008) have evaluated debris in the marine environment, but never highlighted marine debris a primary focus of the Bight Regional Monitoring Program. In 2013, the Bight Program started the first ever comprehensive marine debris survey. The objective for the (Bight '13) Debris Study was to characterize the extent and magnitude of debris in the Southern California Bight and its coastal watersheds. The main monitoring questions for the Bight '13 Debris Study were:

1. What are the quantities and types of debris in marine and estuarine sediments and epibenthos?
2. What is the prevalence of debris in the nearshore demersal and pelagic fish?
3. What are the quantities and types of debris in riverine channels?

The Bight '13 Debris Study focused on evaluating the types and quantities in benthic, epibenthic, and riverine habitats including an analysis of plastic ingestion in near shore demersal and pelagic fish. The coastal wetlands and bays, however, were not studied extensively for the Bight '13 debris study.

The marine environment and the coastal watersheds which were the focus of the Bight '13 debris study represents an important starting point for evaluating the linkages between watershed sources and marine debris. The bay includes several different intertidal habitats that are expected to respond to seasonal changes in debris conditions from storm event flows and these habitats represent a data gap in the Bight '13 Debris Study.

The San Diego Bay Debris Study presented in this Work Plan follows some of the approaches developed in the Bight Debris Study and expands the habitats surveyed for Bight by including a coastal embayment.

3.0 PROJECT MANAGEMENT RESPONSIBILITIES

3.1 Overview of San Diego Bay Debris Study Workgroup

The San Diego Bay Debris Study Workgroup is a multi-agency coalition of stakeholders with an interest in developing a better understanding of debris conditions in San Diego Bay. The members of the workgroup include staff from local and state government agencies, regional and joint power authorities, non-profit organizations, and the University of California. Members of the workgroup are providing support to the study through voluntary contributions of in-kind services, directed funding of various study elements, or sharing of resources from existing programs or projects of similar scope and interest.

3.2 Key Project Personnel

The Bay Debris Study workgroup consists of members from the Surface Water Ambient Monitoring Program (SWAMP) of the California State Water Resources Control Board, San Diego Region Water Quality Control Board, Unified Port District of San Diego, City of Chula Vista, City of Imperial Beach, United States Naval Facilities Engineering Command (NAVFAC), San Diego Coastkeeper, Ocean Discovery Institute, California Sea Grant, Wildcoast, Surfrider Foundation San Diego Chapter, members of the San Diego Bay Port Tenants Association, Southern California Coastal Waters Research Project, and AMEC Environment & Infrastructure.

Additional agencies are contributing to the Bay Debris Study through sharing of resources from current and ongoing projects. The City of San Diego's contribution to the Regional Harbor Monitoring Program and Shallow Water Habitat Bioaccumulation Study are providing important data to the study that will help to provide a better understanding of debris issues in San Diego Bay.

The Work Group also includes third party subject experts for reviewing project documentation, data analyses performed, and the associated reporting. The third party reviewers have key role in assessing the overall conclusions based on the data collected.

A list of the key project personnel included project titles and contributions to the Bay Debris Study are provided in Table 3-1.

Table 3-1. Key Project Personnel

Organization	Name	Bay Debris Study Title	Contribution
SWAMP	Lilian Busse	Lead Agency Program Manager	Principle-In-Charge
Port of San Diego	Philip Gibbons	Agency Project Manager	RHMP, Rip-Rap Habitat Surveys, SD Bay Port Tenants Association Liaison
RWQCB	Chad Loflen	Agency Project Manager	Water Column Trawls, SWHB Liaison
NAVFAC	Christiana Boerger	Agency Project Manager	Project Scientist, Plastic Ingestion Study
City of Chula Vista	Marisa Soriano	Agency Project Manager	Data Management, Sweetwater and Otay River Surveys
City of Imperial Beach	Wbaldo Arellano	Agency Project Manager	Otay River Surveys
SCCWRP	Shelly Moore	Agency Project Manager	Bight '13 Debris Study Lead Scientist
San Diego Coastkeeper	Travis Pritchard	Agency Project Manager	Intertidal Habitat Surveys
San Diego Coastkeeper	Kristin Kuhn	Volunteer Coordinator	Intertidal Habitat Surveys
Ocean Discovery Institute	Lindsey Goodwin	Chollas Creek Outreach Coordinator	Chollas Creek Surveys Program Coordinator
California Sea Grant	Theresa Talley	Chollas Creek Outreach Coordinator	Project Scientist, Wet Weather Tracking Study
WildCoast	John Holder	Volunteer Coordinator	Otay River Surveys
Surfrider Foundation	Haley Haggerstone	Volunteer Coordinator	Field and Lab Team Support
AMEC Environment & Infrastructure	Theodore Von Bitner	Project Manager	Project Coordination
AMEC Environment & Infrastructure	Terra Miller-Cassman	Project Support Staff	Quality Assurance Administrator
AMEC Environment & Infrastructure	Monica Netherly	Project Support Staff	Volunteer Training and Auditor
AMEC Environment & Infrastructure	Michelle Bowman	Project Support Staff	Marinas Property Owner Coordinator
NOAA, Marine Debris Program	Dr. Sherry Lippiatt	Third Party Reviewer	Technical Review
Independent Consultant	Dr. Brock Bernstein	Third Party Reviewer	Project Documentation Review

4.0 SURVEY DESIGN

4.1 Study Goal

The overall goal of this study is to characterize the extent and magnitude of debris in San Diego Bay amongst the various habitats and evaluate the potential ecological impact of plastic on fish communities in the bay. Within this study, three core questions have been developed to answer the study goals:

1) *How do the quantities and types of debris in different habitats vary during dry and wet season?*
    a) *What are the quantities and types of debris found in San Diego Bay habitats?*
    b) *What are the quantities and types of debris found in watersheds flowing to San Diego Bay?*
    c) *How do the quantities and types of trash in different San Diego Bay habitats vary by summer and winter dry season?*
    d) *What are the quantities and types of trash in San Diego Bay following the first storms of the wet weather season?*
2) *What types of riverine debris do wet weather flows transport to the bay?*[1]
3) *What species caught in the bay has ingested plastic pieces?*[1]

The first question seeks to evaluate the differences in the abundance and types of debris found in bay bottom sediments (benthic and epibenthic habitats), water column (open water habitats), estuarine (salt marsh habitats), beaches and mudflats (intertidal habitats), and upland areas (riverine habitats). The approach to answering this question leverages efforts conducted through RHMP study of benthic ecology, Bight Debris Study Riverine Habitat Surveys, and the San Diego Bay Shallow Water Habitat Bioaccumulation Study[2]. In addition to the existing collected data, additional sites in bay habitats will be surveyed in dry weather to establish a baseline comparison of the types and quantities across each of the habitat types. The habitats surveyed for the first question also include a focus on key areas expected to accumulate larger amounts of debris including the wrack line throughout the salt marsh and along the rip-rap shoreline protective barrier. A subset of the bay habitats will also be evaluated after the first major storm events of the 2014-2015 storm season in order to evaluate seasonal changes in debris types and quantities.

[1] Data needed to answer question 2and 3 will be leveraged from existing efforts to extent possible. The data that may be needed is dependent on the availability of funding or in-kind services contributed by project partners and completion of the Bay Debris Study is not contingent upon the completion of Questions 2 and 3.

[2] The RHMP and Bight '13 programs sampled for analysis of bioaccumulative compounds in sediments, invertebrates, fish, plankton, and bird eggs, which represent a primary on-going contaminant source of concern, and a wide range of trophic levels in the food chain. However, all of the sampling in San Diego Bay was focused on areas deeper than 3 meters in compliance with the Bight'13 protocols and station draw. An assessment of bioaccumulative compounds in the more heavily wildlife-utilized and productive shallow water habitats is an important recognized data gap. The initial concept for studying the trophic transfer of bioaccumulative compounds was developed for the Bight '13 program by a collaborative group comprising the City of San Diego, Port of San Diego, Southern California Coastal Water Research Project (SCCWRP), San Diego State University (SDSU), United States Fish and Wildlife (USFW), and the San Diego Regional Water Quality Control Board (SDRWQCB).

The second question focuses on evaluating the types and quantities of debris in riverine habitats that are transported to the bay during storm events. The differences or similarities in the composition of plastics in upland riverine habitats and those that occur in the bay are not fully understood. The second question focuses on better understanding which types of debris are more likely to be transported to the bay during storm events. Based on results of the riverine habitat debris surveys, a subset of the most prevalent types of plastics found will be tagged in place and tracked to the bay following a storm event by using multiple tracking methodologies. These results are intended to help better understand the types of plastics from land based sources that can be transported to the bay in comparison to the plastics that are less mobile and may be entangled on vegetation or structures in the riverine habitats.

The third question seeks to assess demersal and pelagic fish communities in the bay by quantifying the abundance and types of debris ingested. Demersal and pelagic fish collected from the RHMP and SWHB trawls and pelagic fish collected during bay trawls as part of this study will be analyzed.

4.2 Quantities and Types of Plastic Debris in San Diego Bay

4.2.1 Study Approach

To complete this baseline assessment, the Bay Debris Study has been designed with the intention of integrating existing datasets with new monitoring information from additional habitats to develop a more complete understanding of the types, quantities, and locations of debris within San Diego Bay. The data generated for the Bay Debris Study will be leveraged through coordination of ongoing projects, in-kind services, or project-directed contributions from stakeholders. In order to take full advantage of available resources, data collected for the Bight ‘13 Debris Study within San Diego Bay and its associated watersheds, including sediment, epibenthos, riverine samples, and fish gut data will be leveraged with this study dataset to the extent feasible.

This Work Plan provides details on the habitats that will be surveyed, the field and laboratory methods used to generate debris data, and the laboratory methods needed for analyzing ingested plastics in fish guts. Supporting documents to the Work Plan include field and laboratory forms, proposed sampling location lists, and Standard Operating Procedures. In addition, the detailed descriptions of the field methods, laboratory methods, and quality assurance plans that accompany the data generated for the RHMP survey of San Diego Bay (Port of San Diego, 2013) and the Bight ’13 Debris Study are available on-line at the Southern California Coastal Water Research Project (sccwrp.org) website.

4.2.2 Target Population, Sample Frame Development, and Site Selections

The target population for the Bay Debris Study includes all bay or bay-influenced habitats, including high tide zones as well as upland riverine areas. The sample frame will include three habitats studied in previous RHMP, SMC, and Bight surveys and six new habitats, for a total of nine habitats assessed during this study. Within these nine habitats, the goal is to collect a target sample size of thirty sites from each habitat in order to develop statistically based estimates of the debris quantities. The targeted habitats for the Bay Debris Study are listed in Table 3-1.

Table 4-1. Targeted Habitats for Bay Debris Study

Category	Targeted Habitat	Data Source
Bay	Benthic	RHMP and SWHB
	Water Column	RHMP and SWHB
Structures-Facilities	Marinas	This Study
Intertidal	Mudflats	This Study
	Sandy Beaches	This Study
	Salt Marsh	This Study
	Salt Marsh, Wrackline	This Study
	Protective Barriers (Rip-Rap)	This Study
Upland	Riverine	SMC and Bight '13

This study component is being leveraged over resources in place through the RHMP 2013 survey, SMC 2013 Regional Monitoring Program, Bight '13 Debris Study, and San Diego Bay Shallow Water Habitat Study to take advantage of the target population, sample frame, and sites selected by the previous studies. Sites within habitats will be randomly selected to provide an unbiased among sampled sites and allow for inference into bay-wide conditions. For habitats not previously sampled, a systematic component will be used in the site selection to target habitats of interest following approaches adopted for the Bight Regional Monitoring Program. Briefly, a grid system will be placed over a map of the targeted habitat and a subsample of the grid will be randomly chosen from this population, and a debris survey will be conducted at the selected site within the grid cell. The grid structure allows for a systematic approach to sample targeted habitats while the random sites selection of sites within the grid ensures an unbiased estimate of ecological condition.

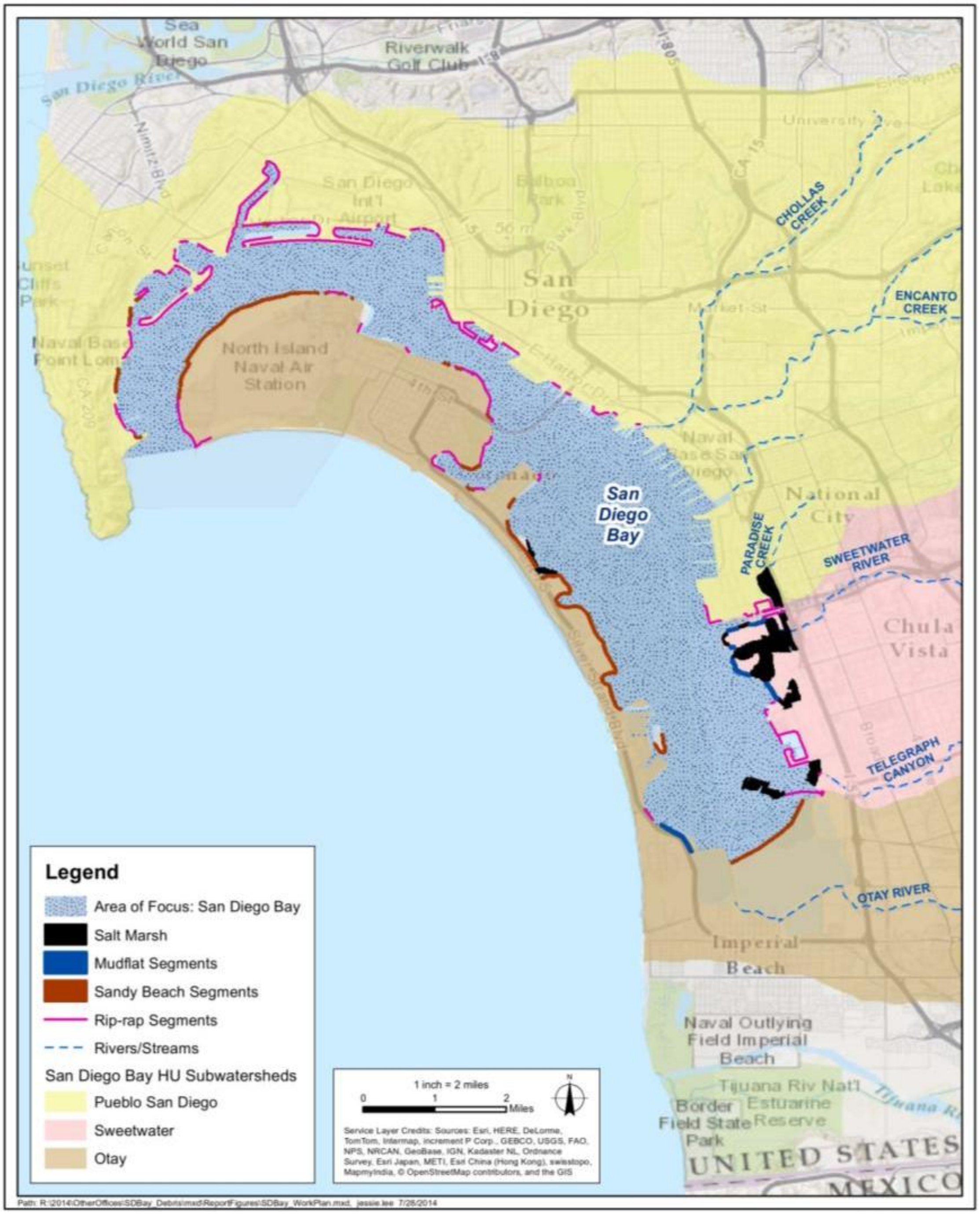

Figure 4-1. San Diego Bay Habitats for Debris Surveys

4.3 Study Schedule

The Bay Debris Study is anticipated to be a multi-year project beginning in the winter of 2014 and continuing until the spring of 2016. The timeline for completing the major elements of the study during the approximately two-year time period are shown below in Table 4-2.

Table 4-2 Bay Debris Study Proposed Schedule

Activity	Schedule	Study Element
Develop Study Design	February 2014 – June 2014	Work Plan
Prepare Work Plan and SOPs	June 2014 – August 2014	Work Plan and Data Quality Assurance
Field training and intercalibration	August 2014 – September 2014	Training and Data Quality Assurance
1st dry weather surveys, all habitats	August 2014 – October 2014	Early Season Dry Weather Condition
Wet weather tracking study	October 2014 – December 2014	Wet Weather Conditions
Post-storm trawls[1]	October 2014 – December 2014	Wet Weather Conditions
2nd dry weather trawl[2]	January 2015 – March 2015	Late Season Dry Weather Conditions
2nd dry weather surveys[2,3]	January 2015 – March 2015	Late Season Dry Weather Conditions
Marina passive samplers	September 2014 – March 2015	Early to Late Season Dry Weather Conditions
Fish gut dissections	December 2014 – May 2015	Plastic ingestion
Draft Report	December 2015	Data Analysis and Reporting
Final Report	March 2016	Reporting

Notes:
1) Post-storm surveys will be dependent on the weather and timing between early season storm events.
2) Surveys will target non-storm event dry weather conditions following an antecedent period of 14-28 days
3) Surveys will not be started until the Post-Storm Surveys are complete, does not include water column trawls.

4.4 Summary of Plastics Data from Recent Debris Surveys

The Bay Debris Study will include plastics data from surveys conducted in San Diego Bay and the contributing watershed during 2013 and 2014. The additional data is needed to develop a more complete understanding of the types and quantities of plastic throughout the bay and the information from the recent surveys helps to fill the data gaps. A summary of the monitoring programs that collected the plastics data, the habitats or studies in which the debris surveys were conducted, the plastics size ranges collected, and whether the habitats will be re-sampled for the Bay Debris Study are listed in Table 4-3.

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Table 4-3. Recent Debris Surveys for Plastics Data Included in the Bay Debris Study

Program	Monitoring Year	Habitat or Study	Debris Size(s)	Number Samples	Resample Station Location for Bay Debris Study?	Bay Debris Study Question
RHMP Benthic Ecology	2013	Benthic	Micro-, Meso-, Macro-	50	NO	1
RHMP Benthic Ecology	2013	Epibenthic	Meso-, Macro-	10	NO	1
San Diego Bay Shallow Water Habitat Bioaccumulation Study	2014	Benthic	Micro-, Meso-, Macro-	30	NO	1
San Diego Bay Shallow Water Habitat Bioaccumulation Study	2014	Epibenthic	Micro-, Meso-, Macro-	9	NO	1
Bight '13 Debris Study Riverine Habitat Surveys*	2013	Riverine	Meso-, Macro-	2	YES	1
Stormwater Monitoring Coalition (SMC) Regional Stream Trash Assessment *	2013	Riverine	Meso-, Macro-	7	YES	1
RHMP Water Column Surveys	2013	Demersal and Pelagic Fish Gut Content	Micro-	TBD	NO	3
San Diego Bay Shallow Water Habitat Bioaccumulation Study	2014	Demersal and Pelagic Fish Gut Content	Micro-	TBD	NO	3

Note: (TBD) Samples collected are currently being analyzed and the final counts of samples passing acceptability criteria have not been finalized at the time this work plan was prepared.

5.0 SAMPLING AND ANALYSIS METHODS

This section describes the field and laboratory methods associated with the data collection. The field and laboratory methodologies performed in concert with the Bight '13 Debris Study have been included in this section to provide details on the sampling and analysis approach used to collect the data that will be included in this study. Samples collected for the RHMP and San Diego Bay Shallow Water Habitat Bioaccumulation Study followed Bight '13 site selection and field methods. For additional details on the Bight '13 methods detailed information is available in the Bight '13 Field Methods Manual and Bight '13 Benthic Manual (Bight '13 Benthic Committee, 2013; Bight '13 Field Sampling & Logistics Committee, 2013).

The summary of sampling and analysis methods detailed in Section 5.0 for the habitats that will be surveyed for plastic are as follows:

5.1 Quantities and Types of Plastic Debris in the Bay Habitats

- 5.1.1 Benthic (Grabs)
- 5.1.2 Epibenthic (Trawls)
- 5.1.3 Water Column (Trawls)
- 5.1.4 Continuous Debris Collection by Trash Skimmers in Marinas

5.2 Quantities and Types of Plastic Debris in Intertidal Habitats

- 5.2.1 Mudflats, Salt Marsh (emergent vegetation), Sandy Beaches
- 5.2.2 Wrackline, Rip-Rap

5.3 Quantities and Types of Plastic Debris in Upland Habitats

- 5.3.1 Riverine

5.4 Wet Weather Debris Tracking from Riverine to Bay Habitats

5.5 Prevalence of Plastic Debris in Demersal and Pelagic Fish Gut Analysis

Sites selected for the targeted habitats in sections 5.1 to 5.3 are listed in Appendix A.

Plastic items collected for the Bay Debris Study will sorted and quantified according to size categories referenced in the NOAA Marine Debris Shoreline Survey protocols. The classification and size ranges that will be analyzed for this study are provided in Table 5-1. Section 7.0 provide details on the quality assurance and quality control procedures that will be incorporated into the data collection process for all habitats surveyed as part of the Bay Debris Study.

Table 5-1. Debris classification and size ranges to be analyzed

Category	Size (mm)
Macrodebris	> 25 cm
Mesodebris	5 mm - 25 cm
Microdebris	4.75 mm
	2.00 mm
	1.00 mm
	0.710 mm
	0.500 mm
	0.355 mm

The sampling and analysis methods described in detail in Section 5.0 are summarized in Table 5-2.

Table 5-2. Summary of sampling and analysis methods in the study habitats according to size of plastic items collected.

Habitat or Study Focus*	Method	Plastic Sizes		
Water Column	Bight '13 Trawl, Boerger 2010	Macrodebris	Mesodebris	Microdebris
Rip-Rap	NOAA Shoreline Survey	Macrodebris	Mesodebris	---
Wrackline	NOAA Shoreline Survey	Macrodebris	Mesodebris	---
Mudflat	NOAA Shoreline Survey	Macrodebris	Mesodebris	---
Salt Marsh	NOAA Shoreline Survey	Macrodebris	Mesodebris	---
Sandy Beach	NOAA Shoreline Survey	Macrodebris	Mesodebris	Microdebris
Riverine	Bight '13 Debris	Macrodebris	Mesodebris	---
Marina Skimmers	This Study	Macrodebris	Mesodebris	Microdebris
Wet Weather Tracking	This Study	Macrodebris	---	---
Fish Gut	Bight '13 Trawl, Boerger 2010	---	---	Microdebris

Note: In conjunction with the US Fish & Wildlife Service, microdebris will not be collected from the salt marsh or mudflat habitats to avoid impacts to important habitats. Similarly, collection of microdebris in these habitats requires the removal of the top 3 cm of high silt content soil and vegetation that would be prohibitive to process on a time and materials basis. Microdebris in rip-rap and riverine habitats will not be collected due to the challenges of working around large rocks and in areas of high gravel content that would be logistically infeasible to sieve.

5.1 Quantities and Types of Plastic Debris in the Bay and Marinas Habitats

Sections 4.1.1 and 4.1.2 provide details on the methods that used to previously collect debris data that will be included in this study. Sections 5.1.3 and 5.1.4 provide details on the method that will be adopted to collect new data for this study. Benthic (Grabs)

The main purpose of benthic sampling is to obtain data on the amounts and types of plastic found in the sediment. Benthic sample collections were conducted in collaboration with the RHMP 2013 survey and San Diego Bay Shallow Water Habitat Bioaccumulation Study following sample collection methods described in the Bight '13 Field Operations Manual.

Field Sampling Methods

A 0.1 m^2 modified Van Veen grab was used to collect sediment samples for physical, chemical, and infaunal analyses (Stubbs et al. 1987). The grab used for infaunal analysis was also used for macroplastic analysis. Grab acceptance criteria were the same as that for infaunal grabs, and were based on two characteristics of the sample: sample condition and depth of penetration. Sample condition was judged using criteria for surface disturbance, leakage, canting and washing (Bight '13 Field Sampling & Logistics Committee, 2013). Sediment penetration depth must have been at least 5 cm; however, penetration depths of 7-10 cm should have been obtained in silt.

Once the sample was found acceptable, any larger plastic items (or items of questionable material) found on top or within (caught in jaws or found inside the grab) the sample were retained and placed in a bag labeled with the sampling date, station and collecting agency (Bight '13 Field Sampling & Logistics Committee, 2013). The sample itself was processed in the field by washing the sediment from the grab and sending it and the wash through a 1.0-mm screen. Once the sample was washed through the screen, the material left was transferred to a labeled sample container. Samples were then returned to the lab for further analysis. Chain of Custody (COC) forms were used to track all samples from the field to the sorting lab for final debris analysis.

Laboratory Analysis Methods

Upon receiving samples at the lab, the samples was washed and transferred to a clean container. Samples were then sorted into broad debris categories for subsequent analysis. All plastic or questionable plastic items were placed in labeled vials with water, ethanol, or left dry (whatever is easiest for the sorting lab). If more than one vial was filled, then the vials were labeled as such, e.g. vial 1 of 2 or 2 of 2. All debris that has been sorted was sent to SCCWRP for delivery to Algalita Marine Research Institute (AMRI) or delivered directly to AMRI for final analysis.

The sorting labs also performed Quality Assurance/Quality Control (QA/QC) for plastic debris. Samples that underwent QA/QC were resorted and debris items that were missed from the original samples during the initial sort were placed in a vial and sent to AMRI for analysis. Error rates were computed and included in the final data analysis.

Final analysis of the debris samples included counting, typing (e.g. fragment, line, film, foam or pellet), categorizing by size (e.g. 1.00 mm - 4.99 mm, >5.00mm), volume, and if resources available, determined the polymer type using the Andrady method[3] (see Appendix D).

5.1.1 Epibenthic (Trawls)

Epibenthic or trawl marine debris sample collections were done in collaboration with the RHMP group and San Diego Bay Shallow Water Habitat Study. Sample collection methods in the field followed the Bight '13 Field Operations Manual, and sample collections occurred during the spring-summer of 2013 and 2014. The main purpose of the trawl survey was to obtain data on localized community structure of fish and invertebrate assemblages; however, the collection of these samples served a dual role in providing a more thorough characterization of the amounts and types of debris found on the bottom of the bay.

Field Sampling Methods

The field sampling methods for trawls (Appendix B) were conducted using a semi-balloon otter trawl with a 7.6-m head rope (25 ft), 8.8-m footrope (29 ft), 3.8-cm (1.5 in) body mesh, and a 1.3-cm cod-end mesh (0.5 in). Trawls were towed along isobaths at a speed-over-ground of 1.0 m/sec (or 1.5 to 2.0 knot) for 10 minutes. At the end of the prescribed trawl time, the net was retrieved and brought onboard the vessel. Any debris caught on the cable was noted, but not included in the talley. The cod-end was then opened and the catch deposited into a tub or holding tank. The criteria used to evaluate the success of any trawl included making sure that proper depth, scope, speed, and distance (or duration) were maintained, whether the net was fouled (net tangled), and whether the catch shows evidence that it was on the bottom (*e.g.*, rocks, benthic invertebrates, benthic fish). The trawl catch were sorted on deck into containers.

Trawl debris were sorted into containers for processing. Debris collected during any trawl was quantified by recording the specific types of material and their quantities on the Bight '13 Trawl Debris Form (Appendix C). This form was developed based on the same form used by the Stormwater Monitoring Coalition (SMC) for collecting debris information for land-based sources. Items within the debris categories are specific and included those commonly found by the RHMP and San Diego Bay Shallow Water Habitat 2013 trawls. Types of items within each of these categories were counted and recorded. If an item was not on the list it was placed in the appropriate "Other" category and a comment made to describe the item. In the case of items that could fit into multiple categories, the item was included in the category that the item consisted most of, and included documenting any of the other categories it would fit in the comments field. Additional descriptive information regarding the debris such as brand names was included in the comments section for that type. For debris of marine or terrestrial origin, counts of each were made; however, estimates were acceptable as well. For estimated counts a qualifier was included in the estimate box based on the following categories: L for low abundance (2-10 items); M for Moderate abundance (11-100 items); and H for High abundance (>100 items). In cases where counts were not easily made, a comment explaining the difficulty was suggested. The volume of debris items were recorded to the extent feasible but comments

[3] Application of the Andrady method on a subset of the overall samples from each habitat may be performed but is pending potential funding.

that better described the debris such as estimated size (e.g. the size of a basketball), condition (e.g. decayed kelp frond in pieces), or type/species (e.g. hard plastic, foam, wrapper, etc) are encouraged. After all of the debris has been categorized and counted, all plastic debris will be retained for further analysis. All or a piece (about the size of a quarter) of each plastic item will be placed in a gallon Ziploc bag and returned to be sent to the lab.

5.1.2 Water Column (Trawls)

Surface waters in San Diego Bay will be sampled for plastic debris sizes and sample collections will be performed using manta trawl field methods based on past southern California plastics trawls (Moore et al., 2001; Moore et al., 2002; Boerger et. al., 2010; Lattin et al., 2004), with modifications for consistency with other sampling conducted by Bight '13. Sample collection methods in the field will follow the Bight '13 Field Operations Manual to the extent feasible, and sample collections will occur from summer of 2014 through spring 2015. The main purpose of the trawl survey is to obtain data on amounts and types of debris located floating on or near the water surface in various portions off the bay. Subsequent mid-depth water column trawls may be conducted if resources are available.

The bay will be split into 4 regions (mouth, north, central, south), to account for differences in tidal flows and circulation, habitat types, watershed inputs, and vessel traffic (Largier, 1995; Largier et al., 1997; Komoroske et al., 2012), with trawls conducted at randomly selected fixed transects in each region. Trawls conducted at the mouth of the bay may also be conducted during both flood and ebb tides on the first event to evaluate the effect of tidal exchange process on debris quantities. Additionally, tide direction stratified sampling may be conducted during subsequent events if the results from the first event indicate significant differences in debris quantities as a result of tidal exchange processes. The project target is a total of 10 trawls per time period within each region and 10 trawls at the mouth of the bay over each tide condition

Trawls will occur within 3 time periods: 1) Summer Dry, 2) Winter Wet, and 3) Winter Dry. Summer Dry trawls will occur in the late summer to early fall (September-October) time period when there is limited to no rainfall and storm event flows to the bay from the adjacent watersheds will not complicate the data interpretation. Winter Wet trawls will occur during the rainy season (October – December) immediately following an early season storm event of at least 0.5 inches over a 24 hour duration, or following the first event of the rainy season depending on the storm totals. Winter Dry will occur during the late rainy season (January - March), but will follow a period of at least 14 to 28 days of preceding dry weather.

