COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

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IN REPLY PLEASE
REFER TO FILE: WM-7

June 26, 2014

Mr. Samuel Unger, P.E.
Executive Officer
California Regional Water Quality
Control Board – Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

Attention Ms. Renee Purdy

Dear Mr. Unger:

SUBMITTAL OF ENHANCED WATERSHED MANAGEMENT PROGRAM WORK PLAN AND COORDINATED INTEGRATED MONITORING PROGRAM PLAN FOR THE MARINA DEL REY ENHANCED WATERSHED MANAGEMENT PROGRAM GROUP

The County of Los Angeles, Los Angeles County Flood Control District, Cities of Los Angeles and Culver City, collectively the Marina del Rey Enhanced Watershed Management Program (EWMP) Group, are submitting the enclosed EWMP Work Plan and Coordinated Integrated Monitoring Program (CIMP) Plan. The Marina del Rey EWMP Group is submitting these documents to fulfill the requirements of Order No. R4-2012-0175 Municipal Separate Storm Sewer System (MS4) Permit.

The enclosed EWMP Work Plan fulfills the requirements identified in Section VI.C.4.c.iv of the MS4 Permit and the enclosed CIMP Plan fulfills the requirements identified in Attachment E Sections IV.C.4 of the MS4 Permit.

If you have any questions, please contact me at (626) 458-4300 or ghildeb@dpw.lacounty.gov or your staff may contact Mr. Bruce Hamamoto at (626) 458-5918 or bhamamo@dpw.lacounty.gov.

Very truly yours,

GAIL FARBER
Director of Public Works

GARY HILDEBRAND
Assistant Deputy Director
Watershed Management Division

MR:ba
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Enc.

cc: City of Los Angeles
City of Culver City

Marina del Rey
Coordinated Integrated Monitoring Program

Prepared For:

Marina del Rey Enhanced Watershed Management Program Agencies

County of Los Angeles
Los Angeles County Flood Control District
City of Los Angeles
City of Culver City

June 28, 2014

Marina del Rey Watershed
Coordinated Integrated Monitoring Program

Prepared For:

Marina del Rey Enhanced Watershed Management Program Agencies

Prepared By:

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

June 28, 2014

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%	percent
BC	Ballona Creek
BMP	best management practice
Caltrans	California Department of Transportation
CFR	Code of Federal Regulations
CIMP	Coordinated Integrated Monitoring Program
CMP	Coordinated Monitoring Plans
CRA	Coastal Resource Area
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
EWMP	Enhanced Watershed Management Program
GIS	Geographic Information System
IC/ID	illicit connection/illicit discharge
LA	load allocation
LACFCD	Los Angeles County Flood Control District
LADPW	Los Angeles County Department of Public Works
LAMC	Los Angeles Municipal Code
LARWQCB	Los Angeles Regional Water Quality Control Board, also Regional Board
LFD	low flow diversion
LID	Low Impact Development
MAL	Municipal Action Levels
MDL	Maximum Daily Load
MdR	Marina del Rey
MRP	Monitoring and Reporting Program
MS4	Municipal Separate Storm Sewer System
Permit	Municipal Separate Storm Sewer System Permit
NPDES	National Pollution Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
PCB	polychlorinated biphenyl
pH	hydrogen ion concentration
PMRP	Plastic Pellet Monitoring and Reporting Plan
p p'-DDE	p p'-dichlorodiphenyldichloroethylene
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RWL	Receiving Waters Limitation
SEA	significant ecological area
SMB	Santa Monica Bay
SMC	Stormwater Monitoring Coalition
SOP	standard operating procedure
SQO	Sediment Quality Objective
SQDV	Stormwater Quality Design Volume
SS	Settleable solids

SUSMP	Standard Urban Stormwater Mitigation Plan
SWAMP	Surface Water Ambient Monitoring Program
TDS	Total dissolved solids
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load
TMRP	Trash Monitoring and Reporting Plan
TOC	Total Organic Carbon
TPH	Total petroleum hydrocarbons
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
WDID	Waste Discharge Identification Number
Weston	Weston Solutions, Inc.
WLA	waste load allocation
WMA	Watershed Management Area
WQBEL	Water quality based effluent limitations
WQO	Water Quality Objective

EXECUTIVE SUMMARY

The Marina del Rey (MdR) watershed is a small sub-watershed located in the larger, Santa Monica Bay watershed. The Marina del Rey Harbor (MdRH) was officially opened in 1965 and is the world's largest man-made small craft harbor.

The tributary area served by an MS4 that drains to MdRH is approximately 1,409 acres and consists of portions of the cities of Culver City and Los Angeles, as well as portions of the unincorporated County of Los Angeles (County). The MdR Watershed Management Area (WMA) is one of the smallest WMAs in the County of Los Angeles, but it is also one of the most important and active watersheds.

The MdR watershed has the one of most aggressive Total Maximum Daily Load (TMDL) schedules for both Toxics and Bacteria and often leads the way in TMDL implementation for the rest of the County.

The extensive ongoing efforts of the County, the Los Angeles County Flood Control District (LACFCD), and the Cities of Culver City and Los Angeles to improve water quality in the MdR watershed include conducting activities and implementing best management practices (BMPs) to help reduce pollutants from stormwater runoff from the watershed to the harbor. Over the past 10 years, responsible agencies in the MdR watershed have spent tens of millions of dollars in special studies, low-flow diversions, non-structural BMPs, structural BMPs, and monitoring efforts.

The water quality in the harbor has significantly improved due to the cooperative efforts of the the County, the LACFCD, and the cities of Culver City and Los Angeles (collectively known as the MdR Enhanced Watershed Management Program [EWMP] Agencies). The MdR EWMP agencies look forward to working with interested stakeholders and the Regional Board to further improve water quality in the watershed.

Background

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175 (Permit) was adopted on November 8, 2012, by the Los Angeles Regional Water Quality Control Board (LARWQCB or Regional Board) and became effective December 28, 2012. This Permit replaced the previous permit (Order No. 01-182). The purpose of the Permit is to ensure the municipal separate storm sewer systems (MS4s) in Los Angeles County are not causing or contributing to exceedances of water quality objectives set to protect the beneficial uses in the receiving waters in the Los Angeles region. The requirements for the Monitoring and Reporting Program (MRP) are included as Attachment E to the Permit. The primary objectives of the MRP are as follows (II.A of the MRP):

1. Assess the chemical, physical, and biological impacts of discharges from the MS4 on receiving waters.

2. Assess compliance with receiving water limitations and water quality-based effluent limitations (WQBELs) established to implement TMDL wet weather and dry weather waste load allocations (WLAs).
3. Characterize pollutant loads in MS4 discharges.
4. Identify sources of pollutants in MS4 discharges.
5. Measure and improve the effectiveness of pollutant controls implemented under the Permit.

Section II.D of the MRP provides flexibility to allow Permittees the option to develop a Coordinated Integrated Monitoring Program (CIMP) that uses alternative approaches to meet the primary objectives of the Permit. The agencies with jurisdiction in the Marina del Rey WMA, including the unincorporated areas of the County of Los Angeles, the LACFCD, and the cities of Los Angeles and Culver City, have elected to pursue a CIMP and have provided justification in this document demonstrating fulfillment of monitoring requirements of the Permit and TMDLs.

The monitoring requirements outlined in this CIMP are in accordance with the requirements of the Permit, the Bacteria TMDL, and the Toxics TMDL. An overview of these regulatory drivers is presented in Appendix A. Monitoring requirements differ between these three regulatory drivers on issues such as monitoring station locations, definition of wet/dry weather, monitoring duration, and monitoring constituents. One objective of this CIMP is to leverage resources to create an efficient and effective monitoring program to represent conditions within the receiving water and tributary MS4. An overview of the CIMP monitoring programs is presented in this section.

Receiving Water Monitoring

The 18 receiving water monitoring stations in the Marina del Rey Enhanced Watershed Management Program (EWMP) are shown in Figure ES-1 below. The stations were selected to address both Bacteria and Toxics TMDLs and Permit monitoring requirements. Nine receiving water stations were selected for Bacteria TMDL monitoring, eight receiving water stations were selected for only the Toxics TMDL monitoring, and one receiving water station was selected for Permit-required receiving water monitoring and the Toxics TMDL monitoring. Constituents for monitoring were selected based on water quality priorities, developed during the writing of the Marina del Rey EWMP Work Plan (Submitted June 28, 2014). The water quality priorities were based on existing TMDLs, Clean Water Act Section (§) 303(d) lists, and exceedance of water quality objectives for other non-TMDL constituents equivalent to the (§) 303(d) listing policy.

Figure ES-1. Marina del Rey WMA Agencies Receiving Water and Outfall Monitoring Locations

Storm Water Outfall Monitoring

Five outfall monitoring locations were selected for monitoring; they are displayed on Figure ES-1, above. One station (MdR-3) was selected for both Permit monitoring and Toxics TMDL monitoring, along with four additional stations which will be monitored as part of the Toxics TMDL outfall monitoring. These stations will capture runoff from representative land use areas, represented in Figure 4-1 through Figure 4-4, of the Marina del Rey watershed and will also be used to assess Permit and Toxics TMDL compliance in accordance with applicable storm water municipal action levels (MALs) and WQBELS.

Non-Storm Water Outfall Program

Non-storm water outfall monitoring is considered to be neither feasible nor necessary in the MS4 of the MdR Watershed. The watershed is strongly tidally influenced and the receiving waters of MdR Harbor function differently than the linear river systems used to model the Permit monitoring requirements. Non-storm water flows to the MS4 are currently addressed through the use of low flow diversions (LFDs) in the Marina del Rey watershed for three major outfalls discharging to the MdR Harbor (Basin E). The fourth major outfall is below tide level and inundated with marine waters at all times (Basin G). Findings of the storm drain outfall identification report (LACDBH, 2004a) show that approximately 700 small drains discharge directly to the MdR Harbor at or below the tide line. The tidal inundation to the MS4 system surrounding the MdR Harbor does not allow for the sampling of outfall discharge. Potential discharge (where not addressed by a LFD) is co-mingled with marine waters, making it impossible to discern the impact of potential non-storm water runoff to the receiving water. Therefore, for the purposes of the MdR Watershed CIMP, the MdR EWMP Agencies will not conduct non-storm water monitoring at the outfalls.

Trash and Plastic Pellet Monitoring

The Permit requires Permittees to develop a Trash Monitoring and Reporting Plan (TMRP) to describe the methodologies that will be used to assess and monitor trash from source areas in the Santa Monica Bay (SMB) WMA and shoreline of the Santa Monica Bay. In 2012, the County submitted a TMRP to the Regional Board. The City of Los Angeles will not be developing a TMRP for MdR because the implementation program for the Ballona Creek (BC) Trash TMDL covers the City's area in MdR. The City does not have plastic pellet facilities in MdR and is therefore not subject to the pellet monitoring requirements of the PMRP; subsequently, the City will coordinate plastic pellets spill and response requirements in conjunction with SMB and BC watersheds.

The City of Culver City is in compliance with the TMRP for the Ballona Creek Trash TMDL and is considered in compliance with the Debris TMDL's trash component. These plans are considered to be independent of this CIMP.

Plastic Pellet Monitoring and Reporting Plans (PMRPs) quantifying potential plastic pellet discharges to Santa Monica Bay, along with supplemental Spill Response Plans (SRPs) to address containment of spilled plastic pellets, were submitted to the Regional Board by the City of Culver City (2012), County (2013), and LACFCD (2013).

New Development and Redevelopment Effectiveness Tracking

The MdR EWMP Agencies have developed mechanisms for tracking new development/re-development projects that include post-construction BMPs pursuant to Permit Section VI.D.7. The specific tracking information for each jurisdiction is unique to each Permittee, and therefore this CIMP provides a general overview of tracking requirements and data necessary to show compliance with the Permit.

Regional Studies

The MRP requires participation in regional studies, including participation in the Southern California Monitoring Coalition's (SMC) Regional Watershed Monitoring Program (Bioassessment Program) and special studies as specified in approved TMDLs.

The LACFCD currently participates in the SMC Monitoring Program. The LACFCD will continue to participate in the Bioassessment Program being managed by the SMC. The LACFCD, on behalf of the MdR EWMP Agencies, will continue to coordinate and assist in implementing the bioassessment monitoring requirement of the MS4 permit on behalf of the permittees in Los Angeles County. Initiated in 2008, the SMC's Bioassessment Program is designed to run over a five-year cycle. Monitoring under the first cycle concluded in 2013, with reporting of findings and additional special studies planned to occur in 2014. The SMC Joint Executive Workgroup is currently working on designing the Bioassessment Program for the next five-year cycle, which is scheduled to run from 2015 to 2019.

In addition to the SMC monitoring program, the MdR EWMP Agencies plan to participate in Bight '18, which is also a regional monitoring program conducted by the Southern California Coastal Water Research Project (SCCWRP). The program is focused on regional assessment of marine waters in Southern California, including assessments of water quality, sediment quality, and bioaccumulation of toxins in fish tissue.

1.0 INTRODUCTION

1.1 CIMP Regulatory Background

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175 (Permit) was adopted on November 8, 2012, by the Los Angeles Regional Water Quality Control Board (LARWQCB or Regional Board) and became effective December 28, 2012. This Permit replaced the previous permit (Order No. 01-182). The purpose of the Permit is to ensure the MS4s in Los Angeles County are not causing or contributing to exceedances of water quality objectives set to protect the beneficial uses in the receiving waters in the Los Angeles region. The Permit allows the Permittees to customize their storm water programs through the development and implementation of a Watershed Management Program (WMP) or an Enhanced Watershed Management Program (EWMP) to achieve compliance with certain receiving waters limitations (RWLs) and water quality-based effluent limits (WQBELs).

Although extensive default monitoring requirements are specified in the Permit Monitoring and Reporting Plan (MRP), the Permittees have the option to develop a Coordinated Integrated Monitoring Program (CIMP) that uses alternative approaches to meet the primary objectives of the Permit. The agencies with jurisdiction in the Marina del Rey (MdR) Watershed, including the unincorporated areas of the County, the LACFCD, and the cities of Los Angeles and Culver City have elected to pursue a CIMP and have provided justification in this document demonstrating fulfillment of monitoring requirements of the Permit and TMDLs. More information about LACFCD participation in the CIMP is in Appendix J.

As defined in the MRP, the MdR Watershed CIMP has the potential to be a vehicle to modify TMDL monitoring requirements and other previously implemented monitoring program requirements. Modifications to the MRP and/or TMDL monitoring requirements must satisfy the primary objectives for the CIMP to be considered approvable by the Regional Board Executive Officer. Two TMDL Coordinated Monitoring Plans (CMPs) have been approved by the Regional Board for the MdR Watershed, the *Marina Del Rey Harbor Mothers' Beach and Back Basins Bacterial TMDL Coordinated Monitoring Plan* (Bacteria TMDL CMP) (LADPW, 2007) and the *Marina Del Rey Harbor Toxic Pollutants TMDL Coordinated Monitoring Plan* (Toxics TMDL CMP) (LADPW, 2008b). The MdR Watershed CIMP reflects modifications to these existing TMDL CMPs based on the Bacteria TMDL, Toxics TMDL, new Permit requirements, implemented Best Management Practices (BMPs), recent monitoring data, and findings and recommendations of the 2013 *Multi-Pollutant TMDL Implementation Plan for the Unincorporated Area of MdR Harbor Back Basins* (LADPW, 2013), the 2012 *Toxics Pollutant TMDL Implementation Plan* prepared by the California Department of Transportation (Caltrans) and the Cities of Los Angeles and Culver City (City of Los Angeles, 2012).

1.2 Enhanced Watershed Management Plan Area

The MdR Watershed is bordered by the Santa Monica Bay Watershed to the west and the Ballona Creek Watershed to the north and east. The MdR Harbor is open to the Santa Monica Bay through the Main Channel and shares a common breakwater with Ballona Creek. The MdR Harbor is an active harbor for pleasure craft, consisting of the Main Channel and eight basins (A through H). Basins A, B, C, G, and H are known as the Front Basins. Basins D, E, and F are known as the Back Basins. The MdR Watershed includes the Venice Canals and the tributary area to the Ballona Lagoons, which discharge to the MdR Harbor, near the exit to the Santa Monica Bay.

For the purposes of this CIMP, the MdR Watershed does not include the Caltrans-owned right-of-way or lands within the jurisdiction of the State of California (e.g., Ballona Wetland Area). Therefore, for the purposes of this CIMP, the MdR Watershed is limited to approximately 1,409 acres that are served by an MS4 under the jurisdiction of the MdR EWMP Agencies participating in the MdR Watershed CIMP. Four subwatersheds make up the MdR Watershed as shown in Figure 1-1. The acreage by jurisdiction and subwatershed is presented in Table 1-1.

Table 1-1. Subwatersheds and Jurisdictions within the MdR Watershed

Agency	CIMP Participant	Sub-watershed 1 (Acres)	Sub-watershed 2 (Acres)	Sub-watershed 3 (Acres)	Sub-watershed 4 (Acres)	CIMP Watershed (Acres)	% CIMP Watershed Area
City of Los Angeles	Yes	32.9	278.1	70.5	589.8	971.3	69%
City of Culver City	Yes	0.0	0.0	0.0	42.2	42.2	3%
County	Yes	336.2	46.8	0.0	12.7	395.7	28%
LACFCD	Yes	N/A	N/A	N/A	N/A	N/A	N/A
MS4 Area of MdR Agencies		**369.1**	**324.9**	**70.5**	**644.7**	**1,409.2**	**100%**
Caltrans	No	5.4	0.0	0.0	26.4	31.8	N/A
State of California	No	49.3	0.0	0.0	0.0	49.3	N/A
MdR Watershed Area		**423.8**	**324.9**	**70.5**	**671.1**	**1,490.3**	--

Figure 1-1 presents the MdR MS4, the subwatershed boundaries, and the jurisdictional area for each agency within the MdR Watershed. The MdR Harbor land area in Subwatershed 1 (369.1 acres) is composed of 336.2 acres of unincorporated County land and 32.9 acres within the boundaries of the City of Los Angeles; it has many small drains that discharge into all the Basins. Subwatershed 2 (approximately 324.9 acres) is composed of 46.8 acres of unincorporated County land and 278.1 acres within the boundaries of the City of Los Angeles; it does not drain into the MdR Harbor Front or Back Basins but drains into the Venice Canal and the Ballona Lagoon, which discharge into the Main Channel near the harbor mouth. Boone Olive Pump Plant serves Subwatershed 3, a tributary area of 70.5 acres that lies entirely within the boundaries of the City of Los Angeles. The pump station discharges into Basin E. Subwatershed

4 lies mainly within the jurisdiction of the cities of Los Angeles and Culver City and totals approximately 644.7 acres. The acreages given exclude the Caltrans and State of California areas. Runoff discharges into Oxford Retention Basin, a storm water retention basin occupying approximately 10 acres within the County. Situated north of the Back Basins, Oxford Retention Basin is operated by the LACFCD and drains into Basin E through two tide gates.

The MdR Watershed includes residential, commercial, recreational, vacant, institutional, and mixed commercial/industrial land uses. The land use area by subwatershed is presented in Table 1-2 and Figure 1-2. Subwatershed 1 consists of right-of-ways, parking lots, and high-density residential land uses immediately surrounding the MdR Harbor, as well as marine waters within the Harbor. Subwatershed 2 consists of residential areas tributary to the Grand Canal (i.e., Venice Canals and Ballona Lagoon). Subwatersheds 3 and 4 consist of a mix of residential, commercial, and mixed commercial/industrial land uses.

Table 1-2. Summary of MdR Watershed Acreage

Land Use Class	Subwatershed Acreage*				Total
	1	2	3	4	
Single Family Residential	1.8	45.8	22.9	167.2	237.7
Multi-Family Residential	137.1	131.8	21.1	96.3	386.3
Institutional/Public Facilities	8.0	10.1	2.6	67.2	87.9
Commercial and Services	120.0	22.8	1.6	124.2	268.6
Industrial/Mixed with Industrial	0.2	0.2	0.3	27	27.7
Transportation/Road Right-of-Way	38.2	83.3	22.0	153.8	297.3
Developed Recreation/Marina Parking	41.6	0.7	0	1.9	44.2
Beach	8.2	0	0	0	8.2
Water**	6.4	30.3	0	7.1	43.8
Vacant	7.6	0	0	0	7.6
Total	369.1	325	70.5	644.7	1,409

*Acreage excludes Caltrans- and State-owned land (Ballona Wetland) not in CIMP Area.

**Marina Boat Area Water and MdR Harbor Water are not included in "Water" class acreage provided here. The Water class includes Ballona Lagoon (14.4 acres), Venice Canals (15.9 acres), Oxford Retention Basin (7.1 acres), and Ballona Shoreline and other water (6.4 acres).

Figure 1-1. Marina del Rey Watershed with MS4, Catch Basins, and Subwatershed Areas

Figure 1-2. MdR Watershed Land Uses and Subwatersheds

1.3 Water Quality Priorities

Multiple monitoring programs and special studies have sought to assess conditions in the MdR receiving waters and surrounding MdR Watershed. All readily available monitoring data, source assessments, and special studies were assessed for interrelationships in terms of pollutants, potential sources, and potential data gaps. Through this evaluation, water-body pollutant combinations were classified into one of the three following categories:

- **Category 1 (Highest Priority):** Pollutants with receiving water limitation or WQBELs as established in Part V1.E and Attachments L through R of the Permit.
- **Category 2 (High Priority):** Section §303(d) listed pollutants in the receiving water that MS4 discharges may be contributing to the impairment.
- **Category 3 (Medium Priority)**: Pollutants with insufficient data to list as §303(d), but which exceed RWLs contained in the permit, and for which MS4 discharges may be causing or contributing to the exceedance.

As presented in Table 1-3, the pollutants currently addressed by the Bacteria TMDL and Toxics TMDL capture all of the Category 1 waterbody-pollutant classifications. The Venice Canal is the only other waterbody in addition to the MdR Harbor that falls within the MdR EWMP Agencies jurisdiction. However, there are no available data assessing the receiving water or discharges to the Venice Canal receiving water. The only Section (§)303(d)-listed constituent for MdR Harbor not currently addressed by a TMDL and, therefore, the only potential Category 2 pollutant, is Dieldrin. However, the USEPA made a finding of non-impairment for this constituent so it will not be considered a Category 2 pollutant. An assessment of the historical datasets (Table 9-1) using the monitoring data completed for the MdR Watershed EWMP Work Plan Draft (submitted to the Regional Board June 28, 2014) did not result in any constituents being classified as a Category 3 pollutant.

Table 1-3. Waterbody – Pollutant Classification

Waterbody	Pollutant	Classification	Notes
Harbor Receiving Water	Dissolved Copper	Category 1	Subject to Toxics TMDL
	Copper	Category 1	Subject to Toxics TMDL
	Lead	Category 1	Subject to Toxics TMDL
	Zinc	Category 1	Subject to Toxics TMDL
	Total PCBs	Category 1	Subject to Toxics TMDL
	Total DDTs	Category 1	Subject to Toxics TMDL
	p p'-DDE	Category 1	Subject to Toxics TMDL
	Chlordane	Category 1	Subject to Toxics TMDL
	Fecal coliform	Category 1	Subject to Bacteria TMDL
	Enterococcus	Category 1	Subject to Bacteria TMDL
	Total coliform	Category 1	Subject to Bacteria TMDL
Venice Canals	None known	None	No Data for assessment.

To date, historical priority sources of non-storm water/dry weather flows have been addressed in the MdR Watershed through the installation of LFDs and re-direction of flow (Table 3-3).

1.4 CIMP Overview

The primary purpose of this CIMP is to outline the process for collecting data to meet the goals and requirements of the MRP. This CIMP is designed to provide the MdR EWMP Agencies the information necessary to guide water quality program management decisions. This CIMP provides information on sample collection and analysis methodologies. Additionally, the monitoring will provide a means to measure compliance with the Permit. The MRP, as outlined in the Permit, is composed of five elements, including:

1. Receiving Water Monitoring
2. Storm Water Outfall Monitoring
3. Non-Storm Water (NSW) Outfall Monitoring
4. New Development/Redevelopment Effectiveness Tracking
5. Regional Studies

In addition to the five elements, which are presented as sections in this CIMP, a specific trash and plastic pellets monitoring section is included. An overview of each of the monitoring types and their monitoring objectives are described in the following subsections.

The monitoring requirements outlined in this CIMP are in accordance with the requirements of the Permit, the Bacteria TMDL, and the Toxics TMDL. An overview of these regulatory drivers is presented in Appendix A. Monitoring requirements differ between these three regulatory drivers on issues such as monitoring station locations, definition of wet/dry weather, monitoring duration, and monitoring constituents. One objective of this CIMP is to leverage resources to create an efficient and effective monitoring program to represent conditions within the receiving water and tributary MS4. This CIMP discusses the following in the context of the MdR Watershed.

1.4.1 Receiving Water Monitoring

The objectives of the receiving water monitoring include the following:

- Determine whether the RWLs are being achieved;
- Assess trends in pollutant concentrations over time, or during specified conditions; and
- Determine whether the designated beneficial uses are fully supported as determined by water chemistry, as well as aquatic toxicity and bioassessment monitoring.

The receiving water monitoring will provide data to determine whether the RWLs and water quality objectives are being achieved in the MdR EWMP area and support management decisions related to EWMP implementation. Over time, the monitoring will allow the assessment of trends in pollutant concentrations. Receiving water monitoring consists of a mass emission monitoring designed to meet all receiving water permit requirements and additional TMDL monitoring locations necessary to evaluate TMDL requirements, 303(d) listings, and other exceedances of RWLs. Implementation of the MdR CIMP will replace existing TMDL monitoring programs.

1.4.2 Storm Water Outfall Monitoring

Storm water outfall monitoring of discharges from the MS4 support meeting three objectives including:

- Determine the quality of storm water discharge relative to municipal action levels.
- Determine whether storm water discharge is in compliance with applicable storm water WQBELs derived from TMDL WLAs.
- Determine whether the discharge causes or contributes to an exceedance of RWLs.

The storm water outfall monitoring is designed to characterize storm water discharges from MS4s at representative outfall locations within the EWMP area and support management decisions related to EWMP implementation. Additionally, implementation of the MdR CIMP will meet the TMDL outfall monitoring requirements.

1.4.3 Non-Storm Water Outfall Program

Objectives of the NSW outfall monitoring include the following:

- Determine whether a discharge is in compliance with applicable NSW WQBELs derived from TMDL WLAs.
- Determine whether a discharge exceeds NSW action levels.
- Determine whether a discharge contributes to or causes an exceedance of RWLs.
- Assist in identifying illicit discharges.

The NSW Outfall Screening and Monitoring Program (NSW Outfall Program) is focused on dry weather discharges to receiving waters from major outfalls. Because dry weather discharges are addressed through LFDs and the MdR watershed MS4 system is tidally inundated, this Permit requirement does not apply for the MdR watershed.

1.4.4 New Development and Redevelopment Effectiveness Tracking

The objective of the New Development/Redevelopment effectiveness tracking is to track whether the conditions in the building permit issued by the Permittee are implemented to ensure the volume of storm water associated with the design storm is retained on-site as required Part VI.D.7.c.i. of the Permit. Permittees are required to maintain a database to track specific information related to new and redevelopment projects subject to the minimum control measure (MCM) requirements in VI.D.7. The Permit contains data tracking requirements in Part X.A of the MRP and in Part VI.D.7.d.iv.

1.4.5 Trash and Plastic Pellet Monitoring

The objective of the trash and plastic pellet monitoring is to satisfy the monitoring requirements of the *Santa Monica Bay Nearshore and Offshore Debris TMDL* (Debris TMDL) in accordance with the requirement in Part III of the MRP.

1.4.6 Regional Studies

The MRP requires participation in regional studies, including participation in the Southern California Monitoring Coalition's (SMC) Regional Watershed Monitoring Program (Bioassessment Program) and special studies as specified in approved TMDLs.

The Los Angeles County Flood Control District (LACFCD) currently participates in the SMC Monitoring Program. The LACFCD, on behalf of the MdR EWMP Group, will continue to participate in the Bioassessment Program being managed by the SMC. The LACFCD will continue to coordinate and assist in implementing the bioassessment monitoring requirement of the MS4 permit on behalf of the permittees in Los Angeles County. Initiated in 2008, the SMC's Bioassessment Program is designed to run over a five-year cycle. Monitoring under the first cycle concluded in 2013, with reporting of findings and additional special studies planned to occur in 2014. The SMC Joint Executive Workgroup is currently working on designing the bioassessment monitoring program for the next five-year cycle, which is scheduled to run from 2015 to 2019.

The MdR EWMP Agencies also plan to participate in the Regional Bight monitoring program, expected to be conducted during 2018.

2.0 RECEIVING WATER MONITORING PROGRAM

The objectives of the receiving water monitoring (Part II.E.1 of the MRP) include the following:

a. Determine whether the receiving water limitations are being achieved;
b. Assess trends in pollutant concentrations over time, or during specified conditions; and
c. Determine whether the designated beneficial uses are fully supported as determined by water chemistry, as well as aquatic toxicity and bioassessment monitoring.

The following presents the CIMP Receiving Water monitoring program, including monitoring sites, monitoring parameters and frequency, as well as monitoring coordination. The MdR CIMP will integrate the MRP, the TMDLs, as well as existing monitoring requirements in the MdR Watershed into a single efficient and effective program; as such, its implementation will replace the existing TMDL CMPs applicable to the MdR Watershed.

2.1 Receiving Water Monitoring Sites

The MRP specifies that receiving water monitoring shall be performed at previously designated mass emission stations, TMDL receiving water stations (as designated in TMDL CMPs approved by the Regional Board Executive Officer), and additional receiving water locations representative of the impacts from MS4 discharges, and that in the case where monitoring at a station will be discontinued, justification should be provided. The receiving water monitoring programs in this CIMP are based on the monitoring requirements defined in the Bacteria TMDL CMP, the Toxics TMDL CMP, and the Permit.

Monitoring stations selected to conduct this monitoring are discussed below. More information about these stations can be found in Appendix B based on a site reconnaissance, performed January 2014, in support of the sites selection process. Detailed parameter lists, analytical methods and method detection limits are detailed in Appendix D. Sampling protocols, sample handling procedures, field quality control sampling requirements, and laboratory analytical methods and quality assurance/quality control (QA/QC) requirements detailed in Appendix C, with reference to Appendix D.

2.1.1 Mass Emission Monitoring Site

Mass emission (ME) receiving water monitoring is intended to determine if RWLs are achieved, assess trends in pollutant concentrations over time, and determine whether designated uses are supported. ME monitoring provides a long-term record to understand conditions within the EWMP area, for the full suite of parameters, including TMDL parameters.

The mass emission station receiving water monitoring requirement of the Permit does not apply to the MdR CIMP. There are ME stations in seven major watersheds throughout the County. These stations are monitored per the existing NPDES Permit (CAS004001) in an effort to estimate the mass emissions from the collective MS4. The closest ME station, Ballona Creek Monitoring Station (S01), is located outside the MdR Watershed.

2.1.2 Permit Monitoring Site

MdRH-MC, located in the Main Channel of MdR Harbor, was selected as the MdR Harbor receiving water station for Permit compliance monitoring. The intent of the Permit is to assess the impacts of storm water runoff on receiving waters, and therefore MdRH-MC is located at the confluence of Basins D, E, and F. The station is located to assess storm water runoff from the major outfalls located in Basin E and other outfalls located in Basin F. Storm water flows are expected to impact the area in the Back Basins near the confluence of Basins D, E, and F.

The location of this station is shown in Figure 2-1.

This receiving water monitoring site meets the MRP objectives and data collected at MdRH-MC will support an understanding of potential impacts associated with MS4 discharges.

2.1.3 TMDL Monitoring Sites

The MdR Watershed is impacted by three TMDLs, including the Bacteria TMDL, Toxics TMDL, and Debris TMDL. Harbor receiving water stations monitored as part of the Bacteria and Toxics TMDLs CMPs are summarized below (Table 2-1 and Table 2-2, respectively). More information about these stations is provided in Appendix B. The analytical procedures, sampling methods, QA/QC procedures are provided in Appendix C.

2.1.3.1 Bacteria TMDL Sites

The Bacteria TMDL requires receiving water monitoring in the Back Basins and at three shoreline stations along Marina Beach, and in the Harbor at major outfalls. Bacteria TMDL receiving water monitoring is conducted at nine receiving water locations; the type and location of the Bacteria TMDL monitoring stations are summarized in Table 2-1 and Figure 2-1. Note that monitoring for Bacteria is scheduled; Dry/Wet Weather classifications are assigned post-monitoring, based on prevailing weather conditions during a scheduled sampling event.

Table 2-1. MdR Receiving Water Bacteria Monitoring Stations

CIMP Station ID	Media Sampled	Monitoring Station Location
MdRH-1	Water	Shoreline Site along Marina Beach at playground
MdRH-2	Water	Shoreline Site along Marina Beach at Main Lifeguard Tower
MdRH-3	Water	Shoreline Site along Marina Beach between the boat dock and lifeguard station
MdRH-4	Water	Basin D, near first slip outside swim area (surface and depth)
MdRH-5	Water	Basin E, in front of tide-gate from Oxford Retention Basin
MdRH-6	Water	Basin E, center of basin (surface and depth)
MdRH-7	Water	Basin E, in front of Boone-Olive Pump Outlet
MdRH-8	Water	Back of the Main Channel at the intersection of Basins D, E, and F (surface and depth)
MdRH-9	Water	Basin F, center of basin (surface and depth)
Monitoring Station in Harbor Receiving Water Basins A, B, C, G, and H, designated by MdRH-10, MdRH-11, MdRH-12, MdRH-13, and MdRH-14, respectively are former monitoring station where monitoring was discontinued.		

2.1.3.2 Toxics TMDL Sites

The CIMP's monitoring includes a total of nine receiving water monitoring stations, one in each of the Basins and one in the Main Channel, to comply with the Toxics TMDL monitoring requirement. These locations are summarized in Table 2-2 and Figure 2-1. Monitoring will be performed at five of these stations each year, two in the Back Basins, two in the Front Basins, and one in the main channel. Based on an assessment of dissolved copper concentrations in the Harbor, Station MdRH-D will be the station to be monitored every year in the Back Basins. More details are provided in Appendix I.

Table 2-2. MdR Receiving Water Toxics Monitoring Stations

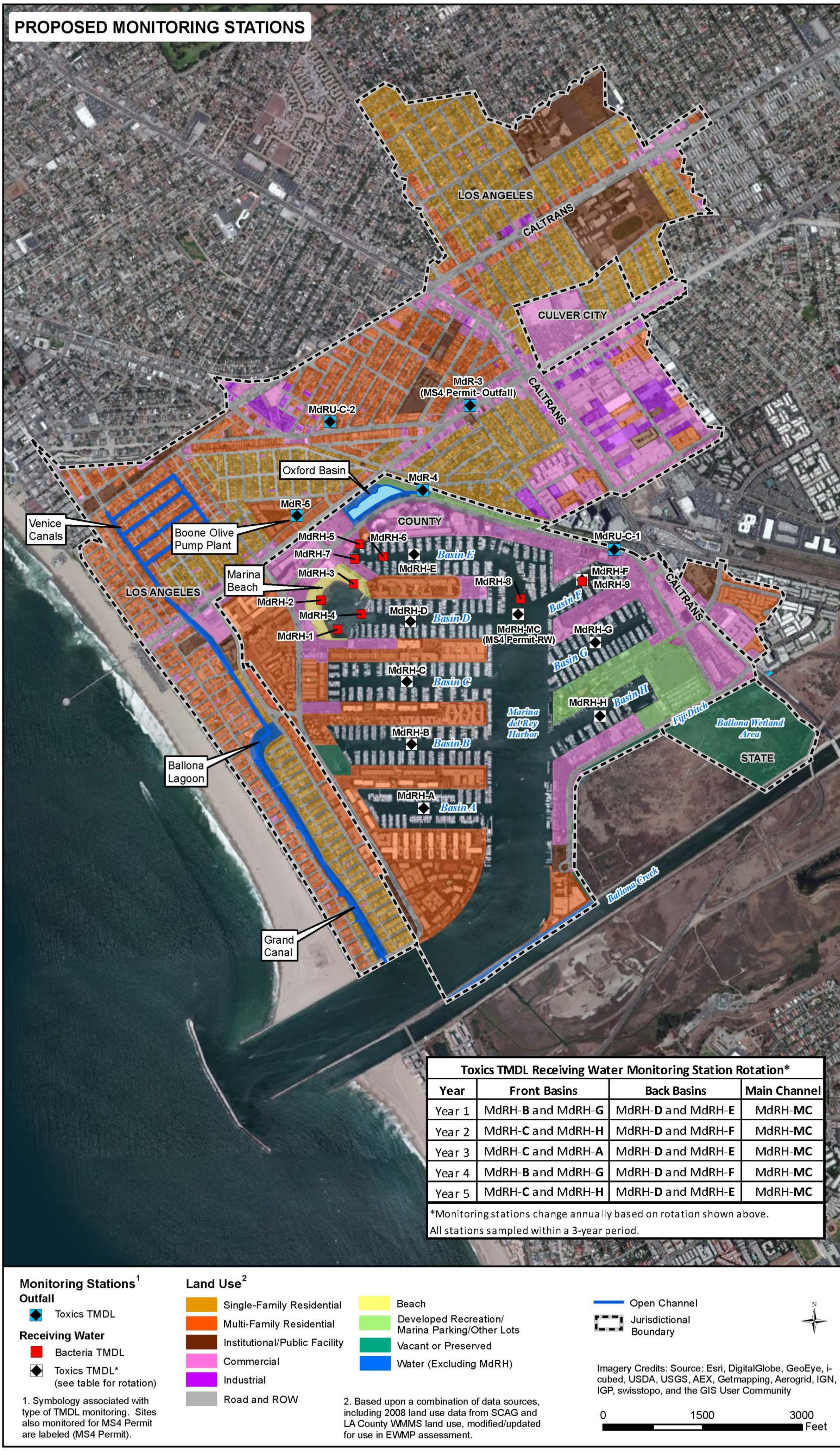
CIMP Station ID	Toxics TMDL CMP Station ID	Media Sampled	Monitoring Station Description
MdRH-A	MdRH-F-1	Water	Mid-channel of Basin A
MdRH-B	MdRH-F-2	Water	Mid-channel of Basin B
MdRH-C	MdRH-F-3	Water	Mid-channel of Basin C
MdRH-D	MdRH-B-1	Water	Mid-channel of Basin D
MdRH-E	MdRH-B-2	Water	Mid-channel of Basin E
MdRH-F	MdRH-B-3	Water	Mid-channel of Basin F
MdRH-G	MdRH-F-4	Water	Mid-channel of Basin G
MdRH-H	MdRH-F-5	Water	Mid-channel of Basin H
MdRH-MC	---	Water	Main Channel
Monitoring will be performed at five Toxics TMDL receiving water stations every year, alternating every year between two of the three Basins in the Back Basins and two of the five Basins in the Front Basins along with the main channel monitoring location. See Table in Figure 2-1 for the Permit's five-year schedule.			

2.1.3.3 Bioaccumulation Monitoring

Fish swim throughout MdR Harbor, therefore, for the purposes of CIMP compliance monitoring, the entire Harbor is considered to be a single representative area for fish sampling. Trawl transects will be run throughout the Harbor to collect targeted fish species.

Mussels are filter feeders that rely on collecting organic particles as food from a large volume of water. Resident mussels have been observed throughout MdR Harbor; however, in order to control for the period of bioaccumulation, the use of planted mussels is recommended in place of resident mussels. Mussels will be planted in the Back Basins and the Front Basins areas, and then composited into two samples representing these two areas.

More information about bioaccumulation monitoring, including the analytical procedures, sampling methods, and QA/QC procedures, are provided in Appendix C.



Toxics TMDL Receiving Water Monitoring Station Rotation*

Year	Front Basins	Back Basins	Main Channel
Year 1	MdRH-**B** and MdRH-**G**	MdRH-**D** and MdRH-**E**	MdRH-**MC**
Year 2	MdRH-**C** and MdRH-**H**	MdRH-**D** and MdRH-**F**	MdRH-**MC**
Year 3	MdRH-**C** and MdRH-**A**	MdRH-**D** and MdRH-**E**	MdRH-**MC**
Year 4	MdRH-**B** and MdRH-**G**	MdRH-**D** and MdRH-**F**	MdRH-**MC**
Year 5	MdRH-**C** and MdRH-**H**	MdRH-**D** and MdRH-**E**	MdRH-**MC**

*Monitoring stations change annually based on rotation shown above.
All stations sampled within a 3-year period.

Figure 2-1. MdR Watershed CIMP Monitoring Stations

The rotation is based on observed Harbor Copper water sampling results (See Appendix I)

2.2 Monitored Parameters and Frequency of Monitoring

The CIMP monitoring programs are summarized in Table 2-3. The table lists all the receiving water stations, their corresponding monitored parameters, and frequency of monitoring for compliance with Bacteria and Toxics TMDL monitoring requirements as well as the Permit monitoring requirements. These monitoring requirements include physical, bacterial, chemical, and toxicity analyses of water, sediment, and tissue samples from the MdR receiving water. Detailed parameter lists, analytical methods and method detection limits are detailed in Appendix D. Sampling protocols, sample handling procedures, field quality control sampling requirements, and laboratory analytical methods and quality assurance/quality control (QA/QC) requirements detailed in Appendix C, with reference to Appendix D.

2.2.1 Permit Compliance Monitoring

Receiving water monitoring will be conducted only during wet weather conditions because there is minimal dry weather flow from the MdR Watershed MS4 system to the receiving water due to LFDs. Grab sampling will be conducted at the MdRH-MC receiving water station three times per year, including the first storm of the year equal to or greater than 0.1 inch. The parameter lists of the entire Table E-2 of the MRP will be monitored during the first large storm of the first monitoring year. The remaining 2 wet events of the year will be limited to those parameters in Table E-2 that fall under Category 1 and 2 described in Section 1.2 of this CIMP.

In addition, toxicity monitoring shall be conducted at this station to evaluate a sublethal effect (e.g., reduced growth, reproduction) twice per year. Year 1 results for Permit compliance storm water monitoring will shape monitoring requirements and parameter lists for subsequent storm events and monitoring years beginning in Year 2, dependent upon results below the MLs on Table E-2 of the permit and/or less than the lowest applicable WQO. Appendix D monitoring lists will be revised and reported as part of the Annual Monitoring Report.

2.2.2 Bacteria TMDL Compliance Monitoring

For Bacteria TMDL compliance monitoring, sampling is performed on a scheduled basis. The MdR EWMP Agencies conduct weekly compliance monitoring at all Bacteria TMDL stations, except at two stations along the Marina Beach shoreline where enhanced monitoring efforts have been implemented voluntarily for informational purposes. Daily sampling (Monday through Saturday) has been initiated at Station MdRH-1. At Station MdRH-2, samples are collected twice per week (Monday and Saturday). Bacteria grab samples are collected from the Harbor receiving water from a boat/skiff or from the ankle deep water of an incoming wave along the Marina Beach. As a safety consideration, samples are not collected during rainfall. Grab samples are collected on a scheduled basis. Bacteria grab samples collected within the 72-hour window after a storm event are classified as wet weather samples, whereas all other samples are classified as dry weather samples.

2.2.3 Toxics TMDL Compliance Monitoring

The existing Toxics TMDL CMP monitoring program has been modified to improve the effectiveness and efficiency of the program, and to take advantage of the increased knowledge of the environmental conditions within the Harbor as a result of the past 10 years of monitoring. For Toxics TMDL receiving water compliance monitoring, water, sediment and tissue samples will be collected from a boat/skiff. Modifications to the existing CMP have been made based on the historical monitoring experience and data gained by the MdR EWMP Agencies. Data analysis supporting the changes below is included in Appendix I.

Samples will be collected as follows:

- Dry weather water quality grab samples will be collected from five Harbor receiving water stations on a monthly basis for copper and a bi-annual (summer/winter) basis for Total PCBs. Four of the receiving water stations will rotate each year, so that each Basin is represented over the course of the Permit cycle. See Figure 2-1 for a schedule of monitoring.
    - Monthly monitoring of dissolved copper has been conducted in both the Front and Back Basins of the Harbor since 2010. Monitoring results have remained relatively consistent over time, and while they do vary somewhat between Basins, it is possible to monitor a sub-set of Basins each year and rotate the monitoring stations without losing important information regarding dissolved copper concentrations. (See Appendix I for details).
    - Total PCBs will be monitored in the Harbor water column twice per year (summer and winter) in five locations within the Harbor instead of required monthly schedule due to the logistical, technical and cost issues for the low-detection limit analysis (see more details in Appendix I).
- Sediment analysis will be conducted consistent with the SQO guidelines. SQO monitoring will be conducted in 2015 for the Stressor Identification Study and in 2018 as part of the Bight Program instead of required annual schedule due to low variability of pollutant concentrations from year to year in the historical dataset collected between 2002-2013 (see more details in Appendix I). The MdR EWMP Agencies will coordinate with the Bight Program to the maximum extent possible to ensure that the sediment analysis in the Harbor continues every 5 years thereafter. Sampling sites will be selected in coordination with the Bight Program. Sampling will include chemistry, toxicity, and benthic infaunal assessment. Required Toxics TMDL constituents will be monitored as part of the SQO chemistry analysis.
- Tissue monitoring (fish and mussel), which provides a strong measure of environmental contamination, will be conducted annually within the Harbor, and will provide a measure of bioaccumulation of Total PCBs and other organics from the water column. Sites for resident mussel installation will be selected based on prevailing conditions, as determined by a field reconnaissance conducted prior to sampling. Nine individuals from two species of fish will be collected (halibut and white croaker), in accordance with OEHHA guidance. See Appendix C for more information.

Table 2-3. MdR Receiving Water Monitoring Stations Sampling Parameters and Frequency for Wet and Dry Weather

Parameter	Permit (Wet Weather*)	Toxics TMDL (Dry Weather)									Bacteria TMDL								
	MdRH-MC	MdRH-A	MdRH-B	MdRH-C	MdRH-D	MdRH-E	MdRH-F	MdRH-G	MdRH-H	MdRH-MC	MdRH-1	MdRH-2	MdRH-3	MdRH-4	MdRH-5	MdRH-6	MdRH-7	MdRH-8	MdRH-9
WATER QUALITY																			
Field Parameters[(a)]	3x/year	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pollutants identified in Table E-2 of Permit *(not otherwise listed below)*[#]	1x/year	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aquatic Toxicity	2x/year	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Indicator Bacteria:</u> Total Coliform, *E. coli*, *Enterococcus*	3x/year	-									6x/week[(b)]	2x/week[(d)]	1x/Week[(c)]	1x/week[(c)]at surface 1x/week at depth	1xWeek[(c]	x/week[(c)]at surface 1x/week at depth	1x/Week[(c)]	x/week[(c)]at surface 1x/week at depth	x/week[(c)]at surface 1x/week at depth
Copper (total/dissolved)	3x/year	1x/month (at 2 Back Basin Stations and 2 Front Basin stations alternating stations every year))**								1x/month**									
Total PCBs	3x/year	2x/year (summer/winter)**								2x/year**									
FISH / MUSSEL TISSUE QUALITY – DRY WEATHER SAMPLING																			
Chlordane Total PCBs Total DDTs p,p'-DDE	-	1x/year[(e)] (Harbor-wide sampling, all basins and Main Channel)																	
TRIAD ASSESSMENT – DRY WEATHER SEDIMENT SAMPLING																			
Grain Size and Percent Solids SQO Parameters[(g)] Sediment Toxicity Benthic Infaunal Analysis	2x/5 years[(f)(g)(h)]	2x/5 years[(f)(g)(h)]																	

* There is no dry weather flow from the MdR Watershed to the receiving water due to LFDs; therefore, dry weather monitoring required by the permit will not be conducted.
** Toxics TMDL receiving water monitoring to occur during dry weather. Four of the receiving water stations will rotate each year, so that each Basin is represented over the course of the Permit cycle. MdRH-D and MdRH-MC will be monitored every year.
[#] All the parameters listed in Table E-2 of the MRP will be monitored during the first large storm of the first monitoring year. Only constituents detected above the lowest applicable water quality objective will be monitored from the second year at the frequency specified in the permit (i.e. 3 wet weather events)
(a) Field parameters are defined as dissolved oxygen (DO), pH, temperature, and specific conductivity.
(b) Samples collected daily (Mondays through Saturdays). Samples collected during an incoming wave.
(c) Monitoring frequency is weekly regardless of the weather condition. A dry/wet classification is assigned post-monitoring.
(d) Samples collected twice a week, on Mondays and Saturdays. Samples collected during an incoming wave.
(e) Historically, tissue sampling occurs in October of each year.
(f) Random locations throughout the MdR Harbor Basins and Main Channel
(g) SQO Parameters include: TOC, Cadmium, Copper, Lead, Mercury, Zinc; lower and higher molecular weighted PAHs; PCBs (congeners); DDTs; Chlordane; and Dieldrin.
(h) SQO will be performed twice the first five years of the CIMP implementations, once as part of the Stressor Identification to be completed by December 2016 and once as part of BIGHT '18 program. Future sediment monitoring will be conducted as part of the Bight program every 5 years after 2018.

2.3 Weather Conditions

The Permit requires storm water monitoring during the first significant storm of the year. MRP Section C.1.b(iii) of the Permit establishes mobilization criteria for the first significant storm as the first storm of the year with a 70% probability of at least 0.25-inch rainfall, at least 24 hours prior to the start of a rainfall event. The Permit generally defines a storm event as greater than or equal to 0.1 inch of precipitation, as measured from at least 50% of the County controlled rain gauges within the region. The Bacteria TMDL also defines Wet Weather as rainfall of 0.1 inch or more. Although the Toxics TMDL does not establish storm mobilization criteria, the Toxics TMDL CMP established a 0.1-inch threshold for storm water monitoring, and capped the number of monitoring events to 24 storms per year. According to both the Permit and the Bacteria TMDL, Wet Weather events shall be separated by a minimum of 3 days of dry conditions (e.g., less than 0.1 inch of rain each day). A minimum of 3 days of dry conditions (i.e., 72 hours) is also required between a qualified storm event and a non-storm water monitoring event.

The MdR EWMP Agencies propose capping the number of Toxics TMDL Wet Weather monitored storm events to seven events per year, one storm per month, for schedule optimization and cost efficiencies. The Bacteria TMDL compliance monitoring program will not be impacted because bacteria samples are collected and analyzed on a scheduled basis (daily and/or weekly) and not collected during rainfall periods. The Wet/Dry Weather season classification of bacteria samples will continue to be characterized based on the 0.1-inch storm threshold of the Bacteria TMDL.

Because a significant storm event is based on predicted rainfall, it is recognized that this monitoring may be triggered without 0.25 inches of rainfall actually occurring. In this case, the monitoring event will still qualify as meeting this requirement provided that sufficient sample volume is collected to do all required laboratory analysis. Documentation will be provided showing the predicted rainfall amount.

2.4 Monitoring Coordination

Monitoring requirements of the Permit, Bacteria TMDL, and Toxics TMDL include several iterative elements that are incorporated into the overall design and implementation of this CIMP. Considering the multiple possible avenues to demonstrate TMDL compliance, such as BMP implementation and/or water quality monitoring, development of the monitoring approaches will likely require ongoing stakeholder engagement with the Regional Board and affected responsible parties.

Monitoring under the Bacteria and Toxics TMDLs is conducted by two different agencies. The Toxics TMDL monitoring, in accordance with the Toxics TMDL CMP, is conducted by the County. The Bacteria TMDL monitoring, in accordance with the TMDL CMP, is conducted by the City of Los Angeles and samples are collected and analyzed by Hyperion Laboratory.

Currently, compliance monitoring for the Permit is conducted regionally by the County. It is anticipated that new Permit monitoring requirements in the MdR Watershed will continue to be coordinated and implemented by the County on behalf of the other MdR EWMP Agencies.

2.5 Receiving Water Monitoring Summary

Eighteen receiving water stations in the MdR EWMP were selected to address both Bacteria and Toxics TMDLs and Permit monitoring requirements. Nine receiving water stations were selected for Bacteria TMDL monitoring, eight receiving water stations were selected for only the Toxics TMDL monitoring, and one receiving water station was selected for Permit-required receiving water monitoring and Toxics TMDL monitoring. Monitoring parameters and frequency by regulatory driver and station are summarized in Table 2-3.

3.0 MS4 INFRASTRUCTURE DATABASE

To meet the requirements of Part VII.A of the MRP, a map(s) and/or database of the MS4's storm drains, channels, and outfalls must be submitted with this CIMP and include detailed information (as described in the Permit, page E20-21). An inventory of storm drains, channels, and MS4 outfalls (Inventory) will be maintained by each of the MdR EWMP Agencies in accordance with these Permit requirements. The Inventory will be developed using existing data from Illicit Connection/Illegal Discharge (IC/ID) investigations, institutional knowledge of the MdR Watershed, and other data and observations documenting outfall conditions from historical studies (i.e., Weston, 2008a; LACDBH, 2004a). Each EWMP Agency is responsible for the development, maintenance, and upkeep of the MS4 outfall database and will be maintained for Permit compliance.

The Non-Storm Water Outfall Program requires the development of an MS4 outfall database by the time that this CIMP is submitted. The objective of the MS4 database is to geographically link the characteristics of the outfalls within the MdR Watershed with watershed characteristics including: subwatershed, waterbody, land use, and effective impervious area (EIA). The information will be compiled into GIS layers as described below.

3.1 Available Information

This section summarizes the GIS database submitted with the CIMP and the existing infrastructure information available for the MdR Watershed.

3.1.1 CIMP GIS Database

The GIS database submitted concurrently with this CIMP (Appendix G) was developed using a compilation of data described in this section. Data are continually gathered by the MdR EWMP Agencies and are continually imported into the GIS database. The information is summarized in Table 3-1 .

Table 3-1. GIS Database Elements Submitted with CIMP

Permit Section	Database Element	Status
VII.A.1	Surface water bodies within MdR Watershed	Submitted
VII.A.2	HUC-12 boundary	Submitted
VII.A.3	Land Use overlay	Submitted
VII.A.4	Effective Impervious Area (EIA) overlay (if available)	Submitted
VII.A.5	Jurisdictional boundaries	Submitted
VII.A.6	Location and length of all open channel and underground pipes 18 inches in diameter or greater	Submitted
VII.A.7	Location of all Dry Weather Diversions	Submitted
VII.A.8	Location of all major MS4 Outfalls* within the EWMP Agency's jurisdictional boundary. Each major outfall has been assigned an alphanumeric identifier and mapped.(1)	Submitted
VII.A.10	Storm drain outfall catchment areas of each major outfall within the MdR Agencies' jurisdiction.(2)	Submitted

Table 3-1. GIS Database Elements Submitted with CIMP

Permit Section	Database Element	Status
VII.A.11a	MS4 Outfall Ownership(3)	Submitted
VII.A.11b	MS4 Outfall Coordinates	Submitted
VII.A.11c	Physical Description of MS4 Outfall	Submitted
VII.A.11d	Photographs of the Outfall, where possible, to provide baseline information to track operation and maintenance needs over time.(4)	Ongoing/ Submitted
*All major Outfalls greater than 36 inches have been identified and defined. (1) Permit MRP Section VII.A.6 requires the MS4 database and maps to include "all open channel and underground pipes 18 inches in diameter or greater" as part of the Outfall-based assessment program and MS4 database. Due to tidal inundation, these Outfalls have been included for reference purposes only and generally are not considered monitorable for non-storm water assessment. (2) Drainage areas were not built for the four 36" outfalls identified in Venice Canal. (3) To the maximum extent feasible. (4) Photographs were included in historic Outfall assessments and have been provided as an electronic attachment to this CIMP in support of field reconnaissance activities. The MdR EWMP Agencies also collect and manage photos which are maintained and managed by each member separately.		

3.1.2 Existing Infrastructure

In 2004, the County, City of Los Angeles, City of Culver City, and Caltrans conducted an assessment of small storm drains across the MdR Watershed (LACDBH, 2004a). The MS4 infrastructure in the MdR Watershed includes four MS4 major outfalls. For the purposes of this MdR CIMP, an MS4 major outfall, as defined by Attachment A of the Permit, is an MS4 outfall that discharges from a single pipe with an inside diameter of 36 inches or more or its equivalent (discharge from a single conveyance other than a circular pipe that is associated with a drainage area of more than 50 acres; or for municipal separate storm sewers that receive storm water from lands zoned for industrial activity (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe). The characteristics and locations of each major outfall have been summarized in Table 3-2 and are represented on Figure 1-1 as yellow dots. Outfalls with an inner diameter of greater than or equal to 18 inches and less than 36 inches are represented on Figure 1-1 as green dots. The available infrastructure information from digitized MS4 data provided by the MdR EWMP Agencies is summarized in Table 3-4. As indicated by the 2004 Small Drain Report (LACDBH, 2004a) and MS4 reconnaissance conducted in 2013 as part of the development of this CIMP (Appendix B), the MS4 system in the MdR Watershed is strongly influenced by tide and a majority of the drains that discharge to the Harbor are partially or fully submerged at their discharge to the receiving water. Due to tidal inundation, these outfalls have been included for reference purposes only and generally are not considered monitorable for non-storm water assessment.

Major outfall CSTL-022A represents discharge from Subwatershed 3 to Basin E, approximately 17.5% (324.7 acres) of the total drainage area of the MdR Watershed. Major outfalls CSTL-022B and C are connected to Oxford Retention Basin, which receives discharge from Subwatershed 4. These major outfalls discharge to Basin E and represent approximately 36.2% (671.1 acres) of the total drainage area of the MdR Watershed. All three major outfalls in Basin

E are fully submerged during a majority of the tide cycle. The tides gates protecting CSTL-022A are located upstream within the MS4 near the Boone Olive Pump Station. Tide gates have been installed at adjoining outfalls CSTL-022B and CSTL-022C for flow regulation and flood control protection for Oxford Retention Basin. The fourth major outfall in the MdR Watershed (CSTL-023B) discharges from MdR subwatershed 1 to Basin G. CSTL-023B drains roads and parking lots within the County and Caltrans jurisdictional areas. The drainage area is flat and the publicly available MS4 data are limited. The tributary area was approximated using a combination of Geographic Information System (GIS) software and field observations. Based on this desktop analysis, CSTL-023B represents approximately 2.3% (41.8 acres) of the total drainage area of the MdR Watershed. CSTL-023B is fully submerged during the entire tidal cycle and the upstream MS4 is tidally inundated.

The MS4 network tributary to the Grand Canal (i.e., Venice Canals and Ballona Lagoon) includes four major outfalls. It is, however, separated from the MdR Harbor receiving water by a large tide gate.

The characteristics and locations of these major outfalls have been summarized in Table 3-2 and are represented on Figure 1-1 as yellow dots.

Table 3-2. Major Outfalls in the MdR Watershed (Diameter ≥ 36 inches)

Outfall ID	Location	MdR Subwatershed	Diameter (inches)	Material	Tidal Influence
CSTL-022A	Basin E	3	51	RCP	Yes; Fully submerged Majority of Tide Cycle; Tide Gate
CSTL-022B	Basin E	4	72	RCP	
CSTL-022C	Basin E	4	72	RCP	
CSTL-023B	Basin G	1	54	RCP	Yes; Always Submerged
22	Grand Canal	2	64	RCB	Half Submerged, Controlled by Tide Gate
21	Grand Canal	2	66	RCB	
7	Grand Canal	2	84	RCB	Fully Submerged
10	Grand Canal	2	84	RCB	Fully submerged, Controlled by Tide Gate

RCB - Reinforced Concrete Box; RCP - Reinforced Concrete Pipe

Several improvements have been made to control runoff to the MS4 infrastructure in the MdR Watershed. Immediately upstream of the tidally influenced zone, LFDs have been installed to redirect non-storm water discharges from the MS4 to the sanitary sewer, that otherwise would have discharged through outfalls CSTL-023A, B, and C into Basin E. Details of the three LFD projects are summarized in Table 3-3. In 2007, Line A, a storm water diversion system, was constructed. This system captured storm water runoff from parking lots and land uses surrounding Marina Beach and directed it to Basin C (Figure 1-1). The outfall for storm drain Line A is a 30-inch RCP that diverts the 10-year frequency runoff storm event from Parking Lots 10 and 11, neighboring restaurants, and streets (an approximate 11-acre area, adjacent to Basin D) into Basin C.

Table 3-3. Existing Low Flow Diversion Structures in MdR Watershed

Location of Diversion	Design	Outfall ID	Receiving Water	Diversion Discharge Endpoint
Project 5243: Intersection of Washington Blvd. and Thatcher Ave[(a)]	Low Flow Diversion with a capacity of 92,000 GPD and overtopping flow (significant flow) of 0.22 CFS.	CSTL-022B, CSTL-022C	Basin E	Sanitary Sewer
Project 3872: Oxford Flood Control Basin Pump House[(a)]	Low Flow Diversion with a capacity of 288,000 GPD and overtopping flow (significant flow) of 0.45 CFS.	CSTL-022B, CSTL-022C	Basin E	Sanitary Sewer
Project 3874: Boone-Olive Pump Station Control House[(a)]	Low Flow Diversion with a capacity of 92,000 GPD and overtopping flow (significant flow) of 0.22 CFS.	CSTL-022A	Basin E	Sanitary Sewer
[(a)] Completed 03/2007 CFS – cubic feet per second; GPD – gallons per day				

Table 3-4. MdR Watershed Outfalls with Diameters Greater than or Equal to 18 Inches and Less than 36 Inches

Outfall ID	Location	MdR Subwatershed	Diameter (inches)	Material	Tidal Influence
MdR Harbor					
CSTL-019	Main Channel	1	18	CMP	Likely None
CSTL-020A	Basin A	1	18	RCP	Fully Submerged
CSTL-020B	Basin A	1	18	RCP	Fully Submerged
CSTL-020C	Basin B	1	18	RCP	Possibly submerged at High tides
CSTL-021	Basin B	1	18	RCP	Possibly submerged at High tides
CSTL-022D	Main Channel	1	18	CMP	Tidal
CSTL-023A	Basin F	1	18	RCP	Tidal
CSTL-024A	Basin H	1	18	CMP	Fully Submerged
CSTL-024B	Main Channel	1	21	RCP	Possibly submerged at High tides
CSTL-024C	Main Channel	1	18	ACP	Fully Submerged
Storm Drain Line A	Basin D → Basin C	1	30	RCP	Possibly submerged at High tides

Table 3-4. MdR Watershed Outfalls with Diameters Greater than or Equal to 18 Inches and Less than 36 Inches

Outfall ID	Location	MdR Subwatershed	Diameter (inches)	Material	Tidal Influence
Grand Canal (Venice Canals / Ballona Lagoon)					
33	Ballona Lagoon	2	18	Unknown	Fully Submerged
30	Ballona Lagoon	2	18	Unknown	Fully Submerged
9	Ballona Lagoon	2	18	Unknown	Fully Submerged
6	Ballona Lagoon	2	18	Catch basin	Fully Submerged
5	Ballona Lagoon	2	18	Catch basin	Fully Submerged
4	Ballona Lagoon	2	18	Concrete	Fully Submerged
3	Ballona Lagoon	2	18	Concrete	Fully Submerged
23	Ballona Lagoon	2	18	PVC	Visible#
31	Ballona Lagoon	2	18	Concrete	Visible
24	Ballona Lagoon	2	18	Concrete	Visible
11	Ballona Lagoon	2	18	PVC	Half Submerged#
8	Ballona Lagoon	2	18	Concrete	Half Submerged#
12	Ballona Lagoon	2	18	PVC	Visible#, Controlled by Tide Gate
13	Ballona Lagoon	2	18	PVC	Visible#
15	Ballona Lagoon	2	18	PVC	Half Submerged#
16	Ballona Lagoon	2	18	PVC	1/3 Submerged#
18	Ballona Lagoon	2	18	PVC	Half Submerged#
19	Ballona Lagoon	2	18	PVC	1/3 Submerged#
20	Ballona Lagoon	2	18	PVC	Half Submerged#
17	Ballona Lagoon	2	18	PVC	Submerged#
14	Ballona Lagoon	2	18	PVC	Half Submerged#
32	Ballona Lagoon	2	22	Concrete	Visible
26	Ballona Lagoon	2	24	Concrete	Visible#
28	Ballona Lagoon	2	24	Concrete	Tide Gate
29	Ballona Lagoon	2	34	Concrete	Half Submerged
ACP - Asbestos Cement Pipe; CMP - Corrugated Metal Pipe; RCB - Reinforced Concrete Box; RCP - Reinforced Concrete Pipe d/s – downstream; u/s – upstream. #Downstream End of Venice Canals					

3.2 Pending Information and Schedule for Completion

The elements described in Table 3-5 represent pending information that is primarily expected to be an outcome of implementing this CIMP and outfall-based monitoring programs. As such, a schedule for completing each of the elements is provided. As the data become available, they will be entered into the GIS and water quality databases. Each year, the storm drains, channels, outfalls, and associated databases will be updated to incorporate the most recent characterization data for outfalls. The updates will be included as part of the annual reporting to the Regional Board.

Table 3-5. Pending Information for MS4 Database and Elements to be developed through CIMP Implementation

Permit Section	MS4 Database Requirement/Element	Status	Date of Submission
VII.A.9	Notation of outfall with significant non-storm water discharges	Generally not applicable	December 2015
VII.A.10	Details of analysis of outfall catchment areas for potential new outfall monitoring locations	As needed	Ongoing assessment of Venice Canals
VII.A.11.e	Determination of whether the outfall conveys significant non-storm water discharges	Generally not applicable	December 2015
VII.A.11.f	Outfall monitoring data	Ongoing. Anticipated to be limited to storm water data.	Ongoing

4.0 STORM WATER OUTFALL MONITORING

As outlined in the MRP (Part VIII.A of the MRP), storm water discharges from the MS4 shall be monitored at outfalls and/or alternative access points upstream of outfalls, such as manholes or in channels representative of the land uses within the Permittee's jurisdiction to support meeting the three objectives of the storm water outfall based monitoring program:

a. Determine the quality of a Permittee's discharge relative to municipal action levels, as described in Attachment G of Permit;
b. Determine whether a Permittee's discharge is in compliance with applicable WQBELs derived from TMDL WLAs; and
c. Determine whether a Permittee's discharge causes or contributes to an exceedance of RWLs.

4.1 Storm Water Outfall Monitoring Sites

Outfall monitoring stations are monitoring stations within the MS4 system of the MdR Watershed. These stations are used to evaluate watershed conditions in accordance with the Toxics TMDL CMP and related special studies. The sites were selected based on an evaluation of the representativeness of the land uses draining to the outfall location, the jurisdictions draining to the outfall location, the safety and accessibility of the site, and the ability to use autosampling equipment at the location. The data collected at the monitored outfalls will be considered representative of all MS4 discharge within the MdR Watershed EWMP area and will be applied to all MdR EWMP Agencies, regardless of whether a site is located within a particular jurisdiction. Assessment of whether an MdR Agency caused or contributed to exceedances of WQBELs and/or RWLs may be based on the evaluation comingled discharges. This approach will provide the representative data needed to meet the specific MRP objectives for storm water outfall monitoring and support management decisions of the MdR EWMP Agencies.

The MdR Watershed includes five outfall stations MdR-3, MdR-4, MdR-5, MdRU-C-1, and MdRU-C-2. The location of these outfalls is summarized in Table 4-1. The tributary drainage area, MS4, jurisdictional boundaries, land uses, and downstream outfall for these Toxics TMDL monitoring stations are presented in Figure 4-1 through Figure 4-4. Note that in 2013, outfall stations MdR-1 and MdR-2 were removed from the Toxics TMDL monitoring program and CMP due to redundancy with downstream outfall station MdR-3 and a decision to focus on an integrated compliance monitoring approach rather than a jurisdiction-specific pollutant reduction compliance monitoring approach.

Table 4-1. MdR Outfall Monitoring Stations

CIMP Station ID[a]	Media Sampled	Monitoring Station Description
MdR-3[b]	Water, Storm-Borne Sediment	Permit Compliance Outfall Station/Toxics TMDL Outfall Station, at the intersection of Washington Blvd. and Thatcher Ave. LFD Project No. 5243
MdR-4[b]	Water, Storm-Borne Sediment	Toxics TMDL Outfall Station at the Oxford Flood Control Basin pump house. LFD Project No. 3872
MdR-5[b]	Water, Storm-Borne Sediment	Toxics TMDL Outfall Station at the Boone-Olive Pump Station control house. LFD Project No. 3874

Table 4-1. MdR Outfall Monitoring Stations

CIMP Station ID[a]	Media Sampled	Monitoring Station Description
MdRU-C-1	Water, Storm-Borne Sediment	Toxics TMDL Outfall Station at the catch basin located north of Bali Way and Admiralty Way
MdRU-C-2	Water, Storm-Borne Sediment	Toxics TMDL Outfall Station at the catch basin located north of Abbot Kinney Blvd. and Woodlawn Ave.

[a]Former Outfall monitoring stations MdR-1 and MdR-2 were removed from the Toxics TMDL CMP with Regional Board approval.
[b]Low flow diversions (LFDs) have been installed and divert all known significant Non-storm Water flows to the sanitary sewer. Only Storm Water monitoring is anticipated to be necessary.

Outfall station, MdR-3, is the representative Permit monitoring station. The station selected for Permit compliance monitoring is the most representative of Watershed impacts to the Harbor. MdR-3 was selected as the MdR outfall Station based on total tributary drainage area, mix of land uses, diversity of jurisdictions, and presence of BMPs (see Appendix B). A map of the tributary drainage area to MdR-3, as well as the land uses and jurisdictional boundaries within the drainage area, is presented in Figure 4-1.

All five outfall Stations MdR-3, MdR-4, MdR-5, MdRU-C-1, and MdRU-C-2 are monitoring stations under the Toxics TMDL compliance monitoring.

4.2 Monitored Parameters and Frequency

Outfalls will be monitored for all required constituents in accordance with Part VIII.B.c. of the MRP. Toxicity sampling will be conducted at the MdR-3 outfall station for Permit compliance monitoring, only if a toxicity identification evaluation (TIE) conducted at the downstream receiving water station (MdRH-MC) during the most recent sampling event was inconclusive. Toxicity testing shall be conducted on a flow-weighted composite sample. If this outfall discharge exhibits aquatic toxicity, then a TIE shall be conducted in accordance with the requirements outlined in Appendix C.

An overview of the constituents for monitoring, including physical, bacterial, chemical, and toxicity analyses of water and stormborne sediment samples from the MdR outfalls, is presented in Table 4-2. Refined parameter lists, completed with analytical methods and detection limits are provided in Appendix D. Sampling methods, sample handling procedures, and details regarding the collection of QA/QC samples are detailed in Appendix C.

In general, a higher concentration of constituents from urban runoff enters the MS4 during the initial stages of flow and during peak flow and/or peak rainfall intensity for small rainfall events, which are typical in southern California (Tiefenthaler et al., 2001). Therefore, a successful storm water monitoring event for sampling within the MS4 will be determined by capturing (at a minimum) the initial rise and peak of runoff from the storm event, and by demonstrating that water levels have decreased in relation to the overall storm hydrograph when monitoring is discontinued. A minimum of 3 days of dry conditions (i.e., 72 hours) is required between qualified storm events.

Flow-weighted storm water composite sampling will be conducted at all outfall station for Permit compliance, Toxics TMDL compliance, and watershed assessments for special studies. The duration of monitoring at the outfalls will be determined by the characteristics of the storm event and will consist of a minimum of 3 hours and a maximum of 24 hours.

For storm-borne sediment collection, the passive collection devices will be deployed the day of the storm event or, if the rain is expected overnight, the devices will be deployed the afternoon before. For the pumped collection systems, the submersible pumps will be placed in the wet well in advance but will not be turned on until the storm discharge begins. The typical cycle for observations during a storm event is approximately once an hour. The observations at the passive sediment sites (MdR-3, MdR-4, MdRU-C1 and MdRU-C2) will primarily focus on checking for debris build up and snags on the devices. The observations at the two pumped samplers (both at MdR-5) will focus on monitoring the filter processing rate to identify pump clogs and/or filter saturation.

Parameters of Table E-2 of the MRP identified as exceeding the lowest applicable water quality objective at MdRH-MC will be monitored during subsequent storm events. Year 1 monitoring at MdR-3 will be focused on Toxics TMDL monitoring requirements.

Table 4-2. Stormwater Outfall Monitoring Stations Sampling Parameters and Frequency

Parameter	Permit, Toxics TMDL	Toxics TMDL			
	MdR-3	MdR-4	MdR-5	MdR-CU-1	MdR-CU-2
WATER QUALITY					
Flow	1x/month*	1x/month*	1x/month*	1x/month*	1x/month*
Field Parameters(a)	1x/month*	-	-	-	-
Pollutants identified in Table E-2 of Permit *(and not otherwise listed below)#*	1x/month*	-	-	-	-
Aquatic Toxicity	(b)	-	-	-	-
Hardness	1x/month*	-	-	-	-
Copper (total/dissolved)	1x/month*	-	-	-	-
Lead (total/dissolved)	1x/month*	-	-	-	-
Zinc (total/dissolved)	1x/month*	-	-	-	-
Total Dissolved Solids (TDS)	1x/month*	1x/month*	1x/month*	1x/month*	1x/month*
Total Suspended Solids (TSS)	1x/month*	1x/month*	1x/month*	1x/month*	1x/month*
Suspended Solids	1x/month*	1x/month*	1x/month*	1x/month*	1x/month*
STORM-BORNE SEDIMENT					
Total Organic Carbon (TOC)	1x/month*				
Copper					
Lead					
Zinc					
Chlordane	Composited over the year				
Total PCBs					
Total Dichlorodiphenyltrichloroethane (DDTs)					
p,p'-DDE					

*Monitoring will be performed for one storm/month with a minimum of three storms and a maximum of seven storms per year.
Table E-2 constituents detected above relevant objectives at the MS4 receiving water monitoring station.
(a) Field parameters are defined as dissolved oxygen (DO), pH, temperature, and specific conductivity.
(b) Toxicity sampling at outfall stations for Permit compliance will be as needed and conducted only if toxicity is observed at the downstream receiving water station and qualifying conditions outlined in the (Appendix C).

Figure 4-1. Outfall Station MdR-3 – Permit and Toxics TMDL Monitoring

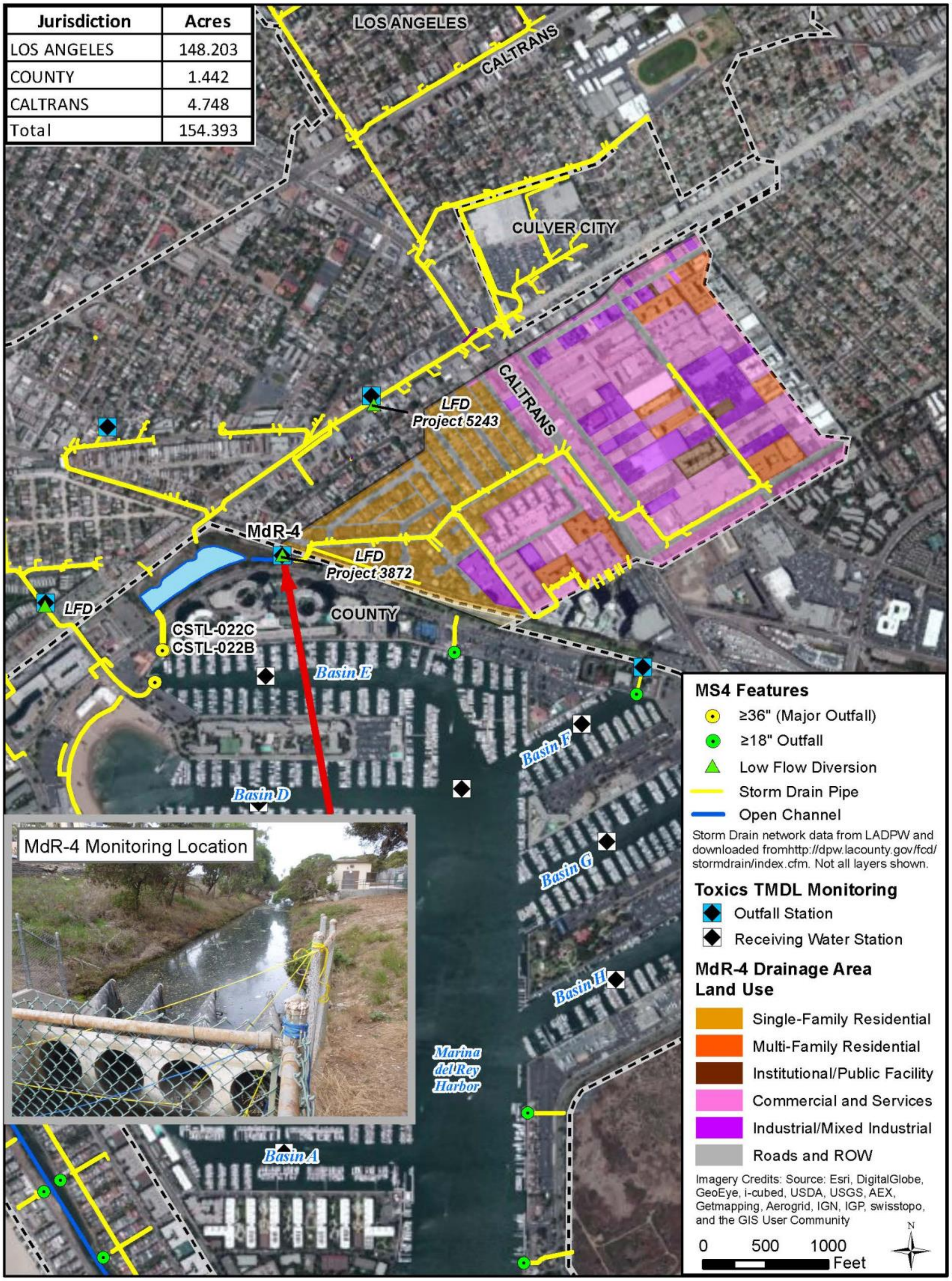


Figure 4-2. Outfall Station MdR-4 – Toxics TMDL Monitoring

Figure 4-3. Outfall Station MdRU-C-1 (Toxics TMDL Monitoring) and Tidally Submerged MS4 Tributary to Major Outfall CSTL-023B

Figure 4-4. Outfall Stations MdR-5 and MdRU-C-2 – Toxics TMDL Monitoring

4.3 Storm Water Outfall Monitoring Summary

Five outfall monitoring locations were selected for monitoring. One station (MdR-3) was selected for both Permit monitoring and Toxics TMDL monitoring, along with four additional stations which will be monitored as part of the Toxics TMDL outfall monitoring. These stations will capture runoff from representative land use areas, represented in Figure 4-1 through Figure 4-4, of the MdR Watershed and will also be used to assess Permit and Toxics TMDL compliance in accordance with applicable storm water MALs and WQBELs.

5.0 NON-STORM WATER OUTFALL PROGRAM

The objectives of the NSW Outfall Program include the following (Part II.E.3 of the MRP):

a. Determine whether a Permittee's discharge is in compliance with applicable NSW WQBELs derived from TMDL WLAs;
b. Determine whether a Permittee's discharge exceeds NSW action levels, as described in Attachment G of the Permit;
c. Determine whether a Permittee's discharge contributes to or causes an exceedance of RWLs; and
d. Assist a Permittee in identifying illicit discharges as described in Part VI.D.10 of the Permit.

The intent of the NSW Outfall Program is to demonstrate that the Permittees are effectively prohibiting NSW discharges that are not exempt or conditionally exempt discharges to receiving waters and to assess whether NSW discharges are causing or contributing to exceedances of RWLs. By detecting, identifying, and eliminating illicit discharges, the NSW Outfall Program will demonstrate Permittees' efforts to effectively prohibit NSW discharges to and from the MS4. Where NSW discharges are deemed "significant", the program will discern whether they are illicit, exempt, or conditionally exempt, and demonstrate whether the discharges may be causing or contributing to exceedances of RWLs.

The NSW Outfall Program is focused on NSW discharges to receiving waters from major outfalls (i.e., discharges occurring during dry weather).

5.1 Non-Storm Water Outfall Screening and Monitoring Program

Non-storm water outfall monitoring is considered to be neither feasible nor necessary in the MS4 of the MdR Watershed. The Watershed is strongly tidally influenced and the receiving waters of MdR Harbor function differently than the linear river systems used to model the Permit monitoring requirements. There are four major outfalls in the MdR Watershed. There are LFDs installed upstream of three major outfalls CSTL-022A, B, and C) that divert non-storm water flows to the sanitary sewer, making a comparison of impact to the Harbor receiving water from the upstream MS4 unnecessary. Major outfall CSTL-0023B is strongly tidally influenced throughout the system and tidal flow is not discernable from non-storm water discharges. Therefore, for the purposes of the MdR Watershed CIMP, the MdR EWMP Agencies will not conduct non-storm water monitoring at the outfalls.

5.2 Identification of Outfalls with Significant Non-Storm Water Discharges

Field reconnaissance conducted in January 2014 confirmed that the MS4 in the MdR Watershed is strongly tidally influenced, limiting opportunities for identification of new monitorable stations representative of all watershed drainage areas (Appendix B). Aside from the three LFDs upstream of three of the four major outfalls in the watershed, the remaining MdR Watershed MS4 infrastructure that discharges to the Harbor is frequently submerged during a period of or the entire tidal cycle. Marine water and other signs of tidal inundation, such as mussels and shells, may be found far up into the watershed. For these reasons, non-storm water monitoring is not considered applicable for the MdR Watershed. Figure 5-1 draws an approximation of the boundary of tidal influence in the MdR Watershed based on the field reconnaissance summarized in Appendix B.

5.3 Non-Storm Water Outfall Monitoring Summary

Non-storm water outfall monitoring is considered to be neither feasible nor necessary in the MS4 of the MdR Watershed. The watershed is strongly tidally influenced and tidal flow is not discernable from non-storm water discharges. In addition, improvements have been made to the MS4 infrastructure to mitigate and eliminate potential water quality impacts of the MS4 on the Harbor receiving waters. These improvements include the installation of LFDs upstream of the three major outfalls to Basin E, thus eliminating the need for outfall-based non-storm water monitoring in these systems.

Figure 5-1. Extent of Tidal Influence in the MdR Watershed

6.0 TRASH AND PLASTIC PELLET MONITORING

The monitoring and reporting requirements of the Santa Monica Bay Nearshore and Offshore Debris TMDLs (Debris TMDL) may be broken up into two categories: (1) Trash and (2) Plastic Pellets. The following subsections detail how the MdR EWMP Agencies will meet the requirements specific to each category.

6.1 Trash

The Santa Monica Bay Nearshore and Offshore Debris TMDL (Debris TMDL) came into effect on March 20, 2012. The Responsible Agencies identified in the Debris TMDL that also have jurisdiction in the MdR Watershed include the County, LACFCD, City of Los Angeles, City of Culver City, and Caltrans. The Debris TMDL requires Responsible Agencies to comply with the final WQBEL of zero trash discharge into waterbodies within the Santa Monica Bay Watershed Management Area (WMA) and then into Santa Monica Bay or the shoreline of Santa Monica Bay.

The Permit requires Permittees to develop a Trash Monitoring and Reporting Plan (TMRP) to describe the methodologies that will be used to assess and monitor trash from source areas in the Santa Monica Bay (SMB) WMA and shoreline of the Santa Monica Bay. In 2012, the County submitted a TMRP to the Regional Board. The City of Los Angeles will not be developing a TMRP for MdR because the implementation program for the Ballona Creek (BC) Trash TMDL covers the City's area in MdR. The City does not have plastic pellet facilities in MdR and is therefore not subject to the pellet monitoring requirements of the PMRP; subsequently, the City will coordinate plastic pellets spill and response requirements in conjunction with SMB and BC watersheds. The City of Culver City is in compliance with the TMRP for the Ballona Creek Trash TMDL and is considered in compliance with the Debris TMDL's trash component.

Trash monitoring will be conducted to assess the quantities of trash in the Harbor receiving water associated with storm events. Visual observations of trash will be made and photographs will be taken at the MdRH-MC prior to the start of storm event monitoring and again at the end of the storm water monitoring. One photograph will be taken across the Main Channel of MdR Harbor, perpendicular to direction of flow along the channel. The photograph will show as much as possible of both sides of the Main Channel when feasible. The post storm photograph must be taken from the same vantage point. Ideally the two photographs will display relative volumes of trash that were deposited by storm flows, if trash is present.

6.2 Plastic Pellets

Plastic Pellet Monitoring and Reporting Plans (PMRPs) quantifying potential plastic pellet discharges to Santa Monica Bay, along with supplemental Spill Response Plans (SRPs) to address containment of spilled plastic pellets, were submitted to the Regional Board by the City of Culver City (2012), County (2013), and LACFCD (2013).

7.0 NEW DEVELOPMENT/RE-DEVELOPMENT EFFECTIVENESS TRACKING

The MdR EWMP Agencies have developed mechanisms for tracking new development/re-development projects that have been conditioned for post-construction BMPs pursuant to Permit Section VI.D.7. The MdR EWMP Agencies have also developed mechanisms for tracking the effectiveness of these BMPs pursuant to Permit Attachment E.X. A sample tracking mechanism is attached for reference (Appendix E).

In 2002, the Permittees developed and implemented the Standard Urban Stormwater Management Plan (SUSMP), a Development Planning Program that outlines BMP requirements for development and re-development projects. The Permit expanded the requirements of the SUSMP program outlined in the previous version of the NPDES permit. The goal of the revised program is to reduce water quality impacts associated with urban development by minimizing impervious surfaces and controlling runoff from impervious surfaces (i.e., smart growth). New Development and Re-Development Projects, defined in Table 7-1, are required to retain on-site the volume of water produced by the greater of the following sources:

- Stormwater Quality Design Volume (SQDV) (i.e., 0.75-inch, 24-hour rain event).
- 85^{th} percentile 24-hour rain event (in accordance with the County's 85^{th} percentile Precipitation Isohyetal Map).

If the analysis determines that on-site containment of the full design volume is technically infeasible, alternative compliance measures such as groundwater replenishment and off-site management should be considered. The technical infeasibility threshold must be demonstrated through an analysis of the maximum application of green roofs and rainwater harvest and use, and the analysis must be endorsed by a registered professional engineer, geologist, architect, and/or landscape architect.

Table 7-1. New Development and Re-development Projects Subject to the Permit BMP Tracking Program Requirements

	Project Area	New Development	Re-Development
Planning and Land Development Program	≥10,000 sq ft and ≥1 acre disturbed area	All Projects	--
	≥10,000 sq ft	Industrial Parks Commercial Malls Streets/Roads	Existing Single-Family Homes in hillside areas[a]
	≥5,000 sq ft	Retail Gas Outlets Restaurants Parking Lots* Automotive Facilities	Alter ≥50% impervious surface at site not subject to post-construction BMPs[a]
	≥2,500 sq ft	All projects located in, directly adjacent to, or discharging directly to the Ballona Creek Coastal Resource Area (CRA) [b]	--
	Single Family Homes in hillside areas	All Projects	New or replace ≥10,000 sq ft impervious surface area.

*Includes parking lots with ≥25 parking spaces.
(a) For projects with <50% impervious surfaces re-developed, only the altered area must be mitigated.
(b) The Permit applies to all projects located in, directly adjacent to, or discharging directly to a Significant Ecological Area (SEA). The County has given the term Coastal Resource Area (CRA) to SEAs located in the California Coastal Zone. The Ballona Creek CRA includes the salt marsh, Ballona Creek Channel, Ballona Lagoon, and Del Rey Lagoon (LADPW, 2014). This criterion would apply to projects directly adjacent to or discharging directly to, the Ballona Creek Wetlands (Area A), Fiji Ditch, and the Ballona Lagoon (i.e., projects along the Venice Canals).

7.1.1 Existing New Development/Re-Development Programs

In accordance with the Permit, the Permittees that have such land use authority over new developments or re-development projects or development construction sites are responsible for implementing a storm water management program to inspect and control pollutants from new development and re-development projects within their jurisdictional boundaries.

The LACFCD has no planning, zoning, development permitting, or other land use authority over new developments or re-development projects located in the incorporated or unincorporated areas of the MdR Watershed.

7.1.1.1 Existing New Development/Re-Development Program – County

In 2008, the County adopted Ordinance 22.52.2210 (Ord. No. 2008-0063 §3, 2008), which incorporates the Low Impact Development (LID) requirements outlined in the Permit into the County Code. This Ordinance is the Local Ordinance Equivalence of the Permit and applies to all of the development and re-development projects identified in Table 7-1. Prior to issuance of building permits and/or commencement of any construction activity, the LID BMPs in the project is reviewed by County staff using the *Standard Urban Stormwater Mitigation Plan Review Sheet* (LADPW, 2008a) and the *County of Los Angeles LID Standards Manual* (LADPW, 2009) describes LID techniques. The County provided an update of the *LID Standards Manual* (LADPW, 2014) to comply with the LID requirements of the 2012 MS4 Permit.

7.1.1.2 Existing New Development/Re-Development Program – City of Los Angeles

In May 2012, the City of Los Angeles adopted Ordinance 181899 to amend the Los Angeles Municipal Code (LAMC) and expand the applicability of existing SUSMP requirements to include rainwater LID strategies on all projects requiring a building permit. The Ordinance is enforced through a LID Plan Check process, wherein City staff review project drawings and the associated storm water mitigation plan for LID measures prior to issuance of a building permit. The *Development Best Management Practices Handbook* (City of Los Angeles, 2011) describes LID techniques and provides examples and descriptions of how LID systems function.

7.1.1.3 Existing New Development/Re-Development Program – City of Culver City

In 2002, the City of Culver City adopted Ordinance 2002-014 to amend Chapter 5.05 of the Municipal Code to include LID mitigation as part of the SUSMP. The Ordinance is enforced through a LID Plan Check process, wherein City staff review project drawings and the associated storm water mitigation plan for LID measures prior to issuance of all applicable permits. Potential enforcement actions for identified seasonal and/or recurrent violations of SUSMP provisions include cease and desist orders, notice to clean orders, permit revocation (if applicable), and other potential civil and/or criminal remedies deemed appropriate. As currently written, the existing Municipal Code exempts single-family structures from redevelopment requirements. This ordinance is scheduled to be updated during the winter of 2014 in order to achieve a Local Ordinance Equivalence to the Permit.

7.1.2 Data Tracking, Inspection, and Enforcement Requirements for Post-Construction BMPs

Section VI.D.7.d.iv of the Permit requires each Permittee to implement an inspection and enforcement program for new development and redevelopment post-construction BMPs and to track data in an electronic database (preferably with a GIS-interface to the MS4 maps). Figure 7-1 presents an iterative approach to collection, tracking, and reporting and data associated with the New Development and Re-Development Program. Existing SUSMP programs may be standardized between MdR EWMP Agencies and shared using a common electronic tracking platform.

The overall data tracking process may be a linear or an iterative process, as needed, based on the findings of each year of implementation. Potential changes to the program and data collection systems will be considered during the annual reporting process, when all available data from the MdR Watershed is compiled by jurisdiction and reviewed in the context of the Permit and TMDLs. The Permittees will conduct a formal review of the overall data tracking program and make necessary programmatic revisions during Year 3 of the program.

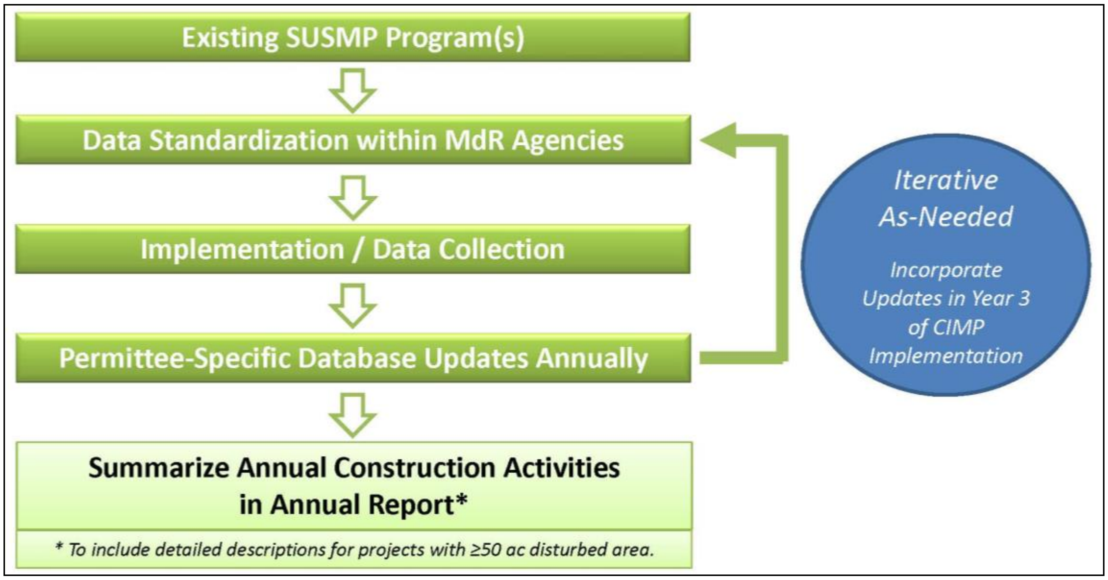


Figure 7-1. Iterative Approach – New Development/Re-Development Program Data Tracking

Existing data tracking protocols and databases, which have been summarized for each Permittee in Appendix E, are based on the SUSMP programs described above. The Permit allows each Permittee to establish Local Ordinance Equivalents to the Permit; therefore, slight variations currently exist for inspection thresholds and data tracking. Therefore, during Year 1 of the program, data review and standardization are necessary to ensure that information collected across the MdR Watershed is consistent and that collected data are tracked and annually shared using consistent methods for reporting purposes.

The Permit minimum data tracking requirements, identified in Table 7-2, establish the basis for data standardization. Key additional data fields, which may allow for more consistent, streamlined data reporting, are also identified in Table 7-2. The additional data fields reflect the following reporting requirements of the Permit:

- A summary of New Development/Re-development Projects are constructed during the reporting year, for each MdR Agency's jurisdictional area.
- A detailed description of control measures applied to projects disturbing more than 50 acres.

An essential factor in overall data standardization between Permittees is agreement on the type of fields to be exported from individual Permittee databases to the master database. This method of standardization may be enhanced through collaborative development of the design and implementation of common inspection forms. Section 7(d)(iv)(1)(c) of the Permit requires Permittees to use a Post-Construction BMP Maintenance Checklist to inspect all BMPs at least once every 2 years after new and re-development projects are completed in order to assess condition, functionality, and maintenance of the BMPs. Checklists, inspection forms, and training materials may be used to establish consistency between Permittees for naming conventions, reporting units, inspection evaluations (e.g., satisfactory/unsatisfactory), corrective actions, and other factors. Example forms are provided in Appendix E.

Table 7-2. Minimum Database Tracking Requirements

Category	2012 Permit Requirements for New Development/Re-Development Database	Minimum Method of Data Tracking By Section of the Permit
Development Project	Jurisdiction	--
	Project Name	MRP - X.A.1
	Municipal Project Identification No.	VI.D.7.d.iv.1.a.i
	State Waste Discharger Identification (WDID) No.	VI.D.7.d.iv.1.a.ii
	Developer Name / Contact Information	MRP - X.A.1
	Construction Start/Completion Dates	--
	Project Location and Site Map *(preferably linked to GIS storm drain map(s), especially for projects with off-site BMPs)*	--
	Location relative to a significant ecological area (SEA) feature	--
BMP Design	Project Area (acres)	VI.D.7.d.iv.1.a.iii
	Total Disturbed Area *(additional reporting requirements for projects ≥50 acres)*	--
	Type of Receiving Water (1)	--
	85^{th} Percentile Storm Event 95^{th} Percentile Storm Event (if "natural" Receiving Water) Other Hydromodification Design Criteria Project Design Storm (inches) Design Storm Volume (gallons/ MGD)	MRP - X.A.4, MRP - X.A.5, MRP - X.A.6, MRP - X.A.7 & 11 MRP - X.A.8 & 10
	Portion of Design Storm to be Retained on-site (%) Portion of Design Storm to be Retained or Treated off-site (%)	MRP - X.A.9 MRP - X.A.12 & 13
BMPs	BMP Type (Infiltration, Biofiltration, Groundwater Replenishment) and Description(2)	VI.D.7.d.iv.1.a.iv
	BMP Location (coordinates)	VI.D.7.d.iv.1.a.v
	BMP Location (on-site / off-site)	--
	Date of Maintenance Agreement	VI.D.7.d.iv.1.a.vii
	BMP Inspection Date and Summary of Findings(3)	VI.D.7.d.iv.1.a.ix
	BMP Corrective Action(s) based on Inspections	VI.D.7.d.iv.1.a.x
	BMP Replacement and/or Repair Date	VI.D.7.d.iv.1.a.xii
	BMP Maintenance Records	VI.D.7.d.iv.1.a.viii
	Date of BMP Acceptance	VI.D.7.d.iv.1.a.vi
	Date Certificate of Occupancy Issued (New Development)	VI.D.7.d.iv.1.a.xi MRP - X.A.3
	BMP Map *(preferably linked to GIS storm drain map(s), especially for off-site BMPs)*	MRP - X.A.2 MRP - X.A.14
	Documentation of Issuance of BMP Requirements to the Developer	MRP - X.A.15

(1) An improved drainage system is a system that has been channelized or armored. A natural drainage system is a system that has not been improved. The clearing or dredging of a natural drainage system does not cause the system to be classified as an improved drainage system.

(2) In order to identify and inspect for project-specific design specifications and criteria, it is recommended to integrate this description with electronic (PDF) files of Project Design Drawings and Calculations, which may be on record in a separate database, and with electronic copies of all maintenance records.

(3) Post-Construction BMP descriptions should integrate with the information in the Inspection check-lists. Basic information may be input to the database from design drawings and then field verified during the initial post-construction inspection.

8.0 REGIONAL STUDIES

8.1 Bioassessment Program

The MRP identifies one regional study: the SMC Regional Watershed Monitoring Program. The SMC is a collaborative effort between SCCWRP, State Water Board's Surface Water Ambient Monitoring Program (SWAMP), three Southern California Regional Water Quality Control Boards, and several county stormwater agencies. SCCWRP acts as a facilitator to organize the monitoring program, conducts the data analysis, and prepares monitoring results reports. The goal of the SMC is to develop a monitoring program on a regional level for Southern California's coastal streams and rivers.

Prior to the initiation of the SMC Regional Watershed Monitoring Program, in-stream monitoring in southern California was conducted by over a dozen different organizations, each of which had disparate monitoring programs that varied in design, frequency, and the indicators selected for measurement. Even where the monitoring designs were similar, the field techniques, laboratory methods, and quality assurance requirements were often not comparable, making region-wide assessments impossible. In addition, the lack of an integrated information management system precluded data sharing among programs. To address these problems, SCCWRP helped the SMC design and implement a coordinated and regional watershed monitoring program. The SMC works with local programs in the region to facilitate greater data collection and provide a regional context to address site- and watershed-specific questions.

The LACFCD will continue to participate in the Bioassessment Program being managed by the SMC. The LACFCD will continue to coordinate and assist in implementing the bioassessment monitoring requirement of the MS4 Permit on behalf of all the Permittees in Los Angeles County during the current permit cycle. Initiated in 2008, the SMC's Bioassessment Program is designed to run over a five-year cycle. Monitoring under the first cycle concluded in 2013, with reporting of findings and additional special studies planned to occur in 2014. The SMC Joint Executive Committee is currently working on designing the Bioassessment Program for the next five-year cycle, which is scheduled to run from 2015 to 2019.

8.2 Bight 2013

The Bight program is led and organized by SCCWRP and is considered to be independent of this CIMP. Data from the study, however, will be used to help evaluate long-term assessment of conditions in the MdR Harbor. Historically, the MdR Harbor was included in Bight 2003, Bight 2008 and Bight 2013. The Bight 2013 survey is organized into five technical components: (1) Contaminant Impact Assessment, (2) Shoreline microbiology, (3) Water Quality, (4) Marine Protected Areas, and (5) Trash and Debris. The MdR Harbor has been included in the 2013 Contaminant Impact Assessment, which focuses on sediment contaminants and associated impacts on benthic infauna and demersal fish. Currently, the MdR EWMP Agencies are planning to voluntarily participate in Bight 2018, which will include the SQO analysis required by the Toxics TMDL.

9.0 SPECIAL STUDIES

9.1 Existing Special Studies

An MRP requirement is that each Permittee conduct the special studies required in an effective TMDL or an approved TMDL CMP. As such, in addition to ongoing monitoring efforts, the MdR EWMP Agencies have completed special studies outlined in the existing TMDL CMPs in accordance with the requirements of the Bacteria TMDL and Toxics TMDL to better understand conditions in the MdR Watershed. For each of the special studies, where applicable, Table 2-1 provides the location and description of monitoring station used for the study, media sampled, and the type of data collected based on monitoring history.

Table 9-1. Special Studies Completed To Date

Report	Year	TMDL CMP Monitoring Station IDs	Parameters	Outfalls/MS4 (Storm Water)	Harbor Water	Sediment	Sediment Cores
Storm Borne Sediment Collection Pilot Project (Brown and Caldwell, 2013)	2011-2014	MdR-4, MdR-5, MdRU-C-1	Organics	x			
			Metals	x			
			Conventional*	x			
Special Study - Low-Detection Level(Brown and Caldwell, 2011b)**	2011	MdRH-B-1, MdRH-B-2, MdRH-B-3, MdRH-B-4, MdR-3, MdR-4, MdR-5, MdRU-C-1, MdRU-C-2	Organics	x	x	x	
Special Study - Partitioning Coefficient (Brown and Caldwell, 2011a)	2011	MdRH-B-1, MdRH-B-2, MdRH-B-3, MdRH-B-4, MdRH-F-1, MdRH-F-2, MdRH-F-3, MdRH-F-4, MdRH-F-5, MdR-3, MdR-4, MdR-5, MdRU-C-1, MdRU-C-2	Metals	x	x	x	
			Conventional*	x	x	x	
MdRH Sediment Characterization Study (Weston, 2008b)	2008	Multiple locations in the Harbor Back Basins, Front Basins, and Main Channle	Organics			x	x
			Metals			x	x
			Conventional*		x	x	
			Benthic Community			x	
			Toxicity			x	
Nonpoint Source Bacteria Study (Weston, 2008a)	2006	MdR Watershed	Bacteria	x	x	x	

*Based on Table E-2 of the MRP, conventional pollutants are Oil and Grease, total Phenols, cyanide, PH, Temperature.
**The study included stormwater, Harbor sediment, and Harbor receiving water characterization.

9.2 Proposed Special Studies

Special studies are a tool to be implemented on an as-needed basis for the adaptive management process throughout the EWMP implementation. The toxics TMDL requires a Stressor Identification Study to be performed as a special study.

- **Stressor Identification Study:** Biological testing is a useful tool for determining the presence of toxicity from sediment contamination; however, it does not indicate the cause of toxicity. If sediments fail to meet the SQOs during the Sediment Triad Assessment, the Toxics TMDL requires a stressor identification study to be conducted in accordance with Section VII.F of the *Water Quality Control Plan for Enclosed Bays and Estuaries* (SWRCB and Cal EPA, 2009) and for the final report to be submitted to the Regional Board by December 15, 2016. The stressor identification investigations use a variety of tools 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. 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." Following a review of the investigation data, conclusions will be made based on the data available and/or recommendations will be developed for future studies to further characterize or identify the condition causing the narrative impairment. To determine whether a site is impacted from toxic pollutants, one or more of the following tools may be applied:
  - Evaluate the spatial extent of the area of concern in relation to anthropogenic sources.
  - Evaluate the body burden of the pollutants accumulated in the animals used for exposure testing.
  - Evaluate the chemical constituent results to mechanistic benchmarks.
  - Compare chemistry and biology data to determine whether correlations exist.
  - Alternative biological assessment such as bioaccumulation experiments, pore water toxicity, or pore water chemistry analyses may be conducted.
  - Phase I TIEs conducted in accordance with USEPA 2007 may also be conducted and are often useful for determining the causative agent or class of compounds causing toxicity.

10.0 NON-DIRECT MEASUREMENTS

Environmental data (water, sediment, and tissue data) collected through other monitoring programs in the MdR Watershed will be incorporated to the extent practicable. The extent practicable will be dictated by the cost of gathering and compiling information from outside programs. It is not the intent or purpose of this CIMP to compile and analyze all available data. Environmental data reported by other entities will be evaluated for suitability for inclusion in this CIMP database and will be accepted if it meets the following requirements:

- Conducted and documented in accordance with the sampling procedures outlined in this CIMP.
- Sampling collection is performed and documented by a competent party in accordance with applicable guidance and this CIMP.
- Sample analysis is conducted using approved analytical method by a certified analytical laboratory.

Non-direct measurements related to tidal measurements (e.g., measurements not physically recoded by field staff during field monitoring activities) will be obtained from the National Oceanic and Atmospheric Administration (NOAA). Additional rainfall information will be obtained from the County, as needed.

11.0 ADAPTIVE MANAGEMENT

11.1 Integrated Monitoring and Assessment Program

One of the main objectives of the MdR Watershed CIMP is to leverage resources and create a regionally efficient and effective monitoring program. Adaptive management is a structured, iterative process designed to use resources both effectively and efficiently, resulting in a robust watershed program adapted to local conditions.

The integrated review of existing monitoring programs, TMDL implementation plans, the Regional Board-approved Bacteria TMDL CMP, Toxics TMDL CMPs, and the monitoring data that was used in the development of the 2014 MdR Watershed CIMP represent the "Initial Assessment" of existing conditions in the MdR Watershed. Lessons learned during Planning and Implementation of Year 1 of the MdR Watershed CIMP (i.e., monitoring station appropriateness and safety considerations for wet weather receiving water monitoring) will be tracked and integrated into the overall program assessment during the quality assurance/quality control review of monitoring data and annual reporting. Each annual report will present a summary of TMDL and Permit compliance and will provide an opportunity to identify, as appropriate, modifications to the MdR Watershed CIMP protocols based on lessons learned and monitoring data. A formal programmatic review will occur during Years 1 and 2 of the program and will be integrated into the Year 3 implementation. A more comprehensive review and update of the MdR Watershed CIMP monitoring protocols may also become necessary, especially when preparing for the Triad Sampling for sediment quality objective (SQO) analysis (required once during the five-year Permit Order period per the SQO guidance).

11.2 CIMP Revision Process

Every two years, hence during Year 3 of the implementation of the Permit monitoring program, available monitoring information will be reviewed in the context of the receiving water monitoring program and outfall-based monitoring objectives.

At any stage of the CIMP implementation, where changes are needed, changes will be made to this CIMP, incorporated into monitoring practice, and described in the next Monitoring Annual Report. Identified changes will be discussed in the annual report and implemented starting no later than the first CIMP monitoring event of the next monitoring year. Such changes include, but are not limited to, adding/removing monitored constituents, modifying laboratories/analytical methods, or amending sampling protocol. Should major changes to the approach be required (e.g., moving or removing a stormwater outfall or receiving water monitoring station location), the modifications will be proposed in the annual report and in a separate letter to the Regional Board requesting Executive Officer approval of the change.

12.0 DATA MANAGEMENT AND REPORTING

Appendix F details the procedures for managing and reporting monitoring data collected under this CIMP. Data management procedures include data review, verification, and validation.

Annual monitoring reports for Permit compliance are required to be submitted by December 15 of every year. These annual monitoring reports will cover the monitoring period of July 1 through June 30. These reports shall clearly identify all data collected during the monitoring year, as well as strategies, control measures, and assessments implemented by each Permittee within its jurisdiction. Annual Reports will also present watershed scale effort implemented by multiple Permittees. Discussion shall be provided in accordance with the requirements laid out in MRP Section XVIII. The annual monitoring reports will include the following:

- Watershed Summary Information
  - Watershed Management Area / Subwatershed (HUC-12) Description,
  - Description of MdR EWMP Agency Drainages Area within the MdR Watershed
- Annual Assessment and Reporting
  - Storm Water Control Measures
  - Effectiveness Assessment of Storm Water Control Measures
  - Non-stormwater Water Control Measures
  - Effectiveness Assessment of Non-Storm Water Control Measures
  - Integrated Monitoring Compliance Report
  - Adaptive Management Strategies
  - Supporting Data and Information.

Additionally, semi-annual annual data reports will be submitted with the annual monitoring report, and six months prior to the annual report (June of each year). The June 15 data submittal will cover the monitoring period of July 1 through December 31, and the December 15 data submittal will cover January 1 through June 30. These semi-annual analytical data reports detail exceedances applicable to WQBELs, RWLs, action levels, or aquatic toxicity thresholds, with corresponding sample dates and monitoring locations.

Monthly monitoring reports are required for Bacteria TMDL compliance and annual monitoring reports are also required for Toxics TMDL compliance. These data reports will be submitted as an attachment to Permit annual reports.

13.0 SCHEDULE FOR CIMP IMPLEMENTATION

The MdR Watershed is impacted by three TMDLs, including the Bacteria TMDL, Toxics TMDL, and Debris TMDL. The compliance schedules for these TMDLs are summarized in Table 13-1. Existing monitoring will continue to be conducted. Implementation of new monitoring programs and modifications to existing monitoring programs will be implemented beginning July 2015 or 90 days after the approval of the CIMP, whichever is later.

Table 13-1. TMDL Compliance Schedules

TMDL	Matrix	Parameters	Goal	Date
Bacteria TMDL	Harbor Water	Total coliform, Fecal coliform, *Enterococcus*	Compliance with allowable exceedance days for summer and winter Dry Weather	3/18/2007
	Harbor Water		Compliance with allowable exceedance days for Wet Weather and geometric mean targets	7/15/2021
Toxics TMDL	Harbor Water	Dissolved Copper (from boats)	Meet LAs	3/22/2024
	Harbor sediments (Back Basins)	Copper, lead, zinc, chlordane, PCBs, DDTs, p p'-DDE	Interim Sediment Allocations	3/22/2016
			Final Compliance	3/22/2018
	Harbor sediments (Front Basins)		Interim Sediment Allocations	3/22/2019
			Final Compliance	3/22/2021
Debris TMDL	Trash		20% reduction	3/20/2016
			40% reduction	3/20/2017
			60% reduction	3/20/2018
			80% reduction	3/20/2019
			100% reduction	3/20/2020

The schedule for MdR CIMP reporting is summarized in Table 13-2. For Bacteria TMDL compliance monitoring, monthly data reports will continue to be submitted to the Regional Board by the City of Los Angeles. For the Toxics TMDL and the Permit, the MdR EWMP Agencies will submit an Annual Monitoring Report to the Regional Board no later than December 15, 2014.