Field Sampling Methods

Trawl field methods will performed to be consistent with monitoring approaches adopted for the Bight '13 surveys to the extent feasible given that surface trawls samples were not collected during the Bight Program (Appendix B). Trawls will be conducted using an aluminum framed manta trawl with 0.335 mm net mesh and cod-end. The manta trawl net opening is 16 cm in height and 60 cm in width with a 4 meter net. Trawls will be towed along fixed bay transects at roughly 1-3 knots over a distance of 1,000 meters. A flow-meter will be attached to the manta trawl in order to calculate volumetric trawl data. At the end of the prescribed trawl time, the net is retrieved and brought onboard the vessel. Any debris caught on the cable will be noted, but not included in the final item talley. The net is then rinsed from the outside using site water to move sample into the cod-end. Large items may be manually removed from the net when necessary. The cod-end is then opened and turned inside out and the catch deposited into a tub, holding tank, or pre-cleaned 1 liter glass jar, depending upon sample size. The criteria used to evaluate the success of any trawl includes making sure that proper depth, scope, speed, and distance (or duration) were maintained, whether the net was fouled (net tangled), and whether the catch shows evidence that the opening was fouled in any way (*e.g.*, kelp, large plastic bags, etc).

The catch will be placed directly into pre-cleaned 1 liter glass jars, if possible. If not, large trawl debris will be sorted into appropriate containers for later processing. Debris collected during any trawl should be field quantified by recording the specific types of material observed, including counts where feasible for large items, and other pertinent quantitative and qualitative information on the Trawl Debris Field Form (Appendix C). This form was developed based on the same form used by the SMC for collecting debris information for land-based sources. The major categories are consistent with Bight ’13, though some items have been removed (e.g. glass, metal), and others added to reflect a more detailed analysis of plastics in the upper water column and surface. Items within these categories are specific and include those commonly found by the Bight ’13 Trawl Group in previous surveys (Appendix C). Full plastics typing, counts, and measurements will be done in the San Diego Water Board laboratory. Samples will be placed on ice in the field and immediately frozen upon return to the San Diego Water Board laboratory.

Laboratory Analysis Methods

All samples analyzed in the lab will follow methods utilized for plastic in Southern California (Moore et al., 2001; Moore et al., 2002; Lattin et al., 2004), with minor deviations for archival purposes. Samples will be thawed and sorted by category (plastics, paper, feathers, etc.) prior to filtering and analysis. Large items will be rinsed with DI water in the lab to remove smaller debris that is adhered to the surface. A dissecting scope will then be used to remove and sort remaining debris in categories. Filtering will then be conducted for each category type using six pre-cleaned *Newark* type sieves, sized 4.75, 2.0, 1.0, 0.710, 0.500, and 0.355 mm. Debris for each category will then be counted for each size class prior to further material identification. Volume will also be measured and recorded for each size class.

Types of items within each of the size class categories will be sorted according to color (i.e. white, red, black, etc.) based on previous studies indicating a feeding preference by fish based on the color of plastic microdebris (Boerger, 2010). If an item is not on the list it will be placed in the appropriate “Other” category and a comment made to describe the item. In the case of items that could fit into multiple categories, the item will be included in the category that the item consists most of, and records will document any of the other categories it would fit in the comments field. Notes will include additional descriptive information regarding the debris such as brand names and item color(s) in the comments section for that item. In cases where counts cannot be easily made, estimates will be generated and a qualifier included in the estimate box based on the following categories: L for low abundance (2-10 items); M for Moderate abundance (11-100 items); and H for High abundance (>100 items).

After all of the debris has been categorized and counted, all plastic debris will be retained and archived at the San Diego Water Board laboratory for future analysis. All or a piece (about the size of a quarter) of each item will be placed in archive.

5.1.3 Continuous Debris Collection by Passive Samplers

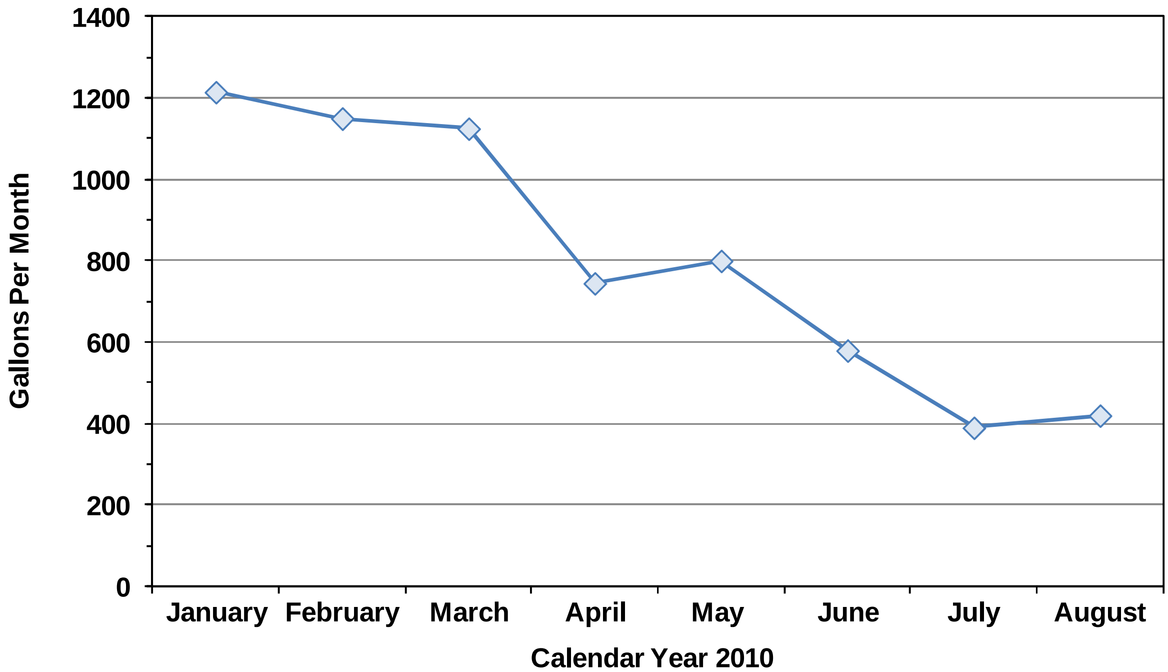
Debris movement throughout the bay is governed by tides and wind directions that vary on daily and seasonal time periods. Tracking the movement of debris in the bay on a daily basis for the Bay Debris Study would be challenging in terms of timing with tides, local wind currents, and seasonal inputs. At the same time, collecting samples of debris on a continuous basis over the study period would also be logistically challenging and resource intensive. In order to capture variations in bay debris types and quantities over the time period of this study, this survey design includes the use of passive samplers anchored in four different marinas throughout the bay. The passive samplers, commonly referred to as a trash skimmers, are situated in four locations throughout the bay and provide an opportunity to collect continuous debris data in concert with habitat survey and trawl events. The trash skimmers are situated in areas of the bay that have been previously documented to accumulate trash from tidal processes and daily surface winds (Port of San Diego, 2011).

Site Selection

The marinas with trash skimmers currently are:

- <u>Pt. Loma Marina</u>: Owned by America's Cup Harbor located along the east end of the main dock. This skimmer location is an area of debris collection located below a high traffic area and is also routinely exposed to prevailing winds transporting debris directly into the area.
- <u>Half Moon Marina</u>: Owned by Humphrey's in Shelter Island located on the east end of the Shelter Island Basin. Humphrey's By the Bay concert venue overlooks the site and is a prime location for debris collection.
- <u>Harbor Island West Marina</u>: Located in Harbor Island located along a channel leading to a low flush area of the Harbor Island Basin. Debris must pass through this region during high tide and again as the tide retreats.
- <u>Pier 32 Marina</u>: Located in Chula Vista along the Sweetwater River outlet to the bay. The skimmer has been placed in a section of the marina that has been previously documented to have low tidal exchange characteristics.

The inclusion of the passive samplers for this project is based on a published report which suggested that the presence of trash skimmers in the marinas can have a notice positive impact on improving water quality through the continuous removal of large and floating debris. Plastics data collected from a trash skimmers located in Half Moon Bay Marina is shown in Figure 5-1 to provide an example of the type of information that can be obtained using passive samplers in this study.



Note: Data reproduced with permission from the Unified Port District of San Diego.

Figure 5-1. Debris Volumes from San Diego Bay Marina Trash Skimmer Study (Port of San Diego, 2011)

Field Sampling Methods

The debris collection and quantification methods for this study will follow methods described in the marina trash skimmer study (Port of San Diego, 2011). The sample collection period will occur September 2014 to March 2015 in order to have the continuous data overlap with the dry weather event, post-storm trawl, and winter dry weather trawl events. The four marinas with trash skimmers will keep detailed logs of debris collected by the skimmer on a weekly to monthly basis. Each marina will record volumes of debris and types of debris following the item descriptions in the Intertidal and Riverine Field Forms (Appendix E and F).

Laboratory Analysis Methods

Macro and mesodebris will be sorted by type and counted. Volumes will be recorded for debris in each size class collected during each assessment. Additional information such as brand names will also be noted on data sheets if available. If available, microdebris collected from skimmers will be sieved for size classes of 4.75, 2.0, 1.0, .710, 0.500, and 0.355 mm. After further sorting the microdebris by these size classes, items will be counted to determine the abundance and the volume will be measured for each size class. Item colors will also be counted for microdebris according to the colors of ingested plastic found previously in fish gut trawl samples (Boerger et al., 2010).

5.2 Quantities and Types of Plastic Debris in Intertidal Habitats

Debris deposited in intertidal habitats accumulates from land-based and bay-based sources, and varies according to geographic location, oceanographic and meteorological conditions, and climatic changes (Lippiatt et al., 2013). The goal of this assessment is to obtain information on the types of amounts of debris which accumulate onshore on the mudflats, salt marsh, sandy beaches, rip-rap structures, and along the high tide line (wrackline) throughout the bay. Section 5.2 provides details on the methods used to collect new data that will be included in this study.

Site Selection

Intertidal assessment sites will be randomly chosen from a set of grids placed over the intertidal habitats. As a general guide for the site selection process for the mudflat, salt marsh – emergent vegetation, and sandy beaches, the following criteria suggested by the NOAA Marine Debris Monitoring Program will be used:

- Clear, direct, year-round access[4]
- At least 100 meter (m) length of shoreline
- No regular cleanup activities such as beach grooming

Survey sites within each stratum will be randomly selected to ensure that sites are selected in each stratum and that the quantities of plastic are based on unbiased estimates.

Field Sampling Methods

Debris collection methods will be adapted from the NOAA Marine Debris Monitoring methodology (Lippiatt et. al 2013; Viehman, 2011; Viehman, 2009). The NOAA shoreline technique is designed to be useable by trained community volunteer organizations while simultaneously providing data that can be used to address key management questions. Sampling efforts will focus on collecting detailed information about macrodebris (greater than 25 cm) and mesodebris (5 mm up to 25 cm) in each assessment site. Microdebris (sizes less than 5 mm) will also be collected, but on a limited extent in order to avoid impacts to sensitive estuarine habitats.

Sampling will be conducted during dry weather conditions and conducted within three hours of low tide if possible in order to take advantage of the maximum width of the shoreline section. A subset consisting of no more than 10 percent of the wrackline and rip-rap sites will re-evaluated after 30 days from the date of survey following the next spring tide event in order to assess whether debris re-accumulation occurred as a result of tidal displacement of the remaining plastic along the high tide zone.

Site specific information recorded at each assessment site includes the substrate type, tidal range, and transect width from the low tide water line to the wrackline. Photo documentation

[4] Seasonal restrictions apply from February 15 to September 15 for intertidal areas within the San Diego Bay National Wildlife Refuge. Debris surveys during the winter dry weather season will be performed in coordination with project partner from US Fish and Wildlife Service during time periods that are expected to not interfere with the nesting season for specific bird species.

will record the physical characteristics of the assessment site prior to the survey being conducted to document the aesthetic condition of the site.

5.2.1 Emergent Vegetation, Mudflat, and Sandy Beach Assessments

Transects for the intertidal assessments will be distributed between the wrackline and the low tide line or water's edge. For the purposes of this study, wrackline assessments will be conducted separately in order to obtain a more detailed assessment of the intertidal habitats as shown in Figure 5-2. Intertidal habitat surveys sites in the emergent vegetation, mudflats, and sandy beach will consist of evenly sized 150 m^2 grid cells follows method previously adopted for intertidal debris surveys (Lippiatt et. al 2013, Viehman 2009).

Note: Red dots indicate locations of GPS coordinates. Image not to scale.

Figure 5-2. Example of Survey Transects in Emergent Vegetation and Wrackline Habitats

Within each transect, surveys will be conducted over the entire transect area for macrodebris (sizes greater than 25 cm). Mesodebris (sizes from 25 cm – 5m) and microdebris (sizes less than 5 mm) will be collected using a quadrat approach (Lippiatt et. al 2013).

Quadrat locations for mesodebris in all intertidal habitats and microdebris surveys on sandy beaches will be randomly distributed over each transect following methods previously published (Moore, et. al, 2001). Quadrats will be distributed at 20 percent margins of the transect length, and alternate between left edge, middle, and right edge in order to capture the distribution of debris over the entire transect area. Within quadrats, debris will be counted and recorded within categories and then collected. Items that do not fall under a specific subcategory will be entered into the "Miscellaneous" category on the field sheets (Appendix E). Field crew will provide a written description and photo documentation of these items.

5.2.2 Wrackline and Rip-Rap Assessments

In order to capture the quantity of debris potentially associated with the wrackline or the high tide elevation in the shoreline protective rip-rap barrier as shown in Figure 4, detailed surveys will be conducted using a modified NOAA shoreline assessment approach. Detailed assessments will be conducted along a 30 m transect length of the wrackline or rip rap, running parallel to the water's edge. Transects will be 5 m wide, and will be measured from the highest edge of the wrackline or rip rap towards the water. The debris collection and quantification approach will be consistent with the intertidal habitat survey method provided in Section 5.2.1.

Note: Red dots indicate locations of GPS coordinates. This image is not to scale.

Figure 3-4. Example of Survey Transects on Intertidal Rip-Rap Habitats.

Laboratory Analysis Methods

Macro- and mesodebris will be sorted by type and counted. Volumes will be recorded for debris in each size class collected during each assessment. Additional information such as brand names will also be noted on data sheets if available. Microdebris collected from sandy beaches will be sieved for size classes of 4.75, 2.0, 1.0, .710, 0.500, and 0.355 mm (Appendix G). After further sorting the microdebris by these size classes, items will be counted to determine the abundance and the volume will be measured for each size class. Item colors will also be counted for each size class of items collected from sandy beaches according to the colors of ingested plastic found previously in fish gut trawl samples (Boerger et al., 2010).

5.3 Quantities and Types of Debris in Riverine Habitats

The goal of this assessment will be to determine the quantities and types debris in the channels of upland wadeable streams in the watersheds draining to San Diego Bay. Debris deposited in riverine habits occurs through land use-based sources, incidental or wind-blown litter from adjacent areas, and direct deposit of debris through littering and illegal dumping. Understanding the quantity and types of debris in riverine habits is a first step in making the connections between land based sources and debris that is ultimately transported to the bay. Section 5.3 provides details on the methods used to collect riverine habitat data that will be included in this study.

Site Selection

This study component follows on the Bight '13 Debris Riverine Habitat Study adopted from the SMC Regional Watershed Monitoring Program, and as such the target population, sample frame, and site selection has been pre-determined by that workgroup. The target population for the SMC surveys is perennial, wadeable, and Strahler second order or higher classification streams across the Southern California watersheds. The sample frame will include the major strata used in previous SMC surveys, which are as follows:

1. Strahler Order
2. Land Use
   a. Urban
   b. Agriculture
   c. Open
3. Watershed Jurisdiction (Hydrologic Unit Boundaries)
4. County Jurisdictional Boundaries
5. Regional Water Quality Control Board Jurisdiction Boundaries

Briefly, SMC sample sites were selected using a probabilistic approach weighting by watershed, land use, and stream order. The sampling frame includes watershed units located from Ventura to San Diego and east to San Bernardino and Riverside Counties. These watersheds equate to combinations of management units utilized by the Regional Water Quality Control Boards (RWQCB) or SMC member agencies. Altogether, these 15 watershed units are comprised of roughly 28,051 km^2. The streamlines used to define the sampling frame were derived from the National Hydrography Dataset. Altogether, there are 9,492 stream miles of Strahler order 2 and greater in the sampling frame. Land use was defined as either urban, agriculture, or open based on the Coastal Change Analysis Program (C-CAP) remote imaging algorithms (National Oceanic and Atmospheric Administration 1995). C-CAP defines 35 different land use classes that have been aggregated into the three categories for this study (i.e., open, agriculture, urban, and water). The dominant land use within a 500-m buffer was assigned to each stream reach.

The Bay Debris Study will focus on the urban stratum riverine sites in the Chollas Creek, Sweetwater River, and Otay River watersheds. The riverine habitat portion of the Bay Debris Study focusing on revisiting sites surveyed during prior regional monitoring programs. Sites sampled for the SMC Regional Monitoring Program and the Bight '13 Debris Study Riverine Assessment will be selected as the first set of potential sites, up to a maximum of 30 sites over the three watersheds. In the event an insufficient number of sites cannot be developed from the existing pool of previously visited sites, additional new sites will be selected.

Field Sampling Methods

The Bight ’13 riverine assessment protocol will serve as the survey approach for the riverine habitats in the Bay Debris Study. The riverine habitat survey approach is based on combination of field methods incorporating a multimetric rapid trash assessment index and an associated item tally. Sites are numerically evaluated using a modified version of the Surface Water Ambient Monitoring Program Rapid Trash Assessment approach developed by the Bight ’13 Debris Study planning committee. In addition to the RTA score, individual debris items will be recorded according to specific item categories on the Stream Trash Item Tally Sheet.

Debris collected during any survey should be record the quantity of plastic material in specific categories on the Riverine Habitat Debris Assessment Tally Worksheet (Appendix F). Types of items within each of these categories will counted and recorded during field surveys. Field information collected during site assessments will include a description of site characteristics that will further aid in the data analysis. The additional site characterization data will include an evaluation of storm drain inputs, presence of homeless encampments, adjacent land features, and summaries of the stream geomorphologies.

Laboratory Analysis Methods

A subset of the macro and mesodebris collected will be re-counted for quality assurance purposes by size and type of item. Volumes will be recorded for each plastic debris category and size class. Additional information such as brand names will also be noted on data sheets if available.

5.4 Wet Weather Debris Tracking from Riverine to Bay Habitats

The goal of this component of the Bay Debris Study is to evaluate pathways and distances traveled of common debris (trash) items during storm events. Much of Southern California’s watersheds are composed of networks of canyons that reticulate most urban neighborhoods and act as downhill pathways to the coast. Many of the higher elevation, lower order creeks are seasonal, where debris accumulates throughout the dry season and washes downstream to the coast during the wet season. Tracking common debris items can reveal the patterns and potential influences on accumulations and flows of these items as they move throughout the watershed. Understanding the patterns and influences on pathways of debris throughout coastal waterways can strength our understanding of how land based debris enters coastal oceans and bays. Section 5.4 provides details on the methods used to track riverine habitat plastic debris that will be included in this study.

Site Selection

Four canyons within the Chollas Creek subwatershed in the City Heights neighborhood of San Diego have been chosen for these tracking studies: Manzanita, Swan, Juniper and Chollas Canyons. The canyons in the Chollas Creek watershed are representative of urban seasonal waterways with surrounding areas being densely populated and heavily urbanized, with land uses including industrial, residential, commercial, and open space. Study sites will be distributed across each of these four canyons to capture a representative assessment of the landscape features (e.g., surrounding land use, vegetation cover and type) present in urban seasonal waterways.

Field Sampling Methods

Assessments will be conducted with the help volunteers from the Ocean Discovery Institute. Before the start of the rainy season in October, at least five sampling locations will be established in each canyon- two each on the right and left sides and one at the canyon head. Based on the availability of volunteers, the number of sites may be increased to as many as 13 sites per canyon if adequate staffing is available (6 sites on each side, one at head). Three (3) types of common, single-use plastic debris items (shopping bags, plastic bottles, Styrofoam or waxed fast food containers) will be labeled for tracking at each site. In order to avoid adding debris back into the environment, plastic items will be collected from the canyon and labeled for tracking purposes. Labels will contain sample information (site, date, item number) and study information (contact, brief explanation of project so item isn't removed). Labeling approaches planned include but may not be limited to painting items with brightly colored paint, wildlife radio frequency identification tags, and electronic trackers (e.g., radio or satellite based systems) to be able to track items placed along the subwatershed (upstream mid reach, near mouth) and to minimize loss in determining distances traveled. At each of the sites five individual items of each type of debris (e.g., 5 bags, 5 bottles, and 5 containers) will be staged for tracking. GPS locations of release sites will be recorded. Cover of land features in the immediate surrounding area will be assessed using a 10 x 10 m quadrat. Within each quadrat, cover of each feature will be assessed using the point intercept method where presence of a feature is recorded at every intersection along a grid containing 1m^2 cells. Bags will be located and mapped every 2 weeks or immediately following a rain event. Land feature quadrats will be taken around each item (where the item is centered in the quadrat) if the items are 10 m or more apart, or taken around the center item in a cluster if items are less than 10m apart. Surveys will be conducted throughout the rainy season (through March) during post-storm event conditions and, if items are still trackable, throughout the dry season on a monthly basis. If degradation or loss of items occurs, a new item will be placed in the last known location and noted.

If funds and volunteer help are available, debris tracking releases can be conducted farther downstream in the intertidal portion of Chollas Creek. In this area of the riverine habitat tracking methods can be evaluated using the painted and labeled items as described above and using adhesive radio tags placed on items as well as receivers placed along the stream to track unidirectional locations (flow downstream).

5.5 Prevalence of Plastic Debris in Demersal and Pelagic Fish

The goal of this part of the Bay Debris Study is to determine the quantities and types debris ingested by pelagic and demersal fish. As noted previously, accumulation of plastics in the gut can have two potential harmful effects on fish communities. Plastic items can provide a false sensation of feeding satiation leading to starvation. Plastics in the marine environment can also act as an intermediary for transmitting persistent organic pollutants that can bioaccumulate in the fish tissue (Rochman, 2013). Section 5.5 provides details on the methods used to previously collect debris data that will be included in this study.

The approach for this component of the Bay Debris Study is to leverage samples collected from RHMP 2013, San Diego Bay Shallow Water Habitat Bioaccumulation 2014 Study, and fish captured during the water column trawls in this study (see Section 5.1) in order to acquire specimens of fish. Fish gut contents will be processed to quantify the size, shape, color and abundance of debris ingested by fish. Comparisons between the types and amounts of different types of plastic among pelagic and demersal fish can provide useful information for determining the extent of area effected as well as suggests pathways for ingestion of debris to determine where and what types of debris to focus on for management actions.

Site Selection

As with the RHMP and SWHB study components, the sample frame and site selection were pre-determined (see Section 5.1).

Field Sampling Methods

Fish species collected during the previous trawls will serve as the initial list of targeted species for the Bay Debris Study. The four categories of fish consisting of species from the Pelagobenthivore Guild, Benthivore Guild, which were previously found to have consumed plastics and Pelagic Species, will represent the initial targeted fish species for this study. Although some species may not be found in San Diego Bay, the initial targeted list of fish species is not intended to be exclusive of other fish potentially collected during trawls of the bay. The species identity of non-target list fish caught during trawls will be recorded and those samples will be included into the overall sample set to be analyzed for ingestion of plastic debris. The final species list of fish that will be analyzed will take into consideration additional factors including number of fish caught, size and effort needed to extract ingested plastic, and feasibility of plastic being ingested based on existing precedence from previous studies. Any fish caught but not analyzed will be determined by consensus of the technical workgroup.

Table 4-3. Targeted fish species to determine ingestion of plastic

Pelagobenthivore Guild:	Benthivores Guild:	Fish previously found with ingested plastic:	Pelagic species:
Pacific sanddab	English sole	white croaker	Deepbody Anchovy
longfin sanddab	blackbelly eelpout	queenfish	Northern Anchovy
Longspine combfish	hornyhead turbot	shiner perch	Sardine
speckled sanddab	curlfin sole	spotted cusk eel	Herring
Bay goby	bearded eelpout	lizardfish	Jack Mackerel
			Pacific Mackerel
			Smelt

Trawls were performed using Bight ‘13 standardized procedures as found in the Bight ‘13 Field Methods Manual. Fish collected, counted, and weighed as part of the RHMP and SWHB species of interest will be analyzed. Fish previously caught were frozen and transferred under COC documentation in order to retain location and specie identity information.

Laboratory Analysis Methods

In the laboratory, each fish will be measured for length, weighed, and sexed. The gut (stomach and intestinal tract) will be removed and washed into a 1 mm sieve. The contents in the sieve will be examined under a 10X magnifying lens or dissecting scope for ingested plastic. Each plastic item will be removed, sized, sorted by shape, color, type (fragment, pellet, line, film, and foam), and archived.

6.0 DATA ANALYSIS

Analysis of the overall plastic debris quantities are an important component for establishing a benchmark of the most abundant type of plastic and being able to measure changes in the plastics quantities over time. The plastics data that will be collected for the Bay Debris Study includes a substantially expanded list of items beyond the data collected during previous SMC and Bight regional monitoring programs to capture a greater level of detail about the most prevalent types of plastic items. The plastics data that will be collected for the Bay Debris Study were categorized according to major plastics categories and examples of items within each category are as follows:

- Bags and Packaging Materials
    - Single use bags, food wrapper, Styrofoam pellets, etc.

- Food Service
    - Sport drink bottles, Styrofoam cups, bottle caps, etc.

- Household
    - Sports balls, synthetic fabric clothing, CDs/DVDs, etc.

- Toxics
    - Lighters, cigarette butts, pens or markers, etc.

- Miscellaneous
    - Balloons, foam balls, PVC pipe, etc.

Additional details on the specific plastic item descriptions and size categories are provided in Appendices C, E, F, and G. The primary data analyses that will be performed to answer the study questions include the following:

Data Analyses for Study Question 1.

1. What are the abundance and volume of plastics by category, item description, and size categories for each habitat type?

2. Are the average and total abundance and volume of plastics different in each habitat between survey events?

3. How do the abundance, category, item description, and volume of plastics in trash skimmers change over the study period?

Data Analyses for Study Question 2.

1. What percent of labeled plastic items were found following a storm event?

2. How does the percent of items found vary between types of plastic items?

3. What is the average distances traveled by a plastic item following storm events?

Data Analyses for Study Question 3.

1. What proportion of fish caught have debris ingested using a presence/absence approach?

2. What is the average number of plastic pieces ingested within fish according to species and body size?

3. What are the total numbers of plastic pieces ingested according to color?

Proposed statistical methodologies include cumulative distribution frequency curves, comparison of averages including rank-sum and analysis of variance, linear and logistical regression, and correlative analyses including Spearman-Rank or Kendall Tau. All data collected will be summarized in tables included as an appendix to the study report.

7.0 DATA QUALITY ASSURANCE AND QUALITY CONTROL

Data quality assurance and quality control guidelines have been developed for the Bay Debris Study to ensure that data generated is representative and reliable for supporting management decisions. The QA/QC guidelines for debris monitoring include:

- **Development of standard operating procedures (SOPs)**: The QA/QC procedures for all habitat data collection and laboratory analyses will include the use of Standard Operating Procedures to establish consistent guidance for all the project partners that perform data collection activities. The SOP prepared for this study provides detailed step-by-step instructions for field data collection, laboratory analyses and performance audits. SOPs will provide a reference for field personnel during field activities, and should be reviewed prior to field events in order to maintain consistent methodology.

Table 7-1. Summary of standard operating procedures for data collection activities.

Habitat or Study Focus	Data Collection Method	SOP Guidance Document
Water Column	Bight '13 Trawl, Boerger 2010	Bight '13 CIA Field Operations Manual
Rip-Rap	NOAA Shoreline Survey	Intertidal Habitat Rip Rap Survey SOP, August 2014
Mudflat	NOAA Shoreline Survey	Intertidal Habitat Rip Rap Survey SOP, August 2014
Salt Marsh	NOAA Shoreline Survey	Intertidal Habitat Rip Rap Survey SOP, August 2014
Sandy Beach	NOAA Shoreline Survey	Intertidal Habitat Sandy Beach Survey SOP, August 2014
Riverine	Bight '13 Debris	Riverine Habitat Survey SOP, August 2014
Marina Skimmers	This Study	Port of San Diego Marina Trash Skimmer Study
Wet Weather Tracking	This Study	Talley 2014
Fish Gut	Bight '13 Trawl,Boerger 2010	Boerger 2010
Quality Assurance	This Study	Performance Evaluation Guidance for Data Collection Activities

- **Completion of pre-project field based training events**: Training will focus on establishing consistency in data collection activities among all field personnel. Training will include instruction in proper field sampling methods, item identification, sampling and preservation procedures, and health and safety precautions. Field teams will perform intercalibration exercises prior to collecting samples to evaluate whether the requirements outlined in the field SOPs are understood by all field personnel.

  Site captains will be appointed for each field team performing intertidal and riverine habitat assessments. These site captains will go through in depth training of all field assessment requirements, item identification, data quality requirements, and site orientation. Field teams will be equipped with field notebooks and supplies, and site captains are required to prepare these items before each field event. Field equipment will be checked for proper performance prior to use.

- **Vessel positioning field forms.** Trawl sample tracks will be performed as to pass within approximately 10 m of the intended target collection location using a digital GPS unit with sites coordinates pre-programmed. The boat captain or field team leader on the boat will be responsible for accurate occupation of the sampling sites and will maintain a record of all station occupation and sampling event data. The data required to be recorded for every trawl is described in Appendix A. The Water Column Habitat Trawl project leader will submit station occupation and sampling event data in electronic format to the Quality Assurance Administrator.
- **Distribution of data collection guides and site maps for field teams**: A field guide will be distributed to all field teams which includes a cross reference chart with photos to identify debris. Volunteers will study this chart so that all debris items are identified consistently during field assessments. It will also be available for volunteers to crosscheck items for which they might be uncertain about the correct category.
- **Field team performance audits**: Routine QC checks of the field team data collection methodology and performance will be conducted using a tiered approach. The performance audit process consists of an initial evaluation by the designated regional team leader when field teams begin the data collection activities followed by periodic audits conducted by the site captains. The goal of the performance audits is to identify potential problems at the onset of data collection activities and maintain a consistent level of oversight during the sampling period as data sets are generated. Following the pre-season training event, the regional team leader conducts a performance audit of the field teams during the first day of data collection activities. Thereafter, the responsibility of maintaining data quality is managed by the site captains who's goal is to completed an auditor of field crews for at least 1 site per sample batch or 10 percent of the field team's sites, whichever is more, to note and provide instruction on areas of inconsistency with SOP methods.
- **Site verification requirements (site and survey area accuracy)**: Field teams will be given GPS coordinates for each site prior to field events. In order to maintain accuracy in site identification, field teams are required to record GPS coordinates for each site on the field sheet. This will be cross checked against the original GPS coordinates in order to verify that the correct site was assessed. To ensure accuracy in the transect area, field teams are also required to measure the length and width of each transect and include this information on the field sheets.
- **Site audits to evaluate data collection thoroughness (data accuracy)**: A minimum of 10 percent of sites will be randomly selected for a site audit. Team leaders will return to the site to verify that all debris items have been collected and the GPS location for the site is accurate.