Table 13-2. MdR Watershed Reporting Schedule

Program	Report Type	Due Date(s)
Bacteria TMDL	Data Summary Report	Monthly (last day of month)
Toxics TMDL	Annual Monitoring Report	December 15, 2014, Annually thereafter.
Permit	Annual Monitoring Report	December 15, 2014, Annually thereafter.
	Municipal Action Level Action Plan *(If running storm event average concentrations are only 20% greater than MALs – only applies to MdR-3 for Permit compliance monitored storms)*	December 15, 2014, Annually thereafter

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APPENDIX A
Regulatory Drivers and Monitoring Requirements

A.0 REGULATORY DRIVERS AND MONITORING REQUIREMENTS

This appendix presents a discussion of the regulatory drivers and ensuing monitoring requirements integrated in the Coordination Implementation Monitoring Plan (CIMP) for the Marina del Rey (MdR) Watershed.

A.1 2010 Section 303(d) List

The federal Clean Water Act (CWA), § 303(d), requires states to identify waters that do not meet applicable water quality standards despite the treatment of Point Sources by the minimum required levels of pollution control technology. States are required not only to identify these "water quality limited segments" but also to prioritize such waters for the purpose of developing Total Maximum Daily Loads (TMDLs). A TMDL is defined as the "sum of the individual Waste Load Allocations (WLAs) for Point Sources and load allocations (LAs) for Non-Point Sources and natural background" (40 Code of Federal Regulations [CFR] 130.2), such that the capacity of the waterbody to assimilate constituent loads (the loading capacity) is not exceeded. A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis conducted by the United States Environmental Protection Agency (USEPA) (USEPA, 2000). The §303(d) list was last updated in 2010 and identifies a number of constituents for the MdR Back Basins and Marina Beach (referred to in the §303(d) listing by the former name Harbor Beach) (Table A-1).

Table A-1. Summary of 2010 Section 303(d) Listings

Water Body	Constituent	Final Listing Decision
Marina del Rey Harbor – Back Basins	Chlordane (tissue and sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Copper (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Dichlorodiphenyltrichloroethane (DDT) (tissue)	Do Not Delist from §303(d) list (TMDL required list)
	Dieldrin* (tissue)	Do Not Delist from §303(d) list (TMDL required list)
	Fish Consumption Advisory	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Indicator Bacteria	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Lead (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Polychlorinated biphenyls (PCBs) (tissue and sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)

Table A-1. Summary of 2010 Section 303(d) Listings

Water Body	Constituent	Final Listing Decision
	Sediment toxicity	Do Not Delist from §303(d) list (being addressed with USEPA-approved TMDL)
	Zinc (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
Marina del Rey Harbor Beach	Indicator Bacteria	List on §303(d) list (being addressed by USEPA-approved TMDL)
*USEPA-approved TMDL has made a finding of non-impairment for this constituent.		

A.2 2012 MS4 Permit

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175 (Permit) was adopted on November 8, 2012, by the Los Angeles Regional Water Quality Control Board (LARWQCB or Regional Board) and became effective December 28, 2012. This Permit replaced the previous MS4 permit (Order No. 01-182). The purpose of the Permit is to ensure the MS4s in the Los Angeles County are not causing or contributing to exceedances of water quality objectives set to protect the beneficial uses in the receiving waters in the Los Angeles region. The agencies with jurisdiction in the MdR Watershed Management Area (WMA), including the unincorporated areas of the County of Los Angeles (County), the Los Angeles County Flood Control District (LACFCD), City of Los Angeles, and City of Culver City (collectively referred to as the MdR Agencies), have elected to pursue a CIMP and have provided justification in this document demonstrating fulfillment of monitoring requirements of the Permit and TMDLs. The Monitoring and Reporting Program (MRP) defines the monitoring requirements of the Permit and incorporates monitoring requirements defined in existing TMDLs and Regional Board-approved CMPs. Water quality data collected from the MdR Receiving Water for Permit compliance will be compared with all applicable receiving water limitations. Outfall-based stormwater Permit compliance monitoring data will be compared to all applicable water quality based effluent limitations (WQBELs).

A.3 Total Maximum Daily Loads

The MdR watershed is subject to three TMDLs; the Santa Monica Bay Nearshore Debris TMDL (Debris TMDL), the Marina del Rey Harbor Mother's Beach and Back Basin Bacteria TMDL (Bacteria TMDL), and the Toxic Pollutants in Marina del Rey Harbor (MdRH) TMDL (Toxics TMDL). Each of these TMDLs is briefly summarized below. The Toxics TMDL supersedes the EPA established Santa Monica Bay DDTs and PCBs TMDL.

A fourth TMDL, the Ballona Creek Wetlands TMDL for Sediment and Invasive Exotic Vegetation, has been established for the neighboring Ballona Creek Wetlands, which is not included in the MdR Watershed.

A.3.1 Santa Monica Bay Nearshore and Offshore Debris TMDL

The Debris TMDL came into effect on March 20, 2012. The Responsible Agencies identified in the Debris TMDL that also have jurisdiction in the MdR Watershed include the County, LACFCD, City of Los Angeles, City of Culver City, and Caltrans. The Debris TMDL requires Responsible Agencies to comply with the final WQBEL of zero trash discharge into waterbodies within the Santa Monica Bay Watershed Management Area (WMA) and then into Santa Monica Bay or the shoreline of Santa Monica Bay.

The Permit requires Permittees to develop a Trash Monitoring and Reporting Plan (TMRP) to describe the methodologies that will be used to assess and monitor trash from source areas in the Santa Monica Bay WMA and shoreline of the Santa Monica Bay. In 2012, the County submitted a TMRP to the Regional Board. Plastic Pellet Monitoring and Reporting Plans (PMRPs) quantifying potential plastic pellet discharges to Santa Monica Bay, along with supplemental Spill Response Plans (SRPs) to address containment of spilled plastic pellets, were submitted to the Regional Board by the City of Culver City (2012), County (2013), and LACFCD (2013). The City of Los Angeles is in the process of developing a PMRP and TMRP; this type of monitoring for the MdR Watershed is currently covered in the TMRP for Santa Monica Bay. The TMRPs/PMRPs for the County, City of Culver City, and LACFCD are provided in Appendix G. These plans are considered to be independent of this CIMP.

A.3.2 Marina del Rey Harbor Mother's Beach and Back Basin Bacteria TMDL

The Bacteria TMDL (LARWQCB, 2004, 2012) was adopted by the USEPA in accordance with LARWQCB Resolution No. 2003-012 and became effective on March 18, 2004. The Responsible Agencies identified for the Bacteria TMDL include the County, LACFCD, City of Los Angeles, City of Culver City, and Caltrans. The Responsible Agencies developed the *Marina Del Rey Harbor Mothers' Beach and Back Basins Bacterial TMDL CMP* (Bacteria TMDL CMP) (LADPW, 2007), which was approved by the Regional Board on February 1, 2007. In addition to compliance monitoring, the Bacteria TMDL CMP included additional monitoring in the MdR Front Basins (non-§303(d) listed basins) to help characterize bacteria levels across the Harbor.

The Bacteria TMDL established numeric bacterial compliance targets for marine recreation of 19 illnesses per 1,000 persons based on the acceptable health risk described by the USEPA (USEPA, 1986). The numeric targets are expressed as both single sample limits and geometric mean limits (Table A-2). In 2012, the Bacteria TMDL was re-opened by the Regional Board with proposed amendments to the geometric mean limits and the Bacteria TMDL WLAs. Resolution R12-007 was adopted by the Regional Board on June 7, 2012 and is waiting for approval from the USEPA and the State Board Office of Administrative Law (OAL).

Table A-2. Bacteria TMDL Numeric Targets

Indicator	Geometric Mean Limits*	Single Sample Limits
Total coliform	1,000 MPN/100 mL	10,000 MPN/100mL** or 1,000 MPN/100 mL (fecal-to-total coliform exceeds 0.1)
Fecal coliform	200 MPN/100 mL	400 MPN/100 mL
Enterococcus	35 MPN/100 mL	104 MPN/100 mL

* Geometric means shall be calculated weekly as a rolling geometric mean using five or more samples, for six week periods, starting all calculations on Sunday.
** Total coliform single sample limit of 10,000 most probable number (MPN) decreases to 1,000 when the fecal coliform value is greater than 10% of total coliform value.

The Bacteria TMDL numeric targets apply throughout the year. The geometric mean targets may not be exceeded at any time. Resolution R12-007 also standardized the rolling geometric mean calculation to a weekly calculation, using five or more samples, for 6-week periods, starting all calculations on Sunday. Each monitoring station is also assigned an allowable number of exceedance days, or the number of days where sampling results can surpass the single sample numeric targets. The Bacteria TMDL WLAs are expressed as allowable exceedance days Allowable exceedance days are specified by three defined seasons (summer dry, winter dry, and Wet Weather) and are based on the lesser of two criteria: (1) exceedances days in the designated reference system, and (2) exceedance days based on historical bacteriological data at the monitoring site. Table A-3 presents TMDL compliance dates, requirements, and limits by compliance season. The allowable number of exceedance days reflects modifications to the Bacteria TMDL WLAs per Resolution R12-007.

Table A-3. Bacteria TMDL Seasons and Allowable Exceedance Days (Single Sample Targets)

Compliance Season	Compliance Season Dates	Allowable Number of Exceedance Days/Year*
Summer dry	April 1 to October 31	0 days/year (daily and weekly sampling)
Winter dry	November 1 to March 31	9 days/year (daily sampling)
		2 days/year (weekly sampling)
Winter wet	Rain event ≥ 0.1 inches at Los Angeles International Airport (LAX) rain gauge, and 3 days following the end of the rain event	17 days/year (daily sampling) 8 days/year (daily sampling)**
		3 days/year (weekly sampling) 1 day/year (weekly sampling)**

*The allowable number of exceedance days applies to the single sample numeric targets only. Geometric mean targets may not be exceeded at any time.
**Only applies to Compliance Station MdRH-9, located in the center of Basin F.

A.3.3 Toxic Pollutants in Marina del Rey Harbor TMDL

9The Regional Board adopted the Toxics TMDL on October 6, 2005 (LARWQCB, 2005). The Toxics TMDL was approved by USEPA and became effective on March 22, 2006. The Toxics TMDL was revised by the Regional Board in 2013. The original Toxics TMDL only addressed certain metals and organics in the Back Basins of MdR (Basins D, E, and F). The metals addressed by the TMDL are copper, lead, and zinc, whereas chlordane and total Polychlorinated Biphenyls (PCBs) are the targeted organic constituents. The Responsible Agencies identified for the Toxics TMDL include the County, LACFCD, City of Los Angeles, City of Culver City, and Caltrans. The Responsible Agencies developed the Toxics TMDL CMP (LADPW, 2008b), which was approved by the Regional Board on March 3, 2009, to address the monitoring requirements defined in the original Toxics TMDL. In 2013, the Toxics TMDL was revised. The revised Toxics TMDL was adopted in 2014 with proposed amendments by the Regional Board, including extending the TMDL to the Front Basins of the Harbor, implementing the final numeric target for PCBs in the water column, reducing the PCB numeric targets for sediment and fish tissue, adding total dichlorodiphenyltrichloroethane (DDTs) and p p'-dichlorodiphenyldichloroethylene (p p'-DDE) sediment targets, changing the metals WLAs, and modifying the monitoring requirements. The final Toxics TMDL numeric targets, in-harbor load allocations, and Storm Water WLAs presented in the February 6, 2014 version of the Basin Plan Amendment are discussed below.

A.3.3.1 Toxics TMDL Numeric Targets

The Toxics TMDL established numeric targets for sediments in the Back Basins of the MdR and water column and fish tissue in the MdR are summarized in Table A-4. The sediment numeric targets were established using the effects range low (ER-L) (Long et al., 1995) guidelines for copper, lead, zinc, chlordane, total PCBs, total DDTs and p p'-DDE. The numeric target for total PCBs in sediments was established based on the fish tissue target and food web bioaccumulation model developed by Gobas and Arnot (2010). Water column numeric targets were established for total PCBs and copper. The numeric target for total PCBs is 0.00017 µg/L. Acute and chronic numeric targets were established for dissolved copper, such that the acute numeric target represents the single sample maximum criterion and the chronic numeric target represents the four-day average criterion. Both the copper and PCB numeric targets were developed using the California Toxics Rule (CTR) criterion for the protection of human health from the consumption of aquatic organisms. The fish tissue numeric target of 3.6 micrograms per kilogram (µg/kg) for total PCBs is derived from the CTR human health criteria. The fish tissue numeric target of 3.6 micrograms per kilogram (µg/kg) for total PCBs is the Office of Environmental Health Hazard Assessment (OEHHA) Fish Contaminant Goal (FCG).

Table A-4. Toxics TMDL Numeric Targets for Sediment, Water and Fish Tissue

Constituent Group	Constituent	Toxics TMDL Numeric Targets*		
		MdR Back Basins	MdR	
		Sediment	Water Column	Fish Tissue
Organics	Chlordane	0.5 µg/kg	--	--
	Total PCBs	3.2 µg/kg	0.00017 µg/L	3.6 µg/kg
	Total DDTs	1.58 µg/kg	--	--
	p p'-DDE	2.2 µg/kg	--	--
Metals	Copper	34 mg/kg	--	--
	Dissolved copper	--	Acute – 4.8 µg/L Chronic – 3.1 µg/L	--
	Lead	46.7 mg/kg	--	--
	Zinc	150 mg/kg	--	--
*The Toxics TMDL numeric targets represent the final values presented in the Final Basin Plan Amendment (dated February 6, 2014) for the Toxics TMDL reconsideration.				

A.3.3.2 Toxics TMDL Load Allocations

The Toxics TMDL established loading capacities and LAs for in-harbor sediments and MdR water column.

The sediment loading capacity was estimated based on annual average total suspended solids (TSS) loads to the MdR (84,612 kilograms per year [kg/year]) based on the assumption that the finer sediments transport the majority of constituents. The Toxics TMDL for sediment was calculated based on the average annual TSS loading and the numeric sediment targets. The sediment in-harbor LAs are the same as the numeric targets. Non-point sources of sediment impairment include direct atmospheric deposition. The sediment LAs for in-harbor sediments and atmospheric deposition are presented in Table A-5.

Table A-5. Toxics TMDL Loading Capacities and Load Allocations for Sediment

Constituent Group	Constituent	Load Allocation*		Sediment Loading Capacity*
		In-Harbor Sediment	Atmospheric Deposition	
--	--	µg/kg	g/year	g/year
Organics	Chlordane	0.5	0.005	0.04
	PCBs	3.2	0.225	1.92
	Total DDTs	1.58	0.016	0.13
	P p'-DDE	2.2	0.022	0.19
--	--	mg/kg	kg/year	kg/year
Metals	Copper	34	0.34	2.88
	Lead	46.7	0.46	3.95
	Zinc	150	1.49	12.69
*The Toxics TMDL LAs and loading capacities represent the final values presented in the Final Basin Plan Amendment (dated February 6, 2014) for the Toxics TMDL reconsideration.				

The Toxics TMDL established the dissolved copper loading capacities for the water column of MdR as 557 kg/year (Table A-6). The water column LA for dissolved copper from boats is a reduction of 85% from the baseline load from boats (3,609 kg/year).

Table A-6. Toxics TMDL Loading Capacities and Load Allocations for the Water Column

Constituent Group	Constituent	Water Column Load Allocation	Water Column Loading Capacity (kg/year)
Metals	Dissolved copper	85% of baseline boat load. ~541 kg/year	557

A.3.3.3 Toxics TMDL Storm Water Waste Load Allocations

The Toxics TMDL established point source WLAs for Storm Water for each of the storm water Permittees. The WLAs for metals and organics are presented in Table A-7. The apportionment between the storm water Permittees has also been presented in Table A-7 based on an estimate of the percentage of land area covered by each storm water permit.

Table A-7. Toxics TMDL Storm Water Waste Load Allocations by Permittee

Storm Water Permittees	Toxics TMDL Storm Water Waste Load Allocations (WLAs)						
	Metals			Organics			
	Copper (kg/year)	Lead (kg/year)	Zinc (kg/year)	Chlordane (g/year)	Total PCBs (g/year)	Total DDTs (g/year)	p p'-DDE (g/year)
MS4 Permittees*	2.26	3.10	9.96	0.0332	1.51	0.10	0.15
Caltrans	0.036	0.05	0.16	0.0005	0.024	0.0017	0.0024
General Construction	0.23	0.32	1.02	0.0034	0.16	0.011	0.015
General Industrial	0.012	0.016	0.053	0.0002	0.0080	0.0006	0.0008
Total WLA	**2.54**	**3.49**	**11.20**	**0.04**	**1.70**	**0.12**	**0.16**
MS4-Municipal Separate Storm Sewer System. MS4 Permittees refer to the MdR Agencies subject to the 2012 MS4 Permit.							

A.4 References

Gobas F. A.P.C. and J.A. Arnot. 2010. Food web bioaccumulation model for polychlorinated biphenyls in San Francisco Bay, California, USA. *Environmental Toxicology and Chemistry* 23(6):1385-1395.

Long et al. (Long E.R., D.D. MacDonald, S.L. Smith and F.D. Calder). 1995. "Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments." *Environ Manag*. 19(1): 81-97.

Appendix B
Monitoring Station Selection Process

This Appendix summarizes the Receiving Water and Outfalls monitoring stations selected under the CIMP. Regional and potential jurisdictional monitoring stations are also described.

1.0 RECEIVING WATER STATIONS

The MdR Receiving Waters assessment consisted of field reconnaissance and a desktop review of current monitoring stations identified in the two TMDL Coordinated Monitoring Plans (CMPs) for the MdR Watershed, the *Marina Del Rey Harbor Mothers' Beach and Back Basins Bacterial TMDL Coordinated Monitoring Plan* (Bacteria TMDL CMP) (LADPW, 2007) and the *Marina Del Rey Harbor Toxic Pollutants TMDL Coordinated Monitoring Plan* (Toxics TMDL CMP) (LADPW, 2008b). These stations are mapped in Figure 1-1. An overview of MS4 infrastructure associated with the Grand Canal (i.e., Venice Canals and Ballona Lagoon) was also conducted.

A field reconnaissance was conducted on January 30 to 31, 2014 to fill data gaps related to monitoring station accessibility, the extent of tidal influence, and resident mussel growth across the Harbor in association with existing monitoring stations. Tables summarizing existing Receiving Water monitoring stations, monitoring programs, and recommended station-specific monitoring modifications are presented for the main channel and each Basin of MdR Harbor. A discussion of the MS4 infrastructure and unique conditions of the Grand Canal (i.e., Venice Canals and Ballona Lagoon) has also been provided.

1.1 FRONT BASINS

These stations are Receiving Water monitoring stations in the Front Basins under the Toxics TMDL.

Harbor Area	Station ID	Recommendations	
Basin A	MdRH-F-1	Rename to MdRH-A	Rotational Sampling. Each year, two stations will be monitored for Copper and Total PCBs. Copper will be monitored monthly and Total PCBs twice per year (Summer/Winter).
Basin B	MdRH-F-2	Rename to MdRH-B	
Basin C	MdRH-F-3	Rename to MdRH-C	
Basin G	MdRH-F-4	Rename to MdRH-D	
Basin H	MdRH-F-5	Rename to MdRH-E	

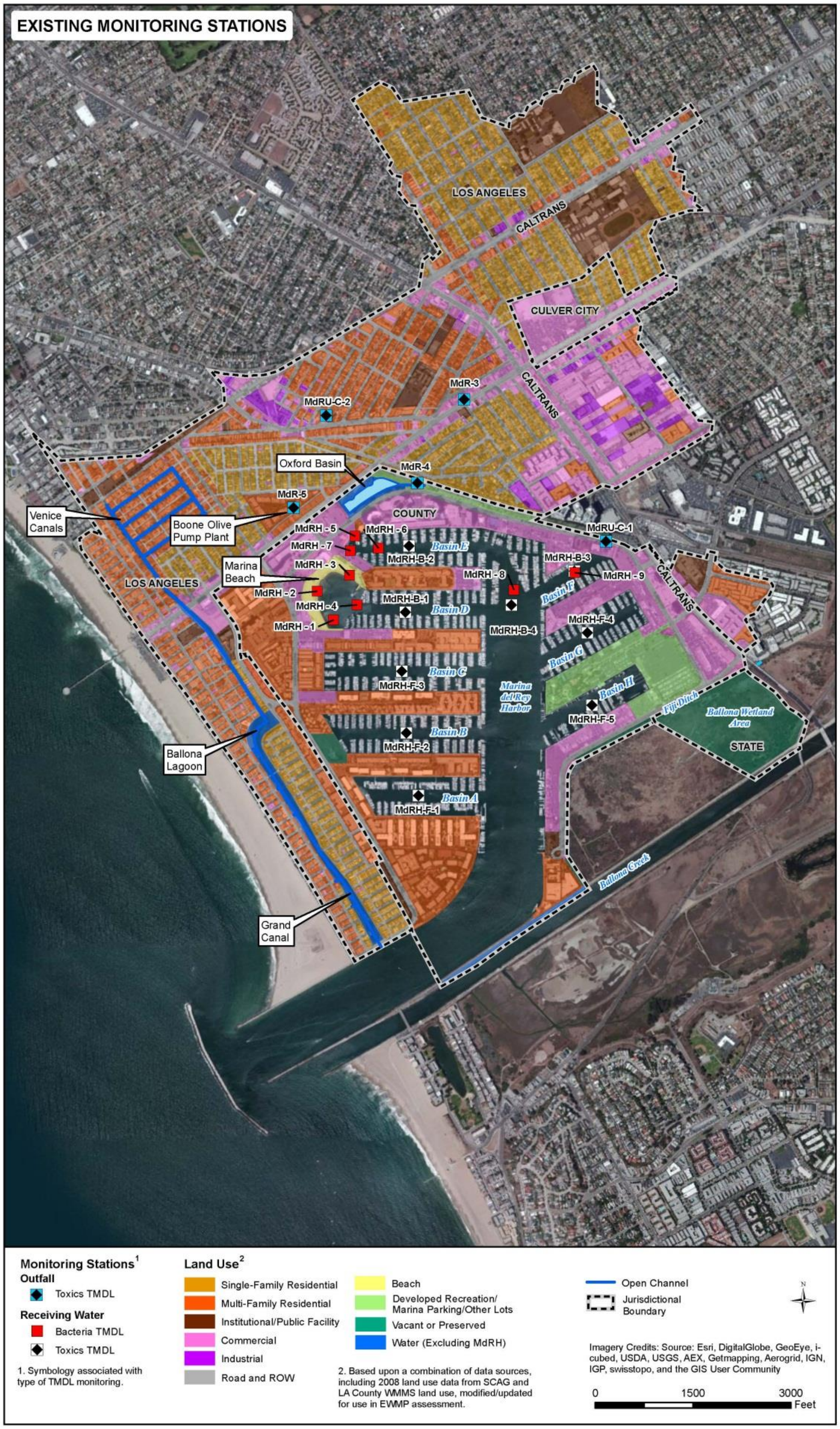


Figure 1-1. Existing CMP Monitoring Stations

1.2 BACK BASINS

These stations are Receiving Water monitoring stations in the Back Basins under the Toxics TMDL.

<table>
<tr><th>Harbor Area</th><th>Station ID</th><th colspan="2">Recommendations</th></tr>
<tr><td>Basin D</td><td>MdRH-B-1</td><td>Rename to MdRH-D</td><td rowspan="3">Rotational Sampling. Each year, two stations will be monitored for Copper and Total PCBs. Copper will be monitored monthly and Total PCBs twice per year (Summer/Winter).</td></tr>
<tr><td>Basin E</td><td>MdRH-B-2</td><td>Rename to MdRH-E</td></tr>
<tr><td>Basin F</td><td>MdRH-B-3</td><td>Rename to MdRH-F</td></tr>
</table>

These stations are Receiving Water monitoring stations in the Back Basins under the Bacteria TMDL. No changes are recommended for monitoring at these stations.

Harbor Area	Station ID	Existing Monitoring Program
Basin D	MdRH-1	One bacteria grab sample is collected from ankle deep water daily (Monday-Saturday).
Basin D	MdRH-2	One bacteria grab sample is collected from ankle deep water 2x/weekly (Mondays and Saturdays).
Basin D	MdRH-3	One bacteria grab sample is collected weekly (Mondays).
Basin D	MdRH-4	Two bacteria grab samples are collected weekly (Mondays). One sample is collected at the water's surface. One sample is collected at depth. The water at this location is approximately 3 to 4 meters deep.
Basin E	MdRH-5	The tide gate outlet is often 2 to 3 meters below the water's surface. One bacteria grab sample is collected at depth weekly (Mondays). The tide height at which the sample is collected is recorded in field notes to denote surface conditions.
Basin E	MdRH-6	Two bacteria grab samples are collected weekly (Mondays). One sample is collected at the water's surface. One sample is collected at depth. The water at this location is approximately 4 meters deep.
Basin E	MdRH-7	MdRH-7 is located downstream of the tide gate where water from the Boone Olive Pump Station flows into the marina (CSTL-022A). The tide gate outlet is often 2 to 3 meters below the water's surface. One bacteria grab sample is collected at depth, and the tide height at which the sample is collected is recorded in field notes to denote surface conditions.
Basin F	MdRH-9	Two bacteria grab samples are collected weekly (Mondays). One sample is collected at the water's surface. One sample is collected at depth. The water at this location is approximately 4 meters deep.

1.3 MAIN CHANNEL

These stations are Receiving Water monitoring stations in the Main Channel under the Bacteria and Toxics TMDL.

Harbor Area	Station ID	Existing Monitoring Program	Recommendation
Main Channel	MdRH-8	This is a Bacteria TMDL monitoring station. Two bacteria grab samples are collected weekly (Mondays). One sample is collected at the water's surface and one e is collected at depth. The water at this location is approximately 4 meters deep.	No change recommended.
Main Channel	MdRH-B-4	This is a Toxics TMDL monitoring station located at the confluence of Basins E, D, and F and represents Receiving Water conditions downstream of three Major Outfalls, two 18-inch Outfalls, and Marina Beach.	Permit and Toxics TMDL compliance monitoring

1.4 GRAND CANAL (VENICE CANALS AND BALLONA LAGOON)

The Grand Canal, consisting of Venice Canals and Ballona Lagoon (within Subwatershed 2), are under the jurisdiction of the City of Los Angeles. The four 36-inch Outfalls, twenty-one 18-inch Outfalls, and four 18-in to 36-inch Outfalls along the Grand Canal are separated from the MdR Harbor by a large tide gate that releases water to the main channel of MdR Harbor at a point west of the Front/Back Basins during outgoing tides (Figure 1-2). The associated MS4 is partially inundated with water from the Grand Canal. According to the City of Los Angeles, the MS4 tributary to the Grand Canal is protected by BMPs (e.g., double screens – one at the catch basin and one at the Outfall). The four major Outfalls along the Grand Canal are fully submerged making the Canal a low priority area for water quality monitoring

Figure 1-2. Tide Gate Separating the Grand Canal from MdR Harbor (Ebbing Tidal Conditions)

2.0 OUTFALL STATIONS

The Watershed Station assessment focused on the identification and prioritization of potential Watershed monitoring stations associated with Major Outfalls. During the desktop review, existing monitoring stations were evaluated for Watershed representativeness. Each monitoring station drainage area was evaluated using total acreage by jurisdiction and land use (Table 1 and Table 2, respectively).

Table 1. Existing Monitoring Stations and Watershed Representativeness by Jurisdiction

Jurisdiction	MdR-3	MdR-4	MdR-5	MdRU-C-2	MdRU-C-1
County	0.00%	0.93%	0.00%	0.00%	100.00%
City of Los Angeles	83.04%	95.99%	100.00%	100.00%	0.00%
City of Culver City	11.21%	0.00%	0.00%	0.00%	0.00%
Other - CALTRANS	5.74%	3.08%	0.00%	0.00%	0.00%

Table 2. Existing Monitoring Stations and Watershed Representativeness by Land Use

Land Use	MdR-3	MdR-4	MdR-5	MdRU-C-2	MdRU-C-1
Single Family Residential	33.44%	18.03%	32.54%	-	-
Multi-Family Residential	9.68%	7.82%	29.95%	63.18%	-
Roads and Right-of-Way	28.06%	18.93%	31.17%	31.50%	92.37%
Public Facilities	15.43%	1.56%	3.69%	0.07%	0.00%
Commercial and Services	12.88%	40.45%	2.31%	5.26%	6.50%
Developed Parks and Recreation	-	0.79%	-	-	1.13%
Industrial	0.51%	12.43%	0.34%	-	-

A field reconnaissance was conducted on January 30 and 31, 2014 to confirm findings from the desktop review and evaluate tidal influence and mussel growth at Outfalls. The field reconnaissance showed that automated flow monitoring and sampling equipment are installed within a secure enclosure (Figure 2-1) at the current Watershed Stations. Conduit frequently runs from the street-level equipment enclosure, through the MS4, to the main Outfall connection. This or equivalent monitoring equipment design and installation has proven to be successful for water quality monitoring in the MdR Watershed. Tables summarizing existing Watershed monitoring stations, monitoring programs, and recommended station-specific monitoring modifications are presented for Basins E, F, and G. These Basins are the only Receiving Water areas in the MdR Harbor that receive discharge from a Major Outfall or uniquely regulated TMDL area.

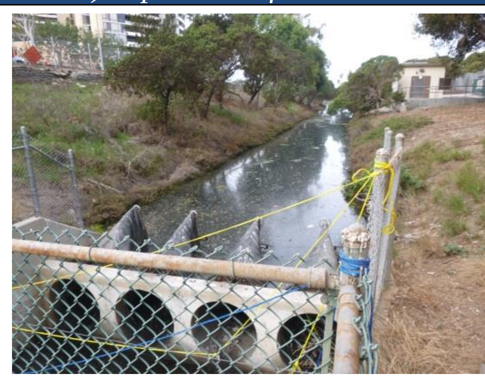
Figure 2-1. ISSCO Type Automated Flow and Sampling Equipment

2.1 BACK BASINS - BASIN E

Basin E receives Storm Water discharge from three Major Outfalls, CSTL-022A, B, and C. Three LFDs have been installed in the MS4, immediately upstream of the tidally influenced zone, to redirect any potential Non-storm Water discharges from Basin E to the sanitary sewer. Based on the presence of LFDs upstream of these Major Outfalls, no Non-storm Water Outfall monitoring is considered necessary.

There are four current Watershed Stations tributary to Basin E (MdR-3, MdR-4, MdR-5, and MdRU-C-2) where Storm Water monitoring is anticipated. As presented in
Table 2, Storm Water discharges assessed at MdR-3, MdR-4, and MdR-5 cover most land uses in the MdR Watershed. Station MdR-3 represents the largest MS4 drainage area of the MdR Watershed that is able to be monitored. MdR-3 represents a mix of land uses representative of the MdR Watershed, as well as multiple jurisdictional areas. MdR-3 also provides co-located monitoring data with an LFD BMP. Based on these findings, MdR-3 is considered to be the Watershed Station most representative of existing conditions within the MdR Watershed and is recommended as the Watershed Station for Permit compliance monitoring. Additional details of the station screening and prioritization are summarized in the tables below.

MdR-3 *Located at the intersection of Washington Blvd. and Thatcher Ave. Upstream of Basin E.*	
SCREENING PARAMETERS: • **Regulatory Compliance:** Meets criteria. • **Historic Data:** Current Storm Water monitoring station (Toxics TMDL). Multiple years of data. • **Safety:** Access from sidewalk/catch basin. No traffic control required. • **Quality Control:** Above tidal zone. Meets laminar flow criteria (Reinforced Concrete Pipe (RCP)). • **Land Use:** Mixed land use *(predominantly single family residential with commercial and public facility areas and roads).* • **Jurisdiction:** Mixed jurisdictions (Cities of Culver City and Los Angeles). • **BMPs:** Co-located with LFD Project No. 5243. Trash screens installed at catch basin inlet.	 Diameter: 18 inches Material: RCP Tributary Area: 376.4 acres (20.3% MdR Watershed)
OUTCOME: Watershed Monitoring Station – Storm Water Monitoring (Permit & Toxics TMDL)	

MdR-4 *Located at the Oxford Basin Flood Control Basin (east side). Upstream of Basin E.*	
SCREENING PARAMETERS: • **Regulatory Compliance:** Meets criteria. • **Historic Data:** Current Storm Water monitoring station (Toxics TMDL). Multiple years of data. • **Safety:** Area surrounded by fence. Requires key for access. Site established on concrete platform adjacent to pump house. • **Quality Control:** Above tide gates. Meets laminar flow criteria (Storm Water). • **Land Use:** Mixed land use *(predominantly single family residential with commercial, industrial, and roads).* • **Jurisdiction:** City of Los Angeles. • **BMPs:** Co-located with LFD Project No. 3872.	 Material: Open channel upstream of four Outfalls (inflow from 42-inch RCP) Tributary Area: 154.4 acres (8.3% MdR Watershed)
OUTCOME: Watershed Monitoring Station – Storm Water Monitoring (Toxics TMDL)	

MdR-5 *Located at the Boone-Olive Pump Station control house. Upstream of Basin E.*	
SCREENING PARAMETERS: • **Regulatory Compliance:** Meets criteria. • **Historic Data:** Current Storm Water monitoring station (Toxics TMDL). Multiple years of data. • **Safety:** Requires key for access. Site established on concrete platform adjacent to control house. • **Quality Control:** Above tide gates. • **Land Use:** Predominantly residential *(mixed single family and multi-family and roads).* • **Jurisdiction:** City of Los Angeles only. • **BMPs:** Co-located with LFD Project No. 3874.	 Material: Open channel upstream of four Outfalls (inflow from 66-inch RCP) Tributary Area: 70.5 acres (3.8% total Watershed)
OUTCOME: Watershed Monitoring Station – Storm Water Monitoring (Toxics TMDL)	

MdRU-C-2 *Located at 602 Woodlawn Avenue. Upstream of Basin E.*	
SCREENING PARAMETERS: • **Regulatory Compliance:** Meets criteria. • **Historic Data:** Current Storm Water monitoring station for storm-borne Sediment special study (Toxics TMDL). Ongoing data collection. • **Safety:** Access from sidewalk/catch basin. No traffic control required. • **Quality Control:** Above tidal zone. The next accessible manhole in the main MS4 (682 Oxford Ave.) is tidally influenced; mussels in catch basins. Meets laminar flow criteria (RCP). • **Land Use:** Predominantly residential *(mixed single family and multi-family and roads).* • **Jurisdiction:** City of Los Angeles. • **BMPs:** Trash screens installed at catch basin inlet.	 Material: 18-inch RCP run into main storm drain line (33-inch RCP) Tributary Area: 6.5 acres (0.35% MdR Watershed)
OUTCOME: Watershed Monitoring Station – Storm Water Monitoring (Toxics TMDL, Storm-Borne Sediment)	

2.2 FORMER BASIN E WATERSHED STATIONS

Figure 2-2. Currently No Safe Access to Former Watershed Station MdR-2

Watershed Stations MdR-1 and MdR-2 are located in the upper reaches of the MdR Watershed and were included in the Toxics TMDL CMP as upstream/downstream jurisdictional boundary monitoring stations. In a letter to the Regional Board dated August 13, 2013, the County formally removed MdR-1 and MdR-2 from the Toxics TMDL CMP, citing changes to the overall MdR Watershed compliance strategy. The letter proposed continuing monitoring at MdR-3, the Watershed Station located upstream of the tidally influenced zone and downstream of MdR-1 and MdR-2. Monitoring at MdR-3 replaces a jurisdictional boundary compliance monitoring approach with the current integrated compliance monitoring approach used in the MdR Watershed CIMP.

MdR-1 represents residential land uses from the City of Los Angeles and MdR-2 represents the combined discharge from City of Los Angeles and Caltrans land uses. To date, no water quality monitoring data have been collected at these stations. The January 30, 2014 field reconnaissance found that MdR-2, located in the middle of Penmar Avenue, approximately 200 feet south of the intersection with Venice Blvd., is no longer safely accessible at street level because of recent street maintenance activities that resulted in paving over the manhole access (Figure 2-2). Caltrans is not a participant in the MdR Watershed CIMP, and, therefore, delineating these upstream/downstream discharges is not appropriate. MdR-1 and MdR-2 have not been included in this CIMP as Watershed Stations.

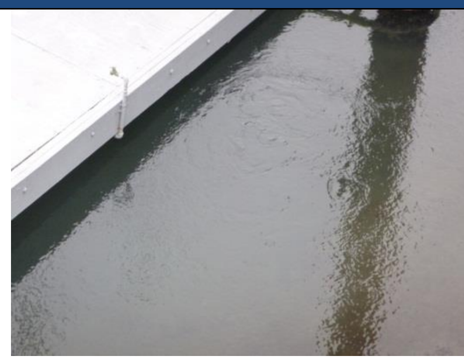
2.3 BACK BASINS - BASIN F

Basin F receives discharge from Outfall CSTL-023A. There is one current Watershed Station, MdRU-C-1, associated with Basin F. The findings of the field reconnaissance are summarized below. Because of the small drainage area, no alternative stations were found.

<table>
<tr><td colspan="2">MdRU-C-1
Located north of Bali Way, near the intersection with Admiralty Way. Upstream of Basin F.</td></tr>
<tr><td><u>SCREENING PARAMETERS:</u>
• Regulatory Compliance: Meets criteria.
• Historic Data: Current Storm Water monitoring station for storm-borne Sediment special study (Toxics TMDL). Ongoing data collection.
• Safety: Access from sidewalk/catch basin. Limited traffic control required (cones for grate access).
• Quality Control: Above tidal zone. Meets laminar flow criteria (RCP).
• Land Use: Predominantly roads.
• Jurisdiction: County.
• BMPs: Temporary (construction) inlet protection BMPs.</td><td>
Material: 18-inch RCP
Tributary Area: 2.6 acres (0.14% total Watershed)</td></tr>
<tr><td colspan="2"><u>OUTCOME:</u> Watershed Monitoring Station – Storm Water Monitoring (Toxics TMDL)</td></tr>
</table>

2.4 FRONT BASINS - BASIN G

There are no existing Watershed Stations in Basin G and there is no monitoring requirement under the Bacteria TMDL because it is a Front Basin. Under the Permit, paired upstream and downstream Receiving Water and MS4 monitoring is not feasible. Major Outfall CSTL-023B is fully submerged for the duration of the tidal cycle. Eddies from the Outfall may be observed from the water's surface during ebbing tides. During the field reconnaissance of the MS4 located upstream of CSTL-023B, tidal intrusion was observed. The manhole cleanout access points along Lincoln Boulevard were observed to contain more than 1 foot of standing tidal water in the vault. No new monitoring stations characterizing Basin G are feasible or recommended.

CSTL-023B (Major Outfall) *MS4 upstream of Basin G.*	
SCREENING PARAMETERS: • **Regulatory Compliance:** Meets criteria. • **Historic Data:** None. • **Safety:** Limited access to MS4, especially main storm drain lines. • **Quality Control:** Tidal influence for the full length of MS4. Outfall fully submerged. • **Land Use:** Predominantly roads. • **Jurisdiction:** County. • **BMPs:** None.	 CSTL-023B Material: 54-inch RCP
OUTCOME: No Watershed Stations Recommended.	

3.0 REGIONAL MONITORING STATIONS – BIGHT 2013

The Bight 2013 survey is organized into five technical components: 1) Contaminant Impact Assessment, 2) Shoreline Microbiology, 3) Water Quality, 4) Marine Protected Areas, and 5) Trash and Debris. The MdR Watershed has been included in the 2013 Contaminant Impact Assessment, which focuses on Sediment contaminants and associated impacts on benthic infauna and demersal fish. MdR Harbor monitoring stations included in Bight 2013 are presented in Table 3.

Table 3. Bight 2013 Monitoring Stations in the MdR Watershed

Bight 2013 Document	Bight 2013 Station ID	Latitude	Longitude	Sample Media	Location
Contaminant Impact Assessment Workplan	B13-8407	33.9643	-118.4535	Sediment, Tissue	Main Channel south, outside MdRH
	B13-8409	33.9703	-118.4482	Sediment, Tissue	Main Channel, south of Basin A
	B13-8413	33.9761	-118.4465	Sediment, Tissue	Between Basin G and Basin H
	B13-8417	33.9833	-118.4506	Sediment, Tissue	Basin E

The Bight program is led and organized by Southern California Coastal Water Research Project (SCCWRP) and is considered to be independent of this CIMP; however, data from the study will be used to help evaluate long-term assessment of conditions and TMDL compliance. Participation in the Bight will be determined by SCCWRP and the MdR CIMP Agencies during each five-year period of the program.

APPENDIX C
Sampling Procedures, Analytical Methods, and Data Quality Control

C.0 SAMPLING PROCEDURES, ANALYTICAL METHODS AND QUALITY CONTROL

C.1 SAMPLING PROCEDURES

This section of the appendix presents a discussion of applicable sampling procedures for water and sediment sample collection, fish and mussel tissue collection, and other monitoring programs during storm water (Wet) and on-storm water (Dry) weather conditions. These procedures include chain-of-custody protocols, safety considerations, storm characterization, Wet Weather and Dry Weather water quality sampling protocols, storm-borne and Harbor sediment sampling protocols, and fish and mussel sampling protocols.

C.1.1 Storm Event Forecasting and Precipitation Monitoring

Storm water monitoring during the Wet Weather is required by the Permit. The MdR EWMP Agencies propose to conduct wet weather monitoring between October 1st and April 15th for schedule optimization and cost efficiencies. In order to identify qualifying storms for storm water monitoring, at least one National Weather Service (NWS) weather forecast tool will be monitored by members of the MdR EWMP Agencies daily during the Wet Weather season. The automatic tipping bucket (intensity measuring) rain gauge located at Electric Avenue Pump Plant (at the intersection of Electric Avenue and Brooks Avenue, latitude: 33.993048, longitude: -188.472793) will be used to evaluate post-storm Wet Weather monitoring criteria for the MdR Watershed. Local rain gauge data may be used in storm water runoff calculations and to help develop runoff characteristics for the MdR Watershed. In the event that the Electric Avenue Pump Plant rain gauge is not operational, the rain gauge at LAX will be used.

For the purposes of this CIMP, mobilization for storm water monitoring will be triggered for storms with a 70% probability of at least 0.25-inch rainfall, at least 24 hours prior to the start of a rainfall event. The number of storm events monitored per year will be capped at nine events. A minimum of 3 days of dry conditions (i.e., 72 hours) is also required between a qualified storm event and a non-storm water monitoring event.

Because a significant storm event is based on predicted rainfall, it is recognized that this monitoring may be triggered without 0.25 inches of rainfall actually occurring. In this case, the monitoring event will still qualify as meeting this requirement provided that sufficient sample volume is collected to do all required laboratory analysis. Documentation will be provided showing the predicted rainfall amount.

C.1.2 Water Quality Sampling

Water quality sampling requirements are summarized by regulatory driver and monitoring station for storm water (Table C-1) and non-storm water (Table C-2) monitoring programs. Note that for Toxics TMDL Non-storm water monitoring at receiving water stations will be conducted in the main channel of MdR annually and in two of the front basins and two of the back basins according to a rotational schedule summarized in Table C-3. All stations will be sampled within a three year period.

Sample preservatives, holding time requirements, analytical methods, detection limits, and holding times for each parameter sampled and analyzed for each monitoring program are provided in Appendix D. The Method Detection Levels (MDLs) must be lower than or equal to the minimum level (ML) value defined in the Permit or per TMDL requirements. Analytical Method Requirements and Water Quality Objectives for constituents listed in MRP Table E-2 (Storm Water Monitoring Program's Constituents with Associated Minimum Levels [MLs]) are presented in Appendix D. Additional Requirements for constituents with TMDLs and/or 303(d)-Listed have been incorporated, as applicable.

Note that PCBs were generally manufactured as a mixture of various PCB congeners and manufactured and sold under many names, the most common of which is the Aroclor series (USEPA, 2014). The Toxics TMDL does not specify the type of analysis required for total PCBs, but historically, water quality samples underwent analysis for Aroclors. The Screening Parameters in MRP Table E-2 list total PCBs in the form of Aroclors. The Sediment Triad Analysis for Sediment Quality Objective (SQOs) requires analysis for Congeners in order to achieve the sediment quality guidelines. Considering that the regulatory drivers applicable to the MdR Watershed require different analytical and reporting methods of total PCBs, this CIMP proposes using a consistent method of analysis for consistency. Therefore, for the purposes of this CIMP, all water, sediment, and tissue samples will undergo analysis for Congeners in place of Aroclors. The 18 PCB Congeners identified in Appendix D of this CIMP are from Appendix A of the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SWRCB and USEPA, 2009) and represent the Congeners necessary to complete the SQO. These are the minimum PCB Congeners to be analyzed in the water column.

Table C-1. Monitoring Program by Monitoring Station – Water Quality – Storm Water (Wet Weather)

Sampling Media	Station Type	Wet Weather Monitoring Program	Parameter(s)	Station ID	Latitude	Longitude	Sampling Frequency	Sample No. and Type @ Sample Location	No. Samples/ Year
Water	Harbor Receiving Water Stations	Permit	Bacteria[a] Metals, Pesticides, Screening Parameters[b][c] Trash Survey *Flow not feasible in harbor.*	MdRH-MC	33.98054	-118.448191	3 storms/year[b]	1 grab @ Water Surface	3
				Duplicate	33.98054	-118.448191	1 storm/year	1 grab @ Water Surface	1
				Field Blank	33.98054	-118.448191	1 storm/year	Laboratory Blank Water	1
			Toxicity	MdRH-MC	33.98054	-118.448191	2 storms/year	1 grab @ Water Surface	2
	Outfall Stations	Permit	Flow, Bacteria,[a] Metals, Pesticides, Screening Parameters [b][c]	MdR-3	33.98919	-118.450627	3 storms/year[b]	1 composite (flow-weighted) @ Water Surface 1 duplicate sample 1 field blank sample	3 + 2 QC
			Toxicity				As needed [d]	1 composite (flow-weighted)	Up to 3
		Toxics TMDL	Flow, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Settleable Solids	MdR-3	33.98919	-118.450627	Up to 7 storms/year	1 composite (flow-weighted)	Up to 7
				MdR-4	33.9846	-118.459222	Up to 7 storms/year	1 composite (flow-weighted)	Up to 7
				MdR-5	33.98567	-118.45297	Up to 7 storms/year	1 composite (flow-weighted)	Up to 7
				MdRU-C-1	33.98325	-118.443414	Up to 7 storms/year	1 composite (flow-weighted)	Up to 7
				MdRU-C-2	33.98849	-118.457609	Up to 7 /year	1 composite (flow-weighted)	Up to 7
				Duplicate	To be determined		1 storm/year	1 composite (flow-weighted)	1
				Field Blank	Not applicable		1 storm/year	1 composite (flow-weighted)	1

[a]City of Los Angeles' regional monitoring program uses *E. coli* in place of fecal coliform bacteria. Both indicator bacteria appear on Table E-2 in the MRP.
[b]Table E-2 in the MRP (Reporting Program No. CI-6948). The first large storm of the first monitoring year will be analyzed for the entire parameters of Table E-2 of the MRP. For subsequent storms during the first year, only Categories 1 and 2 constituents in Table E-2 will be analyzed.
[c]Required for parameters with results at nearest downstream receiving water station that exceeds the lowest applicable WQO.
[d]Toxicity shall be conducted if the TIE conducted during the most recent sampling event at the downstream receiving water monitoring station was inconclusive.

Table C-2. Monitoring Program by Monitoring Station – Water Quality – Non-storm Water (Dry Weather)

Sampling Media	*Station Type*	*Dry Weather Monitoring Program*	*Parameter*	*Station ID*	*Latitude*	*Longitude*	*Sampling Frequency*	*Sample No. and Type @ Sample Location*	*No. Samples/ Year*
Water	*Harbor Receiving Water Stations*	Bacteria TMDL	Indicator Bacteria: Total Coliform, E. coli, (a) Enterococcus	MdRH-1	33.979886	-118.457175	6 days/week(b)	1 grab @ Ankle Deep	312
				MdRH-2	33.981105	-118.458012	2 days/week(b)	1 grab @ Ankle Deep	104
				MdRH-3	33.981785	-118.456382	1x/week(b)	1 grab @ Water Surface	52
				MdRH-4	33.980535	-118.455992	1x/week(b)	1 grab @ Water Surface, 1 grab @ At Depth	52x2
				MdRH-5	33.983435	-118.456112	1x/week(b)	1 grab @ At Depth(c)	52
				MdRH-6	33.982925	-118.454912	1x/week(b)	1 grab @ Water Surface, 1 grab @ At Depth	52x2
				MdRH-7	33.982805	-118.456332	1x/week(b)	1 grab @ At Depth(c)	52
				MdRH-8	33.981185	-118.448062	1x/week(b)	1 grab @ Water Surface	52
				MdRH-9	33.981935	-118.444992	1x/week(b)	1 grab @ Water Surface	52
		Toxics TMDL	Copper	MdRH-MC	33.98054	-118.448191	1x/month	1 grab @ Water Surface	12
				MdRH-A	33.97251	-118.45284	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				MdRH-B	33.97514	-118.453465	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				MdRH-C	33.97773	-118.453722	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				MdRH-D	33.98022	-118.453555	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				MdRH-E	33.98301	-118.453383	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				MdRH-F	33.98198	-118.445015	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				MdRH-G	33.97939	-118.444347	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				MdRH-H	33.97635	-118.444087	1x/month (rotational schedule(d))	1 grab @ Water Surface	12(d)
				Duplicate	To be Determined		1x/quarter – one per Basin	1 grab @ Water Surface	4
				Field Blank	Not Applicable		1x/quarter – one per Basin	1 grab @ Water Surface	4
			Total PCBs	MdRH-MC	33.98054	-118.448191	2x/year (summer / winter)	1 grab @ Water Surface	2
				MdRH-A	33.97251	-118.45284	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				MdRH-B	33.97514	-118.453465	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				MdRH-C	33.97773	-118.453722	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				MdRH-D	33.98022	-118.453555	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				MdRH-E	33.98301	-118.453383	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				MdRH-F	33.98198	-118.445015	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				MdRH-G	33.97939	-118.444347	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				MdRH-H	33.97635	-118.444087	2x/year (summer / winter)(d)	1 grab @ Water Surface	2(d)
				Duplicate	To be Determined		1x/year – one Basin	1 grab @ Water Surface	1
				Field Blank	Not Applicable		1x/year – one Basin	1 grab @ Water Surface	1

(a) City of Los Angeles' regional monitoring program uses *E. coli* in place of fecal coliform bacteria. Both indicator bacteria appear on Table E-2 in the MRP.
(b) Monitoring is scheduled. Samples collected 6 days/week (Monday-Saturday) at MdRH-1 and twice per week (Monday and Saturday) at MdRH-2, designated shoreline stations at Marina Beach. Samples collected weekly are sampled on Mondays. Season classifications (Wet versus Dry) are assigned post-monitoring, based on prevailing weather conditions during a scheduled sampling event. "Dry Weather" is assigned to samples collected at least 72 hours post a rainfall event.
(c) The outfall tide gate is typically 2 to 3 meters below the water's surface. The tide height at which the sample is collected is recorded in field notes to denote surface conditions.
(d) Sampling will be rotated through the front basins and back basins during the 5-year Permit period.

Table C-3. Toxics TMDL Receiving Water Monitoring Station Rotational Schedule for Copper and PCB Sampling

Year*	Front Basins	Back Basins	Main Channel
Year 1	MdRH-B and MdRH-G	MdRH-D and MdRH-E	MdRH-MC
Year 2	MdRH-C and MdRH-H	MdRH-D and MdRH-F	MdRH-MC
Year 3	MdRH-C and MdRH-A	MdRH-D and MdRH-E	MdRH-MC
Year 4	MdRH-B and MdRH-G	MdRH-D and MdRH-F	MdRH-MC
Year 5	MdRH-C and MdRH-H	MdRH-D and MdRH-E	MdRH-MC
*Monitoring stations change annually based on rational schedule shown above. All stations will be sampled within a three-year period. Basin D will be sampled yearly based on the analysis of the historical observed Copper concentration (See Appendix I).			

C.1.2.1 Water Quality Sampling – Composite versus Grab Sampling

There are two main types of samples which are used in water quality monitoring, grab samples and composite samples. The type of sample taken in a given instance will depend on the monitoring station, the type of test to be performed, frequency of testing, and regulatory requirements. A grab sample consists of a single sample taken at a specific time. A composite sample is a mixed or combined sample created by combining a series of discrete samples (aliquots) of specific volume. The protocols and use of these sampling methods under the CIMP are described below.

C.1.2.1.1 Water Quality Sampling – Grab Sampling

Grabs samples will be collected at outfall and receiving water stations to characterize water quality conditions in accordance with regulatory requirements, protocols outlined in this CIMP, as summarized in Table C-4. A single grab sample will be collected at the receiving water station, MdRH-MC, to characterize storm water flows for Permit compliance monitoring. This grab sample will be collected between one and three hours after flow and monitoring is initiated at the upstream outfall station, MdR-3. Grab samples will be collected at outfall stations during storm water monitoring events to help characterize parameters not amenable to composite sampling (Table C-5). These grab samples will be collected during the rising limb of the hydrograph. For safety, grab samples collected during Non-storm water monitoring events for Toxics TMDL and Bacteria TMDL compliance will be collected during daily-light, normal business hours, to the maximum extent practicable.

Table C-4. Primary Method of Grab Sampling for each Monitoring Program

Station Type	Permit	Toxics TMDL	Bacteria TMDL
Outfall	Grab: Center of flow at the peak of storm	Grab: Center of flow at the peak of storm	Grab: incoming wave, surface water, and/or at depth
Receiving Water	Grab: Center of flow, 1-3 hours after start of monitoring at MdR-3.	Grab: surface water	Grab: incoming wave, surface water, and/or at depth

Table C-5. Water Quality Parameters Requiring Grab Sample Collection

Constituents Requiring Grab Samples		
Field Parameters	**Conventional Constituents**	**Indicator Bacteria**
▪ Temperature ▪ Hydrogen ion concentration (pH) ▪ Specific conductance ▪ Dissolved Oxygen (DO) ▪ Turbidity	▪ Oil and grease ▪ Total phenols ▪ Cyanide ▪ Total petroleum hydrocarbons (TPH) ▪ Methyl tertiary butyl ether (MTBE) ▪ 2-Chloroethyl vinyl ether	▪ Total coliforms ▪ Fecal coliforms ▪ Fecal enterococci ▪ *Escherichia coli*

All grab samples will be collected from the horizontal and vertical center of flow, whenever possible. Grab samples will be kept clear from uncharacteristic floating debris. Additional, parameter-specific grab sampling techniques include the following:

- **Bacteria:** Bacteria samples will be collected in a sterile sample bottle and then placed in a clean Ziploc® bag and put on ice container at about 0-4ºC for transport to the laboratory for analysis within the laboratory holding time (e.g., 6 hours).
- **Oil and Grease/Petroleum hydrocarbons:** Oil, grease, and hydrocarbons tend to float. Grab samples characterized by these constituents will be collected at the air–water interface in amber glass bottles. Sample bottle will not be pre-rinsed with sample before collection. If samples are not be able to analyzed within 4 hours, samples will be preserved with HCl or H_2SO_4 to pH less than 2 and put in ice cooler at about 0-4ºC for transport to the laboratory.
- **Field Parameters:** A YSI meter, or equivalent, will be used for collection of pH, dissolved oxygen (DO), specific conductance, turbidity, and temperature data. Meters will be allowed to stabilize for one minute prior to recording readings. Operation of meters will be conducted in accordance with manufacturer instructions, and meters will be calibrated in accordance with manufacturer specifications on the same day field measurements will be taken to ensure accurate functionality. Calibration logs will be available upon request. Field parameters, such as DO and temperature degrade with exposure. Field parameter measurements will be collected and recorded after a sample has been collected. In the event of equipment malfunction and repair, a field parameter grab sample will be re-collected and tested.