- **Duplicate counts of collected items (data precision)**: Macrodebris and mesodebris collected during intertidal field assessments and trawl water column assessments will be reanalyzed at the lab. Debris will be sorted by type and recounted for each size category. The results should be compared to the field data sheets for each site for quality assurance purposes, however, it is recognized that quantities could be skewed by the breakup of debris during the transportation process.

  In light of the fact that data quality objectives have not been developed for debris surveys, variations of more than 30 percent in any portion of the QA/QC analyses would be sufficient to flag that portion of the data. If flagged data is identified during QA/QC reviews, data quality issues will be discussed and agreed upon by the workgroup, and based on the severity of the QA/QC issues may include re-collecting data.

- **Data analysis and reporting**: Following initial field data collection, a QA/QC review of all raw data and field sheets will be conducted by the project partners. Data collected during field surveys and laboratory analyses will be reviewed by the site captains and regional team leaders. Field forms will be reviewed by the site captains following each site survey and regional team leaders will perform random checks of the field forms for completeness. Once field forms have been reviewed and the information is considered complete, the raw data will be entered into a computer database for further review and data validation, preferably in the SWAMP database if appropriate fields for data exist. A 100 percent check of this data against the field sheets will be performed preceding any data analysis. Any data analyses and associated conclusions included in a final report will also go through a 100 percent QA check.

8.0 INFORMATION MANAGEMENT PLAN

The San Diego Bay Debris Study is funded, in part, by SWAMP and is a collaboration between many different stakeholders of San Diego Bay watershed in coordination with the Bight ’13 debris regional monitoring program. The study provides a unique challenge for collecting and organizing the data among the different stakeholders in a comparable way; therefore a data/information management plan is crucial for this study. The San Diego Bay Debris Study will follow the information management plan for Bight ’13 (Bight ’13 Information Management Committee) and the SWAMP database management plan (SWAMP data management plan).

The Bight ’13 Information Management Technical Committee is responsible for creating Standardized Data Transfer Protocols (SDTPs) to ensure data comparability and ease of data analyses for the Bight program. The Bight ’13 information management plan includes SDTPs for the Bight ‘13 Debris Study but does not fully address the information management needs for the San Diego Bay Debris Study.

According to the information management plan for Bight ’13, the information management needs to occur on several levels: (1) a process must be developed to ensure the quality, compatibility, and timeliness of the data each organization collects, (2) the data must be readily available for review, analysis, and interpretation, and (3) the data must be made available to other interested organizations and the general public. The following major functions are described in the Information Management Plan (Bight ’13 Information Management Committee) which will be followed by the San Diego Bay Debris Study:

1. The Standardized Data Transfer Protocols each participating agency will use to transfer data from their internal Information Management System to the Bight’13 Information Management System.
2. The data submission process for submitting data to the Bight’13 Information Management Officer.
3. The technical guidelines of how the data will be organized in the centralized Bight’13 database.
4. The milestones and mechanisms by which the data will be made accessible to project participants, other organizations, and the general public.

Because the San Diego Debris Study is supported by SWAMP funds awarded to the San Diego Water Board, data management also has to follow SWAMP’s data management requirements. Data generated from this study will be stored in the SWAMP database. Field crews will be responsible for entering all field generated data into the database. In cases where laboratory results will be created, results from the laboratory analyses will be uploaded into the SWAMP database by the lab analysts with the help of the SWAMP database management team. It is expected that the data will also be uploaded to the California Environmental Data Exchange Network (CEDEN). The SWAMP Database Manager and support staff will follow their SOPs for data management, including record keeping and tracking, document control, and data handling. They will perform all QA/QC on data before entering into the SWAMP Permanent database.

Standard Data Transfer Protocols (SDTPs):

Field sampling data sheets will be prepared for debris assessments for the riverine habitats, the water columns habitats, and the intertidal habitats. The SWAMP database management team will build the SDTPs for the San Diego Bay Debris Study based on the field sampling data sheets. The SDTPs will be compatible with the Bight ’13 information management plan. Meta data, field data, and lab data (when available) will be stored in the SWAMP database which is organized through a relational structure.

Submission Process

Field crew leaders and lab crew leaders are responsible for compiling the data into the STDP tables. They are also responsible for the QA/QC checks on the data prior to its submission to the SWAMP database.

Database

The data from the San Diego Bay Debris Study will be stored in the SWAMP database. These data will then be uploaded into CEDEN and will not be stored in the Bight ’13 centralized database. However, the program managers for the San Diego Bay Debris Study will coordinate with the Information Management Officer for Bight ’13.

Accessibility to Data

The data from the San Diego Bay Debris Study will be submitted to CEDEN by the SWAMP data management team and will be available on the CEDEN website to the public.

The program managers for the San Diego Bay Debris Study will oversee the implementation of the information/data management plan.

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APPENDIX A

Proposed Locations for San Diego Bay Debris Sample Collection

Habitat	Segment ID	Latitude	Longitude	Waterbody Name	Sample Type	Sample Status
Mudflat	9	32.64759	-117.11119	San Diego Bay	NOAA Method	New Sample
Mudflat	26	32.64782	-117.11033	San Diego Bay	NOAA Method	New Sample
Mudflat	48	32.64813	-117.10922	San Diego Bay	NOAA Method	New Sample
Mudflat	66	32.64879	-117.10874	San Diego Bay	NOAA Method	New Sample
Mudflat	73	32.64908	-117.1086	San Diego Bay	NOAA Method	New Sample
Mudflat	95	32.64664	-117.11515	San Diego Bay	NOAA Method	New Sample
Mudflat	100	32.64671	-117.1149	San Diego Bay	NOAA Method	New Sample
Mudflat	115	32.64322	-117.1155	San Diego Bay	NOAA Method	New Sample
Mudflat	136	32.64042	-117.11508	San Diego Bay	NOAA Method	New Sample
Mudflat	187	32.63842	-117.11422	San Diego Bay	NOAA Method	New Sample
Mudflat	195	32.63818	-117.11399	San Diego Bay	NOAA Method	New Sample
Mudflat	207	32.63795	-117.11344	San Diego Bay	NOAA Method	New Sample
Mudflat	212	32.63783	-117.11322	San Diego Bay	NOAA Method	New Sample
Mudflat	243	32.63744	-117.11166	San Diego Bay	NOAA Method	New Sample
Mudflat	249	32.63565	-117.10816	San Diego Bay	NOAA Method	New Sample
Mudflat	266	32.63504	-117.10761	San Diego Bay	NOAA Method	New Sample
Mudflat	286	32.63426	-117.1071	San Diego Bay	NOAA Method	New Sample
Mudflat	296	32.63385	-117.10689	San Diego Bay	NOAA Method	New Sample
Mudflat	302	32.6336	-117.10676	San Diego Bay	NOAA Method	New Sample
Mudflat	327	32.60726	-117.12955	San Diego Bay	NOAA Method	New Sample
Mudflat	341	32.60689	-117.12895	San Diego Bay	NOAA Method	New Sample
Mudflat	353	32.60657	-117.12844	San Diego Bay	NOAA Method	New Sample
Mudflat	383	32.6058	-117.12713	San Diego Bay	NOAA Method	New Sample
Mudflat	393	32.60556	-117.12668	San Diego Bay	NOAA Method	New Sample
Mudflat	401	32.60538	-117.12631	San Diego Bay	NOAA Method	New Sample
Mudflat	423	32.60485	-117.12532	San Diego Bay	NOAA Method	New Sample
Mudflat	440	32.60424	-117.1248	San Diego Bay	NOAA Method	New Sample
Mudflat	468	32.60313	-117.1241	San Diego Bay	NOAA Method	New Sample
Mudflat	480	32.60264	-117.12384	San Diego Bay	NOAA Method	New Sample
Mudflat	491	32.60219	-117.12359	San Diego Bay	NOAA Method	New Sample

Habitat	Segment ID	Latitude	Longitude	Waterbody Name	Sample Type	Sample Status
Riprap	55	32.70558	-117.23657	San Diego Bay	NOAA Method	New Sample
Riprap	58	32.70636	-117.23682	San Diego Bay	NOAA Method	New Sample
Riprap	63	32.71514	-117.23323	San Diego Bay	NOAA Method	New Sample
Riprap	72	32.71474	-117.23337	San Diego Bay	NOAA Method	New Sample
Riprap	114	32.71089	-117.22943	San Diego Bay	NOAA Method	New Sample
Riprap	141	32.71606	-117.22237	San Diego Bay	NOAA Method	New Sample
Riprap	150	32.71816	-117.22036	San Diego Bay	NOAA Method	New Sample
Riprap	151	32.71842	-117.22033	San Diego Bay	NOAA Method	New Sample
Riprap	191	32.72865	-117.20668	San Diego Bay	NOAA Method	New Sample
Riprap	242	32.72468	-117.20852	San Diego Bay	NOAA Method	New Sample
Riprap	244	32.72474	-117.20789	San Diego Bay	NOAA Method	New Sample
Riprap	245	32.72477	-117.20757	San Diego Bay	NOAA Method	New Sample
Riprap	260	32.72508	-117.20278	San Diego Bay	NOAA Method	New Sample
Riprap	276	32.72505	-117.19766	San Diego Bay	NOAA Method	New Sample
Riprap	280	32.72499	-117.19638	San Diego Bay	NOAA Method	New Sample
Riprap	286	32.72485	-117.19447	San Diego Bay	NOAA Method	New Sample
Riprap	388	32.73515	-117.21118	San Diego Bay	NOAA Method	New Sample
Riprap	465	32.72525	-117.2115	San Diego Bay	NOAA Method	New Sample
Riprap	473	32.72558	-117.20897	San Diego Bay	NOAA Method	New Sample
Riprap	498	32.68519	-117.16378	San Diego Bay	NOAA Method	New Sample
Riprap	544	32.69083	-117.16439	San Diego Bay	NOAA Method	New Sample
Riprap	651	32.7031	-117.18087	San Diego Bay	NOAA Method	New Sample
Riprap	700	32.7045	-117.16617	San Diego Bay	NOAA Method	New Sample
Riprap	718	32.70423	-117.16119	San Diego Bay	NOAA Method	New Sample
Riprap	739	32.70711	-117.16857	San Diego Bay	NOAA Method	New Sample
Riprap	771	32.70662	-117.23687	San Diego Bay	NOAA Method	New Sample
Riprap	826	32.72087	-117.22708	San Diego Bay	NOAA Method	New Sample
Riprap	828	32.72111	-117.22747	San Diego Bay	NOAA Method	New Sample
Riprap	907	32.72693	-117.17567	San Diego Bay	NOAA Method	New Sample
Riprap	931	32.68047	-117.17076	San Diego Bay	NOAA Method	New Sample
Riprap	942	32.69853	-117.1682	San Diego Bay	NOAA Method	New Sample
Riprap	968	32.70326	-117.18093	San Diego Bay	NOAA Method	New Sample
Riprap	1028	32.65119	-117.12039	San Diego Bay	NOAA Method	New Sample
Riprap	1033	32.64986	-117.1201	San Diego Bay	NOAA Method	New Sample
Riprap	1042	32.64785	-117.11922	San Diego Bay	NOAA Method	New Sample
Riprap	1055	32.65005	-117.10988	San Diego Bay	NOAA Method	New Sample
Riprap	1108	32.62451	-117.10553	San Diego Bay	NOAA Method	New Sample
Riprap	1126	32.62533	-117.10177	San Diego Bay	NOAA Method	New Sample
Riprap	1131	32.62405	-117.10125	San Diego Bay	NOAA Method	New Sample
Riprap	1135	32.62302	-117.10084	San Diego Bay	NOAA Method	New Sample
Riprap	1137	32.62251	-117.10063	San Diego Bay	NOAA Method	New Sample
Riprap	1138	32.62225	-117.10053	San Diego Bay	NOAA Method	New Sample
Riprap	1185	32.61957	-117.10061	San Diego Bay	NOAA Method	New Sample
Riprap	1211	32.6137	-117.10161	San Diego Bay	NOAA Method	New Sample
Riprap	1601	32.60043	-117.11363	San Diego Bay	NOAA Method	New Sample
Riprap	1636	32.60126	-117.11205	San Diego Bay	NOAA Method	New Sample

Habitat	Segment ID	Latitude	Longitude	Waterbody Name	Sample Type	Sample Status
Salt Marsh	719	32.65728	-117.1085	San Diego Bay	NOAA Method	New Sample
Salt Marsh	893	32.65647	-117.10839	San Diego Bay	NOAA Method	New Sample
Salt Marsh	1569	32.65323	-117.10708	San Diego Bay	NOAA Method	New Sample
Salt Marsh	1902	32.60955	-117.10221	San Diego Bay	NOAA Method	New Sample
Salt Marsh	1917	32.61017	-117.1019	San Diego Bay	NOAA Method	New Sample
Salt Marsh	1939	32.61109	-117.10145	San Diego Bay	NOAA Method	New Sample
Salt Marsh	1973	32.64876	-117.10767	San Diego Bay	NOAA Method	New Sample
Salt Marsh	2677	32.64613	-117.11628	San Diego Bay	NOAA Method	New Sample
Salt Marsh	2827	32.64579	-117.10711	San Diego Bay	NOAA Method	New Sample
Salt Marsh	3146	32.64491	-117.11691	San Diego Bay	NOAA Method	New Sample
Salt Marsh	3628	32.64419	-117.10326	San Diego Bay	NOAA Method	New Sample
Salt Marsh	3703	32.64405	-117.10443	San Diego Bay	NOAA Method	New Sample
Salt Marsh	4358	32.64307	-117.10922	San Diego Bay	NOAA Method	New Sample
Salt Marsh	4618	32.64283	-117.10495	San Diego Bay	NOAA Method	New Sample
Salt Marsh	4777	32.64251	-117.1123	San Diego Bay	NOAA Method	New Sample
Salt Marsh	4951	32.64242	-117.10601	San Diego Bay	NOAA Method	New Sample
Salt Marsh	5162	32.64215	-117.10559	San Diego Bay	NOAA Method	New Sample
Salt Marsh	5218	32.64198	-117.11102	San Diego Bay	NOAA Method	New Sample
Salt Marsh	5874	32.64023	-117.10887	San Diego Bay	NOAA Method	New Sample
Salt Marsh	5932	32.63997	-117.10823	San Diego Bay	NOAA Method	New Sample
Salt Marsh	6455	32.63808	-117.10736	San Diego Bay	NOAA Method	New Sample
Salt Marsh	6579	32.63766	-117.10906	San Diego Bay	NOAA Method	New Sample
Salt Marsh	6672	32.63739	-117.10916	San Diego Bay	NOAA Method	New Sample
Salt Marsh	7413	32.63256	-117.10411	San Diego Bay	NOAA Method	New Sample
Salt Marsh	7426	32.63257	-117.10272	San Diego Bay	NOAA Method	New Sample
Salt Marsh	7481	32.63244	-117.10133	San Diego Bay	NOAA Method	New Sample
Salt Marsh	8354	32.61627	-117.11215	San Diego Bay	NOAA Method	New Sample
Salt Marsh	8489	32.61609	-117.09862	San Diego Bay	NOAA Method	New Sample
Salt Marsh	8535	32.61589	-117.10853	San Diego Bay	NOAA Method	New Sample
Salt Marsh	9094	32.61425	-117.11064	San Diego Bay	NOAA Method	New Sample

Habitat	Segment ID	Latitude	Longitude	Waterbody Name	Sample Type	Sample Status
Sandy Beach	140	32.71026	-117.23675	San Diego Bay	NOAA Method	New Sample
Sandy Beach	165	32.70916	-117.23695	San Diego Bay	NOAA Method	New Sample
Sandy Beach	232	32.72852	-117.20904	San Diego Bay	NOAA Method	New Sample
Sandy Beach	253	32.68542	-117.23525	San Diego Bay	NOAA Method	New Sample
Sandy Beach	266	32.7005	-117.17340	San Diego Bay	NOAA Method	New Sample
Sandy Beach	318	32.69005	-117.16459	San Diego Bay	NOAA Method	New Sample
Sandy Beach	322	32.68987	-117.16453	San Diego Bay	NOAA Method	New Sample
Sandy Beach	830	32.71401	-117.20605	San Diego Bay	NOAA Method	New Sample
Sandy Beach	946	32.71468	-117.20003	San Diego Bay	NOAA Method	New Sample
Sandy Beach	959	32.71467	-117.1991	San Diego Bay	NOAA Method	New Sample
Sandy Beach	1257	32.70439	-117.22305	San Diego Bay	NOAA Method	New Sample
Sandy Beach	1330	32.7069	-117.22055	San Diego Bay	NOAA Method	New Sample
Sandy Beach	1520	32.71205	-117.21275	San Diego Bay	NOAA Method	New Sample
Sandy Beach	1538	32.7124	-117.21189	San Diego Bay	NOAA Method	New Sample
Sandy Beach	1748	32.60426	-117.10727	San Diego Bay	NOAA Method	New Sample
Sandy Beach	1793	32.60558	-117.10545	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2062	32.6235	-117.129	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2475	32.65045	-117.14499	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2491	32.64988	-117.14447	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2529	32.6483	-117.14374	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2551	32.64736	-117.14337	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2553	32.64727	-117.14334	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2606	32.64509	-117.14221	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2703	32.64119	-117.14017	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2750	32.63927	-117.13909	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2774	32.63826	-117.13865	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2795	32.63792	-117.13955	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2808	32.63779	-117.1402	San Diego Bay	NOAA Method	New Sample
Sandy Beach	2881	32.63557	-117.1403	San Diego Bay	NOAA Method	New Sample
Sandy Beach	3010	32.63052	-117.13759	San Diego Bay	NOAA Method	New Sample

Habitat	Segment ID	Latitude	Longitude	Waterbody Name	Sample Type	Sample Status
Water Column	WC1	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC2	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC3	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC4	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC5	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC6	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC7	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC8	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC9	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC10	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC11	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC12	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC13	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC14	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC15	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC16	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC17	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC18	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC19	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC20	TBD	TBD	San Diego Bay	Trawl	Resample
Water Column	WC21	TBD	TBD	San Diego Bay	Trawl	Resample

Habitat	Segment ID	Latitude	Longitude	Waterbody Name	Sample Type	Sample Status
Marinas	MTS1	32.723459	-117.224659	Pt. Loma Marina	Marina Trash Skimmers	New Sample
Marinas	MTS10	32.726707	-117.208384	Harbor Island West Marina	Marina Trash Skimmers	New Sample
Marinas	MTS18	32.715079	-117.230096	Half Moon Marina	Marina Trash Skimmers	New Sample
Marinas	MTS24	32.6505	-117.108768	Pier 32 Marina	Marina Trash Skimmers	New Sample

Habitat	Segment ID	Latitude	Longitude	Waterbody Name	Sample Type	Sample Status
Riverine	SMC01258	32.64950	-117.05887	Sweetwater River	Bight '13	Resample
Riverine	SMC17918	32.66304	-117.03173	Sweetwater River	Bight '13	Resample
Riverine	WCAP99-1014	32.83213	-116.72650	Sweetwater River	Bight '13	Resample
Riverine	SMC01962	32.66067	-117.03919	Sweetwater River	Bight '13	Resample
Riverine	SMC06458	32.66902	-117.01724	Sweetwater River	Bight '13	Resample
Riverine	SMC06714	32.67579	-117.00604	Sweetwater River	Bight '13	Resample
Riverine	SMC08426	32.65071	-117.05482	Sweetwater River	Bight '13	Resample
Riverine	SMC09162	32.84088	-116.70988	Sweetwater River	Bight '13	Resample
Riverine	SMC16266	32.81856	-116.75313	Sweetwater River	Bight '13	Resample
Riverine	SMC14218	32.82998	-116.73604	Sweetwater River	Bight '13	Resample
Riverine	SMC23495	32.83382	-116.72302	Sweetwater River	Bight '13	Resample
Riverine	SMC05146	32.84458	-116.61367	Sweetwater River	Bight '13	Resample
Riverine	CC-SD8(1)	32.70490	-117.12115	Chollas Creek	Bight '13	Resample
Riverine	CC-NF54	32.74136	-117.08349	Chollas Creek	Bight '13	Resample
Riverine	RCC3	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	RCC4	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	RCC5	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	RCC6	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	RCC7	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	RCC8	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	RCC9	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	RCC10	TBD	TBD	Chollas Creek	Bight '13	Resample
Riverine	SMC04330	32.61428	-117.03332	Otay River	Bight '13	Resample
Riverine	OR-TWAS-1	32.58846	-117.07168	Otay River	Bight '13	Resample
Riverine	ROR1	32.59021	-117.09018	Otay River	Bight '13	New sample
Riverine	ROR2	32.59021	-117.08283	Otay River	Bight '13	New sample
Riverine	ROR3	32.59000	-117.08375	Otay River	Bight '13	New sample
Riverine	ROR4a	32.59072	-117.06206	Otay River	Bight '13	New sample
Riverine	ROR4b	32.59067	-117.06247	Otay River	Bight '13	New sample
Riverine	ROR7	32.59126	-117.0345	Otay River	Bight '13	New sample
Riverine	ROR10	32.59236	-117.00540	Otay River	Bight '13	New sample
Riverine	ROR11	32.59095	-117.07958	Otay River	Bight '13	New sample
Riverine	ROR13	32.59428	-117.09272	Otay River	Bight '13	New sample
Riverine	ROR14	32.59068	-117.07299	Otay River	Bight '13	New sample
Riverine	ROR15	32.59155	-117.07528	Otay River	Bight '13	New sample

APPENDIX B
Trawling Field Data Forms

STATION OCCUPATION

BIGHT'13

Agency Code

Vessel Name

Arrival Time (hh:mm)

Weather

Clear
Overcast
Partly cloudy
Drizzle
Rain
Thunderstorm
Fog

Sea State

Calm
Choppy
Rough

Nav Type

DGPS
GPS

Station ID

Date

Abandoned site? Y or N (If Y explain in comments)

Station Fail Code

Wind

Speed (kts)
Direction (4)

Swell

Period (s)
Height (ft)
Direction (4)

Station Comments

TRAWL EVENTS

Trawl Number		Time (hh:mm)	Latitude (DD°MM.mmmm)	Longitude (DD°MM.mmmm)	Depth (m)	Wire Out	Distance to target (m)	Trawl Fail Code (3)	P/T Sensor Data (Y/N)	Community Structure (Y/N)	Tissue Chemistry (Y/N)
	Net Over										
	Start Trawl										
	End Trawl										
	Net on Deck										
	Net Over										
	Start Trawl										
	End Trawl										
	Net on Deck										
	Net Over										
	Start Trawl										
	End Trawl										
	Net on Deck										

APPENDIX C
Trawl Debris Data Forms

Water Colummn Trawl Debris Form

Agency:___________________ Samplers Initials:________________________ Page_____ of _____

Station:___________________ Trawl #:____________ Check if trawl sample collected ☐

Date:___________________ Time:____________ Check if no macrodebris or mesodebris present in sample ☐

Comments:

MACRODEBRIS WITH IDENTIFIABLE LABELS PROVIDE BRAND NAME OR MANUFACTURER

Bags and Packaging	**Macrodebris Count**	**Mesodebris Count**
Bags (single use plastic)		
Bags (takeout or other)		
Bags (large/retail)		
Food Wrapper		
Other Wrapper		
Pet Waste Bags		
Plastic straw wrapper		
Styrofoam pieces		
Styrofoam pellets		
Soft Plastic Pieces		
Hard Plastic Pieces		
Other (comment required)		

Food Service	**Macrodebris Count**	**Mesodebris Count**
Juice container		
Bottle Caps		
Milk Cartons		
Water Bottles		
Sports drink bottle		
Soda bottle		
Straws		
Lid		
Cups		
Utensils		
Styrofoam Container		
Styrofoam Cup		
6-pack rings		
Waxed Paper Cups		
Waxed Plates		
Other (comment required)		

Water Colummn Trawl Debris Form

Agency:___________________ Samplers Initials:________________________ Page_____ of _____

Miscellaneous	Macrodebris Count	Mesodebris Count
Packaging Ribbon		
Polypropylene Rope		
Fishing Line/Net		
Balloons (mylar)		
Balloons (latex)		
Roping/Ties		
Bandage/Bandaid		
Cigarette Box/Wrapper		
Rubber pieces		
Foam balls		
Other (comment required)		

Household	Macrodebris Count	Mesodebris Count
Storage Containers		
Shampoo Bottles		
Toothbrushes		
CDs / DVDs		
Mechanical Pencils		
Pipe (PVC)		
Tarp		
Furniture		
Sports balls		
Tape		
Toys		
Clothing (synthetic fabric)		
Other (comment required)		

Toxic	Macrodebris Count	Mesodebris Count
Syringes or Pipettes		
Medical Devices		
Lighters		
Computers		
Keyboard		
Phones		
E-waste		
Cigarette Butts		
Chemical Containers		
Pens or Markers		
Bleach Bottles		
Cleaning Bottles		
Other (comment required)		

Water Colummn Trawl Debris Form

STATION ID: ______________________ LAB TECH INITIALS: ______________________

DATE: ______________________ TIME: ______________________

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

Macrodebris Category	VOLUME	UNITS	VOLUME (L)
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	
Mesodebris Category	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	
OVERALL VOLUME	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

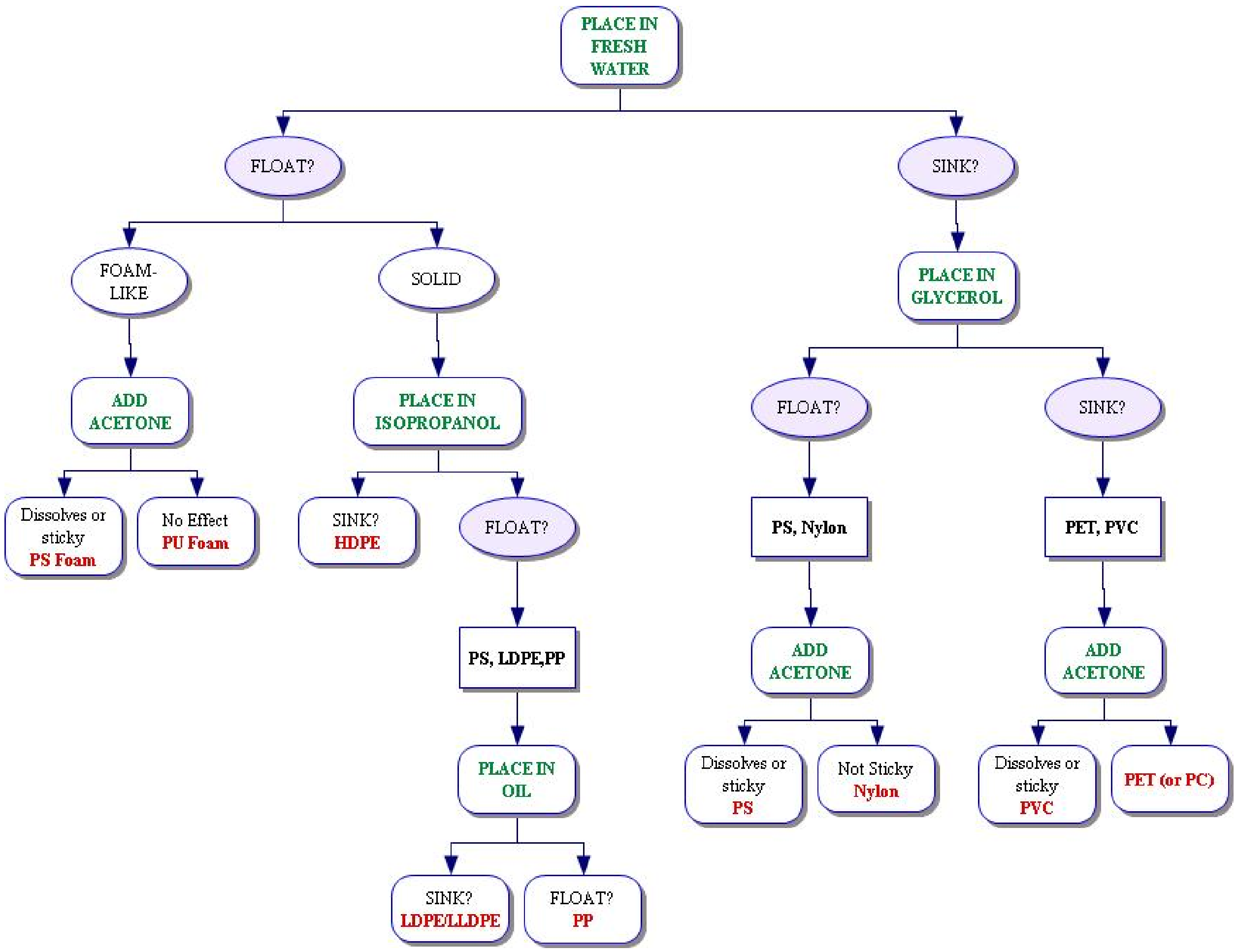
Size	VOLUME	UNITS	VOLUME (L)
>25 cm			
25 mm - 5 mm			
TOTAL VOLUME:		____	

Comments:

APPENDIX D

Andrady Method for Microdebris Plastic Type Determination

Andrady Method for Plastic Type Determination



APPENDIX E

Intertidal Habitat Debris Assessment Field Forms

Intertidal Debris Assessment Worksheet: *Trash Tally*

STATION ID: _______________________________ **DATE**: _____________________________________

SITE CAPTAIN INITIALS: _______________________________ **TIME**:_____________________________________

SAMPLER NAME: _______________________________ **GPS:** Start____________________________________

SAMPLER NAME: _______________________________ **GPS:** End____________________________________

SAMPLER NAME: _______________________________

CONDITION CATEGORY

Trash Assessment Parameter	Optimal	Sub optimal	Marginal	Poor
Aesthetic Condition	No to small visual impact	Small to moderate visual impact from trash present.	Moderate to substantial impact from trash present.	Substantial to severe visual impact from trash present.
Rate impact to aestheric condition of site based on visable trash (*rate higher or lower within each category according to condition. The higher number within each category reflects decreasing aesthetic condition*)	1 _____ 2 _____ 3 _____ 4 _____ 5 _____	6 _____ 7 _____ 8 _____ 9 _____ 10 _____	11 _____ 12 _____ 13 _____ 14 _____ 15 _____	16 _____ 17 _____ 18 _____ 19 _____ 20 _____

SITE CHARACTERIZATION

Check if no data collected:	Number of photos taken:	Provide explanation for why no data collected:

Site Dimensions: **Width** ____________ **(meters)** **Length**______________ **(meters)**

Habitat Type

MARSH MUDFLAT BEACH

WRACKLINE RIP-RAP

Substrate Characteristics

ROCKY	SAND	MUD	VEGETATED
(Y / N)	(Y / N)	(Y / N)	(Y / N)

Access:

Select all features located near the site

Parking Lot (Y / N) **Fence (Y / N)**

Roadway (Y / N) **Heavy or thick vegetation (Y / N)**

Picnic Area (Y / N) **Walkway (Y / N)**

Restricted Access Maintenance Road (Y / N) **Bike Path (Y / N)**

Homeless Encampment: **Within Transect (Y / N)** **Distance from Transect _________(Meters)**

Outfall: **Within Transect (Y / N)** **Distance from Transect _________(Meters)**

Physical Characteristics **Wind Direction:_____________(degrees)** **Wind Speed:______________(meters per second)**

Tide Height:_____________(meters) **Tide Direction: (flood / ebb)**

Comments:

Intertidal Debris Assessment Worksheet: *Trash Tally*

STATION ID: ____________________ SITE CAPTAIN INITIALS ____________

DATE: ____________________ TIME: Start: ____________

BANK: Finish: ____________

	COUNTS	
Bags and Packaging	**> 25 cm**	**25 cm - 5 mm**
Bags (single use plastic)		
Bags (takeout or other)		
Bags (large/retail)		
Food Wrapper		
Other Wrapper		
Pet Waste Bags		
Plastic straw wrapper		
Styrofoam pieces		
Styrofoam pellets		
Soft Plastic Pieces		
Hard Plastic Pieces		
Other (comment required)		
Category Total		
Food Service	**> 25 cm**	**25 cm - 5 mm**
Juice container		
Bottle Caps		
Milk Cartons		
Water Bottles		
Sports drink bottle		
Soda bottle		
Straws		
Lid		
Cups		
Utensils		
Styrofoam Container		
Styrofoam Cup		
6-pack rings		
Waxed Paper Cups		
Waxed Plates		
Other (comment required)		
Category Total		

Check box if no debris present at site ☐

Comments:

Intertidal Debris Assessment Worksheet: *Trash Tally*

STATION ID: ______________________ SITE CAPTAIN INITIALS ____________

Toxic	> 25 cm	25 cm - 5 mm
Syringes or Pipettes		
Medical Devices		
Lighters		
Computers		
Keyboard		
Phones		
E-waste		
Cigarette Butts		
Chemical Containers		
Pens or Markers		
Bleach Bottles		
Cleaning Bottles		
Other (comment required)		
Category Total		
Miscellaneous	**> 25 cm**	**25 cm - 5 mm**
Packaging Ribbon		
Polypropylene Rope		
Fishing Line/Net		
Balloons (mylar)		
Balloons (latex)		
Roping/Ties		
Bandage/Bandaid		
Cigarette Box/Wrapper		
Rubber pieces		
Foam balls		
Other (comment required)		
Category Total		
	COUNTS	
Household	**> 25 cm**	**25 cm - 5 mm**
Storage Containers		
Shampoo Bottles		
Toothbrushes		
CDs / DVDs		
Mechanical Pencils		
Pipe (PVC)		
Tarp		
Furniture		
Sports balls		
Tape		
Toys		
Clothing (synthetic fabric)		
Other (comment required)		
Category Total		
GRAND TOTAL:		

Comments:

Intertidal Debris Assessment Worksheet: *Trash Tally*

STATION ID: ____________________ SITE CAPTAIN INITIALS ____________________

DATE: ____________________ TIME: ____________________

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

Macrodebris Category	VOLUME	UNITS	VOLUME (L)
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		___	
Mesodebris Category	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		___	
OVERALL VOLUME	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		___	

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

Size	VOLUME	UNITS	VOLUME (L)
>25 cm			
25 mm - 5 mm			
TOTAL VOLUME:		___	

Comments:

APPENDIX F

Riverine Habitat Debris Assessment Field Forms

Riverine Debris Assessment Worksheet: *Riverine Characterization*

WATERSHED: ______________________________ DATE: ______________________________

STREAM: ______________________________ TIME: ______________________________

STATION ID: ______________________________ GPS: Start ______________________________

SITE CAPTAIN INITIALS: ______________________________ GPS: End ______________________________

SAMPLER INITIALS: ______________________________

Check box if no data collected at site ☐ **(Provide explanation in comments section)** | **Number of photos taken:**

	CONDITION CATEGORY			
Trash Assessment Parameter	**Optimal**	**Sub optimal**	**Marginal**	**Poor**
1. Aesthetic Condition	No to small visual impact	Small to moderate visual impact from trash present.	Moderate to substantial impact from trash present.	Substantial to severe visual impact from trash present.
Rate impact to aesthetic condition of site based on visable trash (*rate higher or lower within each category according to condition. The higher number within each category reflects decreasing aesthetic condition*)	1 _____ 2 _____ 3 _____ 4 _____ 5 _____	6 _____ 7 _____ 8 _____ 9 _____ 10 _____	11 _____ 12 _____ 13 _____ 14 _____ 15 _____	16 _____ 17 _____ 18 _____ 19 _____ 20 _____

Dimensions: Bank Full Width ___________ **(meters) Wetted Width** ___________ **(meters) Transect Length** ___________ **(meters)**

Stream Bed Characteristics	EARTHEN / CONCRETE (E / C)	EMERGENT VEGETATION (Y / N)	LARGE ROCKS/ COBBLE (Y / N)	SUBMERGED PLANTS (Y / N)
Stream Bank	VEGETATED / EARTHEN (V / E)	RIP-RAP (Y / N)	CONCRETE (Y / N)	SLOPED/VERTICAL (S / V)

Homeless Encampment: Within Transect (Y / N) Distance from Transect __________(meters) (DS / US)

Public Access:

Right Bank: ____ **Easy** ____ **Difficult** ____ **Not at All** **Comments:**___________________________

Left Bank: ____ **Easy** ____ **Difficult** ____ **Not at All** **Comments:**___________________________

Adjacent Land Features | **Near Bridge (Y / N) Fence on Bridge (Y / N) Fence height overhead (estimated)** _______________

Access: Select all features located near the site		**Left Bank**	**Right Bank**	
	Fence	(Y / N)	(Y / N)	
	Heavy or thick vegetation	(Y / N)	(Y / N)	
	Roadway	(Y / N)	(Y / N)	
	Walkway	(Y / N)	(Y / N)	
	Bike Path	(Y / N)	(Y / N)	
	Parking Lot	(Y / N)	(Y / N)	
	Picnic Area	(Y / N)	(Y / N)	
	Restricted Access Maintenance Road	(Y / N)	(Y / N)	
Landuse	**Residential**	(Y / N)	(Y / N)	**Comments:**
	Commercial	(Y / N)	(Y / N)	
	Industrial	(Y / N)	(Y / N)	
	Park	(Y / N)	(Y / N)	
	Open Space	(Y / N)	(Y / N)	

Riverine Debris Assessment Worksheet: *Riverine Characterization*

STATION ID:_______________ SITE CAPTAIN INITIALS _______________________ DATE:__________________

Storm Drains Within Transect Area

Storm Drain Within Transects (Y / N) Sizes Categories (12" / 18" / 24" / 30" / 36" / 48" / 60" / > 96")

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Size:_________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Storm Drains Outside of Transect Area

Storm Drain Upstream Transects (Y / N) Sizes Categories (12" / 18" / 24" / 30" / 36" / 48" / 60" / > 96")

Distance from Transect:_________ Size: ____________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Distance from Transect:_________ Size: ____________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Distance from Transect:_________ Size: ____________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Distance from Transect:_________ Size: ____________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Distance from Transect:_________ Size: ____________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Distance from Transect:_________ Size: ____________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Distance from Transect:_________ Size: ____________ Bank: L or R Trash at Drain (None / < 10 / <50 / <100 / >100)

Comments:

Riverine Debris Assessment Worksheet: *Riverine Characterization*

STATION ID: ______________________ SITE CAPTAIN INITIALS ______________

DATE: ______________________ TIME: Start:______________

BANK: Left / Right Finish: ______________

	COUNTS	
Bags and Packaging	**> 25 cm**	**25 cm - 5 mm**
Bags (single use plastic)		
Bags (takeout or other)		
Bags (large/retail)		
Food Wrapper		
Other Wrapper		
Pet Waste Bags		
Plastic straw wrapper		
Styrofoam pieces		
Styrofoam pellets		
Soft Plastic Pieces		
Hard Plastic Pieces		
Other (comment required)		
Category Total		
Food Service	**> 25 cm**	**25 cm - 5 mm**
Juice container		
Bottle Caps		
Milk Cartons		
Water Bottles		
Sports drink bottle		
Soda bottle		
Straws		
Lid		
Cups		
Utensils		
Styrofoam Container		
Styrofoam Cup/pieces		
6-pack rings		
Waxed Paper Cups		
Waxed Plates		
Other (comment required)		
Category Total		

Check box if no debris present at site ☐

Comments:

Riverine Debris Assessment Worksheet: *Riverine Characterization*

STATION ID: ____________________ **SITE CAPTAIN INITIALS** ____________________

Toxic	**> 25 cm**	**25 cm - 5 mm**
Syringes or Pipettes		
Medical Devices		
Lighters		
Computers		
Keyboard		
Phones		
E-waste		
Cigarette Butts		
Chemical Containers		
Pens or Markers		
Bleach Bottles		
Cleaning Bottles		
Other (comment required)		
Category Total		
Miscellaneous	**> 25 cm**	**25 cm - 5 mm**
Packaging Ribbon		
Polypropylene Rope		
Fishing Line/Net		
Balloons (mylar)		
Balloons (latex)		
Roping/Ties		
Bandage/Bandaid		
Cigarette Box/Wrapper		
Rubber pieces		
Foam balls		
Other (comment required)		
Category Total		
	COUNTS	
Household	**> 25 cm**	**25 cm - 5 mm**
Storage Containers		
Shampoo Bottles		
Toothbrushes		
CDs / DVDs		
Mechanical Pencils		
Pipe (PVC)		
Tarp		
Furniture		
Sports balls		
Tape		
Toys		
Clothing (synthetic fabric)		
Other (comment required)		
Category Total		
GRAND TOTAL:		

Riverine Debris Assessment Worksheet: *Riverine Characterization*

STATION ID: ______________________ SITE CAPTAIN INITIALS ______________

DATE: ______________________ TIME: Start: ______________

BANK: Left / Right Finish: ______________

	COUNTS	
Bags and Packaging	**> 25 cm**	**25 cm - 5 mm**
Bags (single use plastic)		
Bags (takeout or other)		
Bags (large/retail)		
Food Wrapper		
Other Wrapper		
Pet Waste Bags		
Plastic straw wrapper		
Styrofoam pieces		
Styrofoam pellets		
Soft Plastic Pieces		
Hard Plastic Pieces		
Other (comment required)		
Category Total		
Food Service	**> 25 cm**	**25 cm - 5 mm**
Juice container		
Bottle Caps		
Milk Cartons		
Water Bottles		
Sports drink bottle		
Soda bottle		
Straws		
Lid		
Cups		
Utensils		
Styrofoam Container		
Styrofoam Cup/pieces		
6-pack rings		
Waxed Paper Cups		
Waxed Plates		
Other (comment required)		
Category Total		

Check box if no debris present at site ☐

Comments:

Riverine Debris Assessment Worksheet: *Riverine Characterization*

STATION ID: ____________________ SITE CAPTAIN INITIALS ____________________

Toxic	> 25 cm	25 cm - 5 mm
Syringes or Pipettes		
Medical Devices		
Lighters		
Computers		
Keyboard		
Phones		
E-waste		
Cigarette Butts		
Chemical Containers		
Pens or Markers		
Bleach Bottles		
Cleaning Bottles		
Other (comment required)		
Category Total		
Miscellaneous	**> 25 cm**	**25 cm - 5 mm**
Packaging Ribbon		
Polypropylene Rope		
Fishing Line/Net		
Balloons (mylar)		
Balloons (latex)		
Roping/Ties		
Bandage/Bandaid		
Cigarette Box/Wrapper		
Rubber pieces		
Foam balls		
Other (comment required)		
Category Total		
	COUNTS	
Household	**> 25 cm**	**25 cm - 5 mm**
Storage Containers		
Shampoo Bottles		
Toothbrushes		
CDs / DVDs		
Mechanical Pencils		
Pipe (PVC)		
Tarp		
Furniture		
Sports balls		
Tape		
Toys		
Clothing (synthetic fabric)		
Other (comment required)		
Category Total		
GRAND TOTAL:		

Riverine Debris Assessment Worksheet: *Riverine Characterization*

STATION ID: ______________ LAB TECH INITIALS: ______________

DATE: ______________ TIME: ______________

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

Macrodebris Category	VOLUME	UNITS	VOLUME (L)
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	
Mesodebris Category	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	
OVERALL VOLUME	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

Size	VOLUME	UNITS	VOLUME (L)
>25 cm			
25 mm - 5 mm			
TOTAL VOLUME:		____	

Comments:

Riverine Debris Assessment Worksheet: *Riverine Characterization*

STATION ID:_______________ **SITE CAPTAIN INITIALS** _______________________ **DATE:**__________________

Large or Unmoveable Items

ITEM 1	Right Bank	Left Bank	ITEM 2	Right Bank	Left Bank
Location:			Location:		
Description:			Description:		
ITEM 3	**Right Bank**	**Left Bank**	**ITEM 4**	**Right Bank**	**Left Bank**
Location:			Location:		
Description:			Description:		
ITEM 5	**Right Bank**	**Left Bank**	**ITEM 6**	**Right Bank**	**Left Bank**
Location:			Location:		
Description:			Description:		
ITEM 7	**Right Bank**	**Left Bank**	**ITEM 8**	**Right Bank**	**Left Bank**
Location:			Location:		
Description:			Description:		
ITEM 9	**Right Bank**	**Left Bank**	**ITEM 10**	**Right Bank**	**Left Bank**
Location:			Location:		
Description:			Description:		

Comments:

APPENDIX G

Laboratory Forms

Debris Assessment Laboratory Worksheets

STATION ID: ____________________ **LAB TECH INITIALS:** ____________________

LAB ANALYSIS DATE: ____________________ **LAB ANALYSIS TIME:** ____________________

	COUNT		
Bags and Packaging	**> 25 cm**	**25 cm - 5 mm**	**Labels/Brand Names:**
Bags (single use plastic)			
Bags (takeout or other)			
Bags (large/retail)			
Food Wrapper			
Other Wrapper			
Pet Waste Bags			
Plastic straw wrapper			
Styrofoam pieces			
Styrofoam pellets			
Soft Plastic Pieces			
Hard Plastic Pieces			
Other (comment required)			
Category Total			
Food Service	**> 25 cm**	**25 cm - 5 mm**	**Labels/Brand Names:**
Juice container			
Bottle Caps			
Milk Cartons			
Water Bottles			
Sports drink bottle			
Soda bottle			
Straws			
Lid			
Cups			
Utensils			
Styrofoam Container			
Styrofoam Cup/pieces			
6-pack rings			
Waxed Paper Cups			
Waxed Plates			
Other (comment required)			
Category Total			

Comments:

Debris Assessment Laboratory Worksheets

STATION ID: ____________________ LAB TECH INITIALS: ____________________

Toxic	> 25 cm	25 cm - 5 mm	Labels/Brand Names:
Syringes or Pipettes			
Medical Devices			
Lighters			
Computers			
Keyboard			
Phones			
E-waste			
Cigarette Butts			
Chemical Containers			
Pens or Markers			
Bleach Bottles			
Cleaning Bottles			
Other (comment required)			
Category Total			
Miscellaneous	**> 25 cm**	**25 cm - 5 mm**	**Labels/Brand Names:**
Packaging Ribbon			
Polypropylene Rope			
Fishing Line/Net			
Balloons (mylar)			
Balloons (latex)			
Roping/Ties			
Bandage/Bandaid			
Cigarette Box/Wrapper			
Rubber pieces			
Foam balls			
Other (comment required)			
Category Total			
Household	**> 25 cm**	**25 cm - 5 mm**	**Labels/Brand Names:**
Storage Containers			
Shampoo Bottles			
Toothbrushes			
CDs / DVDs			
Mechanical Pencils			
Pipe (PVC)			
Tarp			
Furniture			
Sports balls			
Tape			
Toys			
Clothing (synthetic fabric)			
Other (comment required)			
Category Total			
GRAND TOTAL:			

Debris Assessment Laboratory Worksheets

STATION ID:_________________ **LAB TECH INITIALS:**________________________

DATE: ________________________ **TIME:** ________________________

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

Macrodebris Category	VOLUME	UNITS	VOLUME (L)
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	
Mesodebris Category	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	
OVERALL VOLUME	**VOLUME**	**UNITS**	**VOLUME (L)**
Bags and Packaging			
Toxic			
Miscellaneous			
Food Service			
Household			
TOTAL VOLUME:		____	

If container used to measure not gallon please provide units. Values must be converted to Liters (L) on right

Size	VOLUME	UNITS	VOLUME (L)
>25 mm			
25 mm - 5 mm			
TOTAL VOLUME:		____	

Comments:

Debris Assessment Laboratory Worksheets

STATION ID:_____________ Initials:_______________ Sample Date:_________________ Sample Time:______________

If more than 1 sample, Sample No.________ of ________ Lab Analysis Date:______________ Lab Analysis Time:__________

Size	Count	Total Count
> 4.75 mm		
4.75 mm		
2.0 mm		
1.0 mm		
0.500 mm		
0.355 mm		
Total		

If container used to measure not liters (L) please provide units. Values must be converted to Liters (L) on right

Size	Volume	Units	Volume (L)
> 4.75 mm			
4.75 mm			
2.0 mm			
1.0 mm			
0.500 mm			
0.355 mm			
Total Volume		____	

Colors	Count	Total Count
White		
Clear		
Blue		
Green		
Black		
Yellow		
Grey		
Pink		
Red		
Orange		
Tan		
Peach		
Total		

Comments

WETLAND AND RIPARIAN HABITAT RESTORATION, MAINTENANCE, AND MONITORING PLAN

Paradise Creek Drainage Channel Improvement Project
Kimball Park, National City, California

Prepared for:

City of National City
Engineering Services
1243 National City Blvd.
National City, California 91950
Contact: Kuna Muthusamy, P.E.
Assistant Director, Engineering & Public Works

Prepared by:

DUDEK
605 Third Street
Encinitas, California 92024
Contact: John L. Minchin, Habitat Restoration Specialist/RLA

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Wetland and Riparian Habitat Restoration, Maintenance, and Monitoring Plan
Paradise Creek Drainage Channel Improvement Project
Kimball Park, National City

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EXECUTIVE SUMMARY

This Wetland and Riparian Habitat Restoration Maintenance and Monitoring Plan (Restoration Plan) outlines approximately 0.80 acre) of on-site wetland, riparian and transitional upland habitat establishment, restoration, and enhancement activities, that are proposed to establish (i.e., create), restore and enhance wetland and riparian areas and improve water quality along a disturbed 1,050 foot-long section of Paradise Creek as part of the proposed Kimball Park L.I.D./Paradise Creek Restoration Project (Project). The Project is located along the easterly edge of Kimball Park, north of 16th Street and between National City Boulevard and D Avenue, in National City, California. This Restoration Plan includes information on project location, proposed improvements, project disturbances resulting from the proposed improvements, permitting assumptions, proposed on-site restoration/revegetation strategies, planting recommendations, long-term maintenance requirements, long-term monitoring methodology, ultimate success criteria and long-term site protection.

The proposed project is intended to restore and establish native wetland and riparian creek habitat in order to improve wetland functions and services in the area and to provide water quality improvements. The project proposes to remove concrete lined portions of the existing creek channel that were historically converted to a concrete lined ditch for drainage conveyance purposes. A new widened flow channel will be created through the removal of the existing concrete channel lining and through grading modifications to establish an improved natural creek flow regime. This will involve approximately 0.80 ac.) of wetland, riparian, and transitional upland habitat establishment and restoration within the main creek channel, as well as along the side slopes of the channel. While the project also includes two bio-retention basins, landscaping of these areas outside of the creek are not addressed in this Restoration Plan.

To ensure that the proposed site modifications and stream restoration efforts are implemented seamlessly and successfully, the project will include the removal of a portion of the concrete bank protection at the existing pedestrian bridge crossing at the southwest portion of the site, which will be replaced with more permeable and plantable bank protection treatments. Additional bio-retention areas will be created along the adjacent roadways to help capture and treat drainage runoff from adjacent urban drainage outlet sources. Existing storm drain culvert entrance/inlet locations that have become partially clogged with sediment and non-native vegetation, causing flows to be restricted, will be cleared to restore their functionality. The proposed project will help improve the hydrology in the area and will include removal of sediment and non-native/exotic vegetation from the drainages, widening the creek conveyance area, slowing down flows and capturing pollutants, thereby improving flow through the culverts and the overall drainage system.

The creek area will be restored to native wetland habitat following the exotics clean-out, concrete removal and remedial grading work.

The existing jurisdictional wetland habitats on site are subject to regulation by the following resource agencies: U.S. Army Corps of Engineers (ACOE) pursuant to Section 404 of the federal Clean Water Act (CWA); Regional Water Quality Control Board (RWQCB), pursuant to Section 401 of the federal CWA and Porter-Cologne Water Quality Control Act; and the California Department of Fish and Wildlife (CDFW), pursuant to Section 1602 of the California Fish and Game Code. The project includes up to 19,448 sq. ft. (0.447 acre) of temporary impacts to ACOE jurisdictional wetlands and approximately 19,688 sq. ft. (0.452 acre) of temporary impacts to CDFW jurisdictional wetlands associated with the proposed channel grading and drainage improvements. Stream restoration activities, will include modifications to the drainage channel, including the concrete removal and re-grading of channel bottoms and creek banks/side slopes, as well as the cleanout of sediment and non-native/exotic vegetation from the existing drainage culvert inlet and outlet structures, followed by revegetation and restoration activities. These areas will only be disturbed during construction, as they will be restored and revegetated with native wetland species following the disturbances. The areas will be revegetated and will also be allowed to naturally regenerate on their own over time through additional volunteer native wetland species recruitment. The majority of the impacts within the stream restoration areas would be temporary (although they may be considered as permanent by certain regulatory agencies) and will ultimately result in a net increase in wetland resource functions and services after the restoration and additional wetland establishment work is completed. All impacts will be compensated for as part of the restoration program.

Permanent impacts associated with the project are minor and are limited to the removal of concrete channel lining, the construction of widened creek channel areas, the construction of bio-retention areas and associated outfall structures, and the bridge abutment modifications. The project also involves the minor addition of supplemental rip-rap at existing storm drain outfall locations.

The Project will include the restoration and establishment (i.e., creation) of 0.80 acre of new riparian woodland, riparian scrub wetland brackish marsh, and transitional upland habitat. Approximately 0.66 acre of the 0.80 acre would be considered waters of the U.S/State.

The proposed wetland and riparian habitat restoration program will include the following:

1. The establishment of wetland and riparian habitat through the conversion of developed land areas on-site. The work will include the restoration of wetland areas within the main channel bottom and the establishment of riparian habitat on the channel banks/slopes. In additional

the associated bio-retention areas and associated transitional upland slope areas will be revegetated with appropriate native vegetation (not a part of this Restoration Plan). The wetland and riparian areas will be revegetated with appropriate native wetland vegetation, as well as riparian woodland and riparian scrub vegetation.

2. The restoration of existing jurisdictional wetland areas within the main channel area (i.e., coastal brackish marsh and southern coastal salt marsh, will be accommodated through remedial grading and replanting with appropriate native wetland marsh species within the proposed limits of disturbance/impact.

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Wetland and Riparian Habitat Restoration, Maintenance, and Monitoring Plan Paradise Creek Drainage Channel Improvement Project Kimball Park, National City

1 PROJECT DESCRIPTION, OBJECTIVES AND SITE EVALUATION

1.1 Project Description and Objectives

The proposed project represents a multi-purpose flood control and water quality improvement project, through stream restoration efforts, which will focus on restoring native wetland functions and services and improving water quality through an approximate 1,050 foot-long section of Paradise Creek within Kimball Park in National City, California. Through the design and construction of a more natural meandering and widened drainage channel, along the entire section of the creek, as well as water quality treatment features, the project will provide improved habitat and hydrology functions, as well as flood control and water quality improvements.

The tributary drainage area feeding Paradise Creek, including all surface run-on, is about 68 acres. The associated 85th percentile runoff volume is estimated at 90,000 cubic feet. The existing Paradise Creek configuration experiences approximately 1,100 cubic feet per second (cfs) flow maximum before adjacent park land is affected. The intended project to remove the concrete channel lining is expected to result in a slowing of the channel velocity but a need to widen the channel to be able to accommodate the flows. In its' current condition, sedimentation and vegetation blockage has occurred within portions of the channel itself and at the various storm drain inlet and outfall locations. Several storm drain outlets discharge into the creek from highly urbanized sources, carrying significant pollutants and poor water quality. These locations will be treated with bio-retention treatment functions

The project proposes to reconfigure the existing linear, concrete lined creek channel (i.e., referred to herein as the existing channel) into a wider, more meandering earthen channel, in order to improve flood flow, provide improved wetland vegetation, provide better on-site water filtering and percolation functions, provide enhanced water quality treatment, remove invasive exotic non-native species and help restore appropriate native wetland plant communities within the modified channel area. The project proposes to restore the natural creek habitat conditions through restoration of disturbed areas, removal of concrete facilities, removal of non-native invasive exotic species and through restoration/revegetation of these areas with appropriate native wetland and upland species. The bio-retention areas will be established on the adjacent creek banks above the main creek channel, and will be created through excavation of the areas down to appropriate elevations to support riparian habitat. The bio-retention areas will receive urban storm water and nuisance water flow from storm drain outfalls from the adjacent urban areas. Grading for the modified channel, bio-retention areas and transitional slopes will begin (i.e., daylight) along the edges of the existing channel. The modified drainage channel and side slopes/banks will be revegetated with riparian woodland, riparian scrub and brackish marsh wetland species. The transitional side slopes above the wetland and riparian areas will be revegetated with transitional upland species where appropriate.

In order to ensure that the proposed stream restoration efforts are implemented seamlessly and successfully, all project construction and modifications will be completed prior to the revegetation work being initiated. In addition, appropriate Best Management Practices (BMP's) erosion control protection procedures will be implemented during construction to assure that water quality is protected during construction and throughout the specified maintenance period, prior to all areas becoming adequately revegetated and established to resist erosion.

The project also involves the grading of bio-retention areas, re-grading of the channel bottom and creek side slopes/banks, improvements to the pedestrian bridge crossing abutments and modifications to storm drain structures and outfall locations.

A more detailed description of these impacts is provided below.

Creek Channel Wetland Restoration Areas

Creek channel wetland restoration areas will be re-established within the main creek channel through removal of concrete lining and re-grading of the channel bottom and creek banks/side slopes to restore wetlands and provide increased water treatment over an area of approximately 0.80 acre. Only 0.66 acre of the 0.80 acre would be considered waters of the U.S/State.

Bio-Retention Areas

Two bio-retention areas will be established adjacent to the existing creek channel through grading to establish the intended bio-retention water treatment areas, including the transitional side slopes. The planting of the bio-retention areas and associated slopes is not addressed in this restoration plan.

Rip-Rap Additions

Rock rip-rap protection will also be added to several of the storm drain outlet locations along Paradise creek. The additional rip-rap will help dissipate and direct storm water runoff from the drain outlet locations to the newly configured channel area.

Impacts to Jurisdictional Wetlands/Waters of the U.S.

Implementation of the proposed Project will result in impacts to Jurisdictional Wetlands, including Waters of the U.S., subject to regulation by the U.S. Army Corps of Engineers (ACOE) pursuant to

Section 404 of the federal Clean Water Act (CWA); the Regional Water Quality Control Board (RWQCB) pursuant to Section 401 of the federal CWA and the Porter-Cologne Water Quality Control Act; and the California Department of Fish and Wildlife (CDFW), pursuant to Section 1602 California Fish and Game Code.

The overall intent of the Project is to restore and improve the overall aquatic resource functions and services in the area, so no formal compensatory mitigation is proposed or required for these impacts comprising a total of 19,688 sq. ft. (0.452) acres (assuming both ACOE, RWQCB and CDFW jurisdiction), as all work is considered to be creek restoration work, not requiring mitigation. The extent of the restoration-related impacts and details regarding the proposed restoration program are outlined further in this report.

1.2 Site Evaluation

The main drainage channel project area along Paradise Creek is located along the easterly edge of Kimball Park, north of 16th Street and between National City Boulevard and D-Avenue. The total creek channel project area is approximately 65,500 sq. ft. (1.5 acres) in size.

The property lies in the U.S. Geological Survey (USGS) 7.5 minute map, National City quadrangle: latitude 32 degrees, 40 minutes, 17 seconds N and longitude 117 degrees, 6 minutes ,10 seconds W (Figures 1 and 2). Paradise Creek is mapped as a blueline stream to the west of the project site, but is not mapped as such on the USGS topographical map within the project area. The property is composed of existing park improvements, which includes the previously configured concrete lined drainage channel running along the easterly edge of the park, connecting to underground storm drain facilities to the north and south. A pedestrian bridge crosses the creek channel at the southwest portion of the channel, linking E 16th Street to Kimball Park. The project site is primarily characterized by relatively level terrain with gentle turf grass slopes along the northerly edge of the creek channel dropping off into the existing storm drain channel. Previously disturbed and developed land exists along the southerly edge of the creek channel having slightly steeper slopes and variations in topography. The southeastern side of the creek channel is composed of primarily previously graded and disturbed and developed land, mapped as developed land. That area is characterized by numerous non-native exotic and weed species and a few ornamental species. The biological resources and jurisdictional delineation was conducted and a report was prepared by Rocks Biological Consulting (Rocks, March 2015) and (Appendix B). An existing pedestrian bridge crosses the creek within the southwesterly end of the creek, providing a pedestrian connection from 16th Street to the park.