C.1.2.1.2 Water Quality Sampling – Composite Sampling

Composite samples will be collected at outfall stations during storm water monitoring for Permit and Toxics TMDL programs (Table C-6). All composite samples will consist of a minimum of three sample aliquots, separated by a minimum of 15 minutes within each hour of monitoring/discharge. Sample aliquots will be collected on a flow-weighted basis.

Table C-6. Primary Method of Composite Sampling for each Monitoring Program

Station Type	Permit	Toxics TMDL	Bacteria TMDL
Outfall	Flow-weighted	Flow-weighted	N/A
Receiving Water	N/A	N/A	N/A
N/A – Not applicable. Composite samples will be collected using automated sampling equipment installed on-site prior to an event. In the event of equipment malfunction, composite sampling will be collected manually, if feasible.			

Composite samples will be collected using automated sampling equipment installed on-site prior to an event. Sampling equipment will consist of a configuration and design as historically used in the MdR Watershed at outfall stations. At a minimum, sampling equipment used for flow-weighted composite sampling at outfall stations will include: a flow sensor to continuously measure water stage (level or height), flow meter and logger, peristaltic pump, sample bottles, and lockable housing to secure all monitoring equipment (Figure 1, or equivalent). Flow sensors will be installed in the middle of the MS4 at the system invert. Flow sensors will be used to relay water stage data to the flow meter. The flow meter will be programmed to continually calculate flow rates by inserting the stage information into the preprogrammed discharge equation (e.g., Manning's Equation) or site-specific rating table. All water quality instruments will be calibrated according to the manufacturer specifications during their installation. Equipment quality checks of the calibration may be performed regularly to ensure ongoing equipment performance. Prior to a monitored storm event, automated samplers will be programmed to start automatically when the water level exceeds a site-specific, minimum predetermined level. A sample aliquot will be collected each time a set volume of water has passed the monitoring point. This volume is referred to as the pacing volume or trigger volume. Samples will be stored in glass containers within the sampler. As samples are collected, monitoring data including discrete sample times and runoff data, are logged and stored for transfer. The automated sampler will be deactivated by field personnel within 48 hours after the end of each storm event.

Figure 1. ISCO Type Automated Flow and Sampling Equipment Installed at Existing Monitoring Stations

In the event of equipment malfunction, manual grab samples will be collected. The time of each manual grab sample will be recorded and used to create the time-weighted composite sample, which will be submitted to the laboratory for analysis. Time-weighted sample aliquots will be collected by sampling discretely at established time intervals, as follows:

- **<u>Event Duration >24 hours</u>:** Hourly aliquots for the first 24 hours.
- **<u>Storm Event Duration ≤24 hours and >3 hours</u>:** Hourly aliquots for the duration of the event.
- **<u>Storm Event Duration ≤ 3 hours</u>:** Aliquots separated by a minimum of 15 minutes within each hour of discharge. The MRP requires a minimum of three aliquots total. For

the purposes of this CIMP, sample aliquots will be collected at 15 minute intervals for a total of three hours.

In the event of equipment malfunction at an outfall station, flow data necessary for storm water load estimates will be modeled. Rainfall data from the MdR Watershed precipitation station and other regional precipitation stations may be used to populate the model. Data from storm events either before or after the missing data may also be used for model calibration. Additionally, field observations of flow conditions may be used to calibrate models. Field flow measurement and estimation techniques, listed in order of priority, include the following:

- **Float Method:** Measure of average velocity (average of three measurements representing a known distance traveled and measured interval, multiplied by a correction factor of 0.85) and average cross-sectional flow area (width and depth measurements, at a minimum),
- **Direct Volumetric Measurement:** Measure of the time required to fill a container of known volume (only applicable to small flows), and
- **Visual Approximation:** If storm water discharge is not safely measurable using either of these direct measurement techniques, Visual Approximation of water depth and velocity may be used to estimate flow. Visual Approximation is based on best professional judgment and would only be used to confirm the relative changes in magnitude of storm water discharge for modeled flow.

C.1.2.1.3 Equipment Maintenance

All sampling equipment will be cleaned and calibrated according to manufacture manual prior to sampling. Decontamination procedures as described by the California Department of Fish and Game (Hosea and Finlayson, 2005) will be employed and include immersion of sampling equipment in Sparquat 256.

Field meters use sensitive osmotic membranes for the measurement of pH and DO; therefore, neither freezing nor the use of Sparquat 256 will be employed as a decontamination method. Field meters will be visually inspected after use at each location and all snails, mud, algae, and debris will be removed. The meters will then be thoroughly rinsed on-site with deionized water followed by actual sample before taking measurement. Visual inspection of the field meters will be completed prior to departure from the station and before use at the next monitoring location.

C.1.2.2 Water Quality Sampling – Receiving Water Stations – Storm Water

Wet Weather receiving water monitoring is only subject to compliance under the Permit. Time-weighted storm water composite sampling will be conducted at the Harbor receiving water station for Permit compliance (MdRH-MC). Note that flow monitoring and, therefore, flow-weighted composite sampling is not feasible in the MdR Harbor. Sampling at the receiving water station will be coordinated to begin after sampling begins at the upstream outfall station (MdR-3) in order to monitor the potential effect of the MS4 on the receiving water. Time-weighted sample aliquots will be collected using automated sampling equipment mounted to existing marina infrastructure accessible from land (e.g., marina docks).

Toxicity monitoring shall be conducted at Harbor receiving water station MdRH-MC to evaluate a sublethal effect (e.g., reduced growth, reproduction) to experimental test organisms in accordance with MRP requirements. Toxicity sampling shall consist of time-weighted composite samples, collected using the methods described above. The total sample volume shall be determined both by the specific toxicity test method used and the additional volume necessary for TIE studies. Sufficient sample volume shall be collected to perform both the required toxicity tests and TIE studies. All toxicity tests shall be conducted as soon as possible following sample collection. A 36-hour sample holding time is preferred for test initiation, with no more than 72 hours elapsed before the conclusion of sample collection and test initiation.

Storm water grab samples will be collected at the Harbor receiving water station MdRH-MC from the water's surface, with the assistance of a sampling pole or bucket. Grab samples will be collected during the initial portion of the storm (i.e. on the rising limb of the hydrograph), and from the horizontal and vertical center of flow whenever possible. Field personnel will take all precautions necessary to ensure safe sampling techniques are used in the field.

A field duplicate and field blank sample will be collected at the MdRH-MC Harbor receiving water station for Permit compliance.

All samples shall be delivered under chain-of-custody to the appropriate analytical laboratory for all analyses summarized in Appendix D. Year 1 results for Permit compliance storm water monitoring will shape monitoring requirements and parameter lists for subsequent storm events and monitoring years, dependent upon results below the MDL (non-detect result) and/or less than the lowest applicable WQO. Appendix D monitoring lists will be revised and a written request will be submitted to the Executive Officer of the Regional Board.

C.1.2.3 Water Quality Sampling – Receiving Water Stations – Trash Monitoring

Trash monitoring will be conducted to assess the quantities of trash in the Harbor receiving water associated with storm events. Visual observations of trash will be made and photographs will be taken at the MdRH-MC prior to the start of storm event monitoring and again at the end of the storm water monitoring. One photograph will be taken across the Main Channel of MdR Harbor, perpendicular to direction of flow along the channel. The photograph will show as much as possible of both sides of the Main Channel when feasible. The post storm photograph must be taken from the same vantage point. Ideally the two photographs will display relative volumes of trash that were deposited by storm flows, if trash is present.

C.1.2.4 Water Quality Sampling – Receiving Water Stations – Non-Storm Water

C.1.2.4.1 Water Quality Sampling – Receiving Water Stations – Non-Storm Water Monitoring for Permit Compliance

Non-storm water discharges and outfall-based non-storm water monitoring for Permit compliance is not considered applicable for the MdR Watershed and has not been included in this CIMP. For more information refer to the CIMP section 5.

C.1.2.4.2 Water Quality Sampling – Receiving Water Stations – Bacteria TMDL Compliance

Water quality grab samples will be collected from Harbor receiving water stations MdRH-1 through MdRH-9 for Bacteria TMDL compliance. Samples collected for Bacteria TMDL compliance are collected on a scheduled basis (weekly or six times per week at two Marina Beach shoreline stations). Bacteria grab samples collected at Harbor Receiving Water Stations MdRH-1 through MdRH-3, which are located along the Marina Beach, will be collected from ankle depth during an incoming wave. Bacteria grab samples collected from Harbor receiving water stations MdRH-4 through MdRH-9 will be collected from a skiff. Samples collected from the skiff will be collected from the water's surface and/or at depth, depending on the sampling schedule in Table C-2. Skiff operations will be subject to all existing field safety protocols and sampling standard operating procedures.

Bacteria samples collected within 3 days of a storm event are classified as Wet Weather samples and the sampling location from major outfalls (receiving water stations MdRH-5 and MdRH-7) are subject to TMDL observation requirements. In accordance with the Bacteria TMDL, Wet Weather bacteria grab samples shall represent flow from the outfall into the surf zone/receiving water at the point of mixing of storm water and marine water. Grab samples shall be taken as close as possible to the initial point of mixing with the receiving water. As a safety consideration, this monitoring location may be shifted no further away than 10 meters (m) down current of the MS4 outfall/point of mixing. The Global Positioning System (GPS) coordinates of this event-specific monitoring location will be recorded in field notes. Care will be taken not to collect a sample from the incoming tidal swash. The tide may push the freshwater discharge back into the MS4 during high tide conditions. Tide observations and potential impacts on water quality conditions will be recorded in field notes.

All bacteria grab samples shall be delivered under chain-of-custody to the appropriate analytical laboratory for all TMDL required bacterial analyses identified in Appendix D, within the designated 8-hour holding time.

C.1.2.4.3 Water Quality Sampling – Receiving Water Stations – Non-Storm Water Monitoring for Toxics TMDL

Water quality grab samples of dissolved copper and total PCBs (e.g., Congeners) will be collected from Harbor receiving water stations for Toxics TMDL compliance. Samples will be collected from a skiff. Skiff operations will be subject to all existing field safety protocols and sampling standard operating procedures. As a safety consideration, samples are not collected from the skiff during rainfall. All toxicity samples shall be delivered under chain-of-custody to the appropriate analytical laboratory for all TMDL required analyses (Appendix D).

C.1.3 Sediment Sampling

Multiple sediment monitoring programs are required by the Toxics TMDL. These programs are briefly described below and explained further in the following sections.

The first program required by the Toxics TMDL is the analysis of storm-borne sediment collected from the MdR Watershed. Storm-borne sediment passive collection at outfall stations will be conducted monthly for up to seven events per year. Storm-borne sediment samples will be analyzed for Toxics TMDL pollutants and used to evaluate the potential sediment and pollutant load entering MdR Harbor from the Watershed. Table C-7 lists the monitoring stations applicable to this program. A pilot study is ongoing (LADPW, 2014). The proposed monitoring sampling and analytical protocols may change based on the final study recommendations. Preliminary results of the pilot study can be found in Appendix H.

Sediment monitoring has been conducted in the MdR Harbor for more than 25 years, as part of an annual monitoring program conducted by the Los Angeles County Department of Beaches and Harbors, the Toxics TMDL CMP, a special study conducted by the County in 2008, and the regional Bight program (2003, 2008, and 2013). Sediment monitoring results for the Toxics TMDL constituents have remained relatively consistent over time. Sediment analysis will be conducted in conjunction with Triad Sampling in the Harbor receiving waters for SQO analysis. This analysis will be performed twice during the five year Permit cycle. SQO monitoring will be conducted during 2016 as part of the Stressor Identification study and in 2018 as part of the regional Bight ’18 program. Sampling will include chemistry, toxicity, and benthic infaunal assessment, per SQO guidelines. Required Toxics TMDL constituents will be monitored as part of the SQO chemistry analysis (Table C-8).

Sample preservatives, holding time requirements, detection limits, and holding times for each parameter are provided for each monitoring program in Appendix D.

Table C-7. Monitoring Programs by Monitoring Station – Storm-Borne Sediment – Storm Water (Wet Weather)

Sampling Media	Station Type	*Wet Weather Monitoring Program*	Parameter(s)	Station ID	Latitude	Longitude	Sampling Frequency	Sample No. and Type @ Sample Location	No. Samples/ Year
Storm-Borne Sediment	Outfall Stations	Toxics TMDL	Copper, Lead, Zinc Total Organic Carbon (TOC), Percent Solids, Total PCBs (congeners), DDTs, Chlordane	MdR-3	33.98919	-118.450627	Monthly - Up to 7 storms/year[(a)]	1 composite sample of all sediment collected during the Wet Season.	1
				MdR-4	33.9846	-118.459222	Monthly - Up to 7 storms/year[(a)]	1 composite sample of all sediment collected during the Wet Season.	1
				MdR-5	33.98567	-118.45297	Monthly - Up to 7 storms/year[(a)]	1 composite sample of all sediment collected during the Wet Season.	1
				MdRU-C-1	33.98325	-118.443414	Monthly - Up to 7 storms/year[(a)]	1 composite sample of all sediment collected during the Wet Season.	1
				MdRU-C-2	33.98849	-118.457609	Monthly - Up to 7 storms/year[(a)]	1 composite sample of all sediment collected during the Wet Season.	1
				Duplicate	To be determined		Monthly - Up to 7 storms/year[(a)]	1 composite sample of all sediment collected during the Wet Season.	1 – if material remains

a) Sediment collected during storm water monitoring events at outfalls.

Table C-8. Monitoring Programs by Monitoring Station – (Benthic) Sediment (Dry Weather)

Sampling Media	*Station Type*	*Dry Weather Monitoring Program*	*Parameter(s)*	*Station ID*	*Latitude*	*Longitude*	*Sampling Frequency[(a)]*	*Sample No. and Type @ Sample Location*	*No. Samples/ 5 Years (SQO)*
(Benthic) Sediment	Harbor Receiving Water Stations	Toxics TMDL	**SQO Monitoring:** Grain Size, Percent Solids, Total Organic Carbon (TOC), Benthic Infauna Analysis, Cadmium, Copper, Lead, Mercury, Zinc, PAHS – lower and higher molecular weights, Total PCBs (congeners), DDTs, Chlordane, Dieldrin, Sediment Toxicity	MdRH-MC	33.98054	-118.448191	SQO: 2x/5 years (Stressor ID & Bight)	1 grab of Surficial Sediment	2
				MdRH-B-2	33.98301	-118.453383	SQO: 2x/5 years (Stressor ID & Bight)	1 grab of Surficial Sediment	2
				MdRH-F	33.98198	-118.445015	SQO: 2x/5 years (Stressor ID & Bight)	1 grab of Surficial Sediment	2
				MdRH-B	33.97514	-118.453465	SQO: 2x/5 years (Stressor ID & Bight)	1 grab of Surficial Sediment	2
				MdRH-G	33.97939	-118.444347	SQO: 2x/5 years (Stressor ID & Bight)	1 grab of Surficial Sediment	2
				Duplicate	To be determined		SQO: 2x/5 years (Stressor ID & Bight)	1 grab of Surficial Sediment	2
				Equipment Rinse Blank	Not Applicable		SQO: 2x/5 years (Stressor ID & Bight)	1 grab of Surficial Sediment	2

a) Sediment monitoring has been conducted in the MdR Harbor for more than 25 years. Sediment monitoring results for the Toxics TMDL constituents have remained relatively consistent over time. In place of annual sediment monitoring, this CIMP proposes conducting two SQO studies during the five year Permit period rather than one.

C.1.3.1 Sediment Sampling – Storm-borne Sediments

The Toxics TMDL requires analysis of the settleable and suspended solids of storm water quality samples collected from outfall discharges. At least 54 grams (wet weight) of storm-borne sediment will be required to perform the analyses required by the Toxics TMDL (Brown and Caldwell, 2013; LADPW, 2014). The average TSS concentration measured in the MdR Watershed ranges from 20 milligrams per liter (mg/L) to 61 mg/L (**Error! Reference source not found.**). It is not feasible to collect and filter sufficient storm water during a single storm event to collect sufficient sediment for analysis.

The Storm-borne Sediment Pilot Study was conducted to test custom-built passive sediment collection devices at outfall stations MdR-4, MdR-5, and MdRU-C-1 (Brown and Caldwell, 2013; LADPW, 2014) and develop monitoring protocols for storm-borne sediment sampling. The amount of sediment successfully collected using these devices have ranged from less than 1 gram to 115 grams with TSS concentrations ranging from 2.1 mg/L to 106 mg/L). The Storm-Borne Sediment Pilot Study to date reveals that it will be difficult to collect sufficient sample material to meet the targeted MDLs using conventional analytical methods. Included with the CIMP is a preliminary summary report for the Storm-Borne Sediment Pilot Study (LADPW, 2014), which proposes to use the passive sediment collection devices to collect samples, composite by site, and utilize alternative analytical methods. As part of the adaptive management process, , the MdR EWMP Agencies will re-visit the suitability of passive storm-borne sediment monitoring based on collection and analytical results after two years of implementing the CIMP.

Table C-9. 2011-2014 Pilot Study Sediment Collection Method Results at MdRUC-1, MdR-4, MdR-5

	MdRUC-1		MdR-4		MdR-5	
Event No.	**Sediment Collected(1) (grams)**	**TSS (mg/L)**	**Sediment Collected(1) (grams)**	**TSS (mg/L)**	**Sediment Collected(1) (grams)**	**TSS (mg/L)**
1	<1	2.1	5.5	27	9.3	25
2	<1	205(2)	26.3	85	21	3.2
3	21	251(2)	Insufficient sample	106	23.3	2.5
4	115	54	26.1	49	41.8	55
5	35	17	9.1	40	32.8	16
Estimated Total	171	**Avg = 24.4**	67	**Avg =61**	128.2	**Avg =20**

(1)Field measured (grams-wet)
(2)Outliers and not included in TSS average and Total Estimated Sediment Load. Field observations confirmed that high TSS results were not representative of ambient conditions.

This CIMP has adopted the storm-borne sediment sampling protocols developed for the 2011-2014 Storm-Borne Sediment Pilot Study for Toxics TMDL compliance monitoring (Brown and Caldwell, 2013; LADPW, 2014). Storm-borne sediments will be collected at outfall stations during monitored storm events (up to 7 per year). One sediment sample will be collected per monitored storm event and outfall station. It is expected that not enough storm-borne sediment will be available per a storm event at any of the stations. Therefore, for each station, all samples from the 7 storms will be stored, frozen, until the end of the monitoring season and analyzed as a composite. For each station, the composite sample will undergo analysis for the constituents identified in Appendix D. Storm-borne sediments will be collected using passive sampling devices similar to the systems piloted and documented in Brown and Caldwell (2013) and the storm-borne sediment pilot study summary (LADPW, 2014).

At the end of field storm water monitoring activities at outfall stations, sediments collected in the passive sediment collection devices will be transferred into certified clean glass jars. The field wet weight will be measured and recorded to provide an initial estimate of sediment volume and load for the monitored storm event. The field wet weight will be calculated by subtracting the tare weight of the empty glass jar weight from the weight of the jar containing the sample. If there is sufficient composited sediment material for a duplicate sample, up to one duplicate sample will also be analyzed.

C.1.3.2 Sediment Sampling – MdR Harbor Sediments

The Toxics TMDL requires collection of benthic sediment samples annually and a complete SQO analysis once every five years. Given the large historic sediment dataset, this CIMP proposes only conducting Triad Sampling. Triad Sampling will be conducted at the Harbor receiving water stations historically used for sediment sampling. Samples will undergo the suite of analyses required for SQO analysis, including sediment chemistry, toxicity, and benthic infaunal analysis. Samples will also be analyzed for grain size, percent solids, and total organic carbon (TOC).

After construction of the Oxford Basin Enhancement Project is complete, BMP effectiveness monitoring will be conducted by the LACFCD in accordance with the effectiveness monitoring program proposed for the Proposition 84 grant.

Sediment samples will be collected from the MdR Harbor using a stainless-steel, 0.1-square meter (m^2) Van Veen grab sampler or equivalent. An equivalent sediment sampling device will have the following characteristics:

- Constructed of a material that does not introduce contaminants.
- Samples with minimal surface sediment disturbance.
- Does not leak during sample retrieval.
- Has a design that enables safe/easy sample verification that samples meet all applicable sampling criteria (e.g. access doors that allow visual inspection and removal of the undisturbed surface sediment).
- Grab samplers with smaller sampling surface areas may be acceptable depending on the study needs provided the sediment sample obtained is similar or equivalent to the quality of a Van Veen grab.

A sediment sample will be considered acceptable if the surface of the grab is even with minimal surface disturbance and a penetration depth of at least 5 centimeters (cm). Sediment samples that do not meet these criteria will be discarded and additional grab samples will be collected as needed. Good faith efforts will be made to collect representative sediment samples. If samples cannot be obtained from the exact sample point, a reasonable attempt will be made to collect a sample from the vicinity of the sample point (e.g., within 100 m, as per Bight protocols). If this proves unsuccessful, no sample will be collected from the given sample point. This effort will be fully documented in all field notes. If samples cannot be collected during two consecutive sampling events, alterative sampling point(s) will be proposed to the Regional Board and this CIMP will be updated. Sediment samples will be collected from the top 5 cm of the grab sampler, avoiding sediment within 1 cm of the sides of the grab sampler. Sediment samples will be processed as follows:

- **Grain Size:** Sediments for grain size analysis will be placed in either a quart size Ziploc® bag or a clean glass jar and placed on ice in coolers. These samples will be delivered unfrozen to the laboratory within 2 days of collection for analyses.
- **Sediment Chemistry:** Sediments for chemical analyses will be placed into certified clean glass jars with Teflon® lined lids, kept on ice in coolers, and frozen at -20°C within 24 hours. These samples will be delivered frozen to the laboratory within 2 days of collection for analyses.
- **Sediment Toxicity:** Sediments for toxicity analysis will be placed in a clean food-grade polyethylene bag or multiple 1-L certified clean glass jars, and placed on ice in coolers. These samples will be delivered unfrozen to the laboratory within 2 days of collection for analyses.
- **Benthic Infauna:** Sediment collected for benthic infaunal analysis will be rinsed through a 1.0-mm mesh screen. The material retained on the screen will be transferred to a labeled glass or plastic quart jar. A 7% magnesium sulfate ($MgSO_4$) seawater solution will be added for approximately 30 minutes to relax the collected specimens. The samples will then be then fixed in a 10% buffered formalin solution. These samples will be delivered to the laboratory within 2 days of collection. The benthic infaunal sample will be stored in a formalin solution for a minimum of 3 days and no longer than 5 days.

Final sediment sample volumes necessary for grain size, chemistry, benthic infauna, and toxicity analysis will be determined during discussion with the contacted laboratory and to achieve targeted MDLs (Appendix D).

C.1.4 Bioaccumulation – Fish and Mussel Sampling

Fish and mussel tissue monitoring is required by the Toxics TMDL to determine the integrated accumulation of bioavailable contaminants from various sources. Fish and mussel tissue sampling will be conducted annually, and the timing of sampling will be kept consistent between monitoring years to allow for more reliable long-term data analysis. In 2010 to 2012, fish and mussel sampling were conducted during the month of October. For consistency, this schedule is recommended to continue. The bioaccumulation monitoring program for fish and mussel tissue will be conducted for total PCBs (Congeners), chlordane, and Total DDTs as summarized in Table C-10. Sample preservatives, holding time requirements, analytical methods, detection limits, and holding times for each parameter are presented in Appendix D.

Table C-10. Parameters by Monitoring Program – Fish and Mussel Tissue

Sampling Media	Station ID	Harbor Receiving Water			
		Sample No. and Type	Sampling Frequency	Samples per Year	Parameters
Fish Tissue	MdRH-MC MdRH-A MdRH-B MdRH-C MdRH-D MdRH-E MdRH-F MdRH-G MdRH-H	Individuals and/or composites.	1x/year (October)	18	Chlordane, DDTs, PCBs(a)
Mussel Tissue	MdRH-A MdRH-B MdRH-C MdRH-G MdRH-H	One composite representing transplanted mussels in the Front Basins.	1x/year (October)	1	Chlordane, DDTs, PCBs(a)
	MdRH-MC MdRH-D MdRH-E MdRH-F	One composite representing transplanted mussels in the Back Basins.		1	

(a). 54 PCB congeners: 8, 18, 28, 31, 33, 37, 44, 49, 52, 56, 60, 66, 70, 74, 77, 81, 87, 95, 97, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 132, 138, 141, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 174, 177, 180, 183, 187, 189, 194, 195, 201, 203, 206, and 209. These include all 41 congeners analyzed in the SCCWRP Bight Program and dominant congeners used to identify the aroclors.

C.1.4.1 Fish Sampling

In the Toxics TMDL CMP, six "bottom dwelling fish species" were considered potential candidates for bioaccumulation sampling, including White croaker, California halibut, Barred sand bass, Queenfish, Bat ray, and Shiner perch. Considering the nature of fish and the fact that fish do not always cooperate with monitoring activities, the Toxics TMDL CMP allowed sampling to be limited to two bottom-dwelling fish species. During surveys conducted in October 2010, 2011, and 2012, up to five individual fish per targeted species were caught in three of the Back Basins. A total of 30 individual fish from each survey underwent bioaccumulation analysis.

For the purposes of this CIMP, at least two fish species will be targeted during each survey. In order to evaluate the potential impact to the food chain and associated human health impacts, this CIMP has further refined the species targeted for analysis, such that at a minimum a sport fish will be targeted during each survey. Table C-11 presents the species of fish recommended to be targeted by dietary category. White croaker was selected because the species has a "do not consume" fish advisory from the Office of Environmental Health Hazard Assessment's (OEHHA). It was caught during 34 of the 44 historical fish surveys conducted in MdR Harbor (1985 to 2008) and during surveys in 2011 and 2013 (9 individuals analyzed). California halibut was selected because it is a piscivore and demersal fish (i.e., in direct contact with the sediments). California halibut was caught in MdR Harbor during 42 of the 44 historical fish surveys and all three of the most recent compliance surveys (26 individuals analyzed). Queenfish was selected as a third optional sampling species because it is under a current OEHHA fish consumption advisory and represents a dietary guild that consumes both benthic and pelagic species. It was caught in 31 of the 44 historical surveys. If two of the three targeted species are not caught during monitoring, bottom-dwelling species (e.g., Barred sand bass, Bat ray, and Shiner perch).

Table C-11. Target Fish Species

Fish Species	Dietary Guild	Description of Dietary Guild	Target Size Range (total length in mm)
White Croaker (*Genyonemus lineatus*)	Benthic diet without piscivory	Diet largely composed of small benthic invertebrates, such as amphipods and other crustaceans, bivalve mollusks, and polychaete worms.	160-300
California Halibut (*Paralichthys californicus*)	Piscivore	The majority of the diet is fish. Large predatory invertebrates (e.g. cephalopods, decapod crustaceans, and echinoderms) are also consumed to some degree.	560-820
Queenfish (*Seriphus politus*)	Benthic and pelagic diet with piscivory	Diet includes a combination of benthic invertebrates, pelagic invertebrates (e.g. zooplankton, shrimp, and mysidae), and forage fish.	120-260

Note that inclusion of a prey fish, such as topsmelt (*Atherinops affinis*)[1], may also be appropriate to help evaluate conditions throughout the food chain as part of a potential future SQO Part II (indirect effects) analysis. The SQO Part II analysis is not required by the Toxics TMDL and this information has been included for reference purposes only.

C.1.4.1.1 Number of Fish Samples

A total of 18 fish tissue samples (9 each of two species) will undergo analysis per annual survey for Toxics TMDL compliance.

Fish will be analyzed as individuals, unless the fish caught are of insufficient size for individual sample analysis, then fish must be analyzed as composites. If fish are analyzed as composite samples, each composite sample shall include a minimum of three fish, with up to five fish per sample preferred, especially if smaller fish are caught (OEHHA, 2005). All fish composite samples must follow OEHHA's "75 percent rule," where the length of the smallest fish should be at least 75% of the length of the largest fish of a species in a composite sample.

[1] Topsmelt is one of the three test species required for Toxicity analysis under the Permit. If Topsmelt is identified as the "most sensitive" species and selected for ongoing toxicity analysis under the Permit receiving water monitoring requirements, it would also be the preferred prey fish for tissue sampling and analysis.

C.1.4.1.2 Fish Sampling Protocols

Fish swim throughout MdR Harbor; therefore, for the purposes of this CIMP, the entire Harbor is considered to be a single representative area for fish sampling. Trawl transects will be run throughout the Harbor to collect targeted fish species. Fish will be collected during a single day of trawling. At the end of a trawl day, the entire catch will be evaluated for sampling. Fish sampling protocols shall be conducted in accordance with OEHHA's *General Protocol for Sport Fish Sampling and Analysis*.[2] Fish used for samples shall be of either legal size and/or edible size. The Department of Fish and Wildlife (DFW) Sport Fishing Regulations define legal size requirements using total length. All size measurements are in terms of total length.

In order to have 18 fish tissue samples (e.g., 9 samples representing two targeted species), reasonable attempts will be made to collect 9 to 16 fish of each targeted species during each survey. This will allow for up to 9 individual tissue samples or 6 individual and 3 composite tissue samples to undergo sample analysis. If more than 10 trawls are conducted and none the three targeted species are caught (see Table C-11), bottom-dwelling species identified in the Toxics TMDL CMP may be sampled. Listed in order of preference, targeted fish will include: barred sand bass, shiner perch and bay ray.

Fish will be collected using up to three different gear types, if necessary, due to the variation in gear capture efficiency and strata of the various target species. These include otter trawl, lampara net, and gill net. Prior to deployment of the sampling gear, a survey of the sampling area using a fathometer and direct visual observations will be performed to determine whether possible obstructions exist that could prevent proper deployment or damage gear and whether sensitive submerged aquatic vegetation (in shallow water habitat areas) is present that should be avoided. Based on the findings of this survey, the gear will deployed in order of priority:

1. The first gear type to be employed will be a standard otter trawl with a 7.6-m headrope, 2.5-cm mesh, and 1.3-cm mesh cod end liner. The otter trawl is effective for collecting bottom dwelling demersal fish species. This is the preferred trawl method.
2. The lampara is a semi-pursing, round-haul net, having a cork line of approximately 273 m and a depth of 36 m. The net consists of two full-cut wings (100-m length each; 15-cm stretch mesh), a throat or apron with 5-cm mesh, and a sack or bag of 0.9-cm mesh. The net is set in a circle or ellipse and drawn closed at the bottom during retrieval onto the boat. The lampara net is highly effective for collecting two of the three target species (White Croaker and Queenfish).
3. Obstructive debris on the Harbor bottom may be problematic for the otter trawl and lampara net, in which case a gill net may be used. The gill net is a 50-m flat panel monofilament net with varying mesh sizes. The net has a float line and lead line so it will sit vertically in the water column, either weighted to capture demersal species or floated to capture pelagic species.
4. Collection of prey fish may require hand-fishing.

Trawling will be conducted at a speed-over-ground of approximately 2 knots (1 meter per second [m/s]), ranging between 1.5 and 2.5 knots (0.75 and 1.25 m/s). For collecting targeted species,

[2] Although OEHHA protocols are established for freshwater fish, they may be translated to fish within small and medium sized marine and/or estuarine waterbodies such as MdR Harbor.

the time and length of the trawl may vary, depending on site conditions. In general, the objective will be to limit trawl time to the 5-minute period identified in the original Toxics TMDL CMP. Using a standard otter trawl, this will result in linear trawl coverage of 450 m to 600 m. Lampara and purse seine are both deployed in a circle (or oval if space-limited) and "pursed" or drawn closed toward the center as they are retrieved onto the deck.

Once on deck, the contents of the net will be transferred to tubs and processed. Sample processing for fish tissue samples includes evaluation of the length, weight, and sex of each fish.

Fish will be submitted to the laboratory on ice, unfrozen, within 2 days of sample collection.

C.1.4.2 Mussel Sampling

In the Toxics TMDL CMP, mussels resident to the MdR Back Basin were collected for bioaccumulation sampling and analysis. Although studies have found that analysis of resident mussels yields results nearly identical to analysis of transplanted mussels (SWRCB, 2013), transplanted mussels sampling is recommended in place of resident mussel sampling in order to better control for mussel age and, therefore, assessment of tissue bioaccumulation. Vexar cages, each containing approximately 25 California mussels per cage, will be installed at designated monitoring locations in the MdR Harbor. Vexar cages will remain on-site for one month before transplanted mussels will be retrieved for tissue analysis.

In the Toxics TMDL CMP, tissue from mussels resident to the MdR Back Basins was composited into two replicate samples of five individuals (55 to 65 mm in length, if available). This composite method will be used in this CIMP.

Mussels will be submitted to the laboratory on ice, unfrozen, within 2 days of sample collection.

C.1.5 Chain of Custody Procedures

In accordance with USEPA sampling protocols, all samples collected will be stored in the appropriate container type for the analytical method to be performed. Additionally, all samples will be stored and chilled in ice chests for transfer to the laboratory and between laboratories.

Chain-of-custody procedures (Woodward-Clyde, 1996) are used for all samples throughout the collection, transport, and analytical process. 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 container and secured with an official seal to prevent the sample from being reached without breaking the seal. Chain-of-custody records, field logbooks, and field tracking forms are the principal documents used to identify samples and to document possession. The chain-of-custody procedures will be initiated during sample collection. A chain-of-custody record will be provided with each sample or group of samples. Each person with sample custody will sign the form and ensure the samples are not left unattended unless properly secured. Documentation of sample handling and custody includes the following:

- Bottle label information (i.e., station [site] number, station [site] name, laboratory analysis requested, and date [written at time of sampling]).
- Time (written at time of sampling).
- Number of bottles.

- Temperature of sample.
- Sampler(s), laboratory and sampler/courier signatures, and time(s) sample(s) changed possession (completed upon sample transfer[s]).

Each sample collected shall be associated with a recorded observation of site conditions, which should include (at a minimum) a unique sample identifier, collection date and time, weather conditions, sample characteristics, sampler's name, and field observations that may be relevant to the monitoring being conducted (e.g., types of field investigations conducted, presence/absence of flow and estimated flow volume, connectivity with the receiving water, potential pollutant sources). Field forms and lists of field sampling equipment are provided in Attachment C1.

C.1.6 Field and Laboratory Safety

It is the policy of all participating agencies that all employees have a safe working environment and that all field and laboratory work be performed in a manner that provides the highest level of safety for the protection of every employee.

Sampling should only occur when conditions can be assessed as SAFE. The safety of the sample collector is the top priority and may preclude scheduled sampling, especially during storm water monitoring. Standard Operating Protocols for the MdR Watershed CIMP are summarized below and or may be referenced from the TMDL CMPs.

In addition, in an effort to improve employee safety and health awareness and prevent occupational related injury and illness, all participating laboratories must develop a safety program with the intention of satisfying the applicable federal, state, and local regulations.

C.2 Analytical Procedures

This section of the appendix presents a discussion of analytical methods to be used for sample analysis.

C.2.1 Analytical Procedures for Water Quality

A complete list of chemical and biological parameters with corresponding analytical methods and detection limits for water samples required by the Permit, Bacteria TMDL and Toxics TMDL (not including Triad Analysis requirements) is provided in Appendix D. All analytical methods used to obtain contaminant concentrations will follow USEPA or Standard Methods (SM) 21st Edition (APHA et al., 2005).

C.2.1.1 Analytical Procedures for Aquatic Toxicity Testing for Permit Compliance Monitoring

Toxicity testing at receiving water station MdRH-MC shall be conducted during two storm events. Storm water toxicity testing shall be paired with analyses at outfall station MdR-3. Non-storm water monitoring at outfall station MdR-3 is not anticipated. Toxicity testing will be conducted during the storm water event following an inconclusive toxicity identification evaluation (TIE) finding at the receiving water station. All significant Non-storm water flows have been diverted to the sanitary sewer by low-flow diversion structures (e.g., LFD overtopping flow) is not recorded by on-site flow monitoring telemetry equipment at MdR-3.

As described in the MRP (page E-31), if samples are collected in receiving waters with salinity equal to or greater than 1 ppt or from outfalls discharging to receiving waters with salinity that is equal to or greater than 1 ppt, then toxicity tests should be conducted on the most sensitive test species in accordance with species and short-term test methods in Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms (EPA/600/R-95/136, 1995). The marine and estuarine test species identified in the MRP are listed in Table C-12.

Table C-12. Aquatic Toxicity Monitoring Methods

Media	Species	Taxon	Type of Test	Method
Receiving Water with Salinity ≥1 ppt Outfall discharge to Receiving Water with Salinity ≥1 ppt	Topsmelt	*Atherinops affinis*	Static Renewal Toxicity Test: Larval Survival and Growth	Method 1006.01 [(a)]
	Purple Sea Urchin	*Strongylocentrotus purpuratus*	Static Non-Renewal Toxicity Test: Fertilization	Method 1008.0 [(a)]
	Giant Kelp	*Macrocystis pyrifera*	Static Non-Renewal Toxicity Test: Growth	Method 1009.0 [(a)]
(a) Methods from *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (USEPA/600/R-95/136, 1995).				

Although all the species mentioned have been demonstrated as sensitive to a wide variety of toxicants and have been subject to numerous inter- and intra-laboratory testing using standardized toxicants, two species-- *Macrocystis pyrifera* (*M. pyrifera*) and *Atherinops affinis*

(*A. affinis*)-have limitations when used to assess the toxicity of stormwater compared to the sea urchin fertilization test and the red abalone larval development test.

The method for *M. pyrifera* is a 48-hour chronic toxicity test that measures the percent zoospore germination and the length of the gametophyte germ tube. Although the test may be sensitive to herbicides, fungicides, and treatment plant effluent, the use of *M. pyrifera* as a test species for stormwater monitoring may not be ideal. Obtaining sporophylls for stormwater testing could also be a limiting factor for selecting this test. Collection of *M. pyrifera* sporophylls from the field is necessary prior to initiating the test and the target holding time for any receiving water or stormwater sample is 36 hrs; however, 72 hrs is the maximum time a sample may be held prior to test initiation. During the dry season, meeting the 36-72 hr holding time will be achievable; however, field collection during wet weather may be delayed beyond the maximum holding time due to heavy seas and inaccessible collection sites. In addition, collection of *M. pyrifera* sporophylls during the storm season may include increased safety risks that can be avoided by selection of a different species.

The *A. affinis* test measures the survival and growth test of a larval fish over seven days. At the end of seven days of exposure to a suspected toxicant, the number of surviving fish are recorded, along with their weights, and compared to those exposed to non-contaminated seawater. Positive characteristics of the *A. affinis*s chronic test include the ability to purchase test organisms from commercial suppliers as well as being one of the few indigenous test species that may be used to test undiluted stormwater by the addition of artificial sea salts to within the range of marine receiving waters. Unfortunately, the tolerance of *A. affinis* to chemicals in artificial sea salts may also explain their lack of sensitivity to changes in water quality compared to other test organisms such as the sea urchin or red abalone. There are concerns with the comparability of conducting a seven-day exposure test when most rain events do not occur over a seven-day period.

The *Strongylocentrotus purpuratus* (*S. purpuratus*) fertilization test measures the ability of *S. purpuratus* sperm to fertilize an egg when exposed to a suspected toxicant. The *S. purpuratus* fertilization has been selected as a chronic toxicity test organism in previous MS4 permits and has been used to assess ambient receiving water toxicity, sediment pore water toxicity, as well as stormwater toxicity. The *S. purpuratus* fertilization test is also among the most sensitive test species to metals. The adult test organisms may be purchased and held in the lab prior to fertilization, and the sample volume necessary to conduct the test is small with respect to the other suggested tests. The minimal exposure period (20 min) allows for a large number of tests to be conducted over a short period of time and permits the testing of toxicants that may lose their potency over long periods of time.

The *Haliotis rufescens* larval development test measures the percent of abnormal shell development in larvae exposed to toxic samples for 48 hrs. *H. rufescens* is commonly used to test treatment plant effluent, but has had limited use in stormwater compared to the *S. purpuratus* fertilization test. The advantages of *H. rufescens* include a sensitive endpoint, the ability to purchase abalone from commercial suppliers and hold test organisms prior to spawning, and low variability in results compared to other species (e.g., *S. purpuratus* fertilization test). Thus, though not listed as a potential test species for use in stormwater monitoring in the MS4 permit, it was considered as a potentially sensitive species for the purposes of selecting the most sensitive species.

Due to the limitations of the giant kelp germination and growth test and the topsmelt survival and growth test, in addition to not being particularly sensitive to the constituents identified as problematic in stormwater water runoff from the watershed, these tests are not considered particularly helpful in supporting the identification of pollutants of concern. Based on the sensitivity, smaller test volume requirements, their ability to be housed in the lab prior to testing, and shorter exposure times, the *S. purpuratus* fertilization test and the *H. rufescens* development test will be considered during sensitive species selection to measure toxicity in marine and estuarine environments. Based on historical data of the sensitivity of the *S. purpuratus* and *H. rufescens* tests, and the limiting factors associated with the *A. affinis*and giant kelp tests, the sensitive species test for marine and estuarine species will be conducted with the *S. purpuratus* and *H. rufescens* tests. Species screening was determined to be appropriate for these two species (as opposed to selecting just one) as testing conducted within the region with both species have shown varying sensitivity. Thus, it is appropriate to test both to determine sensitivity at a given site. After the screening testing is completed, monitoring will be conducted with the most-sensitive species.

These critical life stage chronic toxicity tests shall be conducted on undiluted water samples in accordance with the 2005 *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California*. When the State Water Board's draft *Policy for Toxicity Assessment and Control* becomes effective, current toxicity program elements may be replaced with standardized methods and procedures in the policy.

Chronic toxicity test biological endpoint data shall be analyzed using the Test of Significant Toxicity t-test approach specified in *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (U.S. Environmental Protection Agency, Office of Wastewater Management, Washington, D.C. EPA 833-R-10-003, 2010). The critical chronic in stream Waste concentration established in the Permit for the MRP is set at 100% receiving water for receiving water samples and 100% effluent for Wet- and Dry-Weather outfall samples. A 100% receiving water/outfall effluent sample and a control shall be tested.

C.2.1.2 Toxicity Endpoint Assessment and Toxicity Identification Evaluation Triggers

A toxicity test sample is immediately subject to TIE procedures to identify the toxic chemical(s), if either the survival or sublethal endpoint demonstrates a Percent Effect value equal to or greater than 50% at the in stream Waste concentration. Percent Effect is defined as the effect value—denoted as the difference between the mean control response and the mean in stream Waste concentration response, divided by the mean control response—multiplied by 100. A TIE shall be performed to identify the causes of toxicity using the same species and test method. The TIE should be conducted on the test species demonstrating the most sensitive toxicity response at a sampling station. TIEs shall be performed in accordance with guidelines for characterizing chronically toxic effluents including USEPA, 1991; USEPA, 1992; USEPA, 1993a; USEPA, 1993b; and USEPA, 1996.

When a toxicant or class of toxicants is identified through a TIE conducted at a receiving water monitoring station, Permittees shall analyze for the toxicant(s) during the next scheduled sampling event in the discharge from the outfall(s) upstream of the receiving water location. If the toxicant is present in the discharge from the outfall at levels above the applicable receiving water limitation, a toxicity reduction evaluation (TRE) shall be performed for that toxicant. The TRE shall include all reasonable steps to identify the source(s) of toxicity and discuss the appropriate BMP(s) to eliminate the cause(s) of toxicity. TREs shall be performed in accordance with guidelines presented in USEPA, 1999. No later than 30 days after the source of toxicity and appropriate BMPs are identified, the Permittee(s) shall submit a TRE Corrective Action Plan to the Regional Water Board Executive Officer for approval. The requirements of the Corrective Action Plan are outlined in the MRP.

The general approach to conducting aquatic toxicity monitoring is presented in Figure 2, which describes a general evaluation process for each aquatic toxicity sample collected as part of routine Permit compliance sampling conducted. Aquatic toxicity results from a receiving water Station will be compared to appropriate laboratory controls.

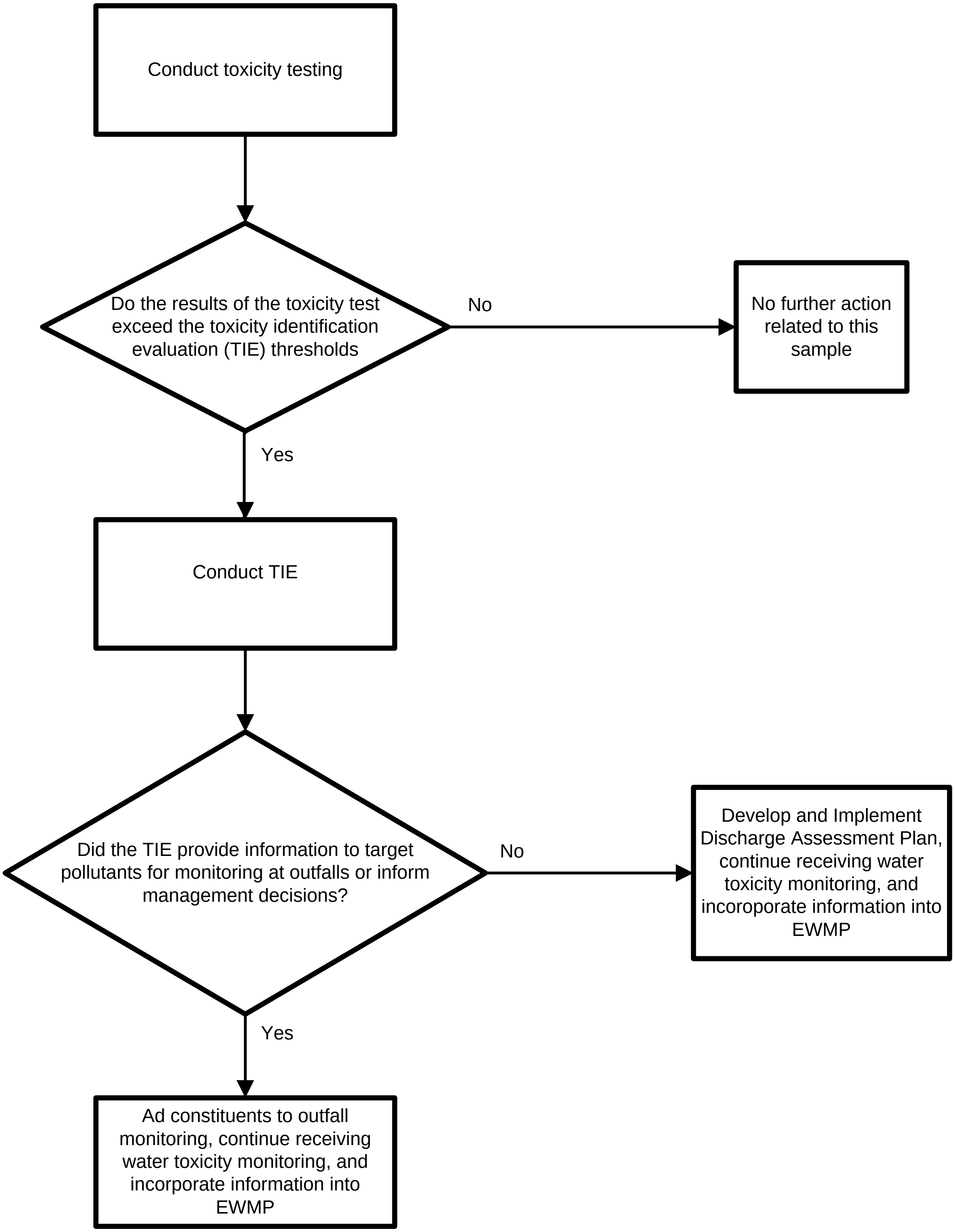


Figure 2. Aquatic Toxicity Assessment Process – Overview Flow Chart

Based on the receiving water result, a TIE may be necessary. If a TIE is conducted at a receiving water station and the findings of the TIE are inconclusive, toxicity sampling may be conducted at the upstream outfall monitoring station for Permit compliance monitoring. Information gained from a TIE will support the identification of pollutants that need to be addressed in the MdR Enhanced Watershed Management Program (EWMP). Control measures and management actions to address confirmed toxicity caused by urban runoff are addressed by the EWMP, either via currently identified management actions or those that are identified via adaptive management.

Toxicity test endpoints will be analyzed, per the MRP, using the Test of Significant Toxicity (TST) t-test approach specified by the USEPA (USEPA, 2010). The Permit specifies that the chronic in-stream waste concentration (IWC) is set at 100% receiving water for receiving water samples. Using the TST approach, a t-value is calculated for a test result and compared with a critical t-value from USEPA's TST Implementation Document (USEPA, 2010). Follow-up triggers are generally based on the Permit specified statistical assessment.

For chronic marine and estuarine aquatic toxicity tests identified for the MdR, the percent effect will be calculated. The percent effect is defined as the difference between the mean control response and the mean IWC response divided by the control response, multiplied by 100. A TIE will be performed if the percent effect value is equal to or greater than 50%.

TIE procedures will be initiated as soon as possible after the toxicity trigger threshold is observed to reduce the potential for loss of toxicity due to extended sample storage. If the cause of toxicity is readily apparent or is caused by pathogen related mortality (PRM) or epibiont interference with the test, the result will be rejected, if necessary, a modified testing procedure will be developed for future testing.

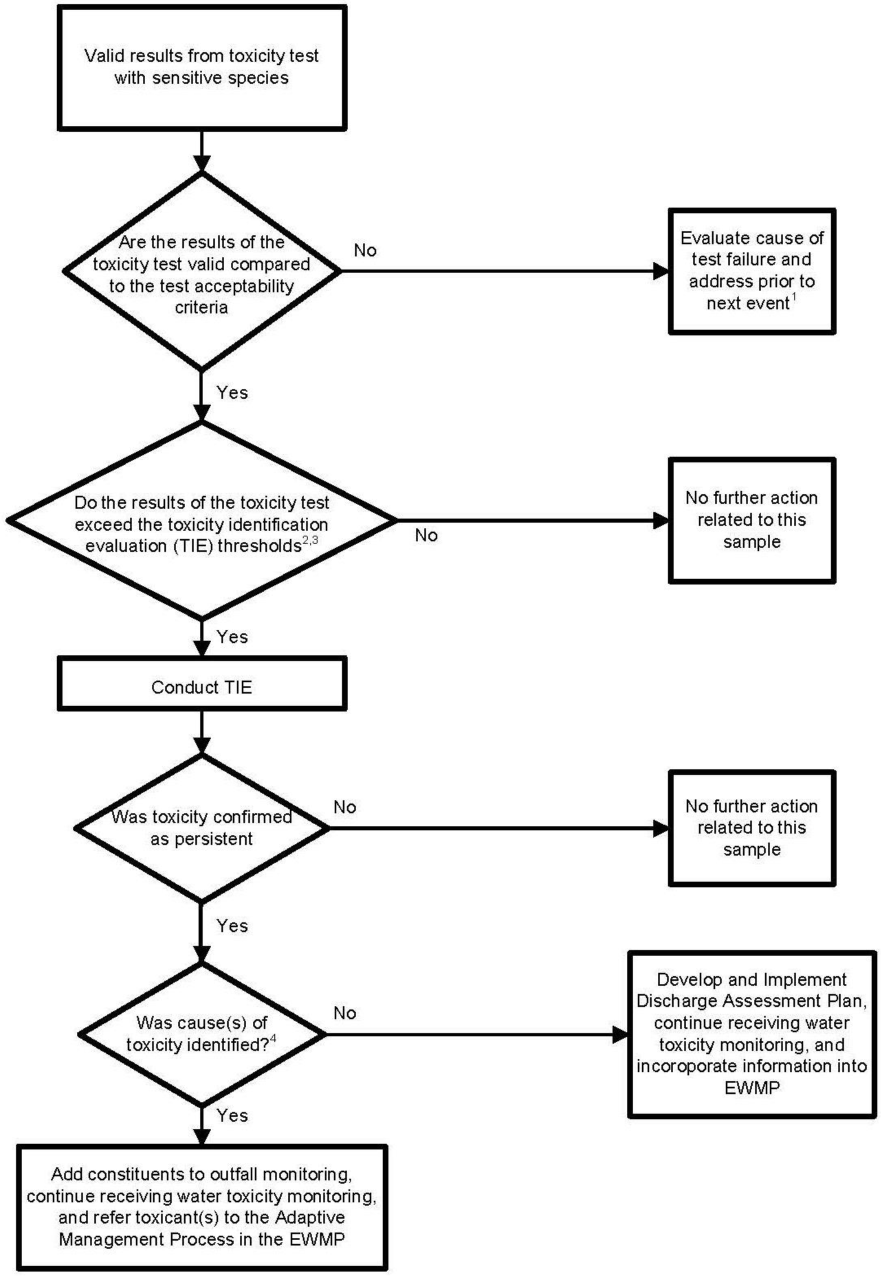
In cases where significant endpoint toxicity effects greater than 50% are observed in the original sample, but the follow-up TIE positive control "signal" is not statistically significant, the cause of toxicity will be considered non-persistent. No immediate follow-up testing is required on the sample. However, future test results should be evaluated to determine if parallel TIE treatments are necessary to provide an opportunity to identify the cause of toxicity

The results of toxicity testing will be used to trigger further investigations to determine the cause of observed laboratory toxicity. As described in USEPA's 1991 Methods for Aquatic Toxicity Identification, a Phase I TIE utilizes methods to characterize the physical/chemical nature of the constituents which cause toxicity. Such characteristics as solubility, volatility and filterability are determined without specifically identifying the toxicants. Phase I results are intended as a first step in specifically identifying the toxicants but the data generated can also be used to develop treatment methods to remove toxicity without specific identification of the toxicants. For Permit compliance monitoring, Phase I TIEs will be conducted on samples that exceed a TIE trigger. Water quality monitoring data will be reviewed to future support evaluation of potential toxicants. TIE methods will generally adhere to USEPA procedures documented in conducting TIEs (USEPA, 1991, 1992, 1993a-b). TIEs will perform the manipulations described in Table C-13. Given the wealth of historical data for the MdR Watershed, TIE sample manipulations have been prioritized based on TMDL targeted constituents such as organics and metals. The Watershed Management Group (WMG) will identify the cause(s) of toxicity using the treatments in Table C-13 and, if possible, using the results of water column chemistry analyses. Phase I TIEs are anticipated to identify causes of toxicity in the MdR Watershed and more rigorous Phase II and Phase III TIEs are generally not necessary.

Table C-13. Toxicity Identification Evaluation Sample Manipulations

Primary TIE Sample Manipulation	**Expected Response**
No Manipulation	Baseline test for comparing the relative effectiveness of other manipulations
pH Adjustment (pH 7 and 8.5)	Alters toxicity in pH sensitive compounds (i.e., ammonia and some trace metals)
Filtration or centrifugation	Removes particulates and associated toxicants
Ethylenedinrilo-Tetraacetic Acid (EDTA)	Chelates trace metals, particularly divalent cationic metals
Sodium thiosulfate (STS) addition	Reduces toxicants attributable to oxidants (i.e., chlorine) and some trace metals
Solid Phase Extraction (SPE) with C18 column	Removes non-polar organics (including pesticides) and some relatively non-polar metal chelates
Sequential Solvent Extraction of C18 column	Further resolution of SPE-extracted compounds for chemical analyses
Secondary TIE Sample Manipulation	**Expected Response**
Carboxylesterase addition(1)	Hydrolyzes pyrethroids
Piperonyl Butoxide (PBO)	Reduces toxicity from organophosphate pesticides such as diazinon, chlorpyrifos and malathion, and enhances pyrethroid toxicity
(1) 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).	

A more detailed approach to conducting aquatic toxicity monitoring using the methodologies described in this appendix has been summarized in detail in Figure 3.



Footnotes

1. Test failure includes pathogen or epibiont interference, which should be addressed prior to the next toxicity sampling event.
2. For freshwater, the TIE threshold is >50% mortality in an acute (wet weather) or chronic (dry weather) sample. If a >50% effect in a sub-lethal endpoint for chronic test is observed, a follow up sample will be collected within two weeks of the completion of the initial sample collection. If the follow up sample exhibits a greater than 50% effect, a TIE will be initiated.
3. For marine and estuarine waters, the TIE threshold is a percent effect value of equal to or greater than 50 percent. Follow up samples will be collected within two weeks of the completion of the initial sample collection and a TIE initiated.
4. The goal of conducting the Phase I TIE is to identify the cause of toxicity so that outfall monitoring can incorporate the toxicant(s) into the list of constituents monitored during outfall monitoring. Thus if the specific toxicant(s) or the analytical class of toxicants (i.e., metals that are analyzed via EPA Method 200.8) are identified sufficient information is available to inform the addition of pollutants to the list of pollutants monitored during outfall monitoring.

Figure 3. Detailed Aquatic Toxicity Assessment Process – Overview Flow Chart

C.2.2 Analytical Procedures for Sediment Quality

Physical and chemical measurements of sediment were selected to provide data on chemicals of potential concern in MdR. All analytical methods follow USEPA or SM 21st Edition (APHA et al., 2005). A complete list of chemical analytes with corresponding analytical methods and detection limits for sediment is provided in Appendix D.

Physical analyses of sediment include grain size and percent solids. Grain size is analyzed to determine the general size classes that make up the sediment (e.g., gravel, sand, silt, and clay). Grain size analysis will be in accordance with the methods given in Plumb (1981). Percent solids are measured to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis and will be conducted using Standard Methods (SM2540B).

The Triad Assessment requires all results to be presented on a dry-weight basis. Laboratories provide MDLs and reporting limits on a wet-weight basis. The final contracted laboratory will be contacted to ensure that reporting limits for SQO analysis (Appendix D) are low enough to meet the dry-weight levels.

C.2.3 Analytical Procedures for Sediment Toxicity

Sediment toxicity shall be conducted as part of a sediment quality objective evaluation every five years as detailed in the *Water Quality Control Plan for Enclosed Bays and Estuaries* (SWRCB and Cal EPA, 2009). Sediment bioassay tests will be used to quantify species-specific responses to exposure to surficial sediments under controlled laboratory conditions. In accordance with SQO guidance, at least one short-term survival test and one sublethal test will be conducted (Table C-14). In accordance with the Toxics TMDL, the acute survival test will be a 10-day test using the marine amphipod *Leptocheirus plumulosus*. This test is a result of findings of toxicity to this species during previous investigations in MdR, which was not observed for other amphipods (e.g., *Eohaustorius estuaries*). The sublethal test will be a 48-hour sediment-water interface test using the marine mussel *Mytilus galloprovincialis* because this species has been used during previous tests. Alternatively, a 28-day *Neanthes arenaceodentata* growth test may be used as the sublethal test in accordance with ASTM E1611-07 and USEPA protocols.

Table C-14. Toxicity Testing Proposed to Evaluate Benthic Sediment Condition

Media	Organism	Taxon	Type of Test	Method
Solid Phase	Amphipod	*Leptocheirus plumulosus*	10-day Acute Survival Test	ASTM E1367-03 and USEPA 1995
Sediment-Water Interface	Mussel	*Mytilus galloprovincialis*	48-Sediment Water Interface Sublethal Development Test	Anderson et al. 1996 and USEPA 1995

False positive sediment toxicity may be determined if naturally high concentrations of ammonia are present in tested sediment samples. The contract laboratory will test ammonia levels in all sediment samples prior to the start of toxicity testing. Toxicity tests will be run as static non-renewal if ammonia concentrations are below test specific criteria, where applicable. If ammonia concentrations are above test-specific criteria, tests may be run as static renewal with no more than two water changes per day; these tests will be initiated after the ammonia concentrations are brought down to levels appropriate for the test species.

Note that MdR Watershed sediment samples collected under the Toxics TMDL CMP in 2013 had ammonia porewater concentrations that do not require ammonia reduction protocols to be initiated.

C.2.4 Analytical Procedures for Sediment Benthic Infaunal Analysis

The benthic infaunal samples will be transported from the field to the laboratory and stored in a formalin solution for a minimum of 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 (i.e., polychaetes, crustaceans, molluscs, echinoderms, and miscellaneous minor phyla). While sorting, technicians will keep a count for quality control (QC) purposes. After initial sorting, samples will be distributed to qualified taxonomists who will identify each organism to species or to the lowest possible taxon (e.g., use of the Southern California Association of Marine Invertebrate Taxonomists [SCAMIT] Edition 7 for nomenclature and orthography [SCAMIT, 2008], or equivalent).

A quality assurance/quality control (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.

C.3 Quality Assurance and Quality Control

This section presents a discussion of quality assurance (QA) and quality control (QC) measures for the MdR Watershed CIMP. Field and laboratory QA data will be assessed for accuracy and precision. In addition, the appropriateness of the analytical methods and the achievement of MDLs and MLs by the laboratory will be verified.

C.3.1 Field Measurements

QA/QC for sampling processes begins with proper collection of the samples to minimize the possibility of contamination. Water samples will be collected in laboratory-certified, contaminant-free bottles. Temperature and pH are measured and recorded using the appropriate calibrated equipment and reviewed immediately using best professional judgment to ensure accurate measurement of parameters. Collected samples are put on ice and appropriately transported to the processing laboratory.

Field measurements for temperature, DO, specific conductance, turbidity, and pH will be made using an YSI meter, or equivalent, according to manufacturer specifications. Operation of field equipment will be conducted according to manufacturer instructions. Calibrations will be performed and recorded to ensure accurate functionality. Proper storage and maintenance procedures will be followed.

A field log will be completed at each station for each monitoring event. The field data log sheets will include empirical observations of the site and water quality characteristics.

C.3.2 Collection of Quality Control Samples

Samples will be collected in appropriate containers, kept on ice during the sampling event, and placed into coolers along with completed chain-of-custody for transfer to the laboratory. Field crews will ensure that sampling containers are being filled properly and the requirement to avoid contamination of samples at all times is met.

The purpose of a field duplicate sample is to evaluate the precision of samples collected in the field. During reporting, the relative percent difference will be calculated and used to determine precision. The purpose of the field blank sample is to show that no contamination of sample equipment occurred during sample collection. The purpose of a field equipment rinse blank is to demonstrate that targeted parameters are not associated with sampling equipment and that there is no cross-contamination associated with sample processing activities.

QC samples will be collected in accordance with general Surface Water Ambient Monitoring Program (SWAMP) guidelines (see SWAMP Standard Operating Procedures [SOPs] in Attachment C2), which will generally represent 5% of the total samples of the program.

For Permit compliance, this translates to one field blank and one duplicate sample per year of monitoring.

For Toxics TMDL compliance monitoring, the following field QC sample sets (one field blank and one duplicate sample) are recommended for water quality sampling:

- **Harbor Receiving Water – Monthly:** Six (6) sets of field QC sample sets per year.
- **Outfalls – Storm Water:** Three (3) sets of field QC sample sets per year.

For Toxics TMDL compliance monitoring, the following QC sample sets (one duplicate and one equipment rinse blank) are commended for sediment sampling:

- **Harbor Receiving Water:** One (1) QC sample set per year.
- **Storm-borne Sediment:** One (1) QC sample set per year.
- **Triad Assessment:** One (1) QC sample set per survey (once every five years).

Field QC samples will not be collected in association with tissue sampling.

Bacteria TMDL compliance monitoring is conducted as part of the City of Los Angeles's Regional program. No unique field QC samples will be collected during MdR Watershed compliance monitoring for the Bacteria TMDL.

C.3.3 Laboratory Quality Control

The chemistry, bacteriological, and toxicity analysis of samples will be performed under the guidelines of the QA/QC programs established by the analytical laboratories and their respective quality assurance project plans (QAPPs). These QAPPs vary by laboratory. Objectives for accuracy and precision involve all aspects of the testing process, and may include, but are not limited to the following:

- Methods and SOPs.
- Calibration methods and frequency.
- Data analysis, validation, and reporting.
- Internal QC.
- Preventive maintenance.
- Procedures to ensure data accuracy and completeness.

Results of all laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology or 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.

C.4 References

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Appendix C1
Field Equipment Lists and Field Forms

The following field equipment lists identify the general types of equipment necessary to complete the CIMP monitoring program. This list is not comprehensive but is intended to provide guidance for planning and preparation for monitoring events.

The following equipment are appropriate for general sample collection activities:

1. Personal protective equipment:
    - i. Safety vest (ANSI 107 Class 2 compliant, high visibility)
    - ii. Slip-resistant shoes/boots
    - iii. Protective eyewear: UV protection; impact resistant
    - iv. Life vest (if entering flood channel or operating skiff).
    - v. First Aid Kit and portable eyewash bottle with saline solution
    - vi. Foaming disinfectant hand cleanser, or equivalent
    - vii. Light (when necessary)
    - viii. Foul weather gear (when necessary)
    - ix. Rain boots (when necessary)

2. Sterile gloves (latex, nitrile, etc.)

3. Site Map and Street Map (GPS-based or Thomas Guide)

4. Chain-of-Custody

5. Field Forms (multiple copies of all forms that apply, or electronic interface)
    - i. Chain-of-Custody
    - ii. Bacteria TMDL Field Forms
    - iii. MdR Watershed CIMP Field Form
    - iii. Flow Assessment Form(s) (when necessary)

6. Water-safe pen and Lab marker (black or blue)

7. Waterproof labels

8. Ice chest with ice (for samples)

9. Bottle Kits (provided by contract laboratory, based on monitoring program)
    - i. Sample Bottle Kits (sufficient for sampling plus 1-2 extra sets in case of error)
    - ii. Quality Control Sample Bottle Kits – Field Blanks and Duplicates

10. Wash bottle filled with de-ionized water

11. Paper towels

12. Trash bag

13. Cell phones (1 per person)

14. GPS (with differential correction capability, preferred)

15. Camera (water proof, recommended)

Additional sampling equipment necessary for water quality sampling:

H20-1. Sampling pole with weighted bottle holder, bucket, or equivalent

H20-2. Skiff with motor or oars (when necessary)

H20-3. Multiparameter Sonde with sensors capable of reading field paramters (pH, Dissolved Oxygen, temperature, specific conductivity)

Additional sampling equipment necessary for sediment sampling:

SED-1. Boat

SED-2. Van-veen or equivalent (1-m^2 or larger recommended)

SED-3. Benthic sampling equipment (Triad Monitoring for SQOs)

Additional sampling equipment necessary for fish tissue sampling (trawls):

FISH-1. Boat

FISH-2. Trawl equipment (in order of priority)

1) Otter trawl with a 7.6-m headrope, 2.5-cm mesh, and 1.3-cm mesh cod end liner. (preferred trawl method).
2) Lampara - a semi-pursing, round-haul net, having a cork line of approximately 273 m and a depth of 36 m. The net consists of two full-cut wings (100-m length each; 15-cm stretch mesh), a throat or apron with 5-cm mesh, and a sack or bag of 0.9-cm mesh. The net is set in a circle or ellipse and drawn closed at the bottom during retrieval onto the boat. The lampara net is highly effective for collecting two of the three target species (White Croaker and Queenfish).
3) Gill net - 50-m flat panel monofilament net with varying mesh sizes. The net has a float line and lead line so it will sit vertically in the water column, either weighted to capture demersal species or floated to capture pelagic species.

Additional sampling equipment necessary for mussel tissue sampling (transplanted mussels):

MUSSEL-1. Vexar Cages or Equivalent – 1 per station

MUSSEL-2. Live mussels from an uncontaminated source (35-50 per cage)

MUSSEL-3. Anchoring equipment (site-specific)

This appendix contains the following field forms:

Chain-of-Custody Form(s)

A chain-of-custody form is to be completed for each sampling event. The form should be prepared prior to leaving to the field. At each sampling station, the sampler enters his/her initials, along with time of collection. The original chain-of-custody form is to follow the samples at all times. The sampler must sign and date the chain-of-custody form when relinquishing the sample to the Laboratory who in turn, signs the form to indicate receipt of the sample. A copy of the chain-of-custody form is given to the sampling staff, and the laboratory retains the original, along with the samples to be analyzed. An example of a chain-of-custody form has been provided. An equivalent form may be used.

Field Log Sheets

Field Log forms are for recording details about each sampling event (including Date, time, locations, method of sampling (automated or manual), comments), and is retained by the sampling staff. The form is to be prepared before leaving to the field, and the appropriate information is filled out after each sample is collected. Field Forms include:

- MdR Watershed CIMP Field Form
- Manual Flow Assessment – Float Method Form
- Manual Flow Assessment – Direct Measurement Form
- Bacteria TMDL Field Forms (from Bacteria TMDL CMP)

FOR REFERENCE ONLY

Date:

Department of Public Works
Bureau of Sanitation
Environmental Monitoring Division

Sample Chain of Custody

EMD
LIMS #: ____________________

EMD Sample ID: ____________________
Project Name: ____________________

Sampling Information:

Sampling Agency: ____________________
Agency Sample ID#: ____________________
Phone Number: ____________________
Fax Number: ____________________
Contact Person: ____________________
email address: ____________________

Sampler's Name: ____________________
Sampler's Title ____________________

Sampler's Signature: ____________________

Witness: Name ____________________
Title ____________________

Name ____________________
Title ____________________

Sample Location: ____________________

Sampling Program: ____________________

Purpose of program: ____________________

Report Time Frame: ____________________

Sample Date: ____________________

Sampling Time: ____________________

Sampling Address: ____________________

Requested Analysis:

Metals: ☐
Organics: ☐
Conventional Chemistry: ☐
Micro Biological: ☐
Toxicity: ☐
Air Testing: ☐

See back of page for specifics analyses

Sample Notification:

PC: ____________________ Date: __________
Wet: ____________________ Date: __________
Micro: ____________________ Date: __________

Toxicity: ____________________ Date: __________
Metals: ____________________ Date: __________
Semi-Vol: ____________________ Date: __________
Volatile: ____________________ Date: __________

Current Holder Name	Signature	Title	Received Date	Received Time	Released Date

FOR REFERENCE ONLY

Analysis to be performed on the Sample(s):

EMD
LIMS #: ____________________

	Locator:	Collection Time:		Locator:	Collection Time:
-1	________	________	-6	________	________
-2	________	________	-7	________	________
-3	________	________	-8	________	________
-4	________	________	-9	________	________
-5	________	________	-10	________	________

Sample Information: Liquid: ☐ Solid: ☐ Other: ☐ Temperature ________
Grab ☐ Composite: ☐
Start time: ______ Finish time: ________ pH ________
Container: Glass Size: ______ Color: ________ Number: ____
Plastic Size: ______ Color: ________ Number: ____ Residual Cl2 ________
Preservative ☐ Number of samples: ☐

Metals:

☐ Ag	☐ Cu	☐ Pb	☐ Other: ________
☐ Al	☐ Fe	☐ Sb	
☐ As	☐ Hg	☐ Se	
☐ Ba	☐ K	☐ Sn	
☐ Be	☐ Mg	☐ Sr	☐ Total
85 ☐ Ca	☐ Mn	☐ Tl	☐ Dissolved
☐ Cd	☐ Mo	☐ V	
☐ Co	☐ Na	☐ Zn	
☐ Cr	☐ Ni		

Organics:

☐ VOC	☐ Pesticides/PCB	☐ Clopyralid	☐ Air VOC
☐ BNA	☐ Dioxin - screen	☐ Dioxin - low resolution	☐ Fixed Gases
☐ TOX	☐ Other: ________	☐ Dioxin - high resolution	☐ GC Sulfur
☐ Herbicides		☐ Tributyltin	☐ Siloxanes

Conventional Chemical:

☐ Alkalinity	☐ MBAS	☐ Solids:
☐ BOD	☐ Nitrogen:	☐ Total Solids
☐ Boron	☐ Ammonia Nitrogen	☐ Total Dissolved Solids
☐ Chloride	☐ Nitrate-N	☐ Total Suspended Solids
☐ COD	☐ Nitrite-N	☐ Settleable Solids
☐ Conductivity	☐ Organic-N	☐ Volatile Suspended Solids
☐ Cyanide (Free)	☐ Kjeldahl Nitrogen	☐ Volatile Total Solids
☐ Cyanide (Total)	☐ Oil & Grease	☐ Sulfates
☐ Flashpoint	☐ pH	☐ Sulfides, Total
☐ Fluoride	☐ Phenols	☐ Sulfides, Dissolved
☐ Grain Size	☐ Phosphate, Total	☐ Thiosulfate
☐ Hardness	☐ Phosphate, Dissolved	☐ TOC
☐ Hexavalent Chromium	☐ Radioactivity	☐ Turbidity
☐ H_2S	☐ Salinity	☐ Other:

Biological:

☐ Total Coliform	☐ Salmonella	☐ Other: ________
☐ Fecal Coliform	☐ Acute Toxicity (Fresh water)	________
☐ E. coli	☐ Chronic Toxicity (Sea water)	
☐ Enterococcus	☐ Chronic Toxicity (Fresh water)	

Remarks: ____

MANUAL SAMPLING - FLOW ESTIMATES (DIRECT VOLUME MEAUSREMENT)

Station I.D.:

Date:

Sample I.D:

Sample □	Time of Measurement	Volume Container Filled[1]	Time to Fill Botle (seconds)	Estimated Q (cfs)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

[1] Please don't forget to record units.

	Conversion Factors
1 US gallon =	0.133 cubic feet
1 Liter =	0.035 cubic feet

SAMPLE VOLUME PROPORTIONS - MANUAL SAMPLING

Bottle No.	Flow (CFS)	Proportion	Rounded	Volume (Gal.)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
			Total Volume:	

Highest Flow:

Each bottle is _____________ gallons

*Proportion % to be calculated after last sample is taken so that peak flow value can be identified and used in the calculations

Proportion = Q from Bottle X / max Q of all samples collected

MdR Watershed
FIELD OBSERVATIONS AND TESTING LOG SHEET

PROJECT/SURVEY NAME	**STATION ID**	**STATION NAME**
DATE	**TIME**	**TYPE OF SAMPLING** ▫ WATER - STORMWATER ▫ SEDIMENT ▫ FISH TISSUE
FIELD TEAM	**RECORDER**	▫ SQO ▫ WATER - NON-STORMWATER ▫ STORMBORNE SEDIMENT ▫ MUSSEL TISSUE

MONITORING PERIOD ☐ SUMMER DRY ☐ WINTER DRY ☐ WET WEATHER		**RAINFALL AMOUNT (POST-STORM)**
TIDE (MLLW, FEET)	**WATER DEPTH (FT)**	**TIDE (MLLW, FEET) = WATER DEPTH - TIDE**
WEATHER CONDITIONS ☐ CLEAR ☐ CLOUDY ☐ FOGGY ☐ DRIZZLING ☐ RAINY		

SURFACE WATER APPEARANCE	**ODOR**	☐ SEWAGE ☐ OIL ☐ CHEMICAL ☐ MARINE ☐ OTHER
	COLOR	☐ COLORLESS ☐ BROWN ☐ YELLOW ☐ GREEN ☐ RED ☐ OTHER
	FLOATING MATERIALS (ALL THAT APPLY)	☐ NONE ☐ SUDS/FOAM (SOME) ☐ SUDS/FOAM (HEAVY) ☐ SCUM ☐ ALGAE ☐ OILY SHEEN ☐ ORGANIC MATERIAL ☐ OTHER (DESCRIBE)
	TRASH	☐ NONE ☐ PLASTIC (CUPS, BOTTLES, BAGS) ☐ PAPER ☐ WRAPPERS ☐ OTHER (DESCRIBE)
	TRASH OBSERVATIONS:	
	TURBIDITY	☐ CLEAR ☐ CLOUDY ☐ HEAVY CLOUDINESS, OPAQUE
FLOW	☐ FLOW METER PRESENT ☐ MANUAL ☐ FLOW NOT APPLICABLE	**NOTES**

QA/QC SAMPLES: ☐ FIELD DUPLICATE ☐ FIELD BLANK ☐ EQUIPMENT RINSE BLANK ☐ NO QC SAMPLES COLLECTED

TYPE OF GRAB ▫ WATER ▫ SEDIMENT ▫ STORM-BORNE SEDIMENT	**GRAB COLLECTION TIME:**	**SAMPLE DEPTH (from surface)**	**NOTES:**
TYPE OF GRAB ▫ WATER ▫ SEDIMENT ▫ STORM-BORNE SEDIMENT	**GRAB COLLECTION TIME:**	**SAMPLE DEPTH (from surface)**	**NOTES:**

FIELD MEASUREMENTS (Take measurements in duplicate)	pH	TEMP (degree C)	CONDUCTIVITY (uS/cm)	DISSOLVED OXYGEN	TURBIDITY
	pH	TEMP (degree C)	CONDUCTIVITY (uS/cm)	DISSOLVED OXYGEN	TURBIDITY

SAMPLING ACTIVITIES (DESCRIBE ALL ACTIONS TAKEN AT EACH SITE VISIT AND PROVIDE ADDITIONAL COMMENTS AS NECESSARY)

IF WATER SAMPLE USING AUTOMATED SAMPLING EQUIPMENT, RECORD LAST SAMPLE TIME FOR EACH BOTTLE

BOTTLE 1 ____________ BOTTLE 2 ____________ BOTTLE 3 ____________ BOTTLE 4 ____________

PRE/POST STORM TRASH PHOSTOS TAKEN: ☐ YES ☐ NO ☐ NOT APPLICABLE

PHOTOS TAKEN: ☐ YES ☐ NO

PHOTO NUMBERS AND NOTES: ____

____

TEAM LEADER'S SIGNATURE ____

FLOW ESTIMATES - MANUAL SAMPLING

Velocity Calculations worksheet (Float Method)

Use only 3 of the 4 recorded times when calculating, discard one outlier.

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

Velocity Calculations			record avg. width and depth below	
Site I.D:		Bottle #: **1**		
	Dist(ft)	Time (sec)	Width(ft)	depth(in.)
1st Run				
2nd Run				
3rd Run				
4th Run				
V= Dist(ft)/Time(sec):				

MANUAL SAMPLING - FLOW ESTIMATES (FLOAT METHOD)

Station I.D.:

Date:

Sample I.D:

		See Page 1				
Sample □	**Time**	**Avg Width (ft)**	**Avg Depth (in)[1]**	**Estimated Velocity (fps)**	**Float Factor**	**Estimated Q (cfs)**
1					0.85	
2					0.85	
3					0.85	
4					0.85	
5					0.85	
6					0.85	
7					0.85	
8					0.85	
9					0.85	
10					0.85	

[1] Please don't forget to convert avg depth to ft by dividing by 12

Q=0.85xWx(D/12)xVEL

SAMPLE VOLUME PROPORTIONS - MANUAL SAMPLING

Bottle No.	**Flow (CFS)**	**Proportion□**	**Rounded**	**Volume (Gal.)**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
			Total Volume:	

Highest Flow:

Each bottle is _____________ gallons

*Proportion % to be calculated after last sample is taken so that peak flow value can be identified and used in the calculations

Proportion = Q from Bottle X / max Q of all samples collected

DATE (Day/Month/Year): SAMPLER NAME AND INITIAL: HTP LOGIN #:

STATION ID	POINT ZERO SITES																			
SAMPLE TIME																				
Beach Refuse																				
Ocean Debris																				
Seaweed																				
Tar																				
Rubber / Plastic Goods																				
Plankton Color																				
Dead Marine																				
Sewage Grease																				
Sewage Susp. Solids																				
Odor																				
Oil																				
Foam																				
Bathers																				
Animals / Birds																				
Storm Drain Flow																				
Storm Drain Position																				
Tide Height□																				
Reached Surf																				
Reverse Flow																				
Conductivity (Reverse Flow only)																				

STATION ID	OPEN BEACH/BASINS				
SAMPLE TIME					
Beach Refuse					
Ocean Debris					
Seaweed					
Tar					
Rubber / Plastic Goods					
Plankton Color					
Dead Marine					
Sewage Grease					
Sewage Susp. Solids					
Odor					
Oil					
Foam					
Bathers					
Animals / Birds					
Storm Drain Flow					
Storm Drain Position					
Tide Height□					
Reached Surf					
Reverse Flow					
Conductivity (Reverse Flow only)					

CODE	0	1	2	3	4	5	6	7
Reverse Flow	NO	YES						
Reached Surf	NO	YES						
Storm Drain Position	Buried in Sand	Submerged (Not Sampled)						
Storm Drain Flow	Dry	Ponded	Low Flow (garden Hose)	Medium flow (between 2 and 4)	Heavy flow (Fire Hose)			
Plankton Color		Brown	Green	Red	Yellow	Blue-Green		
Dead Marine		Fish	Jellyfish	Seal	Dolphin	Bird	Whale	Crab
Odor		Sewage	Oil	Chemical	Marine			
Foam		Some	Heavy					
Animals / Birds or Bathers (50 yards each direction)		1 to 5	5 to 10	10 to 20	20 to 50	50 to 100	> 100	

NOTE: DO NOT PUT YOURSELF AT RISK IN ORDER TO COMPLETE THIS FORM

□BASED ON TIDE CHART

COMMENTS:

Example of Accelerated Field Observation Sheets

WEDNESDAY (accelerated)

DATE:____
SAMPLER NAME AND INITIAL:_________________________
HTP LOGIN #:______________________________________

STATION ID								
SAMPLE TIME								
Beach Refuse								
Ocean Debris								
Seaweed								
Tar								
Rubber / Plastic								
Plankton Color								
Dead Marine								
Sewage Grease								
Sewage Susp. Solids								
Odor								
Oil								
Foam								
Bathers								
Animals / Birds								
Storm Drain Flow								
Storm Drain Position								
Tide Height								
Reached Surf								
Reverse Flow								
Conductivity (Reverse Flow only)								

FRIDAY (accelerated)

DATE:____
SAMPLER NAME AND INITIAL:_________________________
HTP LOGIN #:______________________________________

STATION ID								
SAMPLE TIME								
Beach Refuse								
Ocean Debris								
Seaweed								
Tar								
Rubber / Plastic								
Plankton Color								
Dead Marine								
Sewage Grease								
Sewage Susp. Solids								
Odor								
Oil								
Foam								
Bathers								
Animals / Birds								
Storm Drain Flow								
Storm Drain Position								
Tide Height								
Reached Surf								
Reverse Flow								
Conductivity (Reverse Flow only)								

	WEATHER - MdRH BEACH		
	MON	WED	FRI
DATE			
SAMPLER			
Weather			
Wind Direction			
Wind Speed			
Sea Conditions			
Air Temp			
Surf Temp			
Wave Height			

CODE	1	2	3	4	5	6	7	8
WEATHER	Fair	Cloudy	Fog	Rain	P-Cldy	Hazy	Overcast	
SEA	Calm	Chop	Waves					
WIND DIRECTION	N	NE	E	SE	S	SW	W	NW

BASED FROM THE TIDE CHART

COMMENTS:

APPENDIX C-2
SWAMP SOP

Conventional Parameters in Fresh and Marine Water

A list of parameters included in this category may be found in the associated QAPrPTableReference.

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control: Conventional Parameters in Fresh and Marine Water

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	80-120% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent (n/a for chlorophyll a and pheophytin a)	80-120% recovery
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent (n/a for chlorophyll a and pheophytin a)	80-120% recovery; RPD<25% for duplicates
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent (chlorophyll a/pheophytin a: per method)	RPD<25% (n/a if native concentration of either sample<RL)
Internal Standard	Accompanying every analytical run as method appropriate	Per method
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate[2]	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analyte

[1] Unless method specifies more stringent requirements

[2] Field duplicate relative percent differences are not calculated for chlorophyll a analyses for bioassessment

Table 2: Sample Handling: Conventional Parameters in Fresh and Marine Water

Analyte	Recommended Container[1]	Recommended Preservation[2,3]	Required Holding Time[4]
Alkalinity (as $CaCO_3$)[5]	P	Cool to ≤6 ˚C	14 days
Biochemical Oxygen Demand	P	Cool to ≤6 ˚C; add 1 g FAS crystals per liter if residual chlorine is present	48 hours
Chemical Oxygen Demand (Titrametric)	G	Cool to ≤6 ˚C; H_2SO_4 to pH<2	28 days; biologically active samples should be tested as soon as possible
Chloride	P	None required	28 days
Chlorophyll a Pheophytin a	Per method	Centrifuge or filter as soon as possible after collection; if processing must be delayed, keep samples on ice or at ≤6 ˚C; store in the dark	Samples must be frozen or analyzed within 4 hours of collection; filters can be stored frozen for 28 days
Cyanide (Total)	P	Cool to ≤6 ˚C; NaOH to pH>10; add 0.6 g $C_6H_8O_6$ if residual chlorine is present	14 days
Fluoride	P	None required	28 days
Hardness (as $CaCO_3$)	P	Cool to ≤6 ˚C; HNO_3 or H_2SO_4 to pH<2	6 months
Oil and Grease	G	Cool to ≤6 ˚C; HNO_3 or H_2SO_4 to pH<2	28 days
Organic Carbon (Dissolved)	G	Filter and preserve to pH<2 within 48 hours of collection; cool to ≤6 ˚C	28 days
Organic Carbon (Total)	G	Cool to ≤6 ◦C; acidify to pH<2 with HCl, H_3PO_4, or H_2SO_4 within 2 hrs	28 days
Perchlorate	P, G	Protect from temperature extremes	28 days
Phenols[6]	G	Cool to ≤6 ˚C; H_2SO_4 to pH<2	28 days
Silica	P	Cool to ≤6 ˚C; HNO_3 to pH<2	28 days; 6 months if acidified
Specific Conductance	P	Cool to ≤6 ˚C; if analysis is not completed within 24 hours of sample collection, sample should be filtered through a 0.45 micron filter and stored at ≤6 °C	28 days
Sulfate	P	Cool to ≤6 ˚C	28 days
Turbidity	P	Cool to ≤6 ˚C	48 hours

[1] "P" is polyethylene; "G" is glass

[2] Per the draft *National Coastal Assessment Quality Assurance Project Plan* (August 2009), marine waters in plastic containers may be ultra-frozen to ≤-50 ˚C for a maximum of six months.

[3] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[4] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[5] Marine samples for alkalinity (as $CaCO_3$) may be cooled to ≤6 ˚C for a maximum of 24 hours.

[6] This table applies to phenols analysis using colorimetry. Guidelines for the chromatographic analysis of phenols are located in *Synthetic Organic Compounds in Water* Table 4*: Sample Handling.*

Table 3: Recommended Corrective Action: Conventional Parameters in Fresh and Marine Water

Laboratory Quality Control	Recommended Corrective Action
Calibration Standard	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Inorganic Analytes in Fresh and Marine Water

A list of analytes included in this category may be found in the associated QAPrPTableReference.

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control[1]: Inorganic Analytes in Fresh and Marine Water

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	80-120% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material[2]	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery (70-130% for MMHg)
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery (70-130% for MMHg)
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery (70-130% for MMHg); RPD<25%
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Internal Standard	Accompanying every analytical run when method appropriate	60-125% recovery
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL), unless otherwise specified by method
Field Blank, Equipment Blank	Per method	Blanks<RL for target analyte

[1] Unless method specifies more stringent requirements

[2] Not applicable to selenium speciation

Table 2: Sample Handling: Inorganic Analytes in Fresh and Marine Water

Analyte	Recommended Container[1]	Recommended Preservation[2,3]	Required Holding Time[4]
Hexavalent Chromium (Filtered)	P, G	Cool to ≤6 ˚C, pH 9.3 – 9.7 within 24 hours	28 days at ≤6 ˚C[5]
Mercury (Dissolved)	G, PA	Filter and preserve with 0.5% v:v pre-tested 5% BrCl or 12N HCl within 48 hours	90 days at room temperature following acidiciaftion
Mercury (Total)	G, PA	Preserve with 0.5% v:v pre-tested 5% BrCl or 12N HCl within 48 hours	90 days at room temperature following acidification
Methylmercury (Dissolved)[6]	G, PA	Immediately after collection, cool to ≤6 ˚C in the dark; filter and acidify to 0.5% with pre-tested HCl within 48 hours; if salinity is >0.5 ppt, acidify with H_2SO_4	6 months at to ≤6 ˚C in the dark following acidification
Methylmercury (Total)[6]	G, PA	Immediately after collection, cool to ≤6 ˚C in the dark; acidify to 0.5% with pre-tested HCl within 48 hours; if salinity is >0.5 ppt, acidify with H_2SO_4	6 months at to ≤6 ˚C in the dark following acidification
Selenium Speciation[7]	P	Filter and preserve with 0.4% HCl within 15 minutes of collection; maintain collection temperature as best as possible	6 months
Trace Metals[8] (Dissolved)	P	Filter within 15 minutes of collection; HNO_3 to pH<2 within 48 hours and at least 24 hours prior to analysis	6 months at room temperature following acidification
Trace Metals[8] (Total)	P	HNO_3 to pH<2 within 48 hours and at least 24 hours prior to analysis	6 months at room temperature following acidification

[1] "P" is polyethylene; "G" is glass; "PA" is any plastic that is made of a sterilizable material (polypropylene or other autoclavable plastic)

[2] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (within 15 minutes).

[3] Per 40 CFR 136.3, an aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately.

[4] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[5] If the analytical method doesn't include preservation, analysis must occur within 24 hours.

[6] Methylmercury samples may be shipped to the laboratory unpreserved if they are collected in fluoropolymer bottles, filled to the top with no head space, capped tightly, and maintained at ≤6 °C from the time of collection until preservation. The samples must be acid-preserved within 48 hours of sampling.

[7] Including the species selenite, selenate, and selenocyanate

[8] With the exception of mercury, methylmercury, hexavalent chromium, and selenium speciation

Table 3: Recommended Corrective Action: Inorganic Analytes in Fresh and Marine Water

Laboratory Quality Control	Recommended Corrective Action
Calibration Standard	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Nutrients in Fresh and Marine Water

A list of analytes included in this category may be found in the associated QAPrPTableReference.

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control[1]: Nutrients in Fresh and Marine Water

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	90-110% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	90-110% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery RPD<25% for duplicates
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analyte

[1] Unless method specifies more stringent requirements

Table 2: Sample Handling: Nutrients in Fresh and Marine Water

Analyte	Recommended Container[1]	Recommended Preservation[2]	Required Holding Time[3]
Ammonia (as N)	P	Cool to ≤6 °C; samples may be preserved with 2 mL of H_2SO_4 per L	48 hours; 28 days if acidified
Kjeldahl Nitrogen (Total)	P	Cool to ≤6 °C; H_2SO_4 to pH<2	7 days; 28 days if acidified
Nitrate (as N)	P	Cool to ≤6 °C	48 hours (unless calculated from nitrate + nitrite (as N) and nitrite (as N) analyses)
Nitrate + Nitrite (as N)	P	Cool to ≤6 °C; H_2SO_4 to pH<2	48 hours; 28 days if acidified
Nitrite (as N)	P	Cool to ≤6 °C	48 hours
Nitrogen (Total)	P	Cool to ≤6 °C; H_2SO_4 to pH <2	28 days
Orthophosphate (Dissolved, as P; *Soluble Reactive Phosphorus*)	P	Filter within 15 minutes of collection[4]; cool to ≤6 °C	48 hours
Orthophosphate (Total, as P)	P	Cool to ≤6 °C	48 hours
Phosphorus (Dissolved, as P)	P	Filter within 15 minutes of collection; cool to ≤6 °C; H_2SO_4 to pH <2	28 days
Phosphorus (Elemental)	G	Cool to ≤6 °C	48 hours
Phosphorus (Total, as P)	P	Cool to ≤6 °C; H_2SO_4 to pH <2	28 days

[1] "P" is polyethylene; "G" is glass

[2] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[3] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[4] Per 40 CFR 136.3, the immediate filtration requirement in orthophosphate measurement is to assess the dissolved or bio-available form of orthophosphorus (i.e., that which passes through a 0.45-micron filter), hence the requirement to filter the sample immediately upon collection (i.e., within 15 minutes of collection).

Table 3: Recommended Corrective Action: Nutrients in Fresh and Marine Water

Laboratory Quality Control	Recommended Corrective Action
Calibration Standard	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Semi-Volatile Organic Compounds in Fresh and Marine Water

A list of compounds included in this category may be found in the associated QAPrPTableReference.

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control[1]: Semi-Volatile Organic Compounds in Fresh and Marine Water[2]

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Tuning[3]	Per analytical method	Per analytical method
Calibration	Initial method setup or when the calibration verification fails	• Correlation coefficient (r^2 >0.990) for linear and non-linear curves • If RSD<15%, average RF may be used to quantitate; otherwise use equation of the curve • First- or second-order curves only (not forced through the origin) • Refer to SW-846 methods for SPCC and CCC criteria[3] • Minimum of 5 points per curve (one of them at or below the RL)
Calibration Verification	Per 12 hours	• Expected response or expected concentration ±20% • RF for SPCCs=initial calibration[3]
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material	Per 20 samples or per analytical batch	70-130% recovery if certified; otherwise, 50-150% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	50-150% or based on historical laboratory control limits (average±3SD)
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	50-150% or based on historical laboratory control limits (average±3SD); RPD<25%
Surrogate	Included in all samples and all QC samples	Based on historical laboratory control limits (50-150% or better)
Internal Standard	Included in all samples and all QC samples (as available)	Per laboratory procedure

[1] Unless method specifies more stringent requirements

[2] All detected analytes must be confirmed with a second column, second technique, or mass spectrometry

[3] Mass spectrometry only

Table 1: Quality Control[1]: Semi-Volatile Organic Compounds in Fresh and Marine Water[2] (continued)

Field Quality Control	Frequency of Analysis	Measurement Quality Objective
Field Duplicate	5% of total project sample count	Per method
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analyte

[1] Unless method specifies more stringent requirements

[2] All detected analytes must be confirmed with a second column, second technique, or mass spectrometry

[3] Mass spectrometry only

Table 2: Sample Handling: Semi-Volatile Organic Compounds in Fresh and Marine Water

Recommended Container[2]	Recommended Preservation[3]	Required Holding Time[1]
G	Cool to ≤6 °C	7 days until extraction, 40 days after extraction

[1] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[2] "G" is glass

[3] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

Table 3: Recommended Corrective Action: Semi-Volatile Organic Compounds in Fresh and Marine Water

Laboratory Quality Control	Recommended Corrective Action
Calibration	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Surrogate	Analyze as appropriate for the utilized method. Troubleshoot as needed. If no instrument problem is found, samples should be re-extracted and reanalyzed if possible.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Solid Parameters in Fresh and Marine Water

A list of parameters included in this category may be found in the associated QAPrPTableReference.

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control[1]: Solid Parameters in Fresh and Marine Water

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Laboratory Blank[2]	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Laboratory Duplicate[3]	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)
Field Blank, Equipment Blank	Per method	<RL for target analyte

[1] Unless method specifies more stringent requirements

[2] Not applicable to volatile suspended solids

[3] Applicable only to total suspended solids, total dissolved solids, and ash-free dry mass

Table 2: Sample Handling: Solid Parameters in Fresh and Marine Water

Parameter	Recommended Container[1]	Recommended Preservation[2]	Required Holding Time[3]
Ash-Free Dry Mass	Pre-combusted glass-fiber filter	Field filter; cool to ≤6 °C (foil-wrapped); freeze to ≤-20 °C	28 days
Fixed & Volatile Dissolved Solids **Volatile Suspended Solids**	Per method	Cool to ≤6 °C	7 days
Suspended Sediment Concentration **Total Suspended Solids**	G, P	Cool to ≤6 °C	7 days
Total Dissolved Solids	P	Cool to ≤6 °C	7 days

[1] "P" is polyethylene; "G" is glass

[2] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[3] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

Table 3: Recommended Corrective Action: Solid Parameters in Fresh and Marine Water

Laboratory Quality Control	Recommended Corrective Action
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

Synthetic Organic Compounds in Fresh and Marine Water

Groups associated with this category are defined in the following compound lists:

Carbamate Pesticides	Organotins	Pyrethroid Pesticides
Diesel Range Organics	Polynuclear Aromatic Hydrocarbons	Surfactants
Glyphosates	Polybrominated Diphenyl Ethers	Triazine Pesticides
Organochlorine Pesticides	Polychlorinated Biphenyls	Wastewater Organochlorine Pesticides
Organophosphate Pesticides	Phenols	

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control[1, 2]: Synthetic Organic Compounds in Fresh and Marine Water[3]

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Tuning[4]	Per analytical method	Per analytical method
Calibration	Initial method setup or when the calibration verification fails	• Correlation coefficient (r^2 >0.990) for linear and non-linear curves • If RSD<15%, average RF may be used to quantitate; otherwise use equation of the curve • First- or second-order curves only (not forced through the origin) • Refer to SW-846 methods for SPCC and CCC criteria[4] • Minimum of 5 points per curve (one of them at or below the RL)
Calibration Verification	Per 12 hours	• Expected response or expected concentration ±20% • RF for SPCCs=initial calibration[4]
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analytes
Reference Material	Per 20 samples or per analytical batch (preferably blind)	70-130% recovery if certified; otherwise, 50-150% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	50-150% or based on historical laboratory control limits (average±3SD)
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	50-150% or based on historical laboratory control limits (average±3SD); RPD<25%
Surrogate	Included in all samples and all QC samples	Based on historical laboratory control limits (50-150% or better)
Internal Standard	Included in all samples and all QC samples (as available)	Per laboratory procedure

Table 1: Quality Control[1, 2]: Synthetic Organic Compounds in Fresh and Marine Water[3] (continued)

Field Quality Control	Frequency of Analysis	Measurement Quality Objective
Field Duplicate	5% of total project sample count	Per method
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analytes

[1] Unless method specifies more stringent requirements; ELISA results must be assessed against kit requirements.

[2] Pyrethroids quality control guidelines are presented in Table 2 immediately below.

[3] All detected analytes must be confirmed with a second column, second technique, or mass spectrometry.

[4] Mass spectrometry only

Table 2: Quality Control[1]: Synthetic Organic Compounds in Whole Water - Pyrethroids Only

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Tuning[2]	Per analytical method	Per analytical method
Calibration	Daily, or just prior to analysis; five or more standards spanning the sample result range[3], with the lowest standard at or below the RL	r ≥0.995 (or r^2 ≥0.995, all curve types not forced through origin)
Calibration Verification	Per 10 analytical samples[4]	80-120%[5]
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analytes
Laboratory Control Sample[6,]	Per 20 samples or per analytical batch, whichever is more frequent	50-150%
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	50-150%
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	50-150%; RPD≤35%
Surrogate[7]	Included in all samples and all QC samples	Based on historical laboratory control limits (50-150% or better)
Internal Standard	Included in all samples and all QC samples (as available)	Per laboratory procedure
Field Quality Control[8]	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	5% of total project sample count	RPD ≤ 35%

[1] Unless project specifies more stringent requirements

[2] Mass spectrometry only

[3] Sample results above the highest standard are to be diluted and re-analyzed.

[4] Analytical samples include samples only and do not include clean-out or injection blanks.

[5] Limit applies to a mid-level standard; low-level calibration checks near the reporting limit may have a wider range that is project - specific

[6] Laboratory control samples must be matrix-specific. A clean sediment, roasted sand, or roasted sodium sulfate may be used for sediments.

[7] Laboratory historical limits for surrogate recovery must be submitted to the SWAMP database in the lab result comment section.

[8] A technical group consisting of regional, laboratory, and research representatives determined that field blanks do not provide technical value to a pyrethroids data set.

Table 3: Sample Handling: Synthetic Organic Compounds in Fresh and Marine Water[1]

Matrix	Recommended Container[2]	Recommended Preservation[4]	Required Holding Time[2]
Carbamate Pesticides **Organochlorine Pesticides** **Organophosphate Pesticides** **Wastewater Organochlorine Pesticides**	G	Cool to ≤6 °C; pH 5-9	7 days until extraction, 40 days after extraction
Diesel Range Organics **Triazine Pesticides**	G	Cool to ≤6 °C	7 days until extraction, 40 days after extraction
Glyphosate	G	Cool to ≤6 °C; store in the dark; 0.008% $Na_2S_2O_3$ if residual chlorine is present; freeze to ≤-20 °C	18 months (14 days if unfrozen)
Phenols[5]	G	Cool to ≤6 °C; 0.008% $Na_2S_2O_3$ if residual chlorine is present	7 days until extraction, 40 days after extraction
Polychlorinated Biphenyls (as Congeners/Aroclors)	G	Cool to ≤6 °C	1 year until extraction, 1 year after extraction
Polynuclear Aromatic Hydrocarbons	G	Cool to ≤6 °C; store in the dark; 0.008% $Na_2S_2O_3$ if residual chlorine is present	7 days until extraction, 40 days after extraction
Pyrethroids	G	Cool ≤ 6 °C in the dark; samples must be extracted or preserved according to laboratory procedures with suitable preservative or extraction solvent within 72 hours of collection	7 days until extraction, 40 days after extraction
Surfactants	G	Cool to ≤6 °C, store in the dark	7 days until extraction, 40 days after extraction

[1] Pyrethroids information applies to a whole water matrix.

[2] "G" is glass

[3] Per 40 CFR 136.3, aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[4] Each "Required Holding Time" is based on the assumption that the "Recommended Preservation" (or a method-mandated alternative) has been employed. If a "Required Holding Time" for filtration, preservation, preparation, or analysis is not met, the project manager and SWAMP Quality Assurance Officer must be notified. Regardless of preservation technique, data not meeting the "Required Holding Time" will be appropriately flagged in the SWAMP database.

[5] This table applies to phenols analysis using gas chromatography. Guidelines for the colorimetric analysis of phenols are located in *Conventional Parameters in Water* Table 2*: Sample Handling.*

Table 4: Recommended Corrective Action: Synthetic Organic Compounds in Fresh and Marine Water[1]

Laboratory Quality Control	Recommended Corrective Action
Calibration	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of the contamination.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (such as reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Internal Standard	Check the response of the internal standards. If the instrument continues to generate poor results, terminate the analytical run and investigate the cause of the instrument drift.
Surrogate	Analyze as appropriate for the utilized method. Troubleshoot as needed. If no instrument problem is found, samples should be re-extracted and reanalyzed if possible.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.

[1] Pyrethroids corrective actions are presented in Table 5 immediately below

Table 5: Recommended Corrective Action: Synthetic Organic Compounds in Whole Water – Pyrethroids Only

Laboratory Quality Control	Recommended Corrective Action
Calibration	Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Initial calibration is analyzed immediately after calibration and should be from a source different than the calibration curve. Bracketing continuing calibration standards are used every ten sample runs for quantitation per method protocol. The analysis must be halted, the problem investigated, and the instrument recalibrated. All samples after the last acceptable continuing calibration verification must be reanalyzed.
Laboratory Blank	The sample analysis must be halted, the source of the contamination investigated, the samples along with a new laboratory blank prepared and/or re-extracted, and the sample batch and fresh laboratory blank reanalyzed. If reanalysis is not possible due to sample volume, flag associated samples.
Laboratory Control Sample	The LCS is analyzed in the same manner as an environmental sample and the spike recovery demonstrates the accuracy of the method. Affected samples and associated quality control must be reanalyzed following LCS troubleshooting and resolution. After troubleshooting, compare to matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Appropriately spiked results should be compared to the matrix spike duplicate to investigate matrix interference. If matrix interference is suspected, the matrix spike result must be flagged. Appropriately spiked results should be compared to the matrix spike duplicate to investigate matrix interference. If matrix interference is suspected and LCS recoveries are acceptable, the matrix spike and matrix spike duplicate results must be flagged.
Matrix Spike Duplicate	The spiking level should be should be near the midrange of the calibration curve or at a level that does not require sample dilution. Appropriately spiked results should be compared to the matrix spike to investigate matrix interference. If matrix interference is suspected and LCS recoveries are acceptable, the matrix spike duplicate result must be flagged.
Surrogate	Analyze as appropriate per method. Trouble shoot as appropriate, if no instrument problem is found samples should be re-extracted and re-analyzed if possible.
Internal Standard	Analyze as appropriate per method. Troubleshoot as appropriate. If, after trouble-shooting, the responses of the internal standards remain unacceptable, the analysis must be terminated and the cause of drift investigated.
Field Quality Control	**Recommended Corrective Action**
Field Duplicate	For duplicates with a heterogeneous matrix or ambient levels below the reporting limit, failed results may be flagged. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.

Acute Freshwater Toxicity Testing

A list of species and tests included in this category may be found in the associated QAPrPTableReference.

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control[1]: Acute Freshwater Toxicity Testing

Negative Controls	Frequency of Analysis	Control Limits
Laboratory Control Water	Laboratory control water consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch.	Laboratory control water must meet all test acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Conductivity/Salinity Control Water	A conductivity or salinity control must be tested when these parameters are above or below the species tolerance.	Follow EPA guidance on interpreting data and refer to tables below for tolerance ranges.
Additional Control Water	Additional method blanks are required whenever manipulations are performed on one or more of the ambient samples within each analytical batch (e.g., pH adjustments, continuous aeration).	There must be no statistical difference between the laboratory control water and each additional control water within an analytical batch.
Sediment Control	Sediment control consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch of sediment toxicity tests.	Sediment control must meet all data acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Positive Controls	**Frequency of Analysis**	**Control Limits**
Reference Toxicant Tests	Reference toxicant tests must be conducted monthly for species that are raised within a laboratory, or per analytical batch for commercially-supplied or field-collected species.	Last plotted data point (LC50 or EC50) must be within 2 SD of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. An out of control reference toxicant test result does not necessarily invalidate associated test results. More frequent and/or concurrent reference toxicant testing may be advantageous if recent problems have been identified in testing.

[1]Unless method specifies more stringent requirements.

In special cases where the criteria listed in the above tables cannot be met, EPA minimum criteria may be followed. The affected data should be flagged accordingly.

Test data are reviewed to verify that the test acceptability criteria for a valid test have been met. Any test not meeting the minimum test acceptability criteria is considered invalid. All invalid tests should be repeated with the newly collected sample. If this is not possible, the test should be repeated with an archived sample and all tests must be properly flagged.

Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result. Before rejecting or accepting a test result as valid, the reviewer should consider the degree of the deviation and the potential or observed impact of the deviation on the test result. For example, if dissolved oxygen is measured below 4.0 mg/L in one test chamber, the reviewer should consider whether any observed mortality in that test chamber corresponded with the drop in dissolved oxygen.

Table 1: Quality Control[1]: Acute Freshwater Toxicity Testing (continued)

Field Quality Control	Frequency of Analysis	Control Limits
Sample Duplicate	5% of total project sample count	Recommended acceptable RPD<20%
Field Blanks	Based on project requirements	No statistical difference between the laboratory control water (or sediment control) and the field blank within an analytical batch
Bottle Blanks	Based on project requirements	No statistical difference between the laboratory control water and the equipment blank within an analytical batch

[1]Unless method specifies more stringent requirements.

In special cases where the criteria listed in the above tables cannot be met, EPA minimum criteria may be followed. The affected data should be flagged accordingly.

Test data are reviewed to verify that the test acceptability criteria for a valid test have been met. Any test not meeting the minimum test acceptability criteria is considered invalid. All invalid tests should be repeated with the newly collected sample. If this is not possible, the test should be repeated with an archived sample and all tests must be properly flagged.

Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result. Before rejecting or accepting a test result as valid, the reviewer should consider the degree of the deviation and the potential or observed impact of the deviation on the test result. For example, if dissolved oxygen is measured below 4.0 mg/L in one test chamber, the reviewer should consider whether any observed mortality in that test chamber corresponded with the drop in dissolved oxygen.

Table 2: Corrective Action: Acute Freshwater Toxicity Testing

Negative Controls	Corrective Action
Laboratory Control Water	If tested with in-house cultures, affected samples and associated quality control must be retested within 24 hours of test failure. If commercial cultures are used, they must be ordered within 16 hours of test failure for the earliest possible receipt. Retests must be initiated within 30 hours of receipt, depending on the need for organism acclimation. The laboratory should try to determine the source of the control failure, document the investigation, and document the steps taken to prevent a recurrence.
Conductivity/Salinity Control Water	Affected samples and associated quality control must be flagged.
Additional Control Water	Based on the objectives of the study, a water sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence. This is not applicable for TIE method blanks.
Sediment Control	Based on the objectives of the study, a sediment sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence.
Positive Controls	**Corrective Action**
Reference Toxicant Tests	If the LC50 exceeds +/- two standard deviations of the running mean of the last 20 reference toxicant tests, the test should be flagged.
Field Quality Control	**Corrective Action**
Field Duplicate	For duplicates with a heterogeneous matrix, results that do not meet SWAMP criteria should be flagged. The project coordinator should be notified so that the sampling team can identify the source of variation and perform corrective action prior to the next sampling event.
Field Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.
Equipment Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.