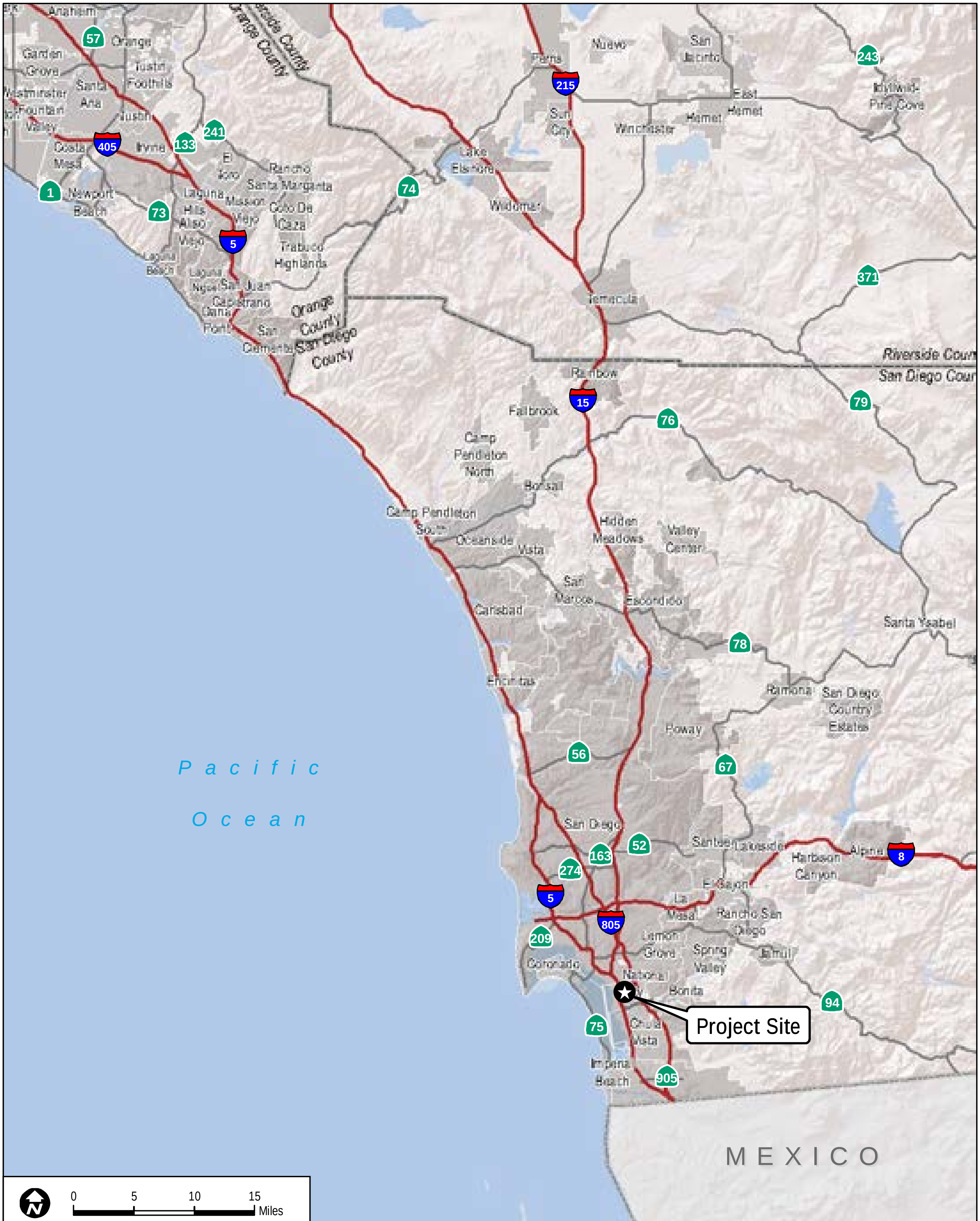
The site supports limited jurisdictional wetlands, under the jurisdiction of both the U.S. Army Corps of Engineers (ACOE) and California Department of Fish and Wildlife (CDFW), as documented in the jurisdictional delineation report (Rocks, March 2015). Minor occurrences of coastal brackish marsh species, as well as southern coastal salt marsh exist within portions of the channel subject to both tidal influence as well as freshwater nuisance water runoff. The interface between tidal influence and freshwater/brackish water runoff occurs in the approximate location of the pedestrian bridge. The site is occupied by minor occurrences of emergent brackish and freshwater wetland vegetation associated with the coastal brackish marsh vegetation community, disturbed habitat, and is interlaced with pockets of ornamental and non-native invasive/exotic species which have previously invaded the creek channel areas.

The current Paradise Creek channel flows through the site within primarily an existing concrete lined channel, flowing from northeast to southwest, trending as an intermittent creek channel, herein referred to as the drainage channel. The southwesterly portion of the channel, up to the approximate location of the pedestrian bridge, is subject to tidal influence and supports coastal salt marsh species tolerant of salty soil conditions.

Elevations within the drainage channel itself range from approximately 4 feet above mean seal level (AMSL) in the northeast channel bottom, to approximately 2 feet AMSL in the southwest creek channel bottom. Tidal inundation reaches approximately the 3 feet AMSL near the pedestrian bridge location. Channel side slopes and adjacent upland areas rise up to approximately 10 feet AMSL along the westerly edge of the creek and up to approximately 28 feet AMSL at the highest location on the easterly edge of the channel. Surrounding land uses include recreational activities within the park, as well as residential and mixed-use commercial areas surrounding the site. The creek receives urban drainage runoff from an approximate 68 acre drainage area to the south.

The project site lies primarily within Assessor's Parcel Number (APN) 560-100-03-00, and also within a smaller parcel 560-091-01-00, both owned by the City of National City.

The overall creek restoration area is surrounded by urban development with no direct native habitat connectivity. However, this section of the creek is one of the few areas passing through the city that is not conveyed in underground storm drain facilities and limited wetlands habitat has developed within the on-site channel area conveying flow through the park. The restoration program will occur on-site within habitat areas mapped as Coastal Brackish Marsh (CBM), Coastal Salt Marsh-High (CSM), Disturbed (DIS), Developed (DEV) and Ornamental (ORM), as described and delineated by Rocks Biological Consulting (Rocks, March 2015) and Appendix B . The restoration program proposed herein has been designed to restore, establish and enhance wetland habitat functions and services and improve water quality following project construction.



DUDEK

8385

FIGURE 1

Regional Map

Restoration Plan for the Kimball Park/Paradise Creek Project

Document Path: Z:\Projects\j838501\MAPDOC\MAPS\KimballPk_ParadiseCrk Restoration Figs\Fig1 Regional.mxd

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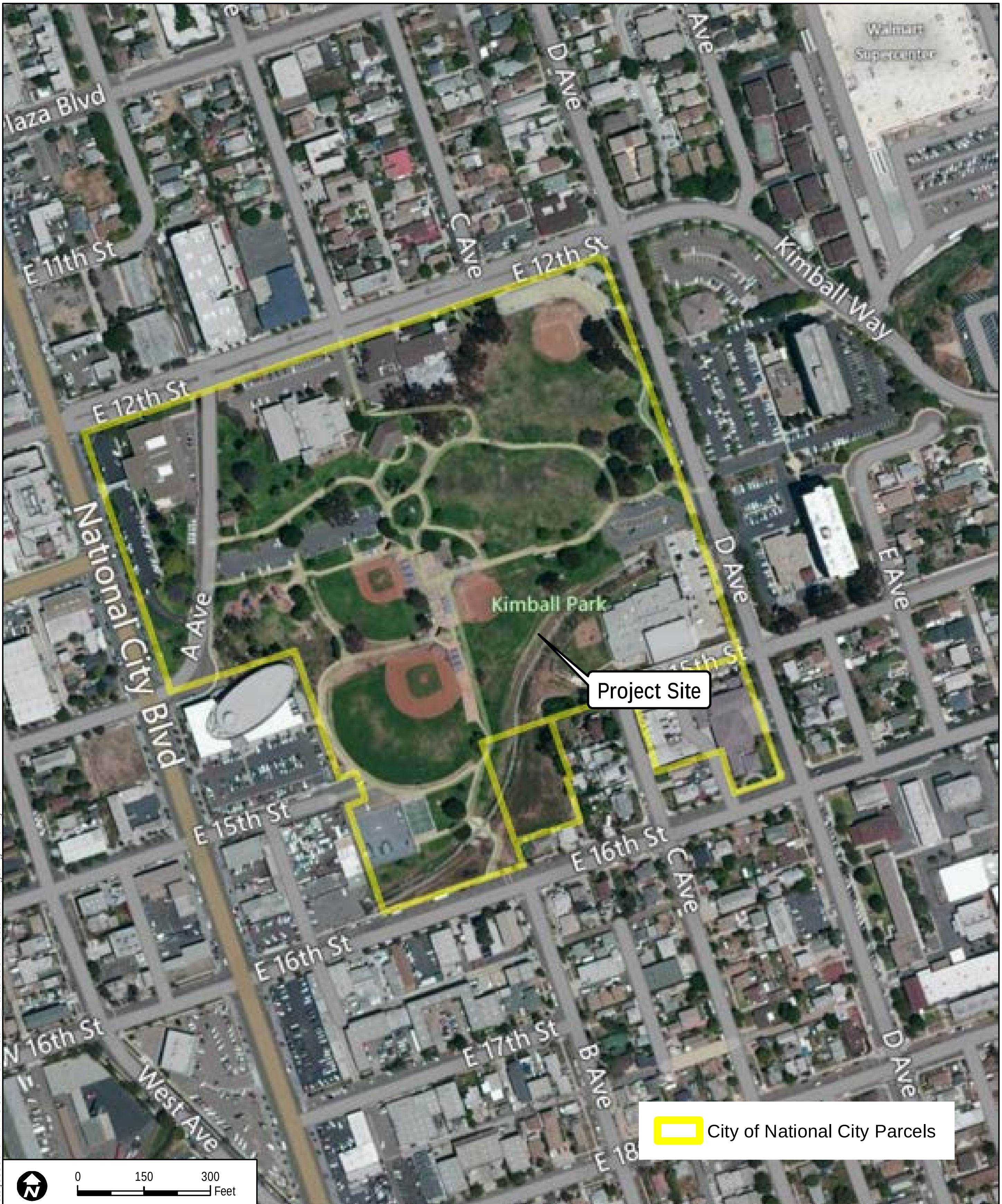

Document Path: Z:\Projects\j838501\MAPDOC\MAPS\KimballPk_ParadiseCrk Restoration Figs\Fig2 Vicinity.mxd

DUDEK

8385

AERIAL SOURCE: BING MAPPING SERVICE

FIGURE 2

Vicinity Map

Restoration Plan for the Kimball Park/Paradise Creek Project

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1.3 Brief Summary of Regulatory Framework

This restoration plan addresses biological impacts that are anticipated to result from the proposed creek improvements and related stream restoration work and which are regulated by both the federal CWA, administered by the ACOE and the RWQCB, the Porter-Cologne Water Quality Control Act, administered by the RWQCB, and the California Fish and Game Code, administered by the CDFW. This plan outlines on-site restoration and revegetation strategies that will help fulfill the regulatory requirements of the federal CWA, the Porter-Cologne Water Quality Control Act, and the California Fish and Game Code for "no net loss of wetlands."

1.4 Responsible Parties

This restoration and monitoring plan was prepared by Dudek, under sub-contract with D-Max Engineering, on behalf of the City of National City (Applicant). The representative for the Applicant is Mr. Kuna Muthusamy, Assistant Director, Engineering and Public Works. Dudek is serving as the habitat restoration/ environmental consultant assisting the project planners and engineers. The representative contacts at Dudek are John Minchin (Landscape Architect #2555/Habitat Restoration Specialist) and Carey Fernandes (CEQA Planner and Senior Project Manager).

The Applicant will be responsible for implementing the restoration and monitoring program as outlined in this plan and as required by the project permits. The Applicant shall also be financially responsible for all permit negotiations and costs associated with the construction improvements as well as the implementation, monitoring, and maintenance of the restoration program, and as specified in the resource agency permits to be issued for the project. The restoration site shall be accessible to all City and resource agency personnel, including ACOE, CDFW, and RWQCB representatives throughout the project review and permitting phase.

1.5 Baseline Information and Jurisdictional Areas Affected

A formal jurisdictional wetlands delineation was conducted in the main channel area by Rocks Biological Consultants, Jim Rocks and Lee Ripma biologists on November 10, 2014 (Rocks, March 2015). The jurisdictional wetland delineation determined the extent of waters of the U.S., including wetlands, under ACOE, CDFW, and RWQCB jurisdiction. The ACOE/RWQCB-jurisdictional wetlands were delineated in accordance with the ACOE *1987 Manual for the Delineation of Wetlands (TR Y-87-1), (ACOE 1987)* and the *2008 Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Arid West Region Version 2.0 (Arid West Supplement) (ACOE 2008)*. Hydrology, hydrophytic vegetation, and soils were examined at potential wetland locations to determine the limits of wetlands. Vegetation mapping was prepared on 100-scale (1 inch = 100 feet) project maps, overlaid onto an aerial photograph image of the site (Appendix B). A list of the vascular plant species detected within the project area is included in Appendix A. Two native jurisdictional wetland habitat areas were identified within the channel area and included, Southern Coastal Salt Marsh – High (SCSM) and Coastal Brackish Marsh - Disturbed (CBM). Non-native habitats determined to be under wetland jurisdiction included disturbed habitat, composed on non-native exotic and weed species and ornamental habitat, composed of one date palm (*Phoenix dactylifera*).

Existing channel hydrology in this area is driven by periodic tidal influence, intermittent storm drain flow, from urban nuisance water runoff sources coming from creek drainage from the northeast of the project area, as well as from on-site storm drains from the adjacent park area and streets that drain into the creek area from the north and south. Creek flow through the site is currently conveyed through a primarily concrete-lined channel that was created when the Kimball Park area was constructed. Limited wetland resources have subsequently developed over portions of the concrete lined channel where sediment has accumulated and within unlined areas adjacent to the channel. The main channel area is currently conveyed along the east edge of the park through a concrete lined ditch that runs from northeast to southwest through the park. The creek joins an underground storm drain system at the far southwest end of the project area. The channel does not connect directly with any native wetland habitat areas, either upstream or downstream of the project area.

Results of the vegetation mapping and wetland delineation analysis concluded that the project area supports minor amounts of wetlands that fall under the jurisdiction of the ACOE, per Section 404 of the Clean Water Act (CWA), the RWQCB per Section 401 of the CWA and the Porter-Cologne Water Quality Control Act, and the CDFW per Section 1602 of the California Fish and Game Code. The results of the wetland delineation indicate that the project area supports 19,448 Sq. ft. (0.447 acre) of jurisdictional wetlands (1,050 lin. ft.) under ACOE and RWQCB jurisdiction and 19,688 sq. ft. (0.452 acre) of jurisdictional wetlands under CDFW jurisdiction. The breakdown of the areas and acreages of the various habitat types per jurisdiction are included in the jurisdictional report prepared by Rocks Biological consulting, included in Appendix B (Rocks, March 2015).

Implementation of the proposed Project will result in impacts to 19,688 sq. ft. (0.452 acre) of wetland habitat under the joint jurisdiction of the ACOE, RWQCB and CDFW (Table 1).

The new configured creek channel areas totaling 0.80 acre, will be restored with riparian woodland, riparian scrub, wetland brackish marsh, freshwater marsh, and upland transitional species. Only 0.66 acre of the 0.80 acre would be considered creation/restoration of waters of the U.S/State. Disturbed and developed land, ornamental vegetation, and non-native exotic species will be converted to wetland, riparian and upland transitional habitat as part of the restoration effort. The restoration work will include the removal of non-native and invasive/exotic tree and shrub species from the existing channel and side slope/bank areas prior to the restoration efforts. These include exotic shrubs, ground covers and grasses such as sweet fennel (*Foeniculum vulgare*), Australian saltbush (*Atriplex semibaccata*), Australian tumbleweed (*Salsola australis*), curly dock (*Rumex crispus*), Bermuda grass (*Cynodon dactylon*), ripgut grass (*Bromus diandrus*), cheeseweed (*Malva parviflora*), crocea iceplant (*Malephora crocea*) and exotic trees such as date palms (*Phoenix* sp.). All of these exotic trees, shrubs, groundcovers and grasses are located within existing creek channel areas, and/or along the immediate creek margins and are currently infringing upon the establishment of desirable native wetland species. Once these exotic/non-native species are removed, the resultant open areas will be converted to native wetland species plantings. A total of 35,000 sq. ft. (0.80 acre) of the reconfigured channel bottom and side slopes will be revegetated with appropriate native vegetation (Table 2).

Table 1
Impacts to Vegetation Communities and Land Covers

Vegetation Community	Stream Restoration Impacts (acres)		Total/Combined Jurisdiction
	Channel Re-Construction ACOE Wetlands	*Channel Re-Construction CDFW Wetlands*	
Southern Coastal Salt Marsh-High	4,488 s.f. (0.103 ac.)	4,488 s.f. (0.103 ac.)	4,488 s.f. (0.103 ac.)
Coastal Brackish Marsh	13,613 s.f. (0.313 ac.)	13,613 s.f. (0.313 ac.)	13,613 s.f. (0.313 ac.)
Disturbed Habitat	1,347 s.f. (0.031 ac.)	1,347 s.f. (0.031 ac.)	1,347 s.f. (0.031 ac.)
Ornamental	0.00	240 s.f. (0.006 ac.)	240 s.f. (0.006 ac.)
Subtotal Wetlands	*19,448 s.f. (0.447 ac.)*	*19,688 s.f. (0.452 ac.)*	*19,688 s.f. (0.452 ac.)*

Table 2
Proposed Aquatic Habitat Restoration and Establishment,

Vegetation	Proposed Restoration (acres) (main channel and southeast culvert)		Total Restoration Area (acres)
	Establishment	*Restoration*	
Riparian Establishment	0.50		0.50
Southern Coastal Salt Marsh - High / Brackish Marsh		*0.16*	0.16
Total	**0.50**	**0.16**	**0.66**

1.6 Functions and Services of Jurisdictional Areas Affected by the Proposed Work

The existing wetland resources on site, while highly disturbed by previous site disturbances including concrete lining of the channel, exotic/non-native species invasion, sediment accretion, and other anthropogenic disturbances, do provide some filtering benefits for the drainage runoff through Paradise Creek and serve to catch and trap some of the pollutants as they travel through the system, however they are not functioning to their potential as the area is highly disturbed and very limited in size. These functions, while minimal, will be disturbed during construction, but will not be permanently lost, as the vast majority of these areas will be restored in place, and/or will be replaced and improved through the establishment, restoration and/or enhancement through the addition of supplemental wetland vegetation. Additional compensation will also be provided for the disturbances/impacts from the project through the establishment (i.e., creation) of a new constructed wetland, through the establishment of bio-retention areas, and through the removal of non-native/exotic plant species from the existing wetland areas to be preserved. Therefore, it is felt that this effort will ultimately provide additional wetland habitat and improved water quality functions and services on site. The existing limited areas of coastal brackish and salt marsh habitat onsite do provide some habitat use for wildlife species, primarily wetland bird species, in addition to limited habitat value for aquatic species. However, the presence of the non-native, exotic/invasive species and the influence from the concrete-lined portions of the channel compromise the full functions and services of these existing habitats. These conditions will be greatly improved through the restoration effort, through the restoration of the wetland areas, expansion of the riparian areas, and through the establishment of the bio-retention areas and upland transitional areas.

1.6.1 Existing Hydrologic Functions and Services

The existing hydrologic functions and services of the Paradise Creek channel area, in its current configuration, includes tidal fluctuations, the conveyance of intermittent creek flow, as well as conveyance of urban nuisance water runoff and storm water flow during storm events. The site provides short term water storage, flood flow conveyance and limited pollutant and sediment deposition in its' current condition. Intermittent creek flow and nuisance water runoff are currently carried throughout the year through the predominantly concrete-lined channel. The tributary drainage area, including all surface run-on, is about 68 acres and the associated 85th percentile runoff volume is estimated at 90,000 cu. feet, per D-Max Engineering estimates.

There are numerous non-native/exotic and ornamental tree, shrub, ground cover, and grass species which have invaded the site and have become established along the creek channel, which have infringed upon the development of desirable native wetland species. This has contributed to the blockage of flood flows in some areas due to sedimentation and non-native vegetation development which has exasperated the flooding situation and has led to less flood flow conveyance and less natural infiltration through the area over time. The non-native/invasive exotic plant species, such as sweet fennel (*Foenicullum vulgare*), Australian tumbleweed (*Salsola australis*), date palms (*Phoenix* sp.) and other non-native/exotic weed species, have also lead to the clogging of the creek, impedance of the creek flows and competition with the more desirable native wetland species.

The proposed wetland restoration areas are shown conceptually on Figure 3.

1.6.2 Existing and Proposed Habitat Functions and Services

The Paradise Creek channel contains limited native wetland habitat areas, as well as numerous ornamental and non-native/exotic plant species. Native and non-native plant species identified as part of the biological resources evaluation and wetland delineation work conducted by Rocks Biological Consulting (Rocks March 2015) are included in Appendix A. The full biological resources report is included in Appendix B. Native habitats identified during the Rocks biological resources and wetlands evaluation included Southern Coastal Salt Marsh – High (SCSM), which is considered a special status habitat. This habitat area is located within the lower portion of the site, primarily from the pedestrian bridge down to the southwest corner of the site at the storm drain inlet location. This area is under the periodic influence of tidal inundation during high tide events and contains predominantly salt tolerant marsh species, due to the salty soils and salt water influence. The other native habitat identified onsite was Coastal Brackish Marsh - Disturbed (CBM), which is located within the central and upper portions of the site, from approximately the pedestrian bridge up to the northeasterly drainage culvert outfall location. This area is a transitional zone between salt water and freshwater influences and is brackish in nature. This area supports plants that can tolerate the transitional conditions. Many of the plants in this area have grown within a sediment substrate that has accumulated over the concrete-lined channel, or occur immediately adjacent to the channel. One special status plant species (*Suaeda esteroa*) estuary sea blight was detected onsite, within the lower southwest portion of the site within the SCSM habitat, as well as within the central portion of the site within CBM habitat. The primary native species identified in each of the native habitats onsite are listed below.

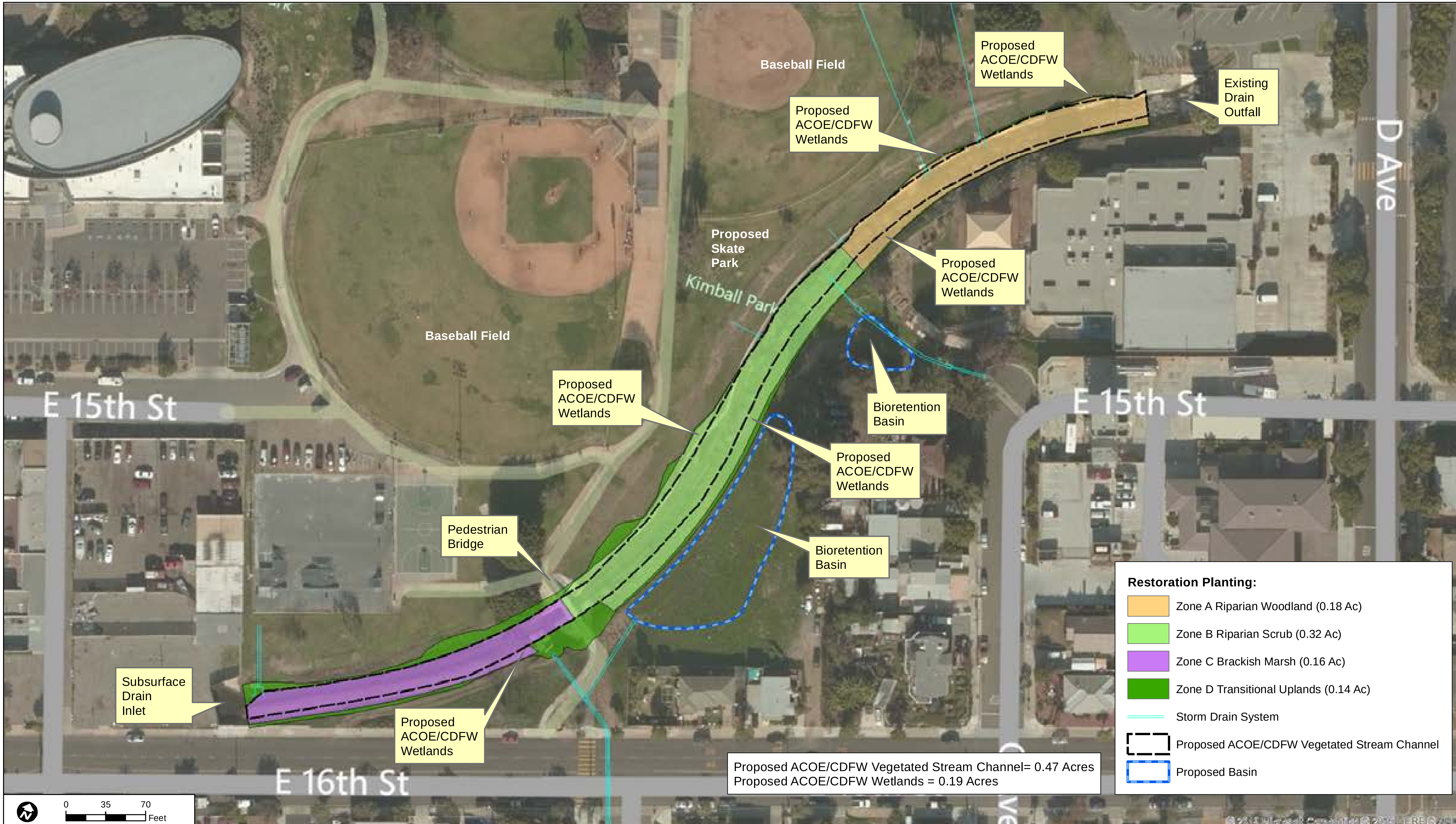
Southern Coastal Salt Marsh – High (SCSM)

- *Atriplex prostrata* (spearscale)
- *Batis maritima* (saltwort)
- *Distichlis spicata* (salt grass)
- *Salicornia pacifica* (Pacific pickleweed)
- *Suaeda esteroa* (estuary sea blight)
- *Triglochin concinna* ssp. *concinna* (arrow grass)

Coastal Brackish Marsh - Disturbed (CBM)

- *Bolboschoenus maritimus* ssp. *paludosus* (prairie bulrush)
- *Epilobium ciliatum* ssp. *ciliatum* (willow herb)
- *Jaumea carnosa* (salty Susan)
- *Plantago lanceolata* (English plantain)
- *Suaeda esteroa* (estuary sea blight)

After project construction, the entire creek channel area will be preserved within open space. These restored/revegetated creek areas, expanded riparian habitat, and bio-retention/ water quality treatments areas will provide important native wetland and riparian habitat for wildlife use. The creek channel riparian areas could also provide nesting and foraging habitat for native riparian bird species.



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SOURCE: KIMLEY HORN 2015

FIGURE 3

Planting Zones

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Restoration Plan for the Kimball Park/Paradise Creek Project

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The channel and its side slopes/banks will ultimately be returned to a more natural earthen channel condition after the removal of the concrete lining and will be revegetated with native wetland species.

Soil types within the immediate creek channel area are considered Made Land (Md) and Huerhuero Urban Land Complex (HuC) per the USDA soil survey data and are highly variable due to past soil disturbances from the surrounding urban development. The soil conditions basically consist of loam, clay loam and sandy marine sediments. The soil appears to be acceptable for wetland plant growth although the soil is salty due to the past tidal influences and the accumulation of salts due to its low-lying condition.

Wetland and riparian vegetation helps to reduce erosion by shielding the soil surface from direct water impact, slows water flow, and provides root systems that help to hold soil in place during flow events. Plants also improve the soil quality and richness by contributing organic matter, which helps improve soil structure, microbiota, and insect habitat. Plants help to uptake nutrients, and some species are able to uptake metals. Wetland and riparian vegetative cover can result in lower water temperatures and lessen evaporation rates. Vegetative cover also provides nesting and foraging habitat for a wide variety of bird and animal species. All of these aspects will be improved through the restoration/revegetation effort.

Due to the site's size and location, the site does not lend itself well to recreational fishing, or hunting. However, after revegetation efforts are complete the presence of wetland and riparian habitat will undoubtedly result in opportunities for bird watching and shading and will provide "natural" open space and greenery that is generally considered a positive attribute in an urban environment.

The creek channel currently functions as a drainage conveyance for rain and flood events that prevents overland flooding of adjacent developed areas (except during unusually high or intense precipitation events). Paradise Creek continues downstream underground, ultimately draining into the Sweetwater Marsh National Wildlife Refuge, which connects to the Sweetwater River and ultimately joins San Diego Bay. The creek channel experiences tidal influence due to the tidal fluctuations in the bay and the low elevation of the southwestern portions of the drainage channel, supporting southern coastal salt marsh habitat, which is a unique attribute of the site.

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2 WETLANDS RESTORATION PROGRAM

2.1 Proposed Restoration Area Site Selection

2.1.1 Location and Size of Restoration Areas

The wetland restoration and riparian establishment areas will be located within areas disturbed and/or developed by the previous creek channel and park construction activities, as well as within other adjacent areas outside of the existing creek channel, which are currently composed of upland non-native/invasive vegetation, including ornamental and disturbed/developed areas. The site has been divided into four primary restoration zones characterized by different habitat strategies, which are depicted on Figure 3.