Table 3: Acute Freshwater Testing: 96-Hour Survival *Ceriodaphnia dubia* Toxicity Test

Method Recommendation	
EPA/821/R-02/012 (Test Method 2002.0) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
Parameter	*Criteria*
Test Acceptability Criteria[1]	≥90% survival in the controls
Data Qualification	
Test Conditions	*Required*
Test Type	Static renewal
Age at Test Initiation	<24hours
Replication at Test Initiation	4 (minimum)
Organisms/Replicate	5 (minimum)
Food Source	YCT and *Selenastrum* or comparable food
Test Duration	96 hours
Renewal Frequency	100% Daily Renewal
Feeding Regime	Feed while holding prior to test and 2 hours prior to test solution renewal
Endpoints	Survival
Test Conditions	*Recommended* [2]
Temperature Range	25 ± 1 °C (±3 °C required)
Light Intensity	10 – 20 µE/m^2/s OR 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	20 - 40 mL
Replicate Volume	≥15 mL
Laboratory Control Water	Moderately hard water prepared in accordance with EPA protocols
Minimum Sample Volume	1 L for one time grab sample
Sensitivity	*Performance Criteria*
Reference Toxicant Testing	See Table 2
Water Chemistry	
Test Parameter	*Required Frequency*
Initial Water Chemistry	One DO, pH, conductivity, ammonia, alkalinity, hardness, and temperature measurement per sample and per dilution
Daily Water Chemistry	One initial DO, one final DO, and one final pH measurement per sample
Final Water Chemistry	One DO, pH, and temperature measurement per sample and per dilution
Test Parameter	*Recommended Criteria*
Initial DO Range	4.0 mg/L - 100% saturation
Initial pH Range	6.0 - 9.0
Conductivity Controls	Include appropriate controls when sample conductivities are 0 – 100, or >1900 µS/cm. Substitute with *Hyalella azteca* if conductivity is >2500.
Sample Handling/Collection	
Test Parameter	*Recommended Conditions*
Relevant Media	Water column
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

[1]Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

[2]Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 4: Acute Freshwater Testing: 96-Hour Survival *Hyalella azteca* Toxicity Test

Method Recommendation	
EPA/821/R-02/012 or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
Parameter	*Criteria*
Test Acceptability Criteria[1]	≥90% survival in controls
Data Qualification	
Test Conditions	*Required*
Test Type	Static renewal
Age at Test Initiation	7 – 14 days old
Replication at Test Initiation	4 (minimum)
Organisms/Replicate	10 (minimum)
Food Source	YCT
Renewal Frequency	80% renewal on Day 2
Test Duration	96 hours
Endpoints	Survival
Test Conditions	*Recommended* [2]
Temperature Range	23 ± 1.0 °C (±3 °C required)
Light Intensity	10 – 20 µE/m^2/s or 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	300 mL
Replicate Volume	100 mL water
Feeding Regime	1.5 mL YCT every other day
Laboratory Control Water	Moderately hard water prepared in accordance with EPA protocols
Minimum Sample Volume	1L for one time grab sample
Sensitivity	*Performance Criteria*
Reference Toxicant Testing	See Table 2
Water Chemistry	
Test Parameter	*Required Frequency*
Initial Water Chemistry	One DO, pH, conductivity, ammonia, alkalinity, hardness, and temperature measurement per sample and per dilution
Renewal Water Chemistry	One initial DO, one final DO, and one final pH measurement per sample
Final Water Chemistry	One DO, pH, and temperature measurement per sample and per dilution
Test Parameter	*Recommended Criteria*
Initial DO Range	2.5 mg/L - 100% saturation
Initial pH Range	6.0 - 9.0
Conductivity Controls	Include appropriate controls when sample conductivities are 0 – 100, or >10,000 µS/cm
Sample Handling/Collection	
Test Parameter	*Recommended Conditions*
Relevant Media	Water
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field; 0 - 6 °C refrigeration in laboratory; dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

[1]Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

[2]Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 5: Acute Freshwater Testing: 10-Day Survival *Hyalella azteca* Toxicity Test

Method Recommendation	
EPA/821/R-02/012 or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
Parameter	*Criteria*
Test Acceptability Criteria[1]	≥80% survival in controls
Data Qualification	
Test Conditions	*Required*
Test Type	Static renewal
Age at Test Initiation	7 – 14 days old
Replication at Test Initiation	5 (minimum)
Organisms/Replicate	10 (minimum)
Food Source	YCT
Renewal Frequency	80% renewal every 48 hours
Test Duration	10 days
Endpoints	Survival
Test Conditions	*Recommended* [2]
Temperature Range	23 ± 1.0 °C (±3 °C required)
Light Intensity	10 – 20 µE/m^2/s or 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	300 mL
Replicate Volume	100 mL water
Feeding Regime	1.5 mL YCT every other day
Laboratory Control Water	Moderately hard water prepared in accordance with EPA protocols
Minimum Sample Volume	1L for one time grab sample
Sensitivity	*Performance Criteria*
Reference Toxicant Testing	See Table 2
Water Chemistry	
Test Parameter	*Required Frequency*
Initial Water Chemistry	One DO, pH, conductivity, ammonia, alkalinity, hardness, and temperature measurement per sample and per dilution
Renewal Water Chemistry	One initial DO, one final DO, and one final pH measurement per sample
Final Water Chemistry	One DO, pH, and temperature measurement per sample and per dilution
Test Parameter	*Recommended Criteria*
Initial DO Range	2.5 mg/L - 100% saturation
Initial pH Range	6.0 - 9.0
Conductivity Controls	Include appropriate controls when sample conductivities are 0 – 100, or >10,000 µS/cm
Sample Handling/Collection	
Test Parameter	*Recommended Conditions*
Relevant Media	Water
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field; 0 - 6 °C refrigeration in laboratory; dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

[1]Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

[2]Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Chronic Freshwater Toxicity Testing

A list of species and tests included in this category may be found in the associated QAPrPTableReference.

Terms appearing in the tables are defined in the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan*, which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control[1]: Chronic Freshwater Toxicity Testing

Negative Controls	Frequency of Analysis	Control Limits
Laboratory Control Water	Laboratory control water consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch.	Laboratory control water must meet all test acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Conductivity/Salinity Control Water	A conductivity or salinity control must be tested when these parameters are above or below the species tolerance.	Follow EPA guidance on interpreting data and refer to tables below for tolerance ranges.
Additional Control Water	Additional method blanks are required whenever manipulations are performed on one or more of the ambient samples within each analytical batch (e.g., pH adjustments, continuous aeration).	There must be no statistical difference between the laboratory control water and each additional control water within an analytical batch.
Sediment Control	Sediment control consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch of sediment toxicity tests.	Sediment control must meet all data acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Positive Controls	**Frequency of Analysis**	**Control Limits**
Reference Toxicant Tests	Reference toxicant tests must be conducted monthly for species that are raised within a laboratory, or per analytical batch for commercially-supplied or field-collected species.	Last plotted data point (LC50 or EC50) must be within 2 SD of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. An out of control reference toxicant test result does not necessarily invalidate associated test results. More frequent and/or concurrent reference toxicant testing may be advantageous if recent problems have been identified in testing.

[1]Unless method specifies more stringent requirements.

In special cases where the criteria listed in the above tables cannot be met, EPA minimum criteria may be followed. The affected data should be flagged accordingly.

Test data are reviewed to verify that the test acceptability criteria for a valid test have been met. Any test not meeting the minimum test acceptability criteria is considered invalid. All invalid tests should be repeated with the newly collected sample. If this is not possible, the test should be repeated with an archived sample and all tests must be properly flagged.

Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result. Before rejecting or accepting a test result as valid, the reviewer should consider the degree of the deviation and the potential or observed impact of the deviation on the test result. For example, if dissolved oxygen is measured below 4.0 mg/L in one test chamber, the reviewer should consider whether any observed mortality in that test chamber corresponded with the drop in dissolved oxygen.

Table 1: Quality Control[1]: Chronic Freshwater Toxicity Testing (continued)

Field Quality Control	Frequency of Analysis	Control Limits
Sample Duplicate	5% of total project sample count	Recommended acceptable RPD<20%
Field Blanks	Based on project requirements	No statistical difference between the laboratory control water (or sediment control) and the field blank within an analytical batch
Bottle Blanks	Based on project requirements	No statistical difference between the laboratory control water and the equipment blank within an analytical batch

[1]Unless method specifies more stringent requirements.

In special cases where the criteria listed in the above tables cannot be met, EPA minimum criteria may be followed. The affected data should be flagged accordingly.

Test data are reviewed to verify that the test acceptability criteria for a valid test have been met. Any test not meeting the minimum test acceptability criteria is considered invalid. All invalid tests should be repeated with the newly collected sample. If this is not possible, the test should be repeated with an archived sample and all tests must be properly flagged.

Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result. Before rejecting or accepting a test result as valid, the reviewer should consider the degree of the deviation and the potential or observed impact of the deviation on the test result. For example, if dissolved oxygen is measured below 4.0 mg/L in one test chamber, the reviewer should consider whether any observed mortality in that test chamber corresponded with the drop in dissolved oxygen.

Table 2: Corrective Action: Chronic Freshwater Toxicity Testing

Negative Controls	Corrective Action
Laboratory Control Water	If tested with in-house cultures, affected samples and associated quality control must be retested within 24 hours of test failure. If commercial cultures are used, they must be ordered within 16 hours of test failure for the earliest possible receipt. Retests must be initiated within 30 hours of receipt, depending on the need for organism acclimation. The laboratory should try to determine the source of the control failure, document the investigation, and document the steps taken to prevent a recurrence.
Conductivity/Salinity Control Water	Affected samples and associated quality control must be flagged.
Additional Control Water	Based on the objectives of the study, a water sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence. This is not applicable for TIE method blanks.
Sediment Control	Based on the objectives of the study, a sediment sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence.
Positive Controls	**Corrective Action**
Reference Toxicant Tests	If the LC50 exceeds +/- two standard deviations of the running mean of the last 20 reference toxicant tests, the test should be flagged.
Field Quality Control	**Corrective Action**
Field Duplicate	For duplicates with a heterogeneous matrix, results that do not meet SWAMP criteria should be flagged. The project coordinator should be notified so that the sampling team can identify the source of variation and perform corrective action prior to the next sampling event.
Field Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.
Equipment Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective action prior to the next sampling event.

Table 3: Chronic Freshwater Testing: 7-Day Survival and Growth *Pimephales promelas* Toxicity Test

Method Recommendation	
EPA/821/R-02/013 (Test Method 1000.0) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
Parameter	*Criteria*
Test Acceptability Criteria[1]	80% or greater survival in controls and an average dry weight per original organism in control chambers equals or exceeds 0.25 mg
Data Qualification	
Test Conditions	*Required*
Test Type	Static renewal
Age at Test Initiation	Newly-hatched larvae <24 hours old. If shipped, <48 hours old with a 24-hour age range
Replication at Test Initiation	4 (minimum)
Organisms/Replicate	10 (minimum)
Food Source	Newly-hatched *Artemia* nauplii (<24 hours old)
Renewal Frequency	Daily
Test Duration	7 days
Endpoints	Survival and growth (biomass)
Test Conditions	*Recommended* [2]
Temperature Range	25 ± 1.0 °C (±3 °C required)
Light Intensity	10 – 20 µE/m^2/s or 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	>500 mL or per method specific requirements
Replicate Volume	>250 mL or per method specific requirements
Feeding Regime	2 or 3 times per day
Laboratory Control Water	Moderately hard water prepared in accordance with EPA protocols
Minimum Sample Volume	7 L for one-time grab sample
Sensitivity	*Performance Criteria*
Reference Toxicant Testing	See Table 2
Water Chemistry	
Test Parameter	*Required Frequency*
Initial Water Chemistry	One DO, pH, conductivity, ammonia, alkalinity, hardness, and temperature measurement per sample and per dilution
Daily Water Chemistry	One initial DO, one final DO, and one final pH measurement per sample
Final Water Chemistry	One DO, pH, and temperature measurement per sample and per dilution
Test Parameter	*Recommended Criteria*
Initial DO Range	4.0 mg/L - 100% saturation
Initial pH Range	6.0 - 9.0
Conductivity Controls	Include appropriate controls when sample conductivities are 0 – 100, or above 1900 µS/cm
Sample Handling/Collection	
Test Parameter	*Recommended Conditions*
Relevant Media	Water column
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

[1]Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

[2]Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 4: Chronic Freshwater Testing: 6-8 Day Survival and Reproduction *Ceriodaphnia dubia* Toxicity Test

Method Recommendation	
EPA/821/R-02/013 (Test Method 1002.0) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
Parameter	*Criteria*
Test Acceptability Criteria[1]	≥80% survival in controls and an average of 15 or more young per surviving female. 60% of the surviving control females must produce three broods.
Data Qualification	
Test Conditions	*Required*
Test Type	Static renewal
Age at Test Initiation	<24 hours old and all released within an 8-h period
Replication at Test Initiation	10 (minimum)
Organisms/Replicate	One (assigned using blocking by known parentage)
Food Source	YCT and *Selenastrum* or comparable food
Renewal Frequency	Daily
Test Duration	6-8 days (when 60% surviving females produces 3rd brood
Endpoints	Survival and reproduction
Test Conditions	*Recommended* [2]
Temperature Range	25 ± 1 °C (±3 °C required)
Light Intensity	10 – 20 µE/m^2/s or 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	20 - 40 mL
Replicate Volume	>15 mL
Feeding Regime	Daily
Laboratory Control Water	Moderately hard water prepared in accordance with EPA protocols
Minimum Sample Volume	2 L for one-time grab sample
Sensitivity	*Performance Criteria*
Reference Toxicant Testing	See Table 2
Water Chemistry	
Test Parameter	*Required Frequency*
Initial Water Chemistry	One DO, pH, conductivity, ammonia, alkalinity, hardness, and temperature measurement per sample and per dilution
Daily Water Chemistry	One initial DO, one final DO, and one final pH measurement per sample
Final Water Chemistry	One DO, pH, and temperature measurement per sample and per dilution
Test Parameter	*Recommended Criteria*
Initial DO Range	4.0 mg/L - 100% saturation
Initial pH Range	6.0 - 9.0
Conductivity Controls	Include appropriate controls when sample conductivities are 0 – 100, or >1900 µS/cm. Substitute with *Hyalella azteca* if conductivity is >2500.
Sample Handling/Collection	
Test Parameter	*Recommended Conditions*
Relevant Media	Water column
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

[1]Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

[2]Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 5: Chronic Freshwater Testing: 96-Hour Growth *Selenastrum capricornutum* Toxicity Test

Method Recommendation	
EPA/821/R-02/013 (Test Method 1003.0) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
Parameter	*Criteria*
Test Acceptability Criteria[1]	Mean cell density of at least 1 X 10^6 cells/mL in the controls and variability (CV%) among control replicates less than or equal to 20% (non-EDTA: Mean cell density of at least 2 X 10^5 cells/mL in the controls; and variability (CV%) among control replicates less than or equal to 20% (required)
Data Qualification	
Test Conditions	*Required*
Test Type	Static non-renewal
Age at Test Initiation	4 - 7 days
Replication at Test Initiation	4 (minimum)10,000 cells/mL (recommended)
Organisms/Replicate	10,000 cells/mL (recommended)
Food Source	n/a
Renewal Frequency	None
Test Duration	96 h
Endpoints	Growth
Test Conditions	*Recommended* [2]
Temperature Range	25 ± 1 °C (+/- 3 °C required)
Light Intensity	86 ± 8.6 µE/m^2/s OR 400 ± 40 ft-c
Photoperiod	Continuous Illumination ("cool white" fluorescent lighting)
Test Chamber Size	125 mL or 250 mL
Replicate Volume	50 mL or 100 mL
Feeding Regime	None
Nutrient Media	Media prepared in accordance with EPA protocols
EDTA Addition	EDTA required per method
Laboratory Control Water	Moderately hard water or stock culture medium prepared in accordance with EPA protocols
Minimum Sample Volume	1 L for one-time grab sample
Sensitivity	*Performance Criteria*
Reference Toxicant Testing	See Table 2
Water Chemistry	
Test Parameter	*Required Frequency*
Initial Water Chemistry	One DO, pH, conductivity, ammonia, alkalinity, hardness, and temperature measurement per sample and per dilution
Daily Water Chemistry	One pH measurement per sample
Final Water Chemistry	One DO, pH, and temperature measurement per sample and per dilution
Test Parameter	*Recommended Criteria*
Initial DO Range	4.0 mg/L - 100% saturation
Initial pH Range	6.0 - 9.0
Conductivity Controls	Include appropriate controls when sample conductivities exceed1500 µS/cm
Sample Handling/Collection	
Test Parameter	*Recommended Conditions*
Relevant Media	Water column
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

[1]Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

[2]Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

APPENDIX D
Monitoring Lists

Table D-1
Permit - Water Quality and Toxicity (Year 1-Screening Parameters)

Constituent	Sample Type	Method[a]	ML[b]	Units	Preservative	Holding Time
Conventional						
Oil and Grease	Grab	EPA413.1	5	mg/L	H_2SO_4	28 days
Total Phenols	Grab	EPA420.1	0.1	mg/L	H_3PO_4, $CuSO_4$	7 days
Cyanide	Grab	SM4500-CNE	0.005	mg/L	NaOH	14 days
pH	Comp	SM4500H B	NA	pH units	-	immediately
Dissolved Oxygen	Grab	SM4500O G	5	mg/L	-	immediately
Temperature	Grab	NA	NA	°Celcius	-	immediately
Indicator Bacteria						
E. coli (fresh water)	Grab	SM9223	235	MPN/100mL	$Na_2S_2O_3$	8 hours
Total Coliform (marine water)	Grab	SM9221E	10,000	MPN/100mL	$Na_2S_2O_3$	8 hours
Fecal Coliform (marine and fresh water)	Grab	SM9221E	400	MPN/100mL	$Na_2S_2O_3$	8 hours
Enterococcus (marine waters)	Grab	SM9230B	104	MPN/100mL	$Na_2S_2O_3$	8 hours
General						
Total Ammonia - Nitrogen	Comp	SM 4500-NH3 D	0.1	mg/L	-	28 days
Chloride	Comp	EPA300.0	2	mg/L	-	28 days
Fluoride	Comp	EPA300.0	0.1	mg/L	-	28 days
Nitrate-Nitrite	Comp	EPA300.0	0.1	mg/L	-	48 hours
Perchlorate[c]	Comp	EPA314	4	μg/L	-	28 days
Alkalinity	Comp	SM2320B	2	mg/L	-	14 days
Hardness, Total	Comp	SM2340C	2	mg/L	HNO_3 or H_2SO_4	6 months
Chemical Oxygen Demand (COD)	Comp	SM5220D	20	mg/L	H_2SO_4	28 days
Total Petroleum Hydrocarbon (TPH)	Grab	EPA418.1	5	mg/L	H_2SO_4	28 days
Specific Conductance	Comp	SM2510B	1	umhos/cm	-	immediately
Total Dissolved Solids (TDS)	Comp	SM2540C	2	mg/L	-	7 days
Turbidity	Comp	SM2130B	0.1	NTU	-	48 hours
Total Suspended Solids (TSS)	Comp	SM2540D	2	mg/L	-	7 days
Volatile Suspended Solids	Comp	SM2540E	2	mg/L	-	7 days
Settleable Solids	Comp	SM2540F	2	mg/L	-	7 days
Methylene Blue Active Substances (MBAS)	Comp	SM5540 C	0.5	mg/L	-	48 hours
Total Organic Carbon (TOC)	Comp	SM5310B/EPA415.1	1	mg/L	HCl, H_2SO_4, or H_3PO_4	28 days
Methyl tertiary butyl ether (MTBE)	Grab	EPA624	1	μg/L	HCl	14 days
Biochemical Oxygen Demand (BOD)	Comp	SM5210B	2	mg/L	-	48 hours
Nutrients						
Dissolved Phosphorus	Comp	SM4500-PE	0.05	mg/L	-	48 hours
Total Phosphorus	Comp	SM4500-PE	0.05	mg/L	H_2SO_4	28 days
Total Ammonia-Nitrogen	Comp	SM4500-NH3	0.1	mg/L	H_2SO_4	28 days
Nitrate-N	Comp	EPA300.0	0.1	mg/L	-	48 hours
Nitrite-N	Comp	EPA300.0	0.1	mg/L	-	48 hours
Total Kjeldahl Nitrogen (TKN)	Comp	SM4500NHorg	0.1	mg/L	H_2SO_4	28 days
Metals						
Dissolved Aluminum	Comp	EPA200.8	100	μg/L	HNO_3	6 months
Total Aluminum	Comp	EPA200.8	100	μg/L	HNO_3	6 months
Dissolved Antimony	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Total Antimony	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Dissolved Arsenic	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Total Arsenic	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Dissolved Berylium	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Total Beryllium	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Dissolved Cadmium	Comp	EPA200.8	0.25	μg/L	HNO_3	6 months
Total Cadmium	Comp	EPA200.8	0.25	μg/L	HNO_3	6 months
Dissolved Chromium	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Total Chromium	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Dissolved Chromium +6	Comp	EPA218.6	5	μg/L	-	24 hours
Total Chromium +6	Comp	EPA218.6	5	μg/L	-	24 hours
Dissolved Copper	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Total Copper	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Dissolved Iron	Comp	EPA200.8	100	μg/L	HNO_3	6 months
Total Iron	Comp	EPA200.8	100	μg/L	HNO_3	6 months
Dissolved Lead	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Total Lead	Comp	EPA200.8	0.5	μg/L	HNO_3	6 months
Dissolved Mercury	Comp	EPA245.1	0.5	μg/L	HNO_3	6 months
Total Mercury	Comp	EPA245.1	0.5	μg/L	HNO_3	6 months
Dissolved Nickel	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Total Nickel	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Dissolved Selenium	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Total Selenium	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Dissolved Silver	Comp	EPA200.8	0.25	μg/L	HNO_3	6 months
Total Silver	Comp	EPA200.8	0.25	μg/L	HNO_3	6 months
Dissolved Thallium	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Total Thallium	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Dissolved Zinc	Comp	EPA200.8	1	μg/L	HNO_3	6 months
Total Zinc	Comp	EPA200.8	1	μg/L	HNO_3	6 months

Table D-1
Permit - Water Quality and Toxicity (Year 1-Screening Parameters)

Constituent	Sample Type	Method[a]	ML[b]	Units	Preservative	Holding Time
Semi-Volatiles Organics (EPA 625)						
2-Chlorophenol	Comp	EPA625	2	µg/L		
2,4-dichlorophenol	Comp	EPA625	1	µg/L		
2,4-dimethylphenol	Comp	EPA625	2	µg/L	Sodium	
2,4-dinitrophenol	Comp	EPA625	5	µg/L	thiosulfate	7 days
2-nitrophenol	Comp	EPA625	10	µg/L	if residual	for extraction
4-nitrophenol	Comp	EPA625	5	µg/L	Chlorine	40 days
4-chloro-3-methylphenol	Comp	EPA625	1	µg/L	is present	for analysis
Pentachlorophenol	Comp	EPA625	2	µg/L		
Phenol	Comp	EPA625	1	µg/L		
2,4,6-trichlorophenol	Comp	EPA625	10	µg/L		
Base/Neutral						
Acenaphthene	Comp	EPA625	1	µg/L		
Acenaphthylene	Comp	EPA625	2	µg/L		
Anthracene	Comp	EPA625	2	µg/L		
Benzidine	Comp	EPA625	5	µg/L		
1,2 Benzanthracene	Comp	EPA625	5	µg/L		
Benzo [b] fluoranthene	Comp	EPA625	10	µg/L		
Benzo(a)pyrene	Comp	EPA625	2	µg/L		
Benzo [g-h-i] perylene	Comp	EPA625	5	µg/L		
Benzo(k)flouranthene	Comp	EPA625	2	µg/L		
Bis(2-Chloroethoxy) methane	Comp	EPA625	5	µg/L	Sodium	7 days
Bis(2-Chloroisopropyl) ether	Comp	EPA625	2	µg/L	thiosulfate	for extraction
Bis(2-Chloroethyl) ether	Comp	EPA625	1	µg/L	if residual	
Bis(2-Ethylhexl) phthalate	Comp	EPA625	5	µg/L	chlorine	40 days
4-Bromophenyl phenyl ether	Comp	EPA625	5	µg/L	is present	for analysis
Butyl benzyl phthalate	Comp	EPA625	10	µg/L		
2-Chloronaphthalene	Comp	EPA625	10	µg/L		
2-Chloroethyl vinyl ether	Grab	EPA624	1	µg/L		
4-Chlorophenyl phenyl ether	Comp	EPA625	5	µg/L		
Chrysene	Comp	EPA625	5	µg/L		
Dibenzo(a,h)anthracene	Comp	EPA625	0.1	µg/L		
1,3-Dichlorobenzene	Comp	EPA625	1	µg/L		
1,4-Dichlorobenzene	Comp	EPA625	1	µg/L		
1,2-Dichlorobenzene	Comp	EPA625	1	µg/L		
Base/Neutral						
3,3-Dichlorobenzidine	Comp	EPA625	5	µg/L		
Diethyl phthalate	Comp	EPA625	2	µg/L		
Dimethyl phthalate	Comp	EPA625	2	µg/L		
di-n-Butyl phthalate	Comp	EPA625	10	µg/L		
2,4-Dinitrotoluene	Comp	EPA625	5	µg/L		
2,6-Dinitrotoluene	Comp	EPA625	5	µg/L		
4,6 Dinitro-2-methylphenol	Comp	EPA625	5	µg/L		
1,2-Diphenylhydrazine	Comp	EPA625	1	µg/L		
di-n-Octyl phthalate	Comp	EPA625	10	µg/L		
Fluoranthene	Comp	EPA625	0.05	µg/L		
Fluorene	Comp	EPA625	0.1	µg/L	Sodium	7 days
Hexachlorobenzene	Comp	EPA625	1	µg/L	thiosulfate	for extraction
Hexachlorobutadiene	Comp	EPA625	1	µg/L	if residual	
Hexachloro-cyclopentadiene	Comp	EPA625	5	µg/L	chlorine	40 days
Hexachloroethane	Comp	EPA625	1	µg/L	is present	for analysis
Indeno(1,2,3-cd)pyrene	Comp	EPA625	0.05	µg/L		
Isophorone	Comp	EPA625	1	µg/L		
Naphthalene	Comp	EPA625	0.2	µg/L		
Nitrobenzene	Comp	EPA625	1	µg/L		
N-Nitroso-dimethyl amine	Comp	EPA625	5	µg/L		
N-Nitroso-diphenyl amine	Comp	EPA625	1	µg/L		
N-Nitroso-di-n-propyl amine	Comp	EPA625	5	µg/L		
Phenanthrene	Comp	EPA625	0.05	µg/L		
Pyrene	Comp	EPA625	0.05	µg/L		
1,2,4-Trichlorobenzene	Comp	EPA625	1	µg/L		

Table D-1
Permit - Water Quality and Toxicity (Year 1-Screening Parameters)

Constituent	Sample Type	Method[a]	ML[b]	Units	Preservative	Holding Time
Chlorinated Pesticides						
Aldrin	Comp	EPA608	0.005	µg/L		
alpha-BHC	Comp	EPA608	0.01	µg/L		
beta-BHC	Comp	EPA608	0.005	µg/L		
delta-BHC	Comp	EPA608	0.005	µg/L		
gamma-BHC (lindane)	Comp	EPA608	0.02	µg/L		
alpha-chlordane	Comp	EPA608	0.1	µg/L		
gamma-chlordane	Comp	EPA608	0.1	µg/L	Sodium	7 days
4,4'-DDD	Comp	EPA608	0.05	µg/L	thiosulfate	for extraction
4,4'-DDE	Comp	EPA608	0.05	µg/L	if residual	
4,4'-DDT	Comp	EPA608	0.01	µg/L	chlorine	40 days
Dieldrin	Comp	EPA608	0.01	µg/L	is present	for analysis
alpha-Endosulfan	Comp	EPA608	0.02	µg/L		
beta-Endosulfan	Comp	EPA608	0.01	µg/L		
Endosulfan sulfate	Comp	EPA608	0.05	µg/L		
Endrin	Comp	EPA608	0.01	µg/L		
Endrin aldehyde	Comp	EPA608	0.01	µg/L		
Heptachlor	Comp	EPA608	0.01	µg/L		
Heptachlor Epoxide	Comp	EPA608	0.01	µg/L		
Toxaphene	Comp	EPA608	0.5	µg/L		
Organophosphate Pesticides						
Chlorpyrifos	Comp	EPA507	0.05	µg/L		7 days
Diazinon	Comp	EPA507	0.01	µg/L		7 days
Prometryn	Comp	EPA507	2	µg/L	Sodium	14 days
Atrazine	Comp	EPA507	2	µg/L	thiosulfate if	14 days
Simazine	Comp	EPA507	2	µg/L	residual chlorine	14 days
Cyanazine	Comp	EPA507	2	µg/L	is present	14 days
Malathion	Comp	EPA507	1	µg/L		14 days
Polychlorinated Biphenyls [d]						
PCB congeners *The 18 PCB Congeners identified for SQO analysis represent the minimum number of PCB Congeners to be analyzed in the water column.*	Comp	EPA 1668	0.5	µg/L	Sodium thiosulfate if residual chlorine is present	7 days for extraction 40 days for analysis
Herbicides						
Glyphosate	Comp	EPA547	5	µg/L	$Na_2S_2O_3$	14 days
2,4-D	Comp	EPA515.3	10	µg/L	-	7 days
2,4,5-TP-SILVEX	Comp	EPA515.3	0.5	µg/L	-	7 days
Toxicity - Receiving Water with Salinity ≥ 1 ppt						
A. affinis Larval Survival and Growth	Comp	EPA/600/R-95/136	NA	Toxic Units	Deliver on ice, store at ≤4°C	36 hours preferred; up to 72 hours acceptable
S. purpuratus Fertilization	Comp	EPA/600/R-95/136	NA	Toxic Units		
M. pyrifera Germination and Growth	Comp	EPA/600/R-95/136	NA	Toxic Units		

[a] Listed methods are those currently utilized for MS4 Permit compliance. Other EPA and Standard Methods may be acceptable.

[b] ML = Minimum Level, from 2012 MS4 Permit. Method Detection Levels (MDLs) must be lower than or equal to the ML value, as published in MLs published in Appendix 4 of the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California (SIP), unless otherwise approved by the Regional Board.

[c] Perchlorate is a new addition to the 2012 MS4 Permit Monitoring and Reporting Plan analyte list.

[d] Although the Screening Parameters listed in the Permit are in the form of Aroclors (1016, 1221, 1232, 1242, 1248, 1254, 1260), this CIMP will analyze PCB in the form of Congeners in order to be consistent with Toxics TMDL monitoring efforts. Also note that the EPA has requested that the Regional Board modify the 2012 MS4 Permit to include PCB congeners in place of PCB aroclors.

NA = Not applicable

Table D-2
Bacteria TMDL - Water Quality

Constituent	Sample Type	Method [a]	ML	Units	Preservative	Holding Time
Indicator Bacteria						
Total Coliform	Grab	SM9221E	20	MPN/100mL	$Na_2S_2O_3$	8 hours
E. coli[b]	Grab	SM92223	20	MPN/100mL	$Na_2S_2O_3$	8 hours
Fecal Enterococcus	Grab	SM9230B	20	MPN/100mL	$Na_2S_2O_3$	8 hours

[a] Methods used should allow for detection at or below numeric targets outlined in the TMDL. Other EPA and Standard Methods may be acceptable.

[b] *E. Coli is* used as a surrogate for fecal coliform; the standard is the same as for fecal coliform.

Table D-3A
Toxics TMDL - Water Quality (Monthly, BACK BASINS)

Constituent	Sample Type	Method [a]	ML/ TMDL Limit*	Units	Preservative	Holding Time
General - Saltwater						
Hardness, Total	Comp	SM2340C	2	mg/L	HNO_3 or H_2SO_4	6 months
Metals - Saltwater						
Dissolved Copper	Comp	EPA1640	0.5	µg/L	HNO_3	6 months
Total Copper	Comp	EPA1640	0.5	µg/L	HNO_3	6 months

*Toxics TMDL numeric targets.

[a] Methods used should allow for detection at or below numeric targets outlined in the Toxics TMDL. Other EPA and Standard Methods may be acceptable. Per the Toxics TMDL, "Currently, several consituents of concern have numeric targets that are lower than readily available detection limits. As analytical methods and detection limits continue to improve and become more environmentally relevant, responsible parties shall incorporate new MDLs in the monitoring plan."

Table D-3B
Toxics TMDL - Water Quality (Monthly, FRONT BASINS)

Constituent	Sample Type	Method [a]	ML/ TMDL Limit*	Units	Preservative	Holding Time
General - Saltwater						
Hardness, Total	Comp	SM2340C	2	mg/L	HNO_3 or H_2SO_4	6 months
Metals - Saltwater						
Dissolved Copper	Comp	EPA1640	0.5	µg/L	HNO_3	6 months
Total Copper	Comp	EPA1640	0.5	µg/L	HNO_3	6 months

*Toxics TMDL numeric targets.

[a] Methods used should allow for detection at or below numeric targets outlined in the Toxics TMDL. Other EPA and Standard Methods may be acceptable. Per the Toxics TMDL, "Currently, several consituents of concern have numeric targets that are lower than readily available detection limits. As analytical methods and detection limits continue to improve and become more environmentally relevant, responsible parties shall incorporate new MDLs in the monitoring plan."

Table D-3C
Toxics TMDL - Water Quality (Bi-Annually, 1 FRONT / 1 BACK)

Constituent	Sample Type	Method [a]	ML/ TMDL Limit*	Units	Preservative	Holding Time
Polychlorinated Biphenyls - Saltwater [c]						
PCB congeners *The 18 PCB Congeners identified for SQO analysis represent the minimum number of Congeners to be analyzed.*	Comp	EPA 1668	0.00017b*	µg/L	Sodium thiosulfate if residual chlorine is present	7 days for extraction 40 days for analysis

*Toxics TMDL numeric targets.

[a] Methods used should allow for detection at or below numeric targets outlined in the Toxics TMDL. Other EPA and Standard Methods may be acceptable. Per the Toxics TMDL, "Currently, several consituents of concern have numeric targets that are lower than readily available detection limits. As analytical methods and detection limits continue to improve and become more environmentally relevant, responsible parties shall incorporate new MDLs in the monitoring plan."

[b] Toxics TMDL numeric target of 0.00017µg/L. Selected laboratory may not be able to achieve the numeric target using the standard version of this method. Variations to the recommended method may be necessary.

[d] Although the Screening Parameters listed in the Permit are in the form of Aroclors (1016, 1221, 1232, 1242, 1248, 1254, 1260), this CIMP will analyze PCB in the form of Congeners in order to be consistent with Toxics TMDL monitoring efforts. Also note that the EPA has requested that the Regional Board modify the 2012 MS4 Permit to include PCB congeners in place of PCB aroclors.

Table D-4
Triad Analysis (SQOs) - Sediment

Constituent	Method[a]	Maximum Reporting Limit[b] (Dry Weight)	Units	Preservative	Holding Time
Physical/Conventional Tests - SQOs					
Particle Size	Plumb (1981)	1.0	%	-	-
Percent Solids	SM 2540B	0.1	%	-	-
Total Organic Carbon (TOC)	EPA 9060A	0.05	%	-	-
Metals - SQOs					
Cadmium (Cd)	EPA 6020	0.09	mg/kg		
Copper (Cu)	EPA 6020	52.8	mg/kg	-	-
Lead (Pb)	EPA 6020	25	mg/kg	-	-
Mercury (Hg)	EPA 7471A	0.09	mg/kg		
Zinc (Zn)	EPA 6020	60	mg/kg	-	-
Total PAHs - SQOs (MLs are based on 2 grams of soil analyzed)					
Low Molecular Weight PAHs					
1-Methylnaphthalene	EPA 8270	20	µg/kg	-	-
1-Methylphenanthrene	EPA 8270	20	µg/kg	-	-
2,6-Dimethylnaphthalene	EPA 8270	20	µg/kg	-	-
2-Methylnaphthalene	EPA 8270	20	µg/kg	-	-
Acenaphthene	EPA 8270	20	µg/kg	-	-
Anthracene	EPA 8270	20	µg/kg	-	-
Biphenyl	EPA 8270	20	µg/kg	-	-
Fluorene	EPA 8270	20	µg/kg	-	-
Naphthalene	EPA 8270	20	µg/kg	-	-
Phenanthrene	EPA 8270	20	µg/kg	-	-
High Molecular Weight PAHs					
Benzo(a)anthracene	EPA 8270	80	µg/kg	-	-
Benzo(a)pyrene	EPA 8270	80	µg/kg	-	-
Benzo(e)pyrene	EPA 8270	80	µg/kg	-	-
Chrysene	EPA 8270	80	µg/kg	-	-
Dibenzo(a,h)anthracene	EPA 8270	80	µg/kg	-	-
Fluoranthene	EPA 8270	80	µg/kg	-	-
Perylene	EPA 8270	80	µg/kg	-	-
Pyrene	EPA 8270	80	µg/kg	-	-
PCBs (Congeners) - SQOs [c]					
2,4'Dichlorobiphenyl (8)	EPA 8270	3	µg/kg	Deliver on ice, store at <4°C	7 days
2,2',5-Trichlorobiphenyl (18)	EPA 8270	3	µg/kg		
2,4,4'-Trichlorobiphenyl (28)	EPA 8270	3	µg/kg		
2,2',3,5'-Tetrachlorobiphenyl (44)	EPA 8270	3	µg/kg		
2,2',5,5'-Tetrachlorobiphenyl (52)	EPA 8270	3	µg/kg		
2,3',4,4'-Tetrachlorobiphenyl (66)	EPA 8270	3	µg/kg		
2,2',4,5,5'-Pentachlorobiphenyl (101)	EPA 8270	3	µg/kg		
2,3,3',4,4'-Pentachlorobiphenyl (105)	EPA 8270	3	µg/kg		
2,3',4,4',5-Pentachlorobiphenyl (118)	EPA 8270	3	µg/kg		
2,2',3,3',4,4'-Hexachlorobiphenyl (128)	EPA 8270	3	µg/kg		
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	EPA 8270	3	µg/kg		
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	EPA 8270	3	µg/kg		
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)	EPA 8270	3	µg/kg		
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)	EPA 8270	3	µg/kg		
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)	EPA 8270	3	µg/kg		
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)	EPA 8270	3	µg/kg		
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)	EPA 8270	3	µg/kg		
Decachlorobiphenyl (209)	EPA 8270	3	µg/kg		
Total PCBs	Calculated	-	µg/kg		

Table D-4
Triad Analysis (SQOs) - Sediment

Constituent	Method[a]	Maximum Reporting Limit[b] (Dry Weight)	Units	Preservative	Holding Time
Organochlorine Pesticides - SQOs					
Chlordane-alpha	EPA 8270	0.50	µg/kg	Deliver on ice, store at <4°C	7 days
Chlordane-gamma	EPA 8270	0.54	µg/kg		
trans-Nonachlor	EPA 8270	4.6	µg/kg		
Dieldrin	EPA 8270	2.5	µg/kg		
2,4'-DDD	EPA 8270	0.50	µg/kg		
2,4'-DDE	EPA 8270	0.50	µg/kg		
2,4'-DDT	EPA 8270	0.50	µg/kg		
4,4'-DDD	EPA 8270	0.50	µg/kg		
4,4'-DDE	EPA 8270	0.50	µg/kg		
4,4'-DDT	EPA 8270	0.50	µg/kg		
Total DDTs	Calculated	-	µg/kg		
Toxicity - Sediment - SQOs					
L. plumulosus 10-day Acute Survival	ASTM E1367-03 and EPA/600/R-95/136	NA	NA	Deliver on ice, store at ≤4°C	10 days preferred; up to 28 days acceptable.
M. galloprovincialis 48-Hour Sediment Water Interface Development Test[d]	Anderson et al. 1996 and EPA/600/R-95/136	NA	NA	Deliver on ice, store at ≤4°C	10 days preferred; up to 28 days acceptable.

[a] All samples will be tested in accordance with USEPA or American Society for Testing and Materials (ASTM) methodologies where such methods exist. Approval of alternative methods should be obtained from the SWRCB. Additional methods may be acceptable if they produce results at or below the desired reporting limits and are comparable to results generated by USEPA methods.

b Maximum reporting limits as recommended in SCCWRP's "Sediment Quality Assessment Technical Support Manual" (January 2014). These limits are "based on the CSI classification ranges and do not necessarily reflect the maximum performance achievable with available analytical methods". This statement applies for all analytes listed in the table above except the following: particle size, percent solids, and total organic carbon. The concentrations associated with the reporting limits in the table are expressed in dry weight as should all analytical results.

[c] This list of 18 PCB congeners is from Appendix A of the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SWRCB and USEPA, 2009).

[d] Alternatively, a 28-day *Neanthes arenaceodentata* growth test may be utilized as the sublethal test in accordance with ASTM E1611-07 and USEPA protocols. However, the *M. galloprovincialis* test has been the sublethal test utilized during previous testing.

Table D-5						
Toxics TMDL - Outfalls (Water, Storms)						
Constituent	**Sample Type**	**Method**	**ML**	**Units**	**Preservative**	**Holding Time**
Total Suspended Solids (TSS)	Comp	SM2540D	2	mg/L	-	7 days
Total Dissolved Solids (TDS)	Comp	SM2540C	2	mg/L	-	7 days
Settleable Solids	Comp	SM2540F	2	mg/L	-	7 days

Table D-6
Toxics TMDL - Outfalls (Stormborne Sediment)

Constituent	Sample Type	Method [a]	TMDL Limit*	ML	Units	Short-Term Shortage		Long-Term Storage	
						Preservative	Holding Time	Preservative	Holding Time
Metals - Sediments									
Copper	Comp	EPA 6010B	34	4.4	mg/kg	Deliver on ice, store at <4°C	-	Deliver on ice; store/freeze at – 20 °C	1 year
Lead	Comp	EPA 6010B	46.7	2.2	mg/kg		-		
Zinc	Comp	EPA 6010B	150	2.2	mg/kg		-		
Metals - Sediments									
Total Organic Carbon (TOC)	Comp	SM 5310B	-	0.01%	%	-	-	-	-
Polychlorinated Biphenyls - Congeners - Sediments [d]									
2,4'Dichlorobiphenyl (8)	Comp	EPA 8270	-	10	pg/g	Deliver on ice, store at <4°C	7 days	Deliver on ice; store/freeze at – 20 °C	1 year to extract, 40 days to analyze after extraction
2,2',5-Trichlorobiphenyl (18)	Comp	EPA 8270	-	2.5	pg/g				
2,4,4'-Trichlorobiphenyl (28)	Comp	EPA 8270	-	2.5	pg/g				
2,2',3,5'-Tetrachlorobiphenyl (44)	Comp	EPA 8270	-	2.5	pg/g				
2,2',5,5'-Tetrachlorobiphenyl (52)	Comp	EPA 8270	-	5	pg/g				
2,3',4,4'-Tetrachlorobiphenyl (66)	Comp	EPA 8270	-	5	pg/g				
2,2',4,5,5'-Pentachlorobiphenyl (101)	Comp	EPA 8270	-	10	pg/g				
2,3,3',4,4'-Pentachlorobiphenyl (105)	Comp	EPA 8270	-	5	pg/g				
2,3',4,4',5-Pentachlorobiphenyl (118)	Comp	EPA 8270	-	5	pg/g				
2,2',3,3',4,4'-Hexachlorobiphenyl (128)	Comp	EPA 8270	-	5	pg/g				
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	Comp	EPA 8270	-	7.5	pg/g				
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	Comp	EPA 8270	-	2.5	pg/g				
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)	Comp	EPA 8270	-	2.5	pg/g				
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)	Comp	EPA 8270	-	2.5	pg/g				
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)	Comp	EPA 8270	-	5	pg/g				
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)	Comp	EPA 8270	-	2.5	pg/g				
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)	Comp	EPA 8270	-	2.5	pg/g				
Decachlorobiphenyl (209)	Comp	EPA 8270	-	2.5	pg/g				
PCB congeners	Comp	Calculated	3.2	-	µg/kg				
Organochlorine Pesticides - Sediments									
Total Chlordane	Calculated	-	0.5	-	µg/kg	Deliver on ice, store at <4°C	7 days	Deliver on ice; store/freeze at – 20 °C	1 year to extract, 40 days to analyze after extraction
Chlordane-alpha	Comp	EPA 8270	-	20	pg/g				
Chlordane-gamma	Comp	EPA 8270	-	20	pg/g				
trans-Nonachlor	Comp	EPA 8270	-	20	pg/g				
2,4'-DDD	Comp	EPA 8270	-	20	pg/g				
2,4'-DDE	Comp	EPA 8270	-	40	pg/g				
2,4'-DDT	Comp	EPA 8270	-	40	pg/g				
4,4'-DDD	Comp	EPA 8270	-	20	pg/g				
4,4'-DDE	Comp	EPA 8270	*220*	40	pg/g				
4,4'-DDT	Comp	EPA 8270	-	40	pg/g				
Total DDT	Calculated	-	1.58	-	µg/kg				

*Toxics TMDL numeric targets.

[a] Methods used should allow for detection at or below numeric targets outlined in the Toxics TMDL. Other EPA and Standard Methods may

[b] Toxics TMDL numeric target of 0.00017µg/L. Selected laboratory may not be able to achieve the numeric target using the standard version

[d] PCB congener analysis is required for SQO analysis (1x/5years). The USEPA has requested that the Regional Board modify the 2012 MS4

Table D-7
Toxics TMDL - Fish and Mussel Tissue (Annual)

Constituent	Method[a]	TMDL Limit*	RL[b]	Units	Preservative	Holding Time
Polychlorinated Biphenyls - Congeners[(d)]						
2,4'Dichlorobiphenyl (8)	EPA 8270	-	20	pg/g	c	7 days for extraction 40 days for analysis
2,2',5-Trichlorobiphenyl (18)	EPA 8270	-	5	pg/g		
2,4,4'-Trichlorobiphenyl (28)	EPA 8270	-	5	pg/g		
2,2',3,5'-Tetrachlorobiphenyl (44)	EPA 8270	-	5	pg/g		
2,2',5,5'-Tetrachlorobiphenyl (52)	EPA 8270	-	10	pg/g		
2,3',4,4'-Tetrachlorobiphenyl (66)	EPA 8270	-	10	pg/g		
2,2',4,5,5'-Pentachlorobiphenyl (101)	EPA 8270	-	10	pg/g		
2,3,3',4,4'-Pentachlorobiphenyl (105)	EPA 8270	-	5	pg/g		
2,3',4,4',5-Pentachlorobiphenyl (118)	EPA 8270	-	10	pg/g		
2,2',3,3',4,4'-Hexachlorobiphenyl (128)	EPA 8270	-	10	pg/g		
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	EPA 8270	-	5	pg/g		
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	EPA 8270	-	5	pg/g		
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)	EPA 8270	-	5	pg/g		
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)	EPA 8270	-	5	pg/g		
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)	EPA 8270	-	5	pg/g		
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)	EPA 8270	-	5	pg/g		
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)	EPA 8270	-	5	pg/g		
Decachlorobiphenyl (209)	EPA 8270	-	5	pg/g		
PCB congeners	Calculated	3.6	-	ug/kg		
Organochlorine Pesticides						
Total Chlordane (calculated)	Calculated	-	-	-	c	7 days for extraction 40 days for analysis
Chlordane-alpha	EPA 8270	-	40	pg/g		
Chlordane-gamma	EPA 8270	-	40	pg/g		
trans-Nonachlor	EPA 8270	-	40	pg/g		
2,4'-DDD	EPA 8270	-	80	pg/g		
2,4'-DDE	EPA 8270	-	80	pg/g		
2,4'-DDT	EPA 8270	-	80	pg/g		
4,4'-DDD	EPA 8270	-	80	pg/g		
4,4'-DDE	EPA 8270	-	80	pg/g		
4,4'-DDT	EPA 8270	-	80	pg/g		

*Toxics TMDL numeric target for Fish Tissue for total PCBs.

[a] Methods used should allow for detection at or below numeric targets outlined in the Toxics TMDL. Other EPA and Standard Methods may be acceptable.

[b] Based on low mass availability for tissue.

[c] Tissue preparation includes whole fish filleting and/or grinding, and/or any less-involved tissue preparation approach.

[d] This list of 18 PCB congeners is from Appendix A of the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (SWRCB and USEPA, 2009).

APPENDIX E
New Development/Re-Development Program Forms

Inspection Check List for Each BMP		
System / Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
Inlet/Outlet		
Drainage • Overall area graded to inlet • No evidence of flow bypassing BMP • Appropriate invert elevation • No evidence of flooding due to clogging/obstruction		
Condition • Sized per specifications • Overall material condition		
Hydromodification Control (riprap/gabions) • No evidence of scouring • Protections visible • Filter fabric intact *(if applicable)*		
Basin/Trench		
Drainage • Dewaters between storms per design specifications • No Ponded/Standing Water* • No Depressions/Low spots		
Aggregate/Rock *(if applicable)* • Clean with no evidence of clogging • Top layer of stone does not need replacement		
Excessive sedimentation (≥ 2 inches deep and/or covers vegetation, or 10% of design capacity)		
Trash/Debris • Adequate maintenance • Requires maintenance		
Vegetation		
Species • Per specifications • No unauthorized plantings		
Health • Lush or dead/diseased/dying • Invasive species** • Maintained or Overgrown (grass greater than 10 inches)		
Embankments		
Hydromodification Control • Coverage per specifications • No erosion/hydromodification • No seeps/leeks/gullies		

Inspection Check List for Each BMP		
System / Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
Bioretention Area (if applicable)		
Drainage • Dewaters between storms per design specifications • No Ponding • No depressions/low spots		
Slopes are stable		
Mulch • Adequate cover • Adequate depth/thickness		
Underdrains • Diameter, Spacing and Material per specifications • Adequate gravel cover		
Excessive sedimentation (covers vegetation or greater than 2 inches deep)		
Trash/Debris • Adequate maintenance • Requires maintenance		
Riser (if applicable)		
Material Reinforced Concrete: ____ Corrugated Metal Pipe:____ Masonry:____ PVC:____		
Condition • Cracks/displacement/joint failures/water tightness • Corrosion • Spalling		
Obstructions • Low flow orifice obstructed • Excessive sediment in riser		
Pre-Treatment Systems (if applicable)		
Grates/Screens • Structural condition • Corrosion		
Obstructions/Clogging		
Sediment/Trash/Debris • Adequate maintenance • Requires maintenance		
Media Filters (if appropriate)		
Media Filter • Filter damage/breakthrough • Staining • Clogging		
Sediment/Trash/Debris • Adequate maintenance • Requires maintenance		
Overflow Bypass (if appropriate)		

Inspection Check List for Each BMP		
System / Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
Spillway Condition • Sized per specifications • Adequate slope protection (e.g., armoring with rip rap)		
Hydromodification • Seeps/leaks on downstream face • Cracking/bulging at toe of spillway • Sliding/gullies		
Obstructions		
Access/Fencing		
Access points in good condition (safe)		
Fences in good condition • No damage which would allow undesirable entry • Lock and gate function		
Other		
All appropriate signage in place		
Animal burrows (gopher holes, etc)		
System modifications since last inspection		
Aesthetics • Vandalism/Graffiti • Odors • Vegetation		
Complaints from residents		
Public Hazards		

* If mosquito larvae are present and persistent, contact the appropriate Vector Control authority.
** Invasive plants should be no greater than 5% of the total vegetated area.

General Post-Construction BMP Inspection Questions	
General Post-Construction BMP Inspection Questions	**Potential Indicators of Improper BMP Design and/or Installation**
1) Has a BMP been installed? 2) Does runoff flow to the BMP? 3) Have the correct inlet/outlet structures been installed? Is there an overflow outlet? 4) Does the BMP drain within design period? 5) Was the correct soil mixture used? 6) Was the BMP protected during construction? 7) Does vegetation meet species/coverage/establishment criteria? Is irrigation needed? 8) Have underdrains been installed to specification? 9) Can the BMP clog? 10) Is there evidence of excess nuisance flow? 11) Are there fencing requirements? 12) Is there access for required maintenance? Is this access safe? <u>Optional Additional Questions:</u> A) Permeability test. B) Is the groundwater table within 10 feet (3 meters) of the BMP invert?	• Limited visible indicators of a BMP (e.g., pipe vent, inlet, etc) • Site grading drains away from an installed BMP • Ponding ○ Deposited trash/sediment/ debris/vegetation ○ High turbidity • Condition of BMP vegetation ○ Coverage ○ Species ○ Vitality • Excess sediment loading (additional controls required) • Rising groundwater table • Soil borings not representative of conditions (e.g., high clay content)

Self-Inspection Form (Maintenance Records)				
What to Look For During BMP Inspection:	**Date of Inspection**	**Satisfactory/ Unsatisfactory**	**Maintenance Required**	**Date of Maintenance / Maintenance Completed**
Accumulation of Sediment, Debris, Litter, Grease, etc.				
Ponded/ Standing Water (Insect Breeding)				
Vegetation: • Overgrown • Establishment • Health				
Erosion/ Sedimentation				
Obstructions				
Clogged Filter Media				
Damage				

APPENDIX F
CIMP Data Management and Assessment

F.0 CIMP DATA MANAGEMENT AND ASSESSMENT

This appendix presents a discussion of the protocols for data management and methods for assessment monitoring data collected under the Coordination Implementation Monitoring Plan (CIMP) for the Marina del Rey (MdR) Watershed.

F.1 Data Management and Review

Laboratories will document, track, and archive the aspects of sample receipt and storage, analyses, and reporting. Further details of each laboratory's data management protocols can be found in each laboratory's respective quality assurance project plans (QAPPs), which will be provided by the laboratories, as needed.

All aspects of the sample collection and analysis process, including final laboratory electronic data deliverables (EDDs), field logs, and chain-of-custody forms will be tracked and documented. All data will undergo verification and validation to ensure accuracy and completeness. The data are compared to information such as the station and sample's history, sample preparation, and quality control (QC) sample data to evaluate the validity of the results. Minimum requirements for data validation include the following:

- Matrix spike and/or duplicate analyses are performed per concentration level and per matrix for every sample batch analyzed (where appropriate).

- Reference materials analyses are compared with "true" values and acceptable ranges. Values outside the acceptable ranges indicate that the sample values are invalid. Following correction of the problem, the reference material should be reanalyzed.

Corrective actions will be taken if data do not meet quality assurance (QA) and QC criteria. Once data are finalized, data will be standardized based on nomenclature developed specifically for the CIMP. Data will then be submitted to the MdR EWMP Agencies on an annual basis for preparation of the Annual Report due December 15.

Additionally, semi-annual annual data reports will be submitted with the annual monitoring report, and six months prior to the annual report (June 15 of each year). The June 15 data submittal will cover the monitoring period of July 1 through December 31, and the December 15 data submittal will cover January 1 through June 30. These semi-annual analytical data reports detail exceedances applicable to WQBELs, RWLs, action levels, or aquatic toxicity thresholds, with corresponding sample dates and monitoring locations.

F.1.1 Regional Monitoring Program Data Management – BIGHT 2013

The Permit requires submission of SMC program data in the latest SMC Standardized Data Transfer Formats (SDTFs) developed and managed by SCCWRP. The SMC program is not currently being conducted in the MdR Watershed and no watershed-specific data will be available. In the event that bioassessment data are collected and reported for the MdR Watershed, data will be formatted and uploaded using the SDTFs. The latest version of the SMC project SDTF templates and directions available at the time of writing are provided in Attachment F1.

Monitoring is currently being conducted under the Bight 2013. Unique SDTFs exist for the Bight 2013. The latest version of the SDTF templates and directions available at the time of writing are also provided in Attachment F1.

F.2 Receiving Water Assessment

F.2.1 Permit – Receiving Water Assessment – Water Quality

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175 (Permit) defines the Monitoring and Reporting Program (MRP) requirements, which will be used to assess conditions in the Receiving Water Monitoring Station(s) where data is collected for Permit compliance. This assessment methodology is only applicable to Permit compliance monitoring data and ought not be extrapolated to data collected for Total Maximum Daily Load (TMDL) compliance data assessment.

Water quality data collected from the MdR Receiving Water for Permit compliance will be compared with all applicable receiving water limitations. According to Section C.2 of the California Ocean Plan, the provisions and water quality objectives defined therein do not apply to enclosed bays and estuaries. Per Appendix I to the California Ocean Plan, enclosed bays include indentation along the coast which enclose an area of oceanic water within distinct headland or harbor works. Therefore, these receiving water limitations do not apply to the MdR Watershed.

The Los Angeles Basin Plan directly or by reference identifies saltwater limitations (Table 1) that may be applicable for assessment of MdR receiving water permit compliance monitoring data.

Table 1. Potentially Applicable Saltwater Receiving Water Limitations for Assessment of MdR Receiving Water Permit Compliance Monitoring Data

Parameter	Units	CMC for Saltwater
4-4'-DDT	µg/L	0.13
Aldrin	µg/L	1.3
Chloride	mg/L	N/A
Chlordane	µg/L	0.09
Cyanide	mg/L	0.001
Dieldrin	µg/L	0.71
Arsenic, Total	µg/L	69
Cadmium, Total	µg/L	42

Table 1. Potentially Applicable Saltwater Receiving Water Limitations for Assessment of MdR Receiving Water Permit Compliance Monitoring Data

Parameter	Units	CMC for Saltwater
Chromium (III), Total	µg/L	N/A
Chromium (VI) Total	µg/L	1,100
Copper, Total	µg/L	4.8
Lead, Total	µg/L	210
Nickel, Total	µg/L	74
Selenium, Total	µg/L	290
Silver, Total	µg/L	1.9
Zinc, Total	µg/L	90
Arsenic, Dissolved	µg/L	69
Cadmium, Dissolved	µg/L	42
Chromium (III), Dissolved	µg/L	BP
Chromium (VI), Dissolved	µg/L	1100
Copper, Dissolved	µg/L	4.8
Lead, Dissolved	µg/L	210
Nickel, Dissolved	µg/L	[Reserved]
Selenium, Dissolved	µg/L	290
Silver, Dissolved	µg/L	1.9
Zinc, Dissolved	µg/L	90
Dissolved Oxygen	mg/L	BP
alpha-Endosulfan	µg/L	0.034
beta-Endosulfan	µg/L	0.034
Endrin	µg/L	0.037
gamma-BHC (lindane)	µg/L	0.16
Heptachlor	µg/L	0.053
Heptachlor epoxide	µg/L	0.053
Nitrate (NO_3)	mg/L	BP
Nitrate-N	mg/L	BP
Nitrite-N	mg/L	BP
Pentachlorophenol	µg/L	13
pH	pH units	BP
Sulfate	mg/L	N/A
Total dissolved solids (TDS)	mg/L	N/A
Toxaphene	µg/L	0.21

Note: This list of parameters is based on the 2012-2013 Monitoring Annual Report and may require modification based on regional (County-wide) implementation of Permit programs.
N/A – Not Applicable.