- **Zone A (Riparian Woodland Restoration and Establishment Area)** would be located in the upper margins of the creek channel towards the northeast end of the site. These areas would be planted with riparian woodland species, composed of wetland trees in the overstory and wetland shrub and herbaceous plant species in the understory.
- **Zone B (Riparian Scrub Restoration and Establishment Area)** would be located in the central margins of the creek channel towards the center of the site. These areas would be planted with riparian scrub species, composed of limited wetland trees and large shrubs in the overstory, and wetland shrub and herbaceous plant species in the understory.
- **Zone C (Brackish Marsh/Southern Coastal Salt Marsh Transition Restoration and Establishment Area)** would be located in the lower portions of the creek channel towards the southwest end of the site, and would be subject to periodic tidal inundation. These areas would be planted with salt marsh and brackish marsh/emergent wetland species, composed of low growing salt tolerant shrubs and herbaceous/ ground cover plant species.
- **Zone D (Transitional Upland)** would be located in the higher portions of the site in transitional slope areas above the creek channel wetland/riparian establishment and restoration areas, as well as surrounding the bio-retention areas, associated with the easterly and westerly portions of the site. These areas would be outside of any proposed wetland influence/jurisdiction. These areas would be primarily slope or transitional graded areas that are necessary in order to create the appropriate elevations to support the wetland and riparian areas and the bio-retention areas. These areas would be planted with native coastal upland species, composed of shrub and herbaceous/ground cover plant species.

The restoration areas will include revegetation of the channel bottoms, creek side slopes, the created wetland areas adjacent to the creek channel, as well as the transitional side slopes and transitionally graded areas. In total approximately 0.80 acre of wetland, riparian, and transitional upland area will be established and restored as a part of the overall wetland restoration effort. Only 0.66 acre of the 0.80 acre would be considered creation/restoration of waters of the U.S/State (See Table 2). Figure 4 shows of the conceptual layout of the proposed restoration areas.

The restored creek channel, wetland restoration areas, the riparian establishment areas and the bio-retention areas will be planted with native container plant species and hydro-seeded with native wetland seed mixes. The lower portions of the creek channel will be planted with salt marsh and brackish marsh species. The higher portions of the creek channel, outside of tidal influence, will be planted with riparian woodland and riparian scrub species from container plants, as well as from seed, in order to provide a wetland transitional habitat. Associated upland areas will be planted with transitional native upland plant species that are appropriate to the area. The entire restoration area will be maintained and monitored subject to the performance guidelines discussed in Section 5.1.

2.1.2 Present and Proposed Uses of Restoration Area

The proposed restoration and establishment areas are currently composed of concrete lined channel areas and disturbed channel banks. There is some accumulated sediment within the existing channel that supports limited wetland species, conveys perennial and nuisance water creek flows, and provides periodic flood flow conveyance through the site. The current creek flows originate in the northeast portion of the site and flow to the southwest across the site. In high flood flow conditions the creek expands/widens to the capacity of the channel and the various storm drain facilities, as it travels through the site. Some areas proposed for wetland restoration and riparian habitat establishment are currently considered developed, disturbed and/or ornamental habitat due to the current upland conditions and the predominance of weeds and non-native/exotic or ornamental vegetation which have previously invaded the areas. The existing state of the disturbed and developed areas, where the proposed wetland restoration and riparian establishment areas are proposed, currently provides little biological value because they are disturbed or developed land, are at improper elevations and do not currently support high quality native wetland and/or riparian vegetation.

The proposed modifications within the restoration and establishment areas are aimed to provide increased native wetland and riparian habitat values, provide better flood flow/drainage conveyance, provide short-term storage, provide increased water percolation and ground water recharge, provide increased wetland habitat functions and services, and also provide increased wildlife habitat opportunities through habitat expansion and revegetation with native species. The restoration areas will be preserved in perpetuity and designated as conserved open space, as part of the overall Kimball Park area.

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SOURCE: Kimley-Horn 2015

FIGURE 4
Paradise Creek Conceptual Restoration Plan

Restoration Plan for the Kimball Park/Paradise Creek Project

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2.2 Restoration Program Goals

The primary goal of this wetland restoration and monitoring program is to ensure that impacts to jurisdictional wetland areas associated with the project are fully mitigated and compensated for, and are restored in accordance with the "No Net Loss" of wetlands policies administered by the ACOE and adhered to by the CDFW. This goal includes revegetation and restoration of the creek channel area, as well as the establishment, rehabilitation (i.e., restoration) and enhancement of additional areas outside of the creek channel construction area to provide functions and services equal to or greater than those provided by the existing plant communities/habitats existing onsite. Secondary goals of the project are to improve the hydrology and water quality within the site and to improve the overall habitat values within the project area. The channel bottom, created wetland, bio-retention areas, associated side slopes and transitional areas surrounding the channel, will be revegetated with appropriate wetland and upland species in order to restore and improve wetland habitat functions and services. Disturbed, ornamental and developed portions of the site, as indicated on the conceptual restoration plan exhibit (Figure 3), will be converted to wetland habitat to provide the required wetland mitigation compensation as well as to help improve and increase habitat functions and services.

2.2.1 Type of Habitat to Be Restored and Established (Created)

The proposed revegetation effort will help convert existing disturbed, developed, ornamental areas, and non-native vegetated areas to a vegetated wetland cover through wetlands restoration (within the main channel bottom, and through establishment (i.e., creation) on the channel side slopes/banks. The lower creek channel plantings will be designed such that the bottom of the channel will support primarily salt marsh/brackish marsh and emergent wetland species, while the higher areas and channel/creek bank side slopes will support a mixture of transitional riparian scrub and riparian woodland tree species. The larger riparian tree species, such as willows, sycamores and cottonwoods have been purposefully precluded from the lower channel bottom areas due to anticipated salty soil conditions, tidal influence and the need to help keep the flood flow conveyance areas open over time. Some willow and mulefat scrub species will be utilized in the outer margins and side slopes of these areas to help stabilize the areas and to provide habitat diversity and habitat connectivity. Lower growing shrub and herbaceous species will be utilized in the low lying areas, with the taller riparian tree species will be utilized in the upper creek channel margins where they can be sustained over the long-term.

A mixture of native grasses, rushes, wetland shrubs, trees and forbs adapted to the periodically moist stream channel conditions and the drier side slope conditions are proposed in the planting schemes for the channel side slopes and transitional zone areas (Tables 3–6). The drier species will be located in the upper margins of the transitional slope areas. Wetter species will be located in the lower margins of the slope areas and within the channel bottoms. The planting palettes have been designed to include a composition of species appropriate to the anticipated hydrological function of the creek channel and that are known to occur naturally in this type of wetland habitat. The planting palettes include species with different germination responses, varying wetland affinities and growth forms to provide for plant growth under varying conditions that are likely to occur in the creek channel and within the proposed establishment/enhancement areas.

The creek channel revegetation areas (i.e., restoration and establishment areas) shall be maintained during an initial plant establishment maintenance and monitoring period, and will have minimal non-native/exotic invasive species present by the end of that period. Non-native/exotic invasive species, such as castor bean, giant reed, pampas grass, tree tobacco, acacia, myoporum, fennel, Brazilian pepper, ash, fan palms and eucalyptus, will be removed and adequately controlled.

Table 3
Zone A: Riparian Woodland Creek Restoration and Establishment Area
(upper 1/3 of creek restoration area northerly portion,)

Scientific Name	Common Name	Size	Approx. Spacing (on center)	Percent Composition
Riparian Woodland Species - Overstory				
Baccharis salicifolia	mulefat	1 gal	8’	25%
Salix gooddingii	black willow	1 gal	25’	10%
Salix lasiolepis	arroyo willow	1 gal	20’	15%
Platanus racemosa	western sycamore	15 gal	30’	5%
Populus fremonti	western cottonwood	15 gal	25’	5%
Riparian Woodland Species - Understory				
Elymus condensatus	giant wild rye	1 gal	6’	10%
Iva hayesiana	San Diego marsh elder	1 gal	4’	15%
Juncus acutus ssp. *leopoldii*	spiny rush	1 gal	5’	10%
Rosa californica	Calif. wild rose	1 gal	6’	3%
Rubus ursinus	Calif. blackberry	1 gal	8’	2%
Riparian Woodland Species – Seed Mix A	**Common Name**	**Minimum PLS***	**Application Rate (lbs/ac.)**	**Percent Composition**
Ambrosia psilostachya	western ragweed	6	2.0	
Artemisia douglasiana	Douglas’ mugwort	10	3.0	
Artemisia palmeri	Palmer’s sagewort	10	2.0	
Castilleja exserta (Orthocarpus purpureus)	Owl’s clover	25	1.0	

Table 3
Zone A: Riparian Woodland Creek Restoration and Establishment Area
(upper 1/3 of creek restoration area northerly portion,)

Scientific Name	Common Name	Size	Approx. Spacing (on center)	Percent Composition
Eschscholzia californica	California poppy	85	2.0	
Elymus (leymus) triticoides	creeping wild rye	80	3.0	
Heliotropium curassavicum var. *oculatum*	salt heliotrope	12	1.0	
Lotus scoparius	deerweed	85	4.0	
Lupinus bicolor	Miniature lupine	90	1.0	
Muhlenbergia rigens	deergrass	60	2.0	
Nassela pulchra	Purple needle grass (deawned)	75	2.0	
Pluchea odorata	Marsh fleabane	15	1.0	
Total			**24.0**	

* PLS = Pure Live Seed (% purity x %germination)

Table 4
Zone B: Riparian Scrub/Emergent Wetland, Creek Restoration Areas
(central portion 1/3 of creek restoration area, above creek bridge crossing)

Scientific Name	Common Name	Size	Approx. Spacing (on center)	Percent Composition
Riparian Scrub/Emergent Wetland Species - Overstory				
Baccharis salicifolia	mulefat	1 gal	8’	30%
Salix exigua	narrow-leaf willow	1 gal	15’	20%
Sambucus mexicana	Mexican elderberry	5 gal	20’	10%
Populus freemonti	freemont cottonwood	15 gal	25’	5%
Riparian Scrub/Emergent Wetland Species - Understory				
Elymus condensatus	giant wild rye	1 gal	6’	5%
Iva hayesiana	San Diego marsh elder	1 gal	4’	10%
Juncus acutus ssp. *leopoldii*	spiny rush	1 gal	5’	10%
Rosa californica	Calif. wild rose	1 gal	6’	5%
Rubus ursinus	Calif. blackberry	1 gal	8’	5%

Table 4
Zone B: Riparian Scrub/Emergent Wetland, Creek Restoration Areas
(central portion 1/3 of creek restoration area, above creek bridge crossing)

Scientific Name	Common Name	Size	Approx. Spacing (on center)	Percent Composition
Riparian Scrub/Emergent Wetland Species – Seed Mix B		*Minimum PLS**	*Application Rate (lbs/ac.)*	
Castilleja exserta (Orthocarpus purpureus)	Owl's clover	25	1.0	
Eschscholzia californica	California poppy	85	2.0	
Elymus (leymus) triticoides	creeping wild rye	80	3.0	
Heliotropium curassavicum var. *oculatum*	salt heliotrope	12	1.0	
Lotus scoparius	deerweed	85	4.0	
Lupinus bicolor	Miniature lupine	90	1.0	
Muhlenbergia rigens	deergrass	60	2.0	
Pluchea odorata	Marsh fleabane	15	1.0	
Total			**15.0**	

* PLS = Pure Live Seed (% purity x %germination)

Table 5
Zone C: Brackish Marsh/Southern Coastal Salt Marsh Creek Restoration Areas
(lower area below bridge crossing)

Scientific Name	Common Name	Size	Approx. Spacing (on center)	Percent Composition
Brackish Marsh/Emergent Freshwater Marsh Species - Understory				
Anemopsis californica	Yerba Mansa	1 gal	18"	5%
Atriplex lentiformis	Big salt bush	1 gal	8'	2%
Disticlis spicata	Salt grass	flat plants	18"	20%
Frankenia salina	Alkali heath	1 gal	6'	10%
Iva hayesiana	San Diego marsh elder	1 gal	4'	10%
Jaumea carnosa	marsh jaumea	1 gal	5'	5%
Juncus acutus ssp. *leopoldii*	spiny rush	1 gal	5'	10%
Pertoma arborea (Isomeris arborea, Cleome isomeris)	bladderpod	1 gal	6'	3%
Salicornia pacifica (virginica)	common pickleweed	1 gal	4'	20%
Schoenoplectus (Scirpus) californicus	California bulrush	1 gal	6'	10%
Suaeda taxifolia	wooly sea-blight	1 gal	6'	5%

Table 5
Zone C: Brackish Marsh/Southern Coastal Salt Marsh Creek Restoration Areas
(lower area below bridge crossing)

Scientific Name	Common Name	Size	Approx. Spacing (on center)	Percent Composition
Brackish Marsh/Emergent Freshwater Marsh Species – Seed Mix C		*Minimum PLS**	*Application Rate (lbs/ac.)*	
Anemopsis californica	Yerba Mansa	50	2.0	
Distichlis spicata	Salt grass	70	4.0	
Frankenia salina	Alkali heath	4	12.0	
Heliotropium curassavicum var. oculatum	salt heliotrope	12	1.0	
Pluchea odorata	Marsh fleabane	15	1.0	
Total			**20.0**	

* PLS = Pure Live Seed (% purity x %germination)

Table 6
Zone D: Native Transitional Uplands Planting Areas
(transitional upland areas surrounding wetland and riparian areas)

Scientific Name	Common Name	Minimum PLS*	Application Rate	Notes
Native Upland Seed Mix D				
Castilleja exserta (Orthocarpus purpurea)	Purple owl's clover	25	2.0	
Elymus (Leymus) triticoides	creeping wild rye	80	1.0	
Encelia californica	bush sunflower	25	3.0	
Eschscholtzia californica	California poppy	85	2.0	
Isocoma menziesii	Coast goldenbush	15	2.0	
Lasthenia californica	California goldfields	60	1.0	
Layia platyglossa	tidy tips	60	2.0	
Lotus scoparius	Deer weed	85	3.0	
Lupinus succulentus	arroyo Lupine	90	4.0	
Melica imperfecta	coast melic	70	1.0	
Mimulus aurantiacus aurantiacus (southern)	sticky monkey flower	2	4.0	
Nemophila menziesii v. *integrifolia*	baby blue eyes	75	1.0	
Plantago erecta	dot-seed plantain	85	2.0	
Sisyrinchium bellum	blue-eyed grass	80	2.0	
Stipa pulchra	purple needlegrass	75	1.0	
Vulpia microstachys	small fescue	85	1.0	
Total			**32.0**	

* Pure Live Seed (% purity x %germination)

Hydroseed Slurry for Mixes A, B, C and D:

1. Seeds as indicated above per mix.
2. 2,500 pounds/acre virgin wood fiber mulch.
3. Ecology Controls M-Binder/seed tackifier, or approved equal, at 80 pounds/acre (for installation on slopes from November through March).
4. Fertilizer 11-55-0 at 200 pounds/acre.

2.2.2 Functions and Services of Habitat to be Restored and Established

The habitats to be restored and revegetated within the on-site creek channel wetland areas, riparian areas and bio-retention establishment areas are ultimately expected to have higher functions and services than within the existing channel areas. This will be achieved by removing non-native/exotic invasive plant species, expanding the wetland and riparian areas and replacing the non-native species with native wetland species thereby improving the wetland and riparian areas and providing increased diversity of wetland plant species. This will also provide increased cover and foraging opportunities for wildlife.

Nutrient cycling, sediment and pollutant trapping will also be enhanced by the increased vegetated brackish marsh, freshwater marsh, riparian scrub and riparian woodland areas. Revegetation of the bottom of the channel areas, as well as increased riparian vegetation in adjacent areas, should help trap sediment and toxicants, thereby improving water quality. Habitat values will be increased with a more varied and structurally diverse vegetated channel and side slope area, than previously existed, which will also provide increased cover and foraging opportunities for wildlife over time. The potential for increased retention of water on site within the bio-retention basins, coupled with improved overall flood flow conveyance should help enhance the overall wetland and riparian site conditions and provide increased habitat for native plant and wildlife species.

2.2.3 Time Lapse

It is expected that the restoration and establishment efforts will take some time to develop into a system that is sufficiently established and capable of resisting invasion by weeds and exotic plant species. It is anticipated that within approximately three years the various establishment and restoration areas should become self-sustaining, and able to survive on natural rainfall and perennial urban flow/runoff to allow the areas to survive under natural conditions.

In order to help assure sufficient plant establishment, and initial 120-day plant establishment maintenance and monitoring period is planned to help ensure that the creek channel, creek side slopes and various revegetation areas are sufficiently established to further develop into the intended habitat types and can survive on their own in perpetuity.

2.2.4 Ballpark Cost Estimate

It is estimated that the initial cost for installation and maintenance of the on-site restoration and establishment effort, including the channel re-construction, construction of the bio-retention basins and the construction of the wetland restoration and establishment areas, will cost approximately $1.22 million, including a 30% contingency. This cost estimate includes finish grading of planting areas, weed control, exotic species removal, grading of the various areas, site preparation, irrigation, container plant installation, hydro-seeding and plant establishment maintenance for the first 120 days following installation.

2.3 Target Acreages

The target habitat functions and services, hydrological regime and jurisdictional acreages to be established and restored are outlined in the following sections.

2.3.1 Target Habitat Functions and Services

The long-term goal of the restoration program is to restore and establish self-sustaining wetland and riparian habitats that can provide increased wetland habitat functions and services to a currently degraded creek channel area. The restoration project will ultimately increase the quality of the existing site conditions by reducing weedy non-native/exotic/ornamental vegetation, increasing native wetland and riparian vegetative cover, and improving the overall hydrology within the creek channel and adjacent floodplain areas.

2.3.2 Target Hydrological Regime

The revegetation of wetland vegetation, within the creek channel and adjacent creek bank/side slope areas, will help improve the hydrology within the creek channel as by providing improved vegetative cover, and increased surface area for flood flow conveyance, with improved flood flow. The target hydrological regime for the new drainage channel revegetation area is to provide storm water flow conveyance and storage through the revegetated channel areas with lower growing vegetation and to decrease the resistance from the larger tree and shrub species within the immediate channel bottom and side slope areas. The larger riparian shrub and tree species will be utilized in the upper wetland areas outside of the immediate creek channel flow areas. Flood waters will still be able to expand out of the immediate channel area into the surrounding channel bank areas.

2.3.3 Target Jurisdictional Acreage to Be Established and Restored

The goal of the wetland restoration program is to provide 0.66 acre of newly established (i.e., created) riparian areas and restored wetlands for areas which will fall under jurisdiction of the ACOE, CDFW, and RWQCB. In addition, 0.14 acre of transitional upland habitat will be restored along the adjacent slopes.

The majority of the restoration and establishment areas will be preserved in perpetuity, as part of the Kimball Park open space area, thus limiting future use or modifications to these areas. Measures that will be implemented to ensure that the restoration areas will not be degraded by human and domestic pet intrusion will include installing and maintaining signage and fencing where appropriate to help protect the areas from intrusion, removing and controlling non-native weeds and exotic vegetation, as well as removing trash and debris from the wetland and riparian areas as necessary.

3 IMPLEMENTATION PROGRAM AND WORK PLAN

The following program describes the necessary implementation measures for establishing (i.e., creating) and re-establishing (i.e., restoring) the creek channel areas (i.e., waters of the U.S. and State) into the desired habitat types.

The City shall submit a Pre-construction Notification of Initiation of Work (per standard form letter attached to the ACOE permit) to the ACOE prior to initiation of work activities.

The City shall clearly mark the limits of the grading areas and shall protect any areas not receiving grading as directed by the project construction drawings.

The City and their designated contractor shall conduct all vehicle maintenance, staging, storage, and refueling activities within upland staging /assembly areas, a minimum of 50 feet from wetland and/or open water areas, where spills cannot enter waters of the U.S., including gutters and storm drains. No debris, soil, silt, sand, sawdust, rubbish, cement, or concrete washings thereof, and oil or petroleum products, from construction shall be allowed to enter into, or be placed where it may be washed by rainfall or runoff into, waters of the U.S. The City and their designated contractor shall employ all appropriate Best Management Practices (BMP's) to ensure that toxic materials, silt, debris, or excessive erosion do not enter waters of the U.S. during project construction. Upon completion of construction activities, any excess materials or debris shall be removed from the work areas and disposed of properly in an appropriate off-site location.

Prior to the initiation of construction, the city shall hire a qualified biological monitor to be onsite during vegetation clearing, project grading and construction in order to ensure compliance with all requirements of the resource agency permits. The biological monitor shall document compliance with the resource agency permits. The biologist shall be trained and qualified to survey for migratory nesting bird species. The City shall submit the biological monitors name, address, telephone number, e-mail address (if applicable) and work schedule for the project implementation, to the ACOE and USFWS, a minimum of fifteen (15) calendar days prior to initiating vegetation clearing or other impacts to waters of the U.S. authorized by the ACOE permit. The biologist shall report any violation to the ACOE contact person within on (1) working day of its occurrence.

3.1 Rationale for Expecting Implementation Success

It is expected that the proposed restoration project will have a high probability of success. The proposed creek channel area will be close to the available water table and should be continually supplied with water from perennial urban runoff and creek flow. This supply of water should provide enough moisture to sustain the intended brackish marsh/freshwater marsh and riparian vegetation within the channel area. The riparian woodland and riparian scrub revegetation/restoration areas are anticipated to be able to establish root growth down to the available water table to sustain growth over the long-term. All areas will also be temporarily irrigated for at least three years after planting in order to supplement the available surface water and groundwater and to ensure adequate plant survival and establishment.

Natural regeneration of native plants within the restoration site is anticipated to supplement the container plantings and seeding proposed by this revegetation program. The result should be establishment of a relatively weed and exotics free wetland area, that should become sufficiently established and be able to resist non-native weed and exotic plant invasion over the long-term. Container plant and seed materials sources will be used from the coastal San Diego County region, thus helping to preserve genetic integrity and increasing the potential for long-term success and sustainability.

3.2 Water Quality Issues

Impacts to water quality from construction of the Project will be minimized by implementation of Best Management Practices (BMPs), which will help control erosion and sediment runoff/deposition downstream. Measures to avoid and/or mitigate impacts to water quality have been incorporated into the final project engineering design, and will include the following:

- All construction vehicles will be adequately maintained and equipped to minimize/eliminate fuel and or lubricant spillage within the wetlands areas. All equipment maintenance work shall occur within designated staging areas, outside of all drainages.
- Construction staging areas will be located in upland areas away from all wetland resources and not adjacent to creeks or drainages.
- All construction practices shall be in compliance with RWQCB requirements. Final measures will be defined on the final engineering plans.
- Implementation of BMPs will be defined on the final engineering plans.
- Construction activities will abide by time of year restrictions and the environmental resource agencies (ACOE, CDFW, and RWQCB) permits and conditions.
- Periodic watering of areas during construction/grading activities to control dust.

- Prompt revegetation of graded creek channel areas, disturbed areas and surrounding slope areas, will occur as soon as possible following grading to prevent erosion and to stabilize the slope surfaces against erosion.

3.3 Migratory Nesting Bird Issues

In order to avoid potential direct and/or indirect impacts to migratory nesting bird species, a time of year restriction will be imposed on initial construction activities and restoration activities. Construction activities will avoid the nesting season (February 15–September 15). If work cannot be avoided during this time frame, then additional protocol level surveys (per USFWS standards) shall be implemented to document the presence/absence of nesting bird species, which will be initiated by a USFWS-approved biologist.

The following post-construction maintenance and monitoring activities can occur without time of year restrictions because they are considered passive and non-impactive to nesting birds:

- Backpack herbicide application sprayers
- Trash and debris removal by hand
- Non-native vegetation removal using hand-operated, non-motorized tools (i.e., trimmers, hoes, shovels, pruners, machetes, etc.)
- Hand application of seed mix

To avoid and/or minimize impacts to nesting birds, the following post-construction maintenance and monitoring activities shall be discouraged during the nesting bird season (Feb. 15-September 15):

- Use of noise-generating motorized equipment and tools to remove non-native vegetation
- Truck-based herbicide application
- Truck-based hydroseed application

However, these activities may occur during this time provided a qualified biologist conducts a survey for nesting birds within 48 hours prior to performing these activities in the area, and ensures no nesting birds or their nests shall be affected by this work.

3.4 Cultural Resources

In the event of any discoveries during construction of either human remains, archaeological deposits, or any other type of historic property, the City shall notify the ACOE staff project manager and ACOE archaeologist within 24 hours of the discovery. The City shall immediately suspend work in any area(s) where potential cultural resources are discovered. The city shall not resume construction in the area surrounding the potential cultural resources until the ACOE re-authorizes construction.

3.5 Preliminary Implementation Schedule

The restoration program outlined herein is contingent upon the approval of this restoration and monitoring plan, and the final revegetation construction documents by the appropriate resource agencies, including ACOE, CDFW and RWQCB. Upon appropriate approvals, implementation of the restoration program is anticipated to begin once grading of the channel areas and installation of the intended improvements is complete, as per the final engineering and revegetation construction documents (i.e., final plans).

3.6 Temporary Irrigation System

A temporary irrigation system will be installed to provide supplemental water to the restoration and establishment areas to ensure native container plant and seed germination/survival until the materials become adequately established. The irrigation system will only be used until the plants are established such that they can survive on their own from the natural water sources and seasonal rainfall. It is expected that the irrigation system will be shut-off/abandoned at the end of year three of the five-year maintenance and monitoring period, depending upon the level of plant establishment achieved by that time. Watering on site will gradually be decreased prior to the irrigation system being abandoned to allow the plants to become acclimated to the site’s natural hydrology.

The irrigation system will be installed as an above-ground system, so that irrigation equipment may be removed once the system has been decommissioned and the site has been signed-off. The irrigation system will utilize a City water source located as close to the site as possible. All on-site irrigation will consist of PVC pipe staked on grade at approximately 10 feet on-center and at all corners, providing 100% coverage of the revegetation areas using spray and/or rotor heads where appropriate. All required creek crossing shall be adequately protected in sleeves and staked to resist creek flow. Check valves will be installed to eliminate low-head drainage where necessary. All irrigation system will be installed and maintained by the Landscape Contractor throughout the length of the installation and plant establishment maintenance period. After that period the system shall be operated by City parks staff for approximately three years. The system will be deactivated by the end of the third year, contingent upon resource agency approval, and all above-ground components shall be removed completely from the site and disposed of or recycled appropriately.

3.7 Site Preparation

The General Contractor shall be responsible for rough grading of the creek channel areas, the created wetland area and the bio-retention areas. The Landscape Restoration Contractor shall be responsible for final finish grading of the restoration areas, site preparation, soil amending, weed eradication, irrigation system installation, container plant installation, hydroseed applications, and initial 120-day plant establishment maintenance, as specified in this restoration plan, the final revegetation construction documents, and/or as modified in consultation with the resource agencies.

Final grading plans for the restoration site will be prepared by the project engineer Kimley Horn and will be provided to the resource agencies as part of the final permit conditions.

The conceptual restoration scheme for the drainage channel and created wetland restoration areas is shown on Figures 3, and 4. The Applicant will acquire all necessary grading permit(s), resource agency permit approvals and final approvals prior to beginning work.

After the grading for the drainage channel bottom, the channel side slope areas and the bio-retention areas are completed, soil will be finish graded by the landscape restoration contractor to provide an overall uniform planting surface to establish the finish grade for planting. A temporary irrigation system will be installed to provide supplemental irrigation to the native seed and container plants to help foster plant establishment. Prior to the installation of native seed and container plants, a “grow and kill” cycle of weed eradication will be conducted by the Landscape Contractor, by activating the irrigation system over an approximate four-week period to encourage non-native seedling emergence. When weeds have begun to grow, a foliar application of an appropriate systemic herbicide will be applied to kill the weeds. All herbicide applications shall be conducted in accordance with manufacturer label instructions under the direction of a state-certified Qualified Pesticide Applicator, and under guidance provided by a Certified Pest Control Advisor. The “grow and kill” cycle shall be repeated at least twice over the four week period to help successfully control the weeds.

3.8 120-Day Plant Establishment Maintenance

During the initial 120-day plant establishment maintenance period, following completion of the hydroseed application and container plant installation, the Biological Monitor will monitor the site conditions, including seedling germination, container plant survival and soil erosion, to determine if the plants are becoming adequately established and to verify whether the hydroseed application has been successful. If the hydroseed application has been successful and adequate germination occurs, then rapid seedling emergence should preclude the need to install additional erosion control Best Management Practices (BMP) measures. Potential remedial actions, if germination is not sufficient, include reseeding, installation of additional erosion control/BMP devices, and follow-up weed control.

The goal of the restoration program is to provide sufficient plant establishment and of the revegetation areas so that they can resist erosion and become adequately established and self-sustaining over the long term. Therefore, the primary effort of the maintenance and monitoring program will be in the first few seasons of growth when the control of weeds and promotion of native plant growth is critical. The Maintenance Contractor shall be responsible for periodic weed/exotic species treatment and removals, pest management, trash and debris removals, fence and signage maintenance, adjustments to the irrigation system, replacement of dead container plants, reseeding where necessary and all necessary site maintenance functions during the 120-day plant establishment maintenance and monitoring period.

General maintenance practices are outlined in the sections below.

3.8.1 Weeds and Exotic Species Removals and Pest Management

Weeds and exotic/invasive plants are expected to be the primary pest problem in the restoration area during the first months. Weeds and exotics shall be controlled so that they will not prevent the establishment of the native species or invade adjacent areas. Weeds and exotics shall be controlled prior to setting seed and shall be removed from the site. The Maintenance Contractor shall control weeds and invasive exotic species within the establishment and enhancement areas on a regular basis. A combination of physical removal and appropriate herbicide treatments shall be used to control the non-native/invasive plant species.

Weeds and non-native grasses shall be adequately controlled during the 120-day plant establishment period to avoid competition with the revegetated species. Annual weeds will be kept under control, so they are not a competitive threat to establishment of the desired native species. Perennial exotic/invasive species shall also be controlled and removed as necessary.

All perennial, invasive, non-native weeds and exotics will be controlled through a combination of hand removals, as well as herbicide applications, during the 120-day plant establishment maintenance and monitoring period. Properly timed, repeat herbicide applications will likely be required to effectively control these species.

All pest infestations, including insects and rodents that are deemed to be at unacceptable levels, as verified by the project biologist, shall be controlled using appropriate environmentally sensitive measures.

3.8.2 Irrigation System Maintenance

The irrigation system shall be checked regularly to ensure proper operation and adequate coverage of the restoration/revegetation areas. Problems with the sprinkler system shall be repaired immediately to reduce potential plant mortality. All broken and/or disrupted systems resulting from annual storm drainage runoff shall be repaired back to working conditions as quickly as possible. The frequency and duration of irrigation applications shall be adjusted seasonally by the maintenance contractor in coordination with the biological monitor to meet habitat needs and to adjust to seasonal conditions. The irrigation system will only be used as necessary during the initial 120-day establishment period and then as necessary for no more than three years to supplement natural rainfall and water sources, and will be terminated at the end of the third year to ensure that the site is self-sustaining. All above-ground components shall be removed completely from the restoration site by the end of the third year.

3.8.3 Clearing and Trash/Debris Removal

Trash and debris consists of all man-made materials, equipment, or debris dumped, thrown, washed or left within the restoration site. All trash shall be removed by the maintenance contractor during each maintenance visit. Pruning or clearing/thinning of native vegetation in the majority of the site will not be done, unless extensive growth is causing a maintenance problem outside of the restoration area boundaries. Any and all pruning or clearing of native vegetation shall be conducted only after approval by, and coordination with, the biological monitor. Deadwood and leaf litter will be left in place to provide organic matter and help replenish soil nutrients and organic soil content. All trash and debris washed into the restoration areas shall be removed on a regular monthly basis and after all major storm events.

3.8.4 Graffiti, Vandalism and Homeless Encampment Issues

Graffiti problems shall be coordinated with the City Parks staff and shall be addressed immediately. Any vandalism problems shall be addressed immediately with repairs made as quickly as possible to avoid adverse impacts to the restoration/revegetation areas.

Any and all homeless encampments, or illegal/unauthorized use of the restored/revegetated habitat areas, shall be brought to the attention of City officials and shall be dealt with as quickly as possible to avoid adverse impacts to the restoration/revegetation areas. Any areas damaged by homeless activities shall be restored to their previous condition as quickly as possible.

3.9 Post Construction Memorandum and As-Built Plan

At successful completion of the installation and the initial 120-day plant establishment maintenance period, the Biological Monitor shall submit a post construction memorandum/report to the resource agencies (i.e., assumed to be ACOE, RWQCB, and CDFW) documenting the completion of the installation phase, describing and documenting the "as-built" conditions of the restoration project. The report shall include a copy of the reduced set of construction drawings and a figure showing the final "as- built" limits of the revegetation areas. A Global Positioning System (GPS)-generated map shall be produced and submitted documenting the final "as-built" conditions and verifying that the appropriate restoration acreages have been achieved as intended. Photographs shall also be included to document the site at the completion of the installation monitoring period, (i.e., at the end of the initial 120-day maintenance period). The three-year interim maintenance and monitoring period shall begin upon successful completion of the 120-day establishment period, as documented in Sections 4 through 6.

The post construction memorandum/report shall include the following:

A. Date(s) work within waters of the U.S., including wetlands was initiated and completed;

B. Summary of compliance status with each special condition of the ACOE verification including any noncompliance that previously occurred or is currently occurring and corrective actions taken to achieve compliance;

C. Color photographs (including maps of photo points) taken at the project site before and after construction of those aspects directly associated with the impacts to waters of the U.S. such that the extent of the authorized fills can be verified;

D. One copy of the "as-built" drawings for the entire project area;

E. Signed Certification of Compliance form letter (if required by ACOE permit).

4 INTERIM THREE-YEAR MAINTENANCE PROGRAM

The interim three-year maintenance program for the restoration areas shall begin upon the successful completion of the 120-day plant establishment maintenance period and shall last for three years, or until the site has been deemed complete and in compliance with the permit conditions as determined by the resource agencies. The goal of the restoration program is to provide sufficient plant establishment, restoration and enhancement of the revegetation areas so that they can resist erosion and become adequately established and self-sustaining over the long term. Therefore, the primary effort of the maintenance and monitoring program will be in the first few seasons of growth when the control of weeds and promotion of native plant growth is critical. The Maintenance Contractor shall be responsible for periodic weed/exotic species treatment and removals, pest management, trash and debris removals, fence and signage maintenance, adjustments to the irrigation system, replacement of dead container plants, reseeding where necessary and all necessary site maintenance functions during the three-year maintenance and monitoring period.

General maintenance practices are outlined in the sections below.

4.1 General Habitat Maintenance Guidelines

4.1.1 Weeds and Exotic Species Removals and Pest Management

Weeds and exotic/invasive plants are expected to be the primary pest problem in the restoration area during the first few years of establishment. Weeds and exotics shall be controlled so that they will not prevent the establishment of the native species or invade adjacent areas. Weeds and exotics shall be controlled prior to setting seed and shall be removed from the site. The Maintenance Contractor shall control weeds and invasive exotic species within the drainage basin and in the created and enhanced areas on a regular basis. A combination of physical removal and appropriate herbicide treatments shall be used to control the non-native/invasive plant species.

Weeds and non-native grasses shall be adequately controlled during the 120-day plant establishment period to avoid competition with the revegetated species. For the remainder of the interim three-year maintenance and monitoring period, annual weeds will be kept under control (i.e., from less than 20% cover at the end of year 1 to less than 10% cover at the end of years 2–3), so they are not a competitive threat to establishment of the desired native species. Perennial exotic/invasive species shall be 5% or less at the end of year 1 and then 0% during years 2–3.

All perennial, invasive, non-native weeds and exotics will be controlled through a combination of hand removals, as well as herbicide applications, during the interim three-year maintenance and monitoring period. Properly timed, repeat herbicide applications will likely be required to effectively control these species.

All pest infestations, including insects and rodents that are deemed to be at unacceptable levels, as verified by the project biologist, shall be controlled using appropriate environmentally sensitive measures.

4.1.2 Irrigation System Maintenance

The irrigation system shall be checked regularly to ensure proper operation and adequate coverage of the restoration/revegetation areas. Problems with the sprinkler system shall be repaired immediately to reduce potential plant mortality. All broken and/or disrupted systems resulting from annual storm drainage runoff shall be repaired back to working conditions as quickly as possible. The frequency and duration of irrigation applications shall be adjusted seasonally by the maintenance contractor in coordination with the biological monitor to meet habitat needs and to adjust to seasonal conditions. The irrigation system will only be used as necessary during the initial two and one half years of the interim maintenance and monitoring period to supplement natural rainfall and water sources, and will be terminated at the end of that period to ensure that the site is self-sustaining for at least six months during the dry period (i.e., one summer) prior to final sign-off from the resource agencies. All irrigation components serving the restoration areas shall be deactivated by the end of the third year.

4.1.3 Clearing and Trash/Debris Removal

Trash and debris consists of all man-made materials, equipment, or debris dumped, thrown, washed or left within the restoration site. All trash shall be removed by the maintenance contractor during each maintenance visit. Pruning or clearing/thinning of native vegetation in the majority of the site will not be done, unless extensive growth is causing a maintenance problem outside of the restoration area boundaries. Any and all pruning or clearing of native vegetation shall be conducted only after approval by, and coordination with, the biological monitor. Deadwood and leaf litter will be left in place to provide organic matter and help replenish soil nutrients and organic soil content. All trash and debris washed into the restoration areas shall be removed on a regular monthly basis and after all major storm events.

4.1.4 Graffiti, Vandalism and Homeless Encampment Issues

Graffiti problems shall be coordinated with the City Parks staff and shall be addressed immediately. Any vandalism problems shall be addressed immediately with repairs made as quickly as possible to avoid adverse impacts to the restoration/revegetation areas.

Any and all homeless activities, vandalism, or illegal/unauthorized use of the restored/revegetated habitat areas, shall be brought to the attention of City officials and shall be dealt with as quickly as possible to avoid adverse impacts to the restoration/revegetation areas. Any areas damaged by homeless activities and/or vandalism shall be restored to their previous condition as quickly as possible.

4.2 Schedule of Maintenance and Monitoring Inspections

The Biological Monitor will perform quarterly (i.e., four times per year) maintenance inspections during year one of the interim maintenance and monitoring period and then bi-annually (i.e., twice per year) during years 2–3. Recommendations for ongoing maintenance activities and remedial maintenance efforts will be based upon these site inspections. Weed control by the maintenance contractor shall be conducted monthly during the first year of the maintenance and monitoring period, and then bi-monthly (six times per year) during years 2–3 of the maintenance and monitoring period, and as directed by the Biological Monitor.

The City will be responsible for assessing the periodic maintenance needs for the various drainage facilities, including bio-retention areas, storm drain inlet and outlet structures, rip/rap outfall locations, etc., including the need to control wetland vegetation and the need to remove accumulated sediment and debris, as necessary. The City or their designated monitor shall coordinate with the biological monitor to verify that all vegetation and sediment removals remain within the designated limits and abide by permit conditions. It is generally intended that no vegetation removals would occur unless the vegetation is deemed to be interfering with the functionality of the drainage facilities. Any long term removals of vegetation from the restoration areas will need to be approved through subsequent permit authorizations.

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5 MONITORING PROGRAM REQUIREMENTS

Biological monitoring of the wetland restoration site has a two-fold purpose: (1) to monitor the progress of the drainage channel and created/enhanced habitats by assessing quantitative measurements, (i.e., percent native and non-native coverage, measured by transect data collection in Year 3) and through functional analysis against the performance guidelines; and (2) to direct and monitor the maintenance activities through qualitative (visual observation and evaluation) methods and to determine remedial actions that may be required to address project shortcomings, in a manner that ensures that appropriate maintenance occurs in a timely manner. The monitoring shall be performed by a qualified biologist or habitat restoration specialist (i.e., Biological Monitor).

The Biological Monitor shall be responsible for monitoring the activities of the grading contractor and landscape restoration contractor during all grading operations, initial channel construction and during restoration activities, in order to assure compliance with the intended restoration program and in conformance with resource agency permit requirements. The Biological Monitor shall be responsible for monitoring the activities associated with the restoration/revegetation of the drainage channel and created, restored and enhanced wetland restoration areas. This monitoring shall include verification of initial weed control, non-native /exotic species removals, rough grading and finish grading, irrigation installation, container planting, hydroseed application, and monthly monitoring during the 120-day plant establishment/maintenance period. The Biological Monitor shall also provide quarterly monitoring during Year 1 of the maintenance and monitoring period, and then semi-annual monitoring in years two through three, of the three-year maintenance and monitoring period. The Biological Monitor will communicate and co-ordinate with the General Contractor and Landscape Restoration Contractor to assure the timely performance of the project activities. The Biological Monitor shall submit an “As-Built” report within 60 days of completion of the installation period (end of 120-day period), and Annual Reports to the City, ACOE, CDFW and RWQCB each year by the anniversary date of the installation, throughout the three-year monitoring period.

5.1 Performance Standards

The performance standards shown in Tables 8 & 9 are proposed to guide the evaluation of the restoration areas throughout the three-year monitoring period. The primary goal for this project is to establish (i.e., create), re-establish (i.e., restore), enhance and preserve wetland vegetation within the creek channel areas and adjacent transitional slope areas. Therefore, the following revegetation coverage guidelines are used as a gauge to determine whether adequate native plant growth (percentage cover) and weed/exotic control is adequate to allow for the intended plant growth and establishment. The performance guidelines are viewed as interim project objectives designed to achieve the final restoration goals. If restoration efforts fail to meet the performance guidelines in any one year, then the Biological Monitor shall recommend appropriate remedial actions to be implemented the following year to enhance the project to a level of conformance with the original guidelines. Both upland and wetland plant species within the channel bottoms, side slopes and establishment/enhancement areas will be included when estimating and calculating percent native cover.

Table 8
Project Performance Standards [Riparian Woodland and Riparian Scrub Establishment, Restoration and Enhancement Areas]

Year	% Minimum Native Cover**	% Survival of Plantings*	% Max. Allowable Non-Native Weed Cover***	% Bare Ground
1	50	100	5	45
2	60	90	5	35
3	70	90	5	25

* Denotes container planted species, with percentage based upon original planting quantities.
** Percentages based upon absolute cover values from transect data collected in Year 3, visual estimates only in Years 1 and 2.
*** Percentages are for annual weed species. The site shall also remain free of invasive exotic/noxious weed species as identified by the California Invasive Plant Pest Council (Cal IPPC), and shall have 0% cover of noxious species by the end of Year 3.

Table 9
Project Performance Standards
[Brackish Marsh and Salt Marsh Establishment, Restoration and Enhancement Areas]

Year	% Minimum Native Cover**	% Survival of Plantings*	% Max. Allowable Non-Native Weed Cover***	% Bare Ground
1	40	100	5	55
2	50	90	5	45
3	60	90	5	35

* Denotes container planted species, with percentage based upon original planting quantities.
** Percentages based upon absolute cover values from transect data collected in Year 3, visual estimates only in Years 1 and 2.
*** Percentages are for annual weed species. The site shall also remain free of invasive exotic/noxious weed species as identified by the California Invasive Plant Pest Council (Cal IPPC), and shall have 0% cover of noxious species by the end of Year 3.

5.1.1 Plant Survival and Percent Cover

All container plantings shall have 100% survival the first year, 90% at the end of years 2 and 3. The project shall also attain the absolute cover goals for native species after three years, per the habitat types specified. Annual weed species cover shall be held to less than 5% maximum each year through year three. Invasive exotic/noxious weed species as identified by Cal IPPC shall be controlled throughout the three-year period, resulting 0% invasive/exotics/noxious by the end of Year 3.

At the end of the 120-day plant establishment maintenance period after installation, all native container plantings will achieve 100% survival. At the end of year one, the survival rate of container plantings will be 100%, 90% at the end of Years 2 and 3. Native cover will achieve the stated goals by the end of the three year period. By the end of Year 3, annual weeds will make up no more than 5% of the entire cover on site and the site will be free of invasive/exotic plant species such as palms, Pampas grass, fennel, mustard, eucalyptus, giant reed, salt cedar, etc. Performance standards by habitat type are listed in Tables 8 and 9.

5.1.2 General Site Requirements

The following general site characteristics must be met by the end of the three-year maintenance and monitoring period.

Wetland Stream Channel Areas Must Meet All Three Wetland Parameters

The wetland stream channel areas under the jurisdiction of the ACOE, must meet the definition of an ACOE-jurisdictional wetland by the end of the three-year maintenance and monitoring period. Therefore, within the re-establishment/restoration areas subject to the conditions of the Section 401 Water Quality Certification and Section 404 Nationwide Permit a delineation of "waters of the U.S./State," including wetlands, under jurisdiction of the ACOE must be conducted prior to resource agency sign-off from the ACOE, CDFW and RWQCB. The ACOE-jurisdictional wetlands delineation will be conducted in accordance with the *1987 U.S. Army Corps of Engineers Wetland Delineation Manual (*TR Y-87-1*),* if appropriate; hydrology, vegetation, and soils will be examined at the potential wetland sites. Munsell Soil Color Charts will be used to determine soil chroma and value and the indicator status of the plant species will be determined using the *U.S. Fish and Wildlife Service National List of Plant Species that Occur in Wetlands: California (Region 0)*.

Site Must Be Self-Sustaining

The restoration site must be self-sustaining (i.e., able to survive on their own without artificial support) by the end of the three-year maintenance and monitoring period. Determination of whether the restoration site is self-sustaining will be if the temporary irrigation system has been shut-off for at least six months prior to the end of the three-year maintenance and monitoring period and the vegetation shows evidence of natural growth cycles.

Site Must Show Evidence of Natural Recruitment

The restoration site must show evidence of natural recruitment of native wetlands and/or riparian species on site. This means naturally occurring native species colonize the site in addition to the originally planted container plants or applied seed.

Site Must Show Evidence of Wildlife Use

The restoration site must exhibit signs or evidence of wildlife use by the end of the third year of monitoring.

Habitat Contiguity

The restoration site must contain wetland vegetation that is contiguous with adjacent wetland/riparian habitats. Habitat connectivity and appropriate habitat linkages will provide nesting and foraging habitat for wildlife species.

Hydrologic Regime

The restoration site must contain some evidence of natural hydrologic riparian processes such as overbank flow, scour, or deposition (i.e., rack lines).

Micro- and Macro-Topographic Complexity

The restoration site must contain some evidence of micro- and macro-topographic complexity such as pits, ponds, hummocks, bars, rills, rock or boulders, meanders, bars, braiding, secondary channels, backwaters, and terraces. Topographic complexity will provide greater flood flow modification and flood storage functions.

Biogeochemical Processes

The restoration site must contain woody debris, leaf litter, or detritus. Expansion of riparian areas will increase natural water quality functions such as uptake of nutrients and toxicants and sediment trapping.

5.2 Monitoring Schedule

5.2.1 Performance Standard Assessments

The Biological Monitor shall conduct quarterly qualitative monitoring visits (based upon visual analysis) during year 1 and bi-annual (twice/year) monitoring visits during years 2–3, to assess site conditions. The monitor shall assess native plant establishment and health, weed and exotic species establishment, trash and debris issues, channel bank stability, and soil erosion problems. All storm water outfalls shall be qualitatively monitored annually to verify that all trash and debris has been removed and that any erosion problems are identified and addressed accordingly by the City/maintenance contractor. The condition of the drainage outfall, adjacent creek banks, and wetland/riparian habitat shall be included in the annual monitoring report. All erosion problems must be rectified prior to final project sign-off at the end of year three.

5.3 Monitoring Methods

5.3.1 Performance Standard Assessment Methods

Quantitative monitoring (via transect data collection) shall be performed by the Biological Monitor in the fall of Year 3 only, in order to assess percent plant cover. Eight random 25-meter transects shall be established within the channel, and side slopes, with point intercepts recorded at 0.5-meter intervals. Five transects shall be placed in the restoration site inside the stream channel area and three transects shall be placed on the transitional side slopes of the channel.

These transect measurements shall be used to evaluate representative site conditions, and to determine percent cover of native and non-native species. Cover of weeds and exotics shall be determined by visual inspections of the entire restoration site to assure that invasive perennial non-native/exotic plants are not present and/or if present are identified for removal. Monitoring visits should assess compliance with the intended yearly guidelines and the need for re-seeding and/or weeding.

5.4 Annual Monitoring Reports

A year-end biological monitoring report, outlining the results of each year's monitoring surveys, within the on-site restoration areas, shall be submitted to the City, ACOE, RWQCB and CDFW by the end of each year's monitoring period, and as described in the final resource agency permits, based upon the anniversary date of completion of the installation, through the end of the three-year maintenance and monitoring period. The monitoring reports shall describe the current yearly conditions of the site, compare current conditions with the yearly performance guidelines, identify any shortcomings of the restoration program, and recommend remedial measures necessary to help guide the project to a successful completion of the on-site restoration program.

The reports also will include the following:

- A list of names, titles and companies of all persons who prepared the content of the annual report and participated in maintenance and monitoring activities.
- Prints of representative monitoring photographs.
- Maps identifying monitoring areas, transect locations, planting zones, etc. as appropriate.
- Results of all qualitative and quantitative monitoring efforts.

6 COMPLETION OF RESTORATION

6.1 Notification of Completion

When the Applicant/Owner and Biological Monitor believe that the three-year maintenance and monitoring period has been successfully completed, and that the performance standards have been met, they shall then notify the resource agencies (i.e., assumed to be ACOE, RWQCB, and CDFW) upon submitting the final year three biological monitoring report and shall solicit final sign-off and acceptance of the project.

6.2 Agency Confirmation

Following receipt of the final year-end report and request for final sign-off/acceptance from the Applicant/Owner, representatives from the ACOE, RWQCB, and CDFW may request a site visit to confirm the condition of the site and completion of the restoration effort.

Written acceptance and/or concurrence from the agencies shall be solicited in order to signify and document completion of the restoration obligations and permit conditions.

6.3 Contingency Measures

If the performance standards have not been met by the end of Year Three, then the Applicant/Biological Monitor will prepare an analysis of the cause(s) of failure and shall propose remedial actions, if determined necessary, in order to meet the intended goals. If the project cannot meet the performance standards, then the responsible party's maintenance and monitoring obligations will continue until they are met, or alternative contingency measures are negotiated with the resource agencies (i.e., assumed to be ACOE, RWQCB, and CDFW), in order to allow for final project permit compliance/approval, or approval for alternative compensation measures.

6.4 Adaptive Management Plan

An adaptive management approach will be implemented in the event of unforeseen, or probable but unpredictable circumstances. Adaptive management is defined, for the purposes of this restoration project, as a flexible, iterative approach to the long-term management of biological resources that is directed over time by the results of ongoing monitoring activities and direct observation of environmental stressors that are producing adverse results within the restoration site.

Adaptive management will include the utilization of regular qualitative assessments and rapid qualitative assessment data gathered in the field, prior to and/or throughout the monitoring period, to assess the health and vigor of habitat within the restoration site. Following an event that causes damage to all or part of the restoration site, these data will be used in part to drive management considerations for repair of the damaged areas. Achieving the key goals of the restoration program and establishment of self-sustaining native habitats will be the focus of all adaptive management decisions. Individual environmental stressors are discussed below, along with an anticipated range of management responses to correct any damage that may occur to the restoration site.

6.5 Financial Assurances and Adaptive Management

The same funding source available for the installation of the intended restoration project, as established by the Applicant /Owner, will be available for any additional planning, implementation and monitoring of any contingency measures and/or adaptive management measures that may be required and/or necessary to achieve the final restoration goals.

6.6 Long-Term Site Maintenance, Management and Site Protection

After the completion of the three-year maintenance and monitoring period, the restoration site is expected to function as naturally regenerating and self-sustaining native habitat, as part of the Kimball Park open space area, under management of and maintenance by the National City Parks Department (Parks Department). The Parks Department shall regularly patrol and inspect the creek area and shall remove all non-native /exotic vegetation, as well as trash and debris, in order to maintain the area as native wetland habitat in perpetuity. Human intrusion into the native habitat areas shall be monitored and steps taken to correct any problems that may develop over time which could jeopardize the health and sustainability of the restored native habitat areas.

The resources agencies, including ACOE, RWQCB, CDFW, or a designee from any of these agencies shall maintain the right to inspect the restoration site at any time and to inform the City of any conditions requiring amelioration and direct them to maintain vegetation and soils on site in qualitatively similar or better condition to those conditions documented at the end of the three-year maintenance and monitoring period.

The Paradise Creek restoration areas will be maintained and managed consistent with National City's Regional MS4 Permit requirements including the goals, strategies, schedules, monitoring, and assessment identified in the San Diego Bay Watershed Management Area Water Quality Improvement Plan.

7 ACKNOWLEDGMENTS

This report was prepared by Dudek staff members including: John L. Minchin (Habitat Restoration Specialist/Landscape Architect #2225); Lesley Terry (GIS/Graphics Specialist), and Devin Brookhart provided word processing support.

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8 LITERATURE CITED AND REFERENCED

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Rocks, March 2015. *Biological Resources and Jurisdictional Delineation Report for the Paradise Creek Restoration Project*, National City, San Diego County, California. March 2015.

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APPENDIX A

Vascular Plant Species Observed On Site (Per Rocks March 2014 Biological Resources and Jurisdictional Delineation Report)

APPENDIX A
Vascular Plant Species Observed on Site

VASCULAR PLANT SPECIES

ANGIOSPERMAE (DICOTYLEDONES)

AIZOACEAE – CARPET-WEED FAMILY

* *Malophora crocea* var. *crocea* – crocea iceplant

APIACEAE – CARROT FAMILY

* *Foeniculum vulgare* – sweet fennel

ARECACEAE – PALM FAMILY

* *Phoenix dactylifera* – date palm

ASTERACEAE – SUNFLOWER FAMILY

Ambrosia confertilora – weak-leaf bur sage
Ambrosia psilostachya var. *californica* – western ragweed
Jaumea carnosa – salty Susan/fleshy jaumea

BATACEAE – BATIS FAMILY

Batis maritima – saltwort/beach wort

CHENOPODIACEAE – GOOSEFOOT FAMILY

Atriplex prostrata – spearscale
* *Atriplex semibaccata* – Australian saltbush
* *Bassia hyssopifolia* – five-hook bassia
* *Beta vulgaris* – beet
Salorconia pacifica – Pacific pickleweed
* *Salsola australis* – Australian tumbleweed
Suaeda esteroa – estuary sea blight

CONVOLVULACEAE – MORNING GLORY FAMILY

Ciscuta pacifica var. *pacifica* – large flower salt marsh dodder

CYPERACEAE – SEDGE FAMILY

Bolboschoenus maritimus ssp. *paludosus* – prairie bulrush

JUNCAGINACEAE – ARROW GRASS FAMILY

Triglochin concinna var. *concinna* – arrow grass

MALVACEAE – MALLOW FAMILY

* *Malva parviflora*– cheeseweed

ONAGRACEAE – EVENING-PRIMROSE FAMILY

Epilobium ciliatum ssp. *ciliatum* – willow herb

PLANTAGINACEAE – PLANTAIN FAMILY

Plantago lanceolata – English plantain, rib-grass

POACEAE – GRASS FAMILY

* *Cycondon dactylon* – Bermuda grass

Disticlis spicata – Salt grass

POLYGONACEAE – BUCKWHEAT FAMILY

* *Rumex crispus* – curly doc

*signifies introduced (non-native) species

APPENDIX B

Biological Resources and Jurisdictional Delineation Report for the Paradise Creek Restoration Project (Rocks Biological Consulting)

ROCKS
BIOLOGICAL CONSULTING

March 18, 2015

Ms. Karina Fidler
Kimley-Horn
401 B Street, Suite 600
San Diego, CA 92101

Subject: Biological Resources and Jurisdictional Delineation Report for the Paradise Creek Restoration Project, National City, San Diego County, California

Ms. Fidler:

This report presents the results of a biological resources survey and jurisdictional delineation for the Paradise Creek Restoration Project (project). The delineation was conducted to identify areas potentially jurisdictional under U.S. Army Corps of Engineers (USACE) pursuant to Section 404 of the Clean Water Act; the Regional Water Quality Control Board (RWQCB) pursuant to Section 401 of the Clean Water Act and Porter-Cologne Act; and wetland and streambed habitats under California Department of Fish and Wildlife (CDFW) pursuant to Section 1602. This information is necessary to evaluate jurisdictional impacts and permit requirements associated with the project.

PROJECT LOCATION

The project study area consists of a channelized portion of Paradise Creek and immediately adjacent areas within Kimball Park in National City, San Diego County, California (Figures 1 and 2).

The project is located in a highly urbanized area that is surrounded by development, including National City Boulevard to the west, Kimball Park to the north, D Avenue to the east, and East 16th Street to the south. The project area occurs within the U.S. Geological Survey (USGS) 7.5-minute National City quadrangle. Paradise Creek is shown as a blue line stream to the west of the site, but is not mapped as such on the USGS topographical map within the project area.

PROJECT DESCRIPTION

The City of National City was awarded a Proposition 84 Stormwater Grant to retrofit a highly urbanized area with Low Impact Development (LID) and restore an adjacent concrete-lined segment of Paradise Creek. The project will include two water quality bioretention areas. One bioretention area will be approximately 1,800 square feet and the second bioretention area will be 11,235 square feet. The wetland will be located within Kimball Park to treat run-on before reaching Paradise Creek. Concrete will be removed from approximately 1,050 linear feet of Paradise Creek in Kimball Park, improving creek habitat. A storm drain bringing flow from a 68 acre drainage area to the south will be diverted to the constructed bioretention areas. Retaining walls may be built along the property line between the publicly owned slope and the neighboring houses to allow for the area devoted to bioretention to be maximized.

5101 SEPTEMBER STREET ● SAN DIEGO, CA 92110-1118
(619) 843-6640 ● JIM@ROCKSBIO.COM

REGULATORY BACKGROUND

Several regulations have been established by federal, state, and local agencies to protect and conserve biological resources. The descriptions below provide a brief overview of agency regulations that may be applicable to the project. The final determination of whether permits are required is made by the regulating agencies.

BIOLOGICAL RESOURCE PROTECTION REGULATIONS

- Federal Endangered Species Act
- Migratory Bird Treaty Act
- Fish and Wildlife Coordination Act
- California Endangered Species Act and Natural Community Conservation Planning Act
- California Coastal Act
- California Environmental Quality Act

WETLAND RESOURCE PROTECTION REGULATIONS

Rivers and Harbors Act of 1899

The Rivers and Harbors Act of 1899 prohibits discharge of any material into navigable waters, or tributaries thereof, of the United States without a permit. The act also makes it a misdemeanor to excavate, fill, or alter the course, condition, or capacity of any port, harbor, or channel; or to dam navigable streams without a permit.

Many activities originally covered by the Rivers and Harbors Act are now regulated under the Clean Water Act of 1972, discussed below. However, the 1899 Act retains relevance and created the structure under which the U.S. Army Corps of Engineers oversees Clean Water Act 404 permitting.

Clean Water Act

Pursuant to Section 404 of the Clean Water Act (CWA), the USACE is authorized to regulate any activity that would result in the discharge of dredged or fill material into waters of the U.S. (including wetlands), which include those waters listed in 33 CFR 328.3. USACE, with oversight from the U.S. Environmental Protection Agency (USEPA), has the principal authority to issue CWA Section 404 permits.

A water quality certification or waiver pursuant to Section 401 of the CWA is required for all Section 404 permitted actions. The RWQCB, a division of the State Water Resources Control Board, provides oversight of the 401-permit process in California. The RWQCB is required to provide "certification that there is reasonable assurance that an activity that may result in the discharge to waters of the United States will not violate water quality standards." Water Quality Certification must be based on the finding that proposed discharge will comply with applicable water quality standards.

The National Pollutant Discharge Elimination System (NPDES) is the permitting program for discharge of pollutants into surface waters of the U.S. under Section 402 of the CWA. Substantial impacts to wetlands may require an Individual Permit. Projects that only minimally affect wetlands may meet the conditions of one of the existing Nationwide Permits.

California Fish and Game Code Sections 1600-1602

Pursuant to Division 2, Chapter 6, Section 1602 of the California Fish and Game Code (CFGC), CDFW regulates all diversions, obstructions, or changes to the natural flow or bed, channel or bank of any river, stream or lake that supports fish or wildlife. A Lake or Streambed Alteration Agreement Application (SAA) must be submitted to CDFW for "any activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake." CDFW has jurisdiction over riparian habitats associated with watercourses. Jurisdictional waters are delineated by the outer edge of riparian vegetation or at the top of the bank of streams or lakes, whichever is wider. CDFW jurisdiction does not include tidal areas or isolated resources. CDFW reviews the proposed actions and, if necessary, submits (to the applicant) a proposal that includes measures to protect affected fish and wildlife resources. The final proposal that is mutually agreed upon by CDFW and applicant is the Lake or Streambed Alteration Agreement.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Water Code Section 13000 et seq.) provides for statewide coordination of water quality regulations. The state Water Resources Control Board was established as the statewide authority and nine separate RWQCBs were developed to oversee water quality on a day-to-day basis.

The RWQCB is the primary agency responsible for protecting water quality in California. As discussed above, the RWQCB regulates discharges to surface waters under the federal CWA. In addition, the RWQCB is responsible for administering the California Porter-Cologne Water Quality Control Act.