Table 1. Potentially Applicable Saltwater Receiving Water Limitations for Assessment of MdR Receiving Water Permit Compliance Monitoring Data

Parameter	Units	CMC for Saltwater
BP – Freshwater receiving water limitation identified in the Basin Plan. CMC - Criterion Maximum Concentration, the acute CTR water quality standard. *The California Ocean Plan receiving water values do not apply to the MdR Watershed.		

F.2.2 Bacteria TMDL – Receiving Water Assessment – Water Quality

Bacteria grab samples will be compared with the single-sample numeric targets presented in the bacteria TMDL. An assessment of the single-sample monitoring data will be conducted monthly using the site-specific allowable number of exceedance days.

Rolling geometric mean calculations will be used to determine compliance with the Bacteria TMDL. Geometric means concentrations will be calculated for each indicator bacteria on a station-by-station basis using the historical dataset available for MdR Watershed. The geometric mean shall be calculated weekly as a rolling geometric mean using five or more samples, for 6-week periods, starting all calculations on Sunday. Geometric mean targets may not be exceeded at any time.

F.2.3 Toxics TMDL – Receiving Water Assessment – Water, Sediment and Fish Tissue Quality

Chemistry data for water, sediment, and fish tissue will be compared to the Toxics TMDL numeric targets defined in the Regulatory Drivers Appendix A.

Sediment toxicity results will be compared to appropriate laboratory controls.

F.2.4 Toxics TMDL – Receiving Water Assessment – Triad Assessment

Sediment chemistry, toxicity, and benthic community condition will be assessed once every five years using California's sediment quality objectives (SQOs) as described in the *Water Quality Control Plan for Enclosed Bays and Estuaries* (SWRCB and Cal EPA, 2009). 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. The SQOs are based on a multiple lines-of-evidence (MLOE) approach in which sediment toxicity, sediment chemistry, and benthic community condition are the lines of evidence (LOEs). The MLOE approach evaluates the severity of biological effects and the potential for chemically mediated effects to provide a final station level assessment.

Categorization values for benthic infauna, sediment quality guidelines (toxicity), and SQOs (chemistry) are described in the *Water Quality Control Plan for Enclosed Bays and Estuaries* (SWRCB and Cal EPA, 2009). Data analyses will be performed to determine what physical and chemical factors most greatly influenced the distribution of benthic organisms as discussed below. Data may be integrated and summarized using the reporting template presented in Figure 1.

Benthic Infauna Index of Biotic Integrity

The Benthic community condition was assessed using a combination of four benthic indices, the Benthic Response Index (BRI), Relative Benthic Index (RBI), Index of Biotic Integrity (IBI), and a predictive model based on the River Invertebrate Prediction and Classification System (RIVPACS). The four indices will be calculated following the 2014 guidance provided by SCCWRP entitled, *Sediment Quality Assessment Technical Support Manual* (SCCWRP, 2014).

Each benthic index result was categorized according to four levels of disturbance, including reference, low, moderate, and high disturbance:

- **Reference:** Equivalent to a least affected or unaffected site.
- **Low Disturbance:** Some indication of stress is present, but is within measurement error of unaffected condition.
- **Moderate Disturbance:** Clear evidence of physical, chemical, natural, or anthropogenic stress.
- **High Disturbance:** High magnitude of stress.

Sediment Quality Guidelines (Toxicity)

Sediment toxicity was assessed using two tests, a 10-day *L. plumulosus* survival test and a sublethal test using the mussel *M. galloprovincialis*. Sediment toxicity test results from each site will be statistically compared to control test results; normalized to the control survival; and categorized as nontoxic, low, moderate, or high toxicity. The average of the test responses will be calculated to determine the final toxicity level of exposure (LOE) category. If the average falls midway between the two categories, it will be rounded up to the higher of the two. Tables with criteria are presented in the SQO guidelines (SCCWRP, 2014).

Sediment Quality Objectives (Chemistry)

Concentrations of chemicals detected in sediments will be compared to the California Logistic Regression Model (CA LRM) and the Chemical Score Index (CSI). The CA LRM is a maximum probability model (P_{MAX}) that uses logistic regression to predict the probability of sediment toxicity. The CSI is a predictive index that relates sediment chemical concentration to benthic community disturbance. Sediment chemistry results according to CA LRM and CSI will be categorized as having minimal, low, moderate, or high exposure to pollutants. The final sediment LOE category is the average of the two chemistry exposure categories. If the average falls midway between the two categories, it will be 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 will be moderate exposure.

Location: MdR Watershed - Harbor Receiving Water Stations
Station:
Final Site Assessment =

Chemical Analyte	Units	Actual Sediment Concentration	CA LRM P Values	Score As part of CSI Calculation (Benthic Disturbance Category)
Cadmium	mg/kg			N/A
Copper	mg/kg			
Lead	mg/kg			
Mercury	mg/kg			
Zinc	mg/kg			
PAHs, total high MW	ng/g			
PAHs, total low MW	ng/g			
Chlordane, alpha	ng/g			
Chlordane, gamma	ng/g		N/A	
Dieldrin	ng/g			N/A
Trans nonachlor	ng/g			N/A
Total PCBs	ng/g			
4,4'DDT	ng/g			N/A
DDDs, total	ng/g		N/A	
DDEs, total	ng/g		N/A	
DDTs, total	ng/g		N/A	
		PMAX value		
		Mean CSI		
		Category		
		Final Chemistry LOE Category		

Test Species/Endpoint	%Normal Alive	% N-A (Control Normalized)	Statistical Significance	Test Response Category	Final Toxicity LOE Category
Eohaustorius survival					
Mytilus Normal					

Index	Score	Index Disturbance Category	Final Benthic LOE Category
BRI			
IBI			
RBI			
RIVPACS			

CA LRM = California Logistics Regression Model
CSI = Chemical Score Index
PMAX value = maximum probability model value
LOE Category = Line of Evidence category
N/A = Not Applicable

Figure 1. Triad Assessment – Integrated Data Summary Template

F.3 Stormwater Outfall Monitoring – Water Quality Assessment

F.3.1 Permit – Stormwater Outfall Monitoring Assessment – Water Quality

The MRP defines the requirements which will be used to assess conditions at Outfall Monitoring Stations where data is collected for Permit compliance. This assessment methodology is only applicable to Permit compliance monitoring data and ought not be extrapolated to data collected for TMDL compliance data assessment. Water quality data collected from the MdR Outfall Monitoring Station(s) for Permit compliance will be compared to the municipal action levels (MALs) defined in Attachment G of the Permit. The MALs, per Attachment G of the Permit and presented in Table 2, are based on nationwide Phase I MS4 monitoring data for pollutants in Storm Water (upper 25th percentile results). Data assessment will include a running average of water quality data for each Outfall Monitoring Station. If the running average is 20% or greater than the MALs, an MAL Action Plan will be written and submitted beginning in Year 3 after the effective date of this Order (first MAL Action Plan due with December 15, 2015 Annual Report) to the Regional Water Board Executive Officer

Table 2. Water Quality Assessment of Outfall Data for Permit Compliance – Storm Water Municipal Action Levels

Parameter	Units	Storm Water MALs
pH	pH Units	6.0 – 9.0
Total Suspended Solids (TSS)	mg/L	264.1
Chemical Oxygen Demand (COD)	mg/L	247.5
Total Kjeldahl Nitrogen (TKN)	mg/L	4.56
Total Nitrate & Nitrite	mg/L	1.85
Total Phosphorous	mg/L	0.80
Cadmium, Total Recoverable	µg/L	2.52
Chromium, Total Recoverable	µg/L	20.20
Copper, Total Recoverable	µg/L	71.12
Lead, Total Recoverable	µg/L	102.00
Nickel, Total Recoverable	µg/L	27.43
Zinc, Total Recoverable	µg/L	641.3
Mercury, Total Recoverable	µg/L	0.32

F.3.2 Permit – Stormwater Outfall Monitoring Assessment – Toxicity Endpoint Assessment and Toxicity Identification Evaluation Triggers

The MRP (page E-33) indicates the following actions should be taken when a toxicant or class of toxicants is identified through a TIE:

1. MdR WMG members shall analyze for the toxicant(s) during the next scheduled sampling event in the discharge from the outfall(s) upstream of the receiving water location.
2. If the toxicant is present in the discharge from the outfall at levels above the applicable receiving water limitation, a toxicity reduction evaluation (TRE) will be performed for that toxicant.

The list of constituents monitored at Outfalls Monitoring Station(s) for Permit compliance will be modified based on the results of any TIEs conducted. Monitoring for those constituents will occur as soon as feasible following the completion of a successful TIE (i.e., the next monitoring event that is at least 45 days following the toxicity laboratory's report transmitting the results of a successful TIE). The requirements of the TREs will be met as part of the adaptive management process in the MdR EWMP rather than conducted via the CIMP. The identification and implementation of control measures to address the causes of toxicity are tied to management of the stormwater program, not the CIMP. It is expected that the requirements of TREs will only be conducted for toxicants that are not already addressed by an existing Permit requirement (i.e., TMDLs) or existing or planned management actions.

Toxicity samples will be collected at Outfall Stations only if receiving water TIEs are inconclusive for two consecutive Permit compliance monitoring events. If toxicity samples have been collected at an Outfall Station for Permit compliance monitoring, toxicity results will be compared to appropriate laboratory controls. Toxicity test endpoints will be analyzed, per the MRP, using the TST t-test approach (USEPA, 2010). The Permit specifies that the chronic IWC is set at 100% effluent for outfall samples. For chronic marine and estuarine aquatic toxicity tests conducted at Outfall Stations for Permit compliance monitoring, the percent effect will be calculated. A TIE will be performed if the percent effect value is equal to or greater than 50%, using the protocols outlined for the Receiving Water aquatic toxicity testing (see Section **Error! Reference source not found.**, above). If the Outfall discharge exhibits toxicity above these triggers, a TIE shall be conducted. Given the extensive monitoring data available for the MdR Watershed, this condition is not anticipated.

F.3.3 Bacteria TMDL – Stormwater Outfall Monitoring Assessment – Water Quality

Not Applicable.

F.3.4 Toxics TMDL – Stormwater Outfall Monitoring Assessment – Water Quality and Storm-Borne Sediment

Monitored parameters data for water and storm-borne sediment samples will be compared to the Toxics TMDL numeric targets. The Toxics TMDL requires the monitoring of Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and Suspended Solids at the corresponding monitoring stations. The storm-borne sediment monitoring parameters include Total Organic Carbon (TOC), Copper, Zinc, Lead, Chlordane, Total PCBs, Total DDTs, and p,p'-DDE. Although not required by the TMDL, the sediment will be tested for Percent Solids. An overview of monitoring frequency and methods is presented in the CIMP. Appendix C describes the analytical methods, sampling procedures, and data management to be used during the implementation of the CIMP.

F.4 Statistical Analysis

Statistical analysis will be used to assess MdR Watershed monitoring data for Permit and TMDLs compliance and evaluate changes in conditions over time.

Environmental monitoring data possess distributional characteristics that generally require specialized approaches to trend testing. Water quality datasets can contain censored (less than) values, outliers, multiple detection limits, missing values, and serial correlation. These characteristics commonly present problems in the use of conventional parametric statistics based on normally distributed datasets. The presence of censored data, non-negative values, and outliers generally leads to a non-normal data distribution, which is common for many datasets. These skewed datasets require use of specific non-parametric statistical procedures for their analysis. Nonparametric statistical tests are more powerful when applied to non-normally distributed data, and almost as powerful as parametric tests when applied to normally distributed data (Helsel and Hirsch, 1992).

For trend analysis for Permit and Toxics TMDL compliance, data will be organized by station, date of collection, and type of monitoring event (Storm Water or Non-storm Water). It is necessary to include a minimum of 3 years of data in this analysis. The nonparametric Mann-Kendall trend analysis will be used to evaluate whether a constituent has increased or decreased significantly since the base year. The test is non-parametric, rank order-based, and insensitive to missing values. Statistical significance will be based on a 95% confidence level (e.g., a 5% probability of obtaining a test statistic, or a p-value of less than 0.05).

Sen’s slope, a non-parametric estimator of the magnitude of the change in parameter concentration over time (Sen, 1968), will be calculated for parameters with statistically significant trends. Sen’s slope can only be calculated if the proportion of samples assessed below the minimum detection limit (MDL) was less than 15% (Sen, 1968). Sen's slope estimator is insensitive to outliers and can be used to infer the magnitude of a trend in the data.

The dataset may contain results below the MDL. These values will be assigned the value of one-half the MDL. Over time, TMDL requirements and laboratory analytical techniques have lowered their limit of detection. An artifact of this advance is that the lower detection limit values of measurements later in the data record may be falsely detected as a downward trend. To avoid this, water quality values will be censored to one-half of the highest detection limit of the analysis period as part of the data handling prior to analysis.

Datasets with large numbers of values identified as detected but not quantified (DNQ) may create statistical problems for trend analyses. The Mann-Kendall test for trend adjusts variance estimates upward for ties in magnitude (Gilbert, 1990). Considering that DNQ values in the raw dataset produce such ties, trend analyses of datasets with high percentages of DNQ results will be based upon greater variances than those without DNQ results. Thus, the power of the trend analyses is reduced for the datasets with values below detection limit (BDLs) compared to those without detection limits censoring.

A simulation analysis on the effect of DNQ results on Mann Kendall test and Sen’s slope estimator has provided standard guidelines for reporting trend statistics (Alden et al., 2000). These guidelines are widely accepted based on the percentage of DNQ results present in the dataset (Ebersole et al., 2002). The simulation analysis found that the power of the Mann-Kendall test begins to noticeably decline when censoring exceeds 35%. However, if the Mann-Kendall test produces a significant result when the level of censoring is between 35% and 50%, this result may be valid despite the loss of power. If the Mann-Kendall test fails to produce a significant result when censoring is in the 35% to 50% interval, this failure may have resulted from a loss of power. Also; the Sen's slope estimator begins to exhibit noticeable bias when censoring exceeds 15%. At levels of censoring of 15% or less, both the Mann-Kendall test results and the Sen's slope estimator were found to be reliable.

The following guidelines were used to report trend information:

- If the percentage of BDL observations is 15 or less, report the trend test p-value, direction, and magnitude of the trend (i.e., Sen Slope).
- If the percentage of BDL observations is greater than 15 and less than or equal to 35, report the trend test p-value and direction only. Do not report the trend magnitude.
- If the percentage of BDL observations is greater than 35 and less than or equal to 50 and the trend test p-value indicates a significant trend, report the trend test p-value and direction. Do not report the trend magnitude.
- If the percentage of BDL observations is greater than 35 and less than or equal to 50 and the trend test p-value does not indicate a significant trend, report that there are too many observations below the detection limit to determine the presence or absence of trend.
- If the percentage of BDL observations is greater than 50, report there are too many observations below the detection limit to determine the presence or absence of trend.

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Appendix H: Marina del Rey Harbor Toxics TMDL – Storm-borne Sediment Collection Summary Report

For Reference Only
Marina del Rey Enhanced Watershed Management Agencies
Coordinated Integrated Monitoring Program

Summarized by: County of Los Angeles

6/30/2014

This is a work-in-progress document and is not intended to be a final work product. Only use for reference/guidance for the MdR CIMP

Appendix H: Storm-borne Sediment Collection Summary Report

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Appendix H: Storm-borne Sediment Collection Summary Report

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1. Introduction

The Basin Plan Amendment for the Marina del Rey Harbor Toxic Pollutants Total Maximum Daily Load (TMDL) (California Regional Water Quality Control Board, Los Angeles Region, XXXX X, 2014?) requires monitoring of harbor water, sediment and fish, and wet-weather storm water and storm-borne sediment. The TMDL establishes waste load allocations for storm water discharges into the Marina del Rey Harbor that are based on attainment of numeric targets for contaminants in sediment. A critical component of the Marina del Rey Toxic Pollutants TMDL monitoring program is assessing the average concentration of toxic pollutants in storm-borne sediments, which is sediment suspended in storm water flow. During the Effectiveness Monitoring Phase, storm-borne sediment samples shall be collected and analyzed during storm events as a means of evaluating progress towards attainment of the TMDL established waste load allocations.

2. Selection of Passive Sediment Collection Device

The passive sediment collection device was assessed for its efficacy of sample collection during a pilot study. The Marina del Rey Harbor Toxic Pollutants TMDL CMP originally estimated that 20 grams of storm-borne sediment sample would be necessary to in order to analyze all of the constituents required by the TMDL. The CMP further estimated that the 20 grams of storm-borne sediment sample would be present in 10 gallons (37.85 liter) assuming an average of 560 mg/L of total suspended solids (TSS). Discussions with laboratories and reviews of the target detection limits indicate that a larger sample would be necessary to analyze using the CMP analytical methods (e.g., the current estimate is 54 grams of sample). In addition, the average total suspended solids value reported for the five storm water locations monitored by the CMP is 62 mg/L (Figure 1) – only 11 percent of the 560 mg/L assumed in the CMP. Based on these revised estimates (target of 54 grams of storm-borne sediment sample and an average TSS value of 62 mg/L), the estimated volume of storm water containing the necessary amount of sediment is approximately 870 liters.

2.1 Existing Installations

The passive sediment collection devices were installed at three locations as part of a pilot study to assess the efficacy of the devices to collect storm-borne sediment.

2.1.1 MdR-4

The MdR-4 sample location is at the pump house at the east end of the Oxford Flood Control Basin and is an open concrete channel approximately 15 feet in width and 8 feet in depth. Anchor bolts and suspension cables are installed to allow placement of the sample collection device in the center of the flow horizontally and vertically. Fabrication and installation at MdR-4 include:

- Construction of a pair of passive sediment collection device including filter basket, filter bag, debris grate and suspension harness.
- Installation of four 3/8-inch-diameter wedge anchors embedded three inches; attachment of 3/8-inch-diameter eye bolts to anchors using coupling nuts; and fabrication and placement of suspension cable across channel and tightened using turnbuckles.

- Fabrication and fitting of tether cable to suspend sampling device in the channel.
- Installation of pulley and rope control system to allow for sampler adjustment and retrieval during storm events from top of channel.

Photographs of the installation are presented in Figures 1 and 2 included in **Attachment A**.

2.1.2 MdR-5

The MdR-5 sample location is at the wet well at the Boone-Olive Pump Station control house. The bottom of the wet well is approximately 20 feet below the ground surface. Two sample collection devices are configured at this location. Fabrication and installation of the two collection devices at MdR-5 includes:

- Device No. 1 – a Flow-Through Baffle Box supplied by a submersible pump (up to 5 gallons per minute) and a drain attached to passive sediment collection device.
    - Fabrication of metal channel strut support frame to hold the Flow-Through Baffle Box (Device No. 1). Frame was secured to railing using u-bolts.
    - Fabrication of Flow-Through Baffle Box including inlet and outlet structure.
- Device No. 2 – a passive sediment collection device fitted inside a pressure chamber supplied by a submersible pump (up to 5 gallons per minute).
    - Assembly of inlet and outlet piping for pressure chamber filter housing (Device No. 2).
    - Fabrication of tether cable for pump and pump discharge hose. Tether was secured to metal channel strut frame to allow for pump depth to be adjusted.

Photographs of the installation are presented in Figures 3-6 included in **Attachment A**.

2.1.3 MdRU-C1

The MdRU-C1 sample location is an 18-inch storm drain lateral accessed by a curb-side cover near Admiralty Way north of Bali Way. Fabrication and installation at MdRU-C1 includes:

- Construction of passive sediment collection device including filter basket, debris grate and suspension harness.
- Installation of two 3/8-inch-diameter wedge anchors embedded three inches and attachment of 3/8-inch-diameter eye bolts to anchors using coupling nuts.
- Fabrication and fitting of tether cable to secure sampling device in catch basin lateral.

Photographs of the installation are presented in Figures 7-8 included in **Attachment A**.

2.2 New Installations

Two additional locations will be designed and implemented during the Effectiveness Monitoring Phase, MdR-3 and MdRU-C1.

2.2.1 MdR-3

The MdR-3 sample location is inside a storm drain near the intersection of Washington Blvd and Thatcher Avenue within the City of Los Angeles. Fabrication and installation at MdR-3 will be similar to MdR-4, and will consist of designing, constructing, and securing a passive sediment collection device with anchoring bolts and suspension cables. The scope of work includes:

- Construction of passive sediment collection device including filter basket, filter bag, debris grate and securing/retrieving mechanism.
- Installation of suspension system for the passive sediment device
- Installation of system to allow for sampler adjustment and retrieval during or after storm events

2.2.2 MdRU-C2

The MdRU-C2 sample location is an 18-inch storm drain lateral accessed through a catch basin near the intersection of Woodland Court and Abbot Kinney Boulevard within the City of Los Angeles. Fabrication and installation of sampling device at MdRU-C2 will be similar to MdRU-C1, and will include:

- Construction of passive sediment collection device including filter basket, debris grate and suspension harness.
- Installation of two 3/8-inch-diameter wedge anchors embedded three inches and attachment of 3/8-inch-diameter eye bolts to anchors using coupling nuts.
- Fabrication and fitting of tether cable to secure sampling device in catch basin lateral.

3. Sample Collection Procedures

3.1 General Sampling Procedures

General sample collection procedures begin with notification of the County of the predicted storm event and a check of necessary equipment including general hardware and tools to configure the sampling equipment, single-use sample collection filters, and laboratory supplied sample containers. The principal sample collection device was a polypropylene filter (7-inch diameter, 16-inch length). The filter is placed in a plastic basket of similar dimensions and configured for deployment at each location. The day before the potential storm the equipment is checked to ensure it is functioning and to address any repair needs. Once checked, the equipment is rinsed with deionized or distilled water to remove any dust or dirt on the equipment. The filter baskets are allowed to air dry before preparation for deployment. The filters is then placed in the baskets for each of the sampling devices and secured for sampling. In addition, where required, the debris grate (or protective screen) is placed over the filter opening and secured using zip ties. A 1 micrometer (um) mesh filter will be used. Once assembled, the equipment and materials are transported to each sampling location for deployment.

To minimize the chance of capturing urban runoff, the passive collection devices are deployed the day of the storm event or, if the rain was expected overnight, the devices are deployed the afternoon before. Once installed, the suspension and control cables and fittings are adjusted for proper location of the sampling device. For the pumped collection systems, the submersible pumps are placed in the wet well in advance but are not turned on until the storm discharge beginns. Photographs of the passive sediment collection devices are also taken to document the conditions and confirm proper installation.

During the storm event periodic field checks are performed to ensure that the sampling devices are functioning and free of debris or clogs. The typical cycle for observations during a storm event is approximately once an hour. The observations at the passive sediment sites (MdR-3, MdR-4, MdRU-C1 and MdRU-C2) will primarily focus on checking for debris build up and snags on the devices. The observations at the two pumped samplers (both at MdR-5) will focus on monitoring the filter processing rate to identify pump clogs and/or filter saturation.

The filter baskets in the passive collection devices at sites MdRU-C1, MdRU-C2, MdR-3 and MdR-4 will be retrieved from outside of the sample point by working with the suspension and control fittings and cables to pull the device back to the surface. The opening to the filter baskets will be covered with clean plastic to prevent debris from entering the filter bag and transported as a complete unit to the Boone-Olive Pump Station (MdR-5) for processing. The filters used in the pumping configurations at site MdR-5 will be retrieved by turning off the pumps and allowing the accumulated water to complete processing though the filter.

After retrieval and transport to Boone-Olive Pump Station, the passive sediment collection device (i.e., the filter basket and the debris grate) are opened and the filter bag is removed. Excess water is allowed to drain through the filter bag. The filter bag is then cut along the top to remove the plastic ring, along the bottom to remove the seal/seam and, finally, along its length to allow access to the inner surface of the filter bag. Once opened, larger pieces of loose trash or organic debris are gently removed, unless covered or imbedded in sediments. Once ready, samples are obtained by removing the accumulated sediment from the inner surface of the filter bag with a polytetrafluoroethylene spatula. Care is used to avoid excessive scraping or pressure on the filter to avoid removing pieces of the filter and collecting it as part of the sample.

Samples are placed in a clean lab-supplied 16-ounce glass jar. The glass jar is weighed and the opened jar weight is noted on the jar lid. The recorded value is subtracted from the sample weight in the jar to estimate the mass of sample collected. This data is a field measurement using a portable electronic scale to determine an initial estimate of the amount of sample collected.

At the conclusion of each storm event, the remaining filters and sample jars are inventoried to determine if any additional field supplies should be purchased in advance of the next sampling event. To prepare for future sample events, additional sample containers are obtained from the laboratory and additional filters are purchased from filter manufacturer. Equipment (i.e. Filter basket) is also inspected for damage or wear and tear so that any required spare parts (cables, zip ties, etc.) are purchased from local suppliers.

Passive sediment collection devices are stored at MdR-5 (Boone-Olive Pump Station). Prior to storing, the sediment collection devices are allowed to dry and the loose debris is then cleaned off of the equipment. Once dry, the equipment is stored inside the existing equipment enclosure at Boone- Olive Pump Plant. If required, any repairs are made prior to storing the equipment to ensure it is ready for the next storm event.

3.2 Sample Collection Procedures

3.2.1 MdR-3 & MdR-4

For MdR-4, the position of the sampler is fixed approximately 1 to 2 feet above the base of the channel at approximately the mid-depth point for full flow conditions. The position of the filters is adjusted based on the storm prediction published by the National Weather Service; for example, the smaller the predicted storm, the lower the filter is placed in the channel to capture as much of the discharge as possible. At this location, the velocity is variable based on the depth of the flow in the channel, intensity of the storm, tide gate position, and the pump station operation. The device is reconfigured to hold two filter baskets to collect additional sample mass.

The procedures for MdR-3 will be similar to MdR-4.

3.2.2 MdR-5

Two collection devices are deployed at MdR-5.

3.2.2.1 Flow-Through Baffle Box

A dedicated submersible pump is used to pump storm water from the bottom of the wet well to the Flow-Through Baffle Box mounted at the rail above the wet well. The sample device is mounted to the bottom discharge point of the baffle box. The storm water is pumped to the baffle box and allowed to drain through the sampling device by gravity. The pump rate is fixed; when the pump discharge rate exceeds the processing rate of the filter, the baffle box would overflow back into the wet well. A rigid ring is used to support the filter basket and distribute the weight when the filter is full of water. The gaps between the rigid ring and baffle box are sealed to prevent sample loss and leaks.

Hydraulic rejection of flow through the filter will lead to a large overflow volume from the baffle box. Change the filters once the point of high rejection had been reached to continue to process the sample during the storm duration.

To address possible low solids content, reduce the sample water content by covering the filter opening with plastic and allowing the filter to rest longer before removal and processing. Once the filters are removed from the device, samples are collected in accordance with the procedures outlined above in Section 3.1.

3.2.2.2 Pressure Chamber

A dedicated submersible pump is used to pump storm water from the bottom of the wet well to the Pressure Chamber that contained the filter. The pressure chamber is placed at the rail above the wet well to allow for the discharge from the filter to drain back to the wet well.

Hydraulic rejection of flow through the filter will lead to a low volume of discharge from the pressure chamber, similar to that of Flow through Baffle Box. Change the filters once the point of high rejection had been reached to continue to process the sample during the storm duration.

As with the Flow-Through Baffle Box, reduce the sample water content by allowing the sealed pressure chamber to rest longer before removal and processing. Once the filters are removed from the device, samples are collected in accordance with the procedures outlined above in Section 3.1.

3.2.3 MdRU-C1 & MdRU-C2

The sampler at MdRU-C1 is positioned at the bottom of the catch basin lateral. The flow velocity will be variable based on the depth of the flow in the lateral, which is a function of the storm duration and intensity.

There is limited ability to control the velocity profile of the flow to maximize sediment loading of the sampler. The nature of the flow in the catch basin laterals also limits the ability to adjust the sampler position to reduce the amount of debris collected. The only control is through the adjustment in the length of the tether cables to control where in the lateral the device is placed. For now, the position of the device will be kept constant. There is potential to add a second sampling device to the set up to increase the mass of sediment captured, if necessary.

Once the filters are removed from the device, samples are collected in accordance with the procedures outlined above in Section 3.1.

This site may produce some unique issues that will affect the results. Any road construction or reconstruction along Admiralty Way, which would require the installation of construction storm water best management practices (BMPs) at the catch basin inlets, will restrict the discharge flow rate and associated storm-borne sediment discharge. In addition, debris dumped into the catch basin can block the flow from the lateral until sufficient depth had been built up behind the unintentional earthen dam. This also restricts the flow rate through the catch basin and has the potential to allow larger particles to settle out. Once the debris and storm water BMPs are removed, the device can successfully start collecting sediment again. Long-term, it will be important to keep track of and document events that may affect the sampling for inclusion in future reporting.

The procedures for MdRU-C2 will be similar to MdRU-C1.

4. Analytical Methods

The preferred methods would report sample reporting limits (RLs) and method detection limits (MDLs) that are less than the TMDL numeric targets. However, for practical and cost reasons, analytical methods may be selected that only report the MDLs as less than the TMDL numeric targets. The reporting of analytical results at the MDL is considered an appropriate approach to identifying the concentrations of TMDL compounds greater than the TMDL numeric target. The use of specialized high resolution methods is not considered necessary based on the objectives of the TMDL.

Appendix H: Storm-borne Sediment Collection Summary Report

4.1 TMDL Targets / Requirements

The 2005 TMDL and the 2009 CMP list numeric targets for the TMDL constituents. The Regional Water Quality Control Board (RWQCB) initiated a TMDL reconsideration and documented the findings in the Reconsideration of the Total Maximum Daily Load for Toxic Pollutants in Marina Del Rey Harbor (California Regional Water Quality Control Board - Los Angeles Region, November 5, 2013), which proposed revised numeric targets. The initial and proposed numeric targets for sediment are presented in Table 6. These numeric targets are also the basis of the loading capacity and waste load allocations presented in the TMDL. The lower concentration of the TMDL numeric targets and the proposed numeric targets will be used. This is a conservative selection and is based on the assumption that the proposed numeric targets will be accepted for the next iteration of the TMDL.

Table 1

Summary of TMDL Constituents and Numeric Targets for Sediment		
Constituent	**2005 TMDL Numeric Target**	**Proposed Numeric Target**
Copper, mg/kg	34	34
Lead, mg/kg	46.7	46.7
Zinc, mg/kg	150	150
Chlordane[1], µg/kg	0.5	0.5
Total PCBs[2], µg/kg	22.7	3.2
4,4'-DDE, µg/kg	N/A	2.2
Total DDT[3], µg/kg	N/A	1.58

Notes:
1 – assumes Technical Chlordane (as the sum of the detected concentrations for cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane) because the TMDL does not specify which form of Chlordane should reported
2 – the TMDL does not specify which form of PCBs should reported
3 – the proposed TMDL does not specify which chemical compounds comprise Total DDT, but lists Total DDT as the sum of DDD+DDE+DDT
DDD – dichlorodiphenyldichloroethaneDDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
N/A – not applicable

4.2 Review of Analytical Methods

The TMDL requires analysis of the storm-borne sediment for concentrations of copper, lead, zinc, chlordane, and total PCBs. The proposed methods are those that are both cost effective and can reported the TMDL compounds at MDLs less than the TMDL numeric targets.

Storm-borne sediment samples are also analyzed for total solids and total organic carbon (TOC) content. The results of the total solids test are used to report the concentrations of the TMDL compounds on a dry-weight basis, which is consistent with the basis of the TMDL numeric targets. Without a conversion to the dry-weight basis, the reported concentrations are biased by the amount of water contained in the sample. The TOC concentration is a typical constituent used to characterize sediments and is related to the distribution and partitioning of certain chemical compounds. Some sediment constituents and sediment benchmarks are presented on an organic carbon basis. However, for the TMDL and this Storm-borne Sediment Collection Summary Report, the TOC will not be used to adjust any of the analytical results or TMDL numeric targets.

4.2.1 Preservation and Holding Time

The objectives for the preservation and holding of sediments are established based on review of available literature. The table in **Attachment C** summarizes the sample preservation method and holding time information identified as part of this research and includes EPA recommended preservation methods and holding times along with preservation methods and holding times selected by relevant projects such as the Sediment Quality Objectives (SQO) and 2013 Southern California Bight Regional Study (Bight '13).

The summary shows a short-term option where the sample is not frozen and a long-term option where the sample is frozen. The sample holding time is related to the sample preservation method. The recommendations from Environmental Protection Agency (EPA) guidance documents that generally apply to bed sediments, are not consistent and vary from document to document. Therefore, judgment is necessary when selecting the methods for a particular project.

Preliminary recommendations are included at the top of the summary and indicate that final sampling and handling procedures for storm-borne sediment sampling should be documented and submitted as part of a revised monitoring plan to be approved by the RWQCB.

4.2.2 Analytical Method for Metals – EPA 6010

For the Marina del Rey Harbor Toxic Pollutants TMDL, sediment samples collected will be analyzed by EPA Method 6010 for concentrations of the metals, copper, lead and zinc. The results from this method will produce RLs and MDLs less than the numeric target. The method details for metals are summarized in Table 2.

Table 2

Summary of Analytical Methods for Metals

TMDL Compound	Method	List Price[1]	Sample Amount As-is[2] Basis (grams)	Reporting Limit As-is[2] Basis	Method Detection Limit As-is[2] Basis	TMDL Numeric Target Dry Weight Basis	Units
Copper	EPA 6010	$45	2	0.5	0.135	34	ppm mg/kg
Lead				0.5	0.132	46.7	ppm mg/kg
Zinc				1.0	0.178	150	ppm mg/kg

Notes:
1 – List price is presented for planning purposes based on a survey of one laboratory in February 2014, competitive prices may be less
2 – As-is basis indicates the sample condition as-collected or as-delivered, with no adjustments for water content or solids content of the sample
ppm mg/kg – part per million, milligrams per kilogram

The RLs and MDLs will be dry weight corrected by the lab to account for the fact that the as-is sample mass is not 100-percent dry solids. For method EPA 6010, detections below the TMDL targets can be achieved for the majority of sample conditions that are likely to occur in the field.

4.2.3 Analytical Methods for Chlordane and DDT – EPA 8270-SIM

Chlordane and DDT are discussed together in this section because they are both chlorinated pesticides and analytical methods for these compounds are generally similar. Chlordane is the name of a commercial product that contained a mixture of many compounds. Analytical results for chlordane may be presented as results for individual chemical compounds of the mixture (usually only a few compounds since the mixture contained a large number of compounds), or reported as a concentration representing the entire mixture without specifying any specific chemical compound of the mixture (e.g., Technical Chlordane). This report recommends that analysis of Chlordane be reported as the sum of the detected concentrations for cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane. Reporting the results as specific chemical compounds will allow any follow up work to be directed at specific compound rather than a group or mixture. These five Chlordane related compounds are also used by other sediment investigations, which will allow an improved amount of comparability between the TMDL data and other sediment related projects. The method details for Chlordane are summarized in Table 3.

There are two isomers of DDT: 2,4’-DDT and 4,4’-DDT; together they are often labeled DDTs. Total DDTs is a term that usually includes the DDTs as well as the DDEs and the DDDs. There are two isomers of DDE (2,4’-DDE and 4,4’-DDE) and two isomers of DDD (2,4’-DDD and 4,4’-DDD). This report recommends that analysis of Total DDT be reported as the sum of the detected concentrations of 2,4’-DDT, 4,4’-DDT, 2,4’-DDE, 4,4’-DDE, 2,4’-DDD, and 4,4’-DDD. The method details for DDTs, DDEs, and DDDs (Total DDT) are summarized in Table 3.

The RLs and MDLs will be dry weight corrected by the lab to account for the fact that the as-is sample mass is not 100-percent dry solids. The MDLs for the various compounds varies from compound to compound. For simplicity, only the highest MDL is represented to present the ‘worst case’ scenario.

The anticipated break points is reviewed for the proposed analytical method EPA 8270-SIM, where the dry weight correction would result in an MDL above the referenced TMDL target. In general, for Chlordane the points are approximately reached at 15-percent solids for EPA 8270 SIM (**Figure 12**, **Attachment D**). For Total DDT the points are approximately reached at 5-percent solids for EPA 8270 SIM (**Figure 13**, **Attachment D**). However, since Total DDT and Chlordane are analyzed concurrently, the Chlordane requirements would drive the method selection since it is most sensitive to the total solids in the sample in regards to meeting desired detection limits.

The original method in the approved CMP, EPA 8081, will not be considered due to low TSS and percent solids. The breakpoints for Chlordane and Total DDT are reached at 65-percent solids and 22-percent solids, respectively.

Table 3

Summary of Analytical Method for Chlordane							
TMDL Compound	**Method**	**List Price[1]**	**Sample Amount As-is[2] Basis (grams)**	**Reporting Limit As-is[2] Basis**	**Method Detection Limit As-is[2] Basis**	**TMDL Numeric Target Dry Weight Basis**	**Units**
cis-chlordane	EPA 8270-SIM	$165	20	0.2	0.067	0.5	ppb µg/kg
trans-chlordane				0.2	0.046	0.5	ppb µg/kg
cis-nonachlor				0.2	0.024	0.5	ppb µg/kg
trans-nonachlor				0.2	0.048	0.5	ppb µg/kg
oxychlordane				0.2	0.076	0.5	ppb µg/kg
2,4'-DDD (o,p'-DDD)				0.2	0.049	1.58	ppb µg/kg
4,4'-DDD (p,p'-DDD)				0.2	0.042	1.58	ppb µg/kg
2,4'-DDE (o,p'-DDE)				0.2	0.048	1.58	ppb µg/kg
4,4'-DDE (p,p'-DDE)				0.2	0.071	2.2	ppb µg/kg
2,4'-DDT (o,p'-DDT)				0.2	0.032	1.58	ppb µg/kg
4,4'-DDT (p,p'-DDT)				0.2	0.081	1.58	ppb µg/kg

Notes:
1 – List price is presented for planning purposes based on a survey of one laboratory in February 2014, competitive prices may be less
2 – As-is basis indicates the sample condition as-collected or as-delivered, with no adjustments for water content or solids content of the sample
ppb µg/kg – part per billion, micrograms per kilogram

4.2.4 Analytical Method for Total PCBs – EPA 8270-SIM

There are 209 PCBs. The individual PCB compounds are referred to as congeners—meaning members of the group. Analytical methods for total PCBs include test methods to measure for individual PCBs and for Aroclors, which is the name of the primary commercial product containing PCBs. Other approaches exist to measure total PCBs (e.g., by homologs); however, they are not discussed in this report. Most of the historical PCBs data for Marina del Rey Harbor sediment is based on the Aroclor measurements (typically seven different Aroclors were reported representing seven different commercial Aroclor products containing various mixtures of individual PCBs). The total PCBs results reported from the March 8, 2013 sampling, storm-borne sediment analyses were reported as the sum of the detected concentrations of seven Aroclors. However, this report recommends that future analysis of total PCBs be reported as the sum of the detected concentrations for approximately 44 PCB congeners including the PCB congeners identified in the Water Quality Control Plan for Enclosed Bays and Estuaries - Part 1 Sediment Quality (State Water Resources Control Board, August 2009) and in the Southern California Bight Regional Marine Monitoring Program (Bight Program) – Quality Assurance Manual (Southern California Coastal Water Research Project, June 2013). The method details for Total PCBs are summarized in Table 4.

Table 4

Summary of Analytical Method for PCB Congeners							
TMDL Compound	**Method**	**List Price[1]**	**Sample Amount As-is[2] Basis (grams)**	**Reporting Limit As-is[2] Basis**	**Method Detection Limit As-is[2] Basis**	**TMDL Numeric Target Dry Weight Basis[3]**	**Units**
PCB Congeners, (approximately 44)	EPA 8270-SIM	$300	20	0.50-1.0	0.06-0.2	22.7 / 3.2	ppb µg/kg

Notes:
1 – List price is presented for planning purposes based on a survey of one laboratory in February 2014, competitive prices may be less
2 – As-is basis indicates the sample condition as-collected or as-delivered, with no adjustments for water content or solids content of the sample
3 – First value shown is current TMDL numeric target, second value shown is proposed value
ppb µg/kg – part per billion, micrograms per kilogram

The RLs and MDLs will be dry weight corrected by the lab to account for the fact that the as-is sample mass is not 100-percent dry solids. The MDLs for the various compounds varies from compound to compound. For simplicity, only the highest MDL is represented to present the 'worst case' scenario.

The anticipated break points is reviewed for the proposed analytical method EPA 8270-SIM, where the dry weight correction would result in an MDL above the referenced TMDL target. In general, for PCBs the points are approximately reached at the existing TMDL Target at less than 1-percent solids for EPA 8270-SIM. For PCBs at the proposed TMDL Target, the points are approximately reached at approximately 7-percent solids for EPA 8270-SIM (**Figure 14**, **Attachment D**).

The original method in the approved CMP, EPA 8082, considered for future analysis, which reports results in Aroclors, will not be. Sediment Quality Objectives requires PCB analyzed for congeners, and EPA 8082 reports in Aroclors. Low sediment TSS and percent-solids also precludes using this method. For PCBs at the existing TMDL Target of 22.7 µg/kg, the breakpoint is reached at 15-percent solids; however, for PCBs at the proposed TMDL Target of 3.2 µg/kg, EPA 8082 would require 90-percent solids to meet the desired MDL (**Figure 14** in **Attachment D**).

4.2.5 Analytical Method for Total Solids and Total Organic Carbon

The total solids content of sediment samples will be measured by the method SM 2540B (Standard Methods for the Examination of Water and Wastewater, American Public Health Association, the American Water Works Association, and the Water Environment Federation). The RLs and MDLs from this method can be at an appropriate level for assessing the storm-borne sediment. The method details for total solids are summarized in Table 5.

Table 5

Summary of Analytical Method							
TMDL Compound	Method	List Price[1]	Sample Amount As-is[2] Basis (grams)	Reporting Limit As-is[2] Basis	Method Detection Limit As-is[2] Basis	TMDL Numeric Target Dry Weight Basis[3]	Units
Total Solids	SM 2540B	$15	10	0.1	0.1	N/A	percent
Total Organic Carbon	SM 2540B	$80	2	50	12	N/A	ppm mg/kg

Notes:
1 – List price is presented for planning purposes based on a survey of one laboratory in February 2014, competitive prices may be less
2 – As-is basis indicates the sample condition as-collected or as-delivered, with no adjustments for water content or solids content of the sample
N/A – not applicable

The TOC of sediment samples has been measured by the EPA Method 9060A (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), United States EPA). The RLs and MDLs from this method have been reported at an appropriate level for assessing the storm-borne sediment. The method details for TOC are summarized in Table 5.

5. Summary of Storm-borne Sediment Collection Pilot Study Results

The results obtained from implementing the passive sediment collection method at MdRUC-1, MdR-4, and MdR-5 are summarized in Table 6, 7, and 8 respectively. To show the variation of recorded rainfall precipitation from the nearest rain gauges near the drainage area, the recorded rainfall precipitations from three rain gauges located at Electric Avenue Pump Plant, LAX International Airport, and Santa Monica Municipal Airport are also included. Because of the proximity to the drainage area, the rain gauge at Electric Avenue Pump Plant is recommended.

Table 6

Sediment Collection Method Results at MdRUC-1							
Event No.	Rainfall Recorded at Electric Ave (inches)	Rainfall Recorded LAX Rainfall (inches)	Rainfall Recorded at Santa Monica Municipal Airport (inches)	Approximately Amount of Sediment Collected(1 (grams)	TSS (mg/L)	Storm Flow (L)	Estimated Sediment Load (kg)
1	0.27	0.38	0.21	<1	2.1	255	0.54
2	0.20	0.26	Trace rainfall amount	<1	205(2)	1,331	273(2)
3	0.24	0.14	0.11	21	251(2)	2,266	569(2)
4	2.97	2.91	3.80	115	54	850	46
5	0.25	0.13	0.22	35	17	453	7.7
Estimated Total	3.93	3.82	4.34	171	**Avg = 24.4**	Total = 5,155	Total = 54

1 – Field measured (grams-wet)
2 –Outliers and not included in TSS average and Total Estimated Sediment Load. Field observations confirmed that high TSS results were not representative of ambient conditions.

Appendix H: Storm-borne Sediment Collection Summary Report

Table 7

Sediment Collection Method Results at MdR-4							
Event No.	**Rainfall Recorded at Electric Ave (inches)**	**Rainfall Recorded LAX Rainfall (inches)**	**Rainfall Recorded at Santa Monica Municipal Airport (inches)**	**Approximately Amount of Sediment Collected* (grams)**	**TSS (mg/L)**	**Storm Flow (L)**	**Estimated Sediment Load (kg)**
1	0.27	0.38	0.21	5.5	27	10,513,347	283,860
2	0.20	0.26	Trace rainfall amount	26.3	85	4,267,003	362,695
3	0.24	0.14	0.11	Insufficient sample	106	5,112,610	541,936,660
4	2.97	2.91	3.80	26.1	49	12,481,417	611,589,433
5	0.25	0.13	0.22	9.1	40	0	0
Estimated total	3.93	3.82	4.34	67	**Avg =61**	Total = 32,374,377	Total = 1,154,172,648

*Field measured (grams-wet)

Table 8

Sediment Collection Method Results at MdR-5							
Event No.	**Rainfall Recorded at Electric Ave (inches)**	**Rainfall Recorded LAX Rainfall (inches)**	**Rainfall Recorded at Santa Monica Municipal Airport (inches)**	**Approximately Amount of Sediment Collected* (grams)**	**TSS (mg/L)**	**Storm Flow (L)**	**Estimated Sediment Load (kg)**
1	0.27	0.38	0.21	9.3	25	0	0
2	0.20	0.26	Trace rainfall amount	21	3.2	0	0
3	0.24	0.14	0.11	23.3	2.5	0	0
4	2.97	2.91	3.80	41.8	55	37,973,892	2,088,564
5	0.25	0.13	0.22	32.8	16	0	0
Estimated total	3.93	3.82	4.34	128.2	**Avg =20**	Total = 37,973,892	Total = 2,088,564

*Field measured (grams-wet)

6. Potential Adjustments to Storm-borne Collection Method

This section will outline adjustments to procedures for collecting storm-borne sediment.

6.1 Collection Recommendations

Aside from the recommended minor modifications to MdRU-C1 and MdR-4 installations, both devices perform well when there is sufficient flow and velocity to transport sediments in the storm flow. There is no current reason to discontinue use of either device as they both function and collect storm-borne sediments. At MdR-5, both the Pressure Chamber and Flow-Through Baffle Box worked well at collecting sample mass overall, but they experienced sample quality issues when the TSS was low in the wet well during small storm events. The main difference was the Flow-Through Baffle Box depended on gravity to process flow and reached its hydraulic rejection faster, where Pressure Chamber would continue to process due to the additional pressure provide by the pump. Both devices function but, in the interest of simplicity, the Flow-Through Baffle Box may be replaced by the Pressure Chamber.

Although the TMDL requires year-round monitoring provided the 0.1-inch activation trigger is met, it is recommended that a season be established for storm-borne sediment collection that allows sufficient time to collect, composite, and analyze the samples within one year of the first storm event of the wet season. From the data collected during the Pilot Study and the CMP implementation, a reasonable time period for this to be conducted is October 1 through April 15 as historically the majority of stormwater discharges occur in this time period. Another consideration would be to only target storms of over 0.25 inches of rainfall in a 24-hour period. Since storms smaller than this typically perform poorly, produce lower quality sediment samples, and transmit a minor fraction of the total suspended sediment load.

The collection of sample from the filters is straight forward from the description above. The main recommendation is to allow a few hours for the retained water to complete filtering to provide an incremental increase to the sample total solids. It is not recommend that the filter ever be squeezed to remove water, since this forces and fines captured in the sediment through the filter and out with the filtrate water.

Laboratory equipment blanks will be incorporated to determine if the collection procedures have a potential to introduce contamination. If there is a potential identified, procedures will be developed to limit the potential contamination.

6.2 Sample Handling Recommendations

It is recommended that the individual samples be frozen at –20 degrees Celsius (+/- 2 degrees Celsius) upon delivery to the laboratory and stored until the established end of the storm season, which should occur less than one year after the first storm of the season. At the conclusion of the storm season the samples would be thawed and prepared for compositing.

It is recommended that the individual samples be combined into one annual composite per site based on the following reasons:

- The small storms have proven difficult to capture sufficient sediment for analysis as a single event; this is largely due to the short duration and low intensity of the storms.
- Compositing a subset of the wet weather season once there is enough sediment for analysis may leave the remaining storms short of sample to analyze at the end of the year. This approach has the potential for over and under representing the annual load.
- It appears that the majority of the discharge is concentrated in a smaller subset of storms.
- To ensure that the sample being analyzed is representative of the majority of discharges.

The composite sample would be prepared with mass taken from each sample proportionally based on the discharge to the MdRH. For the purposes of this process, the samples would be composited on a flow weighted basis by each storm's contribution to the total storm season discharge. If there is no flow into the harbor from a monitoring location for a particular storm, the sediment collection from that site/event would not be included for compositing. Once the proportions are determined, the equivalent wet mass from each stored sample will be combined to create a homogenized sample that would then be used to take aliquots for analysis. It is anticipated that one composite sample will be prepared per site and that multiple sites will not be composited.

Once thawed and composited, pretreatment steps may be considered to reduce water prior to the start of the analytical method. A sample with low solids content may be pretreated at the laboratory to remove water by filtering, air drying, freeze-drying, or centrifugation. The filtering method would be impractical because the small particle size would rapidly clog the filter requiring multiple filter changes. The air-drying method involves spreading the sample out and waiting 1 to 5 days. The freeze-drying method requires many days using specialized equipment. The centrifugation method is recommended because it may be the most reasonable option; it is quick (15 minutes) and usually efficient at separating solids from liquids. Sample specific characteristics such as the amount of settleable verses nonsettleable material and the amount of debris (e.g., twigs, etc.) may influence the performance of a pretreatment method. These methods may be best assessed in consultation with the laboratory chemists after the samples are collected and may be inspected.

Procedures for thawing and compositing in the lab will follow industry standards, and conducted in a consistent fashion. Once the sample is composited further refinement can be made to water reduction strategies.

6.3 Analytical Recommendations

The information available showed that some of the existing CMP methods for Chlordane (EPA 8081) and PCBs (EPA 8082) are likely insufficient to use moving forward with storm-borne sediment analysis. The reason for this is that these methods are unlikely to achieve detection levels below the TMDL Target and would then be inconclusive on the question of contributing to harbor sediment exceedences for non-detects.

As a result the preferred analytical methods are as follows to provide sufficient cushion between the detection levels and the TMDL Targets:

- Total Solids – SM 2540B
- Total Organic Carbon – EPA 9060A
- Metals (Copper, Lead, Zinc) – EPA 6010
- Chlordane, DDT and PCBs – EPA 8270 SIM

As discussed in Section 4.2 above, these methods cover a wide range of total solids that may occur in the sediment sample. If the sediment is collected and handled in accordance with Sections 5.1 and 5.2 above, the ability to collect sufficient sample for analysis is anticipated to occur.

Attachment A - Sampling Sites

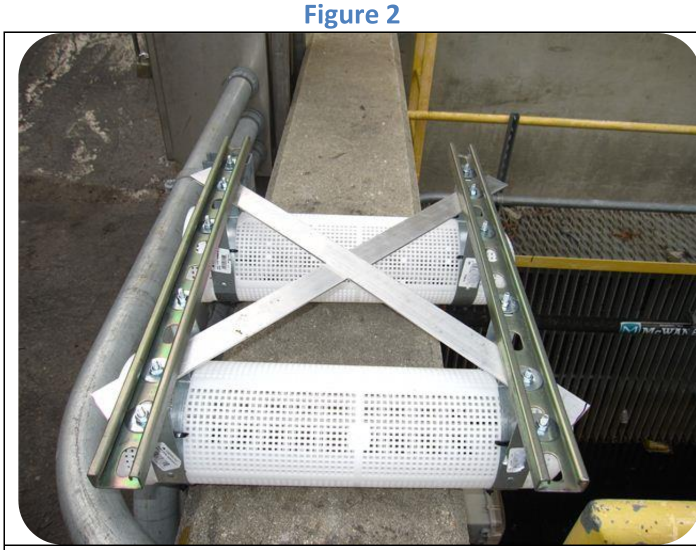
Appendix H: Storm-borne Sediment Collection Summary Report

MdR-4

Figure 1

Two storm-borne sediment collection devices suspended near the bottom of a channel. Suspension system allows the sampling devices to be positioned along the horizontal and vertical position

Figure 2



To increase the amount of storm-borne sediment collected, two sampling devices are fixed next to each other to a custom-made frame and attached to suspension cables

MdR-5

Figure 3

Two different filtration units designed to sample storm-borne sediment from a well

Figure 4

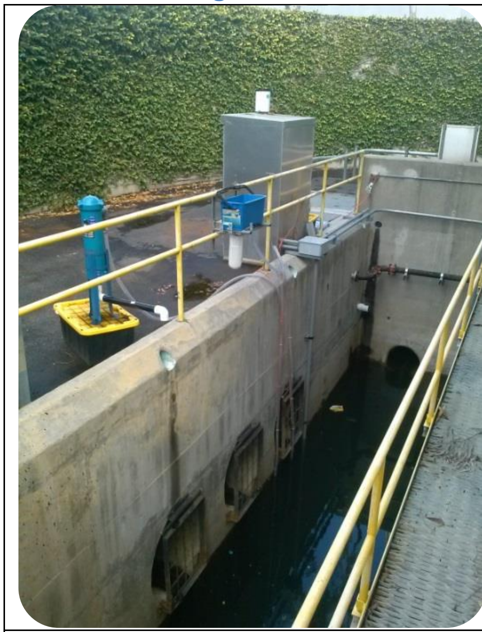
Submersible Pumps used to sample storm water from a well into the filtration units

Figure 5 Main components of filtration units.

	
Left: baffle box, filter basket, debris grate, and frame.	**Right: pressure vessel, filter basket, cover, and inlet/outlet structure.**

Appendix H: Storm-borne Sediment Collection Summary Report

Figure 6.



Filtration units installed for sampling stormwater from well

Appendix H: Storm-borne Sediment Collection Summary Report

MdRU-C1

Figure 7

Storm-borne sediment sampling device placed at the bottom of an 18 inch Reinforced Concrete Pipe connecting to a catch basin and hooked to two eye bolts embedded in the wall of the catch basin

Appendix H: Storm-borne Sediment Collection Summary Report

Figure 8

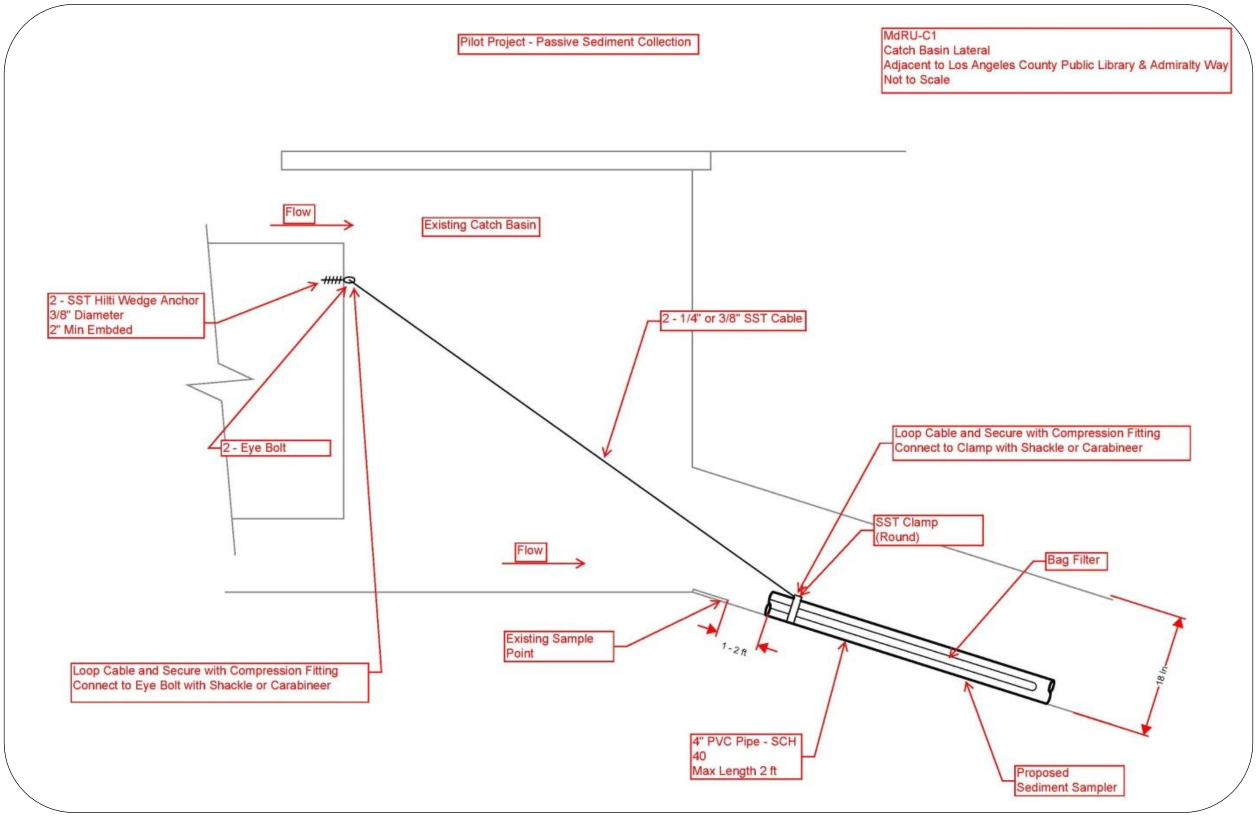
Storm-borne sediment sampling device used
d at a catch basin

Attachment B - Sample Conceptual Drawings

Appendix H: Storm-borne Sediment Collection Summary Report

MdRU-C-1 Conceptual Drawings

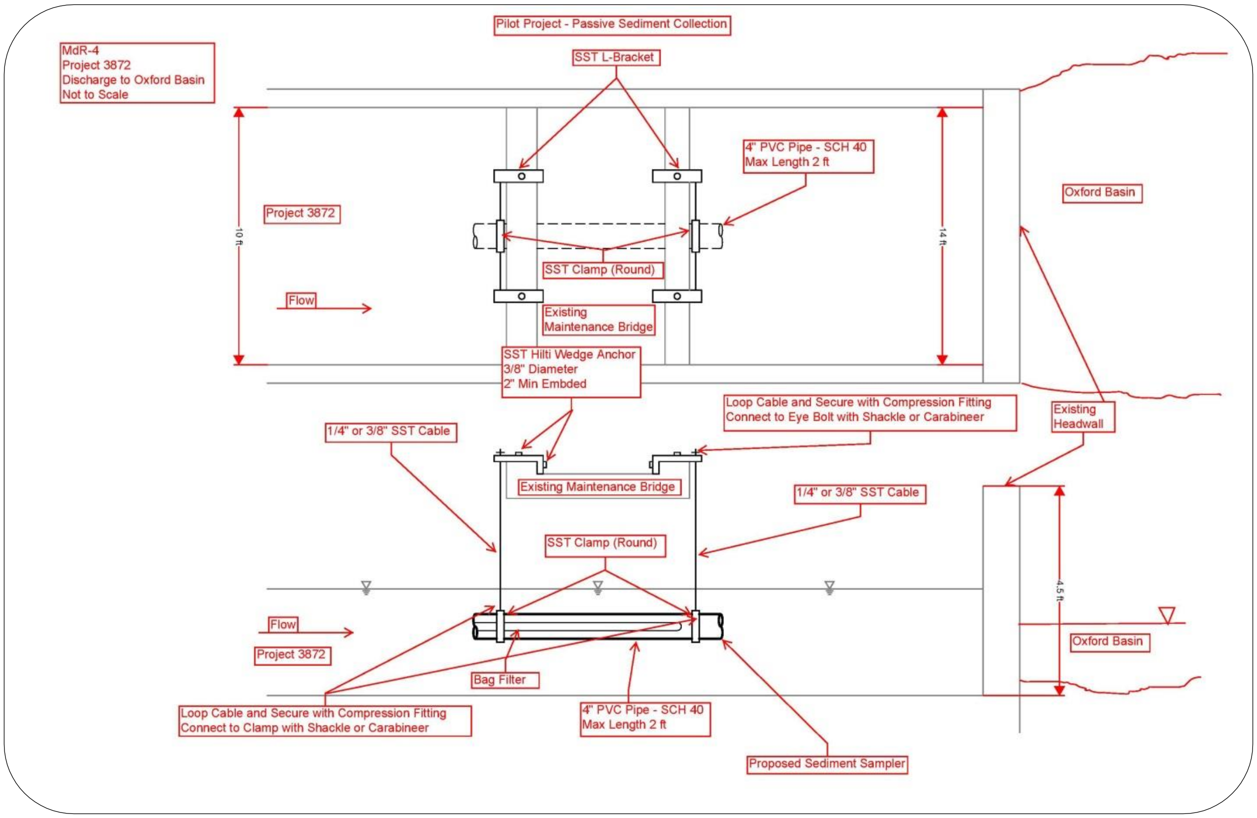
Figure 9
Installation of storm-borne sediment sampling device installed at MdRUC-1 station and applicable to MdRUC-2



Appendix H: Storm-borne Sediment Collection Summary Report

MdR-4 Conceptual Drawings

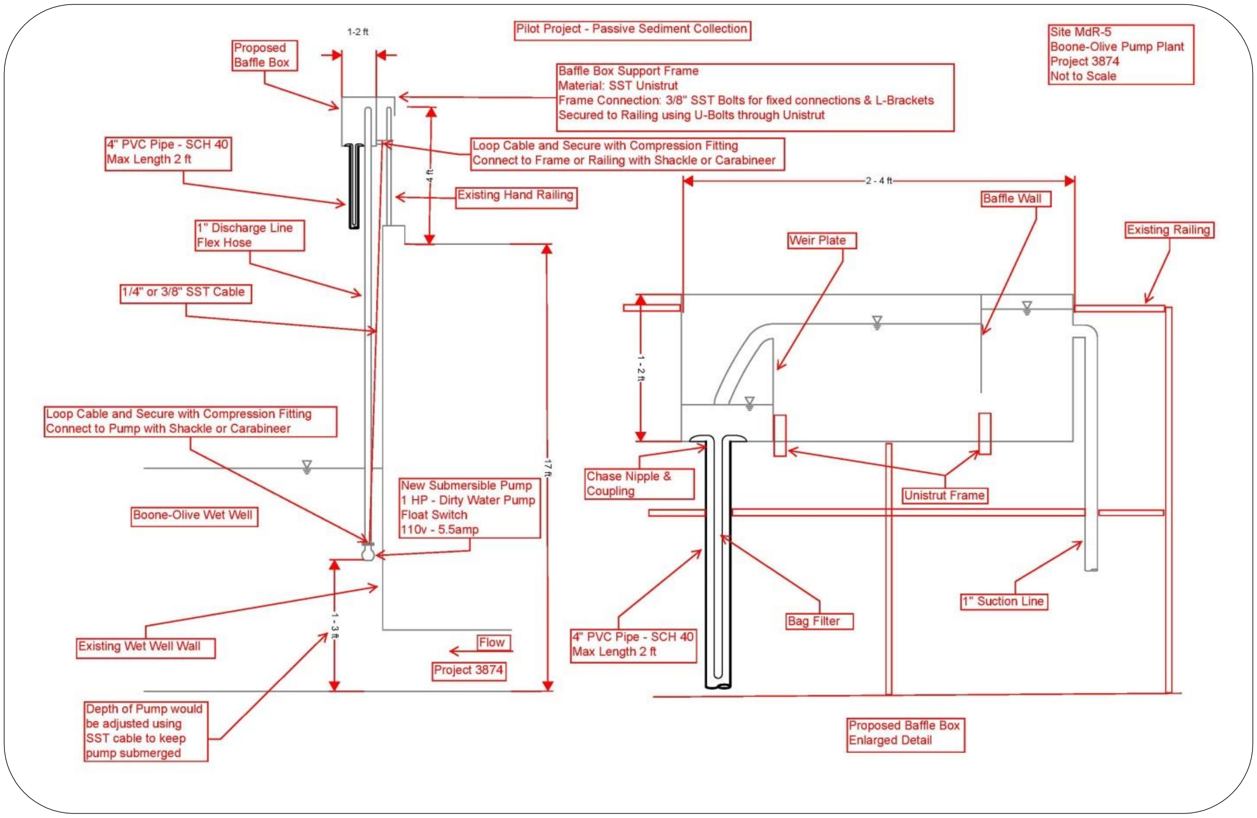
Figure 10
Storm-borne sediment sampling device installed along a channel



Appendix H: Storm-borne Sediment Collection Summary Report

MdR-5 Conceptual Drawings

Figure 11
Set-up of two different sampling devices for storm-borne sediment from a wet well using submersible pumps



Attachment C – Preservation and Holding Times Review

Appendix H: Storm-borne Sediment Collection Summary Report

Table 9

Recommend Preservation and Holding Times for MdRH Toxics TMDL					
Constituent	**Method**	**Short-Term Alternative (Not Frozen)**		**Long-Term Alternative (Frozen)**	
		Preservative	**Sample Holding Time**	**Preservative(1),(2),(3)**	**Sample Holding Time**
Total solids	SM 2540B	Cool, 0-6 °C (transport, and at lab)	7 days to analyze	Freeze, – 20 °C (at lab)	1 year to analyze
Total Organic Carbon (TOC)	EPA 9060	Cool, 0-6 °C (transport, and at lab)	28 days to analyze	Freeze, – 20 °C (at lab)	1 year to analyze
Metals (Copper, Lead, Zinc)	EPA 6010	Cool, 0-6 °C (transport, and at lab)	6 months to analyze	Freeze, – 20 °C (at lab)	1 year to analyze
Pesticides (Chlordane and DDT)	EPA 8081	Cool, 0-6 °C (transport, and at lab)	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C (at lab)	1 year to extract, 40 days to analyze after extraction
PCBs as Aroclors	EPA 8082	Cool, 0-6 °C (transport, and at lab)	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C (at lab)	1 year to extract, 40 days to analyze after extraction
Pesticides (Chlordane(4) and DDT)	EPA 8270-SIM	Cool, 0-6 °C (transport, and at lab)	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C (at lab)	1 year to extract, 40 days to analyze after extraction
PCBs(5) (~44 congeners)	EPA 8270-SIM	Cool, 0-6 °C (transport, and at lab)	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C (at lab)	1 year to extract, 40 days to analyze after extraction

Notes:
1 – If samples are to be frozen, they should be frozen as soon as possible
2 – Samples should be stored in the dark
3 – Specific temperature specifications are usually +/- 2 degrees C
4 – Chlordane - as cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane
5 – DDT - as 2,4'- and 4,4'-dichlorodiphenyltrichloroethane (DDT); 2,4'- and 4,4'-dichlorodiphenyldichloroethylene (DDE); and 2,4'- and 4,4'-dichlorodiphenyldichloroethane (DDD)
6 – PCBs - as Total PCBs by sum of Aroclors or sum of selected congeners

Appendix H: Storm-borne Sediment Collection Summary Report

Table 10

SWRCB SQO Program Preservation and Holding Times (SCCWRP Technical Support Manual, 2014)					
Constituent	**Method**	**Short-Term Alternative (Not Frozen)**		**Long-Term Alternative (Frozen)**	
		Preservative	**Sample Holding Time**	**Preservative(1),(2),(3)**	**Sample Holding Time**
Total Organic Carbon (TOC)	EPA 9060	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	6 months to analyze
Metals (Copper, Lead, Zinc)	EPA 6010	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to analyze
Pesticides (Chlordane and DDT)	EPA 8081	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
PCBs as Aroclors	EPA 8082	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
Pesticides (Chlordane(4) and DDT)	EPA 8270-SIM	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
PCBs(5) (~44 congeners)	EPA 8270-SIM	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
Grain Size		Transport, Cool, 4 °C	6 months to analyze	na	na

Notes:
1 – If samples are to be frozen, they should be frozen as soon as possible
2 – Samples should be stored in the dark
3 – Specific temperature specifications are usually +/- 2 degrees C
4 – Chlordane - as cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane
5 – DDT - as 2,4’- and 4,4’-dichlorodiphenyltrichloroethane (DDT); 2,4’- and 4,4’-dichlorodiphenyldichloroethylene (DDE); and 2,4’- and 4,4’-dichlorodiphenyldichloroethane (DDD)
6 – PCBs - as Total PCBs by sum of Aroclors or sum of selected congeners

Appendix H: Storm-borne Sediment Collection Summary Report

Table 11

Bight '13 Regional Monitoring Program Preservation and Holding Times (SCCWRP QA Manual, 2013)					
Constituent	Method	Short-Term Alternative (Not Frozen)		Long-Term Alternative (Frozen)	
		Preservative	Sample Holding Time	Preservative[(1),(2),(3)]	Sample Holding Time
Total Organic Carbon (TOC)	Not Specified	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to analyze
Metals (Copper, Lead, Zinc)	Not Specified	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to analyze
Pesticides (Chlordane and DDT)	Not Specified	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
PCBs as Aroclors	Not Specified	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
Pesticides (Chlordane[(4)] and DDT)	Not Specified	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
PCBs[(5)] (~44 congeners)	Not Specified	Transport, Cool, 4 °C	na	Storage: Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
Grain Size	Not Specified	Transport, Cool, 4 °C	6 months to analyze	na	na

Notes:
1 – If samples are to be frozen, they should be frozen as soon as possible
2 – Samples should be stored in the dark
3 – Specific temperature specifications are usually +/- 2 degrees C
4 – Chlordane - as cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane
5 – DDT - as 2,4'- and 4,4'-dichlorodiphenyltrichloroethane (DDT); 2,4'- and 4,4'-dichlorodiphenyldichloroethylene (DDE); and 2,4'- and 4,4'-dichlorodiphenyldichloroethane (DDD)
6 – PCBs - as Total PCBs by sum of Aroclors or sum of selected congeners

Appendix H: Storm-borne Sediment Collection Summary Report

Table 12

EPA Manual Preservation and Holding Times: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846, 3rd Edition, SW-846 On-line, Chapter 2 and Chapter 3)					
Constituent	Method	Short-Term Alternative (Not Frozen)		Long-Term Alternative (Frozen)	
		Preservative	Sample Holding Time	Preservative(1),(2),(3)	Sample Holding Time
Total Organic Carbon (TOC)	EPA 9060	Transport, Cool, $\leq$ 6 °C	28 days to analyze	na	na
Metals (Copper, Lead, Zinc)	EPA 6010	None	6 months to analyze	na	na
Pesticides (Chlordane and DDT)	EPA 8081	Transport, Cool, $\leq$ 6 °C	14 days to extract, 40 days to analyze after extraction	na	na
PCBs as Aroclors	EPA 8082	Transport, Cool, $\leq$ 6 °C	none	na	na
Pesticides (Chlordane(4) and DDT)	EPA 8270-SIM	Transport, Cool, $\leq$ 6 °C	14 days to extract, 40 days to analyze after extraction	na	na
PCBs(5) (~44 congeners)	EPA 8270-SIM	Transport, Cool, $\leq$ 6 °C	none	na	na

Notes:
If samples are to be frozen, they should be frozen as soon as possible
Samples should be stored in the dark
Specific temperature specifications are usually +/- 2 degrees C
Chlordane - as cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane
DDT - as 2,4’- and 4,4’-dichlorodiphenyltrichloroethane (DDT); 2,4’- and 4,4’-dichlorodiphenyldichloroethylene (DDE); and 2,4’- and 4,4’-dichlorodiphenyldichloroethane (DDD)
PCBs - as Total PCBs by sum of Aroclors or sum of selected congeners

Appendix H: Storm-borne Sediment Collection Summary Report

Table 13

EPA Manual Preservation and Holding Times: Methods for Collection, Storage and Manipulation of Sediment for Chemical and Toxicity Analyses: Technical Manual (EPA 2001, EPA-823-B-01-002)

Constituent	Method	Short-Term Alternative (Not Frozen)		Long-Term Alternative (Frozen)	
		Preservative	Sample Holding Time	Preservative	Sample Holding Time
Metals (Copper, Lead, Zinc)	na	Transport, Cool, 4 °C	na	Storage: Freeze	6 months to analyze
Pesticides (Chlordane and DDT)	na	Transport, Cool, 4 °C	na	Storage: Freeze	7 days to extract, 30 days to analyze after extraction
PCBs as Aroclors	na	Transport, Cool, 4 °C	na	Storage: Freeze	7 days to extract, 30 days to analyze after extraction
Pesticides (Chlordane and DDT)	na	Transport, Cool, 4 °C	na	Storage: Freeze	7 days to extract, 30 days to analyze after extraction
PCBs (~44 congeners)	na	Transport, Cool, 4 °C	na	Storage: Freeze	7 days to extract, 30 days to analyze after extraction

Notes:
If samples are to be frozen, they should be frozen as soon as possible
Samples should be stored in the dark
Specific temperature specifications are usually +/- 2 degrees C
Chlordane - as cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane
DDT - as 2,4'- and 4,4'-dichlorodiphenyltrichloroethane (DDT); 2,4'- and 4,4'-dichlorodiphenyldichloroethylene (DDE); and 2,4'- and 4,4'-dichlorodiphenyldichloroethane (DDD)
PCBs - as Total PCBs by sum of Aroclors or sum of selected congeners

Appendix H: Storm-borne Sediment Collection Summary Report

Table 14

East Waterway Operable Unit Quality Assurance Project Plan Intertidal Sediment Preservation and Holding Times (Windward, LLC 2009) [Example]

Constituent	Method	Short-Term Alternative (Not Frozen)		Long-Term Alternative (Frozen)	
		Preservative	Sample Holding Time	Preservative	Sample Holding Time
Total solids	SM 2540B	Cool, 0-6 °C	7 days to analyze	Freeze, – 20 °C	6 months to analyze
Total Organic Carbon (TOC)	EPA 9060	Cool, 0-6 °C	14 days to analyze	Freeze, – 20 °C	6 months to analyze
Metals (Copper, Lead, Zinc)	EPA 6010	Cool, 0-6 °C	6 months to analyze	Freeze, – 20 °C	1 year to analyze
Pesticides (Chlordane and DDT)	EPA 8081	Cool, 0-6 °C	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
PCBs as Aroclors	EPA 8082	Cool, 0-6 °C	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
Pesticides (Chlordane and DDT)	EPA 8270-SIM	Cool, 0-6 °C	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction
PCBs (~44 congeners)	EPA 8270-SIM	Cool, 0-6 °C	14 days to extract, 40 days to analyze after extraction	Freeze, – 20 °C	1 year to extract, 40 days to analyze after extraction

Notes:
If samples are to be frozen, they should be frozen as soon as possible
Samples should be stored in the dark
Specific temperature specifications are usually +/- 2 degrees C
Chlordane - as cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane
DDT - as 2,4’- and 4,4’-dichlorodiphenyltrichloroethane (DDT); 2,4’- and 4,4’-dichlorodiphenyldichloroethylene (DDE); and 2,4’- and 4,4’-dichlorodiphenyldichloroethane (DDD)
PCBs - as Total PCBs by sum of Aroclors or sum of selected congeners

Attachment D - Numeric Targets and Analytical Methods Comparison

Appendix H: Storm-borne Sediment Collection Summary Report

Figure 12 Chlordane

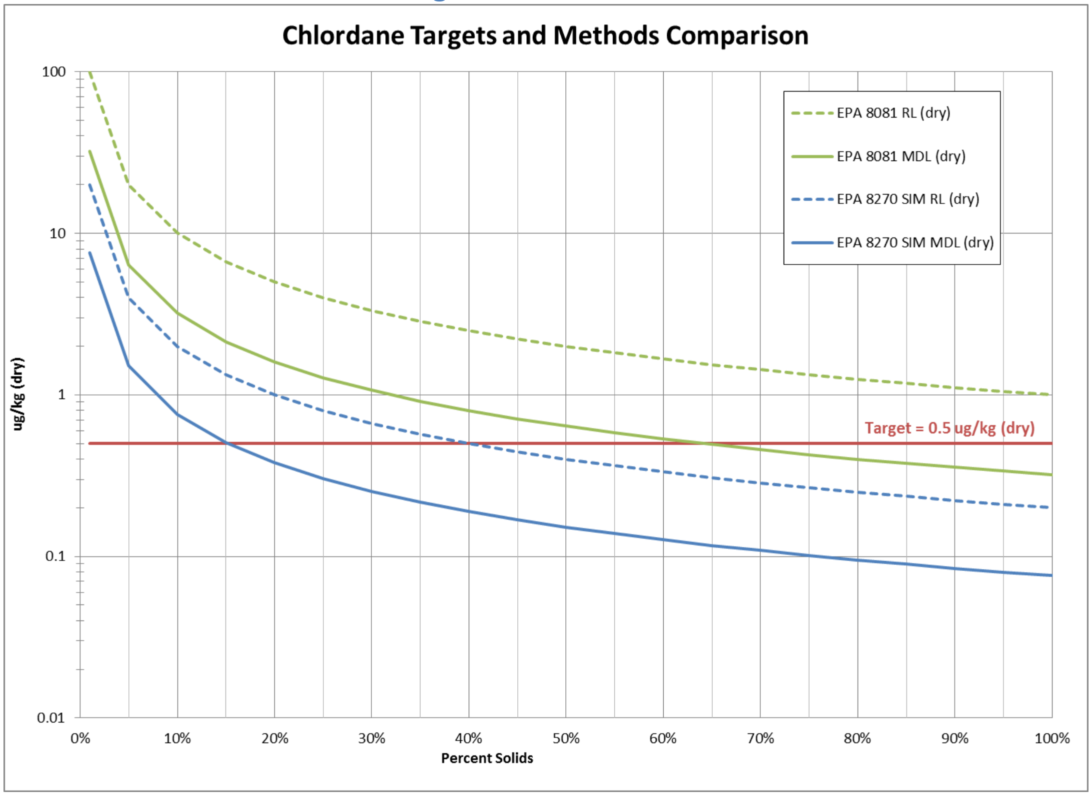
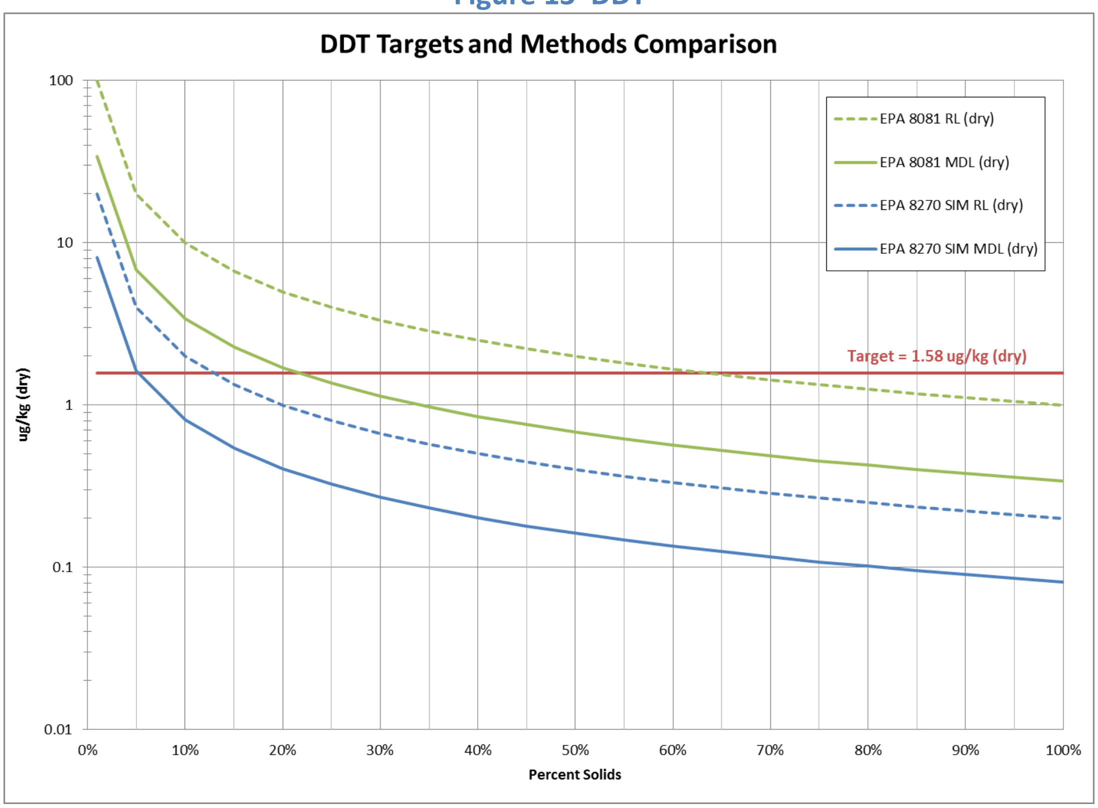
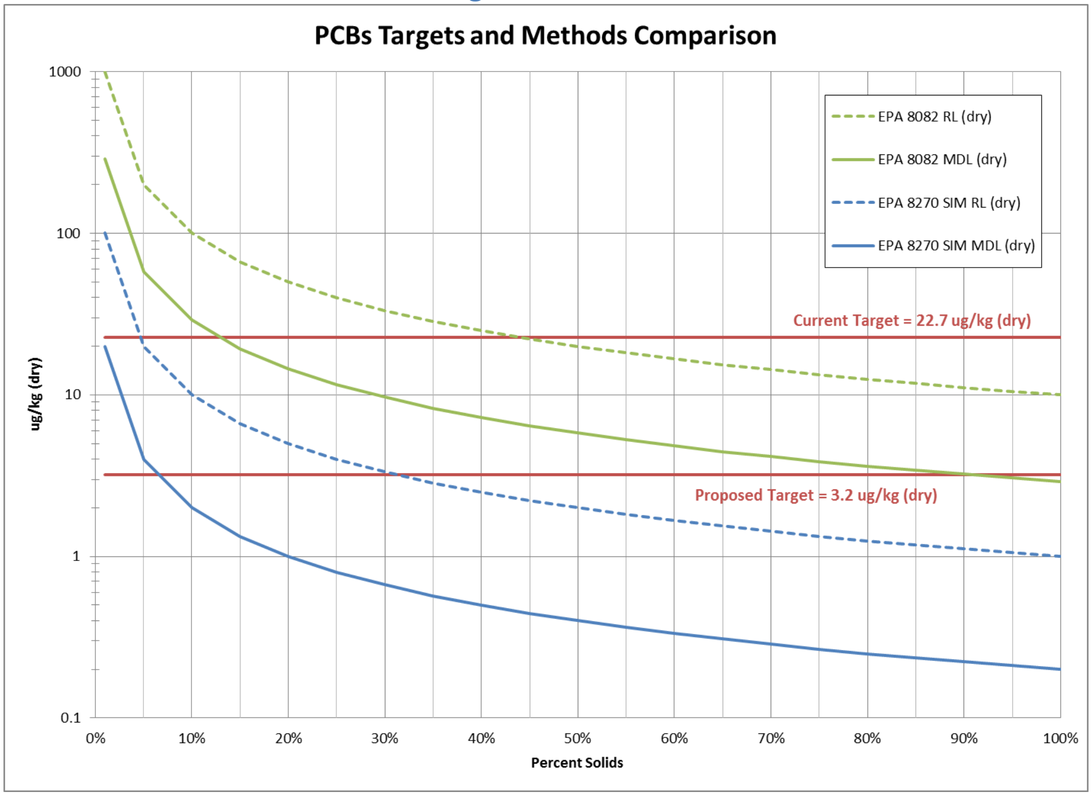


Figure 13 DDT



Appendix H: Storm-borne Sediment Collection Summary Report

Figure 14 PCBs



APPENDIX I
Data Analysis used to Support Toxics TMDL Monitoring Program Changes

I.0 DATA ANALYSIS USED TO SUPPORT TOXICS TMDL MONITORING PROGRAM CHANGES

This appendix presents the data and data evaluations used to support the proposed monitoring program changes for the Toxics TMDL. The proposed changes are included in the main body of the Coordinated Integrated Monitoring Program (CIMP) for the Marina del Rey (MdR) Watershed. A summary of the monitoring requirements and proposed changes is presented in Table I-1. Justification and data analysis for each change follows the table, organized by matrix and contaminant (Harbor Water – Dissolved Copper, Harbor Water – Total PCBs, and Sediment).

Table I-1. Summary of Toxics TMDL Monitoring Requirements and Proposed Changes

Toxics TMDL Monitoring Component	Existing	Proposed
Monitoring Frequency		
Frequency of Toxics TMDL Storm Water Monitoring	During wet weather events, up to 24.	Annual limit of seven storm events at 5 existing monitoring stations (no more than one per month)
Frequency of Toxics TMDL Harbor Water Monitoring	Monthly dissolved copper and Total PCB (Aroclor) monitoring.	1. Dissolved Copper - no change to monitoring frequency (monthly). 2. Total PCBs - Analyze PCB congeners instead of Aroclors, using EPA Method 1668. 3. Reduce PCB monitoring frequency to summer and winter (twice per year).
Frequency of Toxics TMDL Sediment Monitoring	Annual chemistry and toxicity monitoring.	No annual monitoring, Stressor ID study in 2015, Bight monitoring in 2018 and participate in Bight every five years thereafter
Frequency of Toxics TMDL Fish and Mussel Tissue Monitoring	Annual monitoring.	No change.
Monitoring Locations		
Toxics TMDL Monitoring Locations - Storm Water	Five locations within the watershed.	No change.
Toxics TMDL Monitoring Locations - Harbor Water	Dissolved copper monitored in each front and back basin and in the main channel between Basins D and E. PCB Aroclors monitored in each back basin and in the main channel between Basins D and E.	1. Dissolved Copper - Annual rotation such that two Back Basins, two Front Basins, and the main channel station monitored each year. 2. Total PCBs - Seasonal (summer/winter) monitoring of PCB congeners at the same stations as Dissolved Copper (two Back Basins, two Front Basins, and the main channel station each year)

I.1 Toxics TMDL Dissolved Copper Harbor Water Data Analysis

Monthly monitoring of dissolved copper has been conducted in both the Front and Back Basins of the Harbor since 2010. Monitoring results have remained relatively consistent over time, and while they do vary somewhat between Basins, it is possible to monitor a sub-set of Basins each year and rotate the monitoring stations without losing important information regarding dissolved copper concentrations. Box whisker plots of the data collected between 2010 and 2013 are presented in Figure I-1, below. The median is shown, along with the range of the data and the 25th and 75th percentiles. The TMDL target of 4.8 µg/L is shown as a red line.

Further examination of the data was conducted to determine the intra-station variability, and therefore the necessity of continued monthly monitoring at every station each year (i.e., if the observed variability of dissolved copper concentrations at a station is low, it is not necessary to continue monitoring at the same frequency). Table I-3 includes all of dissolved copper samples analyzed between 2010 and 2013 at each of the monitoring locations, as well as summary statistics. Note that the coefficient of variation (standard deviation divided by the mean) for dissolved copper concentrations in the individual Basins has ranged between 0.36 and 0.43. A coefficient of variation less than one is considered low for environmental data.

Monitoring station rotations were based on the results of the dissolved copper monitoring analysis, and stations with the highest observed levels of copper are scheduled for more frequent sampling than those with lower observed concentrations (e.g., MdRH-B-1/MdRH-D is proposed for sampling more frequently than MdRH-E or MdRH-F) (Table I-2).

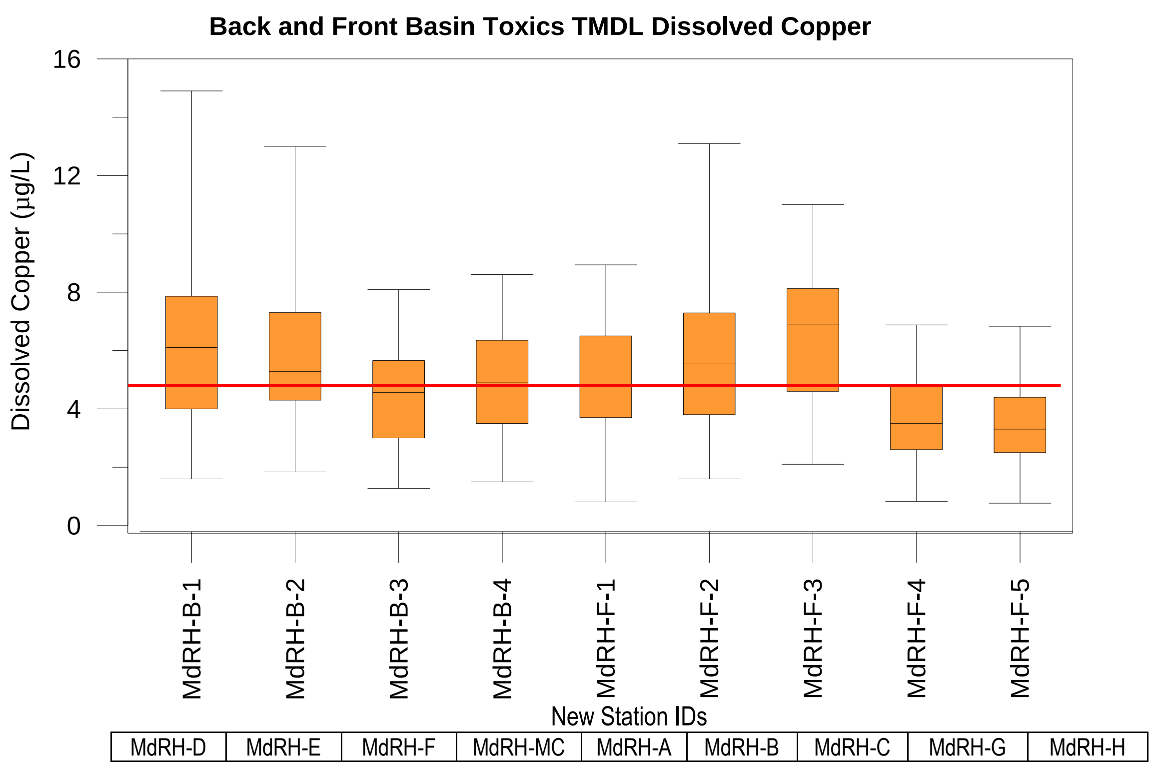


Figure I-1. Marina del Rey Toxics TMDL Dissolved Copper Compliance Monitoring Results (2010-2013)

Table I-2. Marina del Rey Toxics TMDL Harbor Water Monitoring Schedule*

Year	Front Basins	Back Basins	Main Channel
Year 1	MdRH-B and MdRH-G	MdRH-D and MdRH-E	MdRH-MC
Year 2	MdRH-C and MdRH-H	MdRH-D and MdRH-F	MdRH-MC
Year 3	MdRH-C and MdRH-A	MdRH-D and MdRH-E	MdRH-MC
Year 4	MdRH-B and MdRH-G	MdRH-D and MdRH-F	MdRH-MC
Year 5	MdRH-C and MdRH-H	MdRH-D and MdRH-E	MdRH-MC

*Monitoring stations change annually based on the rotation shown above.
All stations sampled within a 3-year period

Table I-3. Marina del Rey Toxics TMDL Dissolved Copper Monitoring Results and Summary Statistics (2010-2013)

Summary Statistics										
Station ID (new)		MDRH-D	MdRH-E	MdRH-F	MdRH-MC	MdRH-A	MdRH-B	MdRH-C	MdRH-G	MdRH-H
Historic Station ID	Units	MdRH-B-1	MdRH-B-2	MdRH-B-3	MdRH-B-4	MdRH-F-1	MdRH-F-2	MdRH-F-3	MdRH-F-4	MdRH-F-5
Average	mg/L	6.20	5.73	4.57	4.92	4.98	5.66	6.66	3.72	3.55
Standard Deviation	mg/L	2.68	2.35	1.69	1.75	1.79	2.46	2.40	1.43	1.38
Coefficient of Variation		0.43	0.41	0.37	0.36	0.36	0.43	0.36	0.39	0.39
Standard error	mg/L	0.446	0.392	0.282	0.292	0.299	0.409	0.400	0.239	0.229

Raw Data										
Date	Units	MdRH-B-1	MdRH-B-2	MdRH-B-3	MdRH-B-4	MdRH-F-1	MdRH-F-2	MdRH-F-3	MdRH-F-4	MdRH-F-5
8/20/2010	mg/L	7.71	5.04	5.26	5.87	6.74	6.6	8.12	5.58	3.61
9/20/2010	mg/L	6.88	5.26	5.26	5.88	6.74	4.47	6.15	5.02	4.96
10/22/2010	mg/L	10.4	8.67	8.09	7.5	8.94	9.82	10.9	6.88	6.63
11/16/2010	mg/L	6.4	3.8	3.6	6.5	4.5	5	7.1	3	3.6
12/9/2010	mg/L	8.6	7.3	5.4	6.1	6.6	8.2	10	2.4	2.4
1/25/2011	mg/L	7.7	5.1	4.6	4.6	5.3	6.1	7.7	3.2	4.4
2/24/2011	mg/L	4.1	2.1	2.6	4.5	4.6	5.8	6.9	2.8	3.2
3/23/2011	mg/L	2.4	2.7	2.1	1.5	0.81	1.6	2.1	0.83	0.77
4/21/2011	mg/L	3.1	4.6	3.2	3.4	4.3	4.3	4.5	2.9	2.8
5/19/2011	mg/L	4	5	3.6	3.5	3.7	4.3	4.6	2.6	2.5
6/23/2011	mg/L	7.4	7.2	5.5	6.4	6.5	6.5	7.9	3.9	3.4
7/21/2011	mg/L	3.6	5.8	4.5	4	3.2	4.6	3.7	1.9	2.9
8/25/2011	mg/L	5.3	6	4.4	5	4.1	3.9	5.1	3.6	3.7
9/22/2011	mg/L	6.1	5.3	4.5	4.9	6.3	6.2	6.2	2.6	3.8
10/27/2011	mg/L	3.4	3.3	2.6	2.5	2.7	1.8	2.2	1.7	2.2
11/17/2011	mg/L	6.1	5.8	4.3	4.7	4.3	4.5	5.5	3.8	3.1
12/14/2011	mg/L	4.7	5.5	5.4	4.1	3.9	3.5	4.8	4.3	3.2
1/11/2012	mg/L	5.6	13	5.9	4.8	3.8	3.9	5.6	3.4	3
2/8/2012	mg/L	4.7	4.7	2.9	2.3	3.5	3.7	4.3	2.3	2.1
3/7/2012	mg/L	4.4	4.9	3	3.8	3.2	3.4	4	2.9	2.4
4/12/2012	mg/L	2.8	2.8	2.6	2.3	3.7	3.8	4.9	2.7	2.7
5/10/2012	mg/L	3.8	4.3	2.5	3.2	3.5	3.4	3.7	2.2	1.8
6/7/2012	mg/L	2.7	3	2.2	2.8	2.8	3.3	3.7	1.9	1.6
7/3/2012	mg/L	7.07	8.55	5.96	4.93	7.69	7.29	7.5	6.33	5.17
8/29/2012	mg/L	1.6	4.54	1.27	2.01	1.63	1.96	6.9	4.09	3.84
9/26/2012	mg/L	9.12	7.15	6.03	8.61	6.43	9.01	9.62	4.24	4.93
10/17/2012	mg/L	6.11	3.79	4.92	5.4	5.18	8.49	7.88	3.06	3.78
11/15/2012	mg/L	7.54	9.98	6.67	6.63	6.37	7.91	9.77	5.97	6.83
12/19/2012	mg/L	7.96	5.68	4.7	6.35	6.26	6.39	7.91	5.06	4.04
1/9/2013	mg/L	14.9	1.84	4.52	6.34	5.28	13.1	10.5	3.97	2.77
2/14/2013	mg/L	7.86	7.77	5.66	4.48	6.65	6.25	7.35	4.82	6.08
3/6/2013	mg/L	9.55	8.44	7.61	8.24	7.12	8.59	11	5.93	5.37
4/4/2013	mg/L	7.03	5.07	3.66	5.04	4.72	5.87	6.91	4.6	2.31
5/14/2013	mg/L	8.46	8.63	7.04	6.49	6.48	7.28	9.49	5.13	4.23
6/5/2013	mg/L	8.16	7.71	7.57	6.73	6.9	7.6	8.3	4.74	4.6
7/1/2013	mg/L	5.99	6.04	4.79	5.59	4.96	5.35	6.92	3.41	3.21

I.2 Toxics TMDL Dissolved Total PCB Data Analysis

Total PCBs in harbor water have been monitored as part of the MdR CMP monitoring from 2010-present. However, Total PCBs have not been detected using Method 608. Method 608 detection limits are higher than the TMDL target for Total PCBs in the water column, which, in turn, makes the compliance assessment uncertain. During the Low Detection Level study (LDL study) conducted by the MdR EWMP Agencies, harbor water samples from the Back Basins of the harbor were analyzed using a high resolution method, EPA Method 1668. Results (

) were consistent during the spring and summer timeframe within a single Basin. The coefficient of variation was also low within each Basin, ranging from 0.07 in Basin D to 0.30 in Basin F and an overall coefficient of variation of 0.31 for the Back Basins as a whole.

Table I-4. Marina del Rey Toxics TMDL Special Study (Low Detection Limit) Total PCB Results

Constituent			Total PCBs	Average	Standard Deviation	Coefficient of Variation
New Station ID	Existing Station ID	Date	pg/L	pg/L	pg/L	pg/L
MdRH-D	**MDRH-B-1**	3/23/2011	3380			
		4/21/2011	3380			
		6/23/2011	3440			
		7/21/2011	3911	3527.8	257.1	0.07
MdRH-E	**MdRH-B-2**	3/23/2011	2100			
		4/21/2011	2260			
		6/23/2011	3760			
		7/21/2011	2536	2664.0	752.5	0.28
MdRH-F	**MdRH-B-3**	3/23/2011	4230			
		4/21/2011	3950			
		6/23/2011	6240			
		7/21/2011	3104	4381.0	1328.6	0.30
MdRH-MC	**MdRH-B-4**	3/23/2011	3580			
		4/21/2011	2030			
		6/23/2011	3560			
		7/21/2011	2499	2917.3	777.7	0.27
Back Basins Average				3372.50	1033.07	0.31
Trip Blanks		3/23/2011	3990	NA	NA	NA
		4/21/2011	1260	NA	NA	NA
		6/23/2011	837	NA	NA	NA
		7/21/2011	1609.5	NA	NA	NA

NA – not applicable

In addition to the successful PCB data collection, the MdR EWMP Agencies learned through the study that:

- Only one laboratory in California and a few in the nation currently have the capability to conduct the high resolution method, which results in an analytical method that is not commercially, locally readily available for a routine monitoring program, such as this CIMP. Using such a method may create logistical issues including shipping and handling of the samples on a regular basis. Moreover, a prime contract laboratory will add-on a surcharge per sample for shipping and handling on top of the already high analytical cost.
- PCBs are ubiquitous in the environment. Background PCB concentrations measured in trip blanks were higher than the TMDL target. Special blank water must be obtained from the contract laboratory in order to properly collect samples, which add to the analytical cost of the method. Properly cleaned sample bottles and sampling equipment are also necessary, which adds even more additional cost.

- Analytical cost per sample is very high compared to the method used in the current monitoring program. PCB analytical cost per sample under the current program is $55 while the high resolution method cost $970 per sample during the LDL study

Due to these logistical, technical, and cost issues, PCBs will be monitored in the Harbor water column twice per year (summer and winter) in five locations (one in the main channel, two back basins and two front basins) within the Harbor instead of the required monthly schedule. The stations will be sampled on the same schedule as the dissolved copper monitoring. This approach will help use monitoring resources as efficiently as possible while ensuring that the recommended detection limits in the Toxics TMDL are met.

I.3 Harbor Sediment Monitoring

Sediment monitoring has been conducted in the Marina del Rey Harbor for more than 25 years, with most recent data from an annual monitoring program conducted by the Los Angeles County Department of Beaches and Harbors (LACDBH [ABC, 2001-2007]), the Toxics TMDL CMP (2010-present), a special study conducted by the County in 2008, and the regional Bight program (2003, 2008, and 2013). Recent sediment results from these monitoring programs were examined to evaluate the variability of pollutant concentrations in the harbor sediment. The averages from each dataset are presented in Table I-5. Results are further discussed below.

The change in results over time was evaluated using visual inspection, with no discernible increase or decrease in contaminant concentration observed. Examination of all the LACDBH dataset revealed a coefficient of variation less than one for all metals (copper, lead, and zinc), as well as 4,4’-DDE, and total chlordane in both the Front and Back Basins, and very close to one for Total DDTs and Total PCBs. As stated above, a coefficient of variation less than one indicates that the variability of sample results is fairly low, and therefore serves as an illustration of the consistency of monitoring results over time. The mean and standard deviation of the LACDBH data were compared with more recent data to show that the results were within the range of the LACDBH dataset and within one standard deviation of the LACDBH dataset mean for all constituents.

In conclusion, sediment concentrations for the Toxics TMDL constituents in the Harbor sediments have been adequately characterized by the large dataset collected over more than 10 years. Based on the datasets discussed above, annual monitoring would not likely detect changes in sediment concentrations between consecutive years due to the relatively low variability over time. Detection of significant changes in contaminant concentration is generally expected to occur in a timeframe longer than five years (Weston 2011, Weston 2006, etc.). Therefore, sampling twice over the next five years and once every five years thereafter as part of the Bight program will is sufficient to evaluate trends in general sediment quality constituents, and also provide information necessary to move forward with decisions regarding sediment in the Harbor.

Table I-5. Marina del Rey Sediment Monitoring Results and Summary Statistics (2002-2013)

Basin Designation	Analyte	Units	LACBH 2002-2007 (All Basins)						Recent Data		
									LADPW 2008 [1]	Bight 2008 [2]	TMDL CMP [3]
			Average	Standard Deviation	CV	Min.	Max.	Count	Average	Average	Average
Back Basins (D, E, F)	Copper	mg/kg	337.5	92.37	0.27	122	511	24	340.3	441.1	355.4
	Lead	mg/kg	87.4	32.21	0.37	43	187	24	73.7	93.4	74.0
	Zinc	mg/kg	336.8	131.63	0.39	44	648	24	348.9	435	344.2
	p,p' DDE	µg/kg	24.1	15.86	0.66	0.5	57.6	20	21.6	63.9	-
	Total DDTs	µg/kg	25.5	16.79	0.66	ND	57.6	24	29.9	97.3	-
	Total Chlordane	µg/kg	12.2	9.01	0.74	7.2	25.7	4	3.4	5.8	ND
	Total PCBs	µg/kg	37.8	39.06	1.03	ND	137.1	24	32.6	61.5	51.8
Front Basins (A, B, C, G, H)	Copper	mg/kg	192.6	63.18	0.33	53	312	27	255.1	277.3	-
	Lead	mg/kg	81.1	43.07	0.53	20	180	27	74.9	70.5	-
	Zinc	mg/kg	300.5	129.85	0.43	91	581	27	284.7	303.2	-
	p,p' DDE	µg/kg	13.5	10.60	0.79	0.5	39.1	23	14.1	22.7	-
	Total DDTs	µg/kg	19.7	24.91	1.26	ND	128	27	17.9	25.8	-
	Total Chlordane	µg/kg	22.2	8.91	0.40	14	31.1	4	5.6	1	-
	Total PCBs	µg/kg	16.3	19.37	1.19	ND	71.95	27	55.9	12	-

CV – coefficient of variation (standard deviation/mean)
[1] Data from Back Basins D, E, F and Back Main Channel; Front Basins B, C, and H
[2] Data from Back Basin E and Front Basin C
[3] Data from Back Basins D, E, F and Back Main Channel

Appendix J
Los Angeles County Flood Control District Background

LACFCD Background Information

In 1915, the Los Angeles County Flood Control Act established the LACFCD and empowered it to manage flood risk and conserve stormwater for groundwater recharge. In coordination with the United States Army Corps of Engineers the LACFCD developed and constructed a comprehensive system that provides for the regulation and control of flood waters through the use of reservoirs and flood channels. The system also controls debris, collects surface storm water from streets, and replenishes groundwater with storm water and imported and recycled waters. The LACFCD covers the 2,753 square-mile portion of Los Angeles County south of the east-west projection of Avenue S, excluding Catalina Island. It is a special district governed by the County of Los Angeles Board of Supervisors, and its functions are carried out by the Los Angeles County Department of Public Works. The LACFCD service area is shown in **Figure 1.**

Unlike cities and counties, the LACFCD does not own or operate any municipal sanitary sewer systems, public streets, roads, or highways. The LACFCD operates and maintains storm drains and other appurtenant drainage infrastructure within its service area. The LACFCD has no planning, zoning, development permitting, or other land use authority within its service area. The permittees that have such land use authority are responsible under the Permit for inspecting and controlling pollutants from industrial and commercial facilities, development projects, and development construction sites (Permit, Part II.E, p. 17).

The MS4 Permit language clarifies the unique role of the LACFCD in storm water management programs: "[g]iven the LACFCD's limited land use authority, it is appropriate for the LACFCD to have a separate and uniquely-tailored storm water management program. Accordingly, the storm water management program minimum control measures imposed on the LACFCD in Part VI.D of this Order differ in some ways from the minimum control measures imposed on other Permittees. Namely, aside from its own properties and facilities, the LACFCD is not subject to the Industrial/Commercial Facilities Program, the Planning and Land Development Program, and the Development Construction Program. However, as a discharger of storm and non-storm water, the LACFCD remains subject to the Public Information and Participation Program and the Illicit Connections and Illicit Discharges Elimination Program. Further, as the owner and operator of certain properties, facilities and infrastructure, the LACFCD remains subject to requirements of a Public Agency Activities Program." (Permit, Part II.F**,** p. 18.).

Consistent with the role and responsibilities of the LACFCD under the Permit, the EWMPs and CIMPs reflect the opportunities that are available for the LACFCD to collaborate with permittees having land use authority over the subject watershed area. In some instances, the opportunities are minimal, however the LACFCD remains responsible for compliance with certain aspects of the MS4 permit as discussed above.

During the development of the CIMP, LACFCD infrastructure was evaluated for monitoring opportunities. The LACFCD will be collaborating with the groups for all of the monitoring.

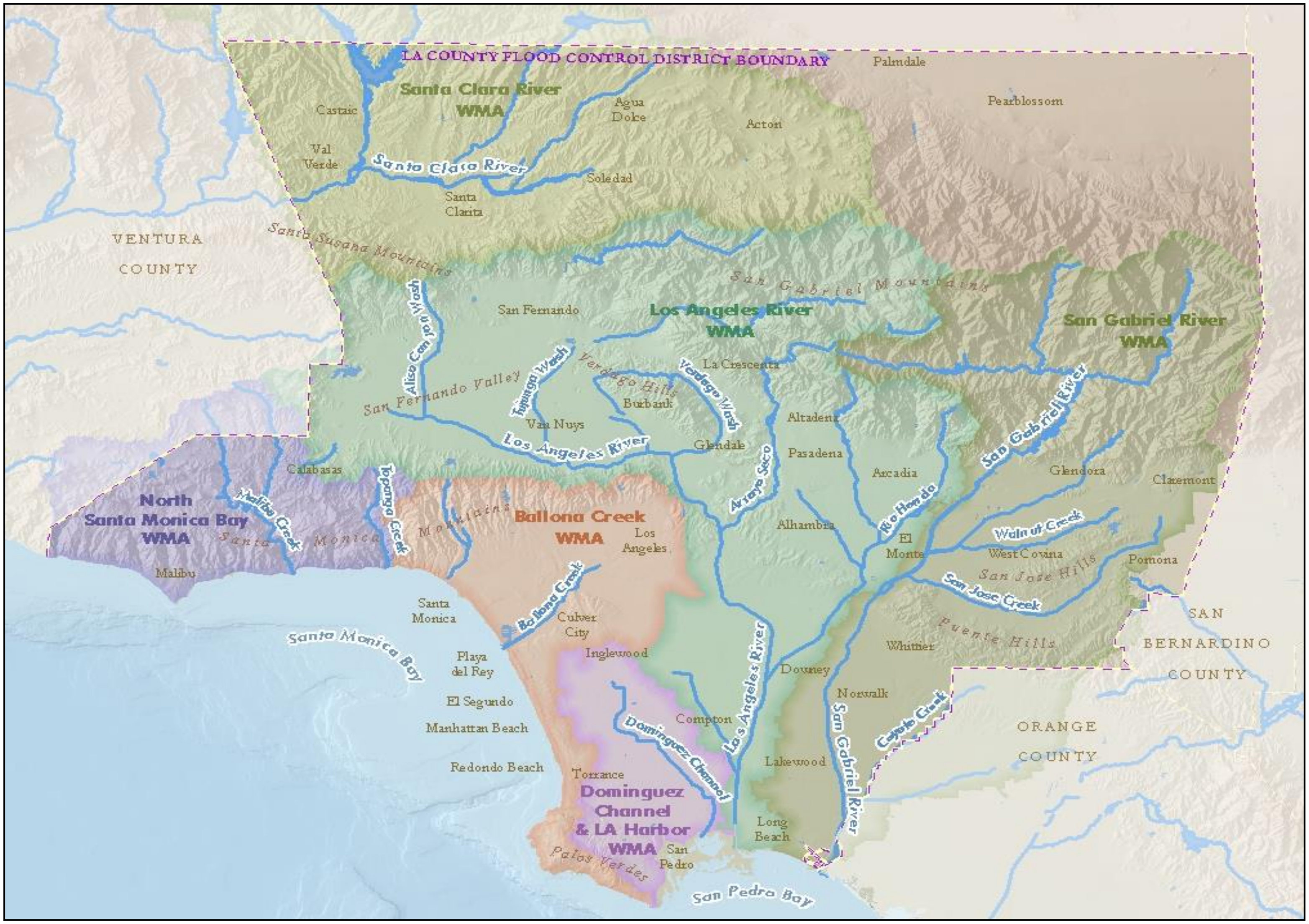


Figure 1: Los Angeles County Flood Control District Service Area