Pursuant to the Porter-Cologne Water Quality Control Act, the state is given authority to regulate waters of the state, which are defined as any surface water or groundwater, including saline waters. As such, any person proposing to discharge waste into a water body that could affect its water quality must first file a *Report of Waste Discharge* if Section 404 is not required for the activity. "Waste" is partially defined as any waste substance associated with human habitation, including fill material discharged into water bodies.

METHODS

Prior to the biological survey, field maps were created using a Geographic Information System (GIS) and incorporating relevant data including a color aerial photograph at a 1:100 scale and the CDFW California Natural Diversity Database (CNDDB) information within one mile of the project site. General surveys were conducted for plants, animals, and habitats that are considered sensitive according to the United States Fish and Wildlife Service (USFWS), California Native Plant Society (CNPS), and/or the CNDDB. USGS topographic maps were also analyzed to determine the locations of potential areas of jurisdiction. Rocks Biological Consulting (RBC) biologists Jim Rocks and Lee Ripma conducted the biological resources survey, vegetation mapping, and jurisdictional delineation on November 10, 2014. Vegetation community classifications follow Holland (1986) as modified by Oberbauer et al. (2008); plant names follow Simpson and Rebman (2014); wildlife names follow CDFW (2014). The survey was conducted in the fall from the morning to early afternoon in warm weather (68-75F). As such, faunal activity at the time was moderate and annual plant species would not have been observable.

Potentially jurisdictional features within the project area were evaluated for the presence of a definable channel and/or wetland vegetation, soils, and hydrology. Note that goal of the jurisdictional determination was to define the outer limits of jurisdiction so that other areas of the project could be designed/engineered. Potential wetland areas on the site were examined using the methods set forth in the U.S. Army Corps of Engineers 1987 Wetland Delineation Manual (Wetland Manual) (Environmental Laboratory 1987) and the 2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region Version 2.0 (Arid West Supplement) (USACE 2008). Lateral limits of non-wetland waters of the U.S. (WUS) were identified using field indicators of an Ordinary High Water Mark (OHWM) (USACE 2008). All areas with depressions, drainage channels, or wetland vegetation were evaluated for the presence of WUS. Areas were mapped as wetlands, non-wetland WUS, or uplands. CDFW jurisdictional boundaries were determined based on the presence of riparian vegetation or regular surface flow (hydrology indicators). Streambeds within CDFW jurisdiction were delineated based on the definition of streambed as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supporting fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports riparian vegetation" (Title 14, Section 1.72). Riparian habitat refers to vegetation and habitat associated with a stream. The CDFW jurisdictional habitat includes all riparian shrub or tree canopy that may extend beyond the banks of a stream.

While in the field, potentially jurisdictional features were recorded on a 1:100 scale aerial photograph using visible landmarks and were mapped using a hand-held Global Positioning Satellite (GPS) unit. Plants were identified according to The Jepson Manual 2nd edition (Baldwin et al. 2012). Wetland affiliations of plant species follow the U.S. Department of Agriculture (USDA) Wetland Indictor Plant List (USDA 2014). Soil chromas were identified according to Munsell's Soil Color Charts (Kollmorgen 2000).

RESULTS

Within Kimball Park, the approximately 1,080 foot long section of Paradise Creek (creek) is highly degraded waterway that consists of a concrete-lined channel. The creek is tidally influenced and at low-tide conveys freshwater flows from southeast to northwest through Kimball Park and flows the opposite direction when tidal push is sufficient. The field survey was conducted at high tide and the tidal pulse from northwest to southeast was clearly evident at high tide.

USACE, RWQCB, and CDFW jurisdictional areas, are present within the survey area. Elevations on-site range from approximately 10 to 40 feet above mean sea level.

PLANTS

Due to its small size and degraded condition, the project site supports low plant species diversity. Approximately 24 plant species were observed within the project area, many of which are non-native. A comprehensive list of plant species that were observed is included as an attachment to this letter report. One special status plant species, estuary sea-blite (*Suaeda esteroa*) was observed in small patches within the southern coastal salt marsh habitat that is immediately adjacent to the creek.

WILDLIFE

The project site supports a moderate level of diversity of wildlife in spite of the degraded nature of the site. The presence of perennial water, patches of native habitat, and adjacent open areas along Paradise Creek provide some wildlife habitat value. Ten bird species, two butterflies, and one fish were observed on the project site.

SPECIAL STATUS BIOLOGICAL RESOURCES

Special status biological resources are those defined as follows: 1) Species that have been given special recognition by federal, state, or local conservation agencies and organizations due to limited, declining, or threatened/endangered population sizes; 2) Species and habitat types recognized by local and regional resource agencies as sensitive; 3) Habitat areas or vegetation communities that are unique, are of relatively limited distribution, or are of particular value to wildlife; 4) Wildlife corridors and habitat linkages; and/or 5) Biological resources that may or may not be considered sensitive, but are regulated under local, state, and/or federal laws.

For the purposes of this report, species are considered to have special status if they meet one or more of the following criteria:

- Listed under the federal or state Endangered Species Act (CDFW 2014; USFWS 2014).
- USFWS Birds of Conservation Concern (USFWS 2014)
- CDFW Special Animals List (CDFW 2014)
- CDFW Species of Special Concern (CDFW 2014).
- CDFW Fully Protected Species (CDFW 2014).
- Covered as a state protected furbearing mammal (California Code of Regulations [14 CCR Section 460]).
- Listed as having a California Rare Plant Rank (CRPR; formerly CNPS List, CNPS 2014).

One special status plant species, estuary sea-blite (*Suaeda esteroa),* and one special status habitat, southern coastal salt marsh, were observed within the project site during the field survey. No special status wildlife species were observed.

Based on the review of the CNDDB records, the field survey, and knowledge of local biological resources, one additional special status plant species and six special status wildlife species have a low potential to occur within the project site. No special status species were deemed to have a moderate or high potential to occur within the project. The 17 special status species that were evaluated for their potential to occur within the project area are presented and discussed in Table 1. Locations of the observed estuary sea-blite are presented in Figure 2. Status explanations are presented in Table 2.

Table 1. Special Status Species - Potential For Occurrence

Species Name	Status	Habitat Description*	Potential to Occur
Plants			
San Diego thornmint *(Acanthomintha ilicifolia)*	FT SE CRPR 1B.1	Annual herb. Blooms Apr-Jun. Clay soils associated with vernal pools in chaparral, coastal sage scrub, and grassland. Elev 30-3,150ft.	None. Suitable clay soils not present.
San Diego ambrosia *(Ambrosia pumila)*	FE CRPR 1B.1	Rhizomatous herb. Blooms Apr-Oct. Often in disturbed areas with sandy loam or clay soils, or sometimes in alkaline areas, within chaparral, coastal sage scrub, grassland, and vernal pools. Elev 65-1,365ft.	None. Marginally suitable alkaline areas do not contain the habitat constituent elements to support San Diego ambrosia. This species would have been observed if present.
Palmer's frankenia *(Frankenia palmeri)*	CRPR 2B.1	Stem succulent. Blooms May-Jun. Chaparral, coastal sage scrub, grassland, and vernal pools. Elev 10-1,480ft.	None. Suitable habitat is limited within the project area and this species would have been observed if present.
decumbent goldenbush *(Isocoma menziesii* var. *decumbens)*	CRPR 1B.2	Shrub. Blooms Apr-Nov. Sandy, often disturbed, areas in chaparral and coastal sage scrub. Elev 30-445ft.	None. Suitable habitat limited within the project area and this species would have been observed if present.
Coulter's goldfields *(Lasthenia glabrata* ssp. *coulteri)*	CRPR 1B.1	Annual herb. Blooms Feb-Jun. Coastal salt marsh, playas, vernal pools. Elev 3-4,005ft.	Low. Marginally suitable alkaline areas do not contain the habitat constituent elements to support Coulter's goldfields.
spreading navarretia *(Navarretia fossalis)*	FT CRPR 1B.1	Annual herb. Blooms Apr-Jun. Shallow freshwater associated with marshes, playas, vernal pools, and chenopod scrub. Elev 95-2,150ft.	None. Suitable clay soils not present.
coast woolly-heads *(Nemacaulis denudata* var. *denudata)*	CRPR 1B.2	Annual herb. Blooms Apr-Sep. Coastal dunes. Elev 0-330ft.	None. Species restricted to immediate coast. No suitable habitat present.
oil neststraw *(Stylocline citroleum)*	CRPR 1B.1	Clay soil in chenopod scrub, coastal scrub, and grassland. Blooms Mar-Apr. Elev 150-1200ft.	None. Suitable clay soils not present.
estuary sea-blite (*Suaeda esteroa*)	CRPR 1B.2	Perennial herb. Blooms May-Oct. Coastal salt marsh. Elev 0-20ft.	Present. Several occurrences along the

Species Name	Status	Habitat Description*	Potential to Occur
			Coastal Salt Marsh of Paradise Creek.
Invertebrates			
western tidal-flat tiger beetle (*Cicindela gabbii*)	CDFW: Special Animals List	Open wet saline soils with sparse vegetation such as estuaries, tidal mud flats, salt marshes, and beaches.	Low. Suitable coastal salt marsh habitat is present but degraded and inland from coast.
western beach tiger beetle (*Cicindela latesignata latesignata*)	CDFW: Special Animals List	Coastal salt marshes and mud flats.	Low. Suitable coastal salt marsh habitat is present but degraded and inland from coast.
Reptiles and Amphibians			
orange-throated whiptail *(Aspidoscelis hyperythra beldingi)*	CDFW: Species of Special Concern	A variety of habitats including sage scrub, chaparral, and coniferous and broadleaf woodlands. Found on sandy or friable soils with open scrub.	Low. Moderately suitable habitat present but project site is surrounded by development and lacks native scrub habitats.
Birds			
burrowing owl *(Athene cunicularia)*	USFWS: BCC CDFW: Species of Special Concern (nesting)	Found mainly in grassland and open scrub from the coast to foothills. Strongly associated with California ground squirrel (Otospermophilus beecheyi) and other fossorial mammal burrows.	None. Suitable habitat not present within the project area, no ground squirrels or burrows observed.
Belding's savannah sparrow *(Passerculus sandwichensis beldingi)*	CDFW: Endangered	Year round resident of pickleweed dominated coastal salt marsh in southern California.	Low. Fragmented suitable habitat present but area is not large enough to support breeding. Not observed during site visit.
light-footed clapper rail (*Rallus longirostris levipes)*	USFWS: Endangered CDFW: Endangered, Fully Protected	Found in southern California in coastal salt marshes, especially those dominated by cordgrass. The Tijuana River estuary is an especially important site.	Low. Fragmented suitable habitat present but area is not large enough to support breeding. Not detected during site visit.
Mammals			
San Diego black-tailed jackrabbit *(Lepus californicus bennettii)*	CDFW: Species of Special Concern	Typical habitats include early stages of chaparral, open coastal sage scrub, and grasslands near the edges of brush.	Low. Suitable large foraging areas with native shrubs and grasses not present.

Table 2. California Rare Plant Rank (CRPR) Definitions.

California Rare Plant Rank (CRPR)	1A	presumed extirpated in California and rare or extinct elsewhere
	1B	rare, threatened, or endangered in California and elsewhere
	2A	presumed extirpated in California but more common elsewhere
	2B	rare, threatened, or endangered in California but more common elsewhere
	3	plants for which more information needed
	4	plants of limited distribution
CRPR Threat Ranks	0.1	Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
	0.2	Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
	0.3	Not very threatened in California (<20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

JURISDICTIONAL HABITATS

Coastal Brackish Marsh – Disturbed

Coastal brackish marsh is dominated by perennial, emergent, herbaceous monocots to 5 feet tall. This community is similar to both salt marshes and freshwater marshes with some plants characteristic of each. The concrete lined creek channel supports an assemblage of salt-tolerant species that can persist in an impervious substrate with limited soil. These include prairie bulrush (*Bolboschoenus maritimus* subsp. *paludosus*), salty Susan (*Jaumea carnosa*), willow herb (*Epilobium ciliatum* ssp. *ciliatum*), and English plantain (*Plantago lanceolata*).

Southern Coastal Salt Marsh – High

Coastal salt marsh is a highly productive association of herbaceous and suffrutescent, salt-tolerant hydrophytes that form a moderate to dense cover and can reach a height of up to 3 feet. Most species grow and flower in summer and are dormant in winter (Holland 1986). Coastal salt marsh-high is segregated horizontally from mid and low coastal salt marsh associations based on the shorter duration of tidal inundation. This community contains a more diverse mixture of species due to a weaker brackish water influence and drier conditions. Species present include pacific pickleweed (*Salicornia pacifica*), estuary sea-blite (*Suaeda esteroa*), saltwort (*Batis maritima*), salt grass (*Distichlis spicata*), spearscale (*Atriplex prostrata*), and arrow grass (*Triglochin concinna* var. *concinna*).

Disturbed Habitat

Disturbed habitats typically include areas that have been previously disturbed by vegetation clearing, development, or agricultural activities. This vegetation community has very little vegetation cover due to a history of disturbance in the southwest corner. Developed habitats associated with the drainage on site are considered jurisdictional habitats due to a tidal influence, as indicated by a salt crust.

Ornamental

Ornamental vegetation typically consists of non-native landscape and/or garden species that are planted in association with buildings, roads, and developments or have escaped cultivation and occur within native habitats. San Diego County supports a wide variety of ornamental trees and shrubs, as well as herbs that decorate urban areas. Ornamental vegetation that grows in association with riparian areas may be jurisdictional by CDFW. One such date palm (*Phoenix dactylifera*) is growing next to the concrete channel south of the pedestrian bridge.

JURISDICTIONAL HABITAT SUMMARY

The project area supports 0.446 acre USACE jurisdictional wetlands (1,080 linear feet) and 0.452 acre CDFW jurisdictional wetland. Jurisdictional habitat areas are detailed in Tables 3 and 4, below.

Table 3. Potential USACE Jurisdictional Areas with the Project Site

Habitat Type	Square Feet On-Site (Acres)
Coastal Brackish Marsh - Disturbed	13,613 (0.313)
Southern Coastal Salt Marsh - High	4,488 (0.103)
Disturbed Habitat	1,347 (0.031)
Total	**19,448 (0.447)**

Table 4. Potential CDFW Jurisdictional Areas with the Project Site

Habitat Type	Area On-Site (Square Feet)
Brackish Channel - Disturbed	13,613 (0.313)
Coastal Salt Marsh - High	4,488 (0.103)
Disturbed Habitat	1,347 (0.031)
Ornamental	240 (0.006)
Total	**19,688 (0.452)**

NON-JURISDICTIONAL HABITATS

The results of vegetation mapping are presented in Figure 2. One non-jurisdictional area, developed land, was observed within the project survey area.

Developed

Developed lands within the project area include areas that were cleared of natural vegetation to build Kimball Park; little or no natural habitat remains. This area is now dominated by planted turf grasses such as Bermuda grass (*Cynodon dactylon*) and contains a variety of variety of ornamental trees. Other ornamental grasses and weeds such as ripgut brome (*Bromus diandrus*), five-hook bassia (*Bassia hyssopifolia*), fennel (*Foeniculum vulgare*), and Russian thistle (*Salsola australis*) are also present.

CONCLUSION

The Paradise Creek Restoration Project area contains one special status plant species, estuary sea-blite, and one special status habitat, Southern Coastal Salt Marsh. Restoration efforts in this area will increase the extent of Southern Coastal Salt Marsh and habitat for the estuary sea-blite and therefore the temporary impacts on this habitat and species would be less than significant. The project area has low potential to support additional special status plant and wildlife species. In addition, the project area supports 0.447 acre USACE jurisdictional wetlands and 0.452 acre CDFW jurisdictional wetland. If the entire creek is impacted during restoration activities the impacts will be within the limits for a Section 404 Nationwide permit from the USACE, and the project would likely qualify under Nationwide Permit 27 Aquatic Habitat Restoration, Establishment, and Enhancement Activities. In addition, a SAA agreement from CDFW and Section 401 water quality certification from RWQCB would be required prior to restoration activities.

Please don't hesitate to contact me at (619) 843-6560 if you have any questions regarding this letter report or need additional information.

Sincerely,

Jim Rocks
Principal Biologist

Lee Ripma
Senior Biologist

Enclosures: Figures 1-2
Site Photographs
Plant List
Wildlife List
Wetland Delineation Field Forms

FIGURE 1

Jurisdictional Delineation

PARADISE CREEK

ROCKS BIOLOGICAL CONSULTING

FIGURE 2 Vegetation Communities

PARADISE CREEK

Paradise Creek Restoration Project Site Photographs
November 10, 2014

Photo 1: Overview of Paradise Creek looking from the pedestrian bridge to the bridge overpass culvert where the restoration site begins. Northwest facing. November 10, 2014.

Photo 2: The far northwestern end of Paradise Creek. The Paradise Creek restoration area begins at the bridge overpass culvert. Northwest facing. November 10, 2014.

Photo 3: The disturbed road area adjacent to concrete lined Paradise Creek has a tidal influence as indicated by the salt-crust. November 10, 2014.

Photo 4: The far northwestern end of Paradise Creek looking southeast towards the pedestrian bridge. Paradise Creek has a tidal influence as indicated by halophytes such as Pickleweed (*Salicornia pacifica*). Southeast facing. November 10, 2014.

Photo 5: Overview of Paradise Creek from the pedestrian bridge showing the concrete lined channel. Southeast facing. November 10, 2014.

Photo 6: Overview of Paradise Creek concrete lined channel southeast of the pedestrian bridge. Wetland vegetation is confined to the concrete channel. Southeast facing. November 10, 2014.

Photo 7: Overview of Paradise Creek concrete lined channel near the southeastern end of the site. Wetland vegetation is confined to the concrete channel. Southeast facing. November 10, 2014.

Photo 8: The triple culvert at the far southeastern end of the site is the end of Paradise Creek restoration area. Southeast facing. November 10, 2014.

PARADISE CREEK RESTORATION PROJECT PLANT LIST

NOVEMBER 10, 2014

Family	Scientific Name	Common Name
Aizoaceae	**Malephora crocea* var. *crocea*	Crocea Iceplant
Apiaceae	**Foeniculum vulgare*	Sweet Fennel
Arecaceae	**Phoenix dactylifera*	Date Palm
Asteraceae	*Ambrosia confertiflora*	Weak-leaf Bur-sage
Asteraceae	*Ambrosia psilostachya*	Western Ragweed
Asteraceae	*Jaumea carnosa*	Salty Susan, Fleshy Jaumea
Bataceae	*Batis maritima*	Saltwort, Beachwort
Chenopodiaceae	*Atriplex prostrata*	Spearscale
Chenopodiaceae	**Atriplex semibaccata*	Australian Saltbush
Chenopodiaceae	**Bassia hyssopifolia*	Five-Hook Bassia
Chenopodiaceae	**Beta vulgaris*	Beet
Chenopodiaceae	*Salicornia pacifica*	Pacific Pickleweed
Chenopodiaceae	**Salsola australis*	Australian Tumbleweed
Chenopodiaceae	**Suaeda esteroa* (CRPR 1B.2)	Estuary Seablite
Convolvulaceae	*Cuscuta pacifica* var. *pacifica*	Large-Flower Saltmarsh Dodder
Cyperaceae	*Bolboschoenus maritimus* ssp. *paludosus*	Prairie Bulrush
Juncaginaceae	*Triglochin concinna* var. *concinna*	Arrow Grass
Malvaceae	**Malva parviflora*	Cheeseweed
Onagraceae	*Epilobium ciliatum* ssp. *ciliatum*	Willow Herb
Plantaginaceae	**Plantago lanceolata*	English Plantain, Rib-Grass
Poaceae	**Bromus diandrus*	Ripgut Grass
Poaceae	**Cynodon dactylon*	Bermuda Grass
Poaceae	*Distichlis spicata*	Saltgrass
Polygonaceae	**Rumex crispus*	Curly Dock

Nomenclature from Baldwin (2012), Simpson and Rebman (2014)
* Non-native species

PARADISE CREEK RESTORATION PROJECT PLANT LIST

NOVEMBER 10, 2014

BIRDS

Common Name	Scientific Name
American crow	*Corvus brachyrhynchos*
American pipit	*Anthus rubescens*
black phoebe	*Sayornis nigricans*
Cassin’s kingbird	*Tyrannus vociferans*
hermit thrush	*Catharus guttatus*
lesser goldfinch	*Spinus psaltria*
mallard	*Anas platyrhynchos*
snowy egret	*Egretta thula*
white-crowned sparrow	*Zonotrichia leucophrys*
yellow-rumped warbler	*Setophaga coronata*

BUTTERFLIES

Dainty Sulphur	*Nathalis iole*
Western Pygmy-Blue	*Brephidium exilis*

FISH

Mosquitofish	*Gambusia affinis*

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Paradise Creek City/County: National City, San Diego Co. Sampling Date: 11/10/14

Applicant/Owner: State: CA Sampling Point: Pit 1

Investigator(s): Lee Ripma and Jim Rocks Section, Township, Range:

Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Slope (%):

Subregion (LRR): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ○ No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ○ No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ●	No ○
Hydric Soil Present?	Yes ●	No ○
Wetland Hydrology Present?	Yes ●	No ○

Is the Sampled Area within a Wetland? Yes ● No ○

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Salicornia pacifica*	90	Yes	OBL
2. *Suaeda nigra*	2	Yes	OBL
3. *Batis maritima*	1	Yes	OBL
4. *Malephora crocea*	1	Yes	FACU
5.			
6.			
7.			
8.			
Total Cover:	94 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75.0 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	93	x 1 =	93
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species	1	x 4 =	4
UPL species		x 5 =	0
Column Totals:	94 (A)		97 (B)

Prevalence Index = B/A = 1.03

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ● No ○

Remarks:

SOIL

Sampling Point: Pit 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-2	10YR 2/1	100					Sandy clay loam	
2-6	10YR 2/2	100					Sandy clay loam	
6-9	10YR3/1	100					Sand	
9-15	10YR3/2	100					Sandy clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☒ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ○ Depth (inches):

Water Table Present? Yes ○ No ○ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ○ Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Area appears to be subject to tidal influence, at high tide 15 inch pit did not hit water table, but tide is pushing water east at high tide and plants indicate saline influence.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Paradise Creek　City/County: National City, San Diego Co.　Sampling Date: 11/10/14

Applicant/Owner: 　State: CA　Sampling Point: Pit 2

Investigator(s): Lee Ripma and Jim Rocks　Section, Township, Range:

Landform (hillslope, terrace, etc.): 　Local relief (concave, convex, none): 　Slope (%):

Subregion (LRR): 　Lat: 　Long: 　Datum:

Soil Map Unit Name: 　NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ◯ No ◯ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◯ No ◯

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◯	No ◉	
Hydric Soil Present?	Yes ◯	No ◉	Is the Sampled Area
Wetland Hydrology Present?	Yes ◯	No ◉	within a Wetland? Yes ◯ No ◉

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Foeniculum vulgare*	10	Yes	Not Listed
2. *Bromus diandrus*	40	Yes	Not Listed
3. *Cynodon dactylon*	1	No	Not Listed
4. *Festuca perennis*	1	No	FAC
5.			
6.			
7.			
8.			
Total Cover:	52 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ %　% Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	1	x 3 =	3
FACU species		x 4 =	0
UPL species	51	x 5 =	255
Column Totals:	52 (A)		258 (B)

Prevalence Index = B/A = 4.96

Hydrophytic Vegetation Indicators:

- ◯ Dominance Test is >50%
- ◯ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ◯ No ◉

Remarks: Disturbed path has salt crust and is considered jurisdictional, this pit is above the grade of this disturbed path and is outside of the jurisdictional area.

SOIL

Sampling Point: Pit 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-12	10YR 3/2	100					Sandy loam	Hit fill at 12 inches

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks: None.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ○ Depth (inches):

Water Table Present? Yes ○ No ○ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ○ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: None.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Paradise Creek   City/County: National City, San Diego Co.   Sampling Date: 11/10/14

Applicant/Owner: State: CA   Sampling Point: Pit 3

Investigator(s): Lee Ripma and Jim Rocks   Section, Township, Range:

Landform (hillslope, terrace, etc.):   Local relief (concave, convex, none):   Slope (%):

Subregion (LRR):   Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ○ No ○ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed?   Are "Normal Circumstances" present? Yes ○ No ○

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic?   (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ●	No ○
Hydric Soil Present?	Yes ●	No ○
Wetland Hydrology Present?	Yes ●	No ○

Is the Sampled Area within a Wetland? Yes ● No ○

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Foeniculum vulgare*	5	No	Not Listed
2. *Bromus diandrus*	5	No	Not Listed
3. *Distichlis spicata*	60	Yes	FAC
4. *Festuca perennis*	1	No	FAC
5. *Atriplex semibaccata*	29	Yes	FAC
6.			
7.			
8.			
Total Cover:	100%		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ %   % Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species	90	x 3 =	270
FACU species		x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	100 (A)		320 (B)

Prevalence Index = B/A = 3.20

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ● No ○

Remarks: Pit 1 foot above channel grade.

SOIL

Sampling Point: Pit 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-16	10YR 2/1	100					Sandy clay loam	Soil moist from channel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks: Does not have a hydric soil indicator from above list, however soil is wet from the channel and the tidal influence, considered hydric.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ○	Depth (inches):
Water Table Present?	Yes ○	No ○	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ○	No ○	Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Tidal influence, salty soil moist from channel.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Paradise Creek City/County: National City, San Diego Co. Sampling Date: 11/10/14

Applicant/Owner: State: CA Sampling Point: Pit 4

Investigator(s): Lee Ripma and Jim Rocks Section, Township, Range:

Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Slope (%):

Subregion (LRR): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ◯ No ◯ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◯ No ◯

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◯	No ◉
Hydric Soil Present?	Yes ◯	No ◉
Wetland Hydrology Present?	Yes ◯	No ◉

Is the Sampled Area within a Wetland? Yes ◯ No ◉

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Foeniculum vulgare*	5	No	Not Listed
2. *Cynodon dactylon*	80	Yes	FACU
3. *Ambrosia psilostachya*	3	No	FACU
4.			
5.			
6.			
7.			
8.			
Total Cover:	88 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum % % Cover of Biotic Crust %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species	83	x 4 =	332
UPL species	5	x 5 =	25
Column Totals:	88 (A)		357 (B)

Prevalence Index = B/A = 4.06

Hydrophytic Vegetation Indicators:

- ◯ Dominance Test is >50%
- ◯ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ◯ No ◉

Remarks: Adjacent to concrete edge of channel.

SOIL

Sampling Point: Pit 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-16	10YR 3/3	100					Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks: Adjacent to channel, no hydric soil indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ○ Depth (inches):

Water Table Present? Yes ○ No ○ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ○ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No hydrology.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Paradise Creek   City/County: National City, San Diego Co.   Sampling Date: 11/10/14

Applicant/Owner: State: CA   Sampling Point: Pit 5

Investigator(s): Lee Ripma and Jim Rocks   Section, Township, Range:

Landform (hillslope, terrace, etc.):   Local relief (concave, convex, none):   Slope (%):

Subregion (LRR):   Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ◯ No ◯ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◯ No ◯

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉	No ◯
Hydric Soil Present?	Yes ◉	No ◯
Wetland Hydrology Present?	Yes ◉	No ◯

Is the Sampled Area within a Wetland? Yes ◉ No ◯

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Salicornia pacifica*	50	Yes	OBL
2. *Suaeda nigra*	10	No	OBL
3. *Batis maritima*	5	No	OBL
4. *Disticalis spicata*	5	No	FAC
5. *Triglochin concinna*	30	Yes	OBL
6.			
7.			
8.			
Total Cover:	100%		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ___ %   % Cover of Biotic Crust ___ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	95	x 1 =	95
FACW species		x 2 =	0
FAC species	5	x 3 =	15
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	100 (A)		110 (B)

Prevalence Index = B/A = 1.10

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ◉ No ◯

Remarks:

SOIL

Sampling Point: Pit 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-16	10YR 2/1	100					Silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks: Low chroma saturated soils.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ○	Depth (inches):
Water Table Present?	Yes ○	No ○	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 8

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Area appears to be subject to tidal influence, saturation at 8 inches

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Paradise Creek City/County: National City, San Diego Co. Sampling Date: 11/10/14

Applicant/Owner: State: CA Sampling Point: Pit 6

Investigator(s): Lee Ripma and Jim Rocks Section, Township, Range:

Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Slope (%):

Subregion (LRR): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ◯ No ◯ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◯ No ◯

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◯	No ◉
Hydric Soil Present?	Yes ◯	No ◉
Wetland Hydrology Present?	Yes ◯	No ◉

Is the Sampled Area within a Wetland? Yes ◯ No ◉

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Salicornia pacifica*	10	Yes	OBL
2. *Oxalis pres-capre*	1	Yes	Not Listed
3. *Cynodon dactalon*	20	Yes	FACU
4. *Distichlis spicata*	20	No	FAC
5.			
6.			
7.			
8.			
Total Cover:	51 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species		x 2 =	0
FAC species	20	x 3 =	60
FACU species	20	x 4 =	80
UPL species	1	x 5 =	5
Column Totals:	51 (A)		155 (B)

Prevalence Index = B/A = 3.04

Hydrophytic Vegetation Indicators:

- ◯ Dominance Test is >50%
- ◯ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ◯ No ◉

Remarks: Just above tidal influence as indicated by Salicornia pacifica.

SOIL

Sampling Point: Pit 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-12	10YR 3/2	100					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5) (**LRR C**)
- [ ] 1 cm Muck (A9) (**LRR D**)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- [ ] 1 cm Muck (A9) (**LRR C**)
- [ ] 2 cm Muck (A10) (**LRR B**)
- [ ] Reduced Vertic (F18)
- [ ] Red Parent Material (TF2)
- [ ] Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ◯ No ◉

Remarks: None.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1) (**Nonriverine**)
- [ ] Sediment Deposits (B2) (**Nonriverine**)
- [ ] Drift Deposits (B3) (**Nonriverine**)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Salt Crust (B11)
- [ ] Biotic Crust (B12)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Plowed Soils (C6)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water Marks (B1) (**Riverine**)
- [ ] Sediment Deposits (B2) (**Riverine**)
- [ ] Drift Deposits (B3) (**Riverine**)
- [ ] Drainage Patterns (B10)
- [ ] Dry-Season Water Table (C2)
- [ ] Thin Muck Surface (C7)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ◯ No ◯ Depth (inches):

Water Table Present? Yes ◯ No ◯ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ◯ No ◯ Depth (inches):

Wetland Hydrology Present? Yes ◯ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: None.